

## Skill Sheet 13-2

## CPR/AED—Child

STEP	ACTION	COMPETENCIES
1	<p><b>Scene size-up:</b></p> <ul style="list-style-type: none"> <li>▪ Scene safety*</li> <li>▪ Standard precautions*</li> <li>▪ Number of patients</li> <li>▪ Nature of illness/mechanism of injury</li> <li>▪ General impression, including severe, life-threatening bleeding*</li> <li>▪ Additional resources needed?</li> <li>▪ Consent</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sequence is not critical if all goals are accomplished and verbalized. (PPE may be worn instead of verbalized.)</li> <li>▪ Resources may include: 9-1-1 or designated emergency number, Advanced Life Support, Rapid Response Team, Code Team, or additional personnel as needed or appropriate.</li> <li>▪ <b>Consent:</b> States name, background, what they plan to do and permission to treat</li> </ul>
2	<p><b>Primary assessment:</b></p> <ul style="list-style-type: none"> <li>▪ Assesses level of consciousness (LOC)*</li> <li>▪ Opens the airway</li> <li>▪ Checks breathing and carotid pulse simultaneously for at least 5 seconds, but no more than 10 seconds*</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>LOC:</b> Shouts, “Are you OK?” (or a reasonable facsimile) to elicit verbal stimuli</li> <li>▪ <b>LOC:</b> Taps the patient’s shoulder to elicit painful stimuli and shouts again (shout-tap-shout)</li> <li>▪ <b>Airway:</b> Opens using head-tilt/chin-lift maneuver slightly past a neutral position or a modified jaw thrust</li> <li>▪ <b>Breathing/pulse check:</b> Checks for breathing and carotid pulse simultaneously for at least 5 seconds, but no more than 10 seconds</li> </ul>
3	<p><b>Chest compressions:</b></p> <ul style="list-style-type: none"> <li>▪ Exposes chest</li> <li>▪ Initiates 30 chest compressions using correct hand placement at the proper rate and depth, allowing for full chest recoil*</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Hand position:</b> Centered on the lower half of the sternum</li> <li>▪ <b>Depth:</b> About 2 inches or 1/3 the anterior-posterior diameter of the chest</li> <li>▪ <b>Number:</b> 30 compressions</li> <li>▪ <b>Rate:</b> Between 100 and 120 compressions per minute (15–18 seconds)</li> <li>▪ <b>Full chest recoil:</b> 26 of 30 compressions</li> </ul>
4	<p><b>Ventilations:</b></p> <ul style="list-style-type: none"> <li>▪ Opens the airway*</li> <li>▪ Gives 2 ventilations using a pocket mask*</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Airway:</b> Head-tilt/chin-lift maneuver slightly past a neutral position</li> <li>▪ <b>Ventilations (2):</b> 1 second in duration</li> <li>▪ <b>Ventilations (2):</b> Visible chest rise</li> <li>▪ <b>Ventilations (2):</b> Minimizes interruptions to less than 10 seconds</li> </ul>

\*Denotes a Critical Action.

(Continued)

## Skill Sheet 13-2

CPR/AED—Child *Continued*

STEP	ACTION	COMPETENCIES
5	<p><b>Continues CPR:</b></p> <ul style="list-style-type: none"> <li>▪ Gives 30 chest compressions using correct hand placement at the proper rate and depth, allowing for full chest recoil*</li> <li>▪ Opens the airway</li> <li>▪ Gives 2 ventilations with pocket mask</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Hand position:</b> Centered on the lower half of the sternum</li> <li>▪ <b>Depth:</b> About 2 inches or 1/3 the anterior-posterior diameter of the chest</li> <li>▪ <b>Number:</b> 30 compressions</li> <li>▪ <b>Rate:</b> Between 100 and 120 compressions per minute (15–18 seconds)</li> <li>▪ <b>Full chest recoil:</b> 26 of 30 compressions</li> </ul>
6	<p><b>Arrival of the AED and additional responder(s):</b></p> <ul style="list-style-type: none"> <li>▪ Initial responder continues care*</li> <li>▪ Communicates with additional responders</li> <li>▪ Prepares for rotation upon AED analysis</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Continues care:</b> Maintains uninterrupted CPR</li> <li>▪ <b>Communicates</b> relevant patient information including patient age if known</li> <li>▪ <b>Verbalizes</b> compression count to coordinate ventilations with additional responder(s)</li> <li>▪ <b>Verbalizes</b> coordination plan to switch compressors upon AED analysis</li> </ul>
7	<p><b>AED applied:</b></p> <ul style="list-style-type: none"> <li>▪ Turns on machine</li> <li>▪ Attaches AED pads*</li> <li>▪ Plugs in connector, if necessary</li> <li>▪ Continues compressions</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>AED on:</b> Activates within 15 seconds of arrival</li> <li>▪ <b>Pads:</b> Applies correct pads for age of child: Pad 1—right upper chest below right clavicle and right of sternum; Pad 2—left side of chest several inches below left armpit on midaxillary line</li> </ul>
8	<p><b>AED analysis and rotation:</b></p> <ul style="list-style-type: none"> <li>▪ Ensures all responders are clear while AED analyzes and prepares for shock*</li> <li>▪ Says, “Stand clear”</li> <li>▪ Rotates responders during analysis to prevent fatigue</li> <li>▪ Prepares BVM</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Clear:</b> Ensures no one is touching the patient during analysis</li> <li>▪ <b>Rotation:</b> Switches compressor during analysis</li> <li>▪ <b>Hover:</b> Hovers hands (new compressor) a few inches above chest during analysis to prepare for CPR</li> </ul>
9	<p><b>Shock advised:</b></p> <ul style="list-style-type: none"> <li>▪ Says, “Stand clear”*</li> <li>▪ Presses shock button to deliver shock*</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Clear:</b> Ensures no one is touching the patient while shock is being delivered</li> <li>▪ <b>Delivers shock:</b> Depresses shock button within 10 seconds</li> </ul>

\*Denotes a Critical Action.

*(Continued)*

## Skill Sheet 13-2

CPR/AED—Child *Continued*

STEP	ACTION	COMPETENCIES
10	<p><b>Resumes CPR:</b></p> <ul style="list-style-type: none"> <li>Continues with 10 cycles of CPR (15 compressions/2 ventilations)*</li> <li>Performs compressions (Responder 2)</li> <li>Manages airway and mask seal (Responder 1)</li> <li>Provides ventilations using BVM (Responder 1)</li> <li>Continues until AED prompts</li> </ul>	<ul style="list-style-type: none"> <li><b>Resumes CPR:</b> Immediately following shock, resumes CPR, starting with compressions, until prompted by the AED for analysis</li> <li><b>Hand position:</b> Centered on the lower half of the sternum</li> <li><b>Depth:</b> About 2 inches or 1/3 the anterior-posterior diameter of the chest</li> <li><b>Number:</b> 15 compressions</li> <li><b>Rate:</b> Between 100 and 120 compressions per minute (7–9 seconds)</li> <li><b>Full chest recoil:</b> 12 of 15 compressions</li> </ul>
11	<p><b>Ventilations with BVM:</b></p> <ul style="list-style-type: none"> <li>Opens the airway from top of the head</li> <li>Maintains mask seal</li> <li>Compresses BVM to give 2 ventilations</li> </ul>	<ul style="list-style-type: none"> <li><b>Seal:</b> Using the E-C technique</li> <li><b>Airway:</b> Head-tilt/chin-lift maneuver slightly past a neutral position</li> <li><b>Ventilations (2):</b> 1 second in duration</li> <li><b>Ventilations (2):</b> Visible chest rise</li> <li><b>Ventilations (2):</b> Minimizes interruptions to less than 10 seconds</li> <li><b>Ventilations (2):</b> Bag squeezed enough to make chest rise; does not fully squeeze bag (avoiding overinflation)</li> </ul>
12	<p><b>Anticipates compressor change:</b></p> <ul style="list-style-type: none"> <li>Communicates with additional responders</li> <li>Prepares for rotation upon AED analysis</li> </ul>	<ul style="list-style-type: none"> <li><b>Verbalizes</b> coordination plan to switch compressors prior to AED analysis</li> </ul>
13	<p><b>AED analyzes:</b></p> <ul style="list-style-type: none"> <li>Says, “Stand clear”</li> <li>No shock advised</li> </ul>	<ul style="list-style-type: none"> <li><b>Clear:</b> Ensures no one is touching the patient during analysis</li> <li><b>Rotation:</b> Switches compressor during analysis</li> <li><b>Hover:</b> Hovers hands (new compressor) a few inches above chest during analysis to prepare for CPR</li> </ul>

\*Denotes a Critical Action.

*(Continued)*

## Skill Sheet 13-2

CPR/AED—Child *Continued*

STEP	ACTION	COMPETENCIES
14	<p><b>Resumes CPR:</b></p> <ul style="list-style-type: none"> <li>Continues with 10 cycles of CPR (15 compressions/2 ventilations)*</li> <li>Performs compressions (Responder 3)</li> <li>Manages airway and mask seal (Responder 1)</li> <li>Provides ventilations using BVM (Responder 2)</li> <li>Continues until AED prompts</li> </ul>	<ul style="list-style-type: none"> <li><b>Resumes CPR:</b> Immediately following shock, resumes CPR, starting with compressions, until prompted by the AED for analysis</li> <li><b>Hand position:</b> Centered on the lower half of the sternum</li> <li><b>Depth:</b> About 2 inches or 1/3 the anterior-posterior diameter of the chest</li> <li><b>Number:</b> 15 compressions</li> <li><b>Rate:</b> Between 100 and 120 compressions per minute (7–9 seconds)</li> <li><b>Full chest recoil:</b> 12 of 15 compressions</li> </ul>
15	<p><b>Anticipates compressor change:</b></p> <ul style="list-style-type: none"> <li>Communicates with additional responders</li> <li>Prepares for rotation upon AED analysis</li> </ul>	<ul style="list-style-type: none"> <li><b>Verbalizes</b> coordination plan to switch compressors prior to AED analysis</li> </ul>
16	<p><b>AED analyzes and rotation:</b></p> <ul style="list-style-type: none"> <li>Says, “Stand clear”*</li> <li>No shock advised</li> </ul>	<ul style="list-style-type: none"> <li><b>Clear:</b> Ensures no one is touching the patient during analysis</li> <li><b>Rotation:</b> Switches compressor during analysis</li> <li><b>Hover:</b> Hovers hands (new compressor) a few inches above chest during analysis to prepare for CPR</li> </ul>
17	<p><b>Spontaneous patient movement:</b></p> <ul style="list-style-type: none"> <li>Checks for breathing and pulse</li> </ul>	<ul style="list-style-type: none"> <li><b>Pulse check:</b> Responder performing ventilations opens the airway and checks for breathing and pulse simultaneously for at least 5 seconds, but no more than 10 seconds</li> </ul>

\*Denotes a Critical Action.



## Skill Sheet 13-3

## CPR/AED—Infant

STEP	ACTION	COMPETENCIES
1	<p><b>Scene size-up:</b></p> <ul style="list-style-type: none"> <li>▪ Scene safety*</li> <li>▪ Standard precautions*</li> <li>▪ Number of patients</li> <li>▪ Nature of illness/mechanism of injury</li> <li>▪ General impression, including severe, life-threatening bleeding*</li> <li>▪ Additional resources needed?</li> <li>▪ Consent</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sequence is not critical if all goals are accomplished and verbalized. (PPE may be worn instead of verbalized.)</li> <li>▪ Resources may include: 9-1-1 or designated emergency number, Advanced Life Support, Rapid Response Team, Code Team, or additional personnel as needed or appropriate.</li> <li>▪ <b>Consent:</b> States name, background, what they plan to do and permission to treat</li> </ul>
2	<p><b>Primary assessment:</b></p> <ul style="list-style-type: none"> <li>▪ Positions infant on a firm, flat surface</li> <li>▪ Assesses level of consciousness (LOC)*</li> <li>▪ Opens the airway</li> <li>▪ Checks breathing and brachial pulse simultaneously for at least 5 seconds, but no more than 10 seconds*</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Position:</b> Places infant on a firm, flat surface</li> <li>▪ <b>LOC:</b> Shouts, “Are you OK?” (or a reasonable facsimile) to elicit a verbal stimuli; uses infant’s name if available</li> <li>▪ <b>LOC:</b> Taps the infant’s foot to elicit stimuli and shouts again (shout-tap-shout)</li> <li>▪ <b>Airway:</b> Opens using head-tilt/chin-lift maneuver to a neutral position</li> <li>▪ <b>Breathing/pulse check:</b> Checks for breathing and brachial pulse simultaneously for at least 5 seconds, but no more than 10 seconds</li> </ul>
3	<p><b>Chest compressions:</b></p> <ul style="list-style-type: none"> <li>▪ Exposes chest</li> <li>▪ Initiates 30 chest compressions using correct finger placement at the proper rate and depth, allowing for full chest recoil*</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Finger position:</b> Centered on the chest, just below the nipple line</li> <li>▪ <b>Depth:</b> About 1½ inches or 1/3 the anterior-posterior diameter of the chest</li> <li>▪ <b>Number:</b> 30 compressions</li> <li>▪ <b>Rate:</b> Between 100 and 120 compressions per minute (15–18 seconds)</li> <li>▪ <b>Full chest recoil:</b> 26 of 30 compressions</li> </ul>
4	<p><b>Ventilations:</b></p> <ul style="list-style-type: none"> <li>▪ Opens airway*</li> <li>▪ Gives 2 ventilations using an infant pocket mask*</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Airway:</b> Head-tilt/chin-lift maneuver to a neutral position</li> <li>▪ <b>Ventilations (2):</b> 1 second in duration</li> <li>▪ <b>Ventilations (2):</b> Visible chest rise</li> <li>▪ <b>Ventilations (2):</b> Minimizes interruptions to less than 10 seconds</li> </ul>
5	<p><b>Continues CPR:</b></p> <ul style="list-style-type: none"> <li>▪ Gives 30 chest compressions using correct finger placement at the proper rate and depth, allowing for full chest recoil*</li> <li>▪ Opens the airway</li> <li>▪ Gives 2 ventilations with an infant pocket mask</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Finger position:</b> 2 fingers centered on the lower half of the sternum, just below the nipple line.</li> <li>▪ <b>Depth:</b> About 1½ inches or 1/3 the anterior-posterior diameter of the chest</li> <li>▪ <b>Number:</b> 30 compressions</li> <li>▪ <b>Rate:</b> Between 100 and 120 compressions per minute (15–18 seconds)</li> <li>▪ <b>Full chest recoil:</b> 26 of 30 compressions</li> </ul>

\*Denotes a Critical Action.

(Continued)

## Skill Sheet 13-3

CPR/AED—Infant *Continued*

STEP	ACTION	COMPETENCIES
6	<b>Arrival of the AED and additional responder(s):</b> <ul style="list-style-type: none"> <li>Initial responder continues care*</li> <li>Communicates with additional responders</li> <li>Prepares for rotation upon AED analysis</li> </ul>	<ul style="list-style-type: none"> <li><b>Continues care:</b> Maintains uninterrupted CPR</li> <li><b>Communicates</b> relevant patient information including patient age if known</li> <li><b>Verbalizes</b> compression count to coordinate ventilations with additional responder(s)</li> <li><b>Verbalizes</b> coordination plan to switch compressors upon AED analysis</li> </ul>
7	<b>AED applied:</b> <ul style="list-style-type: none"> <li>Turns on machine</li> <li>Attaches AED pads*</li> <li>Plugs in connector, if necessary</li> <li>Continues compressions</li> </ul>	<ul style="list-style-type: none"> <li><b>AED on:</b> Activates within 15 seconds of arrival</li> <li><b>Pads:</b> Applies correct pads for an infant: Pad 1—in the center of the anterior chest; Pad 2—on the infant's back between the scapulae</li> </ul>
8	<b>AED analysis and rotation:</b> <ul style="list-style-type: none"> <li>Ensures all responders are clear while AED analyzes and prepares for shock*</li> <li>Says, "Stand clear"</li> <li>Rotates responders during analysis to prevent fatigue</li> <li>Prepares infant BVM</li> </ul>	<ul style="list-style-type: none"> <li><b>Clear:</b> Ensures no one is touching the patient during analysis</li> <li><b>Rotation:</b> Switches compressor during analysis and moves to a head and foot position for encircling thumbs technique</li> <li><b>Hover:</b> Hovers hands (new compressor) a few inches above chest during analysis to prepare for CPR</li> </ul>
9	<b>Shock advised:</b> <ul style="list-style-type: none"> <li>Says, "Stand clear"*</li> <li>Presses shock button to deliver shock*</li> </ul>	<ul style="list-style-type: none"> <li><b>Clear:</b> Ensures no one is touching the patient while shock is being delivered</li> <li><b>Delivers shock:</b> Depresses shock button within 10 seconds</li> </ul>
10	<b>Resumes CPR:</b> <ul style="list-style-type: none"> <li>Continues with 10 cycles of CPR (15 compressions/2 ventilations)*</li> <li>Performs compressions—encircling thumbs technique (Responder 2)</li> <li>Manages airway and mask seal (Responder 1)</li> <li>Provides ventilations using the infant BVM (Responder 1)</li> <li>Continues until AED prompts</li> </ul>	<ul style="list-style-type: none"> <li><b>Resumes CPR:</b> Immediately following shock, resumes CPR, starting with compressions, until prompted by the AED for analysis</li> <li><b>Thumb position:</b> Thumbs centered on the chest side by side, just below the nipple line</li> <li><b>Depth:</b> About 1½ inches or 1/3 the anterior-posterior diameter of the chest</li> <li><b>Number:</b> 15 compressions</li> <li><b>Rate:</b> Between 100 and 120 compressions per minute (7–9 seconds)</li> <li><b>Full chest recoil:</b> 12 of 15 compressions</li> </ul>
11	<b>Ventilations with BVM:</b> <ul style="list-style-type: none"> <li>Open airway from top of the head</li> <li>Maintains mask seal</li> </ul>	<ul style="list-style-type: none"> <li><b>Seal:</b> Using the E-C technique</li> <li><b>Airway:</b> Head-tilt/chin-lift maneuver to a neutral position</li> <li><b>Ventilations (2):</b> 1 second in duration</li> </ul>

\*Denotes a Critical Action.

*(Continued)*

## Skill Sheet 13-3

CPR/AED—Infant *Continued*

STEP	ACTION	COMPETENCIES
	<ul style="list-style-type: none"> <li>Compresses infant BVM to give 2 ventilations</li> </ul>	<ul style="list-style-type: none"> <li><b>Ventilations (2):</b> Visible chest rise</li> <li><b>Ventilations (2):</b> Minimizes interruptions to less than 10 seconds</li> <li><b>Ventilations (2):</b> Bag squeezed enough to make chest rise; does not fully squeeze bag (avoiding overinflation)</li> </ul>
12	<p><b>Anticipates compressor change:</b></p> <ul style="list-style-type: none"> <li>Communicates with additional responders</li> <li>Prepares for rotation upon AED analysis</li> </ul>	<ul style="list-style-type: none"> <li><b>Verbalizes</b> coordination plan to switch compressors prior to AED analysis</li> </ul>
13	<p><b>AED analyzes:</b></p> <ul style="list-style-type: none"> <li>Says, “Stand clear”</li> <li>No shock advised</li> </ul>	<ul style="list-style-type: none"> <li><b>Clear:</b> Ensures no one is touching the patient during analysis</li> <li><b>Rotation:</b> Switches compressor during analysis</li> <li><b>Hover:</b> Hovers hands (new compressor) a few inches above chest during analysis to prepare for CPR</li> </ul>
14	<p><b>Resumes CPR:</b></p> <ul style="list-style-type: none"> <li>Continues with 10 cycles of CPR (15 compressions/2 ventilations)*</li> <li>Performs compressions (Responder 3)</li> <li>Manages airway and mask seal (Responder 1)</li> <li>Provides ventilations using the infant BVM (Responder 2)</li> <li>Continues until AED prompts</li> </ul>	<ul style="list-style-type: none"> <li><b>Resumes CPR:</b> Immediately following shock, resumes CPR, starting with compressions, until prompted by the AED for analysis</li> <li><b>Thumb position:</b> Thumbs centered on the chest side by side, just below the nipple line</li> <li><b>Depth:</b> About 1½ inches or 1/3 the anterior-posterior diameter of the chest</li> <li><b>Number:</b> 15 compressions</li> <li><b>Rate:</b> Between 100 and 120 compressions per minute (7–9 seconds)</li> <li><b>Full chest recoil:</b> 12 of 15 compressions</li> </ul>
15	<p><b>Anticipates compressor change:</b></p> <ul style="list-style-type: none"> <li>Communicates with additional responders</li> <li>Prepares for rotation upon AED analysis</li> </ul>	<ul style="list-style-type: none"> <li><b>Verbalizes</b> coordination plan to switch compressors prior to AED analysis</li> </ul>
16	<p><b>AED analyzes and rotation:</b></p> <ul style="list-style-type: none"> <li>Says, “Stand clear”*</li> <li>No shock advised</li> </ul>	<ul style="list-style-type: none"> <li><b>Clear:</b> Ensures no one is touching the patient during analysis</li> <li><b>Rotation:</b> Switches compressor during analysis</li> <li><b>Hover:</b> Hovers hands (new compressor) a few inches above chest during analysis to prepare for CPR</li> </ul>
17	<p><b>Spontaneous patient movement:</b></p> <ul style="list-style-type: none"> <li>Checks for breathing and pulse</li> </ul>	<ul style="list-style-type: none"> <li><b>Pulse check:</b> Responder performing ventilations opens the airway and checks for breathing and brachial pulse simultaneously for at least 5 seconds, but no more than 10 seconds</li> </ul>

\*Denotes a Critical Action.

# ENRICHMENT

## Preventing Coronary Heart Disease

Recognizing a heart attack and getting the necessary care as soon as possible may prevent a patient from going into cardiac arrest. However, preventing a heart attack in the first place is even more effective—there is no substitute for prevention. Heart attacks are usually the result of disease of the heart and blood vessels.

Coronary heart disease (CHD) develops slowly. Deposits of cholesterol, a fatty substance made by the body and present in certain foods, build up on the inner walls of the arteries. As the arteries that carry blood to the heart get narrower, less oxygen-rich blood flows to the heart. This reduced oxygen supply to the heart can eventually cause a heart attack.

Although a heart attack may seem to strike suddenly, many people gradually put their hearts in danger from cardiovascular disease. Because cardiovascular disease develops slowly, people may not be aware of it for many years. Fortunately, it is possible to slow the progress of cardiovascular disease by making lifestyle changes.

Behavior that can harm the heart and blood vessels may begin in early childhood. Junk food, which is high in cholesterol and saturated fats but has little real nutritional value, can contribute to cardiovascular disease. Cigarette smoking also greatly contributes to cardiovascular disease and to other diseases. Many factors increase a person's chances of developing cardiovascular disease.

These are called risk factors. Some of them you cannot change. For instance, although more women than men die each year from cardiovascular disease in the United States, heart disease generally affects men at younger ages than it does women. Ethnicity also plays a role in determining the risk for heart disease. African-American and Native American/American Indian populations statistically have higher rates of heart disease than do other U.S. populations. A family history of heart disease also increases the risk.

### Altering Risk Factors

Many risk factors can be altered, however. Cigarette smoking; uncontrolled diabetes, high blood cholesterol or high blood pressure; obesity; and lack of regular exercise all increase the risk of heart disease. When you combine one risk factor, such as smoking, with others, such as high blood pressure and lack of regular exercise, the risk of heart attack is much greater.

It is never too late to take steps to control risk factors, thereby improving your chances for living a long and healthy life. It is important to know how to perform CPR and use an AED. However, since the chances of surviving cardiac arrest are poor, the best way to deal with cardiac arrest is to be aware of risk factors and take steps to help prevent it, including exercise and quitting smoking.

# UNIT 5

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## Medical Emergencies

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# 14

## MEDICAL EMERGENCIES

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### ▶ You Are the Emergency Medical Responder

You are the emergency medical responder (EMR) responding to a scene on a downtown street involving a male who appears to be about 60 years old. He is confused and appears agitated. Several bystanders state that they saw the man wandering aimlessly and that he appeared to be lost. Upon interviewing the patient, all you can learn is that his name is Earl. He does not seem to know where he is or where he is going. During your physical exam you note that the patient is sweating profusely but, other than his diminished level of consciousness (LOC), his vital signs are normal. More advanced medical personnel have been called. As an EMR, you want to provide proper care for the patient. What other information would help you to provide proper care? What should you do while waiting for advanced medical personnel?



## KEY TERMS

**Absence seizure:** A type of generalized seizure in which there are minimal or no movements; patient may appear to have a blank stare; also known as a petit mal or nonconvulsive seizure.

**Acute abdomen:** The sudden onset of severe abdominal pain that may be related to one of many medical conditions or a specific injury to the abdomen.

**Altered mental status:** A disturbance in a patient's level of consciousness (LOC) including confusion and delirium; causes include injury, infection, poison, drug abuse and fluid/electrolyte imbalance.

**Aneurysm:** An abnormal bulging of an artery due to weakness in the blood vessel; may occur in the aorta (main artery of the heart), brain, leg or other location.

**Aphasia:** A disorder characterized by difficulty or inability to produce or understand language, caused by injury to the areas of the brain that control language.

**Aura phase:** The first stage of a generalized seizure, during which the patient experiences perceptual disturbances, often visual or olfactory in nature.

**Blood glucose level (BGL):** The level of glucose circulating in the blood; measured using a glucometer.

**Clonic phase:** The third phase of a generalized seizure, during which the patient experiences the seizure itself.

**Complex partial seizure:** A type of partial seizure in which the patient may experience an altered mental status or be unresponsive.

**Diabetes mellitus:** A disease in which there are high levels of blood glucose due to defects in insulin production, insulin action or both.

**Diabetic coma:** A life-threatening complication of diabetes in which very high blood sugar causes the patient to become unconscious.

**Diabetic emergency:** A situation in which a person becomes ill because of an imbalance of insulin and sugar in the bloodstream.

**Diabetic ketoacidosis (DKA):** An accumulation of organic acids and ketones (waste products) in the blood; occurs when there is inadequate insulin and high blood sugar levels.

**Embolism:** A blockage in an artery or a vein caused by a blood clot or fragment of plaque that travels

through the blood vessels until it gets stuck, preventing blood flow.

**Epilepsy:** A brain disorder characterized by recurrent seizures.

**Fainting:** Temporary loss of consciousness; usually related to temporary insufficient blood flow to the brain; also known as syncope, "blacking out" or "passing out."

**FAST:** An acronym to help remember the symptoms of stroke; stands for **F**ace, **A**rm, **S**peech and **T**ime.

**Febrile seizures:** Seizure activity brought on by an excessively high fever in a young child or an infant.

**Generalized tonic-clonic seizures:** Seizures that affect most or all of the brain; types include absence (petit mal) seizures and grand mal seizures.

**Gestational diabetes:** A type of diabetes that occurs only during pregnancy.

**Glucometer:** A medical device that measures the concentration of glucose in the blood.

**Glucose:** A simple sugar that is the primary source of energy for the body's tissues.

**Grand mal seizure:** A type of generalized seizure; involves whole-body contractions with loss of consciousness.

**Hemodialysis:** A common method of treating advanced kidney failure in which blood is filtered outside the body to remove wastes and extra fluids.

**Hyperglycemia:** A condition in which too much sugar is in the bloodstream, resulting in higher than normal BGLs; also known as high blood glucose.

**Hyperkalemia:** Abnormally high levels of potassium in the blood; if extremely high, can cause cardiac arrest and death.

**Hypervolemia:** A condition in which there is an abnormal increase of fluid in the blood.

**Hypoglycemia:** A condition in which too little sugar is in the bloodstream, resulting in lower than normal BGLs; also known as low blood glucose.

**Hypovolemia:** A condition in which there is an abnormal decrease of fluid in the blood.

**Hypoxemia:** A condition in which there are decreased levels of oxygen in the blood; can disrupt the body's functioning and harm tissues; may be life threatening.

(Continued)



## KEY TERMS continued

**Insulin:** A hormone produced by the pancreas to help glucose move into the cells; in patients with diabetes, it may not be produced at all or may not be produced in sufficient amounts.

**Partial seizures:** Seizures that affect only part of the brain; may be simple or complex.

**Peritoneal dialysis:** A method of treatment for kidney failure in which waste products and extra fluid are drawn into a solution which has been injected into the abdominal cavity and are withdrawn through a catheter.

**Physical counter-pressure maneuver (PCM):** Physical maneuver used to hinder the progression from presyncope to syncope.

**Post-ictal phase:** The final phase of a generalized seizure, during which the patient becomes extremely fatigued.

**Presyncope:** The medical term for “faintness” or “feeling faint”; symptoms include light-headedness or dizziness, blurry vision and nausea, while signs include sweating and pallor.

**Seizure:** A disorder in the brain’s electrical activity, sometimes marked by loss of consciousness and often by uncontrollable muscle movement; also called a convulsion.

**Sepsis:** A life-threatening illness in which the body is overwhelmed by its response to infection; commonly referred to as blood poisoning.

**Shunt:** A surgically created passage between two natural body channels, such as an artery and a vein, to allow the flow of fluid.

**Simple partial seizures:** Seizures in which a specific body part experiences muscle contractions; does not affect memory or awareness.

**Status epilepticus:** An epileptic seizure (or repeated seizures) that lasts longer than 5 minutes without any sign of slowing down; should be considered life threatening and requires prompt advanced medical care.

**Stroke:** A disruption of blood flow to a part of the brain which may cause permanent damage to brain tissue.

**Syncope:** A term used to describe the loss of consciousness; also known as fainting.

**Thrombus:** A blood clot that forms in a blood vessel and remains there, slowing the flow of blood and depriving tissues of normal blood flow and oxygen.

**Tonic phase:** The second phase of a generalized seizure, during which the patient becomes unconscious and muscles become rigid.

**Transient ischemic attack (TIA):** A condition that produces stroke-like symptoms but causes no permanent damage; may be a precursor to a stroke.

**Type 1 diabetes:** A type of diabetes in which the pancreas does not produce insulin; formerly known as insulin-dependent diabetes or juvenile diabetes.

**Type 2 diabetes:** A type of diabetes in which insufficient insulin is produced or the insulin is not used efficiently; formerly known as non-insulin-dependent diabetes or adult-onset diabetes.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Identify a patient who has a general medical complaint.
- Describe the general care for a patient with a general medical complaint.
- Identify the signs and symptoms of an altered mental status.
- Describe the care for a patient who has an altered mental status.
- Describe the different types of seizures.
- Identify the signs and symptoms of seizures.
- Describe the care for a patient who has a seizure.
- Identify the signs and symptoms of a diabetic emergency.
- Describe the care for a patient who has a diabetic emergency.
- Identify the different causes of a stroke.
- Identify the signs and symptoms of stroke.
- Describe the care for a patient who has a stroke.
- Identify the signs and symptoms of abdominal pain.
- Describe the care for a patient who has abdominal pain.
- Describe the special considerations for a patient on hemodialysis.



## INTRODUCTION

As an emergency medical responder (EMR), you could someday face a situation involving an unidentifiable medical emergency. Therefore, you may feel uncertain about how to provide care.

When you face an emergency that is unclear, it is normal to feel indecisive. Yet, like any EMR, you will still want to provide care to the best of your ability. You do not have to “diagnose” or choose among possible problems to provide appropriate care. By following a few basic guidelines for care, you can provide appropriate care until more advanced medical personnel arrive. Because you know these guidelines for care, you can approach any medical emergency with confidence.

Medical emergencies can develop rapidly (acute conditions) or gradually (chronic conditions) and may persist for a long time. Sometimes, there are no warning signs or symptoms to alert you or the patient that something is about to happen. At other times, the only symptoms the patient complains of are feeling “ill” or feeling that “something is wrong.” Symptoms may also be atypical; older adults or those with diabetes, for example, may have a heart attack without experiencing chest pain.

Medical emergencies have a wide range of causes, including chronic problems from diseases such as heart disease and diabetes, allergies, seizures from illnesses such as epilepsy, or overexposure to heat or cold. There can be a variety of signs and symptoms, including sudden, unexplained altered mental status. A patient may complain of feeling light headed, dizzy or weak. Or, the patient may feel nauseated or may vomit. Breathing, pulse and skin characteristics may change. Ultimately, if a person looks and feels ill, there could be a medical emergency that requires immediate care.

## GENERAL MEDICAL COMPLAINTS

### Making the Assessment and Providing Care

The assessment and care of general medical complaints follow the same general guidelines:

- Size up the scene to ensure your own safety and the safety of others.
- Form a general impression of the patient as you approach to determine if there are any obvious life-threatening conditions such as severe, life-threatening bleeding and if the patient appears to be conscious or unconscious.
- Conduct your primary assessment to identify and correct any immediately life-threatening conditions.
- Conduct a SAMPLE history and secondary assessment to gather additional information, whenever possible.
- Obtain vital signs.
- Summon more advanced medical personnel.
- Help the patient rest comfortably.
- Keep the patient from getting chilled or overheated.
- Provide reassurance.
- Prevent further harm.
- Administer supplemental oxygen if it is indicated based on local protocols.

## ALTERED MENTAL STATUS

### Causes

Altered mental status can result from many causes. Some of these include the following:

- Fever
- Infection
- Poisoning or overdose, including substance abuse or misuse
- Blood sugar/endocrine emergencies
- Head injury
- Inadequate oxygenation or ventilation
- Any condition resulting in decreased blood flow or oxygen to the brain
- Cardiac emergencies
- Diabetic emergencies
- Shock
- Stroke
- Behavioral illness
- Seizures



### CRITICAL FACTS

Medical emergencies have a wide range of causes, including overexposure to heat or cold; chronic problems from diseases such as heart disease and diabetes; allergies; and seizures from illnesses such as epilepsy.

## Signs and Symptoms of Altered Mental Status

**Altered mental status** is one of the most common medical emergencies. It is often characterized by a sudden or gradual change in a person's level of consciousness (LOC), including drowsiness, confusion and partial or complete loss of consciousness.

## Providing Care for Altered Mental Status

To care for patients with altered mental status, complete primary and secondary assessments, vital signs and history as needed. Perform ongoing assessments as you provide care. Make sure the airway is open, and place an unresponsive patient who is breathing normally with no suspected head, neck, spinal, hip or pelvic injury in a side-lying recovery position following the assessment. If a head, neck, spinal, hip or pelvic injury is suspected, keep the patient in the supine (face-up) position. Have suction equipment available if needed. If the patient is conscious or becomes conscious, do *not* give anything to eat or drink. Eating or drinking can increase the chance of vomiting. If possible, attempt to get information from the patient, family members or bystanders. This is important, as a patient's condition may deteriorate rapidly in these situations, making conversation impossible. Any information you can obtain may help with the patient's treatment upon arrival at the hospital.

## Syncope

Sometimes altered mental status is caused by a temporary reduction of blood flow to the brain, such as occurs when blood collects or pools in the legs and lower body. When the brain is suddenly deprived of its normal blood flow, it momentarily shuts down. This condition is called **fainting**, or **syncope**.

Fainting can be triggered by an emotional shock, such as the sight of blood. It may be caused by pain, specific medical conditions like heart disease, standing for a long time or overexertion. Some people, such as pregnant women or older adults,

are more likely to faint when suddenly changing positions, for example when moving from lying down to standing up. Whenever changes inside the body momentarily reduce the blood flow to the brain, fainting may occur.

A person may faint with or without warning. Often, the person may first feel light headed or dizzy (**presyncope**). There may be signs of shock, such as pale or ashen, cool, moist skin. The person may have blurry vision, feel nauseated and complain of numbness or tingling in the fingers and toes. The person's breathing and pulse may become faster.

## Care for Presyncope and Syncope

A patient with presyncope will feel as if they are going to faint. To prevent a syncopal episode (fainting), help the patient lie down. While they are lying down, you should monitor their breathing and level of consciousness. Have the patient perform a **physical counter-pressure maneuver (PCM)**:

- Grip one hand at the fingers with the other and try to pull them apart without letting go. They should hold the grip for as long as they can or until their symptoms disappear.
- Hold a rubber ball or similar object in their writing hand and then squeeze the object for as long as they can or until their symptoms disappear.
- Cross one leg over the other and squeeze them together tightly. Hold this position for as long as they can or until their symptoms disappear.

Be sure to instruct the patient to avoid holding their breath while performing counter-pressure maneuvers. An easy way to ensure this is to have the patient talk while performing the maneuver. Physical counter-pressure maneuvers help raise the blood pressure through skeletal muscle contraction and, in many cases, will resolve symptoms of faintness. If a person with faintness feels worse with PCM, simply discontinue the maneuver. If a person complains of chest pain, they should be provided care for chest pain, not for presyncope.



### CRITICAL FACTS

Altered mental status is a common medical emergency often characterized by a sudden or gradual change in a person's LOC, including drowsiness, confusion and partial or complete loss of consciousness.

If a patient suffers a syncopal episode (faints), it often resolves itself when the patient is moved from a standing or sitting position to a lying-down position, as normal circulation to the brain often resumes. The patient usually regains consciousness within a minute. Syncope alone does not usually harm the patient, but an injury may occur from falling. Although a fainting patient usually recovers quickly, you may not be able to determine if the fainting is associated with a more serious medical condition. For this reason, more advanced medical care is indicated and the EMS system should be activated.

### **Pediatric Considerations**

#### **Altered Mental Status in Pediatrics**

Children who are experiencing altered mental status may exhibit a change in behavior, personality or responsiveness beyond what is expected at their age. These children may exhibit anxiety, agitation, aggression and/or combativeness. Alternatively, they may be difficult to rouse, sleepy or even unresponsive. It is not unusual for altered mental status to result in decreased muscle tone.

Common causes of altered mental status requiring immediate medical attention include respiratory failure, deficiency in oxygen concentration in arterial blood (**hypoxemia**), shock, hypoglycemia, brain injury (including shaken baby syndrome), seizures, poisoning, intentional overdose, **sepsis**, meningitis, hyperthermia and hypothermia.

Left untreated, altered mental status can lead to life-threatening problems, including inefficient respiration, hypoxemia, airway obstruction and respiratory failure. For care of children with altered mental status, consider the possibility of a spinal injury if the cause is not clear or trauma is suspected. Treat any breathing emergency and care for any other injuries or conditions found. Obtain more advanced medical care and provide ongoing assessment and care.

## **SEIZURES**

When the normal functions of the brain are disrupted by injury, disease, fever, infection, metabolic disturbances or conditions causing a decreased oxygen level, a **seizure** may occur. The seizure is a result of abnormal electrical activity in the brain and causes temporary involuntary changes in body movement, function, sensation, awareness or behavior.

### **Types of Seizures**

#### **Generalized Seizures**

**Generalized tonic-clonic seizures**, also called **grand mal seizures**, are the most well-known type of seizure. They involve both hemispheres (halves) of the brain and usually result in loss of consciousness. The seizure activity is known as tonic-clonic, which refers to the initial rigidity (tonic phase) followed by rhythmic muscle contractions (clonic phase), or convulsions. This type of seizure rarely lasts for more than a few minutes.

#### **Signs and Symptoms of Generalized Seizures**

Before a generalized seizure occurs, the patient may experience an unusual sensation or feeling called an aura. An aura can include a strange sound, taste, smell or an urgent need to get to safety. If the patient recognizes the aura, there may be time to warn bystanders and to sit or lie down before the seizure occurs.

Generalized seizures usually last 1 to 3 minutes and can produce a wide range of signs and symptoms. When a seizure occurs, the patient loses consciousness and can fall, causing injury. The patient may become rigid, and then experience sudden, uncontrollable muscular contractions (convulsions), lasting several minutes. Breathing may become irregular and even stop temporarily. The patient may drool and the eyes may roll upward. As the seizure subsides and the muscles relax, the patient may have a loss of bladder or bowel control.



#### **CRITICAL FACTS**

A seizure is temporary abnormal electrical activity in the brain caused by injury, disease, fever, infection, metabolic disturbances or conditions that decrease oxygen levels.

Generalized seizures, also called grand mal seizures or tonic-clonic seizures, are the most easily recognized type of seizure.

The stages of most generalized seizures are as follows:

1. **Aura phase**—patient may sense something unusual (not all patients will experience an aura)
2. **Tonic phase**—unconsciousness then muscle rigidity
3. **Clonic phase**—uncontrollable muscular contractions (convulsions)
4. **Post-ictal phase**—diminished responsiveness with gradual recovery and confusion (patient may feel confused and want to sleep)

## Partial Seizures

**Partial seizures** may be simple or complex. They usually involve only a very small area of one hemisphere of the brain. Partial seizures are the most common type of seizure experienced by people with epilepsy. Partial seizures can spread and become a generalized seizure. In **simple partial seizures**, the patient usually remains aware. **Complex partial seizures** usually last for 1 to 2 minutes, though they may last longer and awareness is either impaired or lost while the patient remains conscious.

### Signs and Symptoms of Partial Seizures

With simple partial seizures, the patient usually remains aware, but someone experiencing a complex partial seizure experiences altered mental status or unresponsiveness.

In simple partial seizures, there may be involuntary, muscular contractions in one area of the body, for example the arm, leg or face. Some people cannot speak or move during a simple partial seizure, although they may remember everything that occurred. Simple partial seizures may produce a feeling of fear or a sense that something bad is about to happen. Simple partial seizures can also produce odd sensations such as strange smells or hearing voices. In rare instances, feelings of anger and rage or joy and happiness can be brought on by the seizure. Auras are a form of simple partial seizure.

Complex partial seizures often begin with a blank stare followed by random movements such as smacking the lips or chewing. The patient appears dazed, the movements are clumsy and the patient's activities lack direction. They may be unable to follow directions or answer questions. This type of seizure usually lasts for only a few minutes but it may last longer. The patient cannot remember what happened after the seizure is over, and may be confused. This is called the post-ictal phase.

## Absence (Petit Mal) Seizures

Individuals may also experience an **absence seizure**, also known as a petit mal seizure. These are most common in children. During an absence seizure, there is brief, sudden loss of awareness or conscious activity. There may be minimal or no movement, and the person may appear to have a blank stare. Most often these seizures last only a few seconds.

### Signs and Symptoms of Absence Seizures

Absence seizures cause the person to experience loss of awareness for short periods that may be mistaken for daydreaming. This type of seizure may also be referred to as a nonconvulsive seizure, because the body remains relatively still during the episode, though eye fluttering and chewing movements may be seen.

## Febrile Seizures

Young children and infants may be at risk for **febrile seizures**, which are seizures brought on by a rapid increase in body temperature. They are most common in children under the age of 5.

Febrile seizures are often caused by ear, throat or digestive system infections and are most likely to occur when a child or an infant runs a rectal temperature of over 102° F (38.9° C). An individual experiencing a febrile seizure may experience some or all of the following symptoms:

- Sudden rise in body temperature
- Change in LOC
- Rhythmic jerking of the head and limbs



### CRITICAL FACTS

Young children and infants may be at risk for febrile seizures, which are seizures brought on by a rapid increase in body temperature.

Protecting the patient from injury and managing the airway are your priorities when caring for a patient having a seizure.

- Loss of bladder or bowel control
- Confusion
- Drowsiness
- Crying out
- Becoming rigid
- Holding the breath
- Rolling the eyes upward

## Epilepsy

**Epilepsy** is a common neurological disorder, estimated to affect approximately 3 million people in the United States alone. Epilepsy is not a specific disease but a term used to describe a group of disorders in which the individual experiences recurrent seizures as the main symptom. In about one-third of all cases, seizures occur as a result of a brain abnormality or neurological disorder, but in two-thirds there is no known cause.

The risk of having epilepsy for young people (up to the age of 20) is approximately 1 percent, with the greatest likelihood occurring during the first year of life. People aged 20 to 55 may also develop epilepsy but have a somewhat lower risk. The risk increases again after the age of 65 and, in fact, the highest rate of new epilepsy diagnoses are in this age group. The prevalence of epilepsy, or the number of individuals suffering with it at any time, is estimated to be approximately 5 to 8 in every 1000 people. By age 75, approximately 3 percent of people will have been diagnosed with epilepsy.

People of any age can be affected by epilepsy. Patients who have epilepsy often can control the seizures with medication. Those with difficult-to-control seizures may also be treated with surgical resection, which can be curative, or with implanted devices, such as the vagus nerve stimulator, that help reduce their seizure frequency. While some patients require lifelong medical therapy, sometimes medication may be reduced or even eliminated over time. Some childhood epilepsies may resolve with age.

## Providing Care for Seizures

Seeing someone have a seizure may be intimidating, but you can easily care for the patient. The patient cannot control any muscular contractions that may occur and it is important to allow the seizure to run its course, because attempting to stop it or restrain the patient can cause musculoskeletal injuries.

Protecting the patient from injury and managing the airway are your priorities when caring for a patient

having a seizure. To help avoid injury, you should move nearby objects, such as furniture, away from the patient. People having seizures rarely bite the tongue or cheeks with enough force to cause any significant bleeding. Do *not* place anything in the mouth to prevent this type of injury. Foreign bodies in the mouth may cause airway obstruction. Do *not* put fingers into the mouth of an actively seizing patient to clear the airway. During the seizure, position the uninjured patient on their side in a recovery position, if it is possible and safe to do, so that fluids (saliva, blood, vomit) can drain from the mouth. Keep the patient in a side-lying recovery position until they regain consciousness after the post-ictal phase. It is important to have a suction device available for all seizure patients.

In many cases, the seizure will be over by the time you arrive. In this case, the patient may be drowsy and disoriented; this is the post-ictal phase. Check to see if the patient was injured during the seizure. Offer comfort and reassurance, especially if the seizure occurred in public, as the patient may feel embarrassed and self-conscious. If this is the case, keep bystanders well back to provide maximum privacy, and stay with the patient until they are fully conscious and aware of the surroundings.

Care for a child or an infant who experiences a febrile seizure is similar to the care for any other patient experiencing a seizure. Immediately after a febrile seizure, cool the body by removing excess clothing. Do *not* rapidly cool the patient with cold water as this could bring on other complications. Contact a healthcare provider before administering any medication, such as acetaminophen, to control fever. Do *not* give aspirin to a feverish child under 18 years of age, as this has been linked to Reye's syndrome, an illness that affects the brain and other internal organs.

## When to Call for More Advanced Medical Personnel

The patient will usually recover from a seizure in a few minutes. If you discover the patient has a medical history of seizures that is medically controlled, there may be no further need for medical attention. However, in the following cases, more advanced medical care and transportation to a medical facility by ambulance should be provided:

- The seizure lasts more than 5 minutes or a seizure is followed by another seizure without a period of consciousness (status epilepticus).
- This is the patient's first seizure.
- The patient appears to be injured.



- You are uncertain about the cause of the seizure.
- The patient is pregnant.
- The patient is known to have diabetes.
- The patient is a child or an infant.
- The seizure takes place in water.
- The patient fails to regain consciousness after the seizure.
- The patient is a young child or an infant who experienced a febrile seizure brought on by a high fever.
- The patient is an older adult and could have suffered a stroke.

**Status epilepticus** is an epileptic seizure (or repeated seizures) that lasts longer than 5 minutes or a seizure that is followed by another seizure without the patient regaining consciousness. A status epilepticus seizure is a true medical emergency that may be fatal. If you suspect the patient is experiencing this type of seizure, call for more advanced medical personnel immediately. During and after the seizure, place the patient on the side and suction the airway, if possible. If the patient is having difficulty breathing, administer ventilations with a bag-valve-mask (BVM) resuscitator, along with supplemental oxygen based on local protocols.

## DIABETIC EMERGENCIES

### Incidence

**Diabetes mellitus** is one of the leading causes of death and disability in the United States today. In 2016, 29 million Americans were living with diabetes and 86 million had prediabetes, a serious health condition that increases a person's risk of type 2 diabetes and other chronic diseases.

Diabetes contributes to other conditions, including blindness, kidney disease, heart disease, periodontal (gum) disease, stroke and amputations.

### Definition of Terms

#### Diabetes

There are two major types of diabetes. **Type 1 diabetes**, formerly known as insulin-dependent diabetes or juvenile diabetes, causes the body to

produce little or no insulin. Most people who have Type 1 diabetes have to inject insulin into their bodies daily.

In **type 2 diabetes**, formerly known as non-insulin-dependent diabetes or adult-onset diabetes, the body produces insulin, but either the cells do not use the insulin effectively or not enough insulin is produced. This type of diabetes is more common than type 1 diabetes. Most people with type 2 diabetes can regulate their **blood glucose level (BGL)** sufficiently through diet, and sometimes through oral medications, without insulin injections.

People with diabetes must carefully monitor their BGL, diet and amount of exercise. People with diabetes must also regulate their use of insulin. When diet and exercise are not controlled, either of two problems can occur: too much or too little sugar in the body. This imbalance of sugar and insulin in the blood causes illness.

Some women develop diabetes in the late stages of pregnancy; this form usually goes away after the baby is born. This type is called **gestational diabetes** and is caused by the hormones of pregnancy or a shortage of insulin. Women who have had this condition have an increased likelihood of developing type 2 diabetes later in life.

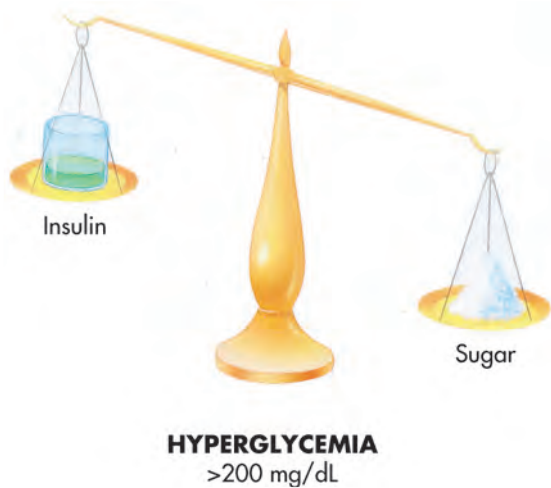
### High Blood Glucose

When the insulin level in the body is too low, the sugar level in the blood is high. This condition is called **hyperglycemia** (Fig. 14-1). Sugar is present in the blood but cannot be transported from the blood into the cells without insulin, causing body cells to become starved for sugar. The body attempts to meet its need for energy by using other stored food and energy sources, such as fats. However, converting fat to energy is less efficient, produces waste products and increases the acidity level in the blood, causing a condition known as **diabetic ketoacidosis (DKA)**. As this occurs, the person becomes ill. The patient may have flushed, hot, dry skin and a sweet breath odor that can be mistaken for the smell of alcohol. The patient may also appear restless or agitated, have abdominal pain or be thirsty. If this condition is not treated promptly, **diabetic coma**, a

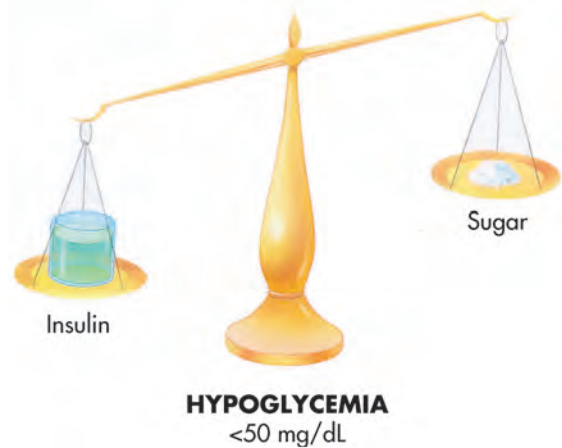


#### CRITICAL FACTS

Type 1 diabetes is characterized by the body's inability to produce insulin. Type 2 diabetes is characterized by the body's inability to use insulin effectively. Type 2 diabetes is more common.



**Fig. 14-1:** A low insulin level results in high blood sugar, called hyperglycemia. It can be life threatening if not quickly treated.



**Fig. 14-2:** A high insulin level results in low blood sugar, called hypoglycemia. Like hyperglycemia, it can be life threatening if not quickly treated.

life-threatening emergency in which very high blood sugar causes the patient to become unconscious, can occur.

### Low Blood Glucose

When the insulin level in the body is too high, the patient has a low sugar level, known as **hypoglycemia** (Fig. 14-2). The blood sugar level can become too low if the person with diabetes:

- Takes too much insulin.
- Fails to eat adequately.
- Over-exercises and burns off sugar faster than normal.
- Experiences great emotional stress.

In this situation, the small amount of sugar is used up rapidly, so not enough sugar is available for the brain to function properly. If left untreated, even for a short time, hypoglycemia from an insulin reaction can cause brain damage or death. Call for more advanced medical care immediately. This condition is also known as insulin shock.

### Role of Glucose

To function normally, body cells need sugar as an energy source. Through the digestive process, the body breaks down food into simple sugars, such as **glucose**, which are absorbed into the

bloodstream. However, sugar cannot pass freely from the blood into the body cells. **Insulin**, a hormone produced in the pancreas, is needed for sugar to pass into the cells. Without a proper balance of sugar and insulin in the blood, the cells will starve and the body will not function properly (Fig. 14-3).

Maintaining normal BGLs reduces the risk of eye, kidney, heart and nerve problems. Many people with diabetes have blood glucose monitors, called **glucometers**, that can be used to check their BGL at home. Many hypoglycemic and hyperglycemic episodes are now managed at home because of the rapid information these monitors provide.

### Signs and Symptoms of Diabetic Emergencies

Although hypoglycemia and hyperglycemia are different conditions, the major signs and symptoms are similar. These include:

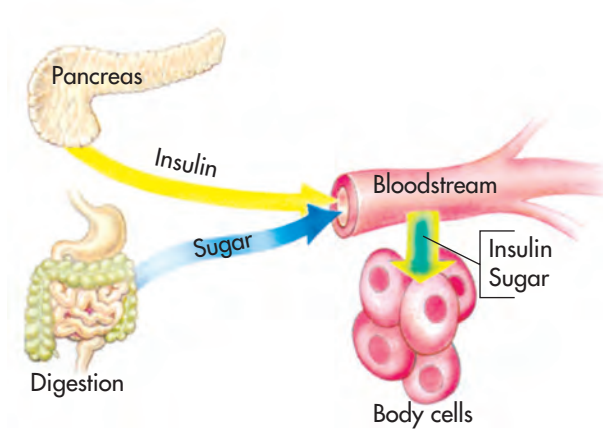
- Changes in LOC, including dizziness, drowsiness and confusion.
- Irregular breathing.
- Abnormal pulse (rapid or weak).
- Feeling and looking ill.
- Abnormal skin characteristics.



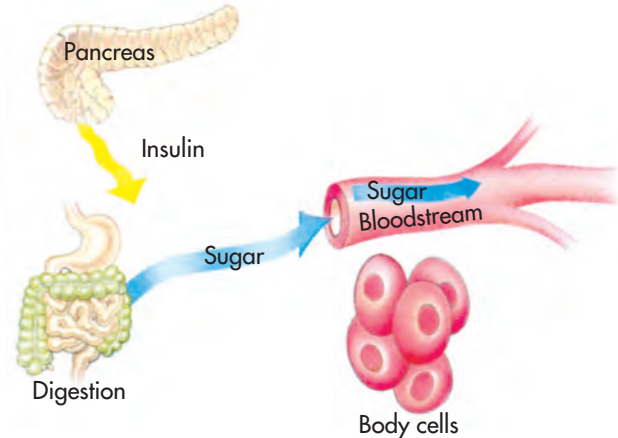
#### CRITICAL FACTS

Hypoglycemia and hyperglycemia have similar signs and symptoms, including changes in LOC, irregular breathing, abnormal pulse, feeling and looking ill and abnormal skin characteristics.

## NORMAL



## DIABETIC



**Fig. 14-3:** The hormone insulin enables sugar in the bloodstream or stored forms of sugar to be used by the body cells for energy.

## Providing Care for Diabetic Emergencies

To care for diabetic emergencies, first perform a primary assessment and care for any life-threatening conditions. If the patient is conscious, conduct a physical exam and SAMPLE history, looking for anything visibly wrong. Ask if the patient has diabetes, and look for a medical identification tag. If the patient is known to have diabetes and exhibits the signs and symptoms previously stated, then suspect a **diabetic emergency**.

If the patient is awake, is able to follow simple commands and can safely swallow, give 15 to 20 grams of sugar, preferably in the form of glucose tablets (Fig. 14-4). If glucose tablets are not available, other forms of dietary sugars have been found to be an effective substitute, including candies containing glucose or sucrose that can be chewed, jelly beans, orange juice, fructose-based fruit strips and whole milk. If none of these options are available, the patient can be given 4 to 5 teaspoons of table sugar dissolved in a glass of water.

Sometimes, patients with diabetes will be able to tell you what is wrong and will ask for something with sugar in it. If the patient's problem is low sugar (hypoglycemia), the sugar you give will help quickly. If the patient already has too much sugar (hyperglycemia), the excess 15 to 20 grams sugar will do no immediate harm.

Do not try to assist the patient by administering insulin. Only give something by mouth if the patient is fully conscious. If the patient is unconscious, monitor the patient's condition, keep the patient



**Fig. 14-4:** Commercial oral glucose tablets are preferred for fast administration of glucose to a hypoglycemic patient who is awake and can safely swallow.

from getting chilled or overheated, summon more advanced medical personnel and administer supplemental oxygen based on local protocols. If the patient is conscious but does not feel better within approximately 10 to 15 minutes after taking sugar, summon more advanced medical personnel and consider giving the patient another 15 to 20 grams of sugar based on local protocols.



## STROKE

A **stroke**, also called a cerebrovascular accident (CVA), is a disruption of blood flow to a part of the brain, which may cause permanent damage to brain tissue if not appropriately treated within several hours.

### Causes

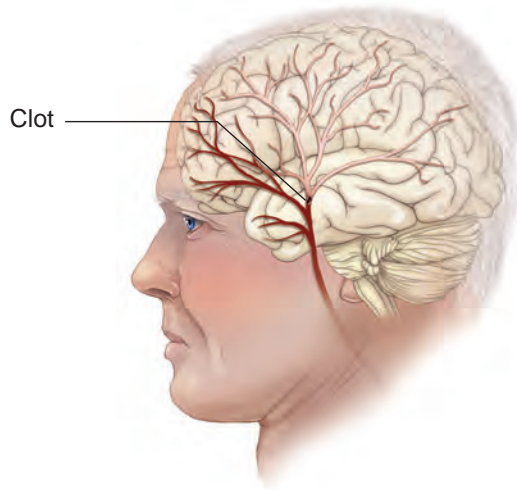
Most commonly, a stroke is caused by a blood clot, called a **thrombus** or **embolism**, that forms or lodges in the arteries supplying blood to the brain (Fig. 14-5). Fat deposits lining an artery (atherosclerosis) may also cause a stroke known as an ischemic stroke.

Another less common cause of stroke is bleeding from a ruptured artery in the brain. Known as a hemorrhagic stroke, this condition is brought on by high blood pressure or an **aneurysm**—a weak area in an artery wall that balloons out and can rupture (Fig. 14-6). Less commonly, a tumor or swelling from a head injury may cause a stroke by directly compressing an artery or brain tissue.

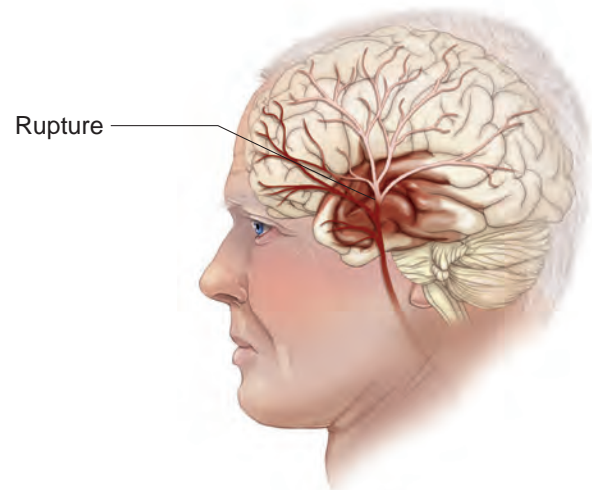
A **transient ischemic attack (TIA)**, often referred to as a “mini-stroke,” is a temporary episode that, like a stroke, is caused by reduced blood flow to a part of the brain. Unlike a stroke, the signs and symptoms of a TIA disappear within a few minutes or hours of its onset. If symptoms persist after 24 hours, the event is not considered a TIA but a stroke.

Although the indicators of TIA disappear quickly, the patient is not out of danger. In fact, someone who experiences a TIA has a nearly 10 times greater chance of having a stroke in the future than does someone who has not experienced a TIA.

The risk factors for stroke and TIA are similar to those for heart disease. Some risk factors are beyond the patient's control, such as age, gender or family history of stroke, TIA, diabetes or heart disease. Others can be controlled, such as blood pressure, smoking, diet and exercise. Stroke is common in the older adult population, but a person of any age, including children, can have a stroke.



**Fig. 14-5:** Strokes are most commonly caused by a blood clot in the arteries that supply blood to the brain.



**Fig. 14-6:** A less common cause of stroke is bleeding from a ruptured artery in the brain.



### CRITICAL FACTS

Two causes of stroke are blood clots that form or lodge in arteries supplying blood to the brain and arteries in the brain that rupture and bleed. Blood clots are the most common cause of stroke.

A TIA, sometimes called a “mini-stroke,” is caused by reduced blood flow to a part of the brain, but unlike a stroke its signs and symptoms disappear within a few minutes or hours of onset.

## Sudden Signs and Symptoms of Stroke

As with other sudden illnesses, looking or feeling ill or displaying abnormal behavior are common signs of a stroke or TIA. Other specific signs and symptoms of stroke come on suddenly, including:

- Facial droop or drooling (Fig. 14-7, A).
- Weakness or numbness of the face, arm or leg, often on one side of the body (Fig. 14-7, B).
- Difficulty with speech. The patient may have trouble talking, getting words out or being understood when speaking and may have trouble understanding (**aphasia**).
- Loss of vision or disturbed (blurred or dim) vision in one or both eyes; pupils of the eyes may be of unequal size.



**Fig. 14-7, A–B:** (A) Sudden facial droop or drooling and (B) weakness or numbness of an arm or leg, often on one side of the body, are signs and symptoms of a stroke.

- Sudden severe headache (unexplained and often described as the worst headache ever).
- Dizziness, confusion, agitation, loss of consciousness or other severe altered mental status.
- Loss of balance or coordination, trouble walking or ringing in the ears.
- Incontinence.

### Stroke Alert Criteria

Two common stroke assessment scales used in the prehospital setting are the Cincinnati Prehospital Stroke Scale and the Los Angeles Prehospital Stroke Screen (LAPSS), which assess facial droop, arm drift and speech. Both scales should be included in your assessment of the stroke patient and reported to the medical facility. A Glasgow Coma Score (GCS) also should be obtained on the patient (see Chapter 7 for further information). Collecting and reporting this information will help ensure the required management of the stroke patient.

### FAST

The **FAST** mnemonic is based on the Cincinnati Prehospital Stroke Scale, which was originally developed for EMS personnel in 1997. The scale was designed to help paramedics identify strokes in the field so that the emergency department can be prepared before the patient arrives. The FAST method for public awareness has been in use in the community of Cincinnati, Ohio, since 1999, and has since been used in several other variations of the message.

FAST stands for the following:

- **Face:** Ask the patient to smile. Does one side of the face droop?
- **Arm:** Ask the patient to raise both arms. Does one arm drift downward?
- **Speech:** Ask the patient to repeat a simple sentence such as, “The sky is blue.” Are the words slurred? Can the patient repeat the sentence correctly?
- **Time:** Try to determine the time of onset of symptoms. If the patient shows any one sign or symptom of a stroke, time is critical. Immediate transport of the patient to a stroke-capable medical facility is necessary.



#### CRITICAL FACTS

As the common mnemonic for stroke identification, FAST stands for **F**ace, **A**rm, **S**peech and **T**ime. Facial drooping, arm weakness and slurred speech are distinctive symptoms, and timely advanced medical care is critical if any one sign or symptom is present.

## LAPSS

The LAPSS mnemonic is another common one-page tool designed to help prehospital personnel rapidly identify strokes in the field.

### Providing Care for Stroke

If the patient is unresponsive, ensure that their airway is open, and care for any life-threatening conditions. If fluid or vomit is in the unresponsive patient's mouth, position the patient in a side-lying recovery position to allow any fluids to drain out of the mouth. You may have to remove some fluids or vomit from the patient's mouth using a finger or suctioning equipment.

Stay with the patient and monitor their condition. If the patient is conscious, check for non-life-threatening conditions. A stroke can make the patient fearful and anxious due to not understanding what has happened. Offer comfort and reassurance and have the patient rest in a comfortable position. Do *not* give anything to eat or drink. Although a stroke patient may find it difficult to speak, the patient may understand what you say. If the patient is unable to speak, you may have to use nonverbal forms of communication, such as hand squeezing or eye blinking (once for yes, twice for no) and communicate in ways that require a yes-or-no response.

In the past, a stroke almost always caused irreversible brain damage. Today, stroke management with new medications and medical procedures can limit or reduce the damage caused by stroke. Many of these new treatments are time sensitive; therefore, you should immediately call for more advanced medical personnel to get the best care for the patient. It is very important to interview the patient, family members and bystanders to determine the time of the onset of symptoms or the time the patient was last known to be well, and to transport the patient to an appropriate stroke-capable medical facility immediately.

## ABDOMINAL PAIN

Abdominal pain is felt between the chest and groin, which is commonly referred to as the stomach region or belly. There are many organs in the abdomen, so when a patient is suffering from abdominal pain it can originate from any one of them. These include digestive organs such as the inferior end of the esophagus, stomach, small and large intestines, liver, gallbladder, pancreas, aorta, appendix, kidneys and spleen. Abdominal emergencies can be life threatening and require immediate care to prevent shock, so they should always be treated seriously. A sudden onset of abdominal pain is called **acute abdomen**.

### Causes

Abdominal pain can be difficult to pinpoint, as the pain may start from somewhere else and could be a result of any number of generalized infections including the flu or strep throat.

The intensity of the pain does not always reflect the seriousness of the condition. Severe abdominal pain can be from mild conditions, such as intestinal gas, whereas relatively mild pain or no pain may be present with life-threatening conditions such as an ectopic pregnancy or appendicitis.

### Signs and Symptoms of Abdominal Pain

If you are called to see a patient who is experiencing abdominal pain, assume the pain is serious, as the patient or family members were concerned enough to seek emergency medical attention. Patients suffering from abdominal pain may show the following signs and symptoms:

- Colicky pain or cramps that come in waves
- Abdominal tenderness, local or diffuse (spread out)
- Guarded position



#### CRITICAL FACTS

Modern stroke management with medications and medical procedures can limit the damage caused by stroke, but timely administration is crucial to reduce the effects of stroke to the brain.

- Anxiety
- A reluctance to move, for fear of pain
- Loss of appetite
- Nausea or vomiting
- Fever
- Rigid, tense or distended stomach
- Signs of shock
- Vomiting blood with a red or brownish appearance
- Blood in the stool, appearing red or black
- Rapid pulse
- Blood pressure changes

When conducting an assessment, monitor the patient's movements. Take note if the patient is restless or quiet and if the patient feels pain when moving. Check to see if the abdomen is distended and, if possible, confirm with the patient whether the appearance of the stomach is normal. See if the patient is able to relax the abdomen, and palpate the 4 quadrants of the

abdomen, using the navel as the center point, to determine if it is rigid or soft (Fig. 14-8). Examine the area the patient indicates as the location of the pain *last*. Do *not* overpalpate, as this can aggravate the condition as well as cause more pain.

### Providing Care for Abdominal Pain

First, ensure there is no severe, life-threatening bleeding and that the patient has an open airway. Call for transport to a medical facility. In the case of abdominal pain, it is important to watch for signs of potential aspiration due to vomiting. In cases in which the patient is experiencing nausea, place the patient on their side if it is not too painful. Do *not* give the patient food, water or medication. Watch for signs of shock. If vital signs and other observations indicate the patient is in shock, place the patient on their back, maintain normal body temperature and administer supplemental oxygen based on local protocols.



**Fig. 14-8:** When assessing abdominal pain in a patient, palpate the stomach to determine if it is rigid or soft.



#### **CRITICAL FACTS**

The source and causes of abdominal pain can be difficult to pinpoint, and intensity of abdominal pain does not always reflect the seriousness of the condition.



## Pediatric Considerations

### Abdominal Pain

Abdominal pain in children can indicate a vast range of conditions. A sudden or progressive onset of pain, excessive vomiting or diarrhea, blood noted in vomit or stool, abdominal distention, high blood sugar, altered mental status and abnormal vital signs are all signs the child could be suffering from a serious condition or illness. Vomiting and diarrhea in children are significant symptoms as they may cause dehydration, which can lead to shock.

To assess a child complaining of abdominal pain, take the following steps:

- Obtain a general impression of the child's appearance, breathing and circulation to determine urgency.
- Evaluate the child's mental status, airway, adequacy of breathing and circulation.
- Take the child's history and perform a hands-on physical examination, noting any injury, hemorrhage, discoloration, distention, rigidity, guarding or tenderness within the four abdominal quadrants.
- If a life-threatening condition is noted, provide immediate treatment before continuing.

Children of different ages tend to have different causes of pain. Causes in an infant can include colic, allergy to cow's milk, reflux esophagitis, volvulus (bowel obstruction) or Hirschsprung's Disease (congenital disease affecting the large intestine). In school-age children, the most frequent cause of abdominal pain is gastroenteritis or "stomach flu," which may result in significant fluid loss. Also common is the ingestion of toxic substances or food poisoning.

In adolescents, growth, development and fertility issues can cause problems such as testicular torsion (twisting of the testicles), ovarian torsion, ovarian cysts, pelvic inflammatory disease, ectopic pregnancy (pregnancy that occurs outside the womb), inflammatory bowel disease, ulcerative colitis, Crohn's disease, DKA, pneumonia and sickle cell anemia.

## Considerations for Older Adults

### Abdominal Pain

Understanding that older adult patients may experience vague symptoms and have non-specific findings on examination is important. Keep in mind that abdominal pain may actually be caused by a heart attack or other medical conditions. Many older adult patients may have much less severe pain than expected for a particular illness or disease, which can lead to patients with serious conditions being misdiagnosed with less serious conditions such as gastroenteritis or constipation. Vomiting and diarrhea are significant symptoms in older adults, as they can cause dehydration and shock.

Causes of abdominal pain in older adults may include biliary tract disease, appendicitis, diverticulitis, mesenteric ischemia (reduced blood flow to the small intestines), bowel obstruction, abdominal aortic aneurysm, peptic ulcer disease, malignancy and gastroenteritis.

## Common Abdominal Emergencies

Many different conditions can cause abdominal pain, including inflammation of the appendix (appendicitis), bowel obstruction, inflammation of the gallbladder, abdominal aortic aneurysm, diverticular disease, shingles, food allergies, food poisoning, gastroenteritis and others. Consider the situation an emergency when the abdominal pain restricts activity.

## GASTROINTESTINAL BLEEDING

There are multiple causes of gastrointestinal bleeding, and these tend to be classified as either upper or lower, depending on the location of the problem within the gastrointestinal tract. Bleeding in the upper gastrointestinal tract originates in the esophagus, stomach or duodenum (first part of the intestine) and may include such problems as peptic ulcers, gastritis, stomach cancer or ingestion of caustic poisons. Bleeding in the lower gastrointestinal tract originates in the small intestine, large intestine, rectum or anus, and includes diverticular disease, polyps, hemorrhoids and anal fissures, as well as cancer and inflammatory bowel disease.

A patient with gastrointestinal bleeding may experience vomiting of blood, bloody bowel movements or black, tarry stools. Symptoms that may accompany the bleeding include fatigue, weakness, abdominal pain, pale appearance and shortness of breath.

Severe gastrointestinal bleeding can have a significant impact on vital signs—for example, causing blood pressure to drop sharply and heart rate to increase. Summon more advanced medical personnel, as the patient may require a blood transfusion or surgery.

## HEMODIALYSIS

People with advanced renal failure, or kidney failure, often need dialysis to filter waste products from the blood using a special filtering solution. There are two types of dialysis: **peritoneal dialysis**, which injects a solution through the abdominal wall and then withdraws it after a period of time, and **hemodialysis**, which uses a machine to clean waste products from the blood. Dialysis is often used on patients with renal disease while they are waiting for a kidney transplant.

Complications of dialysis include hypotension (abnormally low blood pressure), disequilibrium syndrome (a reduction of the blood urea level relative to the levels found in brain tissues), hemorrhage (abdominal, gastrointestinal [GI] and intracranial bleeding), introduction of an air embolus or other foreign body into the patient's circulatory system due to equipment malfunction, and complications caused by temporarily stopping a patient's medications during the dialysis process.

### Special Considerations for Hemodialysis Patients

The following details should be considered when taking a history and physical exam with a patient who has renal failure:

- A comprehensive history should include information about past dialysis and complications; recent sodium, potassium and fluid intake; information about the current dialysis session; and the patient's dry weight

and how much fluid was removed before the session was terminated.

- The general physical assessment should include fluid status, mental status, cardiac rhythm and **shunt** location.

**NOTE:** Shunts in the arm are common in long-term hemodialysis patients. If an active shunt is located in the patient's arm, do *not* take blood pressure using that arm. Old, nonfunctional shunts are not uncommon, and blood pressure can be taken on an arm with a nonfunctional shunt. Ask the patient about active and nonfunctional shunt locations when taking a history. Shunts can also be potential sites of infection and/or blockage.

- Pay attention for associated medical problems such as arrhythmias, internal bleeding, hypoglycemia, altered mental status and seizures.
- Be aware that, after dialysis, patients may have **hypovolemia** (reduced blood volume) and exhibit cold, clammy skin; poor skin turgor (elasticity); tachycardia; and hypotension. Delayed dialysis patients will have **hypervolemia** (increased blood volume) and may have abnormal lung sounds such as crackles, generalized edema, hypertension or jugular venous distension.
- Be alert for altered mental status.
- Be sure to assess cardiac rhythm.

### Life-Threatening Emergencies Associated with Dialysis Patients

Patients on dialysis can experience several types of complications, for example uremia (accumulation of urinary waste products in the blood), fluid overload (reduction in the body's ability to excrete fluid through urine), anemia (hemoglobin deficiency), hypertension, **hyperkalemia** (excess potassium in the blood) and coronary artery disease. Emergencies also can occur as complications of the dialysis itself, including hypotension, disequilibrium syndrome, hemorrhage, equipment malfunction (e.g., introducing an air embolus or other foreign body into the circulatory system) or complications from being temporarily removed from medications.



#### CRITICAL FACTS

People with advanced renal failure, or kidney failure, often need dialysis to filter waste products from the blood using a special filtering solution.

## PUTTING IT ALL TOGETHER

As is true of all emergencies, a medical emergency can strike anyone, at any time. The signs and symptoms for each of the medical emergencies described in this chapter, such as changes in LOC, sweating, confusion, weakness and appearing ill, will indicate the necessary initial care you should provide.

In most cases involving a medical emergency, your biggest challenge is that you may not know the cause. In the case of a diabetic emergency, seizure, stroke and fainting, the causes may be easier to ascertain. However, you can provide proper

care without knowing the exact cause, allowing the patient to remain as comfortable and safe as possible until arrival at a medical facility. You can also recognize the dangers and complications of dealing with those with diabetes or renal failure. And you have learned the importance of age considerations in many conditions, such as abdominal pain and seizure.

Performing a proper assessment and following the general guidelines of care for any emergency will help prevent the condition from becoming worse. While it is not your role to diagnose the problem, it is your job to provide initial care to the patient until a proper diagnosis can be made.

## ▶ You Are the Emergency Medical Responder

As you continue monitoring the patient, he becomes even more confused and agitated. You begin to notice signs of shock. As an EMR, what should you do while awaiting EMS personnel?

# ENRICHMENT

## Basic Pharmacology

### Common Forms of Medication

Emergency medical responders (EMRs) are often called upon to help give or administer medications. These medications come in several types and forms, including tablets, capsules, powders, liquids, creams, auto-injectors and aerosol sprays. They also have a range of options regarding how they are administered and the doses used in a given circumstance.

### Basic Medication Terminology

#### Drug Name

Upon initial discovery, a drug is given a chemical name based on its chemical properties. It is then given a generic, or non-proprietary name, usually a shorter version of the chemical name. This is the name used for the Food and Drug Administration (FDA) approval application. Drugs are also given a brand or trade name, which is used in marketing. It may or may not sound like the generic name, depending on the complexity of the generic name and the drug's purpose. For example, with a chemical name of N-acetyl-*p*-aminophenol, the generic name of this drug is acetaminophen and the trade name is Tylenol®.

#### Drug Profile

A drug's profile is a description of what it does, what it is or is not given for and any issues that may develop as a result of taking it.

- **Actions:** The action of a medication is what it does. If you are administering a drug, you should know how the drug works. For example, does the medication dilate the blood vessels (vasodilator) to lower blood pressure?
- **Indications:** The indication of a drug is the intended use for a specific condition. Why is the drug given? What are you trying to achieve? For example, the indication for nitroglycerin would be for chest pain or angina.
- **Contraindications:** Not everyone can take every medication. Contraindications are the conditions in which you would not administer a drug to a patient. This could be because the patient has a medical condition that would be worsened by administration of the drug, because of adverse interactions with other medications or because the patient may be allergic to the medication. For example, it would be contraindicated to give morphine to a patient who is allergic to it, or to give a medication with a known effect of hypotension (lowering blood pressure) to a patient whose blood pressure is already low.
- **Side effects:** Side effects are reactions caused by the drug that were not intended. Side effects may or may not cause problems. If they do cause problems, these are called adverse effects, adverse reactions or untoward effects. These are the effects you must watch for when administering medications such as nitroglycerin. Nitroglycerin works by dilating the blood vessels, but it can cause the sudden and possibly harmful side effect of lowering blood pressure.
- **Dose:** The usual dose is a range of an acceptable amount of the medication, given the patient's age, weight and reason for giving the drug. There are also times when the patient's gender must be taken into account. Administering an overdose, or too much of a drug, can result in severe, sometimes fatal, consequences. Administering too little of a drug may cause the problem to worsen, because the drug will not have the desired effect on the patient.
- **Route:** You must know by which route a drug is to be given. Some medications can be given in different ways—for example, by injection or intravenously. However, there is a significant difference in the dose given by each route. If a patient receives a dose intravenously that was intended to be delivered by injection, this could result in death.



# ENRICHMENT

## Basic Pharmacology *CONTINUED*

### Prescribing Information

Medication prescriptions must contain the following information:

- Pharmacy's name and address
- Prescription's serial number
- Date of the prescription (initial filling or refill date)
- Prescriber's name
- Patient's name
- Directions for use, including any precautions
- Medication name and strength
- Federal law inscription on transfer of drugs

Medication prescriptions also commonly contain the following additional information:

- Patient's address
- Pharmacist's initials or name
- Pharmacy's telephone number
- Manufacturer's lot number
- Drug's expiration date
- Manufacturer's or distributor's name
- Quantity of medication dispensed
- Number of refills remaining

### Routes of Administration

Medications can be given in many ways, including the following:

- **By mouth:** Many medications, such as tablets, capsules, powders and liquids, may be given by mouth to be absorbed by the stomach and intestines. The amount of time it takes for them to become effective can vary considerably. The patient must be responsive enough to follow directions to swallow and be able to swallow.
- **Sublingually:** These medications dissolve under the tongue and are absorbed into the bloodstream through the mucous membrane.
- **By inhalation:** Some medications are inhaled (i.e., through mouth, nose or tracheostomy) directly into the lungs. These are usually medications for respiratory illnesses like asthma. Oxygen, which is inhaled, is also considered a medication.
- **By injection:** These medications are usually administered by a licensed healthcare professional or by a caregiver. They can be given straight into the muscle or under the skin, depending on the product.
- **Topically:** Topical medications are given by patch or gel and absorbed by the skin. EMRs must be careful when encountering a patch on a patient's skin, as the medication could be absorbed by the responder when trying to remove the patch.
- **Intravenously:** Medications given intravenously must be administered by a licensed healthcare professional. It is one of the quickest ways to deliver fluids and medications, as substances are directly transmitted to the veins.
- **Vaginally:** Some creams and suppositories must be given vaginally.
- **Rectally:** Many medications are available in rectal suppository format.

## Administering Medications Overview

### The “Rights” of Drug Administration

Healthcare personnel who administer medication follow a concept called the “Five Rights.” These help ensure the medication is being given correctly.

- **Right patient:** If administering a patient's own medication, you must ensure it truly is the patient's medication. Check the label for the correct name. An exception may be if medical direction calls for a medication that is available but does not belong to the patient. If you are administering a stock medication (one that is kept on hand until needed), you must understand the action and effects to be sure that it is right for this patient.
- **Right medication:** When reaching for a medication, read the label properly and ensure that the medication in the bottle is what the label says it is. If in doubt, do not give it. If you are reaching for a stock medication, read the label as you remove it from your stock, while you remove the medication from the container and again as you give it to the patient.

*Continued on next page*

# ENRICHMENT

## Basic Pharmacology *CONTINUED*

- Right route: Be sure you are administering the drug as prescribed. You may find a prescription for a drug given by a route with which you are not familiar. When in doubt, double check.
- Right dose: Double check the dosage of the drugs you give to patients. Some medications vary considerably in dose between patients.
- Right date: Medications have expiration dates. This is the first day of the month listed, unless otherwise specified. Do not give expired drugs.

### “Administration of Medication” Versus “Assistance with Medication”

Administering a medication means you are physically giving the medication to the patient. In some situations, the patient is able to take medication alone, such as by a metered dose inhaler (MDI) for a respiratory emergency (Fig. 14-9, A–B). In this case, you may assist by helping get the medication ready and perhaps holding the inhaler while the patient presses the pump. Always follow medical direction, regulations and local protocols regarding your role in administering or assisting patients with medications.



**Fig. 14-9, A–B:** To administer medication, **(A)** physically give it to the patient. **(B)** When assisting, help get the medication ready and assist the patient in taking it, but do not physically administer it.

# ENRICHMENT

## Basic Pharmacology *CONTINUED*

### Administration Routes

You may only administer medications by routes you have been licensed or authorized to administer. Generally, for EMRs, this is by inhalation, orally or sublingually (under the tongue). There may be regulatory exceptions regarding EMR use of auto-injectors and inhalers. Check local protocols and medical direction to know the medications that you can deliver.

### Reassessment

After administering a drug, you must always assess the effect. You will need to watch for:

- Signs and symptoms of the original problem.
- Improvement or deterioration in the patient's condition, including the following:
  - Mental status
  - Respiratory status
  - Pulse rate and quality
  - Blood pressure
  - Skin color, temperature and condition
  - Adverse effects

### Documentation

Any time a drug is administered, from a patient's supply or from your stock, this must be documented thoroughly. You must document: 1) the reason for administration, 2) drug name, 3) dose, 4) route of administration, 5) time(s) of administration, 6) any side effects noted, 7) how often administered, and 8) any improvement noted and any changes in the patient's status.

### Role of Medical Oversight in Medical Administration

Medical direction, the oversight provided by a physician who assumes responsibility for care, provides direction on what medication to give, as well as the dose, route of administration and how often it is given. When receiving medical direction, you must repeat back the order for confirmation even if you are sure you understood correctly (Fig. 14-10).

### Administering Aspirin

#### Generic and Trade Names

Aspirin was the original trade name of acetylsalicylic acid (ASA). It has been marketed under several trade names, such as Ecotrin<sup>®</sup> Enteric Coated Aspirin, Excedrin<sup>®</sup> (which also contains acetaminophen), Pravigard<sup>®</sup> and St. Joseph<sup>®</sup> (Fig. 14-11). In countries where aspirin is trademarked (owned by Bayer), the term ASA is the generic name.

#### Indications

Aspirin, or ASA, was originally an analgesic, which is a type of pain reliever. However, today healthcare providers often use it for its blood-thinning capability to prevent blood clots. Aspirin is used to provide relief for mild-to-moderate pain, including headache, menstrual pain, muscle pain, minor pain of arthritis and toothache. It also reduces fever and inflammation. Aspirin may also be given for angina and heart attack (see Chapter 13 for more information on aspirin and heart attacks). A healthcare provider should be consulted before using aspirin to treat or prevent any cardiovascular condition.



**Fig. 14-10:** When receiving medical direction from a physician, always repeat back the order for confirmation.

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# ENRICHMENT

## Basic Pharmacology *CONTINUED*

### Contraindications

Patients already on blood thinners should not take aspirin. It should not be given to patients who have a known allergy to non-steroidal anti-inflammatory drugs (NSAIDs). Because of the rare complication of Reye's Syndrome, children and adolescents who show flu-like symptoms or who may have a viral illness such as chicken pox should not be given aspirin or products that contain aspirin. Women who are pregnant or nursing should avoid taking aspirin unless they are instructed to by their healthcare provider. Patients with asthma, ulcer or ulcer symptoms; a recent history of stomach or intestinal bleeding; or a bleeding disorder, such as hemophilia, should not take aspirin. Aspirin will not prevent hemorrhagic strokes and should not be given to someone showing signs and symptoms of a stroke.



Fig. 14-11: Aspirin.

### Actions

Aspirin acts to thin the blood by reducing the platelets' ability to produce a chemical that helps form blood clots. To relieve pain, aspirin reduces inflammation at the source, thereby reducing the pain.

### Side Effects

The majority of side effects and complications associated with aspirin are due to taking too much of the medication or from taking it for too long a period. However, side effects can occur with just a few doses in some people. The most common side effects include heartburn, nausea, vomiting and gastrointestinal bleeding. Some people are allergic to aspirin, so it is important to watch for an allergic reaction to the medication.

### Expiration Date

It is important not to administer aspirin past its expiration date. The effect of the drug decreases if it is too old. Therefore, by giving a dose of expired aspirin, you will not know how much of the drug the patient will actually receive. Do not use the aspirin if there is a strong smell of vinegar as this may indicate the medication is expired.

### Dosage

The dosages for pain relief and for blood thinning differ. The average adult dose for minor pain and fever relief is one to two 325-milligram (mg) tablets about every 3 to 4 hours, not to exceed 6 doses a day. For the prevention of a heart attack, the average adult dose is one 81-mg/low-dose tablet daily. For a patient experiencing chest pain that suggests a heart attack, the dose is two to four 81-mg low-dose (162 mg to 324 mg) aspirins or one 5-grain (325-mg) adult aspirin. Have the patient *chew* the aspirin completely, which speeds up the absorption of the aspirin into the bloodstream.

A healthcare provider may recommend a stronger dosage of aspirin. Follow local protocols and medical direction before giving aspirin to treat or prevent cardiovascular conditions.

### Administration

Aspirin is most commonly available in oral form; however, it is also available as a rectal suppository and in a liquid form for children.

# ENRICHMENT

## Basic Pharmacology *CONTINUED*

### Administering Nitroglycerin

#### Generic and Trade Names

Nitroglycerin is the generic name for Nitrolingual<sup>®</sup> Pump Spray, Nitrostat<sup>®</sup> Tablets and the Minitran<sup>®</sup> Transdermal Delivery System. It is also available by the generic name.

#### Indications

Nitroglycerin is given to patients with angina pectoris, a condition in which the blood vessels in the heart constrict and do not allow enough blood and oxygen to circulate. This, in turn, causes chest pain.

#### Contraindications

Nitroglycerin should not be given to patients whose systolic blood pressure is below 90 mmHg. Also, it should not be given more often than prescribed (usually one to three times is indicated, with 5 minutes spaced between doses). Do not give nitroglycerin to patients taking sildenafil (Viagra<sup>®</sup>) or other similar phosphodiesterase type 5 (PDE) inhibitors, as this could lead to life-threatening complications such as a dangerous drop in blood pressure. Nitroglycerin should not be given to individuals who have severe anemia or a brain injury, hemorrhage or tumor. Nitroglycerin may be harmful to an unborn baby.

#### Actions

Nitroglycerin dilates the blood vessels, allowing blood to flow more freely, thus providing more oxygen to the heart tissue.

#### Side Effects

Rapid dilation of the blood vessels can cause a severe and sudden headache. The headaches may become gradually less severe as the individual continues to take nitroglycerin. Other side effects may include dizziness, flushed skin of the neck and face, light-headedness and worsened angina pain.

#### Precautions

Nitroglycerin tablets are reactive to light and should be stored in a dry area in a dark-colored container to maintain their potency.

#### Expiration Date

Check expiration dates for all types of nitroglycerin. Failure to do so may result in administering medication that is no longer active, thereby delaying proper treatment.

#### Dosage and Administration

Nitroglycerin sprays and tablets are usually administered as one spray or pill under the tongue, and can be taken by the patient up to three times, with 5 minutes between each dose, if there is no change in their condition. Have the patient sit while taking nitroglycerin as it can cause dizziness or fainting. Nitroglycerin is a very potent medication. It should never be given without a healthcare provider's order.

### Administering Oral Glucose

#### Action

Oral glucose acts by increasing the amount of blood glucose (sugar) in the bloodstream.

*Continued on next page*

# ENRICHMENT

## Basic Pharmacology *CONTINUED*

### Indication

Oral glucose is administered to patients who have diabetes and whose blood sugar level has dropped below tolerable levels (Fig. 14-12). At this point, the insulin has no glucose to metabolize.

### Contraindications

Oral glucose should not be given to patients with diabetes whose blood sugar is within normal range or above normal range. It also should not be given to patients who are unresponsive and unable to follow instructions to swallow safely.

### Side Effects

Side effects may include nausea, heartburn and bloating.

### Dose

The product comes as glucose tablets that are 4 to 5 grams each.

### Route

Oral glucose is given by mouth.



**Fig. 14-12:** Administer oral glucose to patients with diabetes whose blood sugar has dropped below tolerable levels. *Photo: courtesy of the Canadian Red Cross.*



# ENRICHMENT

## Blood Glucose Monitoring

Blood glucose monitoring refers to the measurement of blood sugar (glucose). Everyone's blood has some glucose in it because our bodies turn the food we eat into this form of sugar, which is transported throughout the body. Insulin, a hormone from the pancreas, helps get the glucose into our cells to be used for energy. Without insulin (e.g., in patients with type 2 diabetes), the BGL rises, leading to long-term health complications if untreated. In patients taking insulin, low blood glucose creates critical health risks and must be treated immediately.

### Testing BGL with a Glucometer

Patients with diabetes check their BGLs regularly, often using a portable device called a glucometer (Fig. 14-13). Monitoring can be done at any time using a glucometer. The test requires a drop of blood on a test strip containing a chemical substance, which is then inserted into the glucometer. The drop of blood is obtained by piercing the skin of a finger pad with a sharp sterile device such as a lancet or needle.

### Using a Glucometer

- Ensure your hands are clean and the glucometer is in good working order.
- Wipe the pad of the patient's finger with an alcohol swab, or clean the finger with soap and water. Allow the skin to dry completely.
- Using a sterile lancet, prick the pad of the finger and allow a blood drop to form.
- Collect a drop of blood on the test strip.
- Insert the test strip into the glucometer, read and record the numerical result.



Fig. 14-13: A glucometer.

Read the owner's manual for the glucometer carefully, and *only use the test strips specified for that meter*. Otherwise, the device may fail to give results or may generate an inaccurate reading.

### What the Numbers Mean

Although the result may vary depending upon the patient and the testing device used, it is generally accepted that the normal range before meals is 90–130 milligrams per deciliter (mg/dL) and after meals is less than 180 mg/dL.

Low blood glucose, also called hypoglycemia, occurs when the BGL drops below 70 mg/dL. This requires immediate treatment. If the patient is conscious, provide 15 to 20 grams of glucose (4 to 5 glucose tablets, depending on the manufacturer) and recheck the blood glucose level after 10 to 15 minutes. If the patient is unconscious or unable to swallow, seek advanced life support immediately.

### Pediatric Considerations

#### Blood Glucose Monitoring

The American Diabetes Association (ADA) warns of the problems that could be caused by blood sugar levels that are too low in children under 7 years of age. Young children require higher blood sugar levels than do adults for brain development. Also, children's food intake and activity level tend to vary quite a bit from day to day, causing blood sugar levels to fluctuate, so they are more at risk of blood sugar levels falling too low. Further, it may be difficult for very young children to report and describe symptoms of low blood sugar, so this may go undetected.

Also keep in mind that, before reaching puberty, children seem to be at lower risk of the complications of diabetes even when blood sugar levels are abnormally high. The ADA recommends aiming for the safe adult range of BGL only when children grow older and can recognize the early symptoms of BGLs dropping too low.

# 15

## POISONING

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### ▶ You Are the Emergency Medical Responder

Your emergency medical services (EMS) unit is summoned to a residence on a report of an unconscious person. When you arrive and size up the scene, you discover an older couple. The wife is distraught and says that her husband had been drinking alcoholic beverages heavily earlier in the day. Shortly after taking his prescribed Valium®, she says he became drowsy and incoherent, and then collapsed. Unable to get him to respond, she called 9-1-1. On assessing the patient, you find that he is unconscious, his breathing is shallow and slow, his heart rate is slow and his pulse is weak. How would you respond?





## KEY TERMS

**Absorbed poison:** A poison that enters the body through the skin.

**Addiction:** The compulsive need to use a substance; stopping use would cause the user to suffer mental, physical and emotional distress.

**Anabolic steroid:** A drug sometimes used by athletes to enhance performance and increase muscle mass; also has medical use in stimulating weight gain for people unable to gain weight naturally.

**Antidote:** A substance that counteracts and neutralizes the effects of a poison.

**Antihistamine:** A type of drug taken to treat allergic reactions.

**Anti-inflammatory drug:** A type of drug taken to reduce inflammation or swelling.

**Cannabis products:** Substances such as marijuana and hashish that are derived from the *Cannabis sativa* plant; can produce feelings of elation, distorted perceptions of time and space, and impaired motor coordination and judgment.

**Carbon monoxide (CO):** An odorless, colorless, toxic gas produced as a byproduct of combustion.

**Dependency:** The desire or need to continually use a substance.

**Depressant:** A substance that affects the central nervous system and slows down physical and mental activity; can be used to treat anxiety, tension and high blood pressure.

**Designer drugs:** Potent and illegal street drugs formed from a medicinal substance whose drug composition has been modified (designed).

**Drug:** Any substance, other than food, intended to affect the functions of the body.

**Hallucinogen:** A substance that affects mood, sensation, thinking, emotion and self-awareness; alters perceptions of time and space; and produces hallucinations or delusions.

**Ingested poison:** A poison that is swallowed.

**Inhalant:** A substance, such as a medication, that a person inhales to counteract or prevent a specific condition; also a substance inhaled to produce mood-altering effects.

**Inhaled poison:** A poison breathed into the lungs.

**Injected poison:** A poison that enters the body through a bite, sting or syringe.

**Naloxone:** A medication used to reverse the effects of an opioid overdose.

**Opioid narcotics:** Drugs often derived from opium or opium-like compounds; used to reduce pain and can alter mood and behavior; also known as opioids.

**Overdose:** The use of an excessive amount of a substance, resulting in adverse reactions ranging from mania (mental and physical hyperactivity) and hysteria, to coma and death.

**Poison:** Any substance that can cause injury, illness or death when introduced into the body, especially by chemical means.

**Poison Control Center (PCC):** A specialized health center that provides information on poisons and suspected poisoning emergencies.

**Stimulant:** A substance that affects the central nervous system and speeds up physical and mental activity.

**Substance abuse:** The deliberate, persistent, excessive use of a substance without regard to health concerns or accepted medical practices.

**Substance misuse:** The use of a substance for unintended purposes or for intended purposes but in improper amounts or doses.

**Synergistic effect:** The outcome created when two or more drugs are combined; the effects of each may enhance those of the other.

**Tolerance:** A condition in which the effects of a substance on the body decrease as a result of continued use.

**Toxicology:** The study of the adverse effects of chemical, physical or biological agents on the body.

**Toxin:** A poisonous substance produced by microorganisms that can cause certain diseases but is also capable of inducing neutralizing antibodies or antitoxins.

**Withdrawal:** The condition of mental and physical discomfort produced when a person stops using or abusing a substance to which the person is addicted.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- List the four ways poisons enter the body.
- Identify the signs and symptoms of poisoning.
- Describe general care guidelines for a poisoning emergency.
- Describe specific care for different types of poisoning emergencies.
- Have a basic understanding of drug interactions.
- Define substance abuse and misuse.
- Identify factors related to substance abuse and misuse, and list prevention strategies.
- List information resources available to responders and the general public from Poison Control Centers (PCCs).

## INTRODUCTION

A **poison** is any substance that causes injury, illness or death if it enters the body. A person can be poisoned by ingesting or swallowing poison, breathing it, absorbing it through the skin or by injecting it into the body.

In 2014, Poison Control Centers (PCCs) received more than 2.1 million calls from people who had come into contact with a poison. Over 91 percent of these poisonings took place in the home and 48 percent involved children under age 6. Poisoning deaths in children under age 6 represented about 1.4 percent of the total deaths from poisoning, while the 20- to 59-year-old age group represented about 66 percent of all deaths from poisoning. Child-resistant packaging for medications and preventive actions by parents and others who care for children have resulted in a decline in child poisonings. At the same time, there has been an increase in adult poisoning deaths, which is linked to an increase in both suicides and drug-related poisonings.

A **toxin** is a poisonous substance produced by microorganisms that can cause certain diseases but is also capable of inducing neutralizing antibodies or antitoxins. **Toxicology** is the scientific study of poisons and **antidotes** and how they affect people. Some poisons—including many medications—are not deadly or harmful in small doses, but become dangerous if taken into the body in larger amounts. When a dangerously large amount of a drug is taken, this is called an overdose.

Poisons can be solid, liquid, spray or fumes (gases and vapors). A solid or liquid substance may turn into a gas if heated or under pressure. Poisonings can be accidental or intentional, and intentional

poisoning can be self-inflicted—in the case of a suicide—or caused by another person intending to harm or kill the person. The severity of a poisoning depends on the type and amount of the substance; the time that has elapsed since the poison entered the body; and the patient's age, size (build), weight and medical conditions. Many substances that are not poisonous in small amounts are poisonous in larger amounts. Medications (prescription or over-the-counter [OTC]) can be poisonous if they are not taken as prescribed or directed.

In a manufacturing facility, Safety Data Sheets (SDSs) are required on site for every product/chemical in use. Formerly called Material Safety Data Sheets (MSDSs), SDSs consist of 16 standardized sections, arranged in a strict order and based on the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals. In the case of a poisoning, the SDS should go with the patient to the hospital, as it will give emergency medical services (EMS) personnel and hospital staff more detailed information as to the treatment of the exposed worker.

In this chapter, you will learn about the four ways in which poisons can enter the body—ingestion, inhalation, absorption and injection. You will also learn about the types of poisons that fall into each of these categories, how to recognize the signs and symptoms of each type of poisoning and how to provide care for each. You will learn about how and when to contact the national Poison Help line or summon more advanced medical personnel. This chapter also provides an overview of substance abuse and substance misuse: the types of substances that can be abused or misused, how they enter the body and how to provide care for someone who has been exposed to, inhaled or ingested a poisonous substance.

## POISON CONTROL CENTERS

**Poison Control Centers (PCCs)** are specialized health centers that provide information on poisons and suspected poisoning emergencies. A network of PCCs exists throughout the United States. Medical professionals in these centers have access to information about virtually all poisonous substances and can tell you how to care for someone who has been poisoned. The American Association of Poison Control Centers operates a 24-hour national Poison Help line, which is staffed by pharmacists, physicians, nurses and toxicology specialists and can be reached at 800-222-1222.

PCCs answer over 2 million calls about poisoning each year. Since many poisonings can be treated without the help of EMS personnel, PCCs help prevent overburdening of the EMS system and hospitals. Approximately 70 percent of poison exposure cases can be managed over the phone without a referral to a healthcare facility. For more information, visit the American Association of Poison Control Centers website at [aapcc.org](http://aapcc.org).

Call for more advanced medical personnel if you are unsure about what to do, you are unsure about the severity of the problem or if it is a life-threatening condition. Otherwise, call the national Poison Help line for assistance.

In general, call for more advanced medical personnel if the patient:

- Is unconscious, confused or has an altered mental status.
- Has trouble breathing or is breathing irregularly.
- Has persistent chest pain or pressure.
- Has pressure or pain in the abdomen that does not go away.
- Is vomiting blood or passing blood.
- Has a seizure, severe headache or slurred speech.
- Acts violently.

## HOW POISON ENTERS THE BODY

Poisons are generally placed in four categories, based on how they enter the body: ingestion, inhalation, absorption and injection.

### Ingested Poison

#### Types of Ingested Poisons

**Ingested poisons** are poisons that are swallowed and include items such as foods (e.g., certain mushrooms and shellfish), drugs (e.g., alcohol), medications (e.g., aspirin) and household items (e.g., cleaning products, pesticides and even household plants).

Young children tend to put almost everything in their mouths, so they are at a higher risk of ingesting poisons, including household cleaners and medications (Fig. 15-1). Older adults may make medication errors if they are prone to forgetfulness or have difficulty reading the small print on medicine container labels.



**Fig. 15-1:** Young children are at a higher risk of ingesting poisons because they tend to put almost everything into their mouths.



### CRITICAL FACTS

A poison is any substance that causes injury, illness or death if it enters the body. A person can be poisoned by ingesting or swallowing poison, breathing it, absorbing it through the skin or by injecting it into the body.

A toxin is a poisonous substance produced by microorganisms that can cause certain diseases but is also capable of inducing neutralizing antibodies or antitoxins.

PCCs are specialized healthcare centers that provide information on poisons and suspected poisoning emergencies.



## CRITICAL FACTS

The national Poison Help line—which is staffed by pharmacists, physicians, nurses and toxicology specialists—can be reached at **800-222-1222**.

Call for more advanced medical personnel if you are unsure about what to do, you are unsure about the severity of the problem or if it is a life-threatening condition. Otherwise, call the national Poison Help line for assistance. Several scenarios warrant calling for more advanced medical personnel, including unconsciousness, breathing problems, chest or abdominal pain or pressure, vomiting blood or passing blood, seizures or violent behavior.

Poisons are generally placed in four categories, based on how they enter the body: ingestion, inhalation, absorption and injection.

In 2011, the Centers for Disease Control and Prevention (CDC) estimated that 48 million people contract foodborne illnesses each year in the United States. Approximately 128,000 people are hospitalized and more than 3000 die from foodborne illness.

Two of the most common categories of food poisoning are bacterial and chemical food poisoning. Bacterial food poisoning typically occurs when bacteria grow on food that is allowed to stand at room temperature after being cooked, which releases toxins into the food. Foods most likely to cause bacterial food poisoning are meats, fish and dairy or dairy-based foods. Chemical food poisoning typically occurs when foods with high acid content, such as fruit juices or sauerkraut, are stored in containers lined with zinc, cadmium or copper or in enameled metal pans. Another primary source of chemical food poisoning is lead, which is sometimes found in older pipes that supply drinking and cooking water. Mercury, a heavy metal, can also be a source of food poisoning. Fish and shellfish, such as shark and swordfish, are a major dietary source of mercury. However, mercury can also come from other dietary items and contact with mercury metal or its compounds (e.g., a mercury thermometer).

Two of the most common causes of food poisoning are salmonella bacteria (most often found in poultry and raw eggs) and *Escherichia coli* (*E. coli*) (most often found in raw meats and unpasteurized milk and juices). The most deadly type of food poisoning is botulism, which is caused by a bacterial toxin usually associated with home canning.

### Signs and Symptoms of Ingested Poisons

A person who has ingested poison generally looks ill and displays symptoms common to other sudden illnesses. If you have even a slight suspicion that

a patient has been poisoned, seek immediate medical assistance. Signs and symptoms to look for include:

- Nausea, vomiting or diarrhea.
- Chest or abdominal pain.
- Difficulty breathing.
- Sweating.
- Changes in level of consciousness (LOC).
- Seizures.
- Headache or dizziness.
- Weakness.
- Irregular pupil size.
- Double vision.
- Abnormal skin color.
- Burn injuries around the lips or tongue or on the skin around the mouth.

The symptoms of food poisoning, which can begin between 1 and 48 hours after eating contaminated food, include nausea, vomiting, abdominal pain, diarrhea, fever and dehydration. Severe cases of food poisoning can result in shock or death, particularly in children, older adults and those with an impaired immune system.

### Providing Care for Ingested Poisons

If the patient is fully conscious and alert, immediately call the national Poison Help line and follow the directions given. **DO NOT** give the patient anything to eat or drink unless you are told to do so. If you do not know what the poison was and the patient vomits, save some of the vomit. The hospital may analyze it later to identify the poison.

In some cases of ingested poisoning, the PCC may instruct you to induce vomiting. Vomiting may prevent the poison from moving to the small intestine, where most absorption takes place.

However, vomiting should be induced only if advised by a medical professional. The PCC or a medical professional will advise you exactly how to induce vomiting. In some instances, vomiting should *not* be induced. This includes when the patient:

- Is unconscious.
- Is having a seizure.
- Is pregnant (in the last trimester).
- Has ingested a corrosive substance (such as drain or oven cleaner) or a petroleum product (such as kerosene or gasoline).
- Is known to have heart disease.

Examples of such poisons are caustic or corrosive chemicals, such as acids, that can eat away or destroy tissues. Vomiting these corrosives could burn the esophagus, throat and mouth. Diluting the corrosive substance decreases the potential for burning and damaging tissues. **DO NOT** give the patient anything to eat or drink unless medical professionals tell you to do so.

Some people who have contracted food poisoning may require antibiotic or antitoxin therapy. Fortunately, most cases of food poisoning can be prevented by proper food handling and preparation.

## Inhaled Poison

### Types of Inhaled Poisons

Poisoning by inhalation occurs when a person breathes in poisonous gases or fumes. A commonly ***inhaled poison*** is ***carbon monoxide (CO)***, which is present in substances such as car exhaust and tobacco smoke. CO can also be produced by fires (gas and natural), defective gas cooking equipment, defective gas furnaces, gas water heaters and kerosene heaters. CO, which is colorless, odorless and tasteless, is highly lethal and can cause death after only a few minutes of exposure.

Other common inhaled poisons include carbon dioxide, chlorine gas, ammonia, sulfur dioxide, nitrous oxide, chloroform, dry cleaning solvents, fire extinguisher gases, industrial gases and hydrogen sulfide. Paints and solvents produce fumes that some people deliberately inhale to get high, as do certain drugs, such as crack cocaine.

### Signs and Symptoms of Inhaled Poisons

Look for paint or solvent around the mouth and nose of the patient if you suspect deliberate inhalation. A pale or bluish skin color, which

indicates a lack of oxygen, may signal CO poisoning. Other signs and symptoms of inhaled poisons include:

- Difficulty breathing or respiratory rate faster or slower than normal.
- Chest pain or tightness.
- Burning in the nose or eyes.
- Nausea or vomiting.
- Cyanosis.
- Headaches, dizziness, confusion.
- Coughing, possibly with excessive secretions.
- Seizures.
- Altered mental status with possible unresponsiveness.

## Providing Care for Inhaled Poisons

When providing care to a patient who may have inhaled poison, follow appropriate safety precautions to ensure that you do not also become poisoned. Toxic fumes may or may not have an odor. If you notice clues at an emergency scene that lead you to suspect toxic fumes are present—such as a strong smell of fuel (sulfur or skunk smell) or a hissing sound (which could indicate gas escaping from a pipe or valve)—you may not be able to reach the patient without risking your own safety. In cases like this, call for specialized services instead of entering the scene. Let EMS professionals know what you discovered, and only enter the scene if you are told it is safe to do so or if you are trained to do so.

All patients who have inhaled poison need supplemental oxygen as soon as possible based on local protocols. If you can remove the patient from the source of the poison without endangering yourself, then do so. You can help a conscious patient by getting them to fresh air and then calling for more advanced care personnel. If you find an unconscious patient, remove the patient from the scene if it is safe to do so, and call for more advanced medical personnel. Then provide care for any life-threatening conditions.

## Absorbed Poison

### Types of Absorbed Poisons

An ***absorbed poison*** enters through the skin or the mucous membranes in the eyes, nose and mouth. Absorbed poisons come from plants, as well as from chemicals and medications. Millions of people each year suffer irritating effects after touching or brushing against poisonous plants such as poison ivy, poison oak and poison sumac



(Fig. 15-2, A–C). Other poisons absorbed through the skin include dry and wet chemicals, such as those used in flea collars for dogs and in yard and garden maintenance products, which may also burn the skin. Some medications, such as topical



**Fig. 15-2, A–C:** (A) Poison ivy; photo: Shutterstock.com/Tim Mainiero; (B) poison oak; photo: Shutterstock.com/Dwight Smith; (C) poison sumac; photo: courtesy of www.poison-ivy.org.

medications or transdermal patches, can also be absorbed through the skin.

## Signs and Symptoms of Absorbed Poisons

Some of the signs and symptoms of absorbed poisons include:

- Traces of the liquid, powder or chemical on the patient's skin.
- Skin that looks burned, irritated, red or swollen.
- Blisters that may ooze fluid, or a rash.
- Itchy skin.

## Providing Care for Absorbed Poisons

To care for a patient who has come into contact with a poisonous plant, follow standard precautions and then immediately rinse the affected area thoroughly with water. Using soap cannot hurt, but soap may not do much to remove the poisonous plant oil that causes the allergic reaction. Before washing the affected area, you may need to have the patient remove any jewelry. This is only necessary if the jewelry is contaminated or if it constricts circulation due to swelling. Rinse the affected areas for *at least 20 minutes*, using a shower or garden hose if possible. If a rash or weeping lesion (an oozing sore) develops, advise the patient to seek the opinion of a pharmacist or healthcare provider about possible treatment. Medicated lotions may help soothe the area.

**Antihistamines** may also help dry up the lesions and help stop or reduce itching. OTC antihistamines are available at pharmacies and grocery stores and should be used according to the manufacturer's directions. If the condition worsens or if large areas of the body or the face are affected, the patient should see a healthcare provider, who may administer **anti-inflammatory drugs**, such as corticosteroids, or other medications to relieve discomfort.

If the poisoning involves dry chemicals, brush off the chemicals using gloved hands before flushing with tap water (under pressure). Take care not to inhale any of the chemical or get any of the dry chemical on you, in your eyes, or in the eyes of the patient or any bystanders. Many dry chemicals are activated by contact with water. However, if continuous running water is available, it will flush the chemical from the skin before the activated chemical can do harm. If wet chemicals contact the skin, flush the area continuously with large amounts of cool, running water. Running water reduces the threat to you and quickly and easily removes the

substance from the patient. Continue flushing for *at least 20 minutes* or until more advanced medical personnel arrive (Fig. 15-3).

If poison has been in contact with the patient's eye or eyes, irrigate the affected eye or eyes, from the nose side of the eye, *not* directly onto the middle of the cornea of the eye, with clean water for *at least 15 minutes*. If only one eye is affected, make sure you do not let the water run into the unaffected eye. To ensure this, tilt the head so the water runs from the nose side of the eye downward to the ear side (Fig. 15-4). Continue care while transporting the patient if you can.

## Injected Poison

### Types of Injected Poisons

**Injected poisons** enter the body through the bites or stings of certain insects, spiders, marine



**Fig. 15-3:** If the poisoning involves chemicals, flush the exposed area continuously with cool, running water for at least 20 minutes.



**Fig. 15-4:** Flush an eye that has come in contact with poison with clean water from the nose side toward the ear side, being sure not to contaminate the unaffected eye.

life, animals and snakes, or as drugs or misused medications injected with a hypodermic needle. Insect and animal bites and stings are among the most common sources of injected poisons. See Chapter 16 for more information about the signs of these bites and how to provide care for them.

## Signs and Symptoms of Injected Poisons

Some of the signs and symptoms of injected poisons include:

- Bite or sting mark at the point of entry.
- A stinger, tentacle or venom sac in or near the entry site.
- Redness, pain, tenderness or swelling around the entry site.
- Signs of allergic reaction, including localized itching, hives or rash.
- Signs of a severe allergic reaction (anaphylaxis), including weakness, nausea, dizziness, swelling of the throat or tongue, constricted airway or difficulty breathing.

## Providing Care for Injected Poisons

Size up the scene and follow standard precautions. Perform a primary assessment and care for conditions found. Applying a cold pack can reduce pain and swelling of the bitten area. To provide specific care for certain bites and stings, see Chapter 16. Call for more advanced medical personnel if there are signs and symptoms of anaphylaxis, and assist the patient with their prescribed epinephrine auto-injector if protocols allow and you are trained to do so.

## SUBSTANCE ABUSE AND MISUSE

A **drug** is any substance, other than food, intended to affect body functions. A drug given therapeutically to prevent or treat a disease or otherwise enhance mental or physical well-being is a medication. **Substance abuse** is the deliberate, persistent and excessive use of a substance without regard to health concerns or accepted medical practices. **Substance misuse** refers to the use of a substance for unintended purposes or for appropriate purposes but in improper amounts or doses. Because of the publicity they receive, we tend to think of illegal (also known as illicit or controlled) drugs when we hear of substance abuse. However, legal substances (also called licit or noncontrolled substances) are among those most



## CRITICAL FACTS

Substance abuse is the deliberate, persistent and excessive use of a substance without regard to health concerns or accepted medical practices. Substance misuse refers to the use of a substance for unintended purposes or for appropriate purposes but in improper amounts or doses.

often abused or misused. These include nicotine (found in tobacco products), alcohol, and OTC medications such as sleeping pills and diet pills.

In the United States, substance abuse costs tens of billions of dollars each year in medical care, insurance and lost productivity. Even more important, however, are the lives lost or permanently impaired each year from injuries or medical emergencies related to substance abuse or misuse. In 2014, drug overdose resulted in a total of 47,055 deaths in the United States. Drug overdose is the leading cause of accidental death in the country, resulting in even more deaths than motor-vehicle collisions. Experts estimate that as many as two-thirds of all homicides and serious assaults occurring annually involve alcohol. Other problems directly or indirectly related to substance abuse include dropping out of school, adolescent pregnancy, suicide, involvement in violent crime and transmission of the human immunodeficiency virus (HIV).

If you think someone has taken an overdose or has another substance abuse problem requiring medical attention or other professional help, size up the scene for safety, then check the person. If you have good reason to suspect a substance was taken, call the national Poison Help line and follow the directions given.

## Forms of Substance Abuse and Misuse

Many substances that are abused or misused are legal. Other substances are legal only when prescribed by a healthcare provider. Some are illegal only for those under a certain age, such as alcohol.

Any drug can cause **dependency**, or the desire to continually use the substance. Those with drug-dependency issues feel that they need the drug to function normally. Those with a compulsive need for a substance and those who would suffer mental, physical and emotional distress if they stopped taking it are said to have an **addiction** to that substance.

The term **withdrawal** describes the condition produced when people stop using or abusing a

substance to which they are addicted. Stopping the use of a substance may occur as a deliberate decision or because the person is unable to obtain the specific drug. Withdrawal from certain substances, such as alcohol, can cause severe mental and physical distress. Because withdrawal may become a serious medical condition, medical professionals often oversee the process.

When someone continually uses a substance, its effects on the body often decrease—a condition called **tolerance**. The person then has to increase the amount and frequency of use to obtain the desired effect.

An overdose occurs when someone uses an excessive amount of a substance. Symptoms can vary but may range from mania and hysteria to coma and death. Specific reactions include changes in blood pressure and heartbeat, sweating, vomiting and liver failure. An overdose may occur unintentionally if a person takes too much medication at one time. For example, an older adult might forget about taking one dose of a medication and thus take an additional dose. An overdose may also be intentional, as in a suicide attempt. Sometimes the patient takes a sufficiently high dose of a substance to be certain to cause death. In other cases, the patient may take enough of a substance to need medical attention but not enough to cause death.

## Abused and Misused Substances

Substances are categorized according to their effects on the body (Table 15-1). The six major categories are stimulants, hallucinogens, depressants, opioid narcotics, inhalants and cannabis products. The category to which a substance belongs depends mostly on the effects it has on the central nervous system or the way the substance is taken. Some substances depress the nervous system, whereas others speed up its activity. Some are not easily categorized because they have various effects or may be taken in a variety of ways. A heightened or exaggerated effect may be produced when two or more substances are used at the same time. This is called a **synergistic effect**, which can be deadly.



Table 15-1:

## Commonly Abused and Misused Substances

CATEGORY	SUBSTANCES	COMMON NAMES	POSSIBLE EFFECTS
Stimulants	Caffeine Cocaine, crack cocaine Amphetamines Methamphetamine Dextroamphetamine Nicotine Ephedra OTC diet aids Asthma treatments Decongestants	Coke, snow, nose candy, blow, flake, Big C, lady, white, snowbirds, powder, foot, crack, rock, cookies, freebase rocks, speed, uppers, ups, bennies, black beauties, crystal, meth, crank, crystal meth, ice, ma huang	Increase mental and physical activity Produce temporary feelings of alertness Prevent fatigue Suppress appetite
Hallucinogens	Diethyltryptamine (DET) Dimethyltryptamine (DMT) LSD PCP Mescaline Peyote Psilocybin 4-Methyl-2,5-dimethoxyamphetamine (DOM)	Psychedelics, acid, white lightning, sugar cubes, angel dust, hog, loveboat, peyote, buttons, cactus, mesc, mushrooms, magic mushrooms, 'shrooms, STP (serenity, tranquility and peace)	Cause changes in mood, sensation, thought, emotion and self-awareness Alter perceptions of time and space Can produce profound depression, tension and anxiety, as well as visual, auditory or tactile hallucinations
Depressants	Barbiturates Benzodiazepines Narcotics Alcohol Antihistamines Sedatives Tranquilizers OTC sleep aids Ketamine Rohypnol® GHB	Valium®, Xanax®, downers, barbs, goofballs, yellow jackets, reds, Quaaludes, ludes, club drugs, date rape drugs, special K, vitamin K, roofies, roach, rope, liquid ecstasy, soap, vita-G	Decrease mental and physical activity Alter level of consciousness Relieve anxiety and pain Promote sleep Depress respiration Relax muscles Impair coordination and judgment
Opioid narcotics	Morphine Codeine Heroin Oxycodone Methadone Opium	Pectoral syrup, Oxycontin®, Percodan®, Percocet®, smack, horse, mud, brown sugar, junk, black tar, big H	Relieve pain Produce stupor or euphoria Can cause coma or death Highly addictive

(Continued)

Table 15-1: continued

CATEGORY	SUBSTANCES	COMMON NAMES	POSSIBLE EFFECTS
Inhalants	Medical anesthetics Lacquer and varnish thinners Propane Toluene Butane Acetone Fuel Propellants	Laughing gas, whippets, glue, lighter fluid, nail polish remover, gasoline, kerosene, aerosol sprays	Alter mood Produce a partial or complete loss of feeling Produce effects similar to drunkenness, such as slurred speech, lack of inhibitions and impaired motor coordination Can cause damage to the heart, lungs, brain and liver
Cannabis products	Hashish Marijuana THC Synthetic cannabinoids	Hash, pot, grass, weed, reefer, ganja, mary jane, dope K2, spice	Produce feelings of elation Increase appetite Distort perceptions of time and space Impair motor coordination and judgment Irritate throat Redden eyes Increase heart rate Cause dizziness
Other	MDMA	Ecstasy, E, XTC, Adam, essence	Elevate blood pressure Produce euphoria or erratic mood swings, rapid heartbeat, profuse sweating, agitation and sensory distortions
	Anabolic steroids	Androgens, hormones, juice, roids, vitamins	Enhance physical performance Increase muscle mass Stimulate appetite and weight gain Chronic use can cause sterility, disruption of normal growth, liver cancer, personality changes and aggressive behavior
	Aspirin		Relieves minor pain Reduces fever Impairs normal blood clotting Can cause inflammation of the stomach and small intestine
	Laxatives and emetics	Ipecac syrup, Senna	Relieve constipation or induce vomiting Can cause dehydration, uncontrolled diarrhea and other serious health problems
	Decongestant nasal sprays		Relieve congestion and swelling of nasal passages Chronic use can cause nosebleeds and changes in the lining of the nose, making it difficult to breathe without sprays



## Stimulants

**Stimulants** are drugs that affect the central nervous system by speeding up physical and mental activity. They produce temporary feelings of alertness and prevent fatigue. They are sometimes used for weight reduction because they also suppress appetite, or to enhance exercise routines because they provide bursts of energy.

Many stimulants are ingested as pills, but some can be absorbed or inhaled. Amphetamine, dextroamphetamine and methamphetamine are stimulants. On the street, an extremely addictive, dangerous and smokable form of methamphetamine is often called “crystal meth” or “ice.” The street term “speed” usually refers to amphetamine or methamphetamine. Other street terms for amphetamines are “uppers,” “bennies,” “black beauties,” “crystal,” “meth” and “crank.”

Cocaine is one of the most publicized and powerful stimulants. It can be taken into the body in different ways. The most common way is sniffing it in powder form, known as “snorting.” In this method, the drug is absorbed into the blood through capillaries in the nose. Street names for cocaine include “coke,” “snow,” “blow,” “flake,” “foot” and “nose candy.” A potent and smokable form of cocaine is called “crack.” The vapors of crack are inhaled into the lungs, reach the brain and cause almost immediate effects. Crack is highly addictive. Street names for crack include “rock” and “freebase rocks.”

Ephedra, also known as “ma huang,” is a stimulant plant that has been used in China and India for over 5000 years. Until it was banned by the Food and Drug Administration (FDA) in 2004, it was a common ingredient in dietary supplements sold in the United States. The dried stems and leaves are put into capsules, tablets, extracts, tinctures or teas, and then ingested. It is used for weight loss, increased energy and to enhance athletic performance.

The FDA banned ephedra because it appears to have little effectiveness, along with some substantial health risks. Taking ephedra can cause nausea, anxiety, headache, psychosis, kidney stones, tremors, dry mouth, irregular heart rhythms, high blood pressure, restlessness and sleep problems. It has been found to increase the risk of heart problems, a stroke and even death.

Interestingly, the most common stimulants in America are legal. Leading the list is caffeine, present in coffee, tea, high-energy drinks, many kinds of sodas, chocolate, diet pills and pills used to combat fatigue. The next most common stimulant is nicotine, found in tobacco products.

Other stimulants used for medical purposes are asthma medications or decongestants that can be taken by mouth or inhaled.

## Hallucinogens

**Hallucinogens**, also known as psychedelics, are substances that cause changes in mood, sensation, thought, emotion and self-awareness. They alter one’s perception of time and space and produce visual, auditory and tactile (relating to the sense of touch) delusions.

Among the most widely abused hallucinogens are lysergic acid diethylamide (LSD), called “acid”; psilocybin, called “mushrooms”; phencyclidine (PCP), called “angel dust”; mescaline, called “peyote,” “buttons” or “mesc”; and ketamine, called “special K” or “vitamin K.” These substances are usually ingested, but PCP is also often inhaled.

Hallucinogens often have physical effects similar to stimulants but are classified differently because of the other effects they produce. Hallucinogens sometimes cause what is called a “bad trip.” A bad trip can involve intense fear, panic, paranoid delusions, vivid hallucinations, profound depression, tension and anxiety. The person may be irrational and feel threatened by any attempt others make to help.

## Depressants

**Depressants** are substances that affect the central nervous system by slowing down physical and mental activity. Depressants are commonly used for medical purposes. All depressants alter consciousness to some degree. They relieve anxiety, promote sleep, depress respiration, relieve pain, relax muscles, and impair coordination and judgment. Like other substances, the larger the dose or the stronger the substance, the greater its effects.

Common depressants are barbiturates, benzodiazepines (e.g., Valium®, Xanax®), narcotics and alcohol. Most depressants are ingested or injected. Their street names include “downers,” “barbs,” “goofballs,” “yellow jackets,” “reds” or “ludes.”

Two depressants that have gained popularity as club drugs (so called because they are used at all-night dance parties) include Rohypnol® (also referred to as “roofies,” “roach” or “rope”), a benzodiazepine that is illegal in the United States; and gamma-hydroxybutyrate (GHB) (also referred to as “liquid ecstasy,” “soap” or “vita-G”), an illicit drug that has depressant, euphoric and body-building effects. These drugs are particularly dangerous because they are often used in combination or with

other depressants (including alcohol), which can have deadly effects, and because they are the “date rape drugs” of choice. As such, they are sometimes slipped to others unnoticed.

Alcohol is the most widely used and abused substance in the United States. In small amounts, its effects may be fairly mild. In higher doses, its effects can be toxic. Alcohol is like other depressants in its effects and risks for overdose. Frequent drinkers may become dependent on the effects of alcohol and increasingly tolerant of those effects. Alcohol poisoning occurs when a large amount of alcohol is consumed in a short period of time and can result in unconsciousness and, if untreated, death.

Drinking alcohol in large or frequent amounts can have many unhealthy consequences. Alcohol can irritate the digestive system and even cause the esophagus to rupture, or it can injure the stomach lining. Chronic drinking can also affect the brain and cause memory loss, apathy and a lack of coordination. Other problems include liver disease, such as cirrhosis. In addition, many psychological, family, social and work problems are related to chronic drinking.

## Opioid Narcotics

While they have a depressant effect, **opioid narcotics** (which are often derived from opium) are used mainly to relieve pain. Opioid narcotics are so powerful and highly addictive that all are illegal without a prescription, and some are not prescribed at all. When taken in large doses, opioid narcotics can produce euphoria, stupor,

coma or death. The most common natural opioid narcotics are morphine and codeine. Most other opioid narcotics, including heroin, are synthetic or semi-synthetic. Oxycodone, also known by the trade names Oxycontin® or Percocet®, is a powerful semi-synthetic opioid narcotic that has recently gained popularity as a street drug.

Opioid narcotic abuse has become a major health concern in the United States and throughout the world. Of the 47,055 deaths in the United States in 2014 attributed to drug overdose, 28,647 (61 percent) involved some type of opioid narcotic.

While there are many factors in treating this epidemic, including increased awareness and education, a medication that can reverse the effects of opioid narcotics is becoming increasingly available. This medication, called **naloxone**, is commonly used by EMS personnel to reverse the effects of opioid drugs. Recent legislation has allowed individuals in some states who are being prescribed opioids by their physician to also be given a prescription for naloxone. In fact, in some states this medication can even be obtained directly from the pharmacist without a prescription.

Naloxone typically comes as a nasal spray (atomizer) or an injectable (Fig. 15-5). Auto-injectors, similar to those used to deliver epinephrine, are also being manufactured for use in the treatment of opioid poisoning. Before using naloxone, it is important to be trained in how to recognize when to administer it and how to give it



**Fig. 15-5:** The nasal administration of naloxone using a nasal atomizer device.

using the different methods of administration. Signs and symptoms of opioid overdose include:

- Slowed and/or shallow breathing (or no breathing).
- Extreme drowsiness or becoming unconscious.
- Small pupils.

Severe opioid poisoning is a life-threatening emergency; in severe cases, the patient may be unconscious, not breathing, and have bluish skin (cyanosis) and a faint or absent heartbeat. If you suspect opioid overdose in a patient, the most important thing to do is to call for more advanced personnel. If used appropriately, based on local protocols, naloxone can reverse all of the effects of opioid poisoning, including unconsciousness and breathing difficulties.

## Inhalants

Substances inhaled to produce mood-altering effects are called **inhalants**. Inhalants also depress the central nervous system. In addition, inhalant use can damage the heart, lungs, brain and liver. Inhalants include medical anesthetics, such as amyl nitrite and nitrous oxide (also known as “laughing gas”), as well as hydrocarbons, known as solvents. The effects of solvents are similar to those of alcohol. People who use solvents may appear to be drunk. Other effects of inhalant use include swollen mucous membranes in the nose and mouth, hallucinations, erratic blood pressure and pulse, and seizures. Solvents include toluene, found in glues; butane, found in lighter fluids; acetone, found in nail polish removers; fuels, such as gasoline and kerosene; and propellants, found in aerosol sprays.

## Cannabis Products

**Cannabis products**, including marijuana, hash oil, tetrahydrocannabinol (THC) and hashish, are all derived from the plant *Cannabis sativa*. Marijuana is the most widely used illicit drug in the United States. Street names include “pot,” “grass,” “weed,” “reefer,” “ganja” and “dope.” It is typically smoked in cigarette form or in a pipe, but it can also be ingested. The effects include feelings of elation, distorted perceptions of time and space, and impaired judgment and motor coordination. Marijuana irritates the throat, reddens the eyes, and causes dizziness and often an increased appetite. Depending on the dose, the person and many other factors, cannabis products can produce effects similar to those of substances in any of the other major substance categories.

Marijuana, although still illegal throughout much of the United States, has been legalized in some

states and is available in others for limited medical use to help alleviate symptoms of certain conditions such as multiple sclerosis. Marijuana and its legal synthetic versions are used as an anti-nausea medication for people undergoing chemotherapy for cancer, for treating glaucoma, for treating muscular weakness caused by multiple sclerosis, and to combat the weight loss caused by cancer and acquired immunodeficiency syndrome (AIDS).

Newer, more potent synthetic marijuana-like products have been available in the United States since the early 2000s. These products are known as synthetic marijuana or synthetic cannabinoids. Street names include “K2” and “spice.” These products are typically smoked or taken orally. They are not a safe alternative to marijuana and, in fact, have more side effects than marijuana and can cause hallucinations, seizures, stupor, coma or death.

## Other Substances

Some other substances do not fit neatly into these categories. These substances include designer drugs, steroids and OTC substances, which can be purchased without a prescription.

### Designer Drugs

**Designer drugs** are variations of other substances, such as narcotics and amphetamines. Through simple and inexpensive methods, the molecular structure of substances produced for medicinal purposes can be modified into extremely potent and dangerous street drugs; hence the term “designer drug.” When the chemical makeup of a drug is altered, the user can experience a variety of unpredictable and dangerous effects. The people who modify these drugs may have no knowledge of the effects a new designer drug might produce.

One of the more commonly used designer drugs is methylenedioxymethamphetamine (MDMA). Another popular club drug, it is often called “ecstasy” or “E.” Although ecstasy is structurally related to stimulants and hallucinogens, its effects are somewhat different from either category. Ecstasy can evoke a euphoric high that makes it popular. Other signs and symptoms of ecstasy use range from the stimulant-like effects of high blood pressure, rapid heartbeat, profuse sweating and agitation to the hallucinogenic-like effects of paranoia, sensory distortion and erratic mood swings.

### Anabolic Steroids

**Anabolic steroids** are drugs sometimes used by athletes to enhance performance and increase muscle mass. Their medical uses include

stimulating weight gain for persons unable to gain weight naturally. They should not be confused with corticosteroids, which are used to counteract toxic effects and allergic reactions. Chronic use of anabolic steroids can lead to sterility, liver cancer and personality changes, such as aggressive behavior. Steroid use by younger people may also disrupt normal growth. Street names for anabolic steroids include “androgens,” “hormones,” “juice,” “roids” and “vitamins.”

## OTC Substances

Aspirin, nasal sprays, laxatives and emetics are among the most commonly abused or misused OTC substances (Fig. 15-6). Aspirin is an effective minor pain reliever and fever reducer that is found in a variety of medicines. People use aspirin for many reasons and conditions. In recent years, cardiologists have praised the benefits of low-dose aspirin for the treatment of heart disease and stroke prevention. As useful as aspirin is, misuse can have toxic effects on the body. Typically, aspirin can cause inflammation of the stomach and small intestine that can result in bleeding ulcers. Aspirin can also impair normal blood clotting.

Decongestant nasal sprays can help relieve the congestion of colds or hay fever. If misused, they can cause physical dependency. Using the spray over a long period can cause nosebleeds and changes in the lining of the nose that make it difficult to breathe without the spray.

Laxatives are used to relieve constipation. They come in a variety of forms and strengths. If used improperly, laxatives can cause uncontrolled diarrhea that may result in dehydration, the excessive loss of water from the body tissues. The very young and older adults are particularly susceptible to dehydration.



**Fig. 15-6:** Many OTC substances, such as pain relievers, decongestants, laxatives and emetics, are abused or misused.

Emetics are drugs that induce vomiting. Ipecac syrup is an emetic that has been used in the past to induce vomiting following the ingestion of some toxic substances. The administration of ipecac syrup for ingested poisons is *not* recommended. Use of ipecac can be quite dangerous and may cause recurrent vomiting, diarrhea, dehydration, pain and weakness in the muscles, abdominal pain and heart problems. Over time, the recurrent vomiting can erode tooth enamel, causing dental problems. For these reasons, it is no longer widely available in the United States, and the American Academy of Pediatrics and the American Association of Poison Control Centers do *not* recommend that ipecac syrup be stocked at home.

The abuse of laxatives and emetics is frequently associated with attempted weight loss and eating disorders, such as anorexia nervosa or bulimia. Anorexia nervosa is a disorder that most often affects young women and is characterized by a long-term refusal to eat food with sufficient nutrients and calories. People with anorexia typically use laxatives and emetics to keep from gaining weight. Bulimia is a condition in which people gorge themselves with food, then purge by vomiting (sometimes with the aid of emetics) or using laxatives. For this reason, the behavior associated with bulimia is often referred to as “binging and purging.” Anorexia nervosa and bulimia have underlying psychological factors that contribute to their onset. The effect of both of these eating disorders can be severe malnutrition, which can result in death.

## Considerations for Older Adults Substance Abuse and Misuse Among Older Adults

Substance abuse and misuse does occur in older populations. Older adults are likely to suffer from chronic diseases or conditions that require multiple prescription medications. These medications can interact with each other or with alcohol, and cause adverse reactions. The slower metabolisms of older adults can cause alcohol and medications to remain in the body longer, increasing the chance of an overdose. Sometimes, because of failing eyesight, an older adult may unintentionally take a drug at the wrong time or consume the wrong dosage and experience an overdose. Mixing medications or mixing drugs with alcohol and failing to follow directions are also factors in substance abuse and misuse among older people.



## Adolescents and Substance Abuse and Misuse

Adolescents and young adults are more likely to be involved in substance abuse and misuse. Males are somewhat more likely to use illicit drugs and alcohol than females, although they are almost equally likely to use psychotherapeutic drugs for nonmedical purposes. Middle and high school students are also likely to abuse or misuse prescription drugs such as narcotic pain killers, sedatives or stimulants because they can access them easily at home, from people they know or on the Internet.

## Signs and Symptoms of Substance Abuse and Misuse

Many of the signs and symptoms of substance abuse and misuse are similar to those of other medical emergencies. Do not necessarily assume that individuals who are stumbling, disoriented or have a fruity, alcohol-like odor on the breath are intoxicated by alcohol or other drugs, as this may also be a sign of a diabetic emergency.

As in other medical emergencies, you do not have to diagnose substance abuse or misuse to provide care. It can be helpful, however, if you detect clues that suggest the nature of the problem. Such clues help you provide more complete information to more advanced medical personnel so that they can provide prompt and appropriate care.

Often these clues will come from the patient, bystanders or the scene. Look for containers, pill bottles, drug paraphernalia and signs of other medical problems. If the patient is incoherent or unconscious, try to get information from any bystanders or family members. Since many of the physical signs of substance abuse mimic other conditions, you may not be able to determine that a patient has overdosed on a substance. To provide care, you only need to recognize abnormalities in breathing, skin color and moisture, body temperature and behavior, any of which may indicate a condition requiring professional help.

The abuse or misuse of stimulants can have many unhealthy effects on the body that mimic other conditions. For example, a stimulant overdose can cause moist or flushed skin, sweating, chills, nausea, vomiting, fever, headache, dizziness, rapid pulse, rapid breathing, high blood pressure and chest pain. In some instances, it can cause respiratory distress, disrupt normal heart rhythms or cause death. The patient may appear very excited, restless, talkative or irritable, or may suddenly lose consciousness. Stimulant abuse can lead to addiction and can cause a heart attack or stroke.

Specific signs and symptoms of hallucinogen abuse, as well as abuse of some designer drugs, may include sudden mood changes and a flushed face. The patient may claim to see or hear something not present, or may be anxious and frightened.

Specific signs and symptoms of depressant abuse may include drowsiness, confusion, slurred speech, slow heart and breathing rates, and poor coordination. A person who abuses alcohol may smell of alcohol. A person who has consumed a great deal of alcohol in a short time may become unconscious or hard to arouse. The person may vomit violently. Specific signs and symptoms of alcohol withdrawal, a potentially dangerous condition that can be life threatening, include confusion and restlessness, trembling, hallucinations and seizures.

A telltale sign of cannabis use is red, bloodshot eyes, while those abusing inhalants may appear drunk or disoriented in a similar manner to a person abusing hallucinogens.

## Providing Care for Substance Abuse and Misuse

Always summon more advanced medical personnel if you suspect a patient is suffering from alcohol withdrawal or from any form of substance abuse. Since substance abuse and misuse are forms of poisoning, care follows the same general principles as for other types of poisoning. As in other medical emergencies, however, people who abuse or misuse substances may become aggressive or uncooperative when you try to help. If the person becomes agitated or makes the scene unsafe in any way, retreat until the scene can be secured. Provide care only if you feel the patient is not a danger to you and others.

Your initial care for substance abuse or misuse does not require that you know the specific substance taken. Follow these general principles as you would for any poisoning:

- Size up the scene to be sure it is safe.
- Perform a primary assessment to check for any life-threatening conditions.
- Summon more advanced medical personnel.
- Perform a physical exam.
- Take a SAMPLE history (signs and symptoms, allergies, medications, pertinent medical history, last oral intake and events leading up to the incident) to try to find out what substance was taken, how much was taken and when it was taken.
- Calm and reassure the patient.
- Keep the patient from getting chilled or overheated.



- Keep the patient's airway clear.
- If the patient is having difficulty breathing, administer supplemental oxygen based on local protocols.

## Preventing Substance Abuse and Misuse

Experts in the field of substance abuse generally agree that prevention efforts are far more cost effective than treatment. Yet preventing substance abuse is a complex process that involves many underlying factors. Various approaches, including educating people about substances and their effects on health and attempting to instill fear of penalties, have not by themselves proved particularly effective. It is becoming clearer that, to be effective, prevention efforts must address the various underlying issues of substance abuse and ways to approach it.

The following factors may contribute to substance abuse:

- A lack of parental supervision
- The breakdown of traditional family structure
- A wish to escape unpleasant surroundings and stressful situations
- The widespread availability of substances
- Peer pressure and the basic need to belong
- Low self-esteem, including feelings of guilt or shame
- Media glamorization, especially of alcohol and tobacco, promoting the idea that using substances enhances fun and popularity
- A history of substance abuse in the home or community environments

Recognizing and understanding these factors may help in the prevention and treatment of substance abuse.

Some poisonings from medications occur when patients knowingly increase the dosage beyond what is directed. Medications should be taken only as directed. On the other hand, many poisonings from medications are not intentional.

The following guidelines can help prevent unintentional misuse or overdose:

- Read the product information and use only as directed.
- Ask your healthcare provider or pharmacist about the intended use and side effects of prescription and OTC medication. If you are taking more than one medication, check for possible interaction effects.
- Never use another person's prescribed medications; what is right for one person is seldom right for another.
- Always keep medications in their original, marked containers.
- Discard all out-of-date medications. Time can alter the chemical composition of medications, causing them to be less effective and possibly even toxic.
- Always keep medications out of the reach of children.

## PUTTING IT ALL TOGETHER

Poisonings can occur in four ways: ingestion, inhalation, absorption and injection. Substance abuse and misuse are types of poisoning that can occur in any of these ways. Substance abuse and misuse can produce a variety of signs and symptoms, most of which are common to other types of poisoning. You do not need to determine the cause of a poisoning to provide appropriate initial care.

If you see any of the signs and symptoms of sudden illness, follow the basic guidelines of care for any medical emergency. For suspected poisonings, contact the national Poison Help line or summon more advanced medical personnel. Beyond following the general guidelines for providing care for a suspected poisoning, medical professionals may advise you to provide some specific care, such as neutralizing the poison.

Six major categories of substances, when abused or misused, can produce a variety of signs and symptoms, some of which are indistinguishable from those of other medical emergencies. Remember, you do not have to know the specific condition to provide care. If you suspect that the patient's condition is caused by substance abuse or misuse, provide care for a poisoning emergency.

## ▶ You Are the Emergency Medical Responder

Based on your findings, you suspect that the patient ingested a combination of drugs and alcohol. What initial care can you provide? What else should you do and why? Is this a case of substance misuse? Why or why not?

# ENRICHMENT

## Administering Nasal Naloxone

With a growing epidemic of opioid (commonly fentanyl, heroin and oxycodone) overdoses in the United States, local and state departments of health have increased access to the medication naloxone, which can counteract the effects of an opioid overdose including respiratory arrest. Naloxone (also referred to by its trade name Narcan™) has few side effects and can be administered intranasally. Trained and authorized responders should assist with the administration of naloxone or administer the drug when the patient is in respiratory arrest or is unconscious and an opioid overdose is suspected. Other signs and symptoms of overdose include small pupils, respiratory depression, such as slowed or shallow breathing, as well as the presence of drug paraphernalia.

Responders should always follow local protocols and regulations for the administration of naloxone including dosing, timing and route of administration.

One of the most common and available routes of administration for naloxone is intranasal, using a nasal atomizer device attached to a syringe containing 2.0 mg of naloxone. To reverse the effects of the opioid, 1.0 mg of naloxone is administered into each nostril of the patient. While naloxone has very few side effects and is considered generally safe for any patient, emergency medical responders should ensure that more advanced medical personnel have been called as the half-life of naloxone (the amount of time the medication will have the desired effect) is often shorter than the half-life of the opioid causing the overdose.

Other complications can occur if the patient has overdosed on several medications at one time. Responders should be ready for different reactions from patients, from improving respiratory effort to regaining consciousness to acting out violently or vomiting. It is important to remember that the purpose of naloxone is to improve a patient's respiratory effort. In other words, ensure that they are breathing normally on their own. It is not necessary to wake up the patient.

All EMRs should follow local protocols when considering the administration of naloxone.

If authorized to assist with or administer intranasal naloxone, always follow local protocols and the following steps:

- Ensure scene safety.
- Maintain appropriate body substance isolation (BSI) precautions.
- Maintain an open airway and assist with ventilations if the patient has a pulse but is not breathing.
- Suction the airway, as needed.
- Assess the level of consciousness and vital signs.
- Summon advanced medical personnel by calling 9-1-1 or the designated emergency number.
- Assist with the administration of Naloxone 2.0 mg Nasal via atomizer (1.0 mg per nostril).
  - Remove the caps from both ends of the needle-free syringe.
  - Remove the cap from the naloxone vial.
  - Screw the open end of the vial into the syringe; it will become difficult to turn when it is sufficiently threaded.
  - Attach the nasal atomizer to the opposite end.
  - Give ventilations using a BVM.
  - Assess the patient to ensure their nasal cavity is free of blood or mucus.
  - Control the patient's head with one hand.
  - Gently but firmly place the atomizer in one nostril, carefully occluding the opposite nostril.
  - Aim slightly upward and toward the ear on the same side as the nostril.
  - Briskly compress the syringe to administer up to 1.0 mg of atomized spray.
  - Repeat in the other nostril. (Note: using both nostrils doubles the surface area available for absorption.)
- Continue giving ventilations as needed.
- If the patient's mental status and respiratory effort do not improve after 3 to 5 minutes, give a second 2.0 mg dose, if available and local protocols allow.

# ENRICHMENT

## Administering Activated Charcoal

If a patient has ingested poison, activated charcoal may be recommended by the PCC or medical control. Ideally, this will be administered within 1 hour of the patient swallowing the poison (Fig. 15-7).

Activated charcoal should only administered if the patient is fully conscious and alert and you have been directed by medical control or the PCC. A patient who is not able to swallow should *not* be given activated charcoal, nor should it be given to a patient who has overdosed on cyanide, swallowed acids or swallowed alkalis (including hydrochloric acid, bleach and ammonia).

Many patients experience black stools after taking activated charcoal. Vomiting is another common side effect, especially if the patient is already feeling nauseated. If the patient does vomit, ask medical control or the PCC for permission to give a second dose of the activated charcoal, and arrange to take the patient to the hospital immediately.

The PCC or local medical authority will give you instructions on how to administer the activated charcoal. The container should also list instructions. Generally, you will be told to shake the bottle to mix the activated charcoal with water. Give it to the patient to drink. Using a straw or opaque container may make it easier for the patient to tolerate the mixture's less-than-appetizing appearance. If the charcoal settles, shake it again to mix it thoroughly; then let the patient finish drinking.

Medical control or the PCC may give you directions about the dose. In general, the dosage is calculated at 1 gram of activated charcoal per kilogram of the patient's weight or 1 g/kg. An adult dose is usually between 30 and 100 grams; for a child or an infant, the dose is between 12 and 25 grams. Follow the correct dosage that is given by the PCC or by local protocols.



Fig. 15-7: Activated charcoal.

# ENRICHMENT

## Carbon Monoxide and Cyanide Poisoning

Carbon monoxide (CO) and cyanide poisoning can result from disasters such as fires and industrial incidents, terrorist attacks and the use of weapons of mass destruction. As with all emergency responses, in cases of inhaled poison, it is essential that responders ensure their own safety before performing rescues.

### Carbon Monoxide

Thousands of individuals die each year in the United States, and thousands more are hospitalized, due to CO poisoning. People often think about CO as related to car exhaust. However, CO is the byproduct of many combustible types of machinery, several of which people have in their homes, including wood stoves and barbecues. It is also the byproduct of larger fires, such as industrial or building fires. CO, which is present in substances such as tobacco smoke, can also be produced by defective cooking equipment, defective furnaces and kerosene heaters. CO is also found in indoor skating rinks and when charcoal is used indoors.

Everyday items that emit CO include:

- Heating systems, large or small (including portable types), that burn coal, gasoline, kerosene, oil, propane and wood; this includes camping stoves.
- Barbecues or grills, both propane and charcoal.
- Natural gas water heaters.
- Gas lawn mowers or any gas-powered vehicle.
- Portable generators, often used during power outages.
- Kitchen stoves, when used for heating homes or house trailers.

CO poisoning is the leading cause of death by poisoning in the United States. Its colorless and odorless presentation increases its danger, as patients may never be aware of its presence before succumbing to its poisonous effects. CO is highly lethal and can cause death after only a few minutes of exposure. CO detectors, which work much like smoke detectors, are widely available for use in homes and businesses (Fig. 15-8). CO is lighter than air, which is why detectors should be placed in homes near sleeping areas at as high an elevation as possible, consistent with the manufacturer's operating instructions.



**Fig. 15-8:** A CO detector.

*Continued on next page*

# ENRICHMENT

## Carbon Monoxide and Cyanide Poisoning *CONTINUED*

### Signs and Symptoms of CO Poisoning

The initial symptoms of CO poisoning, such as a dull or throbbing headache, nausea and vomiting, can easily be mistaken for something benign. Other signs and symptoms of CO poisoning include:

- Bluish skin color.
- Chest pain.
- Confusion.
- Convulsions.
- Dizziness.
- Drowsiness.
- Fainting.
- Hyperactivity.
- Impaired judgment.
- Irritability.
- Loss of consciousness.
- Low blood pressure.
- Muscle weakness.
- Rapid or abnormal heartbeat.
- Shock.
- Shortness of breath.

### Providing Care for CO Poisoning

Because of the danger of CO, it is essential that responders are properly outfitted for safety and that the patient is removed from the situation as quickly as possible. If a patient experiences symptoms of CO poisoning, get the patient to fresh air immediately by opening doors and windows, turning off combustion appliances and leaving the building.

If CO poisoning is suspected, make sure emergency department staff and physicians are aware. Questions to ask the patient should include:

- Where the symptoms occurred.
- Whether symptoms disappear or decrease away from that location (e.g., home).
- Whether anyone else in the building is complaining of similar symptoms and whether those symptoms appeared at about the same time.
- Whether there are any fuel-burning appliances in the location.
- Whether these appliances have been inspected recently to ensure they are working properly.

If CO poisoning has occurred, the patient may be asked to undergo a blood test, which is done soon after exposure to confirm the diagnosis.

Everyone present in the area of the poisoning, even if they do not display any signs or symptoms, should be monitored or treated. The only treatment for CO poisoning that can be administered on the scene is providing supplemental oxygen, based on local protocols.

### Cyanide Poisoning

Cyanide poisoning makes your body unable to utilize oxygen and can quickly cause death. It can occur through the digestive and respiratory tracts and through the skin. It can also be injected.

Cyanide poisoning is generally thought of as a weapon used in terrorism or wartime. However, cyanide is found naturally in some everyday foods, such as apricot pits; in other products, such as cigarettes; and as byproducts of production such as plastic manufacturing. Cyanide is also used in some production processes such as making paper and textiles, developing photographs, cleaning metal and in rodent poisons.

### Signs and Symptoms of Cyanide Poisoning

The signs and symptoms of cyanide poisoning depend on the extent of the exposure and the route by which it enters the body. If exposure is through eating products that have naturally occurring cyanide or by absorbing it through the skin, symptoms may include sudden onset of:

- Dizziness.
- Headache.
- Nausea and vomiting.
- Rapid breathing.
- Rapid heart rate.
- Restlessness.
- Weakness.



# ENRICHMENT

## Carbon Monoxide and Cyanide Poisoning *CONTINUED*

Patients who were subjected to larger, concentrated or more intense exposure to cyanide, such as from an industrial incident or a terrorist attack, could display symptoms such as:

- Convulsions.
- Loss of consciousness.
- Low blood pressure.
- Lung injury.
- Respiratory failure leading to death.
- Slow heart rate.

### Exams and Tests for Cyanide Poisoning

There is no quick, simple blood test that will confirm a patient is suffering from cyanide poisoning at the scene of an incident or at a fire. There are several cyanide detectors available to test for cyanide in the air, but they are often delayed to the scene. Cyanide poisoning must therefore be assumed when it is likely based on circumstances, so that lifesaving care may be started quickly. You should suspect cyanide poisoning at the scene of a fire if the patient has been exposed to smoke in a confined space, whether or not the patient has been burned. If the patient has soot around the mouth and nose and an altered LOC, the probability of cyanide toxicity is greater. The most likely set of symptoms in someone who has suffered cyanide toxicity is altered mental status, abnormal pupil dilation (widening), low respiratory rate, low systolic blood pressure with increased heart rate, metabolic acidosis (increased plasma acidity) and a large increase in lactate levels in the plasma.

### Providing Care for Cyanide Poisoning

Hydrogen cyanide can enter the body through inhalation or ingestion, or by being absorbed into the skin or eyes. Avoid all contact. If you or someone else is exposed, seek medical attention immediately.

If there is a risk of inhalation, seek ventilation or local exhaust, or use breathing protection with a gas mask that has a hydrogen cyanide (HC) canister (escape). The use of positive-pressure self-contained breathing apparatus (SCBA) or SCBA CBRN (chemical, biological, radiological and nuclear), if available, is recommended when responding to nonroutine emergency situations (Fig. 15-9). Use a CBRN, full face-piece air purifying respirator (APR), when available, in nonroutine, emergency situations, environments less than immediately dangerous to life or health concentrations, but above recommended exposure limit or permissible exposure limit levels. If you or someone else is exposed to hydrogen cyanide via inhalation, seek fresh air and rest in a half-upright position. Avoid mouth-to-mouth resuscitation, and administer supplemental oxygen if it is available, based on local protocols.

If there is risk of absorption into the skin, use butyl rubber gloves and Teflon® or Tychem® protective clothing as appropriate. If you or someone else has been exposed through absorption into the skin, remove the contaminated clothing and rinse the skin with plenty of water or use a shower to rinse. Wear protective gloves when administering first aid, and seek medical attention immediately.

Hydrogen cyanide vapor can be absorbed through the eyes. For prevention, wear safety goggles, a face shield or eye protection in combination with breathing protection. If the eyes are exposed, rinse with plenty of water for several minutes. If you or the patient exposed is wearing contact lenses, remove them if easily possible. Seek medical attention immediately.

Hydrogen cyanide can also be ingested. To prevent such an exposure, do not eat, drink or smoke during work, and wash your hands before eating. If you are exposed by ingestion, rinse your mouth and follow the same steps as for inhalation. Do *not* induce vomiting. Seek medical attention immediately.

Hydrogen cyanide poses several hazards associated with fire. It is extremely flammable, and the fire emits toxic or irritating gases. To prevent fire around this gas, ensure that there is *no* smoking and there are *no* open flames or sparks. If fire does break out, shut off the gas supply. If this is not possible and there are no risks to the surrounding environment, let the fire burn out on its own. If you can extinguish it, use powder, water spray, foam or carbon dioxide.

*Continued on next page*

# ENRICHMENT

## Carbon Monoxide and Cyanide Poisoning *CONTINUED*



**Fig. 15-9:** Patients from an industrial incident or terrorist attack can be subjected to larger, concentrated or more intense exposure to cyanide. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*

When mixed with air, hydrogen cyanide also poses a risk of explosion. Keep the area closed and well ventilated, and use explosion-proof electrical equipment and lighting. To prevent an explosion, if there is a fire, keep the cylinder cool by spraying it with water. If you do have to fight the fire, do so from a sheltered position.

If a patient is suspected of exposure to hydrogen cyanide, the SAMPLE history and scene size-up will be vital. The hospital will administer blood tests, X-rays, other diagnostic tests and IV lines. It is important to accurately convey details about the scene to healthcare providers, as they will use this information, along with the patient's presentation and the test results, to determine if the patient has indeed suffered from cyanide poisoning. Also, because cyanide poisoning is rare, healthcare providers may not consider the possibility unless you report it, and treatment may come too late.

# 16

## ENVIRONMENTAL EMERGENCIES

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### ▶ You Are the Emergency Medical Responder

As the nearest park ranger in the area, you are summoned to a campsite for an incident involving a possible venomous snakebite. When you arrive and size up the scene, you find several campers assisting one of the others, a young adult male. As you begin your primary assessment and investigate the patient's chief complaint, you see two puncture wounds and swelling on his right hand. The patient described the snake as having a triangular-shaped head and distinct diamond-shaped patterns on its body. It struck him like "a bolt of lightning" when he bent down to move some rocks beside the stream. He says the pain is about an 8 or a 9, on a scale of 1 to 10. There is a medical facility at the park headquarters and a regional medical center with antivenom nearby. How would you respond?



## KEY TERMS

**Anaphylaxis:** A form of distributive shock caused by an often sudden severe allergic reaction, in which air passages may swell and restrict breathing; also referred to as anaphylactic shock.

**Antivenom:** A substance used to counteract the poisonous effects of venom.

**Arterial gas embolism:** A condition in which air bubbles enter the bloodstream and subsequently travel to the brain; results from a rapid ascent from deep water, which expands air in the lungs too quickly.

**Barotrauma:** Injury sustained because of pressure differences between areas of the body and the surrounding environment; most commonly occurs in air travel and SCUBA diving.

**Conduction:** One of the ways the body loses or gains heat; occurs when the skin is in contact with something with a lower or higher temperature.

**Convection:** One of the ways the body loses or gains heat; occurs when air moves over the skin and carries away or increases heat.

**Core temperature:** The temperature inside the body.

**Decompression sickness:** A sometimes fatal disorder caused by the release of gas bubbles into body tissue; also known as “the bends”; occurs when SCUBA divers ascend too rapidly, without allowing sufficient time for gases to exit body tissues and be removed through exhalation.

**Dehydration:** Inadequate fluids in the body’s tissues.

**Drowning:** An event in which a victim experiences respiratory impairment due to submersion in water. Drowning may or may not result in death.

**Electrolytes:** Substances that are electrically conductive in solution and are essential to the regulation of nerve and muscle function and fluid balance throughout the body; include sodium, potassium, chloride, calcium and phosphate.

**Evaporation:** One of the ways the body loses heat; occurs when the body is wet and the moisture evaporates, cooling the skin.

**Exercise-associated muscle cramps:** Formerly known as heat cramps, these muscle spasms can be intense and debilitating and typically occur in the

legs, arms and abdomen; painful involuntary muscle spasms occur during or after physical exertion, particularly in high heat and humidity, possibly due to loss of electrolytes and water from perspiration; not associated with an increase in body temperature.

**Exertional heat exhaustion (EHE):** An inability to cope with heat and characterized by fatigue, nausea and/or vomiting, loss of appetite, dehydration, exercise-associated muscle cramps, dizziness with possible fainting, elevated heart and respiratory rate, and skin that is pale, cool and clammy or slightly flushed; if a core body temperature can be obtained, it is typically higher than 104° F (40° C). The person may be weak and unable to stand but has normal mental status; often results from strenuous work or wearing too much clothing in a hot, humid environment, and may or may not occur with dehydration and electrolyte imbalance.

**Exertional heat stroke (EHS):** The most serious form of heat-related illness; life threatening and develops when the body’s cooling mechanisms are overwhelmed and body systems begin to fail. People with EHS have exaggerated heat production and an inability to cool themselves.

**Free diving:** An extreme sport in which divers compete underwater without any underwater breathing apparatus.

**Frostbite:** A condition in which body tissues freeze; most commonly occurs in the fingers, toes, ears and nose.

**Heat index:** An index that combines the air temperature and relative humidity to determine the perceived, human-felt temperature; a measure of how hot it feels.

**Heat stroke:** The most serious form of heat-related illness; life threatening and develops when the body’s cooling mechanisms are overwhelmed and body systems begin to fail; can be classified as classic heat stroke or exertional heat stroke.

**Hyperthermia:** Overheating of the body; includes exercise-associated muscle cramps, exertional heat exhaustion and heat stroke (exertional and classic).

**Hypothalamus:** Control center of the body’s temperature; located in the brain.

*(Continued)*

## KEY TERMS continued

**Hypothermia:** The state of the body being colder than the usual core temperature, caused by either excessive loss of body heat and/or the body's inability to produce heat.

**Metabolism:** The physical and chemical processes of converting oxygen and food into energy within the body.

**Rabies:** An infectious viral disease that affects the nervous system of humans and other mammals; has a high fatality rate if left untreated.

**Radiation:** One of the ways the body loses heat; heat radiates out of the body, especially from the head and neck.

**Tetanus:** An acute infectious disease caused by a bacterium that produces a powerful poison; can occur in puncture wounds, such as human and animal bites; also called lockjaw.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Identify the signs and symptoms of a heat-related illness.
- Describe how to care for a patient who has a heat-related illness.
- Identify the signs and symptoms of a cold-related emergency.
- Describe how to care for a patient who has a cold-related emergency.
- Identify the signs and symptoms of anaphylaxis.
- Describe the care provided to a patient experiencing anaphylactic shock.
- Identify the signs and symptoms of the most common types of bites and stings.
- Describe how to provide general care for various bites and stings.
- Describe various methods of rescuing a victim in the water.

## SKILL OBJECTIVES

After reading this chapter, and completing the class activities, you should be able to:

- Demonstrate the use of an epinephrine auto-injector.
- Demonstrate appropriate handling and disposal of an epinephrine auto-injector.

## INTRODUCTION

Environmental emergencies include a wide range of situations—from exertional heat stroke and frostbite, to snakebites and drowning. They range from minor to life threatening. In some cases, the same problem—such as a bee sting—can result in minor pain and discomfort in one patient while causing a life-threatening condition in another, such as anaphylaxis.

Environmental emergencies often occur during the course of everyday events. For example, a teenager

may get caught without shelter and proper clothing during a sudden downpour while on a hike, an older adult may collapse from dehydration during a heat spell or a bathtub may be the cause of a drowning for a small child.

In this chapter, you will learn how to recognize and care for heat-related illnesses and cold-related emergencies, bites and stings, anaphylaxis and drowning incidents.

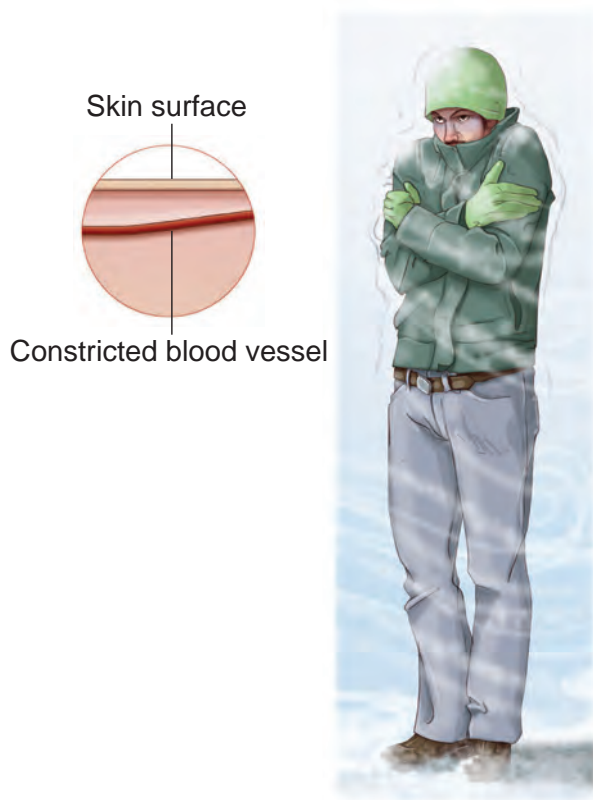


## BODY TEMPERATURE

The human body usually keeps itself at a constant **core temperature** (internal temperature) of 98.6° F, or 37° C. The control center of body temperature is in the brain and is called the **hypothalamus**. The hypothalamus receives information and adjusts the body's function accordingly. The body needs to be kept within a specific range of temperatures for the cells to stay alive and healthy (97.8° F to 99° F, or 36.5° C to 37.2° C). It is vital the body responds properly to temperature signals.

### How the Body Stays Warm

Heat is a byproduct of **metabolism**, the conversion of food and drink into energy. The body also gains heat with any kind of physical activity.

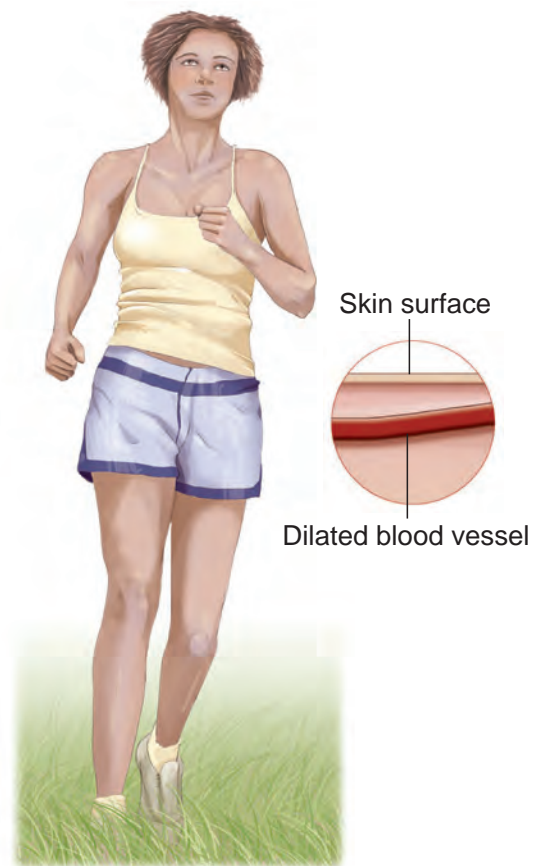


**Fig. 16-1:** The body stays warm by constricting blood vessels close to the skin. If this does not work, it begins to shiver.

If the body starts to become too cold, it responds by constricting (closing up) the blood vessels close to the skin so it can keep the warmer blood near the center of the body (Fig. 16-1). This helps keep the organs warm. If this does not work, the body then begins to shiver. The shivering motion increases body heat because it is a form of movement.

### How the Body Stays Cool

In a warm or hot environment, the hypothalamus detects an increase in blood temperature. Blood vessels near the skin dilate (widen), to bring more blood to the surface, which allows heat to escape (Fig. 16-2).



**Fig. 16-2:** The body stays cool by dilating blood vessels near the skin so heat can escape.



#### CRITICAL FACTS

The human body usually keeps itself at a constant core temperature (internal temperature) of 98.6° F, or 37° C.

In a warm or hot environment, the hypothalamus detects an increase in blood temperature. Blood vessels near the skin dilate (widen), to bring more blood to the surface, which allows heat to escape.

There are five general ways in which the body can be cooled:

- **Radiation:** This process involves the transfer of heat from one object to another without physical contact. The body loses the majority of heat through radiation, mostly from the head, hands and feet.
- **Convection:** This process occurs when cold air moves over the skin and carries the skin's heat away. The faster the air is moving, the faster the body will be cooled. Convection is what makes warm skin feel cooler in a breeze. Convection also assists in the evaporation process.
- **Conduction:** This occurs when the body is in direct contact with a substance that is cooler than the body's temperature. Through conduction, the body's heat is transferred to the cooler substance (e.g., if you are swimming in cold water or sitting on a cool rock in the shade).
- **Evaporation:** This is the process by which a liquid or solid becomes a vapor. When body heat causes one to perspire and the perspiration evaporates, the heat that was absorbed into sweat dissipates into the air which cools off the skin.
- **Respiration:** Heat is also lost through respiration, another term for breathing. Before air is exhaled, it is warmed by the lungs and airway. Respiration normally accounts for approximately 10 to 20 percent of heat loss.

## PEOPLE AT RISK FOR HEAT-RELATED ILLNESSES AND COLD-RELATED EMERGENCIES

Although anyone can be at risk for heat-related illnesses and cold-related emergencies, some people are at even greater risk than others. People who are susceptible to a heat-related illness or cold-related emergency include those who:

- Work or exercise strenuously in a warm or hot and humid environment or a cold environment.

- Have a pre-existing health problem, such as diabetes or heart disease. Pre-existing health problems can increase susceptibility to a heat-related illness. Medications taken for these conditions can also cause dehydration.
- Have had a previous heat-related illness or cold-related emergency.
- Take medications to eliminate water from the body (diuretics). Diuretics increase the risk of dehydration, which, in turn, causes an increase in core body temperature by preventing adequate blood flow to remove excess heat.
- Consume other substances that have a diuretic effect, such as fluids containing caffeine, alcohol or carbonation.
- Live in a situation or environment that does not provide them with enough heating or cooling, depending on the season.
- Do not maintain adequate hydration by drinking enough water to counteract the loss of fluids through perspiration, exertion or exposure to heat and humidity.
- Wear clothing inappropriate for the weather.

Heat-related illnesses and cold-related emergencies occur more frequently among older adults, especially those living in poorly ventilated or poorly insulated buildings, or buildings with poor heating or cooling systems. Young children and people with health problems are also at greater risk because their bodies do not respond as effectively to temperature extremes.

## HEAT-RELATED ILLNESSES

There are several types of illness related to overheating of the body, or **hyperthermia**, including exercise-associated muscle cramps, exertional heat exhaustion and heat stroke (exertional or classic). Heat-related illnesses can happen to anyone, but several predisposing factors can put some people at higher risk.



### CRITICAL FACTS

Heat-related illnesses and cold-related emergencies occur more frequently among older adults, especially those exposed to poor living conditions. The young and those with health problems are also considered high-risk groups.

There are several types of illness related to overheating of the body, or hyperthermia: exercise-associated muscle cramps, exertional heat exhaustion and heat stroke (exertional or classic).



## CRITICAL FACTS

Dehydration can be a serious and even life-threatening situation. The people at highest risk of dying from dehydration are the very young and the very old.

These factors include:

- **Climate.** In very warm or hot and humid weather, the body may not be able to cool off sufficiently. If the temperature is high, the body is not as able to lower its temperature through radiation. The more humid the air, the less the body is able to cool down through sweating. Evaporation decreases as the relative humidity increases because the air contains excessive moisture (Fig. 16-3).
- **Exercise and activity.** Exercise or strenuous labor in the heat does not allow the body to cool off, particularly since exercise itself increases body temperature. When combined with a high **heat index**, there is a much greater risk of increasing the core temperature as it becomes more difficult to cool the body.
- **Age.** The very young and very old are not as able to regulate body temperature as others are. Infants and young children, for example, may not be able to get the fluids they need, move away from the heated area, or speak up and tell someone they are too warm.
- **Pre-existing illness and/or conditions.** Certain illnesses and conditions can make someone feel the heat more than others. Examples include people with diabetes, infections (which can cause fever, increasing the body temperature even more), obesity and heart disease.

- **Drugs and/or medications.** Medications or substances, such as alcohol and diuretics, cause an increase in blood vessel constriction, increase urination, increase the risk of dehydration and increase core temperature.

## Dehydration

**Dehydration** refers to inadequate fluids in the body's tissues. Dehydration can be a serious and even life-threatening situation. The people at highest risk of dying from dehydration are the very young and the very old.

## Signs and Symptoms of Dehydration

The signs and symptoms of dehydration worsen as the body becomes dryer. The first signs of dehydration include:

- Fatigue.
- Weakness.
- Headache.
- Irritability.
- Nausea.
- Dizziness.
- Excessive thirst.
- Dry lips and mouth.

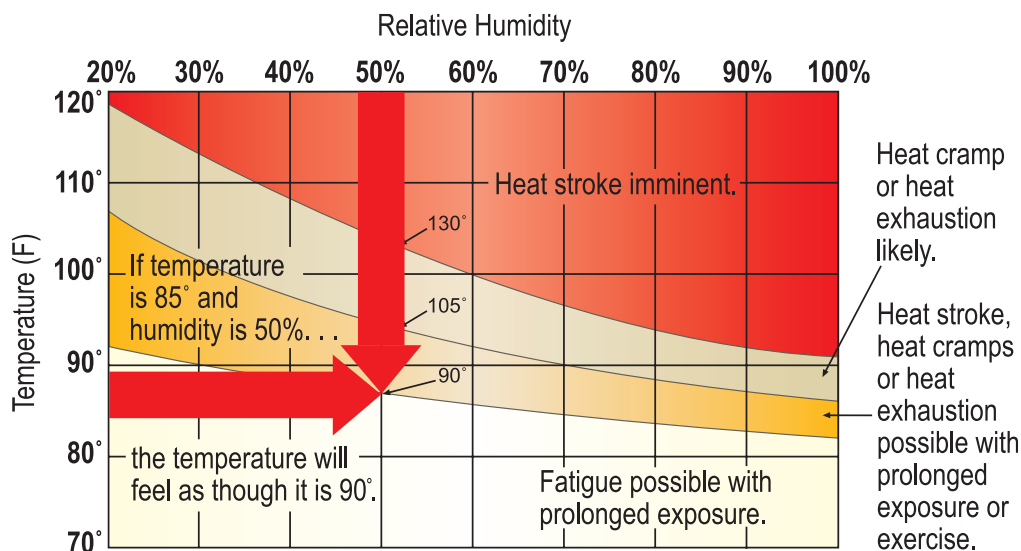


Fig. 16-3: Humidity is a main factor that could contribute to heat-related illnesses or a rise in body temperature.

As dehydration worsens, symptoms can include:

- Disorientation or delirium.
- Loss of appetite.
- Severe thirst.
- Dry mucous membranes.
- Sunken eyes.
- Lowered blood pressure.
- Rapid pulse.
- Dry skin that does not spring back if pinched, creating a “tenting” effect.
- Lack of tears (particularly important among young children).
- Decrease in perspiration.
- Dark, amber urine or complete lack of urine output.
- Unconsciousness.

### Providing Care for Dehydration

To care for a patient who is dehydrated, you need to help them replace the lost fluid. If the patient is still awake and able to swallow, encourage them to drink small amounts of a commercial sports drink or, if not available, water. The patient should be allowed to drink until their thirst sensation is quenched. However, do not let the patient gulp the fluid down; instead, have them sip it at a slow pace. If the patient drinks too quickly, vomiting may occur. If dehydration is severe, the patient will likely need more advanced medical care to receive fluids intravenously.

### Exercise-Associated Muscle Cramps

The exact cause of **exercise-associated muscle cramps** is not known, although it is believed to be a combination of loss of fluid and **electrolytes** from heavy sweating. Exercise-associated muscle cramps develop fairly rapidly and usually occur after heavy exercise or work in warm or even moderate temperatures.

### Signs and Symptoms of Exercise-Associated Muscle Cramps

Exercise-associated muscle cramps are painful spasms of skeletal muscles. While they usually affect the legs, arms and abdomen, they can occur in any voluntary muscle. The person’s body temperature is usually normal and the skin moist.

### Providing Care for Exercise-Associated Muscle Cramps

Exercise-associated muscle cramps must be taken seriously, particularly if there is a history of heart disease or the patient is on a low-sodium diet. To care for exercise-associated muscle cramps, the most important initial action is to reduce the cramps and remove the patient from the heat. Have the patient rest, then gently massage and lightly stretch the cramped muscles to ease the discomfort. To replace what was lost to perspiration, encourage the patient to drink an electrolyte- and carbohydrate-containing fluid such as a commercial sports drink, fruit juice or milk. Water also may be given if the drinks are not available.

While the patient should rest as long as possible, if the cramping has gone away and the patient feels better, activity can be resumed with caution. Advise the patient to rest frequently and drink fluids to prevent further dehydration and cramping.

### Exertional Heat Exhaustion

**Exertional heat exhaustion (EHE)** is a form of heat-related illness. EHE results when fluid lost through perspiration is not replaced by other fluids. This results in the body pulling the blood away from the surface areas of the body to protect the vital organs, such as the heart and brain.

Anyone can be at risk for developing EHE from exposure to a hot or humid environment. However,



#### CRITICAL FACTS

To care for dehydration, if the patient is still awake and able to swallow, encourage them to drink small amounts of a commercial sports drink or, if not available, water.

Exercise-associated muscle cramps are painful, involuntary muscle spasms, most often in the legs and abdomen, caused by loss of fluids and electrolytes after physical exertion, especially (but not always) in high heat. Exercise-associated muscle cramps may indicate severe heat-related illness.

To care for exercise-associated muscle cramps, reduce the cramps and remove the patient from the heat. Have the patient rest, then gently massage and lightly stretch the cramped muscles to ease the discomfort. Encourage the patient to drink an electrolyte- and carbohydrate-containing fluid such as a commercial sports drink, fruit juice or milk. Water also may be given if the drinks are not available.



it happens most often to those engaged in intense physical activity—such as firefighters, construction or factory workers and athletes. Simply being in a hot and humid environment while overdressed with heavy clothes can also cause EHE.

## Signs and Symptoms of Exertional Heat Exhaustion

The signs and symptoms of exertional heat exhaustion include:

- Cool, pale, clammy or slightly flushed skin.
- Fatigue.
- Nausea and/or vomiting.
- Loss of appetite.
- Dehydration.

- Dizziness with possible fainting.
- Elevated heart and respiratory rate.
- Muscle cramps.

## Providing Care for Exertional Heat Exhaustion

Care for exertional heat exhaustion includes the following:

- Move the patient from the hot environment to a cooler environment with circulating air.
- Loosen or remove as much clothing as possible.
- Apply cool, wet cloths, such as towels or sheets, taking care to remoisten the cloths periodically. Spraying the patient with water and fanning also can help increase the evaporative cooling (Fig. 16-4).



**Fig. 16-4:** Applying cool, wet cloths to the skin, fanning and encouraging rehydration are all effective ways to help a patient with exertional heat exhaustion.



### CRITICAL FACTS

Exertional heat exhaustion is a more severe form of heat-related illness. Exertional heat exhaustion results when fluid lost through perspiration is not replaced by other fluids.

To provide care for exertional heat exhaustion, move the patient out of the heat to a cooler area and loosen or remove as much clothing as possible. Spray the person with cool water, apply cool wet cloths or towels to the skin, and fan the person. If the patient is awake and able to swallow, encourage them to drink small amounts of a commercial sports drink or fruit juice; if these are not available, milk or water may also be given.



- If the patient is awake and able to swallow, give them small amounts of a cool fluid such as a commercial sports drink or fruit juice to restore fluids and electrolytes. Milk or water also may be given. Do not let the patient drink too quickly.
- Let the patient rest in a comfortable position, and watch carefully for changes in their condition. The patient should not resume normal activities the same day.
- If the patient's condition does not improve, or they refuse fluids, have a change in level of consciousness or vomit, call for more advanced medical personnel, as these are indications that the patient's condition is getting worse. Stop giving fluids and place the patient on their side in a recovery position if needed. Watch for signs and symptoms of breathing problems. Keep the patient lying down and continue to cool the body any way you can (see Providing Care for Heat Stroke for cooling methods).

Low blood pressure and rapid, weak pulse are signs of shock, so take steps to prevent or minimize shock. Refer to Chapter 18 for more information on how to care for shock.

## Heat Stroke

The most serious of heat-related illnesses is **heat stroke**. Heat stroke is a life-threatening condition that most often occurs when people ignore the signs and symptoms of exertional heat exhaustion or do not act quickly enough to give care. Heat stroke develops when the body systems are overwhelmed by heat and begin to stop functioning. Sweating may stop when body fluid levels are low (i.e., dehydration) but may also still be present for a person suffering from heat stroke. The body's exaggerated heat production, combined with an inability to cool itself, causes body temperature to rise quickly, soon reaching a level at which the brain and other vital organs, such as the heart and kidneys, begin to fail. If the body is not cooled, convulsions, coma and death will result.

Two types of heat stroke are typically reported—classic heat stroke and exertional heat stroke.

Classic heat stroke is normally caused by environmental changes and often occurs during the summer months. Classic heat stroke most often occurs in infants, children, older adults, those with chronic medical illnesses and those who suffer from inefficient body heat-regulation mechanisms—such as those in poor socioeconomic settings with limited access to air conditioning and those on certain medications (e.g., antihistamines, amphetamines, diuretics, and blood pressure and heart medicines). Typically, classic heat stroke develops slowly, over a period of several days, with the person presenting with minimally elevated core temperatures.

Exertional heat stroke is the opposite of classic heat stroke and is experienced more frequently than classic heat stroke. **Exertional heat stroke**—which primarily affects younger, active individuals, such as athletes (recreational and competitive), military recruits and heavy laborers—occurs when excess heat is generated through exercise and exceeds the body's ability to cool off. Exposure to factors such as high air temperature, high relative humidity and dehydration increases the risk for developing exertional heat stroke.

## Signs and Symptoms of Heat Stroke

Heat stroke is a serious medical emergency. You must recognize the signs and symptoms of heat stroke and give care immediately. The signs and symptoms include:

- Changes in level of consciousness, including confusion, agitation, disorientation or unconsciousness.
- Trouble seeing.
- Seizures.
- Extremely high body temperature (above 104° F, or 40° C).
- Flushed or red skin that can be either dry or moist.
- Rapid, shallow breathing.
- Throbbing headache.
- Dizziness, nausea or vomiting.



### CRITICAL FACTS

The most serious of heat-related illnesses is heat stroke. Heat stroke is a life-threatening condition that occurs when the body has become overheated and is no longer able to cool itself down.

## Providing Care for Heat Stroke

Since heat stroke is life threatening, you should immediately call for more advanced medical personnel. Your next priority is to begin rapid cooling of the patient's body, to bring the core temperature down. The quicker you can get the body temperature down, the better the outcome. Bring down the patient's body temperature quickly, to reduce the possibility of brain damage, organ failure or death.

Perform a primary assessment and then provide care by using any of the following techniques to cool the patient rapidly:

- Immerse the patient in cold water up to their neck (preferred method) if it is safe to do so and the resources are available.
- Douse the patient with ice water-soaked towels over the entire body, frequently rotating the cold, wet towels, spraying with cold water, fanning the patient or covering the patient with ice towels or bags of ice placed over the body.
- If you are not able to measure and monitor the patient's core temperature, apply rapid cooling methods for 20 minutes or until the patient's LOC improves.

Low blood pressure and rapid pulse are signs of shock, so take steps to prevent or minimize shock. Refer to Chapter 18 for more information on care for shock. A person in heat stroke may experience respiratory or cardiac arrest. Be prepared to give ventilations or perform CPR, if needed.

## COLD-RELATED EMERGENCIES

### Hypothermia (Generalized Cold Exposure)

**Hypothermia** is the state of the body being colder than the usual core temperature. It is caused by either excessive loss of body heat and/or the body's inability to produce heat. Hypothermia can come on gradually or it can develop very quickly. In hypothermia, body temperature drops below 95° F (35° C).

As the body cools, an abnormal heart rhythm (ventricular fibrillation, or V-fib) may develop. If this happens, the heart will eventually stop and the patient will die if not cared for.

### Contributing Factors

As with heat-related illnesses, anyone can develop hypothermia, but predisposing factors put some people at a higher risk. These factors include:

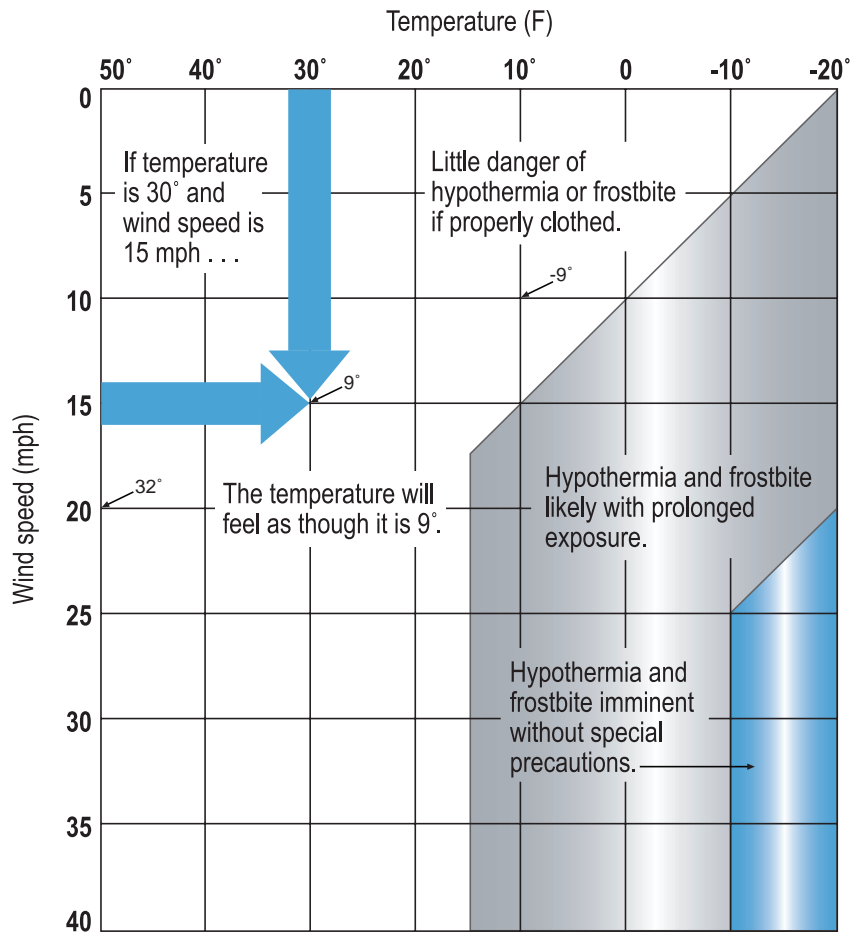
- A cold environment. Even if the ambient temperature is not extremely low, hypothermia can occur if a person is not adequately protected from the cold.
- A wet environment. The presence of moisture (e.g., perspiration, rain, snow or water) will increase the speed at which body heat is lost.
- Wind. Wind makes the environment a lot colder than the ambient temperature indicates. The higher the wind chill effect, the lower the temperature actually is (Fig. 16-5).
- Age. The very young and the very old may have difficulty keeping warm in cool or cold conditions. Infants may not yet be able to shiver effectively. Older adults may not have enough body mass to retain body heat. Both age groups may be unable to help themselves stay warm by removing themselves from the cold environment or by protecting themselves with warmer clothing. In addition, many older adults have impaired circulation.
- Medical conditions. People with certain medical conditions, such as generalized infection, hypoglycemia, shock and head injury, may be at higher risk of developing hypothermia.
- Alcohol, drugs and poisoning. Alcohol and certain types of drugs or poisons can reduce a patient's ability to feel the cold, or can cloud judgment and impede rational thought, preventing the patient from taking proper precautions to stay warm.
- Clothing inappropriate for the weather.



#### CRITICAL FACTS

In cases of heat stroke, call for more advanced medical personnel immediately. Your next priority is to begin rapid cooling methods, such as cold water immersion. The quicker you can get the body temperature down, the better the outcome.

Hypothermia is the state of the body being colder than the usual core temperature. It is caused by either excessive loss of body heat and/or the body's inability to produce heat.



**Fig. 16-5:** Wind speed is a main factor that could contribute to cold-related emergencies or a decrease in body temperature.

## Signs and Symptoms of Hypothermia

The signs and symptoms of hypothermia include:

- Shivering (may be absent in later stages of hypothermia).
- Numbness.
- Glassy stare.
- Apathy or decreasing LOC.
- Weakness.
- Impaired judgment.

In cases of severe hypothermia, the patient may be unconscious. Breathing may have slowed or stopped. The body may feel stiff as the muscles become rigid.

## Providing Care for Hypothermia

Your priority is to move the patient into a warmer environment, if possible. Be careful to move the patient gently, as any sudden movements can cause a heart arrhythmia and possibly cardiac arrest. Then:

- Perform a primary assessment, including a pulse check for up to 30 to 45 seconds based on local protocols.
- Call for more advanced medical personnel.
- Remove any wet clothing and dry off the patient.
- Passively rewarm the patient by wrapping all exposed body surfaces with anything at hand, such as warm blankets, clothing or newspapers. Be sure to also cover the head, since a



### CRITICAL FACTS

For hypothermia, your first priority is to move the patient to a warmer environment. Other critical care steps include removing wet clothing, drying the patient, passively rewarming the patient with dry clothes or blankets, giving the patient warm liquids, administering supplemental oxygen based on local protocols and monitoring the patient's condition.



**Fig. 16-6:** When providing care for a patient with hypothermia, your priority is to move the patient into a warmer environment and begin the process of passive rewarming.

significant amount of body heat is lost through the head (Fig. 16-6).

- If you are far from definitive healthcare, you may begin active rewarming. Place the patient near a heat source and apply heat pads, hot water bottles or chemical hot packs lightly wrapped in a towel or fabric to the wrists, ankles, armpits, groin and back of the neck to warm the blood in major blood vessels. Active rewarming should not delay definitive care.
- Do not immerse the patient in warm water.
- Do not rub or massage the extremities.
- Give warm, not hot, liquids that do not contain alcohol or caffeine if the patient is alert and able to swallow.
- Provide supplemental oxygen based on local protocols.
- Monitor the patient's condition. Capillary refill is affected by cold environments, so refill may be slow and therefore may not be an ideal method for assessing circulation. For more on capillary refill, see Chapters 7 and 8.
- Continue to warm the patient.
- Be prepared to perform CPR and use an automated external defibrillator (AED), if necessary.

## Frostbite (Localized Cold Exposure)

**Frostbite** is the freezing of body tissues, usually the nose, ears, fingers or toes. In both superficial and deep frostbite, the situation is serious and could result in loss of the body part. In fact, frostbite of the fingers and toes can cause enough damage to warrant amputation of hands and feet, and even arms and legs.

In early (or superficial) frostbite, only the first layers of skin are frozen. In late (or deep) frostbite, the skin and underlying tissues are frozen.

## Signs and Symptoms of Frostbite

Signs and symptoms of frostbite include:

- Lack of feeling in the affected area.
- Swelling.
- Skin that appears waxy, is cold to the touch or is discolored (flushed, white, yellow, blue or black) (Fig. 16-7).

In more serious cases, blisters may form and the affected part may turn black and show signs of deep tissue damage.



### CRITICAL FACTS

Frostbite is the freezing of body tissues, usually the nose, ears, fingers or toes. Frostbite can cause serious damage, including loss of the body part or the need for amputation.





**Fig. 16-7:** Frostbitten skin features waxy skin that is cold to the touch and flushed or appears white, yellow, blue or black. *Photo: courtesy of Nigel Vardy and Nottingham University Hospitals NHS Trust.*

### Providing Care for Frostbite

As with hypothermia, the priority is to get the patient out of the cold. Once the patient is removed from the cold, you should also do the following:

- Handle the area gently. Rough handling can damage the body part. *Never* rub the affected area, as this can cause skin damage.
- If there is a chance the body part may refreeze or if you are close to a medical facility, do *not* attempt to rewarm the frostbitten area.
- For minor frostbite, rapidly rewarm the affected part using skin-to-skin contact such as with a warm hand.
- For a more serious injury, rewarm the body part by gently soaking it in water not warmer than about 105° F (41° C). If you do not have a thermometer, test the water temperature yourself. If the temperature is uncomfortable to your touch, it is too warm. Keep the frostbitten part in the water until normal color returns and it feels warm (for 20 to 30 minutes) (Fig. 16-8, A).



**A**



**B**

**Fig. 16-8, A–B:** (A) Gently warm the affected area by soaking it in warm, not hot, water. (B) If the patient's fingers or toes are frostbitten, place dry, sterile gauze between them to keep them separated.

- Loosely bandage the area with dry, sterile dressings.
- If the fingers or toes are frostbitten, place dry, sterile gauze between them to keep them separated (Fig. 16-8, B). If the damage is to the feet, do *not* allow the patient to walk.
- *Avoid* breaking any blisters.
- Take precautions to prevent hypothermia.
- Monitor the person and care for shock.
- Do not give any ibuprofen or other nonsteroidal anti-inflammatory drugs (NSAIDs) when caring for frostbite.



#### CRITICAL FACTS

Your priority in caring for a frostbite patient is getting the patient out of the cold. Handle the frostbitten area carefully. Rewarm in warm water, but *only* if there is no risk of the body part refreezing and you are *not* close to a medical facility. Loosely bandage the area. If fingers and toes are frostbitten, place dry, sterile gauze between them. Avoid breaking blisters and take precautions to prevent hypothermia.



## PREVENTING HEAT-RELATED ILLNESSES AND COLD-RELATED EMERGENCIES

Generally, illnesses caused by overexposure to extreme temperatures are preventable. The easiest way to prevent illness caused by temperature extremes is to avoid being outside during the parts of the day when temperatures are most extreme. For instance, if working outdoors in hot weather, it is safer if the work can be done in the early morning and evening hours when the sun is not as strong. In cold weather, outside work is safer during the warmer part of the day.

Appropriate clothing for the weather and activity level adds protection against illness. It is best to wear light-colored clothing in the heat, which helps reflect the sun's rays. In the cold, the best clothing is made of tightly woven fibers, such as wool, to trap warm air against the body. Head coverings should be worn in both heat and cold. A hat or cap protects the head from the sun's rays in the summer and prevents heat from escaping in the winter. Also, other areas of the body, such as the fingers, toes, ears and nose, should be protected from cold exposure by wearing protective coverings.

Take additional precautions, such as changing activity level and taking frequent breaks. For instance, in very hot conditions, it is best to exercise only for brief periods, then rest in a cool, shaded area. Frequent breaks allow the body to readjust to normal body temperature, enabling it to better withstand brief periods of exposure to temperature extremes. Avoid heavy exercise during the hottest or coldest part of the day. Extremes of temperature promote fatigue, which hampers the body's ability to adjust to changes in the environment.

Whether in the heat or cold, it is important to drink enough fluids. Drinking at least six 8-ounce glasses of fluids daily is the most important way to prevent heat-related illness and cold-related emergency. It is best to drink fluids when taking a break. Drink cool fluids in the summer and warm fluids in the winter. Cool and warm fluids help the body maintain a normal temperature. If cool or warm drinks are not available, drink plenty of water. Avoid beverages containing caffeine or alcohol, which hinder the body's temperature-regulating mechanism.

## ANAPHYLAXIS

Severe allergic reactions to poisons are rare, but when one occurs, it is truly a life-threatening medical emergency. This reaction, called **anaphylaxis**, is a form of shock. It can be caused by an insect bite or sting, or contact with certain drugs, medications, foods and chemicals. Anaphylaxis can result from any of the four modes of poisoning (ingested, inhaled, absorbed and injected) described in Chapter 15.

Every year in the United States, fewer than 100 deaths are caused by anaphylaxis. Fortunately, some deaths can be prevented if anaphylaxis is recognized immediately and cared for quickly.

### Allergic Reactions

Our immune systems help to keep us healthy by fighting off harmful pathogens that can cause disease. But sometimes our immune systems overreact and try to fight off ordinary things that are not usually harmful, such as certain foods, grass or pet dander (tiny flakes of skin that animals shed). A person can have an allergy to almost anything. Common allergens (allergy triggers) include venomous insect stings, certain foods, animal dander, plant pollen, certain medications (such as penicillin and sulfa drugs) and latex. Over 15 million people in the United States have food allergies. Every year in the United States, over 200,000 visits to emergency departments are because of food-related allergies. Certain types of food commonly cause an allergic reaction in individuals with sensitivities to those foods. Peanuts and tree nuts cause the most cases of fatal and near-fatal allergic reactions to food. Other common food allergens include cow's milk, eggs, seafood (especially shellfish), soy and wheat.

### Signs and Symptoms of Anaphylaxis

An allergic reaction can range from mild to very severe. A person who is having a mild to moderate allergic reaction may develop a skin rash, a stuffy nose, or red, watery eyes. The skin or area of the body that came into contact with the allergen usually swells and turns red.

A person who is having a severe, life-threatening allergic reaction (anaphylaxis) may develop one or more of the following signs and symptoms within seconds or minutes of coming into contact with the allergen:

- Trouble breathing
- Swelling of the face, neck, tongue or lips
- A feeling of tightness in the chest or throat
- Skin reactions (such as hives, itchiness or flushing)
- Stomach cramps, nausea, vomiting or diarrhea
- Dizziness
- Loss of consciousness
- Signs and symptoms of shock (such as excessive thirst; skin that feels cool or moist and looks pale or grayish; an altered level of consciousness; and a rapid, weak heartbeat)

To determine if a patient is having a severe, life-threatening allergic reaction (anaphylaxis), look at the situation as well as the patient's signs and symptoms (Table 16-1).

### Care for Anaphylaxis

If you know that the patient has had a severe allergic reaction before, and the patient is having trouble breathing or is showing signs and symptoms of anaphylaxis, call for more advanced medical personnel. If the patient carries medication

(e.g., epinephrine) used for the emergency treatment of anaphylaxis, offer to help them use the medication. If you are alone, help the patient administer the medication and then call for additional resources. While you wait for advanced medical personnel to arrive, make sure the patient is sitting in a comfortable position, or have the patient lie down if they are showing signs of shock.

### Epinephrine

Epinephrine is a drug that slows or stops the effects of anaphylaxis. If a patient is known to have an allergy that could lead to anaphylaxis, they may carry an epinephrine auto-injector (a syringe system, available by prescription only, that contains a single dose of epinephrine). Devices are available containing different doses because the dose of epinephrine is based on weight (0.15 mg for children weighing between 33 and 66 pounds, and 0.3 mg for children and adults weighing more than 66 pounds). Many healthcare providers advise that people with a known history of anaphylaxis carry an anaphylaxis kit containing at least two doses of epinephrine (i.e., two auto-injectors) with them at all times (Fig. 16-9). This is because more than one dose may be needed to stop the anaphylactic reaction. A second dose is administered only if emergency medical responders are delayed and the patient is still having signs and symptoms of anaphylaxis 5 to 10 minutes after administering the first dose.

Table 16-1:

## How Do I Know If It Is Anaphylaxis?

SITUATION	LOOK FOR
You do not know if the patient has been exposed to an allergen.	<ul style="list-style-type: none"> <li>▪ Any skin reaction (such as hives, itchiness or flushing) <b>OR</b></li> <li>▪ Swelling of the face, neck, tongue or lips <b>PLUS</b></li> <li>▪ Trouble breathing <b>OR</b></li> <li>▪ Signs and symptoms of shock</li> </ul>
You think the patient may have been exposed to an allergen.	<p>Any <b>TWO</b> of the following:</p> <ul style="list-style-type: none"> <li>▪ Any skin reaction</li> <li>▪ Swelling of the face, neck, tongue or lips</li> <li>▪ Trouble breathing</li> <li>▪ Signs and symptoms of shock</li> <li>▪ Nausea, vomiting, cramping or diarrhea</li> </ul>
You know that the patient has been exposed to an allergen.	<ul style="list-style-type: none"> <li>▪ Trouble breathing <b>OR</b></li> <li>▪ Signs and symptoms of shock</li> </ul>



**Fig. 16-9:** It is advisable to carry a kit containing at least two doses of epinephrine because more than one dose may be needed to stop anaphylaxis. *EpiPen®* is a registered trademark owned by the Mylan companies.

It is important to act fast when a patient is having an anaphylactic reaction because difficulty breathing and shock are both life-threatening conditions. If the patient is unable to self-administer the medication, you may need to help. You may assist a patient with using an epinephrine auto-injector when the patient has a previous diagnosis of anaphylaxis and has been prescribed an epinephrine auto-injector; the patient is having signs and symptoms of anaphylaxis; the patient requests your help using an auto-injector; and your state laws permit giving assistance. Where state and local laws allow, some organizations (such as public safety agencies or schools) keep a stock epinephrine auto-injector for designated staff members who have received the proper training to use it in an anaphylaxis emergency. If you are using a stock epinephrine auto-injector, follow your organization's emergency action plan, which may include verifying that the patient is showing signs and symptoms of anaphylaxis, ensuring that the patient has been prescribed epinephrine in the past as appropriate and making sure to use a device containing the correct dose based on the patient's weight.

Different brands of epinephrine auto-injectors are available, but all work in a similar fashion. Begin by holding the patient's leg firmly just above the knee to help prevent injury to the patient, and then activate the device by pushing it against



**Fig. 16-10:** Pushing the auto-injector against the leg activates the device. It should be used on the muscular area of the person's mid-outer thigh.

the patient's mid-outer thigh (Fig. 16-10). Once activated, the device injects the epinephrine into the thigh muscle. The device must be held in place for the recommended amount of time (e.g., 3 seconds, although the recommended time may vary by device) to deliver the medication. Some medication may still remain in the auto-injector even after the injection is complete. After removing the auto-injector, massage the injection site for several seconds (or have the patient massage the injection site). Handle the used device carefully to prevent accidental needlestick injuries. When placing the used auto-injector in a sharps container, hold it with one hand and avoid touching

the tip. If a sharps container is not available, give the auto-injector to the transporting EMS personnel when they arrive so they can properly dispose of the discharged device. For step-by-step instructions on helping a patient to use an epinephrine auto-injector, see Skill Sheet 16-1.

If a patient is awake and able to use the auto-injector, help them in any way they ask you to. This might include getting the auto-injector from a purse, car, home, or out of a specially designed carrier or belt; taking it out of the plastic tube; or assisting with or administering the injection.

## BITES AND STINGS

### Insects

Between 0.5 and 5 percent of the American population is severely allergic to substances in the venom of bees, wasps, hornets and yellow jackets. For highly allergic people, even one sting can result in anaphylaxis, a life-threatening condition. Such highly allergic reactions account for an average of 34 reported deaths from insect stings each year. For most people, however, insect stings may be painful or uncomfortable but are not life threatening.

### Providing Care for an Insect Sting

To care for an insect sting, follow standard precautions and examine the sting site to see if the stinger is in the skin. Remove it, if it is still present. Scrape the stinger away from the skin with the edge of a tongue depressor or plastic card, such as a credit card (Fig. 16-11). With a bee sting, the venom sac may still be attached to the stinger and can continue to release venom for up to several minutes afterward. Do not use tweezers to grasp the stinger or the venom sac that could still be attached to the stinger. Grasping the stinger or venom sac could squeeze it, resulting in more venom being released.



**Fig. 16-11:** Remove an insect stinger by scraping it away from the skin with the edge of a rigid item, such as a plastic card.

Cleanse the site and cover with a dressing. A cold pack may be applied to the area to reduce pain and swelling. Ask if the patient has any history of allergies to insect bites or stings and observe for signs of an allergic reaction, even if there is no known history. An allergic reaction can range from a minor localized skin rash to anaphylaxis. Look for signs of anaphylaxis, including:

- Difficulty breathing, wheezing or shortness of breath.
- Tight feeling in the chest and throat.
- Swelling of the face, neck or tongue.
- Weakness, dizziness or confusion.
- Rash or hives.
- Low blood pressure.
- Shock.

If anaphylaxis occurs, provide emergency care *immediately*, including assisting with the patient's prescribed epinephrine auto-injector or administering an epinephrine auto-injector, if local protocols allow. (For more information on administering an epinephrine auto-injector, see the section on anaphylaxis.) Administer supplemental oxygen based on local protocols and call for more advanced medical personnel.



### CRITICAL FACTS

In the United States, up to 5 percent of the population is severely allergic to insect stings. Such allergic reactions account for approximately 34 reported deaths each year.

If anaphylaxis occurs, provide emergency care immediately, including assisting with the patient's epinephrine auto-injector or administering an epinephrine auto-injector if local protocols allow. Administer supplemental oxygen based on local protocols, and call for more advanced medical personnel.





**Fig. 16-12, A–B:** (A) A tick, such as this deer tick that spreads Lyme disease, can be as small as the head of a pin. Photo: iStockphoto.com/Martin Pietak. (B) A person with Lyme disease may develop a rash. Photo: iStockphoto.com/Heike Kampe.

## Ticks

Ticks can contract, carry and transmit serious diseases to humans. These include Rocky Mountain spotted fever and Lyme disease (Fig. 16-12, A–B). For signs and symptoms of these diseases, see Table 16-2.

### Providing Care for Tick Bites

If a tick is still embedded in the skin, it must be removed. With a gloved hand, grasp the tick with fine-tipped, pointed, nonetched, nonrasped (smooth inside surface) tweezers as close to the

skin as possible. Pull slowly, steadily and firmly (Fig. 16-13).

- Do not try to burn the tick off.
- Do not apply petroleum jelly or nail polish to the tick.

Place the tick in a jar containing rubbing alcohol to kill it. Clean the bite area with soap and water, and apply antiseptic or antibiotic ointment if protocols allow and the patient has no known allergies or sensitivities to the medication. Advise the patient to seek medical advice, because of the risk of contracting a tickborne disease. If the tick cannot be removed, the patient should seek more advanced medical care.

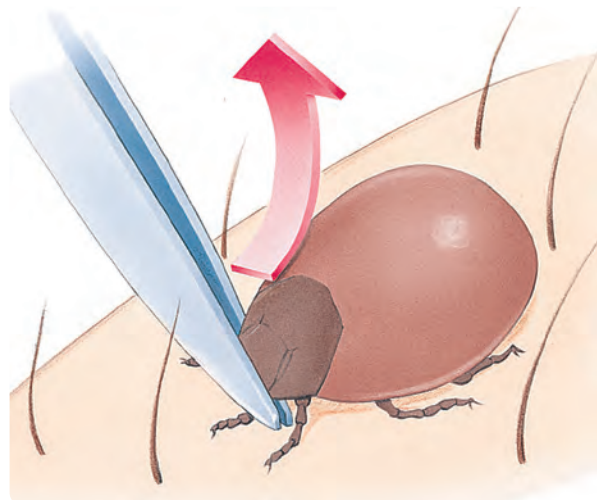
Table 16-2:

### Infections from Ticks

INFECTIOUS DISEASE	SIGNS AND SYMPTOMS
Rocky Mountain spotted fever	Fever, nausea, vomiting, muscle pain, lack of appetite, severe headache, rash, abdominal pain, joint pain and diarrhea
Babesia infection	Nonspecific flu-like symptoms, such as fever, chills, sweats, headache, body aches, loss of appetite, nausea or fatigue, and anemia which can lead to jaundice and dark urine
Ehrlichiosis	Fever, headache, fatigue, muscle aches, nausea, vomiting, diarrhea, cough, joint pains, confusion and occasional rash
Lyme disease	Fever, headache, fatigue and a characteristic skin rash (e.g., “bull’s-eye”)

## Spiders and Scorpions

Few spiders in the United States have venom that causes serious illness or death. However, the bites of black widow and brown recluse spiders



**Fig. 16-13:** Remove a tick that is still embedded in the skin by pulling slowly, steadily and firmly on the tick with a pair of fine-tipped, pointed, nonetched, nonrasped tweezers.



can, in rare instances, be fatal (Fig. 16-14, A–B). The venom of recluse spiders (known as brown recluse, fiddle back or violin) is necrotizing (tissue destroying), while the venom of widows (black, red and brown) contains neurotoxin and affects neuromuscular function. Symptoms will vary depending on the amount of venom injected and the patient’s sensitivity to the venom. Most spider bites resolve on their own with no adverse effects or scarring. Signs and symptoms of venomous spider bites can mimic other conditions. The only sure way of knowing a person has been bitten by a spider is to have witnessed it.



**Fig. 16-14, A–B:** (A) Black widow spider. Photo: ©iStockphoto.com/Mark Kostich; (B) brown recluse spider. Photo: Department of Entomology, The Ohio State University.

Bites usually occur on the hands and arms of people reaching into places where spiders are residing. The bite of the black widow spider and its relatives is the more painful and often the more deadly, especially in very young and older adult patients. The bite usually causes an immediate sharp pinprick pain, followed by a dull pain in the area of the bite. Sometimes, however, no pain is felt initially. Other signs and symptoms may include muscular rigidity in the shoulders, chest, back and abdomen; restlessness; anxiety; dizziness, headache and profuse sweating; weakness; and drooping or swelling of the eyelids.

A brown recluse spider bite may produce little or no pain initially, but localized pain develops an hour or more later. The brown recluse is also called the “fiddle back” or “violin” spider because of the distinctive violin-shaped pattern on the back of its front body section. A blood-filled blister forms under the surface of the skin, sometimes in a target or bull’s-eye pattern. Over time, the blister increases in size and eventually ruptures, leading to tissue necrosis (destruction) and a black scab.

Another potentially dangerous spider is the northwestern brown, or hobo, spider. It can produce an open, slow-healing wound similar to that of the brown recluse.

An **antivenom** to counteract the poisonous effects of the venom is available for black widow bites. Antivenom is used mostly for children and older adults, and is rarely necessary when bites occur in healthy adults.

Scorpions typically live in dry regions of the southwestern United States and Mexico, but they are also common in other southern regions of the United States including Florida. They are usually about 3 inches long and have 8 legs and a pair of crablike pincers (Fig. 16-15). At the end of the tail



**Fig. 16-15:** Scorpion. Photo: iStockphoto.com/John Bell.

is a stinger, used to inject venom. Scorpions live in cool, damp places, such as basements, junk piles, woodpiles and under the bark of living or fallen trees. They are most active in the evening and at night, which is when most stings occur. Like spiders, only a few species of scorpions have a potentially fatal sting, and these are mostly found in the southwest. Scorpions from the southeastern part of the country are usually nonpoisonous. Their sting can cause localized allergic reactions similar to a bee sting and can be cared for in the same way. However, because it is difficult to distinguish highly poisonous scorpions from nonpoisonous scorpions, all scorpion stings should be treated as medical emergencies. If it is possible and safe to do so, carefully attempt to capture the scorpion so that it could possibly be identified as poisonous or nonpoisonous by the Poison Control Center.

General signs and symptoms of spider bites and scorpion stings may include:

- A mark indicating a possible bite or sting.
- Severe pain in the sting or bite area.
- A blister, lesion or swelling at the entry site.
- Nausea and vomiting.
- Stiff or painful joints.
- Chills or fever.
- Difficulty breathing or swallowing or signs of anaphylaxis.
- Sweating or salivating profusely.
- Irregular heart rhythms.
- Muscle aches or severe abdominal or back pain.
- Dizziness or fainting.
- Chest pain.
- Elevated blood pressure and heart rate.
- Infection of the bite.

## Providing Care for Spider Bites and Scorpion Stings

If a patient has been bitten by a spider or stung by a scorpion, wash the wound thoroughly and bandage it. Additionally, consider applying a topical antibiotic ointment to the bite to prevent infection, if protocols allow and the patient has no known allergies or sensitivities to the medication. Apply a cold pack to the site to reduce swelling and pain. The patient should seek medical attention or, if severe symptoms are present, should be transported to a medical facility, keeping the bitten area elevated and as still as possible.

## Venomous Snakes

Snakebites kill few people in the United States. Of the estimated 7000 to 8000 people reported bitten annually, fewer than five die. Most deaths occur because the person has an allergic reaction, is in poor health or because too much time passes before the person receives medical care. Fig. 16-16, A–D shows the four kinds of venomous snakes found in the United States. Rattlesnakes account for most snakebites and nearly all deaths from snakebites.

Signs and symptoms of a venomous snakebite include:

- One or two distinct puncture wounds, which may or may not bleed. The exception is the coral snake, whose teeth leave a semicircular mark.
- Severe pain and burning at the wound site immediately after or within 4 hours of the incident.
- Swelling and discoloration at the wound site immediately after or within 4 hours of the incident.



### CRITICAL FACTS

If a patient has been bitten by a spider or stung by a scorpion, wash and bandage the wound. Consider applying a topical antibiotic if no known allergies or sensitivities to the medication exist and local protocols allow. Apply a cold pack to reduce swelling and pain.

The patient should seek medical attention. Severe symptoms require immediate transportation to a medical facility. While seeking more advanced medical attention, keep the bitten area elevated and as still as possible.





**Fig. 16-16, A-D:** (A) Rattlesnake. Photo: ©Audrey Snider-Bell, 2010, Used under license from Shutterstock.com; (B) cottonmouth. Photo: ©Leighton Photography & Imaging, 2010, Used under license from Shutterstock.com; (C) copperhead. Photo: Rauch, Ray/USFWS; (D) coral snake. Photo: iStockphoto.com/Mark Kostich.

## Providing Care for Snakebites

If the bite is from a venomous snake such as a rattlesnake, copperhead, cottonmouth or coral snake, call for more advanced medical personnel. To give care until help arrives:

- Wash the site with soap and water. Keep the injured area still and lower than the heart. Consider splinting the extremity if feasible. The patient should walk *only* if absolutely necessary.
- For any snakebite:
  - Do *not* apply ice.
  - Do *not* cut the wound.
  - Do *not* apply suction.
  - Do *not* apply a tourniquet.
  - Do *not* use electric shock, such as from a car battery.

While considered controversial based on available evidence, some local protocols recommend the use of a pressure immobilization bandage (elastic bandage) to slow the spread of venom through the lymphatic system for all venomous snakes in North America. However, evidence supports the use of a pressure immobilization bandage *only* for the coral snake when access to advanced care and antivenom is delayed. To apply a pressure immobilization bandage follow these steps:

- Check for feeling, warmth and color of the limb and note changes in skin color and temperature.
- Place the end of the bandage against the skin and use overlapping turns.
- The wrap should cover a long body section, such as an arm or a calf, beginning at the point farthest from the heart. For a joint, such as the knee or ankle, use figure-eight turns to support the joint.



### CRITICAL FACTS

To care for a venomous snakebite, wash the wound and keep the injured area still and lower than the heart.

For any snakebite, *never* apply ice, cut the wound, apply suction, apply a tourniquet or administer an electric shock.

- Check above and below the injury for feeling, warmth and color, especially fingers and toes, after you have applied an elastic roller bandage. By checking before and after bandaging, you may be able to tell if any tingling or numbness is from the elastic bandage or the injury.
- Check the snugness of the bandaging—a finger should easily, but not loosely, pass under the bandage.
- Keep the injured area still and *lower* than the heart. Transport the patient via stretcher or carry the patient. The patient should walk *only* if absolutely necessary.

## Marine-Life Stings

The stings of some forms of marine life are not only painful but can also make you sick and, in some parts of the world, can kill you (Table 16-3). The side effects include allergic reactions that can cause breathing and heart problems, as well as paralysis and death. The lifeguards and public safety officials in your area should know the types of marine life that may be present.

### Signs and Symptoms of Marine-Life Stings

Signs and symptoms of marine-life stings include:

- Rash, which may be red, raised or purplish in the shape of tentacles.
- Tentacles stuck to the skin.
- Puncture wounds (from stingrays or sea urchins).
- Pain or itching.
- Swelling.
- Signs and symptoms of an allergic reaction.

### Providing Care for Marine-Life Stings

Call for advanced life support resources if the patient does not know what stung them, has a history of allergic reactions to marine-life stings, is stung on the face or neck, or starts to have trouble breathing. Additional steps to take if you encounter someone who has sustained a marine-life sting include:

- Get a lifeguard to remove the patient from the water as soon as possible. If a lifeguard is not available, use a reaching assist, if possible. Avoid touching the patient with your bare hands, which could expose you to the stinging tentacles.
- Use gloves or a towel when removing any tentacles. A credit card edge or shell can be used to gently scrape away remaining tentacles.
- If you know the sting is from a jellyfish, irrigate the injured part with large amounts of seawater as soon as possible for at least 30 seconds. This can help to remove the tentacles and stop the injection of venom.
- Do *not* rub the wound or apply a pressure immobilization bandage, aluminum sulfate, meat tenderizer or other remedies because these may increase pain.
- Once the stinging action is stopped and the tentacles are removed, care for pain by hot-water immersion. Have the patient take a hot shower if possible for at least 20 minutes. The water temperature should be as hot as can be tolerated (non-scalding) or about 113° F (45° C) if the temperature can be measured.
- Pain from most jellyfish stings in U.S. waters resolves within 20 minutes. If pain persists, consider applying a topical over-the-counter lidocaine gel or cream.
- If you know the sting is from a stingray, sea urchin or spiny fish, flush the wound with tap water. Seawater also may be used. Keep the injured part still and soak the affected area in non-scalding hot water (as hot as the patient can stand) for at least 20 minutes or until the pain goes away. If hot water is not available, packing the area in hot sand may have a similar effect if the sand is hot enough. Carefully clean the wound and apply a bandage. Watch for signs and symptoms of infection and check with a healthcare provider to determine if a tetanus shot or additional care is needed.







#### CRITICAL FACTS

The stings of some forms of marine life are not only painful, but they can make you sick, and in some parts of the world, can kill you. The side effects of a marine-life sting can include allergic reactions that can cause breathing and heart problems, as well as paralysis and death.

For stingray, sea urchin or spiny fish stings, flush the wound with tap or ocean water, immobilize the injured part, and soak it in water as hot as the patient can stand for 30 minutes or until the pain subsides.

Table 16-3:

## Venomous Marine Life

MARINE LIFE	USUALLY FOUND
<p>Jellyfish</p> 	<p>East and west coasts of the continental United States</p>
<p>Portuguese man-of-war (bluebottle jellyfish)</p> 	<p>Tropical and subtropical waters</p>
<p>Stingray</p> 	<p>Tropical and subtropical waters</p>
<p>Sea urchin</p> 	<p>Oceans all over the world (warm and cold water)                      In rock pools and mud, on wave-exposed rocks, on coral reefs, in kelp forests and in sea grass beds</p>

Photos: jellyfish, [iStock.com/Mshake](https://www.iStock.com/Mshake); Portuguese man-of-war (bluebottle jellyfish), [Yann Hubert/Shutterstock.com](https://www.iStock.com/YannHubert); stingray, [iStock.com/naturediver](https://www.iStock.com/naturediver); sea urchin, [iStock.com/naturediver](https://www.iStock.com/naturediver).



## Domestic and Wild Animals

The bite of a domestic or wild animal carries the risk of infection, as well as soft tissue injury. Dog bites are the most common of all bites from domestic or wild animals.

### Providing Care for Animal Bites

A patient who is bitten should be removed from the situation if possible, but only without endangering yourself or others. Do *not* restrain or capture the animal. Your concerns should be for your own safety and caring for the patient. Clean minor wounds with large amounts of saline or clean water and control any bleeding. The patient should be transported or advised to see a healthcare provider for more advanced medical care. If the wound is bleeding heavily, control the bleeding and transport the patient for further medical care.

**Tetanus** and **rabies** immunizations may be necessary, so it is vital that bites from any wild or unknown domestic animals be reported to the local health department or other agency according to local protocols. Follow local protocols regarding contacting animal control to capture the animal. Try to obtain and provide a description of the animal and the area in which the animal was last seen.

## Humans

Human bites are quite common and differ from other bites because they may be more contaminated, tend to occur in higher-risk areas of the body (especially on the hands) and often receive delayed care. Children are often the inflictors and the recipients of human bite wounds.

As with animal bites, if the wound is minor, clean it with large amounts of saline or clean water and control any bleeding. Advise the patient to seek follow-up care by a healthcare provider or medical facility. If the bite is severe, control bleeding and prepare the patient for transport to a medical facility.

## WATER-RELATED EMERGENCIES

### Drowning Incidents

One of the most common water-related emergencies is **drowning**. Drowning occurs when a person experiences respiratory impairment due to submersion in water. Drowning may or may not result in death; however, it is the fifth most common cause of death from unintentional injury in the United States among all ages, and it rises to the second leading cause of death among those 1 to 14 years of age. More than 3500 Americans die annually from drowning, and more than 50 percent of drowning victims treated in emergency departments require hospitalization or transfer for further care. Children younger than 5 years of age have the highest rate of drowning.

### Contributing Factors

Drowning cannot just happen on its own. A person must be in a situation that causes the submersion. These situations include:

- Young children left alone or unsupervised around water (e.g., tubs, pools, lakes).
- Use of alcohol and recreational drugs, which may cause people to do things they otherwise would not.



### CRITICAL FACTS

The bite of a domestic or wild animal carries the risk of infection, as well as soft tissue injury. Dog bites are the most common of all bites from domestic or wild animals.

Clean minor wounds from animal bites and control bleeding. Patients should seek more advanced medical care. Heavy bleeding requires immediate control and transportation to a medical facility.

Tetanus and rabies immunizations may be necessary. It is vital that wild or unknown domestic animal bites are reported to the local health department or other agency according to local protocols.

Human bites are common, tend to be more contaminated than other bites and occur in higher-risk areas, and often receive delayed care. Caring for human bites is the same as for animal bites.

- Traumatic injury, such as diving into a shallow body of water.
- Condition or disability, such as heart disease, seizure disorder or neuromuscular disorder, that may cause sudden weakness or loss of consciousness while in the water.
- History of mental illness; for example, depression, suicide attempt, anxiety or panic disorder.

## Shallow Water Blackout

The practice of voluntarily hyperventilating (extremely rapid or deep breathing) followed by holding one's breath and then swimming underwater or holding one's breath for extended periods of time is dangerous and can be fatal. Some swimmers use this technique to try to swim long distances underwater or to try to hold their breath for an extended period while submerged in one place.

People mistakenly think that by taking a series of deep breaths in rapid succession and forcefully exhaling, they can increase the amount of oxygen they breathe, allowing them to hold their breath longer underwater. This is not true. Instead, it lowers the carbon dioxide level in the body. The level of carbon dioxide in the blood is what signals a person to breathe.

When a person hyperventilates and then swims underwater, the oxygen level in the blood can drop to a point where the swimmer passes out before the carbon dioxide level is high enough to trigger the need to inhale. When the need to inhale finally does trigger instinctively, water rushes into the unconscious person's mouth and nose, causing laryngospasm and allowing the drowning process to begin. Even highly skilled swimmers can die from this practice.

## Severity

Whether people die depends on how long they have been submerged and are unable to breathe. It also can depend on the temperature of the water. Children submerged in icy water have been successfully revived after considerable periods of time.

Brain damage or death can begin to occur in as little as 4 to 6 minutes. The sooner the drowning process is stopped by getting the patient's airway out of the water, opening the airway and providing resuscitation (ventilations or CPR), the better the chances for survival without permanent brain damage. If the submersion lasts any longer, often the result is death. These times are estimates; brain damage and/or death can occur more quickly.

## Signs and Symptoms of Drowning

Signs of a drowning incident include:

- Persistent coughing.
- Shortness of breath or no breathing at all.
- Disorientation or confusion.
- Unconsciousness, although the patient may have regained consciousness.
- Vomiting.
- Respiratory and/or cardiac arrest.

Signs of a fatal drowning incident include:

- Unconsciousness.
- No breathing.
- No pulse.
- Rigor mortis.

Because drowning victims may appear deceased when they are not (imperceptible heart rate and breathing), CPR and emergency efforts are recommended in all cases.

## Water Rescues

Before beginning the rescue, consider the patient's condition, the condition of the water and the resources available once you get the patient on dry land. Also consider the responders' ability to affect a rescue safely. You should make every effort to assist without entering the water.



### CRITICAL FACTS

Contributing factors for submersion incidents include children left alone or unsupervised around or with access to water, use of alcohol and recreational drugs, traumatic injury, sudden illness or mental illness.

## Patient's Condition

Ask yourself the following questions:

- Is the patient responsive and able to cooperate with the rescue? If so, the safest method may be a reaching or throwing assist, such as by using a pole or rope.
- What position is the patient in? If the patient is submerged, basic life support will likely be needed right away. Submersion may also make it difficult to find the patient in murky or cloudy water.
- Does the patient seem to be injured? If so, you may have to remove the patient from the water before providing care.
- Is their condition potentially due to head or neck trauma (e.g., a diving incident)? If so, you may need to stabilize the spine while attempting to remove the patient from the water.

## Condition of the Water

There are several aspects of the water's condition that will influence how you respond to a water rescue, including:

- **Visibility.** Are you able to see the patient and visualize any injuries? Are you able to see any hazards under the water?
- **Water temperature.** You will need to continue resuscitation for a cold-water drowning until the patient is rewarmed at the hospital. Also, consider the type of clothing the patient is wearing. A wetsuit provides much more protection against hypothermia than do street clothes.
- **Movement of the water.** How fast is the water flowing? Fast-flowing water can be deceptively strong. If the water is above your knees, do not attempt to wade through without being harnessed. Otherwise, you could be swept away. Also, be aware that a patient's location can change in fast-moving water.
- **Depth of the water.** Is the depth of the water such that you will be able to stand or will you require additional equipment?

- **Additional hazards.** In floods or situations where a motor vehicle is submerged, there is the potential for exposure to a hazardous material, such as oil or gas. Hazardous materials may also escape from buildings in a flood.

## Resources Available

Determine what other resources are available to assist in a water rescue. Are you the only responder? Will there be several other responders available once you get the patient on dry land? Are they all able to swim? Are there sufficient personal flotation devices (PFDs) for each responder?

## Rescuing the Victim

People who drown are not always in easy-to-manage situations. If the patient is in the water, consider your own safety before all else when attempting a water rescue.

As mentioned earlier, water rescues require special training and should only be attempted by those who are properly trained. To attempt a water rescue, you must be:

- A good swimmer.
- Specially trained in water rescue.
- Wearing a PFD.
- Accompanied by other qualified responders.

If you are not trained in water rescue, do not attempt one unless the patient is conscious and close to shore and the emergency has taken place in open, shallow water with a stable bottom.

Before entering the water, be sure you are secure so you will not be pulled in. Any sturdy object that can be grasped will do.

Follow the "reach, throw, row then go" technique (Fig. 16-17, A–C). You can reach with an object, such as an oar, a sturdy branch or even a large towel. If the victim is too far for a reaching assist, you can throw out a floating object for the victim to hang on to, such as a life preserver or even an



### CRITICAL FACTS

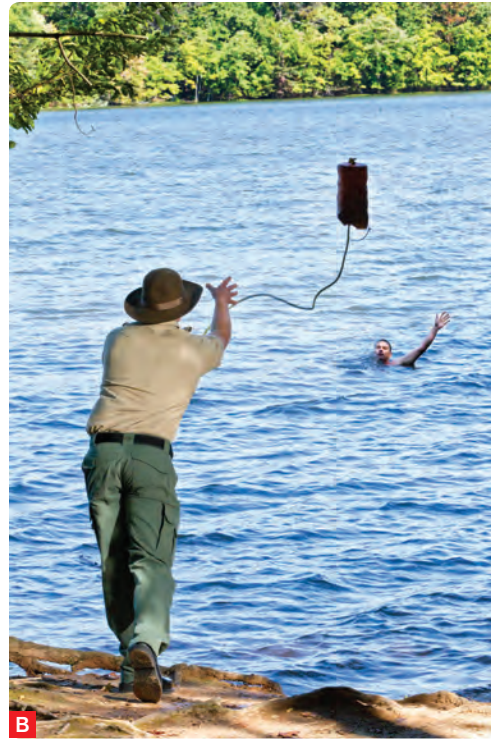
Submersion situations are not always easy to manage. Consider your own safety above all else when working on a water rescue. Water rescues require special training and should only be attempted by properly trained responders.

To perform a water rescue, follow the "reach, throw, row then go" technique. "Go" is only for those who are trained to perform deep-water rescue.





**A**



**B**



**C**

**Fig. 16-17, A–C:** (A) Reaching assist; (B) throwing assist; (C) rowing assist. Consider your own safety before following the “reach, throw, row then go” technique to rescue a person from the water. “Go” only if you are trained to do so.

empty picnic cooler. Tie a rope to this object if possible, so you can pull the victim to shore.

If possible, use a boat to get closer (row), but not close enough that the victim can grab the side of the boat and tip it. The “go” part of this technique is only for those who are trained and who can perform deep-water rescue. Further training in water rescue is available in other American Red Cross courses, such as Lifeguarding.

## Providing Care for Drowning

Remove any victim of a drowning incident from the water as soon as possible. How and when to remove the victim depends on their overall condition (e.g., LOC), the victim’s size, the potential for spinal injury, how soon help is expected to arrive and whether anyone can help. The priority in providing care in a water emergency is ensuring the patient’s face (mouth and nose) is out of the water and appropriate care

is given. Ventilations and/or CPR must be initiated immediately on an unresponsive patient who is not breathing and has no pulse. Ventilations may be started in the water; however, chest compressions cannot. If CPR is required, the patient must be removed from the water first. If a spinal injury is suspected, minimize movement to the spine, but priority must be given to airway management. Make sure additional personnel have been summoned.

Follow local protocols for spinal motion restriction. This may include the application of a cervical collar (C-collar), as well as using a backboard or another extrication device to remove the patient from the water. Before you place the patient on the backboard, make sure there are enough responders helping you. Their role is to make sure the patient's face does not become submerged. Once the head and neck are stabilized, slide the board under the patient. Let the board float up until it is against the patient's back. Secure the patient to the backboard.

Many patients who have been submerged vomit because water has entered the stomach or air has been forced into the stomach during ventilations. If the patient vomits, roll them onto their side to prevent aspiration or choking. To remove vomit from the mouth, use a finger or suction device.

Always take patients who have been involved in a drowning incident to the hospital, even if you think the danger has passed. Complications can develop as long as 72 hours after the incident and may be fatal.

For more information on water rescues, refer to Chapter 32.

## PUTTING IT ALL TOGETHER

Environmental emergencies include a wide range of situations that often occur during the course of everyday events. As an emergency medical responder (EMR), it is important you know how to identify the signs and symptoms of environmental emergencies and be able to provide appropriate care.

Maintaining body temperature is vital for proper cell function. If the body temperature drops below or rises above the acceptable level, the body tries to protect itself but can only do so to a certain extent. If the body cannot protect itself, it begins to shut down. Therefore, it is crucial for you to be able to identify the various issues that can contribute to heat-related illnesses and cold-related emergencies, including who is at highest risk of falling ill and how to help a patient who is succumbing to such an emergency.

While there are many thousands of species of snakes, spiders and insects, only a few are venomous and pose any danger to humans. Quick action by the EMR can minimize or reduce the effects of a sting or bite that has the potential to cause a serious reaction.

Finally, with all the access to water in this country, be it a bathtub, a bucket full of water, a creek or the ocean, people are constantly exposed to the danger of drowning, particularly young children. As always, it is essential that EMRs ensure their own safety before they try to help others, so you *must* know your limits when it comes to water rescues. You cannot help a drowning person if you become a victim yourself.

Drownings can be caused by other emergencies, such as a spinal injury or a cardiac arrest. An EMR must be prepared for *any* situation when it comes to water rescue.

## You Are the Emergency Medical Responder

Based on your findings, you suspect that the snake was venomous and the patient appears to be reacting to the bite. What initial care can you provide? What else should you do and why?



## Skill Sheet 16-1

# Administering an Epinephrine Auto-Injector

After conducting a scene size-up, checking the patient, and calling for more advanced medical personnel, check the auto-injector:

- Remove the auto-injector from the carrier tube or package, if necessary.
- If applicable, confirm it is prescribed for the patient.
- Check the expiration date of the auto-injector. If it has expired, do not use the auto-injector.
- If the medication is visible, confirm that the liquid is clear and not cloudy. If it is cloudy, do not use it.

Put on disposable latex-free gloves and make sure the patient is sitting or lying down.

**NOTE:** These instructions are based on the EpiPen®. If you are using a different device, follow the manufacturer's instructions.

If the patient is unable to self-administer the auto-injector, and if state regulations allow and you are authorized by your organization to do so:

## STEP 1

With the patient sitting or lying down, locate the outside middle of one thigh to use as an injection site.

**NOTE:** If injecting through clothing, check that there are no obstructions at the injection site (such as a pant seam, keys or a mobile phone).

## STEP 2

Grasp the auto-injector firmly in one fist, and pull off the safety cap with your other hand.

**NOTE:** Hold the auto-injector with the orange tip (needle end) pointing down; pull straight up on the blue safety cap without bending or twisting it.

**NOTE:** Never put your thumb, fingers or hand over the ends of the auto-injector.



## STEP 3

Hold the patient's leg firmly just above the knee to limit movement during the injection. While you are holding the patient's leg, make sure your hands are a safe distance away from the injection site.

(Continued)

## Skill Sheet 16-1

Administering an Epinephrine Auto-Injector *Continued***STEP 4**

Hold the auto-injector so that the needle end of the auto-injector is against the patient's outer thigh at a 90-degree angle (perpendicular) to the thigh.

**STEP 5**

Quickly and firmly push the tip straight into the outer thigh. You will hear and/or feel a click indicating that the spring mechanism in the auto-injector has been triggered.

**STEP 6**

Hold the auto-injector firmly in place for 3 seconds (counting "1-1000; 2-1000; 3-1000") to deliver the medication.

**STEP 7**

Remove the auto-injector from the thigh carefully and massage (or have the patient massage) the injection area with gloved hands for 10 seconds.

**STEP 8**

Encourage the patient to remain seated and to lean forward to make it easier for them to breathe. If signs and symptoms of shock are present, encourage the patient to lie down and provide reassurance to the patient while waiting for more advanced medical personnel to arrive.

*(Continued)*

## Skill Sheet 16-1

Administering an Epinephrine Auto-Injector *Continued***STEP 9**

Handle the used auto-injector carefully while placing it in a sharps container with one hand, and avoid touching the tip of the auto-injector. If a sharps container is not available, give the auto-injector to the transporting EMS personnel when they arrive so they can properly dispose of the discharged device.

**STEP 10**

After administering the injection, ensure more advanced medical personnel has been called if this has not already been done, and monitor the patient's response as follows:

- Continue to reassure the patient.
- Ask the patient how they feel.
- Check the patient's breathing.

*If, after 5 to 10 minutes, more advanced medical personnel have not arrived and if symptoms of anaphylaxis have not improved or they have improved but have gotten worse again, administer a second dose of epinephrine in the other thigh.*

# ENRICHMENT

## Lightning

On average, lightning causes more deaths annually in the United States than any other weather hazard, including blizzards, hurricanes, floods, tornadoes, earthquakes and volcanic eruptions. The National Weather Service (NWS) estimates that lightning kills nearly 100 people annually and injures about 300 others.

Lightning occurs when particles of water, ice and air moving inside a storm cloud lose electrons. Eventually, the cloud becomes divided into layers of positive and negative particles. Most electrical currents run between the layers inside the cloud. However, occasionally the negative charge flashes toward the ground, which has a positive charge. An electrical current travels back and forth between the ground and the cloud many times in the moment you see lightning flash. Anything with demonstrable height (e.g., a tower, tree or person) can provide a path for electrical current.

Traveling at speeds of up to 300 miles per second, a lightning strike can hurl a person through the air, burn clothes off and cause the heart to stop beating. The most severe lightning strikes carry up to 50 million volts of electricity, enough to light 13,000 homes. Lightning can “flash” over a person’s body or, in its more dangerous path, it can travel through blood vessels and nerves to reach the ground.

Besides burns, lightning can also cause neurological damage, fractures and loss of hearing or eyesight. The patient sometimes acts confused and may describe the episode as getting hit on the head or hearing an explosion.

People should use common sense during thunderstorms to prevent being struck by lightning. If a thunderstorm threatens, the NWS advises individuals to:

- Postpone activities promptly and not wait for rain to begin. Thunder and lightning can strike without rain.
- Go quickly inside a completely enclosed building, *not* a carport, open garage or covered patio. If no enclosed building is convenient, a cave is a good option outside, but move as far back as possible from the cave entrance.
- Watch cloud patterns and conditions for signs of an approaching storm.
- Designate safe locations and move or evacuate to a safe location at the first sound of thunder. Every *5 seconds* between the flash of lightning and the sound of thunder *equals 1 mile* of distance.
- Use the 30-30 rule where visibility is good and there is nothing obstructing your view of the thunderstorm. When you see lightning, count the time until you hear thunder. If that time is 30 seconds or less, the thunderstorm is within 6 miles. Seek shelter immediately. The threat of lightning continues for a much longer period than most people realize. *Wait at least 30 minutes* after the last clap of thunder before leaving shelter.
- If inside during a storm, keep away from windows. Injuries may occur from flying debris or glass if a window breaks.
- Stay away from plumbing, electrical equipment and wiring during a thunderstorm. Water and metal are both excellent conductors of electricity.
- Do *not* use a corded telephone or radio transmitter except for emergencies.

If people are caught in a storm outdoors and cannot find shelter, they should avoid:

- Water.
- High ground.
- Open spaces, such as meadows, football fields and golf courses.
- All metal objects, including electric wires, fences, machinery, motors and power tools.
- Unsafe places, such as under canopies, under small picnic shelters or rain shelters, or near trees.

# ENRICHMENT

## Lightning *CONTINUED*

If lightning is striking nearby when people are outside and cannot access shelter, they should:

- Crouch down and limit the amount of the body that is touching the ground (Fig. 16-18). Feet should be placed together. If possible, weight should be placed on only the balls of the feet. Hands can be placed over the ears to minimize possible hearing damage from thunder.
- Avoid proximity to other people. A minimum distance of 15 feet between people should be maintained.

If there is a tornado alert, a previously specified location (as indicated by a disaster plan) should be located as soon as possible. This may be the basement or the lowest interior level of a building.



**Fig. 16-18:** If lightning is striking nearby when people are outside and cannot access shelter, they should crouch down and limit the amount of the body that is touching the ground. *Photo: courtesy of the Canadian Red Cross.*



# ENRICHMENT

## SCUBA and Free Diving Emergencies

The growing popularity of SCUBA (self-contained underwater breathing apparatus) and **free diving** has increased the number of diving-related incidents that occur each year. Most of these incidents are the result of complications arising from the fact that pressure underwater is greater than that on land, with the pressure increasing relative to the depth.

### SCUBA

**Barotrauma** simply means pressure-related (*baro*) injury (*trauma*), and results from the inability to equalize the body's internal pressure with that of the external environment. The most frequent examples of barotrauma occur in air travel and SCUBA diving. The external pressure exerts a crushing type force on the body parts affected; hence the nickname, "lung squeeze." Barotrauma can affect multiple areas of the body. Signs and symptoms may vary depending on the body part or parts affected. The most common areas affected are the lungs, face and ears, with predominant signs and symptoms including pain in the affected area, disorientation, dizziness, nausea and bleeding from the mouth, nose or ears.

### Pulmonary Overinflation Syndrome

Pulmonary Overinflation Syndrome (POIS), or Pulmonary Overpressure Syndrome, occurs because gases under pressure (including air) contract and take up less volume. The air inhaled at depth will expand during ascent as the pressure decreases, and can go beyond the lungs' capacity. If a SCUBA diver holds their breath while ascending, the lungs can rupture, hence the common name "burst lung." POIS can also result in **arterial gas embolism**, as the excess volume of air created on ascent can be forced into the bloodstream and travel to the brain. Signs and symptoms may include numbness or tingling of the skin, weakness, paralysis and loss of consciousness.

Under pressure, inert gases from inhaled air—mostly nitrogen—are absorbed into body tissues at higher concentration than normal. The longer time spent at depth, the more this occurs. In addition, at increased depths, more gases are forced into body fluids and tissues due to the increased pressure.

### Decompression Sickness

**Decompression sickness** occurs when a diver ascends too quickly, without sufficient time for gases to exit body tissues and be removed from the body through exhalation. These gases expand as pressure decreases during ascent, creating bubbles in the body. Decompression sickness is often called "the bends" because when these bubbles occur in joints (specifically the elbow, shoulder, knee and/or hip), the joint(s) involved feels better when held bent rather than held straight. Type I decompression sickness signs and symptoms include:

- Rash.
- Dull, deep and/or throbbing pain in the body tissues or joints.
- Itching or burning sensation of the skin or bubbles under the skin (subcutaneous emphysema).

Type II signs and symptoms can have delayed onset of up to 36 hours and include the following:

- Pulmonary problems, such as:
  - A burning sensation in the chest upon inhalation
  - Non-productive coughing
  - Respiratory distress
- Hypovolemic shock and neurological symptoms

# ENRICHMENT

## SCUBA and Free Diving Emergencies *CONTINUED*

### Nitrogen Narcosis

Another common danger to recreational divers is nitrogen narcosis. This condition occurs at depths over 100 feet when the pressure causes nitrogen to dissolve into brain nerve membranes. This causes a temporary disruption in nerve transmission, resulting in an altered LOC similar to intoxication. It is particularly dangerous because, like any type of intoxication, judgment is impaired and bad judgment underwater can lead to the conditions mentioned above or drowning.

### Free Diving

Free diving is an extreme sport in which divers compete to see how deep they can dive without any underwater breathing apparatus. This is accomplished through excessive breath holding and hyperventilation. It is a dangerous activity because of the risk of loss of consciousness due to lack of oxygen to the brain (hypoxia), and subsequent drowning. Some divers utilize buoyancy devices to pull them to the surface if they lose consciousness, but this is not a reliable method of getting to oxygen in time. Other conditions associated with free diving include barotrauma, ear perforation, nitrogen narcosis and drowning.

### Providing Care

All of the conditions mentioned above are life threatening and require immediate medical attention. The diver needs immediate medical attention if they lose consciousness, show paralysis or show symptoms of stroke within 10 minutes of surfacing.

- If the patient is alert, place them in a supine position.
- If their mental state is altered, place the patient in a supine (face-up) position.
- If a spinal injury is suspected, maintain spinal motion restriction.
- If breathing appears adequate, administer supplemental oxygen, if available, based on local protocols.
- If breathing is inadequate, begin positive pressure ventilation and log the exact time of oxygen delivery.
- If needed, initiate ventilations or CPR and apply the AED.
- Try to obtain the patient's diving log and bring it to the hospital. (Divers keep diving logs to mathematically track how long they have been at a given depth in order to avoid decompression sickness.)
- Transport immediately or call for more advanced medical personnel.
- Medical control will determine if the patient should be transported directly to a facility with a recompression (hyperbaric) chamber. The Divers Alert Network (DAN) maintains a list of recompression facilities and can be reached around the clock at 919-684-9111 or 919-684-4326 collect; you can also visit [diversalertnetwork.org](http://diversalertnetwork.org).

# 17

## BEHAVIORAL EMERGENCIES

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### ▶ You Are the Emergency Medical Responder

Your fire rescue unit responds to a local mall concerning a man who is threatening violence to anyone who comes near him. When you arrive, police and security guards have the man in protective custody and are trying to calm him down. As you begin interviewing the man and taking a history, his mood abruptly swings to one of remorse and sadness. The smell of alcohol on his breath is overpowering. How would you respond to this patient and what are some things you can do to earn his trust?



## KEY TERMS

**Anxiety disorder:** A condition in which normal anxiety becomes excessive and can prevent people from functioning normally; types include generalized anxiety disorder, obsessive-compulsive disorder, panic disorder, post-traumatic stress disorder, phobias and social-anxiety disorder.

**Behavior:** How people conduct themselves or respond to their environment.

**Behavioral emergency:** A situation in which a person exhibits abnormal behavior that is unacceptable or intolerable, for example violence to oneself or others.

**Bipolar disorder:** A brain disorder that causes abnormal, severe shifts in mood, energy and a person's ability to function; the person swings from the extreme lows of depression to the highs of mania; also called manic-depressive disorder.

**Child abuse:** Action that results in the physical or psychological harm of a child; can be physical, sexual, verbal and/or emotional.

**Child neglect:** The most frequently reported type of abuse in which a parent or legal guardian fails to provide the necessary, age-appropriate care to a child; insufficient medical or emotional attention or respect given to a child.

**Clinical depression:** A mood disorder in which feelings of sadness, loss, anger or frustration interfere with everyday life for an extended period of time.

**Elder abuse:** Action that results in the physical or psychological harm of an older adult; can be physical, sexual, verbal and/or emotional, usually on someone who is disabled or frail.

**Elder neglect:** A type of abuse in which a caregiver fails to provide the necessary care to an older adult.

**Hallucination:** Perception of an object with no reality; occurs when a person is awake and conscious; may be visual, auditory or tactile.

**Mania:** An aspect of bipolar disorder characterized by elation, hyperexcitability and accelerated thoughts, speech and actions.

**Panic:** A symptom of an anxiety disorder, characterized by episodes of intense fear and physical symptoms such as chest pain, heart palpitations, shortness of breath and dizziness.

**Paranoia:** A condition characterized by feelings of persecution and exaggerated notions of perceived threat; may be part of many mental health disorders and is rarely seen in isolation.

**Phobia:** A type of anxiety disorder characterized by strong, irrational fears of objects or situations that are usually harmless; may trigger an anxiety or panic attack.

**Rape:** Non-consensual sexual intercourse often performed using force, threat or violence.

**Rape-trauma syndrome:** The three stages a victim typically goes through following a rape: acute, outward adjustment and resolution; a common response to rape.

**Schizophrenia:** A chronic mental illness in which the person hears voices or feels that their thoughts are being controlled by others; can cause hallucinations, delusions, disordered thinking, movement disorders and social withdrawal.

**Self-mutilation:** Self-injury; deliberate harm to one's own body used as an unhealthy coping mechanism to deal with overwhelming negative emotions.

**Sexual assault:** Any form of sexualized contact with another person without consent and performed using force, coercion or threat.

**Suicide:** An intentional act to end one's own life, usually as a result of feeling there are no other options available to resolve one's problems.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Identify behavior that suggests a person may be experiencing a behavioral emergency.
- Describe how to approach and care for a patient experiencing a behavioral change or psychological crisis.
- Make appropriate decisions about care when given an example of an emergency in which someone is experiencing a behavioral emergency.
- Identify risk factors for suicide.
- Describe how to assess a patient who is contemplating or has already attempted violence toward themselves.

## INTRODUCTION

**Behavior** is how people conduct themselves or respond to their environment. A **behavioral emergency** is a situation in which a patient exhibits abnormal behavior that is unacceptable or intolerable. Such is often the case with people who become violent, attempt to take their own lives or believe that other people are out to harm them. A behavioral emergency can pose unique problems that, as an emergency medical responder (EMR), you will have to manage.

## BEHAVIORAL EMERGENCIES

A behavioral emergency can be present in someone who acts abnormally, or in ways that are unacceptable or dangerous to themselves, their family or the community at large. People exhibiting abnormal behavior may be violent toward themselves or others. They may appear agitated or speak in a rapid or incoherent manner, or they may be subdued or withdrawn. They may also appear to be intoxicated.

### Assessment

Assume that a patient with a behavioral emergency has an altered mental status. Size up the scene to gather information relevant to safety. Consider the mechanism of injury (MOI) or nature of illness. When it is safe to enter the scene, remain cautious as you approach the person (Fig. 17-1). Just because the scene may appear safe does

not necessarily mean that it is. A person may be carrying a weapon or other object, or have one nearby, that could cause injury. Always be prepared for any potential threat, keep your eyes on the person and never turn your back.

Observe the person's general appearance and behavior as you talk. Determine the person's level of consciousness (LOC) and activity level. Is the person active or subdued? How does the person speak? Explain what you would like to do, including checking vital signs and providing care for any injuries, such as external bleeding. If family or friends of the patient are available, ask if the patient has a history of aggressive behavior or if there are any underlying medical issues. A seemingly intoxicated person may have an underlying medical condition that is triggering the behavior.

Signs and symptoms commonly seen during a behavioral emergency may present with a rapid onset and include:

- Emotional reactions such as panic, anxiety, fear, agitation, depression, withdrawal, confusion and anger.
- Unusual appearance.
- Unusual speech patterns.
- Abnormal or bizarre behavior or thought patterns.
- Loss of contact with reality.
- Aggressive behavior including threats or intent to harm self or others.



**Fig. 17-1:** Approach a person having a behavioral emergency with caution.





## CRITICAL FACTS

A behavioral emergency is a situation in which a patient exhibits abnormal behavior that is unacceptable or intolerable. Such is often the case with people who become violent, attempt to take their own lives or believe that other people are out to harm them.

Signs and symptoms commonly seen during a behavioral emergency may present with a rapid onset and can include emotional reactions, such as fear, panic or anger; unusual appearance or speech; abnormal or aggressive behavior; loss of bladder control and hallucinations.

- Certain odors on the patient's breath, such as alcohol.
- Pupils that are dilated, constricted or that react unequally.
- Excess salivation.
- Loss of bladder control.
- Visual **hallucinations**.

## Behavioral Changes

### Causes of Behavioral Emergencies

The primary causes of behavioral emergencies include:

- Injury. Any condition that reduces the amount of oxygen to the brain, such as a head injury, can result in a significant change in behavior. Too little oxygen could make a normally calm person suddenly become anxious or even violent. Cognitive changes associated with head injury can also be factors in behavioral change.
- Physical illness.
- Past history of behavioral emergency.
- Alcohol or drug use or abuse.
- Noncompliance regarding taking prescribed psychiatric medications.
- Adverse effects of prescribed medications.
- Mental illness. Mental illnesses that can alter behavior include depression, schizophrenia and bipolar disorder. The exact cause of mental illness is not always known, but it is sometimes the result of a chemical abnormality in the brain. The behavior exhibited by a patient with a mental illness can be bizarre and can include excited or depressed behavior.
- Extreme stress. Extreme emotional distress, such as grief at the loss of a loved one, can trigger a change in an individual's behavior. People react differently to stressful situations. The impact of the incident and the way the

person copes or fails to cope can lead to an emotional situation that the person cannot handle. People can react with uncontrollable crying, denial, anger or depression.

Other circumstances that can lead to altered behavior include heat or cold exposure, diabetes, low blood sugar, lack of oxygen, shock, head trauma, brain infection, seizure disorders, poisoning or drug overdose, withdrawal from alcohol or drugs, mind-altering substance or substance abuse and problems with the nervous system associated with aging.

Some behavioral emergencies may pose a particular danger to the EMR, to the patient and to others, including when the patient displays agitation, bizarre thinking and behavior, danger to themselves or danger to others.

## Excited Delirium Syndrome

Excited delirium syndrome poses challenges for police as well as EMS personnel. With excited delirium, the person exhibits some or a combination of the following signs and symptoms:

- Agitation
- Violent or bizarre behavior
- Insensitivity to pain
- Extreme increase in body temperature

Individuals with excited delirium develop high body temperatures. They may also exhibit increased body strength. Unfortunately, this syndrome is life threatening, and if immediate advanced medical intervention is not sought out, it usually ends in death. This syndrome is most often associated with incidents involving the police. It can be associated with drug use, particularly cocaine or methamphetamine, but can occur in non-drug users as well.

## PSYCHOLOGICAL EMERGENCIES

### Anxiety and Panic

While a certain amount of anxiety is a normal reaction to stress, excessive anxiety may be part of an **anxiety disorder**. There are several types of anxiety and panic disorders, all with potential to have dramatic effects on the afflicted person. People having a severe anxiety or panic attack are in real distress and need assistance. A person's anxiety and **panic** are often based on the feeling that they have no control over the situation and a fear of what may happen next. Anxiety attacks can last any length of time, but panic attacks generally last no longer than 30 minutes.

Someone who is experiencing an anxiety attack may show any of these signs and symptoms:

- Fatigue
- Headaches
- Muscle tension
- Muscle aches
- Difficulty swallowing
- Trembling or twitching
- Irritability
- Sweating
- Hot flashes

People experiencing a panic attack may have any of the above signs and symptoms, as well as:

- Difficulty breathing.
- Heart palpitations.
- An out-of-control feeling.

### Phobias

**Phobias** are irrational fears of objects or events that are usually harmless. They can cause an anxiety or panic attack. When people have a phobia about a certain situation or event, they may display an exaggerated response of fear, referred to as a phobic reaction, when exposed to the situation or event.

A person having a phobic reaction, such as an anxiety or panic attack, may display any of these behaviors:

- Irrational fear
- Unexplained, uncontrolled anxiety
- Desire to flee the situation or avoid the object
- Inability to continue functioning as long as the person is in the situation or the object is present
- Acknowledgement that the fear reaction is out of proportion to the situation or event
- Physical symptoms such as heart palpitations, difficulty breathing and sweating

### Clinical Depression

Although **clinical depression** is a chronic illness, people who are clinically depressed can have an emergency that may trigger thoughts of suicide. Depression is more than just “the blues.” It is a recognized medical illness that may require not only psychological therapy but also medical intervention.

It is important to keep in mind that there are many ways people can exhibit signs and symptoms of depression, including thoughts of impending suicide. For more information about suicide, refer to the section later in this chapter.

Signs and symptoms of clinical depression are numerous. They include but are not limited to:

- Persistent feeling of being useless.
- Loss of interest in regular activities.
- Feeling hopeless or guilty.
- Unexplained sadness.
- Crying spells.
- Irritability and restlessness.
- Insomnia or sleeping too much.
- Lack of appetite or overeating (followed by weight loss or gain).
- Inability to concentrate and make decisions.
- Physical aches and pains with no medical basis.
- Loss of sexual desire.
- Thoughts of suicide.



#### CRITICAL FACTS

The primary causes of behavioral emergencies include injury, physical illness, past history of behavioral emergencies, alcohol or drug use/abuse, noncompliance regarding taking prescribed psychiatric medications, adverse effects of prescribed medications, mental illness and extreme stress.

## Bipolar Disorder

**Bipolar disorder** is a mental illness in which the person swings from the extreme lows of depression to the highs of mania. A person with **mania** exhibits elation, hyperexcitability and accelerated thoughts, speech and actions. Bipolar disorder is sometimes called manic-depression. Because of the extreme mood swings, the person can be in danger of self-harm when on either end of the spectrum. When depressed, the person may consider suicide. When manic, self-destructive or risky behaviors could result in severe injury or death.

Someone who is in a depressive episode would exhibit signs and symptoms of depression such as feeling useless or hopeless, alternating between sleeping too much or too little, being unable to go to work and being unable to concentrate. When experiencing the manic phase, the person could show signs and symptoms such as:

- Rapid speech and quickly changing thought patterns.
- Inability to sit still and/or concentrate.
- Inability to finish a task.
- Euphoria.
- Increased physical activity.
- Participating in risky activities.
- Inability to sleep.
- Increased desire to have sex.
- Agitation.
- Aggressive behavior.

## Paranoia

**Paranoia** is a condition characterized by feelings of persecution and exaggerated notions of perceived threat. It may be part of many mental health disorders and, rarely, is seen in isolation. Paranoia is marked by irrational and delusional behavior. Paranoid individuals often believe that someone or several people are “out to get them.” Paranoia can be limited to believing that they are being watched or followed, or it can become more fantastical in nature, such as believing there are implants in the brain being monitored by people who want to do the paranoid person harm. Paranoia can also be a side effect of medication or recreational drug use, particularly stimulants.

If a patient is paranoid, it can be difficult for you to provide care because they may fear that you are part of the plot or group trying to cause harm.

Patients who are paranoid may display behaviors such as:

- Checking for wiretaps (bugs) in every room.
- Accusing people of following them or listening to their conversations.
- Being suspicious of every person who approaches them.
- Refusing to eat or drink anything that they have not prepared.

## Schizophrenia

**Schizophrenia** is a severe, chronic mental illness in which the person hears voices or feels that their thoughts are being controlled by others. These voices or thoughts can instruct the person to do things they would otherwise not do, like becoming violent toward a family member or a stranger. For this reason, you must exercise particular caution when attempting to help a patient whom you know or suspect suffers from schizophrenia.

Someone with schizophrenia may display some or all of the following:

- Hallucinations (visual or auditory, but mostly auditory)
- Delusions
- Lack of personal care or hygiene
- Inappropriate emotions for the situation or lack of emotions altogether
- Anger
- Suspicions and paranoid behavior
- Social isolation

## VIOLENCE

Behavioral emergencies require extra sensitivity. Every person copes in a different way and every person has a breaking point. People experiencing a behavioral emergency may have no control over what they are feeling at any given moment, and those feelings are real and valid. A behavioral emergency may cause a person to become violent toward self or others. A head injury, low blood sugar in someone with diabetes, a lack of oxygen, and mind-altering substances (such as alcohol, depressants, stimulants or narcotics) can all cause a person to act in a violent manner.

## Patients Who Are Violent Toward Themselves

Patients who are violent toward themselves may attempt or threaten suicide. Your primary concern



## CRITICAL FACTS

People experiencing a behavioral emergency may have no control over what they are feeling at any given moment and can become violent toward themselves or others.

Males are about four times more likely to commit suicide than females, although females are more likely to have suicidal thoughts. People of any age, race or socioeconomic status are at risk of making suicide attempts.

as an EMR is to treat any injuries or medical conditions arising from the violence or suicide attempt and then transport the patient to a facility where they can receive medical and psychiatric treatment. If it is necessary to prevent the patient from harming you, themselves or others, you may need to use medical restraints to transport the patient.

### Suicide

The term **suicide** refers to an intentional act to end one's own life. People who commit suicide often feel they have no other option for resolving their problems but to end their own lives. Males are about four times more likely to commit suicide than females, although females are more likely to have suicidal thoughts. People of any age, race or socioeconomic status are at risk of making suicide attempts.

Those in the 15–34 age group are at the highest risk of dying by suicide. Suicide is the second-leading cause of death for people in this age group in the United States.

### Assessing Suicide Risk

Many people who attempt suicide suffer some form of mental or emotional problem or illness, especially depression. Substance misuse or abuse, primarily of alcohol and other drugs, plays a major role in attempted suicides.

In any behavioral emergency, it is important to assess the patient's risk for attempting suicide. Some risk factors include:

- Mental or emotional disorders, especially depression.
- History of substance misuse or abuse.
- Feelings of hopelessness.
- Impulsive or aggressive tendencies.
- Past attempts at suicide.
- Failing or failed relationship with a spouse, family or friend.

- Serious illness or death of a close family member or friend.
- Serious, prolonged or chronic personal illness.
- A long period of failure at work or school or a long period of unemployment.
- Failure to achieve sufficient occupational, educational or financial success.
- Dramatic change in the economy.
- Feelings of isolation.
- Mass suicides (e.g., in a group/cult setting).
- Reluctance to seek help for mental-health problems due to the stigma attached to suicidal thoughts, suicide attempts or general mental health problems.
- Inability to access mental health services.

When assessing a patient for suicide risk, keep the following in mind:

- Take any threat of suicide seriously, ensure the patient is transported for evaluation and ask the patient if they have ever considered suicide.
- Address any injuries or medical conditions related to a suicide attempt.
- Always listen carefully, as the patient may reveal important information indirectly (Fig. 17-2).
- Do not dismiss what you may consider to be unimportant feelings.
- Be nonjudgmental and remember that people react differently to different problems.
- The patient may tell you that everything is fine but transport the patient anyway, as help may still be needed.
- Make specific plans to help the patient, for example making arrangements for the patient to meet with a particular healthcare worker or clergy.
- Be careful not to show disgust or fear when caring for the patient. These feelings can be revealed through your words and your body language.



**Fig. 17-2:** When assessing the suicide risk of a patient, listen carefully for important information that may be communicated indirectly and always take the patient seriously.

- Never deny that the patient attempted suicide. This may give the message that you are unable to accept the patient's feelings.
- Never try to use strong emotions to either shock the person out of attempting suicide or to call the person's bluff and provoke them.

To better assess the patient, ask the patient questions to improve your understanding of the situation. These questions include:

- How do they feel?
- Is the patient thinking of hurting or killing themselves or anyone else?
- Is the patient a threat to themselves or others?
- Does the patient have a medical problem?
- Is the patient suffering from a recent trauma?
- Does the patient have any weapons on them or nearby?
- What interventions are necessary?

## Self-Mutilation

**Self-mutilation**, or self-injury, refers to deliberately harming one's own body, through acts such as burning or cutting. It is not usually meant as an attempt to commit suicide, but is an unhealthy coping mechanism to deal with overwhelming negative emotions such as tension, anger and frustration. The individual experiences momentary calmness and a release of tension but then quickly feels a sense of shame and guilt, in addition to a return of the negative feelings the person was trying to avoid. Self-mutilation may be a component of a mental illness such as depression, an eating disorder or a personality disorder.

Sometimes, a suicidal patient may have a last-minute change of heart and inflict nonlethal wounds (sometimes called hesitation marks) to receive help or to punish someone. Child abuse and rape survivors may turn to self-mutilation such as nonlethal cutting or burning as a way to cope with



### CRITICAL FACTS

There are many factors to consider when assessing a patient's suicide risk. Risk factors include mental or emotional disorders; history of substance abuse or past suicide attempts; feelings of hopelessness or isolation; impulsiveness or aggressiveness; failed relationships; personal illness; and failure at work, school or in financial matters.



the trauma. A patient who has committed self-mutilation will need to be treated for bleeding, shock and other soft-tissue injuries.

## Patients Who Are Violent to Others

Patients experiencing a behavioral emergency may become aggressive or violent. The violence may be caused by a medical emergency, a mental health issue, alcohol or drug intoxication, a lack of oxygen or a head injury.

Violent behavior can take many forms, from verbal abuse to punching, kicking, biting and using weapons. While the violence may not be directed toward you, you could easily become an indirect victim caught in the middle. In some cases, these acts may be specifically targeted to people in positions of authority, like you. Attempt to identify exit or escape routes for your safety.

A patient's posture and comments can indicate potential violence. Threatening comments and posture, such as clenching fists or assuming a fighting stance, may indicate the patient's intentions.

Be alert to the following signs:

- Agitation; the patient may pace or move erratically
- Rapid or incoherent speech
- Shouting or making threats
- Clenched fists or a fighting stance
- Using objects as a weapon or throwing objects

## Sexual Assault

**Sexual assault** is defined as any form of sexual contact, against a person's will, often by coercion, force or threat. Victims of rape and sexual assault often know their attackers—a friend, a family member, a relative, a date or a friend of the family. These patients suffer from

physical and emotional trauma, and need to be treated with sensitivity.

## Rape

**Rape** is defined as non-consensual sexual intercourse often performed using force, threat or violence. It is devastating, and many patients will go into acute emotional distress and shock during and after the attack.

Some common signs and symptoms include:

- Confused, dazed state.
- Nausea, vomiting, gagging or urination.
- Intense pain from assault and penetration.
- Psychological and physical shock and paralysis.
- Possible bleeding or body fluid discharge.
- Torn or removed clothing.

Because of the significant legal issues, it is vital to manage the rape scene appropriately to preserve evidence that will be required for the police investigation. If possible, the patient should be treated by someone of the gender of their choosing to avoid further emotional trauma. If present, work with the sexual assault nurse examiner (SANE). If possible, transport the victim to a medical facility that has a rape crisis unit and can take the proper specimens as well as comfort the victim.

Tell the patient what you will be doing and why you are doing it. Encourage having the patient treated on a clean white sheet. If the victim must remove clothing or if clothing must be removed from the patient in order to provide care, do so while on the clean white sheet to catch any debris that was left on the patient during the crime. Try to determine the patient's emotional state and complete a patient assessment, checking for trauma around the lower abdomen, thighs, genital and anal areas. Do *not* clean the patient. Prevent the patient from showering, bathing, brushing teeth or urinating, since cleaning can destroy evidence. Police will be



### CRITICAL FACTS

Asking the patient questions will help you better assess the situation. These questions can include: "How do you feel?"; "Are you thinking of hurting yourself or anyone else?"; "Have you suffered a personal trauma recently?"; or "Do you have a weapon nearby?"

Patients experiencing a behavioral emergency may become aggressive or violent. Violent behavior can take many forms, from verbal abuse to punching, kicking, biting and using weapons. Be alert to signs of violence, such as agitation, rapid or incoherent speech, shouting, making threats, clenched fists or other aggressive stances, throwing objects or using objects as a weapon.

responsible for evidence collection. Any evidence you collect while treating the patient for injuries should be isolated, and each piece of evidence needs to be bagged individually in a paper bag to prevent cross-contamination. Plastic bags do not allow for air movement and cause the DNA to deteriorate due to moisture buildup. Follow local protocols, and give the evidence to the police as soon as possible.

Most victims of rape experience symptoms of **rape-trauma syndrome** following a rape.

There are three stages:

- **Acute.** This occurs immediately after the rape, a time when the patient needs critical support. Whether or not a patient suffered physical injuries, a rape victim has experienced significant emotional trauma. This phase lasts anywhere from a few days to a few weeks.
- **Outward adjustment.** This phase may last weeks or months after the attack. The victim resumes what appears to be their “normal” life, but is experiencing turmoil internally, including depression, rage and flashbacks.
- **Resolution.** Moving on from a rape may take months or years, and may involve professional counseling to assist the patient in dealing with the lasting emotional trauma.

## **Pediatric Considerations**

### **Child Abuse and Neglect**

You may encounter a situation involving an injured child in which you have reason to suspect child abuse. **Child abuse** is the physical, verbal, psychological or sexual assault of a child resulting in injury and/or emotional trauma. Typically, the child’s injuries cannot be logically explained, or a parent or legal guardian gives an inconsistent or suspicious account of how the injuries occurred.

The signs and symptoms of child abuse include:

- Situations in which the description of the injury does not fit the cause.
- Patterns of injury that include cigarette burns, whip marks and hand prints.
- Obvious or suspected fractures in a child less than 2 years of age.
- Unexplained fractures.
- Injuries in various stages of healing, especially bruises and burns.

- Unexplained lacerations or abrasions, especially around the mouth, lips and eyes.
- Injuries to the genitals; pain when the child sits down.
- More injuries than are common for a child of the same age.
- Repeated calls to the same address.

**Child neglect** is a type of abuse in which the parent or legal guardian fails to provide the necessary, age-appropriate care to a child.

Signs and symptoms include:

- Lack of adult supervision.
- A child who appears to be malnourished.
- An unsafe living environment.
- Untreated chronic illness; for example, an asthmatic child with no medications.

When providing care for a child who may have been abused, your first priority is to care for the child’s injuries or illness. An abused child may be frightened, hysterical or withdrawn. The child may be unwilling to talk about the incident in an attempt to protect the abuser. If you suspect abuse, explain your concerns to responding police officers or other emergency medical services (EMS) personnel, if possible.

If you think you have reasonable cause to believe that abuse has occurred, you must report your suspicions to the proper authorities. Familiarize yourself with the mandatory reporting laws in your state or jurisdiction. Depending on your role and state, you may be considered a mandatory reporter and be required to report suspected incidents of abuse or neglect.

Do not be afraid to report suspected abuse because of fear of getting involved or of being sued. In most states, when you make a report in good faith, you may be immune from civil or criminal liability or penalty, even if you made a mistake. In this instance, “good faith” means you honestly believe that abuse has occurred or the potential for abuse exists and a prudent and reasonable person in the same position would also believe this. You do not need to identify yourself when you report child abuse, although your report will have more credibility if you do.

Refer to Chapter 25 for more information.

## Considerations for Older Adults

### Elder Abuse and Neglect

As with child abuse, older adults are also susceptible to abuse from the willful infliction of injury by physical or sexual assault, emotional mistreatment and neglect.

**Elder abuse** is a growing problem in the United States as the population ages. EMRs may encounter a situation that involves the possible abuse of an older adult.

The signs and symptoms of elder abuse include:

- Any unexplained injury or an injury that has an unlikely explanation.
- Burns, bruises or reddened areas that do not go away.
- Abrasions on arms, legs or torso.
- Unexplained hair loss.
- Injuries in various stages of healing (especially bruises and burns).
- Scratches, cuts or bite marks.
- Cuts and scratches around the breasts, buttocks or genitals; vaginal or rectal bleeding.
- Withdrawn, sad or fearful demeanor and failure to make eye contact.
- Upset or fearful behavior when the abuser enters the same room.

**Elder neglect** is a type of abuse in which a caregiver fails to provide the necessary care for an older adult.

The signs and symptoms of elder neglect include:

- An unkempt appearance.
- Improper clothing for the weather conditions.
- Lack of availability of food, water or utilities.
- An unsafe living environment.
- Dehydration.
- Untreated or chronic medical conditions.
- Confusion or disorientation.
- Withdrawn, sad or fearful demeanor and failure to make eye contact.
- Upset or fearful behavior when the abuser enters the same room.

If you think you have reasonable cause to believe that elder abuse or neglect has occurred, report your suspicions to the proper authorities (Fig. 17-3). Familiarize yourself with the mandatory reporting laws in your state or jurisdiction. Depending on your role and state, you may be considered a mandatory reporter and be required to report suspected incidents of elder abuse or neglect.

Refer to Chapter 26 for more information.



**Fig. 17-3:** Elder neglect is a type of abuse in which a caregiver fails to provide the necessary care for an older adult.

## PROVIDING CARE FOR BEHAVIORAL EMERGENCIES

### Scene Size-Up and Personal Safety

When responding to a possible behavioral emergency, assess the scene to identify any possible sources of harm to yourself, the patient or any bystanders. Do *not* approach the scene unless you feel confident that it is safe to do so. Be wary of sudden behavior changes in the patient, which are the most common cause of injuries to responders.

Be sure to identify and locate the patient before you enter the scene. A disturbed individual may try to jump you from behind or otherwise take you by surprise. Attempt to identify exit or escape routes for your safety and make sure you remain between the patient and an exit, so you can leave the scene if it is necessary for your own safety. As soon as possible, clear the scene of any objects that can be used to injure the patient or others. Do *not* enter the scene if the patient has any kind of weapon. Keep in mind there may be more than one patient (as in a suicide pact).

Assessing the scene can also provide you with hints about what has happened to cause or contribute to the crisis. Are there empty beer, liquor or pill bottles lying around? Do you see drug paraphernalia or signs of injury, such as blood stains?

As with other behavioral emergencies, your first job upon arriving at a scene of a potential suicide is to ensure your own safety. Selected methods of suicide, such as carbon monoxide in fumes from a running vehicle engine in an enclosed area or emissions from a gas stove, can create a dangerous environment for responders. In addition, the suicidal individual may further endanger you by attacking or attempting to attack you to prevent your interference.

Some patients may be experiencing hallucinations or delusions. Do *not* play along with these or lie to the patient and say that you believe they are real.

Do *not* think that you can manage a situation involving an emotional crisis by yourself. A suicidal person or a rape victim needs professional counseling. Summon more advanced personnel. This could include law enforcement, EMS personnel, or local mental health or rape crisis center personnel. While waiting for others to arrive, continue to talk with the patient.

### Establishing Rapport

Once you have entered the scene, you will need to establish rapport with the patient before getting too close. To do this, speak directly to the patient and maintain eye contact. Acknowledge that the patient appears upset and state that you are there to help. Tell the patient who you are and exactly what you want to do to help. Use a calm, reassuring voice, and keep your distance until the patient has indicated it is acceptable to approach. Use slow, deliberate movements. Do not touch the patient without permission. Touch can be very disturbing to some patients, particularly for those who are recent victims of an attack.

Once you have established a rapport with the patient, you can begin to communicate to find out what happened and determine what interventions are needed. Speak directly to the patient and be supportive and empathetic, never threatening, judgmental or confrontational. Show you are listening by repeating and rephrasing the patient's answers to your questions, nodding or stating phrases such as "go on" or "I understand." Make sure that no one interrupts, except in the case of medical necessity.



#### CRITICAL FACTS

When responding to a possible behavioral emergency, assess the scene to identify any possible sources of harm to yourself, the patient or any bystanders.

Do not think that you can manage a situation involving an emotional crisis by yourself. Summon more advanced personnel and continue to talk to the patient while waiting for help to arrive.

Once you have entered the scene, you will need to establish rapport with the patient before getting too close. Once you have established a rapport with the patient, you can begin to communicate to find out what happened and determine what interventions are needed.



## Patient Assessment

Observe the patient and look for signs of disorientation or life-threatening conditions, such as a serious injury or difficulty breathing. Also, continue to observe the patient for signs of potential violence, such as a threatening posture or the possession of a weapon. Look for signs of fear, anxiety, confusion, anger, mania, depression, withdrawal or loss of contact with reality. Also look for sudden behavioral changes, such as quiet withdrawal followed by sudden, explosive anger.

Once you get the patient talking, try to find out what happened. Determine the level of orientation and responsiveness, and attempt to find out what the chief complaint is. If the patient allows, take a set of baseline vital signs. Also try to obtain a SAMPLE history. If the patient is unconscious, perform a rapid head-to-toe assessment and try to obtain a SAMPLE history from family, friends or other bystanders.

## Calming the Patient

In addition to maintaining a calm voice and slow, deliberate movements, several techniques can be used to help calm a patient. If the patient is disoriented, explain who you are, where you are and what is happening. Reassure the patient that the disorientation is temporary. Do not stand too close to the patient. If the patient's friends or family members are around, ask the patient if it is okay to enlist others to help in calming the patient. Encourage the patient to tell you what the problem is and explain that you are there to listen. Never leave the patient alone, and stay alert to any changes in the patient's emotional state.

## Restraining the Patient

When patients are so agitated or violent that they cannot be approached safely and may pose a danger to themselves or others, you may need to assist EMS personnel with the use of restraints. If this occurs, follow their instructions exactly. Try to stay clear of the patient's arms and legs. Do not use restraints unless instructed to do so by more advanced medical or law enforcement personnel.

When using restraints, the goal is to use the minimum force needed. Thus, the amount of force used will depend on factors such as the patient's strength and level of agitation. Soft leather or cloth straps are considered humane restraints, while metal cuffs are not.

## Legal Considerations

Restraining a person without justification can give rise to a claim of assault and battery. You may be required to obtain police authorization before you can use patient restraints. Be aware of the laws regarding the use of patient restraints in your jurisdiction. Wait for someone who is authorized to use restraints if you are not legally allowed to do so. Seek medical direction and approval before applying restraints. Be aware of and follow local protocols involving the use of patient restraints.

Be sure a restrained patient can breathe. The patient should be placed in a face-up position, and breathing should be monitored regularly. A struggling patient who appears to calm down may actually be suffering from breathing difficulties or may have lost consciousness.

For legal reasons, it is important to document everything you do while participating in the use of restraints.

## PUTTING IT ALL TOGETHER

Behavioral emergencies pose special challenges for EMRs. Patients experiencing behavioral emergencies may act in unexpected ways, and may pose a danger to themselves or others by reacting in a violent or aggressive manner. Behavioral emergencies can be triggered by injury, physical or mental illness, extreme stress, or the use of alcohol or other drugs.

When responding to a patient with a behavioral emergency, begin by assessing the scene to identify any possible sources of harm to you, the patient or any bystanders. Do *not* enter the scene unless you feel confident that it is safe to do so. Be wary of sudden behavioral changes in the patient, which is a common cause of injury to responders.

Consider the need for law enforcement personnel. If a patient appears to be a threat to themselves or others, or the patient appears to be a victim of sexual assault, rape or child abuse, summon law enforcement support immediately.

When dealing with a rape or sexual assault patient, remember that emotional trauma will be present, even when physical injuries are absent. Acute emotional shock is a normal reaction. Be careful not to disturb any evidence found at the scene.

Cases of child abuse or neglect need to be carefully documented. You must follow local protocols around mandatory reporting if you suspect the injuries are due to abuse or neglect.



Assess both the patient's physical and mental status by asking specific questions in a calm and reassuring manner. Evaluate the patient's mental status by observing appearance, demeanor, level of activity and speech. Ask bystanders if the patient has underlying medical conditions, or a history of mental issues or violent actions. Do *not* leave the patient alone. Good communication skills, respect and empathy can defuse potentially explosive situations.

Restraining a patient should be a last resort, done in consultation with law enforcement and advanced medical direction. Use only as much force as is necessary to restrain the patient, and *always* follow local protocols. Ensure that you clearly document all the circumstances if medical restraints are required, including the names and contact information for any third-party observers, law enforcement personnel and medical personnel.

## **▶ You Are the Emergency Medical Responder**

As you continue to calmly interview the patient, you gradually earn his trust and soon learn that he has had trouble sleeping and has not eaten much in the past 2 weeks. He says he got out of drug rehab 3 months ago. He has not been taking his prescribed medication for about a month and recently lost two very close relatives. The patient says he “sort of went off the wagon.” What other steps must you consider in providing proper care for this patient? What additional resources should you consider?

# UNIT 6

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## Trauma Emergencies

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# 18

## SHOCK

### ► You Are the Emergency Medical Responder

Your ambulance unit is the first to arrive on an isolated road where an 18-year-old male driver lost control of a motor vehicle and collided with a tree. In the crash, the driver's legs were broken and he is pinned in the wreckage. You find the driver conscious, restless and in obvious pain. After a couple of minutes, the patient's condition has changed. He begins to look ill. You notice he responds only to loud verbal stimuli, is breathing fast and looks pale. His skin is cold and moist, and his pulse is rapid and weak. What would you do to help the patient?



## KEY TERMS

**Cardiogenic shock:** The result of the heart being unable to supply adequate blood circulation to the vital organs, resulting in an inadequate supply of nutrients; caused by trauma or disease.

**Dilation:** The process of enlargement, stretching or expansion; used to describe blood vessels.

**Distributive shock:** A type of shock caused by inadequate distribution of blood, either in the blood vessels or throughout the body, leading to inadequate volumes of blood returning to the heart.

**Hypoglycemic shock:** A type of shock that is a reaction to extremely low blood glucose levels.

**Hypoperfusion:** A life-threatening condition in which the circulatory system fails to adequately circulate oxygenated blood to all parts of the body, resulting in inadequate tissue perfusion; also referred to as shock.

**Hypovolemic shock:** A type of shock caused by an abnormal decrease in blood volume.

**Metabolic shock:** A type of shock that is the result of a loss of body fluid, which can be due to severe diarrhea, vomiting or a heat-related illness.

**Neurogenic shock:** A type of distributive shock caused by trauma to the spinal cord or brain,

where the blood vessel walls abnormally constrict and dilate, preventing relay of messages and causing blood to pool at the lowest point of the body.

**Obstructive shock:** A type of shock caused by any obstruction to blood flow, usually within the blood vessels, such as a pulmonary embolism.

**Psychogenic shock:** A type of shock that is due to factors such as emotional stress that cause blood to pool in the body in areas away from the brain, which can result in fainting (syncope).

**Respiratory shock:** A type of shock caused by the failure of the lungs to transfer sufficient oxygen into the bloodstream; occurs with respiratory distress or arrest.

**Septic shock:** A type of distributive shock that occurs when an infection has spread to the point that bacteria are releasing toxins into the bloodstream, causing blood pressure to drop when the tissues become damaged from the circulating toxins.

**Shock:** A life-threatening condition that occurs when the circulatory system fails to provide adequate oxygenated blood to all parts of the body, resulting in inadequate tissue perfusion; also referred to as hypoperfusion.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- List conditions that can result in shock.
- List the signs and symptoms of shock.
- Describe how to provide care to minimize shock.
- Make appropriate decisions about care when given an example of an emergency in which shock is likely to occur.

## INTRODUCTION

Injuries and medical emergencies can become life threatening as a result of shock. When the body experiences injury or sudden illness, it responds in a number of ways. Survival depends on the body's ability to adapt to the physical stresses of injury or illness. When the body's measures to adapt fail, the injured or ill person can progress into a life-threatening condition called shock. Shock complicates the effects of injury or sudden illness. In this chapter, you will learn to recognize the signs and symptoms of shock and how to provide care to minimize it.

## WHAT IS SHOCK?

**Shock**, or **hypoperfusion**, is a progressive condition in which the circulatory system fails to adequately circulate oxygenated blood to all parts of the body, resulting in inadequate tissue perfusion. When vital organs, such as the brain, heart and lungs, do not receive sufficient oxygenated blood, the body begins a series of responses to protect those organs. The amount of blood circulating to the less important tissues of the arms, legs and skin is reduced so that more can go to the vital organs. This reduction in blood circulation to the skin causes

a person in shock to appear pale or ashen (grayish) and feel cool. While, in the short term, this can protect the body's most crucial organs, if the situation is not treated quickly, shock can lead to death.

When the body is healthy, three conditions are necessary to maintain adequate blood flow:

- The heart must be working well.
- The blood vessels must be intact and able to adjust blood flow and pressure.
- An adequate amount of blood must be circulating in the body.

Injury or sudden illness can interrupt normal body functions. In cases of minor injury or illness, this interruption is brief, because the body is able to compensate quickly. With more severe injuries or illnesses, however, the body is unable to adjust. When the body is unable to meet its demands for oxygen because the blood fails to circulate adequately, shock occurs.

## WHY SHOCK OCCURS

Shock results from inadequate delivery of oxygenated blood to the body's tissues. There are several possible reasons for shock to occur. It can be the result of:

- Severe bleeding or loss of fluid from the body through excessive vomiting and diarrhea.
- Failure of the heart to pump enough oxygenated blood.
- Abnormal dilation of the vessels.
- Impaired blood flow to the organs and cells.

## The Heart

The condition and functioning of the heart can have a significant impact on the likelihood of shock. If the heart rate is too slow, the rate of new oxygenated blood cells reaching each part of the body will not be enough to keep up with demand. If the heart beats too rapidly (ventricular tachycardia [V-tach]) or if the heartbeat becomes erratic (ventricular fibrillation [V-fib]), the oxygenated blood is not sent throughout the body as it should be. Damage to the heart can lead to weak and ineffective contractions; this can be

related to disease (e.g., diabetes or cardiovascular disease), poisoning or respiratory distress.

## Blood Vessels

If blood vessels are not able to adequately constrict or become abnormally dilated, even though the blood volume is adequate and the heart is beating well, the vessels are not filled completely with blood. Since oxygen is absorbed into the body through the walls of the blood vessels, this condition leads to less oxygen being available to the body. Abnormal dilation of the blood vessels can be caused by a spinal cord injury, or by infection or anaphylaxis.

## Blood

Insufficient blood volume can lead to shock. Also, if the levels of some components of the blood, such as plasma or fluids, become too low, blood flow will be impaired and shock can result. These conditions can occur due to bleeding, severe vomiting, diarrhea and burns.

## Chest and Airway

Shock can also occur following any injury to the chest, obstruction of the airway or any other respiratory problem that decreases the amount of oxygen in the lungs. This means insufficient oxygen enters the bloodstream.

## TYPES OF SHOCK

There are four major types of shock: hypovolemic, obstructive, distributive and cardiogenic. All cause a drop in blood pressure and have the same outcome if not treated quickly.

## Hypovolemic

**Hypovolemic shock** is due to a severe lack of blood and fluid within the body. Hemorrhagic shock is the most common type of hypovolemic shock. It results from blood loss, either through external or internal bleeding, which causes a decrease in total blood volume.



### CRITICAL FACTS

Shock, or hypoperfusion, is a progressive condition in which the circulatory system fails to adequately circulate oxygenated blood to all parts of the body.

There are several possible reasons for shock to occur. It can be the result of severe bleeding or loss of fluid, failure of the heart to pump enough oxygenated blood, abnormal dilation of the vessels, and impaired blood flow to the organs and cells.



## Obstructive

**Obstructive shock** is caused by some type of obstruction to blood flow, usually within the blood vessels, such as a pulmonary embolism, tension pneumothorax or cardiac tamponade.

## Distributive

**Distributive shock** refers to any type of shock caused by inadequate distribution of blood either in the blood vessels or throughout the body, leading to inadequate volumes of blood returning to the heart. It includes the following:

- **Neurogenic shock** is caused by spinal cord or brain trauma. The blood vessel walls normally constrict and dilate to circulate the blood throughout the circulatory system. In neurogenic shock, the messages are not relayed, and the blood pools at the lowest point of the body.
- Anaphylaxis (also referred to as anaphylactic shock) occurs as a result of exposure to an allergen. It is a whole-body reaction that causes **dilation** (enlargement, stretching or expansion) of the blood vessels and constriction (closing) of the airways, which in turn causes blood to pool and trouble breathing. The airways may close completely from inflammation. For more information on anaphylaxis, refer to Chapter 16.
- **Septic shock** occurs when an infection has spread to the point that bacteria are releasing toxins into the bloodstream. The blood pressure drops when the tissues become damaged from the circulating toxins.

## Cardiogenic

**Cardiogenic shock** is the result of the heart being unable to supply adequate blood circulation to the vital organs, resulting in an inadequate supply of oxygen and nutrients. Disease, trauma or injury to the heart causes this type of shock.

## Other Types of Shock

Other types of shock include hypoglycemic, metabolic, psychogenic and respiratory shock.

**Hypoglycemic shock** is a reaction to extremely low blood glucose levels. **Metabolic shock** is the result of a loss of body fluid, which can be due to severe diarrhea, vomiting or a heat-related illness.

**Psychogenic shock** is due to factors such as emotional stress that cause blood to pool in the body in areas away from the brain, which can result in fainting (syncope). **Respiratory shock** is the failure of the lungs to transfer sufficient oxygen into the bloodstream and occurs with respiratory distress or arrest.

## SIGNS AND SYMPTOMS OF SHOCK

Because this is a progressive condition, the signs and symptoms you see will depend on what stage of shock the person is in, and this will change over time (Fig. 18-1). At first, the signs and symptoms may seem minor, but responding to them promptly will increase the patient's chance of survival.

### Early Signs and Symptoms

You may observe that:

- The patient expresses feelings of apprehension and anxiety.
- The patient's body temperature is slightly lower than normal.
- The patient is breathing quickly.
- The patient's pulse is slightly increased.
- The patient's blood pressure is normal or slightly decreased.
- The patient's skin is pale or ashen (grayish) and cool.



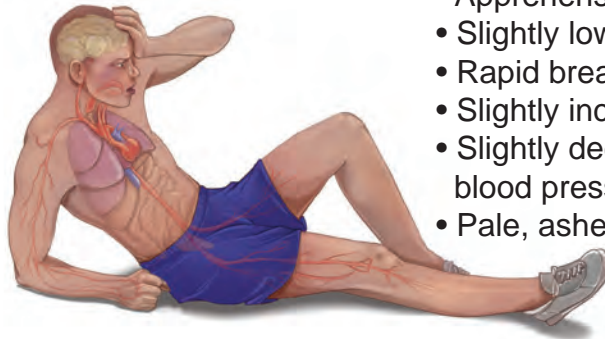
### CRITICAL FACTS

There are four major types of shock: hypovolemic, obstructive, distributive and cardiogenic. All cause a drop in blood pressure and have the same outcome if not treated quickly.

Other types of shock include hypoglycemic, metabolic, psychogenic and respiratory shock.

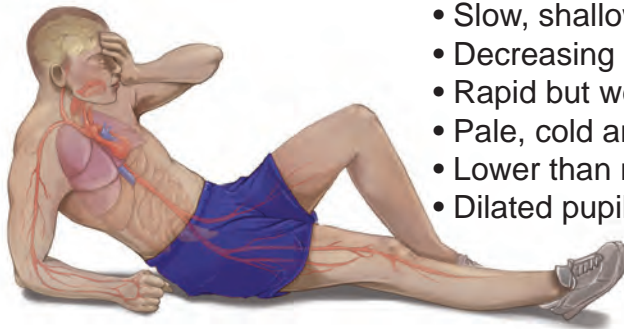
Early signs and symptoms of shock may include feelings of apprehension and anxiety; slightly low body temperature; rapid breathing; slight increase in pulse rate; normal or slightly decreased blood pressure; and pale, ashen and cool skin.

## Early Stages of Shock



- Apprehension and anxiety
- Slightly lower body temperature
- Rapid breathing
- Slightly increased pulse
- Slightly decreased or normal blood pressure
- Pale, ashen, cool skin

## Later Stages of Shock



- Listlessness and confusion
- Slow, shallow, irregular breathing
- Decreasing blood pressure
- Rapid but weak and irregular pulse
- Pale, cold and clammy skin
- Lower than normal blood pressure
- Dilated pupils

**Fig. 18-1:** Shock is a progressive condition, so the stage the person is in determines what signs and symptoms you see.

## Later Signs and Symptoms

You may observe that:

- The patient is listless and confused, and may have difficulty speaking.
- The patient's breathing has slowed down and is shallow and irregular.
- The patient's blood pressure is decreasing; diastolic blood pressure may reach zero.
- The patient's pulse is rapid, but the pulse is weak and irregular.
- The patient's skin is pale, cold and clammy, and the body temperature is much lower than normal.
- The patient's pupils are dilated and slow to respond to light.

## Pediatric Considerations

Early signs of shock may be absent in young children or infants, because their bodies can compensate for some of the factors that cause shock by maintaining blood pressure at normal levels. If the conditions continue, however, the situation can suddenly deteriorate into severe shock. Because a child is smaller than an adult, blood volume is less, and losing what seems like a small amount of blood can be serious, making children more susceptible to shock. Do not wait for signs and symptoms of shock to develop when treating a young child or infant, but treat promptly based on your assessment of the injuries or trauma.



### CRITICAL FACTS

Later signs and symptoms of shock can include listlessness; confusion; difficulty speaking; irregular breathing; decreased blood pressure (diastolic blood pressure may reach zero); rapid yet weak or irregular pulse; pale, cold and clammy skin with a low body temperature; and dilated pupils.



**Fig. 18-2, A–B:** (A) Administer supplemental oxygen to a patient who is showing signs and symptoms of shock based on local protocols. (B) Cover a patient in shock with a blanket to prevent loss of body heat in order to maintain a normal body temperature.

## PROVIDING CARE

Once you have assessed the patient and determined that there are signs and symptoms of shock present, quick response is essential:

- Take steps to control any severe, life-threatening bleeding and prevent further blood loss.
- Ensure the patient's airway is open and clear. Perform a primary assessment and call for more advanced medical personnel. Administer supplemental oxygen based on local protocols, and provide appropriate ventilatory support (Fig. 18-2, A).
- Since you may not be sure of the patient's condition, leave them in a supine position.
- If you see any suspected broken bones or dislocated or damaged joints, immobilize them to prevent movement after ensuring other life-threatening conditions have been addressed. Broken bones or dislocated or damaged joints can cause more bleeding and damage.
- Cover the patient with a blanket to prevent loss of body heat (Fig. 18-2, B). It is important not to overheat the patient—your goal should be to maintain a normal body temperature. If the patient is lying on cold ground and if it is possible to do so without causing harm, you may want to put a blanket under the patient as well.
- Talk to the patient in a calm and reassuring manner to reduce the harmful effects of emotional stress. If you can help the patient rest in a comfortable position and reduce the pain, this will also be beneficial; pain intensifies the body's reactions and can accelerate the progression of shock.

- Do not give any food or drinks, even if the patient asks for them. The patient is likely to be thirsty due to the fluid loss. However, depending on the condition, surgery may be needed and it is better for the patient's stomach to be empty if that is the case. More advanced emergency medical personnel will be able to provide fluid replacement intravenously if appropriate.
- Treat any specific injuries or conditions, and have the patient transported to a hospital as soon as possible.

## PUTTING IT ALL TOGETHER

Any condition or trauma situation where the body's ability to get oxygenated blood to the vital organs is compromised can lead to shock. Left untreated, shock is a progressive condition that can be fatal. Shock can be caused by loss of blood or body fluids, when the heart is not pumping blood effectively, by over-dilation of the blood vessels or by damage to the chest or airways. If any of these conditions are present, it is important to watch the patient for signs and symptoms of shock. These include decreasing blood pressure; increasing heart rate; increasing respiratory rate; pale or ashen, cool, clammy skin; pupils that are dilated and slow to respond; and anxiety and apprehension at first, turning into confusion and listlessness as shock progresses.

To treat shock, first control any severe, life-threatening bleeding that may be present. Ensure the patient has an open and clear airway and is breathing. Call for more advanced medical personnel and transport the patient to a hospital

as soon as possible. Administer supplemental oxygen or artificial ventilation as appropriate. Keep the patient in a supine position. Splint any broken bones or joints and keep the patient warm

by covering the patient with a blanket. Reassure and comfort the patient; try to keep the patient comfortable and reduce any pain. Do *not* give food or drink.

## **> You Are the Emergency Medical Responder**

After extrication teams arrive, they finally free the driver from the vehicle and remove him from the car. You notice that the patient looks worse. He now responds only to painful physical stimuli. His breathing has become very irregular. You know that the hospital is 20 minutes away. How would you respond? What should you do to provide care until the patient arrives at the hospital?



# 19

## BLEEDING AND TRAUMA

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### ▶ You Are the Emergency Medical Responder

As a member of your company's medical emergency response team (MERT), you are called to assist a worker whose arm has been lacerated by a part that came loose from a lathe. The man's arm is bleeding severely. You arrive to find a co-worker attempting to stop the bleeding. How would you respond?





## KEY TERMS

**Adult respiratory distress syndrome (ARDS):**

A lung condition in which trauma to the lungs leads to inflammation, accumulation of fluid in the alveolar air sacs, low blood oxygen and respiratory distress.

**Arteries:** Large blood vessels that carry oxygen-rich blood from the heart to all parts of the body, except for the pulmonary arteries, which carry oxygen-poor blood from the heart to the lungs.

**Bandage:** Material used to wrap or cover a part of the body; commonly used to hold a dressing or splint in place.

**Bandage compress:** A thick gauze dressing attached to a gauze bandage.

**Bleeding:** The loss of blood from arteries, veins or capillaries.

**Blood volume:** The total amount of blood circulating within the body.

**Capillaries:** Tiny blood vessels linking arteries and veins that transfer oxygen and other nutrients from the blood to all body cells and remove waste products.

**Clotting:** The process by which blood thickens at a wound site to seal an opening in a blood vessel and stop bleeding.

**Contusion:** An injury to the soft tissues that results in blood vessel damage (usually to capillaries) and leakage of blood into the surrounding tissues; caused when blood vessels are damaged or broken as the result of a blow to the skin, resulting in swelling and a reddish-purple discoloration on the skin; commonly referred to as a bruise.

**Direct pressure:** Pressure applied on a wound to control bleeding.

**Dressing:** A pad placed directly over a wound to absorb blood and other body fluids and to prevent infection.

**Elastic bandage:** A bandage designed to keep continuous pressure on a body part; also called an elastic wrap.

**External bleeding:** Bleeding on the outside of the body; often, visible bleeding.

**Golden Hour:** A term that refers to the critical first hour after a patient sustains a life-threatening traumatic injury; the highest risk of dying from shock or bleeding occurs during this time; providing early interventions and advanced

medical care to the patient as soon as possible within the hour can result in the best chance of patient survival.

**Head-on collision:** A collision in which a vehicle hits an object, such as a tree or other vehicle, straight on.

**Hemorrhage:** The loss of a large amount of blood in a short time or when there is continuous bleeding.

**Hemostatic dressing:** A dressing treated with an agent or chemical that assists with the formation of blood clots; used with direct pressure to help control severe, life-threatening bleeding.

**Internal bleeding:** Bleeding inside the body.

**Occlusive dressing:** A special type of dressing that does not allow air or fluid to pass through.

**Perfusion:** The circulation of blood through the body or through a particular body part for the purpose of exchanging oxygen and nutrients with carbon dioxide and other wastes.

**Pressure bandage:** A bandage applied snugly to create pressure on a wound, to aid in controlling bleeding.

**Roller bandage:** A bandage made of gauze or gauze-like material that is wrapped around a body part, over a dressing, using overlapping turns until the dressing is covered.

**Rollover:** A collision in which the vehicle rolls over.

**Rotational impact:** A collision in which the impact occurs off center and causes the vehicle to rotate until it either loses speed or strikes another object.

**Side-impact collision:** A collision in which the impact is at the side of the vehicle; also known as a broadside, t-bone or lateral collision.

**Tourniquet:** A tight, wide band placed around an arm or a leg to constrict blood vessels in order to stop blood flow to a wound.

**Trauma dressing:** A dressing used to cover very large wounds and multiple wounds in one body area; also called a universal dressing.

**Trauma system:** A regional or community-based system that provides definitive care for injured (trauma) patients; provides patients with a seamless transition from prehospital care to acute and post-hospital care, leading to improved patient outcomes. A comprehensive trauma system also participates in community outreach activities, including injury prevention programs.

(Continued)

## KEY TERMS continued

**Triangular bandage:** A triangle-shaped bandage that can be rolled or folded to hold a dressing or splint in place; can also be used as a sling to support an injured shoulder, arm or hand.

**Veins:** Blood vessels that carry oxygen-poor blood from all parts of the body to the heart, except for the pulmonary veins, which carry oxygen-rich blood to the heart from the lungs.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Describe the components of a trauma system.
- Differentiate among arterial, venous and capillary bleeding.
- Describe how to care for external bleeding, including when and how to use a tourniquet and hemostatic dressing.
- List appropriate standard precautions to follow when controlling external bleeding.
- Explain the functions of dressing and bandaging.
- List the signs of internal bleeding.
- Describe how to care for a patient who exhibits the signs and symptoms of internal bleeding.
- Make appropriate decisions about care when given an example of an emergency in which a patient is bleeding.

## SKILL OBJECTIVES

After reading this chapter, and completing the class activities, you should be able to:

- Demonstrate how to control external bleeding with direct pressure, dressings and bandages, including caring for shock.
- Demonstrate how to control severe, life-threatening bleeding using a commercial tourniquet.

## INTRODUCTION

**Bleeding** is the loss of blood from **arteries**, **veins** or **capillaries**. Bleeding is either internal or external. External bleeding is usually obvious because it is typically visible. Internal bleeding is often difficult to recognize. Uncontrolled bleeding, whether internal or external, is a life-threatening emergency. A large amount of bleeding occurring in a short time is called a **hemorrhage**.

If left untreated, severe bleeding can result in shock and, eventually, death. Check for and control severe, life-threatening bleeding during the primary assessment *before* you check for breathing and a pulse. You may not identify internal bleeding until you perform a more detailed check during the physical exam and history.

## INCIDENCE/SIGNIFICANCE OF TRAUMA

The **Golden Hour** refers to the critical first hour after a patient sustains a life-threatening traumatic injury. The highest risk of dying from shock or bleeding occurs during this time. Providing early interventions and advanced medical care to the patient as soon as possible within the hour can result in the best chance of patient survival.

**Trauma** is a physical injury, wound or shock caused by an agent, force or mechanism. The trauma patient requires rapid assessment and care of the conditions found. This is often done by a multidisciplinary team, supported by the appropriate healthcare providers, to minimize or eliminate the risk of death or permanent disability. A trauma system must determine the necessary level of care for the injury.

## TRAUMA SYSTEM

A **trauma system** is a regional or community-based system that provides definitive care for injured (trauma) patients. These systems consist of many different components that provide patients with a seamless transition from prehospital care to acute and post-hospital care, leading to improved patient outcomes. A comprehensive trauma system also participates in community outreach activities, including injury prevention programs.

There are four primary levels of facilities for trauma care:

- **Level I trauma center:** This facility must have the capability to deal with all levels and types of patient injury on a 24-hour basis. These facilities are leading medical care facilities, often university-based teaching hospitals, and must have an adequate depth of resources and personnel to deal with all levels of patient care. These facilities also conduct research and community outreach.
- **Level II trauma center:** This facility is expected to be able to provide definitive care to patients, despite the type of injury the patient may have suffered. Its care capabilities are generally the same as a Level I trauma center, but they may not conduct research.
- **Level III trauma center:** These facilities are often found in smaller communities that do not have immediate access to larger Level I or Level II trauma centers. They can provide prompt assessment, resuscitation and emergency operations, and arrange for transport to a Level I or II facility as required.
- **Level IV trauma center:** These facilities are often rural clinics in remote areas and can generally only offer initial patient care until arrangement for transportation can be made. Treatment protocols for resuscitation, transfer protocols, data reporting and participation in system performance improvement are essential at a Level IV trauma center.

In selecting the appropriate level of trauma center, transport considerations must also be taken into account. State and regional guidelines dictate the maximum transport time depending on the acuity of the patient; for example, whether the patient has an uncontrolled hemorrhage or a compromised airway. Similar to adult patients, pediatric trauma patients are often transported to the nearest pediatric trauma center, even if it is farther away than other hospitals, based on local trauma triage guidelines and local point-of-entry plans.

## MULTI-SYSTEM TRAUMA

Patients who are subjected to significant forces are at an increased risk for injuries to multiple organs within the body at the same time. A multi-system trauma is one involving more than one body system. For example, a patient who was in a major collision may have broken bones (skeletal system), but may also be experiencing difficulty breathing (respiratory system). Multi-system trauma patients are also at a greater risk of developing shock (see Chapter 18). Suspect multi-system trauma in any patient subjected to significant external forces.

## PERFUSION

**Perfusion** is the circulatory system's method of delivering oxygen and nutrients while eliminating carbon dioxide and other wastes. The entire body requires perfusion, but different parts of the body require different amounts. Some organs are especially sensitive to changes in the efficiency of perfusion. For example, a major organ such as the heart, when denied constant perfusion, cannot function properly. The brain can only last about 4 to 6 minutes without constant perfusion before damage could begin to occur. Kidneys can last up to 45 minutes without perfusion. The skeletal system can withstand a lack of perfusion for as long as 2 hours before damage becomes permanent.



### CRITICAL FACTS

Bleeding is the loss of blood from arteries, veins or capillaries. Bleeding is either internal or external. External bleeding is usually obvious because it is typically visible. Internal bleeding is often difficult to recognize.

A trauma system is a regional or community-based system that provides definitive care for injured (trauma) patients. These systems consist of many different components that provide patients with a seamless transition from prehospital care to acute and post-hospital care, leading to improved patient outcomes.

# BLEEDING

## General Considerations

To reduce the risk of disease transmission when controlling bleeding, *always* follow standard precautions, including:

- Avoiding contact with the patient's blood, directly or indirectly, by using barriers such as disposable latex-free gloves and protective eyewear.
- Avoiding eating, drinking and touching your mouth, nose or eyes while providing care or before washing your hands.
- Always washing your hands thoroughly before (if practical) and after providing care, even if you wore gloves or used other barriers.
- Changing gloves before you care for a different patient, and cleaning equipment (e.g., handles) and surfaces (e.g., zippers and door knobs) after providing care.

The severity of blood loss can be estimated based on the signs and symptoms with which the patient presents, as well as your general impression of the amount of blood loss. It is important to control bleeding. Uncontrolled bleeding, or significant blood loss, will lead to shock and possibly death. Do *not* wait for shock to develop before providing care to someone who is injured or suddenly ill.

## Types of Bleeding

Bleeding is the loss of blood from arteries, veins or capillaries and can result in either internal or external bleeding. The most severe of these is arterial bleeding, followed by venous bleeding. Hemorrhaging occurs when a large amount of blood is lost in a short period of time or when there is continuous bleeding.

### Arterial Bleeding

Arterial bleeding is typically the most urgent type of bleeding (Fig. 19-1, A). Arterial blood is oxygenated and pumped from the heart to supply the body with

nutrients. External arterial bleeding can be caused by both blunt and penetrating trauma. Arterial bleeding can also occur when organs and blood vessels are damaged.

Arterial blood:

- Is bright red.
- spurts from the wound as it is being pushed by the heart's pumping action.
- Will not clot or stop easily because of the pressure.
- Decreases in pressure as the patient's blood pressure drops, due to decreased **blood volume**.

### Venous Bleeding

Venous bleeding is usually the result of an outside force causing trauma or an internal force breaking through a vein, such as a broken bone or organ damage (Fig. 19-1, B). The blood is returning to the heart so it does not have as much pressure to move it forward. Bleeding from a vein can be severe.

Venous blood:

- Is darker red than arterial blood.
- Flows steadily, but the flow can still be quick and severe.
- May be easier to stop because it does not have the same pressure as arterial bleeding.

### Capillary Bleeding

Capillary bleeding is not usually a concern in healthy people (Fig. 19-1, C). It is usually slow because the vessels are small and the blood is under low pressure.

Capillary blood:

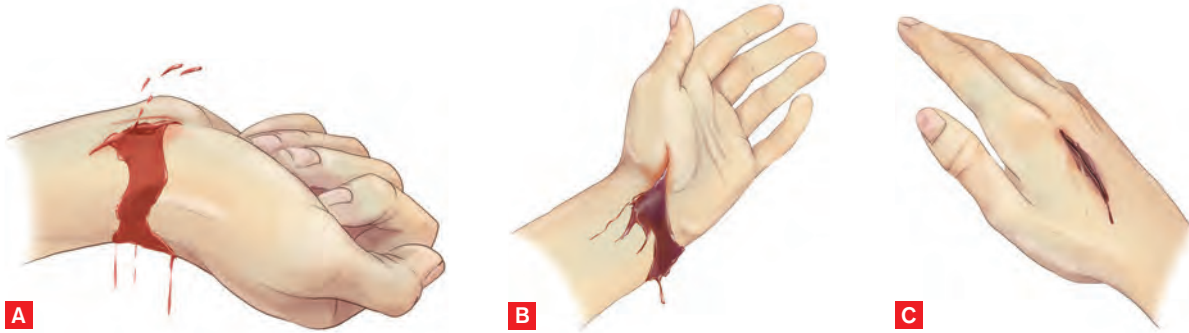
- Is darker red than arterial blood.
- Oozes from the capillaries.
- Usually clots spontaneously or with direct pressure.



#### CRITICAL FACTS

The most severe bleeding is typically arterial bleeding, followed by venous bleeding.

Hemorrhaging occurs when a large amount of blood is lost in a short period of time or when there is continuous bleeding.



**Fig. 19-1, A–C:** (A) Arterial bleeding is typically the most severe type of bleeding, followed by (B) venous bleeding. (C) Capillary bleeding is not usually a concern in healthy people.

## DRESSINGS AND BANDAGES

All open wounds need some type of covering to help control bleeding, absorb drainage, and prevent contamination and infections. These coverings are commonly referred to as dressings and bandages. There are many different types of both.

### Dressings

**Dressings** are pads placed directly on the wound to absorb blood and other fluids and to prevent infection. To minimize the chance of infection, dressings should be sterile. Most dressings are porous, allowing air to circulate to the wound to help promote healing. Standard dressings include varying sizes of cotton gauze (sterile and nonsterile), commonly ranging from 2- to 4-inch squares (i.e., 2-inch x 2-inch pads). Much larger dressings, called universal dressings or **trauma dressings**, are used to cover very large wounds and multiple wounds in one body area (Fig. 19-2). Some dressings have nonstick surfaces to prevent the dressing from sticking to the wound.

A special type of dressing, called an **occlusive dressing**, does not allow air or fluids to pass through. Plastic wrap and petroleum jelly-soaked gauze are examples of this type of dressing. Occlusive dressings are used for open abdominal wounds. For more information on the use of an occlusive dressing, refer to Chapter 21.

### Application of Dressings

For most dressings, place pressure directly on the wound with a sterile gauze pad. Place your fingers

or hand over the gauze pad and apply firm, **direct pressure** (Fig. 19-3). If you do not have gauze available, apply pressure with your own gloved hand or have the injured person apply pressure with the hand.



**Fig. 19-2:** Standard dressings include varying sizes of cotton gauze, commonly ranging from 2- to 4-inch squares. Larger dressings, called trauma dressings, are used to cover very large wounds and multiple wounds in one body area.



**Fig. 19-3:** To care for external bleeding, place pressure directly on the wound with your gloved fingers or hand over a dressing.



### CRITICAL FACTS

All open wounds need some type of covering to help control bleeding, absorb drainage, and prevent contamination and infections. These coverings are commonly referred to as dressings and bandages. There are many different types of both.



## Bandages

A **bandage** is any material used to wrap or cover any part of the body. Bandages are used to hold dressings in place, to apply pressure to control bleeding, to help protect a wound from dirt and infection, and to provide support to an injured limb or body part. Many different types of bandages are available commercially (Fig. 19-4). A bandage applied snugly to create pressure on a wound or injury is called a **pressure bandage**.

A common type of bandage is a commercial adhesive compress. Available in assorted sizes, an adhesive compress consists of a small pad of nonstick gauze (the dressing) on a strip of adhesive tape (the bandage) applied directly to small injuries. Also available is the **bandage compress**, a thick gauze dressing attached to a gauze bandage. This bandage can be tied in place. Because it is designed to help control severe bleeding, the bandage compress usually comes in a sterile package.

A **roller bandage** is usually made of gauze or gauze-like material. Some gauze bandages are made of a self-adhering material that easily conforms to different body parts. Roller bandages are available in assorted widths from 1/2 to 12 inches and lengths from 5 to 10 yards. A roller bandage is generally wrapped around the body part, over a dressing, using overlapping turns until the dressing is completely covered. It can be tied or taped in place. A folded strip of roller bandage may also be used as a dressing or compress. In Chapter 22, you will learn to use roller bandages to hold splints in place.

A special type of roller bandage is an **elastic bandage**, sometimes called an elastic wrap. Elastic bandages are designed to keep continuous pressure on a body part (Fig. 19-5). When properly applied, they can effectively control swelling or support an injured limb. Elastic bandages are available in assorted widths from 2 to 6 inches. They are very effective in managing injuries to muscles, bones and joints. Elastic bandages are frequently used in athletic environments and should be applied only by those who are trained and proficient in their use.

Another commonly used bandage is the **triangular bandage**. When it is folded, it can hold a dressing or splint in place on most parts of the body. Used as a sling, the triangular bandage can support an injured shoulder, arm or hand (Fig. 19-6).

### Application of Bandages

A pressure bandage will hold gauze pads in place while maintaining direct pressure (Fig. 19-7).



**Fig. 19-4:** Bandages are used to hold dressings in place, apply pressure, protect a wound from infection and provide support to an injured limb or body part.



**Fig. 19-5:** An elastic roller bandage is designed to keep continuous pressure on a body part.



**Fig. 19-6:** Used as a sling, the triangular bandage can support an injured shoulder, arm or hand.



**Fig. 19-7:** A pressure bandage can be applied to maintain direct pressure.

To apply a roller bandage, follow these general guidelines:

- Secure the end of the bandage in place. Wrap the bandage around the body part until the dressing is completely covered and the bandage extends several inches beyond the dressing. Tie or tape the bandage in place (Fig. 19-8, A–F).
- Do not cover fingers or toes, if possible. By keeping these parts uncovered, you will be able to tell if the bandage is too tight. If fingers or toes become cold, numb or begin to turn pale, ashen or blue, the bandage is too tight and should be loosened slightly.
- If blood soaks through the bandage, do not remove the original dressing or bandage, but remove excess blood-soaked bandages. Then apply an additional dressing and another bandage and reapply firm direct pressure.

Elastic bandages can easily restrict blood flow if not applied properly. Restricted blood flow is not only painful but also can cause tissue damage if not corrected. Fig. 19-9, A–D shows the proper way to apply an elastic bandage.

## EXTERNAL BLEEDING

External bleeding is usually easy to control. Follow standard precautions when providing care. Wash your hands before (if possible) *and* after providing care, and wear disposable latex-free gloves. You may use alcohol-based hand sanitizers if there is no visible matter present and soap and water are not available.

### Providing Care

When treating a bleeding patient, apply a sterile gauze dressing or trauma pad over the wound and then apply direct pressure to the wound with your gloved hand (see Skill Sheet 19-1). If necessary, use your gloved hand to begin applying direct pressure to the wound while someone else obtains the necessary material(s) (Fig. 19-10). If conscious and able, the patient may use their hand to apply pressure while you obtain the necessary equipment or perform other, more urgent duties.

For severe bleeding, apply strong, direct pressure to the wound to counter the pressure from the beating heart. Use fingertip pressure (using the flat part of fingers) first to control bleeding. If the wound is large and fingertip pressure does not work, use hand pressure with gauze dressings to stop the

bleeding. If you are controlling bleeding from an open fracture, do *not* apply direct pressure over the bones but instead pack sterile gauze around the area to control bleeding and prevent infection.

If the dressing becomes saturated with blood while you are applying pressure, *do not remove the original dressing or bandage*. Instead, leave the original and replace other dressings and bandages with new dressings and reapply direct pressure. Then cover the dressings with a bandage to hold them in place. Adding multiple dressings and bandages can reduce the overall effectiveness of the dressings by spreading the pressure out over a wider area. Keep the patient warm and position them flat on their back. Care for other conditions, including shock.

Part of your care for severe bleeding is to always assess and care for shock, since the risk of (hypovolemic) shock is high with significant blood loss (see Chapter 18 for more information on shock). Do not give food or drink if shock is suspected.

### Nosebleeds

Nosebleeds are usually self-contained and can most often be stopped easily. They can be caused by trauma or develop from a medical reason, such as dryness or high blood pressure. In your assessment of the patient, you can expect to find pain or tenderness in the area and bleeding from the nose. The patient could also vomit swallowed blood. For an unconscious patient, a nosebleed can potentially block the airway.

To care for a nosebleed:

- Ensure the conscious patient is sitting in an upright position.
- Tilt the patient's head and upper body forward slightly, if possible, to prevent swallowing or choking on the blood.
- Pinch the patient's nostrils together firmly for about 5 to 10 minutes to slow down the blood flow (Fig. 19-11).
- Tell the patient not to sniffle or blow their nose.
- Do not pack the patient's nose to stop the bleeding.

As with bleeding from external wounds, monitor the patient for signs of shock if the bleeding does not stop. If you suspect a fractured skull, do *not* try to stop a nosebleed as this might increase pressure on the brain. Instead, cover the nostrils loosely with sterile gauze and call for more advanced medical personnel.



**A**



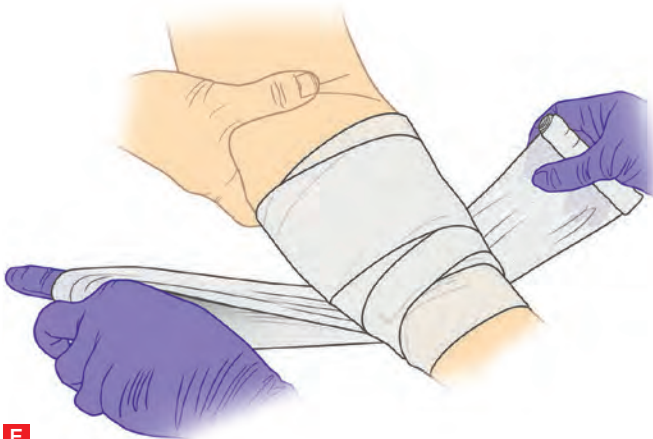
**B**



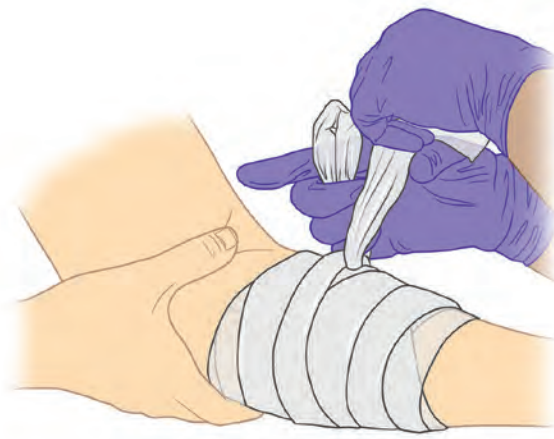
**C**



**D**



**E**



**F**

**Fig. 19-8, A–F:** To tie a bandage: **(A)** Begin by placing the end of the bandage on the dressing at a 45-degree angle. **(B)** Wrap the bandage one full turn, and then fold the angled end of the bandage up, creating a “dog-ear.” **(C)** Continue wrapping the bandage, overlaying the “dog ear” to anchor it and moving upward. **(D)** Once the dressing is covered, roll out the remaining length of bandage. **(E)** While holding the bandage, use the index finger of the other hand to split the bandage in half, moving it down and underneath the limb. **(F)** Bring the two ends of the bandage up and tie them in a bow or knot.





**Fig. 19-9, A–D:** To apply an elastic bandage: **(A)** Start the elastic bandage at the point farthest from the heart. **(B)** Anchor the bandage. **(C)** Wrap the bandage using overlapping turns. **(D)** Tape the end of the bandage in place.



**Fig. 19-10:** When treating a bleeding patient, apply a dressing or trauma pad and use a gloved hand to apply direct pressure to the wound.



**Fig. 19-11:** To care for a nosebleed, firmly pinch or have the patient pinch the nostrils together for about 5 to 10 minutes.

## Other Methods to Control Severe, Life-Threatening Bleeding

For a wound that is bleeding severely, if direct pressure fails to control the bleeding or is not possible, application of a manufactured (commercial) tourniquet or a hemostatic dressing by a properly trained responder can be considered. Manufactured tourniquets are preferred over makeshift or homemade devices. For wounds

not on an extremity or when a tourniquet is not available or effective, a hemostatic dressing with firm direct pressure may be considered, following the manufacturer's instructions and local protocols.

## Tourniquets

A **tourniquet** is a device placed around an arm or leg to constrict blood vessels and stop blood flow to a wound. In some life-threatening

circumstances, you may need to use a tourniquet to control bleeding as the first step instead of maintaining direct pressure over several minutes. Examples of situations where it may be necessary to use a tourniquet include:

- Severe, life-threatening bleeding that cannot be controlled using direct pressure.
- A physical location that makes it impossible to apply direct pressure to control the bleeding (e.g., the injured patient or their limb is trapped in a confined space).
- Multiple patients with life-threatening injuries who need care and there are limited resources available.
- A scene that is or becomes unsafe.

Tourniquets can be extremely painful. If you must apply a tourniquet, make sure the patient understands the reason for the tourniquet, and warn them that it may be painful.

If you find yourself in a situation where you need to apply a tourniquet, follow the manufacturer's instructions for applying it. Although tourniquets may have slightly different designs, all are applied in generally the same way. First, place the tourniquet around the wounded extremity about 2 inches above the wound, avoiding the joint if possible. Secure the tourniquet tightly in place according to the manufacturer's instructions. Twist the rod (windlass) to tighten the tourniquet until the bleeding stops, then secure the rod in place (Fig. 19-12, A–B). Note and record the time

that you applied the tourniquet, and be sure to give the transporting personnel this information when they arrive. Once the tourniquet is applied, it should not be removed until the patient reaches a healthcare facility. Skill Sheet 19-2 describes step-by-step how to apply a commercially manufactured tourniquet.

If it is necessary to use a tourniquet and a commercially manufactured tourniquet is not available, make a tourniquet using a strip of soft material that is 2 to 4 inches wide (such as a triangular bandage that has been folded into a tie) and a short, sturdy stick or other rigid object. Tie the stick or other rigid object into the material and twist it to tighten the makeshift tourniquet.

## Hemostatic Dressings

A **hemostatic dressing** is a dressing treated with an agent or chemical that speeds up **clotting**. As is the case with tourniquets, hemostatic dressings are used when severe, life-threatening bleeding exists and standard procedures (direct pressure) for bleeding control fail or are not practical. Typically, hemostatic dressings are used on parts of the body where a tourniquet cannot be applied, such as the neck, torso and junctional areas such as the abdomen and groin. Hemostatic dressings may also be used on extremities when a tourniquet is not available or is not effective.

Hemostatic dressings must be applied at the site of the bleeding and be packed deep inside the wound along with direct pressure. Follow the



**Fig. 19-12, A–B:** To apply a tourniquet: **(A)** Secure the tourniquet in place around the injured body part. **(B)** Tighten it by twisting the rod and securing it into place. Note and record the time the tourniquet was applied.



### CRITICAL FACTS

Tourniquets can be extremely painful. If you must apply a tourniquet, make sure the patient understands the reason for the tourniquet, and warn them that it may be painful.





**Fig. 19-13:** To be effective, hemostatic dressings require continuous direct pressure at the source of the bleeding until the bleeding is controlled. *Photo: courtesy of the Canadian Red Cross.*

manufacturer's instructions for proper application of the hemostatic dressing according to local protocols. To be effective, hemostatic dressings require continuous direct pressure at the source of the bleeding until the bleeding is controlled (Fig. 19-13). Any time a hemostatic dressing is applied, the patient needs to be evaluated by a healthcare provider.

## Splints

In an open wound to an extremity where the bone or joint is also injured, the bone ends or fragments can be displaced and cause damage to soft tissues and blood vessels, causing further bleeding. Using a splint to immobilize the extremity can help prevent this problem. If the wound is over an open fracture (on the bones), do *not* apply direct pressure but instead pack sterile gauze around the area to control bleeding and prevent infection.

## INTERNAL BLEEDING

### Causes

Internal bleeding is the escape of blood from arteries, veins or capillaries into spaces in the body. Internal bleeding can be caused by a variety of injuries or conditions, including blunt force trauma. For example, the impact of the chest or head against the steering wheel during a motor-vehicle collision can cause internal bleeding. It can also be caused by a fracture, which may cause bones to pierce internal organs. Because this type of damage may

not be visible, it may lead to extensive concealed bleeding. It may also cause unexplained shock.

Internal bleeding can also occur along with external bleeding. For example, if a patient is bleeding from a knife wound, the blade may have penetrated an organ, which then begins bleeding inside the body.

The patient may experience injuries to extremities, causing pain, swelling or deformity. This may lead to serious internal blood loss from long bone fractures. Internal bleeding is not always easy to recognize unless the patient is losing blood from the ears, mouth, vagina, rectum or possibly from the nose.

As with external bleeding, arterial bleeding is typically the most severe. The strength of the heartbeat will cause the blood to flow from the blood vessels into the interior of the body quickly and with great force.

### Signs and Symptoms of Internal Bleeding

Some signs and symptoms of internal bleeding include:

- Discoloration of the skin around the area (bruising) on the neck, chest, abdomen or side.
- Nausea, vomiting or coughing up blood.
- Discolored, painful, tender, swollen or firm tissue (e.g., the abdomen).
- Tenderness and guarding (protecting the area).



## CRITICAL FACTS

Some signs and symptoms of internal bleeding include bruising on the neck, chest, abdomen or side; nausea, vomiting or coughing up blood; patient guarding the area; rapid pulse or breathing; skin that is cool or moist or looks pale, ashen or bluish; excessive thirst; declining LOC and drop in blood pressure.

If a patient is bleeding internally, call for more advanced medical personnel, keep the patient still and care for shock.

Signs and symptoms of shock may be present, including:

- Anxiety or restlessness.
- Rapid, weak pulse.
- Rapid breathing.
- Skin that feels cool or moist or that looks pale, ashen or bluish.
- Excessive thirst.
- Declining level of consciousness (LOC).
- Drop in blood pressure.

## Providing Care

If a patient is bleeding internally:

- Call for more advanced medical personnel if serious internal bleeding is suspected.
- Ensure the patient remains as still as possible, to reduce the heart's blood output.
- Care for shock.

When internal bleeding is from the capillary blood vessels, the result is bruising around the wound area and is not serious. To reduce discomfort for the patient, you can apply a cold pack.

## PUTTING IT ALL TOGETHER

One of the most important things you can do in any emergency is to recognize and control

severe bleeding. External bleeding is easily recognized and should be cared for immediately. Check and care for severe, life-threatening bleeding as you form your general impression and conduct the primary assessment. Severe external bleeding is life threatening. Although internal bleeding is less obvious, it also can be life threatening. Recognize when a serious injury has occurred and suspect internal bleeding. You may not identify internal bleeding until you perform the physical exam and patient history. When you identify or suspect severe bleeding, quickly transport or arrange for transport of the patient to a hospital. Continue to provide care until more advanced medical personnel take over.

Do *not* wait for shock to develop before providing care to someone who is injured or suddenly ill, especially if there is blood loss or if the normal function of the heart is interrupted. Care for life-threatening conditions, such as severe external bleeding, before caring for lesser injuries. Remember that managing shock effectively begins with recognizing a situation in which shock may develop, and providing appropriate care. Summon more advanced medical personnel *immediately* if you notice signs and symptoms of shock. Shock can often be reversed by advanced medical care, but *only* if the patient is reached in time.

## > You Are the Emergency Medical Responder

You have called for more advanced medical personnel. Blood is spurting with each beat of the patient's heart. The bandage is soaked with blood and your partner notices that the patient is turning pale and his LOC is changing. How would you respond? What other concerns do you have and what additional steps should you take until EMS personnel arrive?

## Skill Sheet 19-1

# Using Direct Pressure to Control External Bleeding

**NOTE:** Always follow standard precautions when providing care.

**STEP 1**

Cover the wound with a sterile gauze pad and apply direct pressure until the bleeding stops.

- If blood soaks through the dressing, leave the original dressing in place, but remove any excess dressings or bandages and apply a new one on top. Then apply additional direct pressure (press harder than you did before, if possible). It may take several minutes for the bleeding to stop.

**STEP 2**

When the bleeding stops, check for circulation (feeling, warmth and color) beyond the injury.

**STEP 3**

Apply a roller bandage. Wrap the bandage around the wound several times to hold the gauze pad(s) in place.

- Tie or tape the bandage to secure it.
- Check for circulation (feeling, warmth and color) beyond the injury. If there is a change in feeling, warmth or color (indicating that the bandage is too tight), gently loosen it.

**STEP 4**

Remove your disposable latex-free gloves and wash your hands.

**NOTE:** If the bleeding does not stop with the application of direct pressure, call for more advanced medical personnel if you have not already, and give care for shock if necessary.

## Skill Sheet 19-2

## Using a Commercial Tourniquet with a Windlass

**NOTE:** Always follow the manufacturer's instructions and local protocols when applying a tourniquet. Always follow standard precautions when providing care.

After conducting a scene size-up, checking the patient and having someone else call for more advanced medical personnel and then determining that standard first aid care for bleeding (direct pressure) is not effective or appropriate for controlling the severe, life-threatening bleeding:

**STEP 1**

Place the tourniquet around the limb, approximately 2 inches above the wound. Avoid placing the tourniquet over a joint.

**STEP 2**

Route the tag end of the strap through the buckle of the tourniquet, if necessary.

**STEP 3**

Pull the strap tightly and secure it in place.

**STEP 4**

Tighten the tourniquet by twisting the rod (windlass) until the flow of bleeding stops and then secure the rod in place. Do not cover the tourniquet with clothing.

**STEP 5**

Note and record the time that you applied the tourniquet, and give this information to the transporting personnel when they arrive to take over care.



# ENRICHMENT

## Mechanisms of Injury—The Kinematics of Trauma

### Vehicle Collisions

Motor-vehicle collisions are some of the most frequent scenes to which an emergency medical responder (EMR) may be called. Collisions are categorized as head-on impact, rear impact, side impact, rotational impact and rollover. Each collision category shows a predictable pattern of injury, which is influenced by the type of restraint the occupant was using at the time of the collision.

A **head-on collision** is one in which a vehicle hits an object, such as a tree or a stopped vehicle, straight on. When the car makes impact in a head-on collision, the bodies of the occupants will continue to move until they strike an object such as a secured seat belt, an air bag, the steering wheel or the windshield. Additionally, the organs within the body also continue to move forward until they strike an internal structure such as the sternum or skull. Injuries common to head-on collisions include face, head, neck, chest and abdominal injuries. This is also true for rear-impact collisions.

In **side-impact collisions**, also known as broadside, lateral or t-bone collisions, the person on the impact side of the crash sustains more injuries than do occupants on the opposite side. Due to the impact sustained during a side-impact collision, the body moves one way and the head the other. This makes head and neck injuries more common. Chest and pelvic injuries are also possible in this situation.

**Rotational impact** occurs off center, when the car strikes an object and rotates around it until the car either loses speed or strikes another object. Injuries similar to head-on and side-impact collisions can be expected in these cases.

**Rollovers** see the occupants of the car changing positions as the car does (Fig. 19-14, A–D). In these cases, predicting injury is impossible, as every object in the car becomes potentially lethal. If occupants are not wearing seat belts, it is more likely that they may be thrown from the car, dramatically increasing the likelihood of death. Common injuries in rollovers include soft tissue injuries, multiple broken bones and crushing injuries.



Fig. 19-14, A–D: In a rollover, unrestrained occupants of the car change positions as the car does.

*Continued on next page*



# ENRICHMENT

## Mechanisms of Injury—The Kinematics of Trauma *CONTINUED*

When someone is struck by or falls against a blunt object—one with no sharp edges or points—the resulting injuries are often closed wounds. This means that, although the soft tissues of skin, muscle, nerves and blood vessels may be damaged, the skin is not broken and there is no visible bleeding. The patient may look unharmed, but there may be serious, even fatal, injury to the internal organs and significant internal bleeding.

Proper use of restraints in a vehicle will help to lessen the likelihood of injury for the occupants. However, injuries can still be sustained. Restraints vary based on the type of vehicle, and some can be more effective than others in preventing injury.

- Lap belts
  - Prevent occupants from being thrown from a car.
  - Do not prevent head, neck and chest injuries.
  - Can cause internal injuries if not worn properly.
  - Can cause injury to the diaphragm.
- Lap and shoulder belts
  - Prevent occupants from striking the steering wheel and dashboard.
  - Upon severe impact can cause damage to the clavicle.
  - Do not prevent head and neck injury.
- Air bags
  - Are located in the steering wheel, dashboard and/or side curtains.
  - Must have high impact to deploy.
  - Are fully effective only when occupants are wearing seat belts.
  - Can cause burns, **contusions** (bruises) and other, more serious injuries.
  - Protect the occupant only from the first collision in a multi-collision crash.
- Head rests
  - When properly adjusted, limit the effects of head, neck and spinal injuries.

### Pediatric Considerations

Because an air bag could seriously injure or even kill a child, or even an adult of short stature, these individuals are safest in the rear seat. A child or an infant in a rear-facing seat is close to the dashboard and could easily be struck by the air bag with sufficient force to cause serious harm or even death. Older children who have outgrown child seats are also at risk from a deploying air bag, if not properly restrained.

Infants should always be transported in car seats. However, as with seat belts and air bags, car seats vary based on type, and some can be more effective than others in preventing injury.

- Infant car seats facing backward help prevent head and neck injuries.
- The greatest danger is to the infant's neck.
- Seats vary, based on the age and size of the occupant.

In motorcycle crashes, there are four potential scenarios: head-on, angular, ejection and laying the bike down (Fig. 19-15). The purpose of laying the bike down is to minimize impact in the case of an impending crash. The rider may turn the motorcycle sideways and drag a leg along the ground to lose speed in order to get off the bike. This can result in severe burns and abrasions, but lessens the likelihood of internal injuries.

Head-on impacts will usually result in the driver impacting the handlebars at the same speed the bike is traveling. Multiple injuries can result.

# ENRICHMENT

## Mechanisms of Injury—The Kinematics of Trauma *CONTINUED*



**Fig. 19-15:** In motorcycle crashes, there are four potential scenarios: head-on, angular, ejection and laying the bike down (shown). *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*

Angular impact can result in severe amputations, as the rider strikes an object at an angle. Ejection from the bike causes the rider to fly over the handlebars, which can result in severe head, spinal and face injury, especially if the rider is not wearing a helmet.

All-terrain vehicle (ATV) crashes commonly result in head, neck and extremity injuries similar to those seen in motorcycle collisions. These vehicles are prone to crashes and rollovers.

### Falls

A significant number of trauma-related injuries each year are caused by falls, particularly among older adults. The severity of the injury depends on:

- The distance of the fall.
- Any interruptions during the fall.
- Which body parts impact first.
- The surface on which the patient lands.
- The patient's physical condition *before* the fall took place.

There are two types of falls. Feet-first falls cause energy to travel up the skeleton as the patient lands (Fig. 19-16). When a patient's knees are bent on landing, injury will be less severe. Spine, hip socket, femur, heel and ankle are the most common sites for injury from these falls. If hands are outstretched to help "break" a fall, then wrists will be also be impacted. Broken shoulders and clavicles are also common.

Headfirst falls begin with the arms and extend to the shoulders on impact. Therefore, spine and head injuries are common. Chest, lower back and pelvis injuries often occur as the body is falling and the torso and legs are thrown forward or backward.

Falls on the side of the head (as in skiing incidents) often do not show signs and symptoms until 1 to 2 hours after the injury. Be sure to tell this to patients, so that they are aware of it. Strongly encourage patients to get checked out by a healthcare provider before symptoms occur.

*Continued on next page*

# ENRICHMENT

## Mechanisms of Injury—The Kinematics of Trauma *CONTINUED*

### Penetrating Injuries

When an object is pushed through the surface and soft tissue of the body, a penetrating injury occurs. There are low-velocity and medium-high velocity penetrating injuries. Low-velocity injuries occur most commonly with the use of hand-powered weapons such as knives or arrows. The severity of the injury can be determined by the location of the injury and the length of the weapon. The strength and force capacity of the attacker is also a determining factor.

Medium-high velocity injuries are caused by guns. Tissue damage can be much more widespread in a patient with a gunshot wound than may be indicated by the surface wound. Little external bleeding can still be a result of a devastating internal injury.

### Blast Injuries

Explosions can produce unique patterns of injury, often inflicting multiple life-threatening injuries on several patients simultaneously. Blast injuries are divided into four categories: primary, secondary, tertiary and miscellaneous.

Primary blast injury is caused by the direct effect of blast overpressure on a patient's tissue, resulting in injury to air-filled structures such as the lungs, ears and gastrointestinal tract. A primary blast injury damages organs and tissue solely by the shock of the blast wave.

Secondary blast injury is caused when a patient is struck by flying objects and is responsible for the majority of casualties in many explosions. Injuries most commonly include penetrating thoracic trauma, including lacerations of the heart and major blood vessels, which is a common cause of death by secondary blast injuries.

Tertiary blast injuries are caused by individuals flying through the air and striking other objects, generally from high-energy explosions. The patient is usually very close to the explosion source when injured this way.

Miscellaneous blast-related injuries, sometimes termed quaternary blast injuries, encompass all other injuries a patient may experience caused by explosions, including burns, crush injuries and inhalation of toxic fumes or substances. It is probable that wheezing associated with a blast injury is from one of the following:

- Pulmonary contusion
- Inhalation of toxic gases or dusts
- Pulmonary edema from myocardial contusion
- **Adult respiratory distress syndrome (ARDS)**

If possible, try to determine:

- What material caused the explosion.
- The patient's location relative to the center of the explosion.
- If there is evidence of radiation and/or chemicals.



**Fig. 19-16:** In a jump or fall from a height, the impact can cause injury to the spine, hip socket, femur, heel and ankle.

# 20

## SOFT TISSUE INJURIES

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### ► You Are the Emergency Medical Responder

You are on the medical emergency response team (MERT) responding to a call at a power plant that at least one worker has suffered an electrical shock from a live junction box. Plant workers thought that a colleague had turned off the power, but when the injured worker reached inside and touched a wire, he received a shock and an electrical burn. The injured worker lost consciousness momentarily. A second worker at the scene moved away from his co-worker and called for help. When you arrive, the co-worker who placed the call relates what happened. How should you respond? What are your immediate concerns?





## KEY TERMS

**Abrasion:** The most common type of open wound; characterized by skin that has been rubbed or scraped away.

**Amputation:** The complete removal or severing of an external body part.

**Avulsion:** An injury in which a portion of the skin, and sometimes other soft tissue, is partially or completely torn away.

**Burn:** An injury to the skin or other body tissues caused by heat, chemicals, electricity or radiation.

**Chemical burn:** A burn caused by strong, caustic chemicals damaging the skin.

**Closed wound:** A wound in which soft tissue damage occurs beneath the skin and the skin is not broken.

**Compartment syndrome:** Condition in which there is swelling and an increase in pressure within a limited space that presses on and compromises blood vessels, nerves and tendons that run through that limited space; usually involves the leg, forearm, arm, thigh, shoulder or buttock.

**Critical burn:** Any burn that is potentially life threatening, disabling or disfiguring; a burn requiring advanced medical care.

**Crush injury:** An injury to a body part, often an extremity, caused by a high degree of pressure; may result in serious damage to underlying tissues and cause bleeding, bruising, fracture, laceration and compartment syndrome.

**Dermis:** The deeper layer of the skin; contains the nerves, sweat glands, oil glands and blood vessels.

**Electrical burn:** A burn caused by contact with an electrical source, which allows an electrical current to pass through the body.

**Epidermis:** The outer layer of the skin; provides a barrier to bacteria and other organisms that can cause infection.

**Full-thickness burn:** A burn injury involving all layers of skin and underlying tissues; skin may be brown or charred, and underlying tissues may appear white; also referred to as a third-degree burn.

**Hypodermis:** A deeper layer of skin located below the epidermis and dermis; contains fat, blood vessels and connective tissues.

**Laceration:** A cut, usually from a sharp object, that can have either jagged or smooth edges.

**Open wound:** A wound resulting in a break in the skin's surface.

**Partial-thickness burn:** A burn injury involving the epidermis and dermis, characterized by red, wet skin and blisters; also referred to as a second-degree burn.

**Puncture/penetration:** A type of wound that results when the skin is pierced with a pointed object.

**Radiation burn:** A burn caused by exposure to radiation, either nuclear (e.g., radiation therapy) or solar (e.g., radiation from the sun).

**Rule of Nines:** A method for estimating the extent of a burn; divides the body into 11 surface areas, each of which comprises approximately 9 percent of the body, plus the genitals, which are approximately 1 percent.

**Soft tissues:** Body structures that include the layers of skin, fat and muscles.

**Superficial burn:** A burn injury involving only the top layer of skin, characterized by red, dry skin; also referred to as a first-degree burn.

**Wound:** An injury to the soft tissues.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- List the types of soft tissue injuries.
- Describe the emergency medical care for a patient with a soft tissue injury.
- Describe the emergency medical care for a patient with an injury from an embedded object.
- Describe the emergency medical care for a patient with an open wound.
- Describe the emergency medical care for a patient with an amputation.



## LEARNING OBJECTIVES continued

- List the signs and symptoms of closed wounds.
- List the causes of a burn injury.
- List conditions under which you would summon more advanced medical personnel for a burn injury.
- Describe the emergency medical care for burns.
- Describe the kinds of injuries that might occur from a thermal, electrical, chemical and radiation burn.
- Describe how to care for thermal, chemical, electrical and radiation burns.

## INTRODUCTION

An infant falls and bruises an arm while learning to walk; a child needs stitches in the chin after tumbling from the “monkey bars” on the playground; a teenager gets a sunburn during a weekend at the beach; and an adult cuts a hand while working in a woodshop. What do these injuries have in common? They are all soft tissue injuries.

In the course of growing up and in our daily lives, soft tissue injuries occur often and in many different ways. Fortunately, most soft tissue injuries are minor, requiring little attention. Often, only an adhesive bandage or a cold pack and rest are needed. Some injuries, however, are more severe and require immediate medical attention.

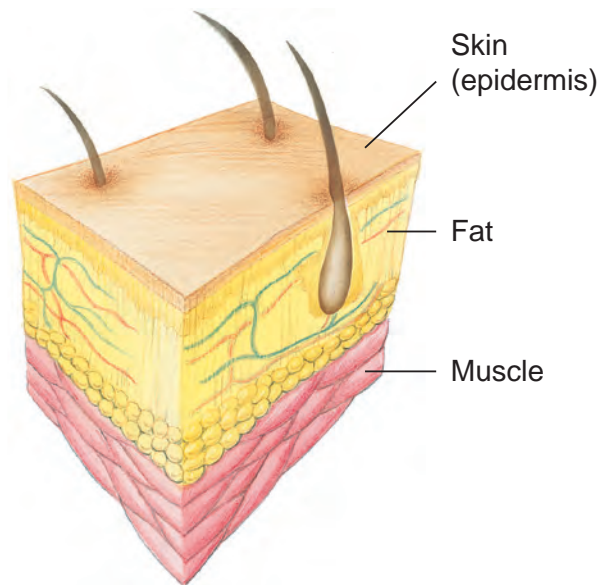
Burns are a special kind of soft tissue injury. Like other types of soft tissue injury, burns can damage the top layer of skin or the skin and the layers of fat, muscle and bone beneath. In this chapter, you will learn how to recognize and care for soft tissue injuries.

## SKIN AND SOFT TISSUE INJURIES

### Soft Tissues

The **soft tissues** include the layers of skin, fat and muscle that protect the underlying body structures (Fig. 20-1).

In Chapter 4, you learned that the skin is the largest single organ in the body and that, without it, the



**Fig. 20-1:** Layers of skin, fat and muscle protect underlying structures of the body.

human body could not function. The skin provides a protective barrier for the body; it helps regulate the body’s temperature and it receives information about the environment through the nerves that run through it.

The outer layer of skin, the **epidermis**, provides a barrier to bacteria and other organisms that can cause infection. The deeper layer, the **dermis**, contains the important structures of the nerves, the sweat and oil glands, and the blood vessels. The **hypodermis**—located beneath the epidermis and dermis—contains fat, blood vessels and connective tissues. Because the skin is well supplied with



### CRITICAL FACTS

The skin is the largest organ in the body. The outer layer, called the epidermis, provides a barrier to bacteria and other organisms that can cause infection.

An injury to the soft tissues is called a wound. Soft tissue injuries are typically classified as either closed wounds or open wounds.

blood vessels and nerves, most soft tissue injuries are likely to bleed and be painful.

Beneath the skin layers lies a layer of fat. This layer helps insulate the body, to help maintain body temperature. The fat layer also stores energy. The amount of fat varies in different parts of the body and in each person.

The muscles lie beneath the fat layer and comprise the largest segment of the body's soft tissues. Most soft tissue injuries involve the outer layers of tissue. However, violent forces, such as those that cause deep burns or cause objects to penetrate the skin, can injure *all* the soft tissue layers. Muscle injuries are discussed more thoroughly in Chapter 22, along with other musculoskeletal injuries.

## Types of Soft Tissue Injuries

An injury to the soft tissues is called a **wound**. Soft tissue injuries are typically classified as either **closed wounds** or **open wounds**. A wound is considered closed when the soft tissue damage occurs beneath the surface of the skin, leaving the outer layer intact; this often results in internal bleeding. A wound is considered open when there is a break in the skin's outer layer; this usually results in external bleeding.

**Burns** are a special kind of soft tissue injury. A burn injury occurs when intense heat, certain chemicals, electricity or radiation contact the skin or other body tissues. Burns are classified as superficial, partial thickness or full thickness.

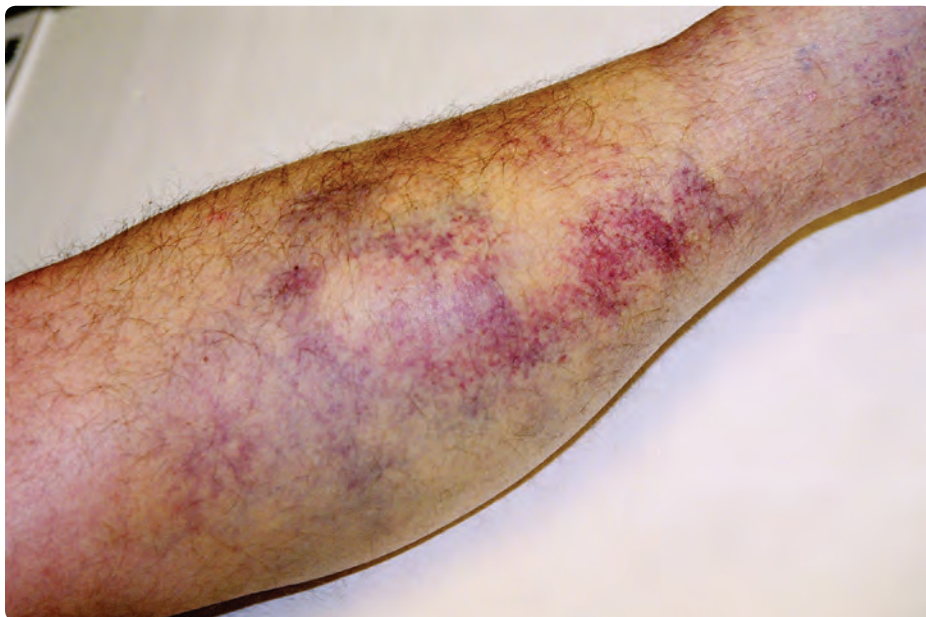
## CLOSED WOUNDS

Closed wounds occur beneath the surface of the skin. The simplest closed wound is a bruise, also called a contusion (Fig. 20-2). Bruises result when the body is subjected to blunt force, such as when you bump your leg on a table or chair. Such a blow usually results in damage to soft tissue layers and blood vessels beneath the skin, causing internal bleeding.

A much more serious closed wound can be caused by a violent force hitting the body. This type of force can injure larger blood vessels and deeper layers of muscle tissue, causing heavy bleeding beneath the skin, which causes a localized tissue mass that can be discolored by the internal bleeding. These injuries are referred to as hematomas.

## Signs and Symptoms of Closed Wounds

When blood and other fluids seep into the surrounding tissues, the area discolors (turns black and blue) and swells. The amount of discoloration and swelling varies depending on the severity of the injury. At first, the area may only appear red. Over time, more blood may leak into the area, making the area appear dark red or purple. Violent forces can cause more severe soft tissue injuries involving larger blood vessels, the deeper layers of muscle tissue and even organs deep within the body. These injuries can result in profuse internal bleeding. With deeper injuries, you may or may not see bruising immediately.



**Fig. 20-2:** Bruises result when the body is subjected to blunt force. *Photo: courtesy of Ted Crites.*

## Providing Care for Closed Wounds

Many closed wounds, such as bruises, do *not* require special medical care. To care for a closed wound, be sure to keep the injured area still.

Applying cold can be effective early on in helping control both pain and swelling (Fig. 20-3). When applying cold:

- Make a cold pack by filling a sealable plastic bag with a mixture of ice and water, and then apply it to the injured area for about 20 minutes. Place a thin towel as a barrier between the cold pack and the bare skin. If an ice-and-water mixture is not available, use a bag of frozen vegetables or a chemical cold pack as an alternative. Do *not* place ice directly on a wound.
- Remove the cold pack and wait 20 minutes before reapplying a new cold pack.
- If the patient is not able to tolerate a 20-minute application, limit application to 10 minutes.
- Elevating the injured part may help to reduce swelling; however, do *not* elevate the injured part if doing so causes more pain or you suspect a dislocation or fracture.

Do *not* assume that all closed wounds are minor injuries. Take the time to find out whether more serious injuries could be present. With the cases that follow, the patient may be bleeding internally and need emergency medical care. Call for more advanced medical care if:

- The patient complains of severe pain or cannot move a body part without pain.



**Fig. 20-3:** Applying cold to a closed wound can be effective in helping control pain and swelling.

- The force that caused the injury seems great enough to cause serious damage.
- An injured extremity is blue or extremely pale.
- The patient's abdomen is tender and distended.
- The patient is vomiting blood or coughing up blood.
- The patient shows signs and symptoms of shock.

With all closed wounds, help the patient to rest in the most comfortable position possible. If you suspect the patient may be in shock, have them lie flat on their back and care for shock. In addition, keep the patient from getting chilled or overheated. Be sure that a patient with an injured lower extremity does not bear weight on it until advised to do so by a healthcare provider.

## OPEN WOUNDS

In an open wound, the break in the skin can be as minor as a scrape of the surface layers or as severe as a deep penetration or even the loss of a body part. The amount of bleeding depends on the location and severity of the injury as well as other factors, including the patient's use of certain medications such as blood thinners or aspirin. Any break in the skin provides an entry point for disease-producing microorganisms, or pathogens.

There are six main types of open wounds, including:

- Abrasions.
- Amputations.
- Avulsions.
- Crush injuries.
- Punctures/penetrations.
- Lacerations.

## Types of Open Wounds

### Abrasions

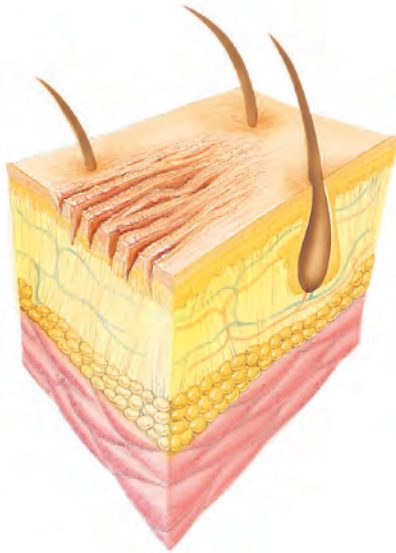
An **abrasion** is the most common type of open wound. It is characterized by skin that has been rubbed or scraped away, such as when someone falls and scrapes their hands or knees (Fig. 20-4). An abrasion is sometimes called a "rug burn," "road rash" or "strawberry." Because the scraping of the



### CRITICAL FACTS

Burns are a soft tissue injury that has three classifications: superficial, partial thickness and full thickness.





**Fig. 20-4:** An abrasion is characterized by skin that has been rubbed or scraped away.

outer skin layers exposes sensitive nerve endings, an abrasion is usually painful. Bleeding is easily controlled and not severe, since only the capillaries are affected. Because of the way the injury occurs, dirt and other matter can easily become embedded in the skin, making it especially important to clean the wound.

### Amputations

In some severe injuries, the force is so violent that a body part, such as a finger, may be severed. A complete severing of a part (usually involving a bone or limb) is called an **amputation** (Fig. 20-5).



**Fig. 20-5:** An amputation is a complete severing of a part of the body.

Although damage to the tissue is severe, bleeding may not be as profuse as you might expect. The blood vessels usually constrict and retract (pull in) at the point of injury, slowing bleeding and making it relatively easy to control with direct pressure. In the past, a completely severed body part could not be successfully reattached. With today's technology, reattachment is often successful, making it important to carefully handle and send the severed part to the hospital with the patient.

### Avulsions

An **avulsion** is an injury in which a portion of the skin and sometimes other soft tissue is partially or completely torn away (Fig. 20-6). A partially avulsed piece of skin may remain attached but hang like a flap. Bleeding can be heavy because avulsions often involve deeper soft tissue layers.

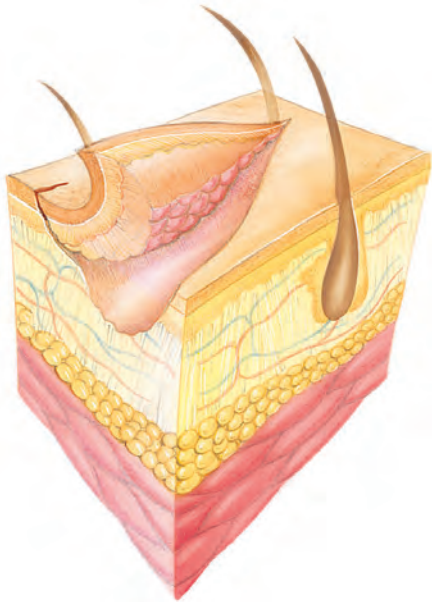
### Crush Injuries

A **crush injury** is the result of a body part, usually an extremity, being subjected to a high degree of pressure, in most cases after being compressed between two heavy objects (Fig. 20-7). This type of injury may result in serious damage to underlying tissues and cause



#### CRITICAL FACTS

Open wounds are injuries that break the skin. These breaks can be as minor as a scrape of the surface layers or as severe as a deep penetration or even the loss of a body part. The six types of open wounds are abrasions, amputations, avulsions, crush injuries, punctures/penetrations and lacerations.



**Fig. 20-6:** In an avulsion, part of the skin and other soft tissue is torn away. *Photo: courtesy of the Canadian Red Cross.*



**Fig. 20-7:** Crush injuries occur when a body part is subjected to a high degree of pressure.

bleeding, bruising, fracture, laceration and **compartment syndrome**. In a severe crush injury to the torso, internal organs may rupture. Crush injuries can be open or closed.

Crush syndrome is common in people who are trapped in collapsed structures due to, for example, an earthquake or act of terrorism. The injury does not happen at the time that the tissue is crushed, but once the crushed muscle is released from compression and the tissue is re-perfused with blood. At that point, multiple adverse processes occur, as the products of muscle breakdown are released into the blood. The patient may suffer major shock and renal failure, and death may occur.

## Punctures/Penetrations

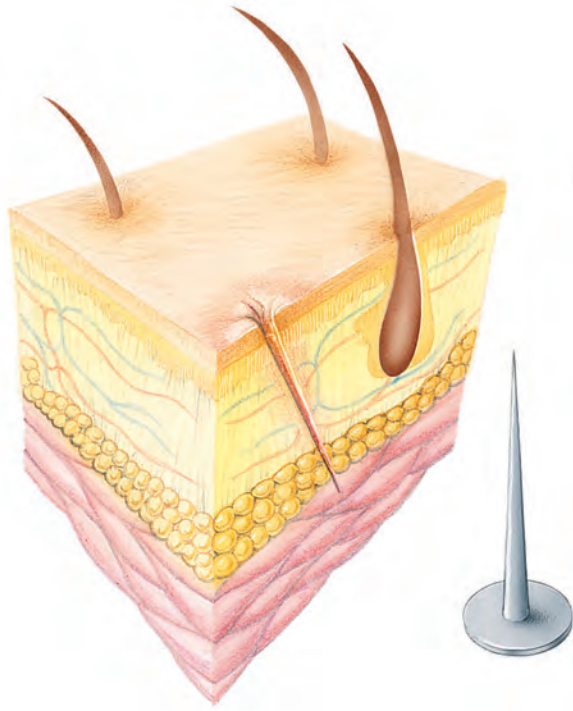
A **puncture/penetration** wound results when the skin is pierced with a pointed object, such as a nail, piece of glass, splinter or knife (Fig. 20-8). A bullet wound is also considered a puncture wound. Because the skin usually closes around the penetrating object, external bleeding is generally not severe. However, internal bleeding may be quite severe if the penetrating object damages major blood vessels or internal organs. An object that remains in the open wound is called an embedded object. An object may also pass completely through a body part, creating two open wounds—one at the entry point and one at the exit point.

Although puncture wounds generally do *not* bleed profusely, they are potentially more dangerous than wounds that bleed more, because they are more likely to become infected. Objects penetrating the soft tissues carry microorganisms that cause infections. Of particular danger is the microorganism that causes tetanus, a severe infection.

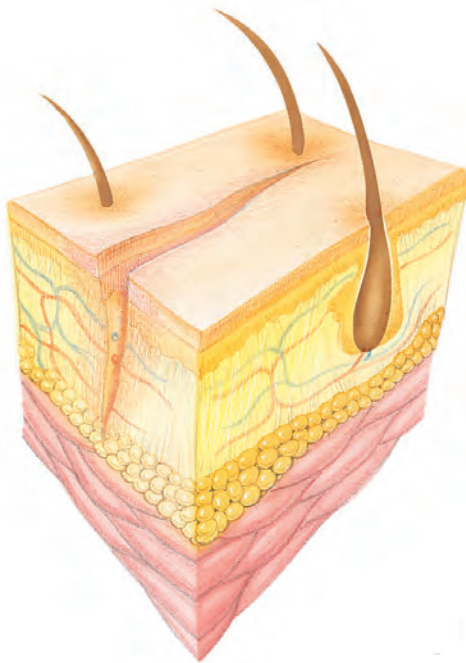
## Lacerations

A **laceration** is a cut, usually from a sharp object. The cut may have jagged or smooth edges (Fig. 20-9). Lacerations are commonly caused by sharp-edged objects, such as knives, scissors or broken glass. A laceration can also





**Fig. 20-8:** A puncture wound results when skin is pierced by a pointed object.



**Fig. 20-9:** A laceration is a cut in the skin. It may have either jagged or smooth edges.

result when a blunt force splits the skin. Such splits occur in areas where bone lies directly under the skin's surface, such as the jaw. Deep lacerations can also affect the underlying layers of fat and muscle, damaging both nerves and blood vessels. Lacerations usually bleed freely and, depending on the structures involved, can bleed profusely. Because the nerves may also be injured, lacerations are not always immediately painful.

## Providing Care for Open Wounds

With any open wound, always follow standard precautions to avoid contact with blood and OPIM.

### Major Open Wounds

A major open wound involves serious tissue damage and may bleed severely. As you learned in Chapter 19, the main priority of care for a major open wound is to control bleeding *immediately* with direct pressure using sterile dressings and pressure bandages and care for shock.

### Minor Open Wounds

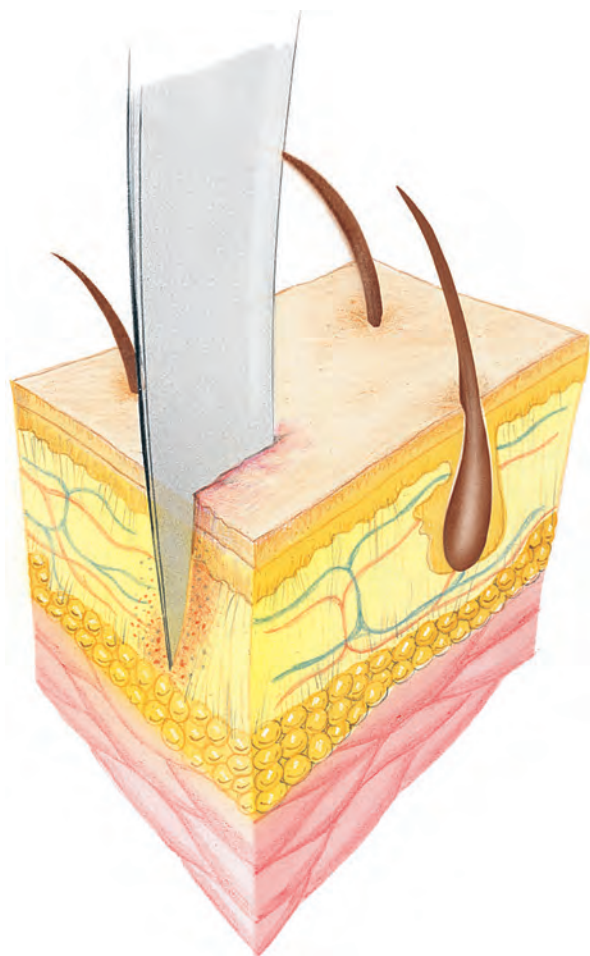
In minor open wounds, such as abrasions, damage is only superficial and bleeding is normally minimal. To care for a minor open wound, follow these general guidelines:

- Use a barrier between your hand and the wound. If readily available, put on disposable latex-free gloves and place a sterile dressing on the wound.
- Apply direct pressure for a few minutes to control any bleeding.
- Wash the wound thoroughly with soap and water and gently dry it with clean gauze. If possible, irrigate an abrasion for 5 minutes with clean, warm, running tap water.
- Cover the wound with a clean dressing and a bandage (or with an adhesive bandage) to keep the wound moist and prevent drying. Apply an antibiotic ointment or wound gel to the dressing or bandage first if the patient has no known allergies or sensitivities to the medication. Do not apply the ointment or gel directly to the wound as doing so may contaminate the tube.
- Wash your hands immediately after giving care, even if you wore gloves.

## Impaled Objects

An impaled object is one that has been embedded into an open wound (Fig. 20-10). There are two situations in which it is appropriate to remove an impaled object. The first is if the impalement is through the cheek, with uncontrolled bleeding and interference with airway management. The second is if the object impales the chest and interferes with CPR. When providing emergency care for an impaled object, securing the object is highly important so that it cannot move and cause further damage.

Carefully secure the object manually, remove any clothing from the area if possible and control bleeding by applying direct pressure with sterile dressings to the edges of the wound. Avoid placing pressure on or moving the object. Once



**Fig. 20-10:** An impaled object is one that has been embedded into the body.



### CRITICAL FACTS

With any open wound, always follow standard precautions to avoid contact with blood and OPIM.



bleeding has stopped, apply a bulky dressing around the object, pack dressings around it and secure everything in place (Fig. 20-11).

## Amputations

In cases of amputation, first provide emergency care by controlling external bleeding. While it is important to care for the severed body part, it is vital to care for the patient first. Ask another responder to search for and provide care for the body part while you tend to the patient.

If the amputation is incomplete (i.e., an avulsion), *never* remove the body part. Care for it as you would any soft tissue injury, stabilizing the part.

If the body part is completely severed, find it, wrap it in sterile gauze, moistened in sterile saline if available. Then place it in a plastic bag, seal the bag, label it with the patient's name and the time and date it was placed in the bag. Keep the bag cool by placing it in a larger bag or container of an ice and water slurry, *not* on ice alone and *not* on dry ice (Fig. 20-12). Transfer the bag to the



**Fig. 20-11:** To care for an impaled object, use bulky dressings to support the embedded object. Use bandages over the dressing to control bleeding.



**Fig. 20-12:** Wrap a severed body part in sterile gauze, seal it in a plastic bag and put the bag in an ice and water slurry.

emergency medical services (EMS) personnel transporting the patient to the hospital.

## BURNS

Burns are another type of soft tissue injury, caused primarily by heat. They can also occur when the body is exposed to certain chemicals, electricity or radiation.

When burns occur, they first affect the top layer of skin, called the epidermis. If the burn progresses, the dermis, or the second layer, can also be affected. Deep burns can damage underlying tissues. Burns that break the skin can cause infection, fluid loss and loss of temperature control. They can also damage the respiratory system and eyes.

The severity of a burn depends on the:

- Temperature of the source of the burn.
- Length of exposure to the source.
- Location of the burn.
- Size of the burn.
- Patient's age and medical condition.

In general, patients under 5 years of age and over age 60 have thinner skin and often burn more severely. People with chronic medical problems

also tend to have more severe burns, especially if they are not well nourished, have heart or kidney problems, or are exposed to the burn source for a prolonged period because they are unable to escape.

## Classifying Burns

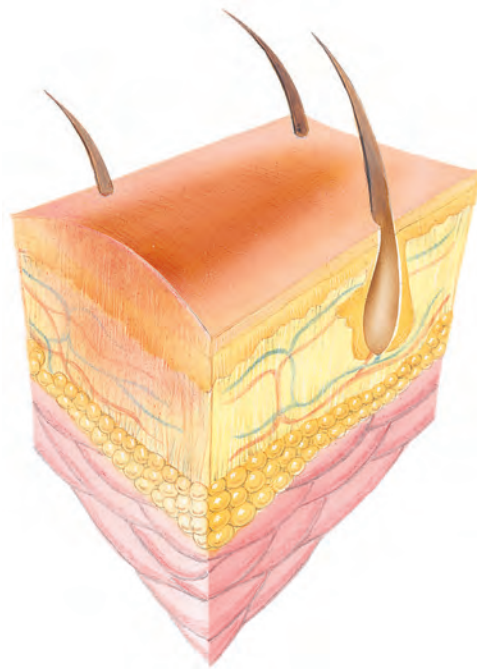
Burns are classified in several ways, including their depth, their extent, whether or not there is respiratory involvement, the body part burned and the source (or cause): heat (thermal), chemical, electrical or radiation (such as from the sun).

## Depth of Burn

Burns are classified by depth. The deeper the burn, the more severe it is. The three classifications of burns include superficial burns (formerly referred to as first degree), partial-thickness burns (formerly referred to as second degree) and full-thickness burns (formerly referred to as third degree).

## Superficial Burns

A **superficial burn** involves only the top layer of skin, the epidermis (Fig. 20-13). The skin is red and dry, and the burn is usually painful. The area may swell. Most sunburns are superficial burns. Superficial burns generally heal in 5 to 6 days without permanent scarring.



**Fig. 20-13:** A superficial burn involves only the top layer of skin. *Photo: courtesy of Alan Dimick, M.D., Professor of Surgery, Former Director of UAB Burn Center.*



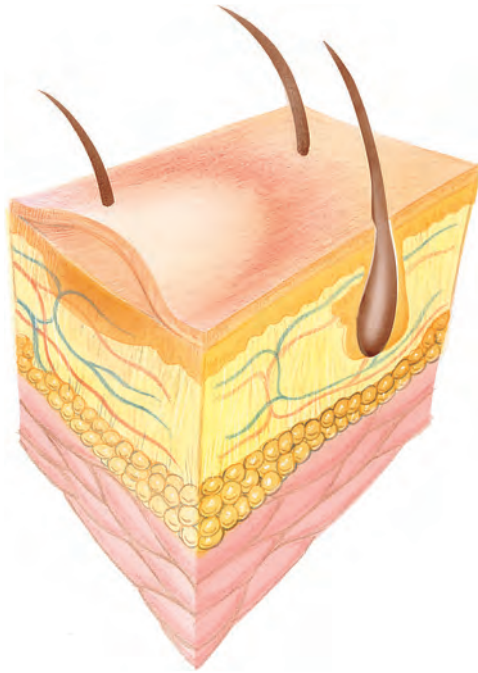
### **Partial-Thickness Burns**

A **partial-thickness burn** involves both the epidermis and the dermis (Fig. 20-14). These injuries are also red and have blisters that may open and weep clear fluid, making the skin appear wet. The burned skin may look mottled (blotchy). These burns are usually painful, and the area often swells. The body loses fluid, and the burn is susceptible to infection. Although the burn usually heals in 3 or 4 weeks, extensive partial-thickness

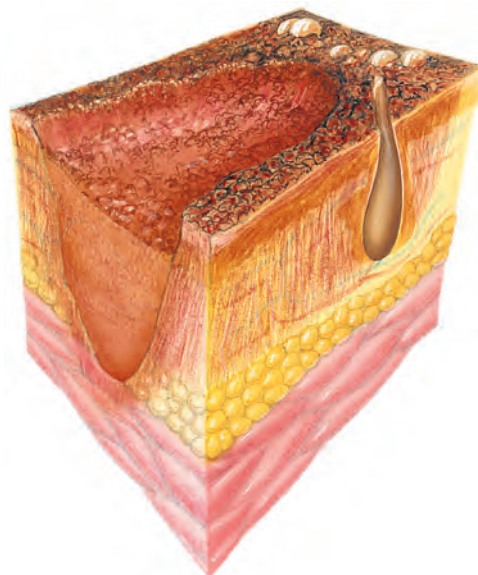
burns can be serious, requiring more advanced medical care. Scarring may occur from partial-thickness burns.

### **Full-Thickness Burns**

A **full-thickness burn** destroys both layers of skin as well as any or all of the underlying structures: fat, muscles, bones and nerves (Fig. 20-15). These burns may look brown or charred (black), with the tissues underneath sometimes appearing white.



**Fig. 20-14:** A partial-thickness burn involves the epidermis and the dermis. *Photo: courtesy of Alan Dimick, M.D., Professor of Surgery, Former Director of UAB Burn Center.*



**Fig. 20-15:** A full-thickness burn destroys both layers of the skin in addition to any or all of the underlying structures, including fat, muscles, bones and nerves. *Photo: courtesy of Alan Dimick, M.D., Professor of Surgery, Former Director of UAB Burn Center.*

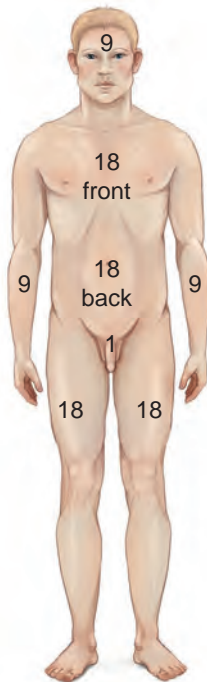
They can be either extremely painful or relatively painless if the burn destroys nerve endings in the skin. Full-thickness burns are often surrounded by painful partial-thickness burns.

Full-thickness burns can be life threatening. Because the burns are open, the body loses fluid, and shock is likely to occur. These burns also make the body highly prone to infection. Scarring occurs and may be severe. Many burn sites eventually require skin grafts.

## Extent of Burn

The extent of a burn is another important aspect of the severity of the burn. It is commonly described using the **Rule of Nines**. This method is used in the field to quickly determine if patients need to go to a specialty burn center for treatment. It approximates the percentage of burned surface area of the patient. In an adult, the body surface is divided into the following 11 sections, each comprising approximately 9 percent of the body's skin coverage (Fig. 20-16):

- Head
- Right arm
- Left arm
- Chest
- Abdomen
- Upper back
- Lower back



**Fig. 20-16:** The Rule of Nines is used to estimate what percentage of the body is affected by burns.

- Right thigh
- Left thigh
- Right leg (below the knee)
- Left leg (below the knee)

These body parts equal 99 percent, leaving the genitals to make up the last one percent. The Rule of Nines is applied by adding up all the areas of the body that have partial- or full-thickness burns. Partial areas are approximated.

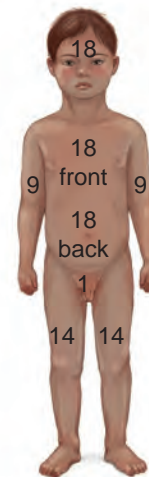
With pediatric patients, considerations must be made for the fact that the head is a proportionally larger contributor to body surface area and the upper legs contribute less. The pediatric Lund-Browder diagram reflects this difference (Fig. 20-17).

The patient's palm can be used to estimate the size of a patchy burn. Assume that the patient's palm represents approximately 1 percent of a body's total surface area.

If you do not remember the Rule of Nines, simply communicate to more advanced medical personnel or the specialty burn center how the burn occurred, the body parts involved and the approximate type of burn. For example, "The patient was injured when an overheated car radiator exploded. The patient has partial-thickness burns on the face, neck, chest and arms."

## Respiratory Involvement

The respiratory system may also be damaged when a patient is burned. If you note soot or burns around the mouth, nose or the rest of the face, this may be a sign that air passages or lungs have



**Fig. 20-17:** The Lund-Browder diagram is used to assess the severity of burns in pediatric patients.



**Fig. 20-18:** Soot burns around the mouth, nose or the rest of the face may indicate air passages or lungs have been burned.

been burned (Fig. 20-18). Respiratory damage may include airway closure due to swelling of the face and throat. Consider a hoarse voice a sign of respiratory involvement.

There may also be swelling of the larynx due to inhalation of superheated air, which may also cause fluid accumulation in the lungs. With more severe inhalation of smoke and toxic gases, there may be respiratory arrest or compromise, or poisoning. Burns around the chest can reduce the patient's ability to expand the chest. This can cause trouble breathing.

Circumferential burns are also of concern. Circumferential burns refer to burns that circle an entire body part. Circulatory compromise in that extremity can be the result of a circumferential burn to an extremity. A circumferential burn to the chest is of critical concern because of expansion and contraction during respiration.

## Body Part Burned

The particular part of the body burned also determines the seriousness of the burn. Burns to certain parts of the body are more critical than to others. In particular, burns to the head, face, eyes and ears may be associated with respiratory problems and may be disfiguring. Burns to the hands and feet are serious because of the potential impact on the patient's function. Burns to the genitals or groin area are considered critical because of the potential loss of function and because these areas are susceptible to infection.

Burns in any area where there is a significant joint (e.g., hips and shoulders) are serious because of potential loss of joint function.

## Cause of Burn

It is also important to take into account the source of the burn. Thermal burns include those caused by an open flame; contact with a hot object, steam or gas; or scalding by hot liquid. Burns can also be caused by chemicals, electricity and radiation.

Expect that burns caused by flames or hot grease will require medical attention, especially if the patient is under 5 or over 60 years of age. Hot grease is slow to cool and difficult to remove from the skin. Burns that involve hot liquid or flames contacting clothing will also be serious, since the clothing prolongs the heat contact with the skin.

Some synthetic fabrics melt and stick to the body. The melted fabrics may take longer to cool than the soft tissues. Although these burns may appear minor at first, they can continue to worsen for a short time.

## Severity of the Burn

It is important to be able to identify a **critical burn**. A critical burn requires the immediate attention of more advanced medical personnel. Critical burns are potentially life threatening, disfiguring and/or disabling.

Knowing whether you should summon more advanced medical personnel for a burn injury can sometimes be difficult. It is not always easy or possible to assess the severity of a burn immediately after injury. Even superficial burns to large areas of the body or to certain body parts can be critical. You cannot judge severity by the pain the patient feels, because nerve endings may have been destroyed.

Consult with medical control for a decision on when to transport the patient. Call for more advanced medical personnel immediately for assistance in caring for the following:

- Burns causing breathing difficulty
- Signs of burns around the mouth and nose
- Burns covering more than one body part
- Burns to the head, face, neck, hands, feet or genitals



### CRITICAL FACTS

Consult with medical control for a decision on when to transport the patient involved in a burn incident. Advanced medical personnel must assist in the care of serious burn injuries, such as those causing difficulty breathing, burns covering more than one body part or to delicate body parts, any serious burns to a child or older adult patient, and any burns from chemicals, explosions or electricity.



- Any partial-thickness or full-thickness burn to a child or an older adult
- Burns resulting from chemicals, explosions or electricity

Patients should be referred to a burn unit if they have:

- Partial- or full-thickness burns that cover more than 10 percent of the body surface, for those patients under the age of about 5 or over about 60.
- Partial- or full-thickness burns that cover more than 2 percent of the body surface, for those in other age groups.
- Partial- or full-thickness burns that involve the face, hands, feet, genitalia, perineum or major joints.
- Full-thickness burns that cover more than 5 percent of the body surface, in patients of any age.
- Electrical burns, including injury caused by lightning.
- Chemical burns.
- Inhalation injury.
- Circumferential burns.
- A burn injury and a pre-existing medical condition that could make their care more complicated or lengthy, or that could affect mortality (e.g., diabetes).
- Both burns and other injuries (e.g., fractures or blast injury) where the burn injury poses the greatest risk of morbidity or mortality.
- A burn injury (in a child) and the hospital lacks qualified personnel or equipment. In this case, the child with burns should be transferred to a burn center with the required personnel and equipment needed to look after a child with burns.
- A burn injury (in a child) where there are special circumstances (e.g., suspected child abuse or substance abuse) and where social/emotional and/or long-term rehabilitative support will be needed.

## Thermal Burns

### Signs and Symptoms of Thermal Burns

The signs and symptoms of thermal burns depend upon the extent of the burn. The signs and symptoms, based on the degree of the burns, are as follows:

- Superficial burns. Painful, red area that turns white when touched; no blisters; moist-appearing skin
- Partial-thickness burns. There are two kinds of signs and symptoms—superficial and deep:
  - Superficial signs and symptoms: Painful, red area that turns white to touch; mottling, blisters, moist skin; hair is still present
  - Deep signs and symptoms: May or may not be painful (nerve endings may be destroyed); may be moist or dry (sweat glands may be destroyed); may or may not turn white when area is touched; hair is usually gone
- Full-thickness burns. Painless, no sensation to touch, pearly white or charred, dry and may appear leathery

### Providing Care for Thermal Burns

As you approach the patient, decide if the scene is safe. Look for fire, smoke, downed electrical wires and warning signs for chemicals or radiation. If the scene is *not* safe and you have not been trained to manage it, summon specially trained personnel.

If the scene *is* safe, approach the patient cautiously. If the source of the burn is still in contact with the patient, take steps to remove and extinguish it. Doing so may require you to smother the flames or extinguish them with water or to remove smoldering clothing. For example, if the burn is caused by hot tar or plastic, cool the area with water but do *not* attempt to remove the tar or plastic.

Perform a primary assessment. Pay close attention to the patient's airway. Note soot or burns around the mouth, nose and the rest of the face, which may be a sign that air passages or lungs have been burned. If you suspect a burned airway or burned lungs, continually monitor breathing and call for advanced medical personnel immediately. Air passages may swell, impairing or stopping breathing. Administer supplemental oxygen if it is available.

As you do a physical exam, look for additional signs of burn injuries. Also look for other injuries, especially if there was an explosion or electrical shock.

If thermal burns are present, once you have removed the patient from the source, follow these three basic care steps:

1. Cool the burned area.
2. Cover the burned area.
3. Minimize shock.



#### CRITICAL FACTS

To care for a thermal burn, remove the patient from the source, cool and cover the burned area, and take steps to minimize shock.



## Cool the Burned Area

Even after the source of the burn has been removed, soft tissue will continue to burn, causing more damage. Therefore, it is essential to cool any burned areas *immediately* with large amounts of cool or cold running water for at least 10 minutes or until pain is relieved (Fig. 20-19, A). Do *not* use ice or ice water. Ice or ice water can cause critical body heat loss and may make the burn deeper. Flush the area using whatever resources are available (e.g., a tub, shower or garden hose). You can apply soaked towels, sheets or other wet cloths to a burned face or other area that cannot be immersed. Be sure to keep these compresses cold by frequently re-soaking them with cold water; otherwise, they will not absorb the heat from the skin's surface. Be careful to not cause hypothermia when cooling large burns or burns on small children, who are more prone to hypothermia than adults due to their greater skin surface area relative to their weight.

Allow adequate time for the burned area to cool. If pain continues or if the edges of the burned area are still warm to the touch when the cooling source is removed, continue cooling. When the burn is cool, remove any remaining clothing from the area by carefully removing or cutting material away. Do *not* try to remove any clothing that is stuck to skin. Remove any jewelry only if doing so will not further injure the patient, as swelling may occur.

In some jurisdictions, you may be provided more specific directions for when and how to cool burns. Follow your local protocols.

## Cover the Burned Area

Burns often expose sensitive nerve endings. Cover the burned area to keep out air and help reduce pain (Fig. 20-19, B–C). Use dry, sterile dressings, and loosely bandage them in place. The bandage should *not* put pressure on the burn surface. If the burn covers a large area of the body, cover it with clean, dry sheets or other clean cloths.

Covering the burn helps prevent infection. Do not put ointments, butter, oil or other commercial or home remedies on any burn that will receive medical attention. These products seal in heat and do not relieve pain. Other home remedies can contaminate open skin areas, causing infection. Do not break blisters. Intact skin helps prevent infection.

For small superficial burns or small burns with open blisters that are not sufficiently severe or

extensive enough to require medical attention, care for the burned area as an open wound. Wash the area with soap and water. Cover the burn with a dressing and bandage. Apply antibiotic ointment or wound gel if your protocols permit you to do so, one is available, and the patient has no known sensitivities or allergies to the medication. Tell the patient to watch for signs of infection.

## Minimize Shock

Full-thickness burns and large partial-thickness burns can cause shock as a result of pain and loss of body fluids. Have the patient lie down unless they are having trouble breathing. Administer supplemental oxygen based on local protocols and if it is safe to do so.

## Risk of Hypothermia

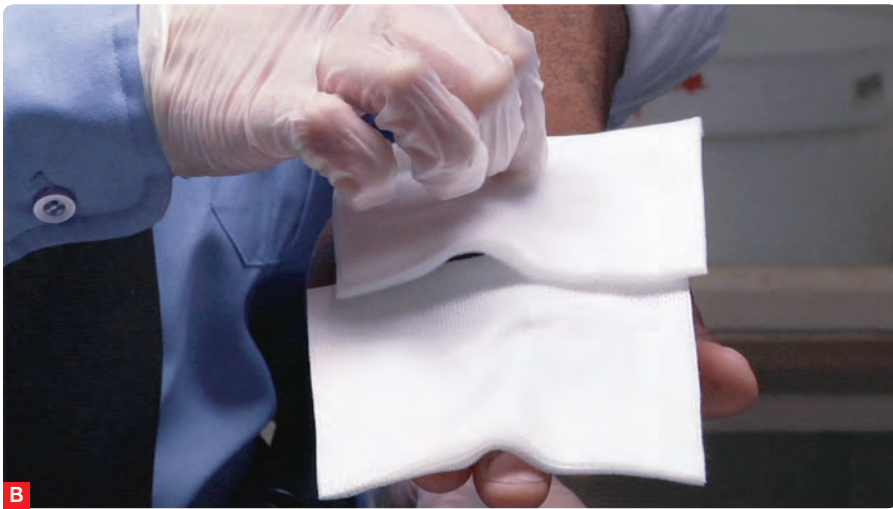
Patients who have sustained a burn have an impaired ability to regulate the body's temperature. Therefore, there is a tendency to chill. Keep the patient warm to prevent hypothermia. Help the patient maintain normal body temperature by protecting the patient from drafts. Remember that cooling burns over a large area of the body also risks inducing hypothermia in the burned patient. Be cautious and aware of this risk when cooling a burn that covers a large area.

## Pediatric Considerations

### Providing Care for Burns

Children have a larger body surface area relative to their weight than do adults. Body surface area is a major factor in determining how much water is lost through evaporation in burn patients. Therefore, children with burns lose more water through evaporation than do adult patients. This means that children usually tend to have greater fluid needs during resuscitation. Evaporative water loss leads to greater heat loss, so children or infants with burns are prone to hypothermia. Keep the room temperature high.

When dealing with pediatric burn patients, be aware of the possibility that the burns are the result of child abuse. Inflicted burns often leave characteristic patterns of injury that cannot be concealed. A detailed history, including previous trauma, presence of recent illnesses and immunization records, will help determine if your suspicions are correct.



**Fig. 20-19, A–C:** To stop the burning of soft tissue: **(A)** Cool burned areas with large amounts of cold water. **(B–C)** Cover and wrap it with sterile dressings when fully cooled.

## Chemical Burns

Chemical burns are common in industrial settings, but also occur in the home. Cleaning solutions, household bleach, oven or drain cleaners, toilet bowl cleaner, paint strippers, and lawn or garden chemicals are common sources of caustic chemicals that can eat away or destroy tissue. Caustic chemicals cause **chemical burns**.

Typically, burn injuries result from chemicals that are strong acids or alkalis. These substances can quickly injure the skin. As with heat burns, the stronger the chemical and the longer the contact, the more severe the burn. The chemical will continue to burn as long as it is on the skin. You must remove the chemical from the skin as quickly as possible, and then call for more advanced medical personnel immediately. If you suspect a chemical burn, also check to see whether the eyes are burned.

### Signs and Symptoms of Chemical Burns

Signs and symptoms of chemical burns include:

- Pain.
- Burning.
- Numbness.
- Change in level of consciousness (LOC).
- Respiratory distress.
- Oral discomfort or swelling.
- Eye discomfort.
- Change in vision.

### Providing Care for Chemical Burns

Always brush dry or powdered chemicals off with a gloved hand or a cloth, if possible. If not, flush them off with water. In some cases, a continuous flow of water will remove a dry substance before the water can activate it. Continue flushing until more advanced medical personnel arrive or for at least 20 minutes. If the substance is a liquid, flush the burn continuously with large amounts of *cool*, running water until more advanced medical personnel arrive or for at least 20 minutes (Fig. 20-20). Have the patient remove contaminated clothing and jewelry, if possible. Take steps to minimize shock.

Chemical burns to the eyes can be exceptionally traumatic. Ensure more advanced medical personnel have been called. If an eye is burned by a chemical, flush the affected eye until more



**Fig. 20-20:** Flush a chemical burn with large amounts of cool, running water.

advanced medical personnel arrive or for at least 20 minutes. Flush the affected eye from the nose outward and downward to prevent washing the chemical into the unaffected eye.

Be aware that chemicals can be inhaled, potentially damaging the airway or lungs. Call the national Poison Help line at 800-222-1222 if you believe chemicals have been inhaled and give that information to the call taker.

## Electrical Burns

The human body is a good conductor of electricity. When someone comes into contact with an electrical source, such as a power line, a malfunctioning household appliance or lightning, electricity is conducted through the body. Body parts resist electrical current; some body parts, such as the bones, resist the electrical current more strongly than others. This resistance produces heat, which can cause **electrical burns** along the flow of the current (Fig. 20-21).

### Signs and Symptoms of Electrical Burns

The severity of an electrical burn depends on the type and amount of contact, the current's path through the body and how long the contact lasted. Electrical burns are often deep; although these wounds may look superficial, the tissues beneath may be severely damaged. Some electrical burns will be marked by entry and exit wounds indicating where the current has passed through the body.

The signs and symptoms of electrical injury include:

- Unconsciousness.
- Dazed, confused behavior.
- Obvious burns on the skin's surface.





**Fig. 20-21:** Although electrical burns may look superficial, they are often deep, following the current's path through the body, and may severely damage underlying tissues.

- Trouble breathing or no breathing.
- Burns both where the current entered and where it exited the body, often on the hand or foot.

### Providing Care for Electrical Burns

Scene safety is of utmost importance. Once it is determined that the electrical current is secured and no longer passing through the patient, perform a primary assessment and care for any immediate life-threatening conditions. During the physical exam, look for two burn sites (entry and exit wounds). Cool any electrical burns with cool or cold running water as you would a thermal burn; then cover any burn injuries with a dry, sterile dressing, and provide care to minimize shock. Look for painful, swollen and deformed extremities, because the resistance to the electrical current can cause severe muscle contractions, which may produce musculoskeletal injuries.

With someone who has been struck by lightning, look for and provide care for life-threatening conditions such as respiratory or cardiac arrest. The patient may also have fractures, including spinal fracture, so do not move the patient unless evacuation is required due to the scene becoming unsafe. Caring for any immediate life-threatening conditions takes priority over caring for burns.

Exposure to high- or even low-voltage electric current can cause dangerous cardiac arrhythmias

in addition to electrical burns. Be prepared to perform CPR and use an AED. Anyone who suffers an electrical shock needs an advanced medical assessment to determine the extent of injury.

### Radiation Burns

**Radiation burns** may occur from exposure to nuclear radiation, X-rays or as a side effect of radiation therapy. It can also be caused by tanning beds, or as the result of solar radiation from the sun. Solar burns are similar to heat burns, often resulting in superficial and sometimes partial-thickness burns. Usually they are mild, but they can be painful (Fig. 20-22). They may blister, involving more than one layer of skin. Care for sunburn as you would any other burn. Cool the burn and protect the burned area from



**Fig. 20-22:** Radiation burns, such as sunburns, are usually mild but they can be painful and blister when involving more than one layer of skin.



further damage by keeping it away from the source of the burn.

People are rarely exposed to other types of radiation unless working in special settings, such as certain medical, industrial or research sites. If you work in such settings, you will be informed and will be required to take precautions to prevent overexposure.

## PUTTING IT ALL TOGETHER

Caring for wounds involves controlling bleeding and minimizing the risk of infection. Your primary concern with minor wounds is to clean the wound to prevent infection. For major wounds, control the bleeding quickly and summon more advanced medical personnel. *Always* use a barrier such as disposable latex-free gloves, dressings or a clean folded cloth, to avoid contact with blood. Dressings and bandages, when correctly applied, help control bleeding, reduce pain and minimize the risk of infection. Apply pressure to help stop bleeding.

Burns damage the layers of the skin and sometimes the internal structures, which can be life threatening. Heat, chemicals, electricity and radiation all cause burns. When caring for someone who has sustained a burn, *always*

ensure the scene is safe. Approach the patient and check for life-threatening conditions and for non-life-threatening conditions, if necessary.

Once the patient has been removed from the burn source, follow the steps of burn care:

- Cool the burned area with water to minimize additional tissue destruction.
- Protect the burned area by covering it with sterile dressings, clean sheets or other cloth.
- To minimize shock, keep the patient from getting chilled or overheated.
- Summon more advanced medical personnel for any critical burn.

In addition, *always* check for inhalation injury if the person has a heat or chemical burn involving the face. With electrical burns, check carefully for other problems, such as difficulty breathing, cardiac problems and painful, swollen, deformed areas.

Remember to take care with pediatric patients, especially infants, as they are prone to hypothermia. With electrical burns, check carefully for additional conditions, such as difficulty breathing, cardiac arrest and fractures.

## ▶ You Are the Emergency Medical Responder

The safety officer quickly verifies that power has been shut off and it is safe to approach the scene. You perform a primary assessment. The patient regains consciousness and complains of pain in his hand and elbow. Your partner has called for more advanced medical personnel. What types of injuries or conditions should you suspect and what emergency care should be provided? Is calling for EMS personnel appropriate? Why or why not?

# 21

## INJURIES TO THE CHEST, ABDOMEN AND GENITALIA

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### ▶ You Are the Emergency Medical Responder

Your police unit responds to a call in a part of town plagued by violence. When you arrive, you find the scene is empty except for a young woman lying on the sidewalk. After sizing up the scene and approaching the young woman, you notice that she has been shot and is bleeding profusely. How would you respond?



## KEY TERMS

**Chest tube:** A tube surgically inserted into the chest to drain blood, fluid or air, and to allow the lungs to expand.

**Evisceration:** A severe injury that causes the abdominal organs to protrude through the wound.

**Flail chest:** A serious injury in which multiple rib fractures result in a loose section of ribs that does not move normally with the rest of the chest during breathing and often moves in the *opposite* direction.

**Hemopneumothorax:** An accumulation of blood and air between the lungs and chest wall.

**Hemothorax:** An accumulation of blood between the lungs and chest wall; caused by bleeding that may be from the chest wall, lung tissue or major blood vessels in the thorax.

**Hyperresonance:** Abnormal sounds during percussion on the affected side of the chest.

**Hypotension:** Abnormally low blood pressure.

**Impaled object:** An object that remains embedded in an open wound; also referred to as an embedded object.

**Intercostal:** Located between the ribs.

**Jugular venous distension (JVD):** Neck veins that are swollen due to pressure from inside the vein.

**Parenchyma:** Tissue that is involved in the functioning of a structure or organ as opposed to its supporting structures.

**Percussion:** A technique of tapping on the surface of the body and listening to the resulting sounds, to learn about the condition of the area beneath.

**Peritoneum:** The membrane that lines the abdominal cavity and covers most of the abdominal organs.

**Pleural space:** The space between the lungs and chest wall.

**Pneumothorax:** Collapse of a lung due to pressure on it caused by air in the chest cavity.

**Subconjunctival hemorrhage:** Broken blood vessels in the eyes.

**Subcutaneous emphysema:** A rare condition in which air gets into tissues under the skin that covers the chest wall or neck; may occur as a result of wounds to those areas.

**Sucking (open) chest wound:** A chest wound in which an object, such as a knife or bullet, penetrates the chest wall and lung, allowing air to pass freely in and out of the chest cavity; breathing causes a sucking sound, hence the term.

**Tension pneumothorax:** A life-threatening injury in which the lung is completely collapsed and air is trapped in the pleural space.

**Thoracic:** Relating to the thorax, or chest cavity.

**Traumatic asphyxia:** Severe lack of oxygen due to trauma, usually caused by a thoracic injury.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Describe general care steps for injuries to the chest, abdomen and pelvis.
- List the different types of chest injuries.
- List the signs and symptoms of chest injuries.
- Describe how to care for a sucking (open) chest wound.
- Describe how to care for an impaled or embedded object in the chest.
- List different types of abdominal injuries.
- List the signs and symptoms of abdominal injuries.
- Explain assessment techniques for abdominal injuries.
- Describe how to care for closed and open abdominal injuries.
- List the signs and symptoms of genital injuries.
- Describe how to care for genital injuries.

## INTRODUCTION

Many injuries to the chest and abdomen involve only soft tissues. Often these injuries, like those that occur elsewhere on the body, are only minor cuts, scrapes, burns and bruises. Occasionally, a violent force or mechanism, known as trauma, results in more severe injuries. These include fractures and injuries to organs, which can cause severe bleeding or impair breathing. Occupants who are not wearing seat belts during motor-vehicle collisions often suffer fractures and lacerations. Falls, athletic injuries and many other forms of trauma may also cause such injuries. Injuries to the pelvis may be minor soft tissue injuries or serious injuries to bone and internal structures.

Because the chest, abdomen and pelvis contain many organs important to life, injury to these areas can be fatal if left untreated. A force capable of causing severe injury in these areas may also cause injury to the spine.

General care for these injuries includes:

- Calling for more advanced medical personnel.
- Limiting movement.
- Monitoring breathing and other vital signs.
- Controlling bleeding.
- Minimizing shock.

## ANATOMY OF THE CHEST, ABDOMEN AND GENITALIA

The chest cavity, also called the **thoracic** cavity, is the second-largest body cavity and contains the heart and lungs (Fig. 21-1). The ribs, sternum and upper portion of the spine (thoracic vertebrae) frame the wall of the thoracic cavity, also referred to as the thoracic cage. The diaphragm, a large muscular partition, separates the thoracic cavity from the abdominal cavity.

Below the diaphragm is the abdominal cavity. The abdominal cavity contains the major organs of several of the body's systems: the digestive system, urinary system and endocrine system (Fig. 21-2).

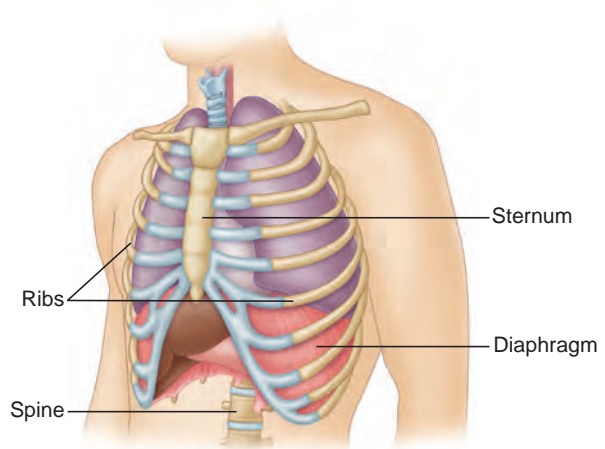


Fig. 21-1: The thoracic cavity.

The abdominal cavity is lined with a thick membrane called the **peritoneum**, which supports the organs, including the stomach, gallbladder, urinary bladder, intestines, liver, spleen, pancreas and kidneys. It also contains important vascular structures such as the abdominal aorta and inferior vena cavae.

Genitalia are part of the reproductive systems of women and men. The male genitalia include the testicles, a duct system and the penis. The female genitalia include the ovaries, fallopian tubes, uterus and vagina (Fig. 21-3).

## CHEST INJURIES

Chest injuries are a leading cause of trauma deaths each year in the United States. Motor-vehicle collisions, direct blows and falls can all lead to chest injuries (Fig. 21-4, A–C).

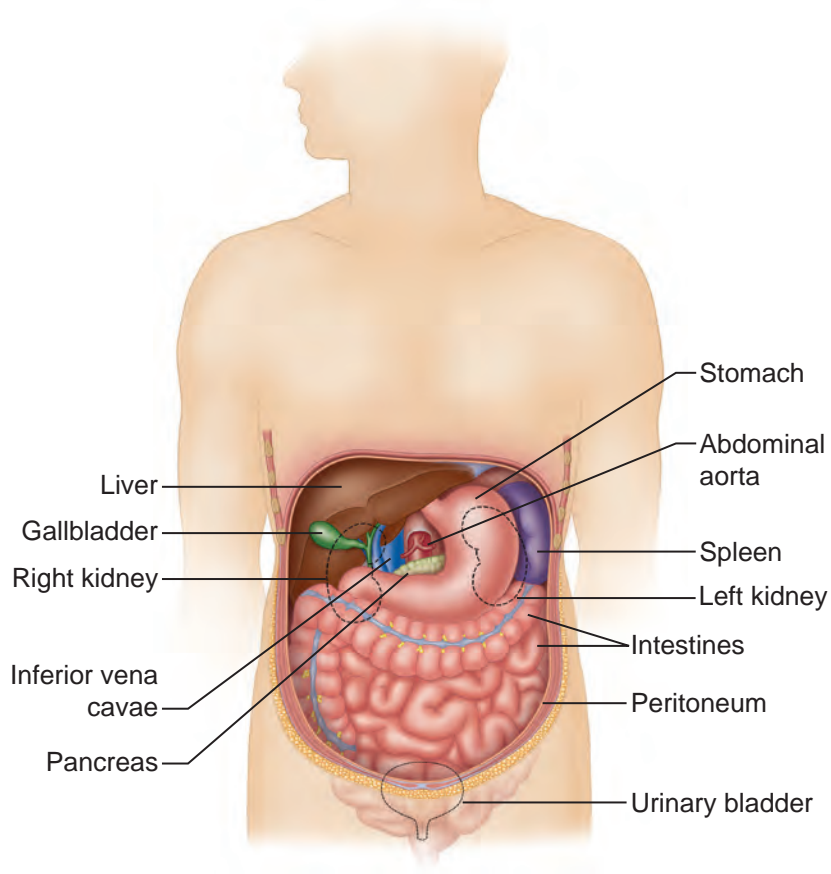
Chest wounds can be either open or closed. Open chest wounds occur when an object, such as a knife or bullet, penetrates the chest wall. Open chest wounds also can be caused by fractured ribs that break through the skin. A chest wound is considered closed if the skin is not broken. Closed chest wounds are generally caused by a blunt object.



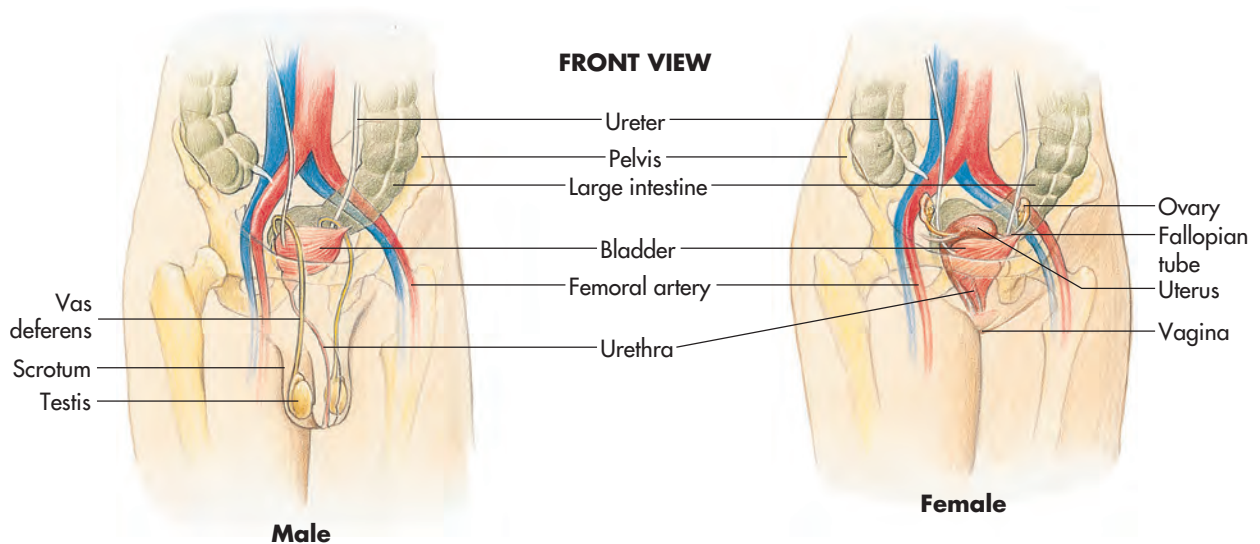
### CRITICAL FACTS

Because the chest, abdomen and pelvis contain many organs important to life, injury to these areas can be fatal if left untreated. General care for these injuries includes calling for advanced medical personnel, limiting movement in the patient, monitoring breathing and other vital signs, controlling bleeding and taking steps to minimize shock.





**Fig. 21-2:** The abdominal cavity.



**Fig. 21-3:** Genitalia are part of the reproductive systems of women and men.

### Types of Chest Injuries

Certain types of chest injuries may be life threatening, and others merely cause discomfort. You will likely be able to recognize severe injuries. It is important to summon more advanced medical personnel in those situations.

### Blunt Trauma

Blunt trauma is injury caused by the force of an object that impacts with, but does not penetrate, the body. Signs and symptoms include severe shortness of breath, chest pain and rapid, possibly irregular pulse. The possibility of blunt trauma should be considered



**A**



**B**



**C**

**Fig. 21-4, A–C:** (A) Motor-vehicle collisions, (B) direct blows and (C) falls can lead to chest injuries, which are a leading cause of trauma deaths in the U.S. each year.

in patients who sustain a blow to the abdomen or chest and show signs of respiratory distress.

Often, associated injuries will occur with blunt trauma, including major trauma to the spleen, liver or large blood vessels. Therefore, it is not unusual for patients with these injuries to go into hypovolemic shock, a type of shock in which there is multiple organ failure due to major fluid loss—usually blood.

## Traumatic Asphyxia

**Traumatic asphyxia**, or severe lack of oxygen due to trauma, can result from chest injury. These injuries often are caused by a strong crushing mechanism or by situations in which patients have been pinned under a very heavy object.

Signs and symptoms of traumatic asphyxia include:

- Shock.
- Distended neck veins.
- Bluish discoloration of the head, tongue, lips, neck and shoulders (cyanosis).
- Broken blood vessels in the eyes (**subconjunctival hemorrhage**).
- Black eyes.
- Pinpoint-sized red dots (petechiae) on the head and neck.
- Rounded, “moon-like” facial appearance.
- Bleeding from the nose or ear.
- Coughing up or vomiting blood.
- Loss of consciousness, seizures or blindness.

Traumatic asphyxia is a very serious emergency that requires immediate intervention. If it is suspected, call for more advanced emergency medical services (EMS) personnel immediately. Assess the patient for associated chest and abdominal injuries. Elevate the patient’s head to approximately 30° to decrease pressure to the head. Establish and maintain adequate airway and breathing, and administer supplemental oxygen, based on local protocols.

## Fractured Ribs

Rib fractures are usually caused by a forceful blow to the chest. Although painful, a simple rib fracture is rarely life threatening. The patient will usually attempt to ease the pain by leaning toward the side of the fracture and pressing a hand or arm over the injured area, thereby creating an anatomical splint (Fig. 21-5). When ribs are fractured, suspect the possibility of internal injuries.

The first priority with fractured ribs is adequate breathing. A patient with a fractured rib often



## CRITICAL FACTS

Certain types of chest injuries may be life threatening, and others merely cause discomfort. You will likely be able to recognize the difference.

Blunt trauma is injury caused by the force of an object that impacts with, but does not penetrate, the body.

Traumatic asphyxia, or severe lack of oxygen due to trauma, can result from chest injury. These injuries often are caused by a strong crushing mechanism or by situations in which patients have been pinned under a very heavy object.



**Fig. 21-5:** Patients with rib injuries usually attempt to ease the pain by creating an anatomical splint with their hand or arm and leaning toward the side of the injury.



**Fig. 21-6:** Give a patient with fractured ribs or flail chest a pillow or rolled blanket to hold against the injury to immobilize the injured area. Use a sling and binder to hold the patient's arm against the injured side of the chest.

has shallow breathing because normal or deep breathing is painful. Give the patient a rolled blanket or pillow to hold against the fractured ribs to immobilize the injured area (Fig. 21-6). Use a sling and binder to hold the patient's arm against the injured side of the chest. Monitor breathing.

Possible complications of fractured ribs include:

- Collapse of a lung due to air in the chest cavity pressing on the lung (pneumothorax).
- Accumulation of blood between the lungs and chest wall (hemothorax).

- Air in the tissues under the skin (subcutaneous emphysema).
- Bruising or piercing of the lung and injuries to the spleen or liver.
- Lacerated blood vessels between the ribs.

### Flail Chest

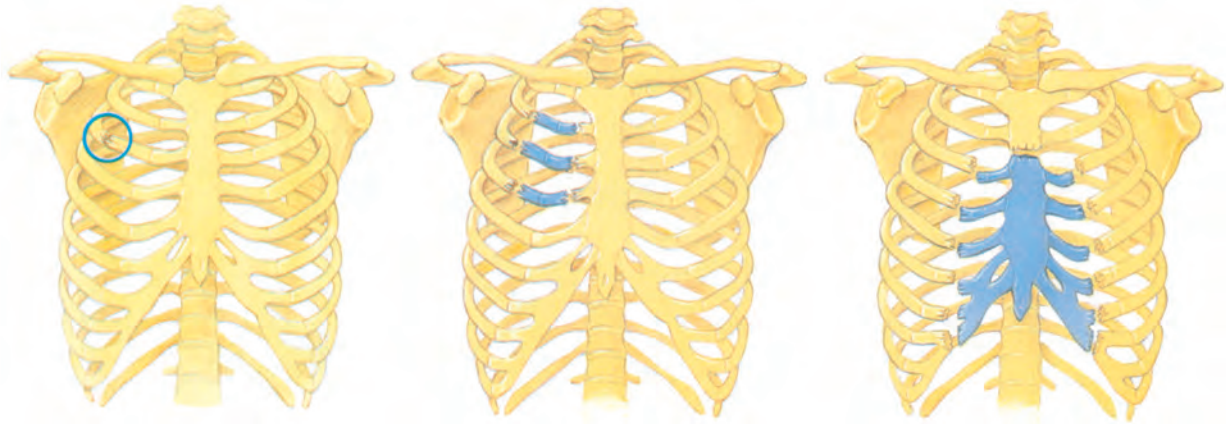
In situations involving severe blows or crushing injuries, multiple ribs can fracture in multiple places. These fractures can produce a loose section of ribs that does not move normally with



## CRITICAL FACTS

Rib fractures are usually caused by a forceful blow to the chest.

A flail chest injury is a serious, life-threatening rib fracture. It results from a severe blow or crushing injury in which multiple ribs fracture in multiple places, causing loose sections of ribs that move abnormally in the chest.



**Fig. 21-7:** Severe blows or crushing injuries can cause flail chest, in which multiple ribs fracture in multiple places, creating a loose section of ribs.

the rest of the chest during breathing. Usually, the loose section will move in the opposite direction from the rest of the chest. This injury is called a **flail chest**, which is considered a serious rib fracture and can be life threatening (Fig. 21-7). When a flail chest involves the breastbone, the breastbone is separated from the rest of the ribs.

In flail chest, the lung tissues may be bruised, leading to inadequate oxygenation. There is also a risk of the ribs puncturing a lung. If you suspect a fractured rib or ribs, have the patient rest in a position that will make breathing easier. Binding the patient's arm to the chest on the injured side will help support the injured area and make breathing more comfortable. You can use an object such as a pillow or rolled blanket to help support and immobilize the injured area. Serious fractures often cause severe bleeding and trouble breathing, and shock is likely to develop. Administer supplemental oxygen based on local protocols, and continue to monitor the patient's vital signs.

## Pneumothorax

**Pneumothorax** is the collapse of a lung due to air in the chest cavity pressing on the lung and preventing it from expanding (Fig. 21-8, A). Pneumothorax can occur in two ways. In blunt chest

trauma, it may result when a fractured rib penetrates the lung, causing air to leak. It can also occur when air enters the chest cavity because of a sucking (open) chest wound. Pneumothorax reduces lung pressure and leads to respiratory distress.

Patients may report pain while breathing, and pain at the site of the rib fractures. Decreased breath sounds will be present upon examination, and many patients with traumatic pneumothorax also have some element of severe bleeding (hemorrhage), causing a **hemothorax**. Patients with pneumothorax will require a **chest tube** in the hospital setting to fully re-expand the lung.

## Hemothorax

**Hemothorax** is an accumulation of blood between the lungs and chest wall (**pleural space**) that creates pressure on the heart and lungs and prevents the lungs from expanding, resulting in the same symptoms as those which occur in pneumothorax (Fig. 21-8, B). The bleeding that leads to hemothorax may be from the chest wall, the lung's functional tissue (**parenchyma**) or major blood vessels in the thorax. It may occur following blunt or penetrating injury to the chest, and often occurs together with pneumothorax.



### CRITICAL FACTS

Pneumothorax is the collapse of a lung due to air in the chest cavity pressing on the lung and preventing it from expanding.

Hemothorax is an accumulation of blood between the lungs and chest wall (pleural space), which creates pressure on the heart and lungs and prevents the lungs from expanding.



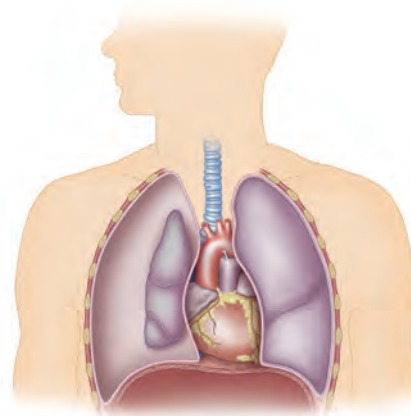
Again, patients will complain of pain and shortness of breath, and the condition may cause shock. During patient assessment, if trained to do so, you likely will note a decrease in breath sounds when listening and dullness when tapping (**percussion**) over the affected area. A massive hemothorax will also cause abnormal or unstable blood pressure.

### Tension Pneumothorax

**Tension pneumothorax** is a serious, life-threatening injury in which there is complete collapse of the lung. Air enters the space around the lungs and remains trapped there (Fig. 21-8, C). It is caused by the same traumas as those that produce a simple pneumothorax. Tension pneumothorax causes air to continue leaking from an underlying injury to the functional lung tissue (pulmonary parenchymal injury), which increases pressure within the affected side of the chest cavity.

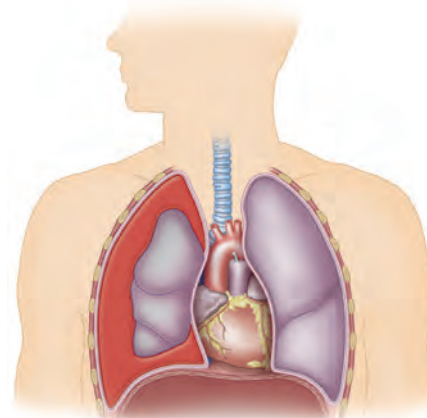
Patients experiencing a tension pneumothorax are typically in respiratory distress with diminished or absent breath sounds and abnormal sounds (**hyperresonance**) during percussion on the affected side of the chest. The trachea shifts away from the side of the injury (a very late sign of tension pneumothorax that may not be seen in the out-of-hospital setting) and the neck veins become swollen, which is known as **jugular venous distension (JVD)**. The patient will show signs of unstable blood pressure, such as abnormally low blood pressure (**hypotension**), which can quickly develop into complete cardiovascular collapse.

Extreme pressure in the chest cavity prevents blood from returning to the heart, and the blood is no longer pumped out. Death can occur quickly. Immediate care provided by advanced medical personnel for this life-threatening condition includes decompression of the affected lung by inserting a large-bore needle through the second or third **intercostal** space, along an imaginary line that passes through the midpoint of the clavicle (midclavicular line), or through the fourth or fifth intercostal space on the lateral chest wall. Typically, a chest tube is then inserted in the hospital setting.



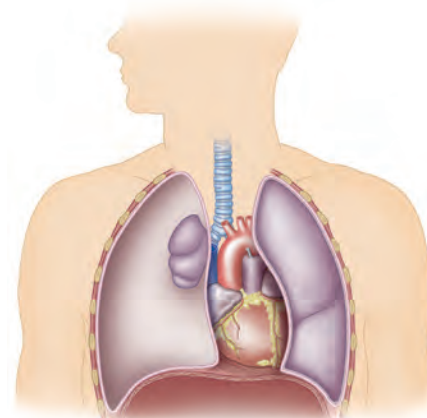
**A**

Pneumothorax



**B**

Hemothorax



**C**

Tension Pneumothorax

**Fig. 21-8, A–C:** In the term hemothorax, “hemo” refers to blood. In pneumothorax and tension pneumothorax, “pneumo” refers to air.



#### **CRITICAL FACTS**

Tension pneumothorax is a serious, life-threatening injury in which there is complete collapse of the lung. Air enters the space around the lungs and remains trapped there.

## Signs and Symptoms of Chest Injuries

You should know the signs and symptoms of serious chest injury. These may occur with both open and closed wounds. They include:

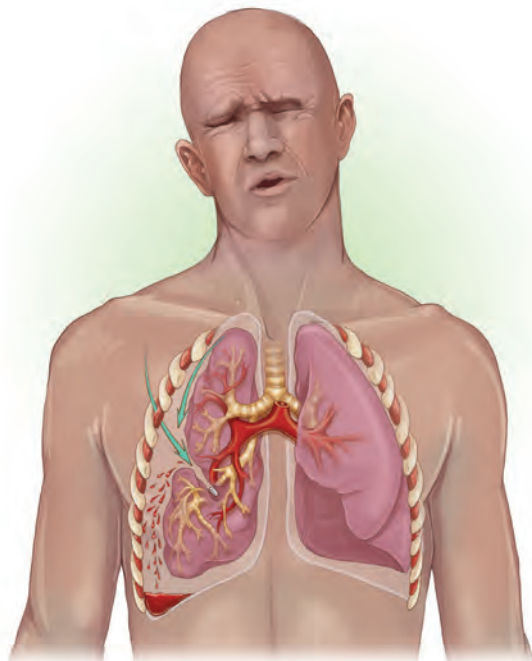
- Shortness of breath and difficulty breathing.
- Pain during breathing.
- Pain at the site of the injury that increases with deep breathing or movement.
- Obvious deformity, such as that caused by a fracture.
- Flushed, pale, ashen or bluish discoloration of the skin.
- Coughing up blood.
- Distended (protruding) neck veins.
- Drop in blood pressure.

## Providing Care

### Providing Care for a Sucking (Open) Chest Wound

Puncture wounds to the chest range from minor to life threatening. A forceful puncture may penetrate the rib cage and allow air to enter the chest through the wound. This prevents the lungs from functioning normally (Fig. 21-9).

Puncture wounds cause varying degrees of internal or external bleeding. If the injury penetrates the rib cage, air can pass freely in and out of the chest



**Fig. 21-9:** If a puncture wound penetrates the rib cage, air can pass freely in and out of the chest cavity and the patient cannot breathe normally.

cavity and the patient cannot breathe normally. With each breath the patient takes, you may hear a sucking sound coming from the wound. This is the primary sign of a penetrating chest injury, called a **sucking (open) chest wound**.

Without proper care, the patient's condition will worsen quickly. The affected lung or lungs will fail to function, and breathing will become more difficult. Your main concern is the breathing problem. To care for a sucking (open) chest wound, ensure that advanced medical personnel have been summoned. Control any bleeding with a sterile gauze dressing but do not let the wound become occluded by changing the dressings frequently.

Most open chest wounds do not bleed heavily so you may be able to leave the wound uncovered and exposed to the air, based on local protocols. Because of the risk of creating a tension pneumothorax, most open chest wounds should be left uncovered and not be sealed unless advanced medical personnel are on scene to recognize and treat a tension pneumothorax should one develop. Some local protocols call for open chest wounds to be sealed with an occlusive dressing, one that does not allow air to pass through it.

The most effective occlusive dressing is called a vented chest seal (Fig. 21-10). Other occlusive dressings can be taped in place on all sides except for one side that should remain loose. (For more information on occlusive dressings, see Chapter 19.) Taping the dressing this way keeps air from entering the wound during inhalation but allows it to escape during exhalation. If none of these materials is available, a folded cloth or, as a last resort, your gloved hand, may be used. Administer supplemental oxygen, based on local protocols, and take steps to minimize shock. If no spinal injury is suspected, have the patient sit or lie in a comfortable position.



**Fig. 21-10:** A vented chest seal.

## Providing Care for Impaled Objects in the Chest

An **impaled object**, or embedded object, is one that remains in an open wound. In the case of an impaled object in the chest, it is extremely important *not* to remove the object, unless it interferes with chest compressions. Instead, the object must be stabilized to keep it from moving. This can be accomplished by using a bulky dressing or gauze around the object. This will also assist in controlling bleeding.

Emergency care for an impaled object includes the following steps:

- Stabilize the object to prevent further damage.
- Remove clothing to expose the wound.
- Control bleeding by applying direct pressure to the edges of the wound (but avoid placing direct pressure on the object).
- Use a sterile bulky dressing to help hold the object in place. Carefully pack the dressing around the object.
- Secure the sterile bulky dressing in place with gauze, a cravat or tape.

## ABDOMINAL INJURIES

The abdomen is the area immediately below the chest and above the pelvis. It is easily injured because it is not surrounded by bones, although it is protected at the back by the spine and ribs. The upper abdomen is only partially protected in front by the lower ribs. The muscles of the back and abdomen also help protect the internal organs, many of which are vital. Certain organs are easily injured or tend to bleed profusely when injured, such as the liver, spleen and stomach.

The liver is rich in blood. Located in the upper right quadrant of the abdomen, the lower ribs somewhat

protect this organ. However, it is delicate and can be torn by blows from blunt objects or penetrated by a fractured rib. The resulting bleeding can be severe and quickly be fatal. The liver, when injured, can also leak bile into the abdomen, which can cause severe infection.

The spleen is located in the upper left quadrant of the abdomen, behind the stomach, and is protected somewhat by the lower left ribs. Like the liver, this organ is easily damaged. The spleen may rupture when a blunt object strikes the abdomen forcefully. Since the spleen stores blood, a spleen injury can cause a severe loss of blood in a short time and can be life threatening.

The stomach is one of the main digestive organs. The upper part of the stomach changes shape depending on its contents, the stage of digestion, and the size and strength of the stomach muscles. Many blood vessels and nerves line the stomach. It can bleed severely when injured, and food contents may empty into the abdomen and possibly cause infection.

## Acute Abdomen

Abdominal pain is common and often not serious. However, acute and severe abdominal pain, referred to as acute abdomen, is usually a symptom of intra-abdominal disease such as appendicitis or peritonitis, but it may also be a symptom of abdominal trauma.

## Signs and Symptoms of an Abdominal Injury

The signs and symptoms of serious abdominal injury include:

- Severe abdominal pain.
- Bruising.



### CRITICAL FACTS

With an impaled object injury to the chest, do not remove the object unless you need to do chest compressions. Stabilize it with bulky dressing or gauze to prevent further damage, and control bleeding by applying direct pressure to the edges of the wound.

Signs and symptoms of serious chest injury are similar in both open and closed wounds. They include trouble breathing, including shortness of breath and pain when breathing (especially deep breathing); pain at the site of the injury; obvious deformity; pale or bluish skin; coughing up blood; protruding neck veins; and a drop in blood pressure.

Puncture wounds to the chest range from minor to life threatening. A forceful puncture may penetrate the rib cage and allow air to enter the chest through the wound. This prevents the lungs from functioning normally.



- External bleeding.
- Nausea and vomiting (sometimes vomit containing blood).
- Pale or ashen, cool, moist skin.
- Weakness.
- Thirst.
- Pain, tenderness or a tight, swollen feeling in the abdomen.
- Organs possibly protruding from the abdomen.

### Assessment Techniques for Abdominal Injury

Several steps must be taken when assessing a patient with a potential abdominal injury:

- First, establish spinal motion restriction if a spinal injury is suspected.
  - Check the patient's position. Knees flexed toward the chest are a good indication the patient has suffered an abdominal injury (Fig. 21-11).
  - Inspect the abdomen for contusions, lacerations, abrasions and punctures.
  - Look for signs of potential internal bleeding, including a distended abdomen as well as discoloration and bruising around the navel and sides.
  - Inspect the patient for internal organs protruding from an open abdominal wound (abdominal evisceration or disembowelment).
  - Palpate the four quadrants of the abdomen from the farthest point away from the pain, noting tenderness or masses.
- If the patient has a decreased mental status, it is important to note grimacing or signs of pain as you palpate. Keep in mind that the patient may be contracting stomach muscles to avoid pain, or the contractions may be the result of muscle spasms.
  - Assess both the upper and lower extremities for injury and a pulse, as abdominal aortic injury may cause the pulses of the lower extremities to be weaker than the upper. If no foot pulses are found, check the pulses at the back of the knee or thigh. These should be equal to or stronger than the radial pulse, even in the case of shock.
  - Assess motor and sensory function.
  - Log roll the patient and inspect for signs of trauma on their back.
  - Assess baseline vital signs, especially for indications of blood loss and shock. Symptoms such as low blood pressure, rapid heartbeat or pale, cool, moist skin are all indications of shock.
  - Ensure that the airway is open and the patient is able to breathe adequately. If inspection of the airway shows signs of bloody vomitus, suctioning may be required. If the patient is not breathing adequately, begin positive pressure ventilation with supplemental oxygen based on local protocols.

### Providing Care for Abdominal Injury

Like a chest injury, an injury to the abdomen is either open or closed. Even with a closed wound, the rupture of an organ can cause serious internal



**Fig. 21-11:** Patients who have suffered abdominal injuries often guard the injury by flexing their knees toward their chests.





## CRITICAL FACTS

Signs and symptoms of serious abdominal injury may include severe pain, tenderness or swollen feeling in the abdominal area; bruising; external bleeding; nausea and vomiting; pale or ashen, cool, moist skin; weakness; thirst; and protruding organs.

To care for a closed abdominal injury, carefully position the patient on the back, avoid applying direct pressure, bend their knees slightly, administer supplemental oxygen based on local protocols, take steps to minimize shock and summon more advanced medical personnel.

bleeding that can quickly result in shock. Injuries to the abdomen can be extremely painful. Serious reactions can occur if organs leak blood or other contents into the abdominal cavity.

To care for a closed abdominal injury:

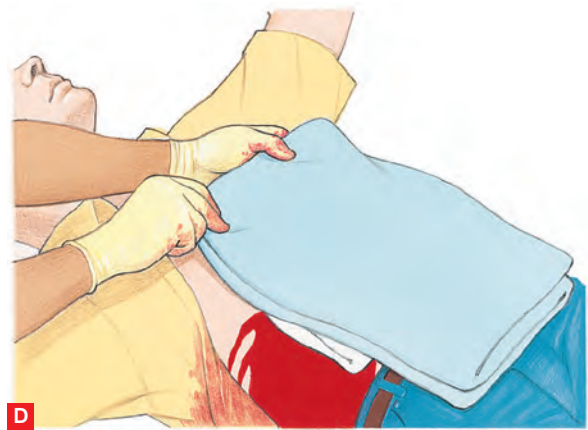
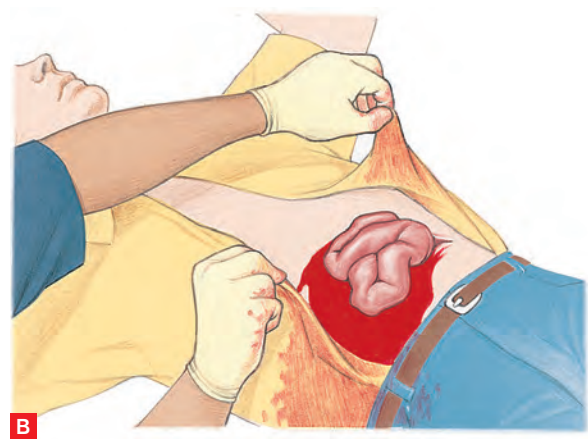
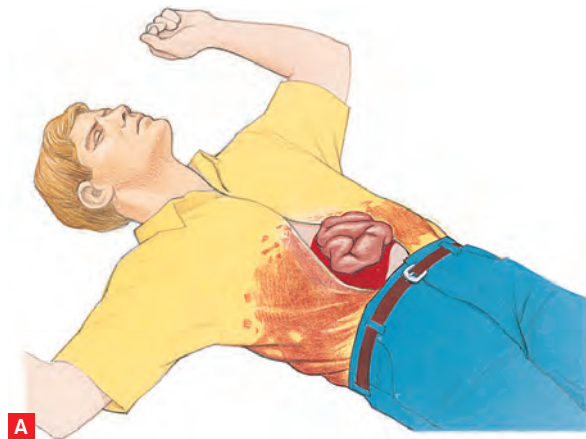
- Carefully position the patient on their back.
- Avoid applying direct pressure.
- Bend the patient's knees slightly. Doing so allows the muscles of the abdomen to relax. Place rolled-up blankets or pillows under the patient's knees. If moving the patient's legs causes pain, or you suspect spinal injury, leave the legs straight.

- Administer supplemental oxygen based on local protocols.
- Take steps to minimize shock.
- Summon more advanced medical personnel.

## Providing Care for Eviscerations

A severe open injury may result in **evisceration**, a situation in which abdominal organs protrude through the wound (Fig. 21-12, A). To care for an open wound in the abdomen, follow these steps (Fig. 21-12, B–D):

- Summon more advanced medical personnel.
- Carefully position the patient on the back.



**Fig. 21-12, A–D:** (A) Severe injuries to the abdominal cavity can result in protruding organs. (B) Carefully remove clothing from around the wound. (C) Apply a large, moist, sterile dressing over the wound and cover it with plastic wrap. (D) Place a folded towel over the dressing to maintain warmth.



## CRITICAL FACTS

A severe open injury may result in evisceration, a situation in which abdominal organs protrude through the wound. To care for an evisceration: summon more advanced medical personnel; position the patient on their back; remove clothing from around the wound; apply moist, sterile or clean dressings loosely over the wound; cover the dressings loosely with plastic wrap, if available, then cover lightly with a folded towel; keep the patient from getting chilled or overheated; and administer supplemental oxygen based on local protocols.

- Avoid applying direct pressure.
- Avoid pushing the organs back in.
- Remove clothing from around the wound.
- Apply moist sterile or clean dressings loosely over the wound.
- Cover the dressings loosely with plastic wrap, if available.
- Cover the dressings lightly with a folded towel to maintain warmth.
- Keep the patient from getting chilled or overheated.
- Administer supplemental oxygen based on local protocols.

## Providing Care for Impaled Objects in the Abdomen

If the patient has been impaled by an object in the abdomen, it is important *not* to remove the object. Instead, dress the wound around the object to control the bleeding. Stabilize the object with bulky dressings to prevent movement.

## GENITAL INJURIES

Assessing and treating a patient with a genital injury requires a calm and professional approach, as it can be embarrassing not only for the patient, but also for you. Using a sensitive approach to the patient's situation, such as clearing onlookers from the scene, supplying a drape for privacy and reassuring the patient, will help the process be less embarrassing. If possible, someone of the gender of the patient's choosing should treat them.

Injuries to the penis usually occur as a result of an accident or assault. They can be either closed wounds, such as a bruise, or open wounds, such

as an avulsion or laceration. Regardless, genital injuries are extremely painful.

The female organs, like those of the male, can cause extreme pain when injured. However, these types of injuries are rare, as the female genitals are smaller and much more protected. Straddle injury and sexual assault are the most common situations in which the female genitals can be injured, as well as childbirth. Injuries can cause severe bleeding and pain due to the large amount of blood vessels in this area. Despite excessive bleeding, these injuries are rarely life threatening.

## Signs and Symptoms of Genital Injuries

Signs and symptoms of genital injury are similar to those for an abdominal injury. They include:

- Severe pain.
- Bruising.
- External bleeding.
- Nausea.
- Vomiting (sometimes containing blood).
- Weakness.
- Thirst.
- Pain, tenderness or a tight feeling in the area.
- Protruding organs.
- Rigid abdominal muscles.
- Other signs of shock.

## Providing Care for Genital Injuries

Care for a closed wound to the male genitals as you would for any closed wound. Wrap the penis in a soft, sterile dressing moistened with saline



## CRITICAL FACTS

Signs and symptoms of genital injury are the same as those for an abdominal injury.

To care for injuries to the male genital region, remember never to remove an impaled object. Closed wounds to this area should be treated as any other closed wound injury. For open wounds, apply sterile dressing and direct pressure, either with your gloved hand or allow the patient to do it.



## CRITICAL FACTS

To provide care for injury to the female genitals, control bleeding with pressure using compresses moistened with saline. Use a diaper-like dressing for the wound and stabilize any impaled objects with a bandage. Use cold packs over the dressing to reduce swelling and ease pain.

solution, and apply a cold pack to reduce pain and swelling. As with any injury, *never* remove an impaled object. Stabilize the object and bandage it in place for transport.

If the injury is an open wound, apply a sterile dressing and direct pressure with your gloved hand or the patient's hand, or use a protective barrier to avoid contact. In the case where the penis is partially or completely amputated, apply a sterile pressure dressing to help stop bleeding, which may be significant. Aggressive direct pressure may also be needed if bleeding is excessive. As with an avulsion, if the penis is found, follow the procedure for preserving and transporting body parts. If any parts are avulsed or completely amputated, wrap them in sterile gauze, moistened in sterile saline if available. Then place them in a plastic bag, labeled with the patient's name and the time and date they were placed in the bag. Keep the bag cool by placing it in a larger bag or container of ice and water slurry, *not* on ice alone and *not* on dry ice. Transfer the bag to the EMS personnel transporting the patient to the hospital.

It is also possible for injuries to affect the scrotum and testicles. A blow to this area can rupture the scrotum and can cause pooling of blood, which is extremely painful. A ruptured testicle requires surgery. Apply a cold pack to the area to reduce swelling and pain, and if the scrotal skin has become avulsed, try to find it. Wrap the skin in sterile dressing and transport with the patient. The scrotum should be dressed with gauze sterilized and moistened with saline. Apply pressure to control bleeding.

To provide care for injury to the female genitals, control bleeding with pressure using compresses moistened with saline. Use a diaper-like dressing for the wound and stabilize any impaled objects with a bandage. Use cold packs over the dressing

to reduce swelling and ease pain. *Never* place anything in the vagina, including dressing. Treat the patient for shock as required.

Remember your training regarding a crime scene if you suspect a patient has been a victim of sexual assault. Take care to provide the patient with privacy by clearing the area of onlookers and draping a sheet or blanket over the patient. Do *not* touch the genitals; discreetly ask if the patient has suffered any other injuries, such as to the head. If bleeding is life threatening, this will take priority over maintaining the integrity of the crime scene. Do *not* allow the patient to bathe or douche, and discourage the patient from washing their hair or cleaning under their fingernails. Unless injuries are life threatening, do *not* clean or touch any wounds. Handle the patient's clothing as little as possible, placing them in paper bags separately from any other items. If there is blood on the items, do *not* use plastic bags and be sure to follow local protocols.

## PUTTING IT ALL TOGETHER

Injuries to the chest, abdomen or genitalia can be serious. They can damage soft tissues, bones and internal organs. Although many injuries are immediately obvious, some may be detected only as the patient's condition worsens over time. Watch for signs and symptoms of serious injuries that require immediate medical attention.

Care for any life-threatening condition and then give any additional care needed for specific injuries. *Always* call for more advanced medical personnel as soon as possible. Have the patient remain as still as possible. For open wounds to the chest, abdomen or genitalia, control bleeding. If you suspect a fracture, immobilize the injured part. Use occlusive dressings for open abdominal wounds when these materials are available. Your actions can make the difference in the patient's chances of survival.

## ► You Are the Emergency Medical Responder

As you begin your assessment, you notice that the young woman has multiple gunshot wounds to her chest and abdomen. How should you care for this patient?



# INJURIES TO MUSCLES, BONES AND JOINTS

## ▶ You Are the Emergency Medical Responder

You arrive on the scene of a minor motor-vehicle collision. Local law enforcement have secured the scene. As you approach, you find the driver sitting on the ground against her vehicle complaining of knee pain. How would you respond?





## KEY TERMS

**Air splint:** A hollow, inflatable splint for immobilizing a part of the body.

**Anatomic splint:** A splint formed by supporting an injured part of the body with an uninjured, neighboring body part; for example, splinting one finger against another; also called a self-splint.

**Angulation:** An angular deformity in a fractured bone.

**Binder:** A cloth wrapped around a patient to securely hold the arm against the patient's chest to add stability; also called a swathe.

**Bone:** A dense, hard tissue that forms the skeleton.

**Cardiac muscle:** A specialized type of muscle found in the heart.

**Circumferential splint:** A type of splint that surrounds or encircles an injured body part.

**Closed fracture:** A type of fracture in which the skin over the broken bone is intact.

**Cravat:** A folded triangular bandage used to hold splints in place.

**Crepitus:** A grating or popping sound under the skin that can be due to a number of causes, including two pieces of bone rubbing against each other.

**Direct force:** A force that causes injury at the point of impact.

**Dislocation:** The displacement of a bone from its normal position at a joint.

**Extremity:** A limb of the body; upper extremity is the arm; lower extremity is the leg.

**Fracture:** A break or disruption in bone tissue.

**Immobilize:** To use a splint or other method to keep an injured body part from moving.

**Indirect force:** A force that transmits energy through the body, causing injury at a distance from the point of impact.

**Joint:** A structure where two or more bones are joined.

**Ligament:** A fibrous band that holds bones together at a joint.

**Muscle:** A tissue that contracts and relaxes to create movement.

**Open fracture:** A type of fracture in which there is an open wound in the skin over the fracture.

**Rigid splint:** A splint made of rigid material such as wood, aluminum or plastic.

**Self-splint:** A splint formed by supporting one part of the body with another; also called an anatomic splint.

**Smooth muscles:** Muscles responsible for contraction of hollow organs such as blood vessels or the gastrointestinal tract.

**Soft splint:** A splint made of soft material such as towels, pillows, slings, swathes and cravats.

**Splint:** A device used to immobilize body parts.

**Sprain:** The partial or complete tearing or stretching of ligaments and other soft tissue structures at a joint.

**Strain:** The excessive stretching and tearing of muscles or tendons; a pulled or torn muscle.

**Swathe:** A cloth wrapped around a patient to securely hold the arm against the patient's chest, to add stability; also called a binder.

**Tendon:** A fibrous band that attaches muscle to bone.

**Traction splint:** A splint with a mechanical device that applies traction to realign the bones.

**Twisting force:** A force that causes injury when one part of the body remains still while the rest of the body is twisted or turns away from it.

**Vacuum splint:** A splint that can be molded to the shape of the injured area by extracting air from the splint.

**Voluntary muscles:** Muscles that attach to bones; also called skeletal muscles.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- List the three mechanisms of muscle, bone and joint injuries.
- Describe different types of musculoskeletal injuries.
- Describe how to assess for muscle, bone and joint injuries.
- List the signs and symptoms of muscle, bone and joint injuries.
- Describe general care for muscle, bone and joint injuries.
- List general guidelines for splinting.
- List the purposes of immobilizing an injury.

## SKILL OBJECTIVES

After reading this chapter, and completing the class activities, you should be able to:

- Demonstrate how to immobilize muscle, bone and joint injuries.

## INTRODUCTION

Although musculoskeletal injuries are almost always painful, they are rarely life threatening. However, when not recognized and taken care of properly, they can have serious consequences and even result in permanent disability or death. Broken bones, dislocated joints, strained muscles and similar injuries are common, and most people will experience one or more of these during their lifetime. Injuries to muscles, bones and joints range from simple, minor problems such as a sprained finger, to serious situations such as a fractured pelvis.

In this chapter, you will learn how to recognize and care for muscle, bone and joint injuries. Developing a better understanding of the structure and function of the body's framework will help you assess musculoskeletal injuries and give appropriate care.

## MUSCULOSKELETAL SYSTEM

The musculoskeletal system is a combination of two body systems—the muscular and skeletal systems. It consists of the bones, muscles, tendons and ligaments. The skeletal system creates a structural framework for the body and is composed of approximately 206 **bones** of varying shapes and sizes. Six sections comprise the skeleton: the skull, spine, thorax, pelvis, upper extremities and lower extremities.

There are three types of **muscles**: the voluntary muscles, smooth muscles of the walls of organs, and cardiac muscles of the heart. **Voluntary muscles**, also called skeletal muscles, are the major muscles that make up the body and enable movement (Fig. 22-1). Ligaments and tendons join structures of the musculoskeletal system together.

**Ligaments** hold the bones at a joint together and **tendons** connect muscle to bone. All **joints**

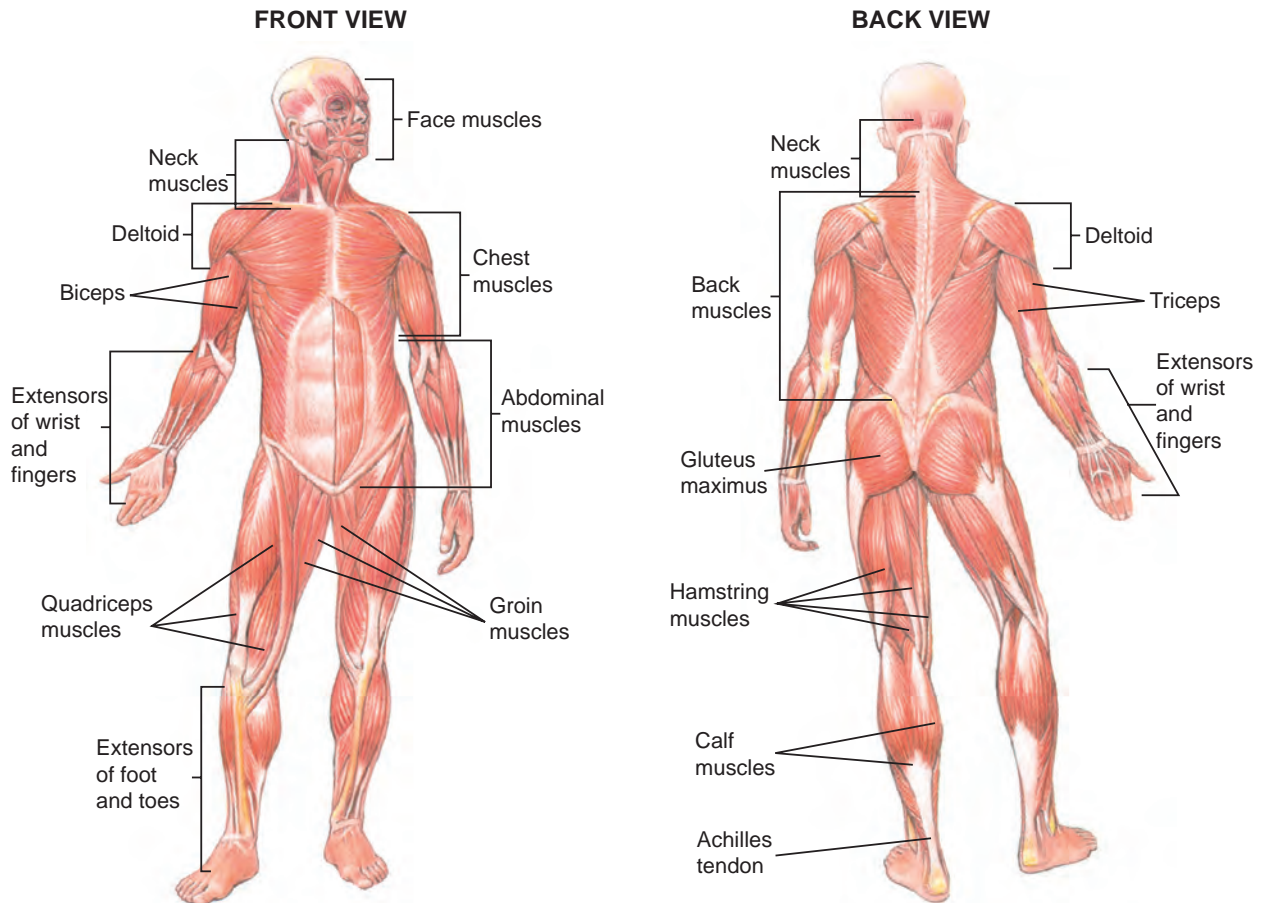


### CRITICAL FACTS

The musculoskeletal system is a combination of two body systems—the muscular and skeletal systems. It consists of the bones, muscles, and tendons and ligaments.

There are three types of muscles: the voluntary muscles, smooth muscles of the walls of organs and cardiac muscles of the heart.

Muscles, bones and joints are injured when force is applied to them. The three basic mechanisms of injury (MOIs) are direct force, indirect force and twisting force.



**Fig. 22-1:** The major muscles of the body.

have a normal range of movement—an area in which they can move freely without too much stress or strain. When joints are forced beyond this range, ligaments can stretch and tear. Muscles and tendons can also become stretched or torn when placed under a lot of stress or worked too hard.

## INJURIES TO MUSCLES, BONES AND JOINTS

### Causes of Injury

Muscles, bones and joints are injured when force is applied to them. Knowing the specific mechanism, or cause, of injury can give you important clues about which parts of the body may be injured, what other hidden injuries may exist along with the more obvious ones and how serious the injuries may be.

There are three basic mechanisms of injury (MOIs):

- **Direct force** causes injury at the point of impact (Fig. 22-2, A). For example, the patient may have been hit by a loose pitch during a baseball game, fracturing the bone in the ankle.

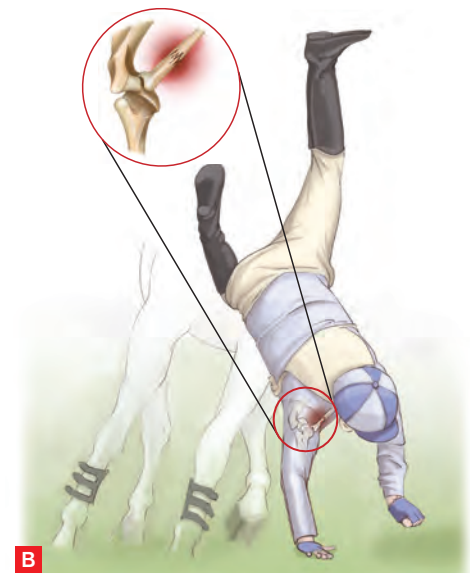
- **Indirect force** transmits energy through the body and causes injury at some distance from the original point of impact (Fig. 22-2, B). For example, the patient might have a fall from a galloping horse, and stretch out the arms while landing so that the hands hit the ground first. The collarbone is broken when the force is transmitted up the arm to the shoulder.
- **Twisting force**, or rotating force, causes injury when one part of the body remains still while the rest of the body is twisted or turned away from it (Fig. 22-2, C). For example, a patient may be skiing and fall to the side, causing a leg to twist while still in a ski boot that is pointing downhill.

### Types of Injuries

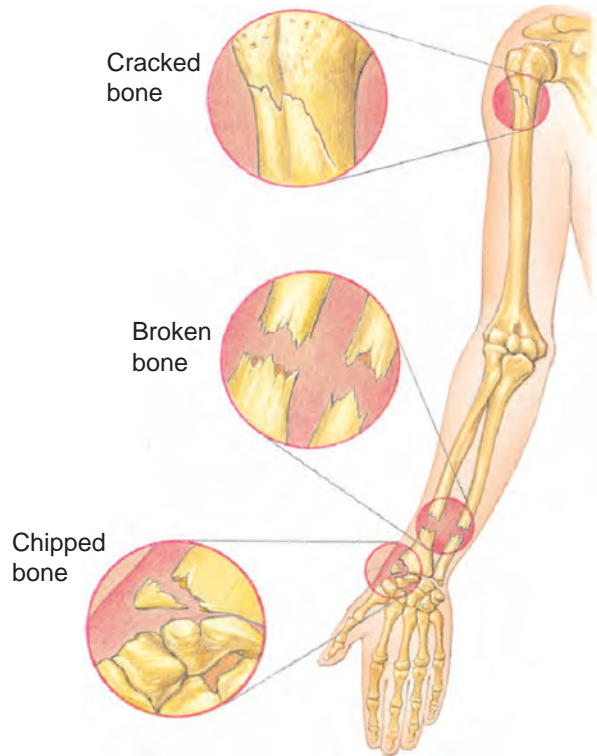
The four basic types of injuries to muscles, bones and joints are fractures, dislocations, strains and sprains.

#### Fractures

A **fracture** is a break or damage to a bone. Fractures can involve bones that are broken all the way through, chipped or cracked (Fig. 22-3). A fall,



**Fig. 22-2, A–C:** The three basic MOIs are **(A)** direct force, **(B)** indirect force and **(C)** twisting force.



**Fig. 22-3:** Fractures include chipped or cracked bones and bones broken all the way through.

a blow or sometimes even a twisting movement can cause a fracture. Some fractures are obvious, but others may not be easy to detect without an X-ray. While most isolated fractures are not considered critical or life threatening, if the femur or pelvis is fractured, the patient is at serious risk of excessive blood loss, shock and death. These two bones contain many blood vessels, and any injury tends to cause heavy bleeding. Fracture to the spine can also result in damage to the spinal cord.

There are two kinds of fractures:

- **Closed fractures:** The skin over the broken bone is intact (Fig. 22-4, A).
- **Open fractures:** There is an open wound in the skin over the fracture. In some cases, the broken bone actually protrudes from the skin or is visible through the wound (Fig. 22-4, B).

While closed fractures are more common, open fractures are more dangerous because they carry a risk of infection and severe bleeding. In general, fractures are life threatening only if they involve



**CRITICAL FACTS**

The four basic types of injuries to muscles, bones and joints are fractures, dislocations, strains and sprains.





Fig. 22-4, A–B: (A) Closed fracture. (B) Open fracture.

breaks in large bones such as the femur, sever an artery or affect breathing. Since you cannot always tell if a person has a fracture, you should consider the MOI. A fall from a height or a motor-vehicle crash could signal a possible fracture. When in doubt, suspect a fracture and provide care accordingly.

## Dislocations

Dislocations are usually more obvious than fractures. A **dislocation** is the displacement of a bone at a joint away from its normal position (Fig. 22-5). The bones in the human body are linked together at joints. When the bones that normally meet at a particular joint have been displaced or separated from each other, and the ligaments or tendons have been stretched, displaced or torn, this is called a dislocation.

Some joints, such as the shoulder and fingers, dislocate more easily because they are relatively exposed and not as well protected by ligaments. Other joints, such as the elbow, are less likely to become dislocated, but are just as serious as any joint dislocation. In general, dislocation requires a severe force. However, if a joint has become dislocated once and the ligaments holding the bones in place were damaged, subsequent dislocations are then more likely to occur. In some cases, dislocation can become chronic so that relatively minor movements can cause joint instability.

A force strong enough to cause an initial dislocation can also cause a fractured bone,



Fig. 22-5: A dislocation is the movement of a bone at a joint away from its normal position.

bleeding and damaged nerves, so it is important to check for those injuries as well. A dislocation can be extremely painful.

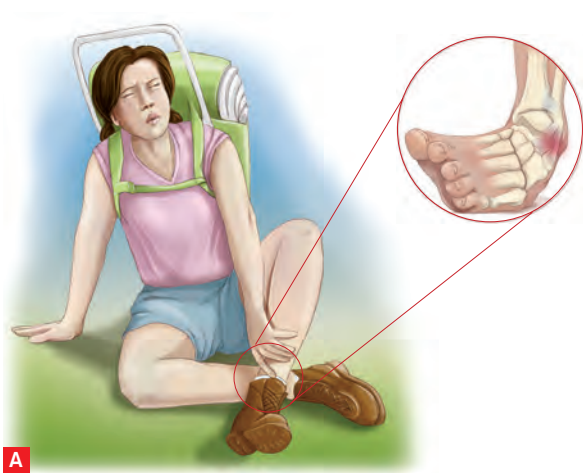
## Sprains

A **sprain** is the partial or complete tearing or stretching of ligaments and other tissues at a joint (Fig. 22-6, A). If the bones that meet at a joint are forced beyond their usual range of movement, the ligaments can be stretched or torn even though the bones are not actually dislocated. The greater the number of ligaments torn, the more severe is the injury. Severe sprains, caused by a great deal of force being applied, can also involve fractured or dislocated bones. Milder sprains are caused when the only injury is stretched ligaments.

Patients generally find that the pain of these mild sprains is quickly resolved and they return to their normal activities. However, this often leads to re-injury of the joint that was sprained. Proper care should always be given once ligaments have been stretched or torn, even if the injury is mild. Otherwise, the joint may become less stable and the partially healed, less stable joint will be much more susceptible to re-injury. The joints most easily injured are at the ankle, knee, wrist and fingers.

## Strains

A **strain** is the excessive stretching and tearing of muscles or tendons, sometimes called a pulled muscle or a tear (Fig. 22-6, B). Tendons are



**Fig. 22-6, A–B:** (A) A sprain is the partial or complete tearing or stretching of ligaments and other tissues at a joint. (B) A strain is the excessive stretching and tearing of muscles or tendons.

stronger than muscles and more resistant to injury, so damage more often happens in muscles or at the attachment between the muscle and tendon. Strains can result from overexertion, such as lifting something too heavy, or from working a muscle for too long. They can also result from sudden or uncoordinated movements. Strains most often involve the muscles in the neck, back, thigh or calf.

Like sprains, strains are often neglected and this may lead to re-injury. The muscles need time and rest to repair the damage. Repeated strains of the neck and back are common causes of workers being absent from work.

### Assessing Signs and Symptoms of Injuries to Muscles, Bones and Joints

Injuries to the musculoskeletal system are identified during the physical examination. Because these injuries often appear to be similar, it may be difficult for you to determine exactly what type of injury has occurred. As you complete the physical examination, think about how the body normally looks and feels. Check for deformity; compare the injured side to the uninjured side.

Ask how the injury happened. The cause of the trauma may alert you to the possibility that the muscles, bones and joints have been injured. As the patient or bystanders explain how the injury occurred, listen for clues, such as a fall from a height or a serious motor-vehicle crash. Also ask the patient if any areas are painful. Then carefully examine the entire body, starting with the head.

Keep in mind as you assess the patient that if there was sufficient force present to fracture a bone or dislocate a joint, that force may also cause

bleeding, internal injuries and shock. Fractures can cause severe pain and there may be so much focus on this that the patient will not mention other problems such as abdominal pain, which may actually indicate more serious injuries.

Some common signs and symptoms associated with musculoskeletal injuries include:

- A snapping sound. If a bone has fractured, the patient may report hearing or feeling the bone snap or break.
- Deformity or **angulation** (Fig. 22-7). If you suspect injury in one arm or leg but not the other, compare the two arms or two legs to see if the injured limb is bent at an abnormal angle, or has changed in shape compared to the uninjured one. Other fractured bones may show indentations, and a dislocated joint often shows an indentation where the bones would normally meet.



**Fig. 22-7:** Serious bone or joint injuries may appear deformed.

- Pain and tenderness. The pain of a fractured bone or dislocated joint is often severe.
- **Crepitus.** There may be a grating sound or feeling when attempting to move the fractured bone, caused by the two pieces of bone rubbing against each other.
- Swelling. Swelling may be present and may obscure some indentations.
- Restricted movement. The patient may be unable to move the affected area, due to pain or because of a dislocated joint.
- Visible break. In an open fracture, the broken ends of the bones may be visible.
- Bruising or discoloration. Internal bleeding may cause bruising as blood pools under the skin.
- Loss of circulation or sensation. There may be a loss of circulation or sensation in an **extremity** (the shoulders to the fingers; the hips to the toes).

It is often impossible to determine whether a patient has experienced a fracture, dislocation, sprain or strain at the initial examination. X-rays and other tests by a healthcare provider will determine the precise nature of the injuries. Fortunately, it is not necessary to know whether the swelling of an ankle, for example, is caused by a fracture or a sprain to provide appropriate care.

## Providing Care for Injuries to Muscles, Bones and Joints

A gentle, reassuring approach is important in caring for patients with muscle, bone and joint injuries. The patient is likely to be experiencing severe pain and may be frightened. Avoid moving the injured parts of the patient's body as much as possible, as this is likely to increase the pain and may cause further injury. Keep the injured area stable in the position found until more advanced medical personnel take over.

For any muscle, bone or joint injury, follow these general guidelines when providing care:

- Follow standard precautions.
- Control bleeding if present.
- Ensure that the patient is breathing effectively, and administer supplemental oxygen based on local protocols.
- If a spinal injury is suspected, maintain spinal motion restriction and keep the patient flat.
- Avoid any movements or changes in position that cause pain. The patient will usually find the most comfortable position. Keep the injured area immobile in that position (Fig. 22-8).
- Remove any jewelry or restrictive clothing in the affected area so that swelling does not cause more pain or injury.
- Clean and bandage any open wounds before splinting.
- Follow the steps on Skill Sheets 22-1 to 22-4 to **immobilize** the injured joint or bones with splints only if you must transport the patient to definitive medical care *and* you can do so without causing more pain.
- Check for circulation and sensation to the limb. Feel for the patient's distal pulse, skin temperature, and ability to move and detect touch in the injured parts, before and after splinting.

Call for more advanced medical personnel if:

- You suspect a fracture to an area proximal to the wrist or ankle.
- The injury involves severe bleeding.
- The injury impairs breathing.
- The injury involves the head, neck or spine.
- You see or suspect multiple injuries.

The general care for all musculoskeletal injuries is similar: rest, immobilize, cold and elevate, or "RICE."

### Rest

Avoid any movements or activities that cause pain. Help the patient find the most comfortable position. If you suspect head, neck or spinal injuries, leave the patient lying flat.

### Immobilize

Stabilize the injured area in the position it was found. In most cases, it will *not* be necessary to



#### CRITICAL FACTS

Signs and symptoms of musculoskeletal injuries include a snapping sound, deformity/angulation, pain and tenderness, crepitus, swelling, restricted movement, bruising, and loss of circulation or sensation.

Call for more advanced medical personnel if you suspect a fracture to an area proximal to the wrist or ankle; if the injury involves severe bleeding or impairs breathing, involves the head, neck or spine; or if you see or suspect multiple injuries.



**Fig. 22-8:** When caring for a musculoskeletal injury, have the patient rest in a comfortable position and avoid moving the injured body part, then immobilize, cool and elevate the injured area.

apply a splint. For example, the ground can provide support to an injured leg, ankle or foot, or the patient may cradle an injured elbow or arm in a position of comfort.

### Cold

Apply a cold pack for periods of 20 minutes. If 20 minutes cannot be tolerated, apply a cold pack for periods of 10 minutes. If continued cold is needed, remove the pack for 20 minutes, and then replace it.

Cold helps reduce swelling and eases pain and discomfort. Commercial cold packs can be stored in a kit until ready to use, or you can make a cold pack by placing ice (crushed or cubed) with water in a plastic bag and wrapping it with a towel or cloth. Place a thin layer of gauze or cloth between the source of cold and the skin to prevent injury to the skin. Do *not* apply a cold pack directly over an open fracture, because doing so would require you to put pressure on the open fracture site and could cause discomfort to the patient. Instead, place cold packs *around* the site. Do *not* apply heat, as there is no evidence that applying heat helps.

### Elevate

Elevating the injured area above the level of the heart helps slow the flow of blood, helping to reduce swelling. Elevation is particularly effective in controlling swelling in extremity injuries. However, *never* attempt to elevate a seriously injured area of a limb unless it has been adequately immobilized. Also, only elevate it if it does not cause additional pain.

## SPLINTING

When an injury to bones, muscles or joints is suspected, immobilizing the affected body part is an important step in treatment. Preventing the bones, joints and ligaments from moving helps to reduce the risk of further injury, and minimizes the risks of some possible complications such as:

- Broken bone ends injuring blood vessels, nerves or muscles as they move. This can cause loss of sensation in the affected area or increase the bleeding.
- Broken bone ends breaking through the skin.
- Blood vessels being compressed by broken or dislocated bones, thus reducing blood flow.
- Paralysis caused by damage to the spine.

The purposes of immobilizing an injury are to:

- Lessen pain.
- Prevent further damage to soft tissues.
- Reduce the risk of severe bleeding.
- Reduce the possibility of loss of circulation to the injured part.
- Prevent closed extremity injuries from becoming open extremity injuries.

A tool or device used to immobilize an injury is called a **splint**. There are many commercially manufactured types of splints, but if necessary one can be improvised from items available at the scene.





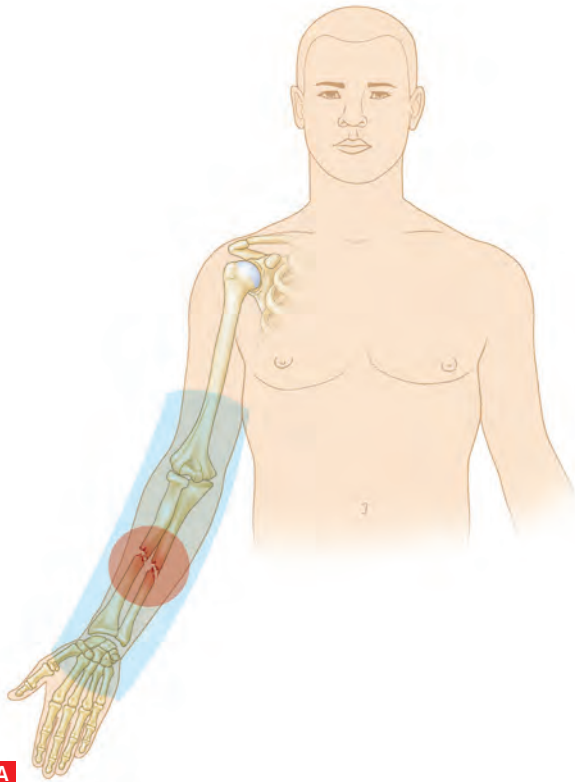
## CRITICAL FACTS

Immobilizing an injury is important. It lessens pain, prevents further damage to soft tissues, reduces the risk of severe bleeding, reduces the possibility of loss of circulation to the injured part and prevents closed injuries from becoming open injuries.

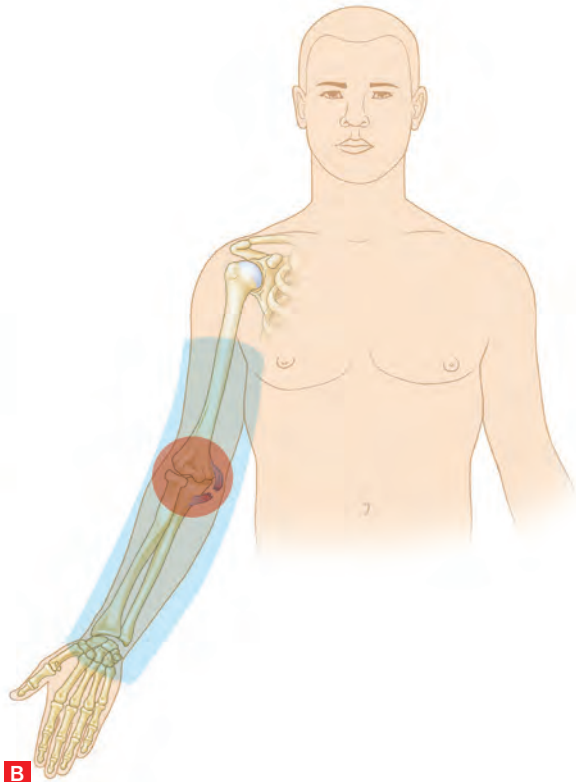
### Rules for Splinting

No matter where the splint will be applied, or what the injury is, there are some general rules for splinting:

- Splinting should *only* be performed if you have to move or transport the patient to receive medical care *and* you can do so without causing more pain.
- Assess the patient's distal pulse, skin temperature, ability to move and ability to feel the body part that is on the other side of the injury from the heart. For example, if the elbow has been injured, check pulse, skin temperature, mobility and sensation at the wrist. If a leg bone is injured, check at the ankle. Continue to assess these three signs every 15 minutes after the splint has been applied. This will let you know if the splint, or swelling under the splint, has impaired circulation to the affected area.
- If a fracture is suspected, immobilize the joints above and below the injury (Fig. 22-9, A). For example, if a bone in the lower leg is broken, you would immobilize the ankle and the knee. If a joint injury is suspected, immobilize the bone above and below the injury (Fig. 22-9, B).
- Cut off or remove any clothing around the injury site. If the patient is wearing a watch or jewelry near the injury, these should also be removed. Swelling may occur beyond the actual injury site. If an elbow is injured, for example, any bracelets, watches or rings on the wrist and hand should be removed.
- Cover any bleeding or open wounds, including open fractures, with sterile dressings, and carefully bandage with minimal pressure.
- Do *not* try to push protruding bones back below the skin.



A



B

**Fig. 22-9, A–B:** (A) If a fracture is suspected, immobilize the joints above and below the injury. (B) If a joint injury is suspected, immobilize the bones above and below the injury.

- Do *not* attempt to straighten any angulated fracture; always splint the limb in the position found.
- Do *not* allow the patient to bear weight on an injured lower extremity.
- Pad the splints you are using so that they will be more comfortable and conform to the shape of the injured body part.
- Secure the splint in place with folded triangular bandages, roller bandages or other wide strips of cloth.
- Elevate the splinted part, if possible.

## Types of Splints

Whether commercially made or improvised, there are six general types of splints: soft, rigid, traction, circumferential, vacuum, and anatomic or self-splint.

### Soft Splints

**Soft splints** include folded blankets, towels, pillows, slings, swathes (also called binders) and cravats (Fig. 22-10). Many improvised splints are made from soft materials such as bed pillows or blankets, and they can be effective if secured properly. A **swathe** is a cloth wrapped around a patient to securely hold the arm against the patient's chest, to add stability. **Cravats** are folded triangular bandages used to hold splints in place.

A sling is a type of soft splint made from a triangular bandage. It can provide stability when the shoulder, elbow or upper arm has been injured. The sling will support the weight of the arm. To immobilize the injury, you should then apply a



**Fig. 22-10:** Soft splints use soft, pliable materials, such as folded blankets or towels, to immobilize an injury.

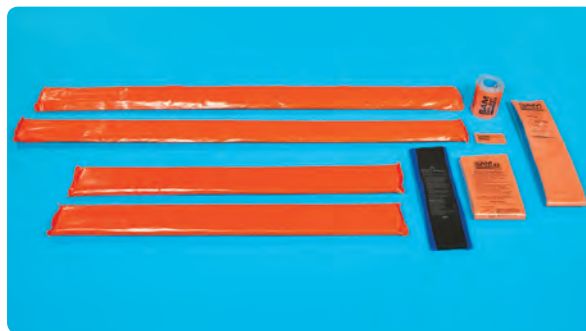
**binder**—wrapping the cloth around the patient and the arm to hold the arm securely against the side of the patient's chest. With both the sling and binder in place, the arm will not be able to move, the weight of the arm will be supported and the patient's pain should be significantly reduced (Fig. 22-11).

### Rigid Splints

A **rigid splint** is one that is made of a rigid material such as wood, aluminum, plastic, cardboard or composite materials (Fig. 22-12). Some are specially shaped to be used for a particular body part, such as an arm or a finger. Some are designed to be pliable so they can be shaped to the body part. They may come with padding or require padding to be added at the time of use.



**Fig. 22-11:** A sling made from a triangular bandage can provide stability to an injury to the shoulder, elbow or upper arm, while a binder wrapping the injured body part to the chest can be used to immobilize.



**Fig. 22-12:** Commercially manufactured rigid splints.



#### CRITICAL FACTS

Splints can be commercially made or improvised with items you have on hand. There are six different types of splints: soft, rigid, traction, circumferential, vacuum and anatomic (self-splint).

If commercial splinting materials are not available, improvised rigid splints can be created from cardboard boxes, rolled-up magazines, an athlete's shin guards or other items available at the scene. Look for an item that is light but rigid, and strong enough to resist breaking. It should be long enough to prevent movement on either side of the injury, and wide enough that it will cover the entire injured area. You should also be able to pad it effectively to protect the skin and any wounds.

## Traction Splints

A **traction splint** contains a mechanical device that is attached to the body part above and below the injury and provides a steady counter-pull (Fig. 22-13). This is not the same as applying manual traction to realign the bones, and these splints are not intended to reposition fractured bones. Instead, they reduce pain and blood loss by immobilizing bones that might otherwise move in the direction opposite to the splint's pull. Each brand or type of traction splint will have instructions about correct use.



Fig. 22-13: A traction splint.

## Circumferential Splints

A **circumferential splint** surrounds or encircles the injured body part. One example is a commercial **air splint**, which begins as a soft, pliable splint that can be positioned around the injured area. It is then filled with air and becomes rigid and applies pressure to the injured area. Air splints have the potential to interfere with circulation, making it difficult to check the patient's pulse or temperature. They can, however, be helpful in reducing bleeding. Air splints should only be used under medical direction.

## Vacuum Splints

A **vacuum splint** starts out soft and pliable so that it can be shaped to fit the area that has been injured. Once it is in place, the air can be sucked out, creating a vacuum inside and making the splint rigid and immobilizing.

## Anatomic or Self-Splints

In many cases, the patient's own body can act as a splint. This is called an **anatomic splint** or **self-splint**. For example, if the right leg is broken, the left leg can be used as a splint (Fig. 22-14). The legs are fastened together using cravats or roller bandages. Any gaps between the legs are filled with padding.

## Splinting Upper Extremities

The upper extremities are the arms and hands. The bones in the upper extremities are the collarbone, scapula, humerus, radius and ulna, as well as the



Fig. 22-14: In an anatomic splint, the patient's own body is used to immobilize an injured body part. Photo: courtesy of the Canadian Red Cross.



bones in the hand, wrist and fingers. The upper extremities are the most commonly injured parts of the body. Since people who are falling or about to crash instinctively try to protect themselves by throwing out their arms and hands, these areas receive the force of the impact. Often, the result is a fracture, sprain or dislocation.

### Splinting the Collarbone

When the collarbone is broken, the patient's shoulder may look lower than the uninjured side. You may see obvious deformity in the collarbone. It is best splinted with a sling, to reduce the pull from the arm's weight, and a binder to immobilize the arm against the chest.

### Splinting the Shoulder

A dislocated shoulder will appear deformed and a hollow may be visible in the upper arm below the shoulder. This injury is extremely painful. There is a risk that nerves and arteries near the shoulder can be damaged by movement, so be cautious as you apply any splints. A sling and binder should be used, with some padding between the arm and the chest to maintain a reasonably comfortable position (Fig. 22-15).



**Fig. 22-15:** Splint for a shoulder injury.

### Splinting the Upper Arm

The humerus is a strong bone, so if it is broken (most often near the shoulder or partway towards the elbow), check for other injuries, as considerable force probably was involved. This injury can be splinted with a padded rigid splint on the outside of the arm. If the elbow can be comfortably bent, you can then use a sling and binder. If the elbow cannot be bent without causing more pain, or if the rigid splint you are using is longer than the upper arm, keep the arm straight at the patient's side and wrap the bandages or binders around the arm and chest (Fig. 22-16).

### Splinting the Elbow

Do not attempt to straighten or bend the elbow or change its position. If the elbow is bent, even if it is deformed, splint with a sling and binder (Fig. 22-17). You may use a flat pillow or towel wrapped around the injured area and then secured to the chest. If the elbow is straight, use rigid splints along the length of both sides of the arm, from fingertips to underarm.

### Splinting the Forearm and Wrist

A rigid splint extending from the elbow to the fingertips should be applied first. Then a sling and



**Fig. 22-16:** Splint for an upper arm injury.





**Fig. 22-17:** Splint for an elbow injury.



**Fig. 22-18:** Splint for a forearm injury.

binder can be applied to support the arm against the chest (Fig. 22-18). If there is no open wound, a circumferential air splint, extending from elbow to past the fingertips, can be applied instead of the rigid splinting.

### **Splinting the Hands and Fingers**

If a single finger has a broken bone, you may be able to create a self-splint or anatomic splint by taping the injured finger to the one beside it. A tongue depressor or similar-sized piece of cardboard can also work as a rigid splint, taped to the finger (Fig. 22-19).

When several fingers have broken bones or the back of the hand is involved in the injury, you will need to splint the entire hand. To immobilize the hand, place a small ball, or a rolled-up bandage or face cloth, inside the palm of the person's hand, with the fingers curled naturally around it. Then wrap the entire hand, and splint the lower arm and wrist with a rigid splint or arm board. A sling can be added to help support the arm.

### **Splinting Lower Extremities**

#### **Splinting the Pelvis**

Injuries to the pelvis are potentially life threatening because of the risk of heavy bleeding in this area.



**Fig. 22-19:** Splint for a finger injury.

Assess the patient for shock and internal blood loss. To immobilize a pelvic fracture, a pelvic binder can be used, following the manufacturer's instructions and if you are trained to apply one (Fig. 22-20). If a pelvic binder is not available, one can be improvised using a sheet that is repeatedly folded lengthwise to create a thick, 8-inch-wide strip. Slide this strip under the small of the patient's back and pull it through until equal lengths appear on each side of the patient's body. Using the extended ends of the fabric, slide the strip of fabric down so that it is behind the injured pelvis, and cross the ends in front of the pelvis. Twist the ends together so that the fabric is tightly



**Fig. 22-20:** Splint for a pelvis injury.

secured around the pelvis. Tuck the leftover fabric ends under the patient or tie them in a knot. Alternatively, the patient can be lowered onto an ambulance stretcher with the pelvic sheet and/or a long backboard in place, using a scoop stretcher, based on local protocols.

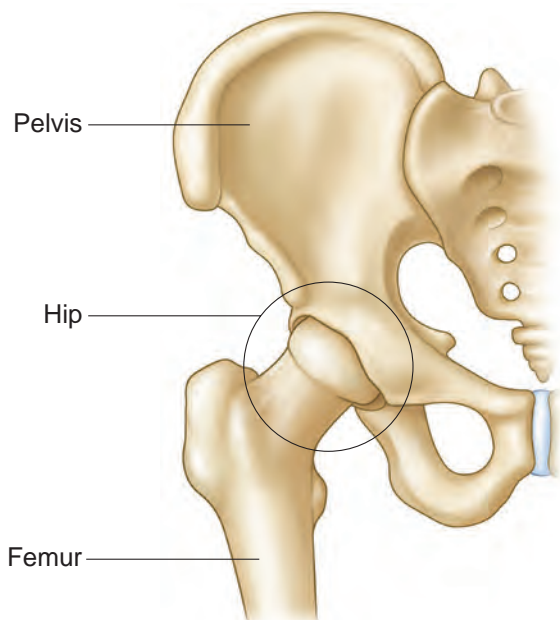
Use a blanket or pillow for padding between the patient's legs, and add padding on both sides of the patient's hips. Minimize movement of the pelvis and legs.

### Splinting the Hip

The hip is the joint where the thigh bone, or femur, fits into the pelvis (Fig. 22-21). Like the pelvis, the femur has significant blood vessels, and any injury in this area can cause dangerous bleeding, which can be difficult to detect. Look for swelling in the thigh area. Assess and treat for bleeding and shock before beginning to splint. To immobilize the hip you will need to splint the patient's entire body on a long backboard.

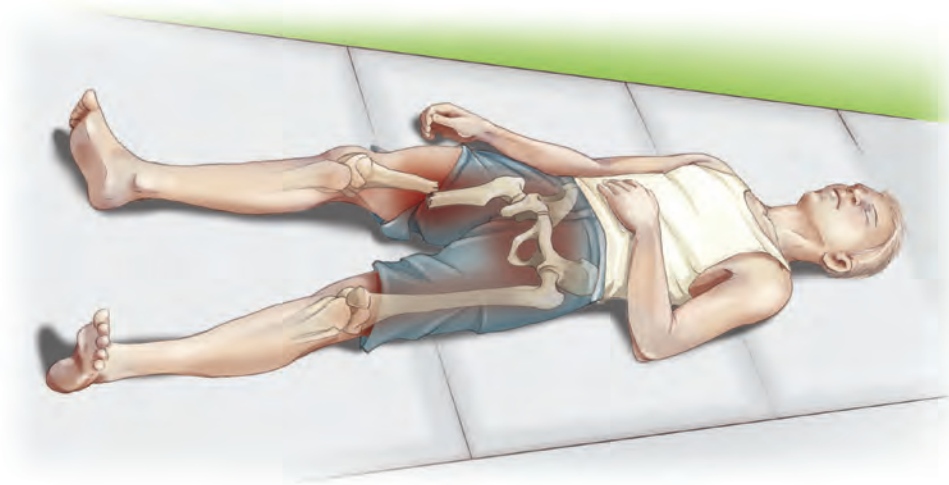
### Splinting the Femur

As mentioned previously, injuries to the femur can be very serious because of the risk of bleeding, which may be internal and not noticed. A broken femur causes a great deal of pain and significant swelling; the deformity of the thigh is usually quite noticeable, and the muscle often contracts (shortens) with this type of break (Fig. 22-22). The leg may also be turned inward or outward. Use a traction splint if one is available and you have the training to apply this type of splint correctly.



**Fig. 22-21:** The hip joint.

If a traction splint cannot be applied, you can use two long rigid splints instead, with padding to fill any gaps between the splint and the patient's body (Fig. 22-23). One splint or board must start at the patient's groin area and extend past the bottom of the patient's foot, on the inside of the affected leg. The other should go from the patient's armpit to below the bottom of the patient's foot. Wrap the boards tightly, using cravats at the chest, hips, knees and ankles to immobilize the body.



**Fig. 22-22:** The deformity of the thigh from a broken femur is usually quite noticeable.



**Fig. 22-23:** Splint for a femur injury.



**Fig. 22-24:** Splint for a tibia or fibula injury.

## Splinting the Knee

Knees may be injured in either a bent or straight position. Do *not* attempt to change the position of the knee. If it is straight, use two padded rigid splints, one on the outside and one on the inside of the leg. The inside splint should start at the groin and extend past the bottom of the foot. The outside splint should start at the hip and also extend past the foot. Use cravats to keep the splints in place. If the knee is bent, use a pillow or folded blanket under the knee to maintain the bent position. Then use short, padded rigid splints running along either side of the knee to immobilize the upper and lower leg in relationship to the knee.

## Splinting the Tibia and Fibula (Lower Leg Bones)

The tibia (shinbone) and fibula are the two bones that extend from the knee to the ankle. The tibia is covered by only a thin layer of skin, so open fractures of this bone are common. The fibula is not

a weight-bearing bone and fractures of this bone may not be as easily detected. Injuries to either bone are splinted in the same way, using a circumferential air splint, extending from above the knee to below the foot. Or you can use two padded rigid splints, one on the inside running from the groin to below the foot, and the other on the outside running from the hip to below the foot (Fig. 22-24).

## Splinting the Ankle and Foot

Injuries to the foot or ankle are often caused by heavy objects falling on the foot, or when a falling person lands on the feet. Twisting forces during a fall or while running can also cause an ankle injury. Whether the injury is a break or a sprain, *both* should be splinted in the same way, by immobilizing the entire foot and ankle (Fig. 22-25). A circumferential air splint is a good choice, but a pillow or thick blanket wrapped around the foot and ankle and secured in place will also work.





**Fig. 22-25:** Splint for an ankle or a foot injury.

## PUTTING IT ALL TOGETHER

Injuries to bones, muscles and joints are generally caused by significant force, so careful assessment should be done to identify or rule out other injuries. Injuries can include fractures to bones; dislocations of joints; and strains and sprains involving muscles, ligaments and tendons. It is not always easy to identify the type of injury present.

Injuries to the pelvis or femur are potentially critical because of the major blood vessels running through these parts of the body. Assess the patient for bleeding and shock.

## ▶ You Are the Emergency Medical Responder

After approaching the driver, you find out that she slammed her knee into the dashboard and cannot put weight on the right leg without significant pain. The ambulance has not yet arrived on scene. How should you respond? What actions should you take?

Assess for severe, life-threatening bleeding and take steps to control bleeding if necessary. Ensure that the patient is breathing effectively and provide supplemental oxygen based on local protocols. If a spinal injury is suspected, maintain spinal motion restriction and keep the patient flat. Avoid any movements or changes in position that cause pain. Help the patient find the most comfortable position. Remove any jewelry or restrictive clothing in the affected area.

Clean and bandage any open wounds before splinting. Follow guidelines to immobilize the injured joint or bones with splints. Check the patient's pulse and ability to move and detect touch in the injured parts before and after splinting. Apply a cold pack to reduce swelling and ease pain and discomfort. If there is no spinal injury and the limb has been securely immobilized, elevate it so that it is above the level of the patient's heart.

In most cases, splinting the injured area will help prevent further damage, reduce bleeding and reduce pain. A variety of commercial splints are available for this purpose; many splints can be improvised if commercial products are not available. After splinting, check every 15 minutes to see that the patient's pulse, ability to move, skin temperature, color and ability to detect touch in the part of the body past the injured area are still stable.



## Skill Sheet 22-1

## Applying a Rigid Splint

To apply a rigid splint:

**STEP 1**

Follow standard precautions and obtain consent.

**STEP 2**

Support the injured body part *above and below* the site of the injury.

**STEP 3**

Check for circulation and sensation beyond the injured area.

**STEP 4**

Place an appropriately sized rigid splint (e.g., padded board) under the injured body part.

**NOTE:** Place padding, such as a roller gauze, under the palm of the hand to keep it in a normal position.



(Continued)

## Skill Sheet 22-1

Applying a Rigid Splint *Continued***STEP 5**

Tie several folded triangular bandages *above and below* the injured body part.

**STEP 6**

Recheck for circulation and sensation beyond the injured area.

**NOTE:** *If a rigid splint is used on an injured forearm, immobilize the wrist and elbow. Bind the arm to the chest using folded triangular bandages or apply a sling. If splinting an injured joint, immobilize the bones on either side of the joint.*



Skill Sheet 22-2

# Applying a Sling and Binder

To apply a sling and binder:

**STEP 1**

Follow standard precautions and obtain consent.

**STEP 2**

Support the injured body part *above and below* the site of the injury.



**STEP 3**

Check for circulation and sensation beyond the injured area.



**STEP 4**

Place a triangular bandage under the injured arm and over the uninjured shoulder to form a sling.



(Continued)

**Skill Sheet 22-2****Applying a Sling and Binder** *Continued***STEP 5**

Tie the ends of the sling at the side of the neck.

**STEP 6**

Bind the injured body part to the chest with a folded triangular bandage.

**STEP 7**

Recheck for circulation and sensation beyond the injured area.





## Skill Sheet 22-3

## Applying an Anatomic Splint

After checking the scene and the injured patient:

**STEP 1**

Follow standard precautions and obtain consent.

**STEP 2**

Support the injured part.

- Support both *above and below* the site of the injury.

**STEP 3**

Check for circulation.

- Check for feeling, warmth and color beyond the injury.

**STEP 4**

Position the bandages.

- Place several folded triangular bandages above and below the injured body part.



(Continued)

## Skill Sheet 22-3

Applying an Anatomic Splint *Continued***STEP 5**

Align body parts.

- Place the uninjured body part next to the injured body part.

**STEP 6**

Place padding between the body parts and fill any voids. Tie the bandages securely around both legs.

*Photo: courtesy of the Canadian Red Cross.*

**STEP 7**

Recheck for circulation.

- Recheck for feeling, warmth and color.

**TIP:** *If you are not able to check warmth and color because a sock or shoe is in place, check for feeling.*



Skill Sheet 22-4

# Applying a Soft Splint

To apply a soft splint:

**STEP 1**

Follow standard precautions and obtain consent.

**STEP 2**

Support the injured body part *above and below* the site of the injury.



**STEP 3**

Check for circulation and sensation beyond the injured area.



**STEP 4**

Place several folded triangular bandages *above and below* the injured body part.



(Continued)

## Skill Sheet 22-4

Applying a Soft Splint *Continued***STEP 5**

Gently wrap a soft object (e.g., a folded blanket or pillow) around the injured body part.

**STEP 6**

Tie triangular bandages securely with knots.

**STEP 7**

Recheck for circulation and sensation beyond the injured area.

**NOTE:** *If you are not able to fully check circulation because a sock or shoe is in place, check for sensation.*





# ENRICHMENT

## Agricultural and Industrial Emergencies

Because of the heavy equipment involved, some of the most serious injuries occur on agricultural and industrial sites. You can expect to see crush injuries, avulsions, amputations, and other major open and closed soft tissue and musculoskeletal injuries.

### Scene Size-Up and Safety

As always, size up the scene of an agricultural or industrial emergency before entering. *Never* enter a scene if there is any risk to your safety. Look out for toxic chemicals, fires or fire hazards, unstable or running machinery, and unsecured livestock. If necessary, call specialized personnel, such as the fire department or a hazardous material (HAZMAT) removal team, to stabilize the scene before entering (Fig. 22-26).

Be sure to observe lockout/tagout procedures. Lockout/tagout refers to a set of procedures and practices that safeguard against the unexpected startup of machinery and equipment, or the possible release of hazardous energy when machinery is being maintained. The individual using the machinery turns off and disconnects it from its energy source before performing maintenance, and an authorized employee either locks or tags the energy-isolating device to prevent inadvertent release of energy. Machinery that is on and/or that might be leaking fuel or hydraulic fluid should *not* be approached. An agricultural storage area should *not* be entered alone.

Working in confined spaces is another safety concern. A confined space is one with restricted openings for entry and exit, poor ventilation with possible air contaminants, and physical hazards related to engulfment (being surrounded and overwhelmed by a substance such as soil or grain) or collapse. Such scenes might include pits, tunnels, storage tanks, sewers, ventilation and exhaust ducts, underground utility vaults and pipelines.

A responder who is required to enter a confined space should follow these guidelines:

- An emergency rescue involving entry into a confined space must *never* be attempted without training in safe confined space entry and rescue procedures.
- Assume a confined space is hazardous.
- A person qualified to do so must ensure that structures are safe from collapse prior to anyone entering the confined space.
- An attendant must be present immediately outside the space to provide help to the responder inside, and there must be a plan for emergency rescue.
- There must be a safe method of communication between the responder inside the space and the attendant.
- Appropriate PPE must be worn by the responder entering. Exact equipment is determined by the specific hazards encountered in the confined space (e.g., eye/face and head and foot protection, respiratory protection, safety belts, lifelines and harnesses).
- Once a confined space has been identified, warning signs should be posted and, when possible, the entry physically blocked.
- The conditions must be tested prior to entry and continuously monitored during entry. Testing must be performed by someone who is properly trained and has the appropriate equipment; one's senses should *never* be trusted to determine if the air in a confined space is safe. Many toxic gases and vapors cannot be seen or smelled. This is also not a reliable way to determine if sufficient oxygen is present.
- Adequate air conditions *must* be maintained in the confined space, through proper ventilation.
- If safe atmospheric conditions cannot be maintained, the absolute necessity of entering should be evaluated. If it is necessary to enter, an appropriate respirator must be worn, and this equipment must be evaluated by someone with the proper training to do so.
- Properly trained workers must control utilities prior to entry into confined spaces, including, for example, electrical services, gas, propane, water, sanitary systems, communications and any secondary service systems.
- If an unsafe condition develops, the space should be exited *immediately*.

# ENRICHMENT

## Agricultural and Industrial Emergencies *CONTINUED*



**Fig. 22-26:** Emergencies occurring on industrial sites often involve heavy, powerful, mechanized equipment, and injuries are often compounded by exposure to gases, fumes and chemicals.  
*Photo: courtesy of David Denniston, Director, National FARMEDIC Training Program.*

### Agricultural Emergencies

On an agricultural site, the combination of long hours, powerful mechanized equipment that may or may not be properly maintained and remote locations can be deadly. Expect severe trauma, patients left unfound for hours and a high incidence of spinal injury.

### Typical Injuries

On an agricultural site, injuries most often involve the hands and arms, which can get caught in machinery. The most common injuries include:

- Abrasions.
- Amputations.
- Animal bites.
- Avulsions.
- Burns.
- Concussions.
- Contusions.
- Eye injuries.
- Fractures.
- Lacerations.
- Punctures.
- Sprains.
- Strains.

*Continued on next page*

# ENRICHMENT

## Agricultural and Industrial Emergencies *CONTINUED*

### Working with the Equipment

Injuries associated with different types of machinery each involve a different approach. It is important to have a basic understanding of how each piece of equipment works and how it can cause harm in order to avoid injuries to yourself or further injury to the patient.

Before trying to extricate a patient from agricultural equipment, the equipment must be stabilized and shut down. If necessary, call a specialized crew to do this.

As a general principle, agricultural equipment can be stabilized by blocking or chocking the wheels, putting on the parking brake or tying the equipment to another vehicle. The equipment should be shut down by entering the cab to access the main controls. The engine should be slowed down with the throttle and then the machine switched off using the ignition key. Some diesel-powered machines are shut down via an air shut-off lever rather than an ignition key.

The engine can also be shut off by shutting the fuel line. This is done using the shut-off valve at the bottom of the fuel tank or using vice-grip pliers. If a diesel engine cannot be shut down and the patient is in a life-threatening situation, a 20-pound CO<sub>2</sub> fire extinguisher can be emptied into the air intake. This will shut down the engine but will also cause considerable damage.

*Never touch a control on a piece of agricultural machinery unless you are sure you know what it does.*

### Tractors

Be aware that tractors can be fueled by diesel, gasoline or propane, and that fuel leaks, fires and explosions are a real possibility. Tractors often cause injuries by rolling over onto the rider. Do *not* approach the site until the tractor has been stabilized.

A patient trapped by a tractor can be freed by digging a trench underneath the patient's body or by cutting off a piece of the machine, such as the steering wheel. In some cases, however, the tractor may need to be lifted off the patient by a specialized team.

### Combines

Some common trouble spots on a combine include the auger, which is the rotating part of the screw conveyor; the heads, with their oscillating cutting bars; the reels, steel tines that can impale someone; and the snapping rollers, which can cause crush injuries (Fig. 22-27).



**Fig. 22-27:** Combine parts such as the auger, heads, reels and snapping rollers can cause serious injuries. *Photo: courtesy of Michelle Lala Clark.*

# ENRICHMENT

## Agricultural and Industrial Emergencies *CONTINUED*

The reverse feature should *never* be used in an attempt to extricate a patient from a combine. The safest approach is to keep the machinery from moving, so pry bars and other tools should be used to jam the moving parts into place before beginning extrication. The hydraulic system must be locked. Usually a bar near the hydraulic cylinder will lock the header. If possible, the combine header should be divided from the drive mechanism. An acetylene torch can be used to cut pieces of the combine to free a patient, but the combine and surrounding soil should first be washed down and the inside of the combine flushed, to reduce the risk of fire.

If a patient is trapped in the auger, the auger may need to be first cut free, and it should be transported with the patient. First, a large pipe wrench should be wedged on the shaft to prevent it from reversing, and then the auger drive disconnected. No attempt should be made to extricate a patient in the field if the auger has caused an avulsion.

On older equipment, rescue tools can be used to spread snapping rollers, but this approach will *not* work on newer equipment.

### **Hay Balers**

To free a patient caught in a hay baler, the tines may need to be disassembled by unscrewing the bolts holding it together. The drive belts that drive the cross auger or raise the auger may need to be disassembled with rescue tools. To prevent reverse motion, a pipe wrench can be used to hold on to the input shaft as the auger is cut free. To release a patient from the smooth rollers, the mounting bolts at each end should be removed, to remove the bearings.

An acetylene torch should *never* be used to take apart a hay baler, as the combustible dust inside the baler may ignite.

### **Other Areas**

In addition to the fields, agricultural emergencies may occur in silos, manure storage devices and places where livestock are held. Each of these areas carries its own hazards.

### **Silos**

The major hazard in a silo is the gas formed during fermentation of stored crops, which, when inhaled, can kill within minutes (Fig. 22-28). Keep in mind that “silo gas” can leak out to the surrounding area. Signs of this gas include a bleach-like smell, the presence of dead birds and insects, a yellowish or reddish vapor, and sick livestock nearby. A self-contained breathing apparatus (SCBA) must be worn to rescue a patient in the presence of silo gas. Administer supplemental oxygen to the patient, based on local protocols, and transport them as soon as possible.

### **Manure Storage**

Manure is often flushed from livestock facilities into a holding pond or a closed structure. The hazards include toxic fumes and risk of drowning. To rescue a patient in a manure storage area, you must wear an SCBA and lifeline. Treat an immersed patient as you would a victim of drowning. If the patient is breathing, connect the patient to an SCBA. Also administer supplemental oxygen, based on local protocols. Before transporting the patient, remove any contaminated clothing and flush the patient’s body with water. Do *not* bring any contaminated materials into the transport vehicle. Anyone and everything that came into contact with manure will require decontamination.



#### **CRITICAL FACTS**

If the patient is breathing after a manure storage incident, connect the patient to an SCBA.

*Continued on next page*



# ENRICHMENT

## Agricultural and Industrial Emergencies *CONTINUED*



**Fig. 22-28:** The gas formed during fermentation of crops stored in a silo can kill within minutes when inhaled. *Photo: © Shutterstock.com/Jorg Hackemann.*

### ***Livestock***

Never enter an area with unsecured livestock. Treat injuries inflicted by livestock as you would any similar injury, but be sure to flush animal feces from any wound.

### ***Chemicals Used in Farming***

Many types of chemicals, particularly pesticides and fertilizers, are used in farming. Use protective clothing before entering a scene that may contain pesticides or other chemicals. If necessary, call a HAZMAT removal team. If you know what pesticide was involved in a particular emergency, check the label for instructions and precautions, and take the label with you to the hospital. Before transporting a patient, remove all clothing and flush the patient's body with water.

## **Industrial Emergencies**

The hazards of industrial emergencies often mimic those of agricultural emergencies and include exposure to gases, fumes or other chemicals and to unstable machinery. The specific hazards depend on the site.

### **Scene Size-Up and Safety**

Once again, it is important to size up the scene and not enter it until it has been secured. Keep in mind that even small industrial sites, such as newspaper printers and garages, may present significant hazards. These may include dangerous equipment and machinery, hazardous materials, a risk of explosion or fire, and confined spaces.

When responding to the scene of an industrial emergency, determine whether there are hazardous materials present at the scene before entering. Communicate with staff about potential hazards, especially if you are unfamiliar with the operations. Determine if more than one patient is ill or has been injured, and if so, how many. Also determine the type of environment in which the emergency occurred: was it on the main level, in an elevated location or in a confined space?

# ENRICHMENT

## Agricultural and Industrial Emergencies *CONTINUED*

Once you have performed the scene size-up, communicate with safety or management personnel at the site, prior to entering the scene. Call for any specialized teams that may be needed, for example, to manage hazardous materials. Find out if the site has an emergency plan and whether or not that plan has already been activated. Also initiate the incident command system. Always ensure your safety and that of others in the area before entering the scene.

### Safety Equipment and Guidelines

Before attempting a rescue in an industrial site, locate and speak to the industrial safety or management personnel. They can guide you through the emergency protocols that should be in place at every industrial site.

### Equipment

Hazardous equipment that you may find at industrial sites includes all types of dangerous chemicals and machinery. Chemicals can cause toxic inhalations or absorptions, as well as burns. Be sure to use proper protective gear any time you approach a scene that is suspected of being contaminated with toxic chemicals.

Dangerous types of machinery include presses, hoists, conveyors and crushing devices. As with agricultural emergencies, never approach any equipment that has not been stabilized and shut down. Enlist the help of the safety or management personnel to properly stabilize and shut down machinery.

### Dangerous Locations

Dangerous locations on industrial sites include trenches and confined spaces, especially if there are toxic chemicals that can collect there, and elevated locations. A confined space should *not* be entered until the need for an SCBA has been determined and the possible risk of collapse has been evaluated by a person trained to do so. Sick or injured people in elevated (aboveground) locations may require rescue by specialized high-angle rescue teams.

### Chemicals

A wide range of industrial chemicals is used across various industries and may be found in a gas, aerosol, liquid or solid state. These chemicals can be hazardous either because of the chemicals they contain (e.g., carcinogens, reproductive hazards, corrosives, or agents that affect the lungs or blood) or because of their physical properties (e.g., flammable, combustible, explosive or reactive). Large quantities of these chemicals are present throughout the United States and may pose a risk because of exposure through either routine use or through acts of terrorism. If these hazardous chemicals are released, they could have extremely serious effects on exposed individuals.

In any of their states (gas, aerosol, liquid or solid), these toxic industrial chemicals could enter the body by being inhaled, absorbed through the skin or ingested. The time it takes for these substances to have an effect depends mainly on the route they use to enter the body. Generally, poisoning occurs more quickly if the chemical enters the body through the lungs. Safety Data Sheets (SDS) or chemical information cards will provide information on the effects of each chemical on humans and the symptoms of exposure.

If you or someone you are helping is exposed to a toxic industrial chemical, get yourself and the patient away from the area as quickly as you can. Avoid passing through the contaminated area, if possible. Employers should have an effective plan in place to assist employees in reaching shelter safely. They may be required to “shelter-in-place” if they cannot get out of a building or if the nearest place with clean air is indoors. Health and safety plans should take into account the possible impact of a release of toxic industrial chemicals. Plans should include guidelines such as monitoring, detection, awareness training, PPE, decontamination and medical surveillance of acutely exposed workers.

Responders may have available to them a wide variety of direct reading instruments, as well as procedures for analytical sampling and analysis, to detect toxic industrial chemicals.

*Continued on next page*

# ENRICHMENT

## Agricultural and Industrial Emergencies *CONTINUED*

During or after a toxic chemical release, and if the duration of the chemical release or airborne concentration of chemicals is unknown, Occupational Safety and Health Administration (OSHA) PPE Level B protection should be considered a minimum. Level B requires the highest level of respiratory protection but a lower level of skin protection. Required equipment would include an SCBA, hooded chemical-resistant clothing, special gloves, boots with covers and a hard hat.

# 23

## INJURIES TO THE HEAD, NECK AND SPINE

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### ▶ You Are the Emergency Medical Responder

You are the emergency medical responder (EMR) with an ambulance crew responding at the scene of a motorcycle crash. As you round a curve and approach the scene, you begin your size-up and see that the motorcycle driver is lying on the road, not moving, and two bystanders appear to be rendering assistance. The motorcycle is a considerable distance from where the driver is located. The motorcyclist is wearing a helmet. As you begin your primary assessment, how should you adjust your methods? What types of injuries should you suspect?



## KEY TERMS

**Cerebrospinal fluid:** A clear fluid that flows within the ventricles of the brain, and around the brain and spinal cord.

**Cervical collar:** A commercially produced rigid device that is positioned around the neck to limit movement of the head and neck; also called a C-collar.

**Concussion:** A temporary loss of brain function caused by a blow to the head; considered a traumatic brain injury (TBI).

**Manual stabilization:** A technique used to achieve spinal motion restriction by manually supporting the patient's head and neck in the position found *without* the use of any equipment.

**Spinal column:** The series of vertebrae extending from the base of the skull to the tip of the tailbone (coccyx); also referred to as the spine.

**Spinal cord:** A cylindrical structure extending from the base of the skull to the lower back, consisting mainly of nerve cells and protected by the spinal column.

**Spinal motion restriction (SMR):** A collective term that includes all methods and techniques used to limit the movement of the spinal column of a patient with a suspected spinal injury.

**Traumatic brain injury (TBI):** An injury to the brain resulting from an external force such as a blow to the head or a penetrating injury to the brain; TBIs are associated with temporary and/or permanent impairment to brain function, including physical, emotional and cognitive functioning; a concussion is a common type of TBI.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Relate the mechanism of injury to potential injuries of the head, neck and spine.
- List signs and symptoms of head, neck and spinal injuries.
- Describe general care for head, neck and spinal injuries.
- Describe care for specific head injuries.
- Describe the method of determining if a responsive patient may have a spinal injury.
- Explain the importance of minimizing the movement of a victim with a possible head, neck or spinal injury.
- Discuss various ways of preventing head, neck and spinal injuries.

## SKILL OBJECTIVES

After reading this chapter, and completing the class activities, you should be able to:

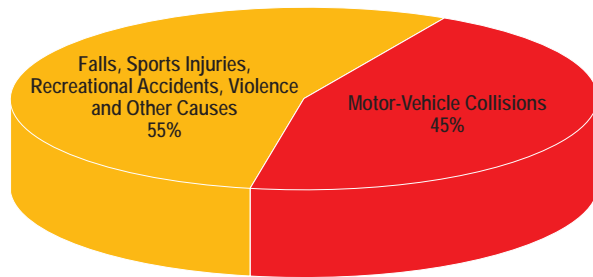
- Perform the proper care for specific head injuries.
- Demonstrate manual stabilization of the head, neck and spine.
- Demonstrate how to immobilize a head, neck or spinal injury to move a patient from the scene to a stretcher (*Enrichment skill*).

## INTRODUCTION

Although injuries to the head, neck and spine account for only a small percentage of all injuries, they are the cause of a significant number of fatalities annually. **Traumatic brain injury (TBI)** alone accounts for about 30 percent of

all injury deaths and approximately 2.5 million emergency department visits a year in the United States. Falls are the leading cause of TBI and other head, neck and spinal injuries, with a large percentage occurring in children up to 14 years of age and adults over the age of 65.

## Causes of Head, Neck and Spinal Injuries



**Fig. 23-1:** Falls, being struck by an object and motor-vehicle collisions are the leading causes of TBI.

Being struck by an object is the second leading cause of TBI, followed by motor-vehicle collisions. Other causes of head, neck and spinal injuries include sports-related mishaps, incidents related to recreational activities and violent acts such as assault (Fig. 23-1).

Survivors of serious head, neck and spinal injuries have a wide range of physical and mental impairments, including paralysis, speech and memory problems, and behavioral disorders.

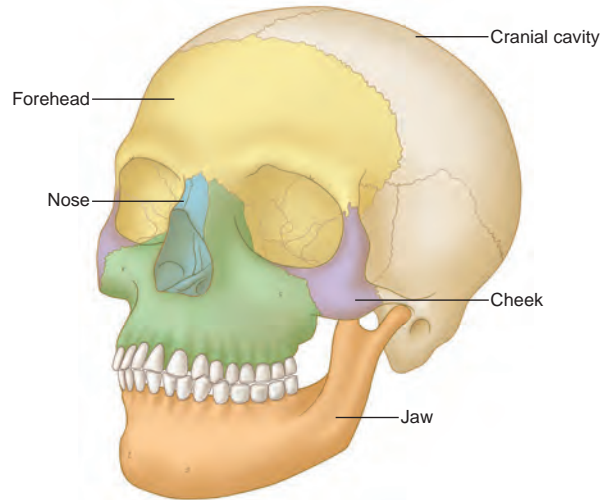
Fortunately, prompt, appropriate care can help minimize the damage from most head, neck and spinal injuries. In this chapter, you will learn how to recognize when a head, neck or spinal injury may be serious. You will also learn how to provide appropriate care to minimize these injuries.

## ANATOMY OF THE HEAD, THE NECK AND THE SPINE

The head contains special sense organs (e.g., eyes, nose and ears), the brain, mouth and related structures. The head is formed by the skull and the face. The four flat bones of the skull are fused together to form a hollow shell. This shell, known as the cranial cavity, contains the brain. The face is on the front of the skull. The bones of the face include the bones of the cheek, forehead, nose and jaw (Fig. 23-2).

The neck contains the esophagus, larynx and part of the trachea. It also contains major blood vessels, muscles and tendons, and the cervical bones of the spine.

The back is made up of soft tissue, bones, cartilage, nerves, muscles, tendons and ligaments. It supports the skull, shoulder bones, ribs and pelvis, and protects the **spinal cord** and other vital organs.



**Fig. 23-2:** The head.

## INJURIES TO THE HEAD

### Head Injuries

The head is easily injured because it lacks the padding of muscle and fat that are found in other areas of the body. The most common cause of death in patients with head injuries is a lack of oxygen to the brain. Also, swelling of the brain tissues or bleeding within the brain can cause increased pressure inside the skull that, in turn, can cause damage to the brain. A brain injury may lead to altered consciousness with airway and breathing problems. The two types of head injury are open and closed.

### Open Head Injuries

Open head injuries involve a break in the skull or occur when an object penetrates the skull. There is direct damage to the skull, and brain damage may be involved. Head injuries bleed profusely, and a patient may lose blood quickly. With open head injuries, it is important that you:

- Control bleeding promptly with dressings, direct pressure and a pressure bandage, while limiting spinal movement (see Skill Sheet 23-1).
- Do *not* apply direct pressure over where there is an obvious skull fracture or depression.
- Do *not* remove any penetrating object; instead stabilize it with thick dressings.

### Closed Head Injuries

Closed head injuries occur when the brain is struck against the skull but the skull remains intact. They can also occur from impact with a blunt object. This type of injury may be more challenging to detect as there may *not* be any visible damage to the skull although, in some cases, swelling

or a depression is evident. In addition to the general signs of head injury, there may be a softness or depression on the skull and blood, or **cerebrospinal fluid** may be leaking from the nose or ears. If you suspect a closed head injury, do *not* control bleeding using direct pressure, as this could cause further injury by pushing bone fragments into the brain. Because of the rigid nature of the skull, if swelling or bleeding in the brain occurs, brain damage may occur depending on the nature and force of the injury.

## Skull Fractures

You should suspect a skull fracture any time there has been significant trauma to the head, even if the patient has suffered a closed head injury. Skull fractures may be accompanied by brain damage, caused by bleeding or swelling within the brain, which is a life-threatening condition. If the patient is showing any of the signs of head injury, a skull fracture may be present and brain injury is possible. A patient with a skull injury should be seen by a more advanced medical professional immediately.

The signs and symptoms of a skull fracture with brain injury include:

- Damage to the skull, including deformity to the skull or face.
- Pain or swelling at the site of injury.
- Blood or other fluids leaking from the mouth, nose, ears or scalp wound.
- Unequal facial movements; drooping, unequal or unresponsive pupils; or vision problems in one or both eyes.
- Bruising around the eyes (“raccoon eyes”) (Fig. 23-3, A).
- Bruising behind the ear (“Battle’s sign”) (Fig. 23-3, B).

## Concussion

A **concussion** is a common type of traumatic brain injury that involves a temporary loss of brain function. Concussions are particularly common sports-related injuries, but they can occur whenever a person experiences a bump, blow or jolt to the head or body that results in rapid movement of the head. A patient who has had one concussion is at increased risk for subsequent concussions.

A concussion can result from even a seemingly minor bump, blow or jolt and may be tricky to recognize. Many patients who experience a concussion do not lose consciousness, or they may only lose consciousness very briefly. Your best clues that a patient may have a concussion are often changes in their behavior noted after they have experienced a bump, blow or jolt. For example, the patient may seem confused, dazed or stunned; lose the ability to remember or follow simple instructions; or ask repeatedly what happened. The patient may complain of a headache, feel nauseated or vomit, have blurred or double vision, complain of dizziness, or be especially sensitive to light or noise. Many patients who have experienced a concussion say that the concussion caused them to feel “sluggish,” “groggy” or just “not right.” Signs and symptoms of a concussion (Table 23-1) usually are apparent soon after the injury, although some can appear hours or days later. For example, the patient may sleep more or less than usual. Children may show changes in playing or eating habits. The effects of the concussion can last for several days, weeks or longer.

If you think that a patient has sustained a concussion, advise them to stop the activity they were engaged in when the incident occurred. The patient should follow up with a healthcare



### CRITICAL FACTS

The head is easily injured because it lacks the padding of muscle and fat that are found in other areas of the body.

Open head injuries involve a break in the skull or occur when an object penetrates the skull. There is direct damage to the skull, and brain damage may be involved. Closed head injuries occur when the brain is struck against the skull but the skull remains intact. They can also occur from impact with a blunt object.

You should suspect a skull fracture any time there has been significant trauma to the head, even if the patient has suffered a closed head injury.

A concussion is a temporary loss of brain function caused by a blow to the head. It is considered a brain injury, although there may be no detectable damage to the brain.



**Fig. 23-3, A–B:** (A) Bruising around the eyes or (B) behind the ear indicates a skull fracture with a possible brain injury.

provider for a full evaluation. A healthcare provider is best able to evaluate the severity of the injury and make recommendations about when the patient can return to normal activities. And, while rare, permanent brain injury and death are potential consequences of failing to identify and respond to a concussion in a timely manner.

### Penetrating Wounds

If an object such as a bullet, knife or nail passes through the skull and lodges in the brain, it is

considered a penetrating wound. Penetrating wounds can cause long-term damage.

Do *not* try to remove an object that is impaled in the skull. Stabilize the object and the wound site with bulky dressings, and then dress the surrounding area with sterile gauze. If you suspect an object has penetrated the skull, but it is not visible, cover the area lightly with sterile dressings. *Never* apply firm, direct pressure to a head injury that shows bone fragments, exposed brain tissue or where a depression is visible. Do *not* stop the flow of blood



Table 23-1:

## Signs and Symptoms of a Concussion

THINKING AND REMEMBERING	PHYSICAL	EMOTIONAL	BEHAVIORAL
<ul style="list-style-type: none"> <li>▪ Difficulty thinking clearly</li> <li>▪ Difficulty remembering events that occurred just prior to the incident and just after the incident</li> <li>▪ Difficulty remembering new information</li> <li>▪ Difficulty concentrating</li> <li>▪ Feeling mentally “foggy”</li> <li>▪ Difficulty processing information</li> </ul>	<ul style="list-style-type: none"> <li>▪ Headache</li> <li>▪ Blurry vision</li> <li>▪ Nausea or vomiting</li> <li>▪ Dizziness</li> <li>▪ Sensitivity to noise or light</li> <li>▪ Balance problems</li> <li>▪ Feeling sluggish (lack of energy)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Irritability</li> <li>▪ Sadness</li> <li>▪ Heightened emotions</li> <li>▪ Nervousness or anxiety</li> </ul>	<ul style="list-style-type: none"> <li>▪ Changes in sleeping habits (sleeping more or less than usual, difficulty falling asleep)</li> <li>▪ Changes in playing and eating habits (in children)</li> </ul>

or cerebrospinal fluid draining from the ears or nose. Apply loose gauze dressings. Keep the patient still and minimize movement of the head and neck.

### Scalp Injuries

Scalp bleeding can be minor or severe. A scalp injury may bleed more than expected due to the large number of blood vessels in the scalp. The bleeding is usually easily controlled with direct pressure. Because the skull may be injured, be careful to press gently at first. If you feel a depression, a spongy area or bone fragments, do *not* put direct pressure on the

wound. Attempt to control bleeding with pressure on the area *around* the wound (Fig. 23-4). Examine the injured area carefully because the patient’s hair may hide part of the wound. If you are unsure of the extent of the scalp injury, summon more advanced medical personnel who will be better able to evaluate the injury. Severe bleeding from the scalp can cause shock in young children and infants.

Once bleeding is controlled, apply several dressings and hold them in place with a gloved hand. Secure the dressings with a roller bandage. Use a pressure bandage if necessary.



**Fig. 23-4:** Control bleeding from a scalp injury by applying pressure around the wound. Avoid direct pressure.

## Signs and Symptoms of Head and Brain Injury

Some of the typical signs and symptoms of head and brain injury include the following:

- Damage to the skull, including deformity to the skull or face
- Pain or swelling at the site of the injury
- Irregular breathing
- A sudden, debilitating headache
- Nausea or vomiting
- Incontinence (involuntary urination or defecation)
- High blood pressure and slowed pulse
- Paralysis or droopiness, often on one side of the body; rigidity of limbs
- Loss of balance
- Asymmetrical facial movements
- Confusion, unresponsiveness or other type of altered mental state
- Facial bruising, including “raccoon eyes” (visible bruising around the eyes)
- External bleeding of the head
- Unusual bumps or depressions on the head
- Blood or other fluids draining from the ears, mouth or nose
- Bruising behind the ears (“Battle’s sign”)
- Unequal pupil size and unresponsive pupils; disturbance of vision in one eye or both
- Speech problems
- Seizures

## Providing Care

Your first step should be to summon more advanced medical care. Making sure to follow standard precautions to prevent disease transmission, provide the following care while waiting for more advanced medical personnel to arrive:

- Establish **manual stabilization** of the head and neck (Fig. 23-5, A–C), perform a primary assessment and maintain manual stabilization while at the scene.
- Maintain an open airway. Monitor the airway, suction if needed and administer supplemental oxygen, based on local protocols.
- Control any bleeding and apply dressings to any open wounds.
- Do *not* apply direct pressure if there are any signs of an obvious skull fracture.
- If there is leaking of cerebrospinal fluid from the ears or a wound in the scalp, cover the area loosely with a sterile gauze dressing.



**Fig. 23-5, A–C:** After summoning more advanced medical care, care for a suspected head and neck injury by maintaining manual stabilization, keeping the head in the position found.

- Do *not* attempt to remove any penetrating object; instead stabilize it with a bulky dressing.
- Maintain manual stabilization until other emergency medical services (EMS) responders relieve you. If you are trained to do so and protocols allow, apply a cervical collar (also called a C-collar). (For more information on backboards, refer to Chapter 5.)
- Monitor the patient's vital signs and mental status closely, and watch for any changes in the patient's status.
- Try to calm and reassure the patient. Encourage the patient to engage in conversation with you; it may prevent loss of consciousness.

## Nosebleed

Nose injuries often result from a blow by a blunt object. A broken nose may be deformed and will swell. Nosebleeds can also be caused by dryness and high blood pressure. Nosebleeds can be painful or the nose may be tender, there can be bleeding only from the nose or the patient could vomit swallowed blood. If the patient is unresponsive, the airway can become blocked by blood. Care for soft tissue injuries to the nose as you would other soft tissue injuries. Apply cold packs to reduce swelling and take special care to maintain an open airway. You can usually control bleeding by having the patient sit with the head slightly forward while pinching the nostrils together for about 10 minutes (Fig. 23-6).

Advanced medical care is needed if the bleeding does not stop, recurs or the patient has a history of high blood pressure. Tell the patient *not* to sniffle or blow their nose. If the patient loses consciousness, place the patient in a side-lying recovery position to allow the blood to drain away from the airway.

Children may have objects in the nose. Do *not* attempt removal, as special lighting and instruments are required. Reassure the child and parent, and call for more advanced medical personnel.



**Fig. 23-6:** Control a nosebleed by having the patient sit with the head slightly forward, pinching the nostrils together.

## Eye Injuries

Injuries to the eye can involve the eyeball, the bone and the soft tissue surrounding the eye. Blunt objects, like a fist or a baseball, may injure the eye and surrounding area, or a smaller object may penetrate the eyeball. Care for open and closed wounds around the eye as you would for any other soft tissue injury.

Injuries to the eyeball itself require different care. Injuries that penetrate the eyeball or cause the eye to be removed from its socket are very serious and can cause blindness. *Never* put direct pressure on the eyeball. Remember that *all* eye injuries should be examined by a healthcare provider. It is *not* necessary to cover both the injured and the uninjured eyes, because sympathetic or involuntary eye movement occurs even when both eyes are covered and not exposed to outside stimuli. Covering both eyes can also cause fear and increase anxiety, especially in children, and pose a safety risk to the patient, but follow local protocols or, if in doubt, contact medical control.

## Assessment

To assess what type of care the patient will need, first determine when the injury occurred, whether one or both eyes were injured, and when the patient first noticed the symptoms. Then, using a small penlight, follow these guidelines:

- Check the eye sockets and eyelids for bruising, lacerations, swelling or deformity.
- Check the whites of the eyes for foreign objects, discoloration or discharge.
- Check that the eyes can move in all directions, and that the pupils react equally to light. Ensure that there is no pain when the eyes move.
- Check that the pupils are equal in size.
- Check that there are no lacerations or foreign objects in the eyeballs.



### CRITICAL FACTS

There are numerous signs and symptoms of head or brain injury, including irregular breathing, high blood pressure and slowed pulse, loss of balance, external bleeding of the head, bruising behind the ears and seizures—among others.

To provide care for a head injury, maintain an open airway and manual stabilization until other emergency medical services (EMS) responders relieve you.

Nose injuries often result from a blow by a blunt object. A broken nose may be deformed and will swell. Nosebleeds can also be caused by dryness and high blood pressure.



## Foreign Bodies

Foreign bodies that get in the eye, such as dirt or slivers of wood or metal, are irritating, painful and can cause significant damage to the cornea. It is important to tell the patient *not* to rub the eyes. *Never* touch the eye and always follow standard precautions when caring for the patient.

If you determine there is a foreign body in the eye, try to remove it by telling the patient to blink several times. If the object is visible on the lower eyelid, pull the eyelid down and try to remove the object with the corner of a sterile gauze pad. Be careful *not* to touch the eyeball.

Next, gently flush the eye with irrigation/saline solution or water (Fig. 23-7). After irrigating, if the object is visible on the upper eyelid, gently roll the upper eyelid back over a cotton swab and attempt to remove the object with the corner of a sterile gauze pad, being careful *not* to touch the eyeball (Skill Sheet 23-2). If the object remains, the patient should receive advanced medical care. Cover the injured eye with an eye pad/shield.

## Chemical Exposure to the Eye

If chemicals have been in contact with the patient's eyes, irrigate the affected eye or

eyes with clean water for at least 15 minutes. If only one eye is affected, make sure you do *not* let the water run into the unaffected eye. If water is not available, you can use sterile saline. Continue care while transporting the patient, if you can.

## Impaled Objects

Do *not* attempt to remove an object that is impaled in the eye. Keep the patient in a face-up position and enlist someone to help stabilize the patient's head. Stabilize the object by encircling the eye with a gauze dressing or soft sterile cloth, being careful *not* to apply any pressure to the area. Position bulky dressings around the impaled object, such as roller gauze, and then cover it with a shield such as a paper cup (Fig. 23-8, A–B). Do *not* use Styrofoam®-type materials, as small particles can break off and get into the eye.

The shield should *not* touch the object. Bandage the shield and dressing in place with a self-adhering bandage and roller bandage covering the patient's injured eye, to keep the object stable and minimize movement (Skill Sheet 23-3). Comfort and reassure the patient. Do *not* leave the patient unattended.



**Fig. 23-7:** Gently flush an eye with a foreign object or one that has undergone chemical exposure with water.



### CRITICAL FACTS

Do *not* attempt to remove an object that is impaled in the eye. Keep the patient in a supine position and enlist someone to help stabilize the patient's head.





**Fig. 23-8, A–B:** To care for an impaled object in the eye, do not attempt to remove the object. Instead, **(A)** stabilize the object with a shield such as a paper cup and **(B)** bandage the cup in place.

## Oral Injuries

Patients with facial injuries may have injuries to their teeth or jaws. Situations that fracture or dislocate the jaw can also cause head, neck or spinal injuries. Maintaining an open and clear airway and restricting spinal motion should be priorities.

The signs and symptoms of oral injuries include:

- Teeth that do not meet or are uneven, loose or missing.
- A patient who is unable to open or close the mouth.
- Saliva mixed with blood.

- Pain in areas around the ears.
- Difficulty or pain when speaking.

If the patient is bleeding from the mouth, and a head, neck or spinal injury is *not* suspected, place the patient in a seated position with the head tilted slightly forward or on their side in a recovery position to allow any blood to drain from the mouth.

If the injury has penetrated the lip, place a rolled dressing between the lip and the gum and another dressing on the outer surface of the lip. If the tongue is bleeding, apply a dressing and



**Fig. 23-9:** For a knocked-out tooth, control bleeding by placing a rolled gauze pad into the space left by the missing tooth and have the patient gently bite down to maintain pressure.

direct pressure. A cold pack may alleviate pain and swelling.

If a tooth is knocked out, control the bleeding by placing a rolled gauze pad into the space left by the missing tooth and have the patient gently bite down to maintain pressure (Fig. 23-9). Try to locate and save the tooth, because a dentist or other healthcare provider may be able to reimplant it. Place the tooth in Hanks' Balanced Salt solution (e.g., Save-A-Tooth®), if available. If you do not have Hanks' Balanced Salt solution, place the tooth in egg white, coconut water or whole milk. If these are not available, place the tooth in the injured patient's saliva. Be careful to pick up the tooth only by the crown (the part of the tooth that is normally visible above the gum line) rather than by the root. The patient should seek dental or emergency care as soon as possible after the injury. The sooner the tooth is reimplanted, the better the chance that it will survive. Ideally, reimplantation should take place within 30 minutes.

Leave intact dentures in position to support the mouth structure. Remove broken dentures and send them with the patient to assist the oral surgeon with jaw alignment.

## INJURIES TO THE NECK AND SPINE

Injuries to the neck or spine can damage both bone and soft tissue, including the spinal cord. It is difficult to determine the extent of damage in neck or spinal injuries. Since generally only X-rays, computerized tomography (CT or CAT) scans or magnetic resonance imaging (MRI) scans can

show the severity of these injuries, you should always care for them as if they are serious.

### Mechanism of Injury

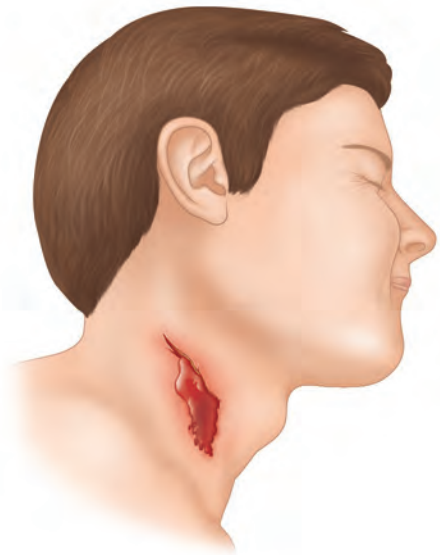
Consider the possibility of a serious neck or spinal injury in a number of situations. These may include:

- Any injury caused by entry into shallow water.
- Injury as a result of a fall greater than a standing height.
- An injury involving a diving board, water slide or entering water from a significant height, such as an embankment, cliff or tower.
- Any injury, such as from a car or other vehicle collision, involving severe blunt force to the person's head or trunk.
- A motor-vehicle, motorized cycle or bicycle collision involving a pedestrian or driver or passengers not wearing safety belts, or one that results in a broken windshield or a deformed steering wheel.
- Injury as the result of a hanging.
- Any unresponsive trauma patient.
- Injury involving a penetrating trauma to the head, neck or torso.
- Any person thrown from a motor vehicle.
- Any injury in which a patient's industrial hard hat or helmet is broken, including a motorcycle, bicycle, football or other sports helmet.
- A person who has other painful injuries, especially of the head and neck.
- A person complaining of neck or back pain or tenderness, tingling in the extremities or weakness.
- An injured person who appears to be frail.
- A person who is not fully alert or appears to be intoxicated.
- Someone with an obvious head or neck injury.
- Sensory deficit or muscle weakness involving the torso or upper extremities.
- Children less than 3 years of age with evidence of head or neck trauma.

### Lacerations of the Neck

The carotid artery and jugular vein are both located in the neck, and injuries to one or both will produce serious, possibly fatal bleeding (Fig. 23-10).

An open wound in the neck may result in an air embolism, which is caused by air being sucked into the wound. A fractured larynx or collapsed trachea is also a common neck injury. If the laceration is caused by an object impaled in the neck, do *not* attempt to remove it.



**Fig. 23-10:** Injuries to the carotid artery or jugular vein will produce serious, possibly fatal, bleeding.

## Signs and Symptoms of Neck and Spinal Injuries

The signs and symptoms of neck injuries may include:

- Obvious lacerations, swelling or bruising.
- Objects impaled in the neck.
- Profuse external bleeding.
- Impaired breathing as a result of the injury.
- Difficulty speaking or complete loss of voice.
- A crackling sound when the patient is speaking or breathing, due to air escaping from an injured trachea or larynx.
- An obstructed airway caused by swelling of the throat.

The signs and symptoms of spinal injuries may include:

- Pain or pressure in the back, independent of movement or palpation.
- Tenderness in the area of the injury.
- Pain associated with moving.

- Numbness, weakness, tingling, or loss of feeling or movement in the extremities.
- Partial or complete loss of movement or feeling below the suspected level of injury.
- Difficulty breathing or shallow breathing.
- Loss of bladder and/or bowel control.

If the patient can walk, move and has feeling in the arms and legs, it does *not* necessarily rule out the possibility of injury to the bones of the spine or to the spinal cord.

## Providing Care

If you suspect a patient has a neck or spinal injury, restrict spinal motion and control any bleeding. Do *not* move the patient or ask the patient to move to try to find a pain response. It is essential when treating neck injuries to maintain an open airway. If the patient is wearing a helmet, do *not* remove it unless you have been trained to do so and have the appropriate resources, or unless it is necessary to access and assess the patient's airway. Because movement of an injured neck or spine can irreversibly damage the spinal cord, keep the patient still. To restrict spinal motion initially, use manual stabilization with your hands or knees. Perform a primary assessment on the scene while maintaining spinal motion restriction (SMR). Assess the patient's pulse, movement and feeling in the extremities.

Approach patients from the front so they can see you without turning their heads, and tell patients to respond verbally to your questions. Ask the responsive patient the following questions, while maintaining SMR, to further assess the situation:

- Does your neck or back hurt?
- What happened?
- Where does it hurt?
- Can you move your hands and feet?
- Can you feel where I am touching?

For an unresponsive patient, maintain an open airway using the jaw-thrust (without head extension) maneuver and assist ventilation if needed. You



### CRITICAL FACTS

Injuries to the neck or spine can damage both bone and soft tissue, including the spinal cord. It is difficult to determine the extent of damage in neck or spinal injuries. Always care for these types of injuries as if they are serious.

You should suspect possible serious neck or spinal injury in many situations, including but not limited to diving board mishaps, motor-vehicle crashes where a person has been thrown from the vehicle, and situations where hard hats or helmets have been broken.

should *not* attempt to align the head and neck with the body unless you cannot maintain an open airway, you need to remove a helmet or you need to assist with the application of a C-collar.

Administer supplemental oxygen based on local protocols. While obtaining further information, maintain SMR of the head and neck in the position in which they were found. Obtain any further information from others at the scene to determine the mechanism of injury and the patient's mental status before your arrival.

Keeping the head, neck and spine from moving (**spinal motion restriction**) helps prevent further damage to the **spinal column**. If a second responder is available, that person can provide care for any other conditions while you keep the head and neck stable.

Assist more advanced medical personnel upon arrival by maintaining SMR. More advanced medical personnel will then apply a cervical collar to further assess the patient to determine the best way to prepare them for transport. If you must move the patient, secure the patient to a backboard or other extrication device prior to moving them. Backboards should be used only for extricating the patient from the scene and moving them to the ambulance, as evidence has shown that backboards are not beneficial for spinal cord injuries and can cause harm. Always follow local protocols when considering care for a suspected spinal injury.

## Helmet Removal

When you encounter a patient who has sustained injuries while wearing a helmet, you must assess whether it is necessary to remove the helmet. As always, assess breathing and pulse and determine your course of action.

Since properly fitted helmets fit snugly to the head, it is difficult to remove one without moving the patient's head and neck. Removing a helmet requires a minimum of two responders. When providing care to a patient with a helmet, you should only remove it if it is impeding your care, you are unable to access and assess the airway, or if the patient is in cardiac arrest. Otherwise,

do *not* try to remove it. If the patient is breathing and the airway is clear, maintain SMR with the helmet in place. Consider the need to pad under the shoulders to maintain the airway in a neutral position. Additionally, both the helmet and the shoulder pads, if worn, should be removed to maintain the patient in a neutral position.

Some helmets are closed in front with face protectors. If the protector cannot be lifted out of the way, it is preferable that it be cut off rather than the helmet removed.

Situations that may require removing the helmet include those in which:

- You cannot access or assess the patient's airway and breathing.
- The airway is impeded and cannot be opened with the helmet on.
- The patient is in cardiac arrest.
- You cannot immobilize the spine.

If a helmet is loose, this does *not* necessarily mean you must remove it. Try to stabilize the helmet by adding padding between the helmet and the patient's head.

## Preventing Head, Neck and Spinal Injuries

While some injuries are unavoidable, many others are preventable by being aware of potential dangers in the environment and taking appropriate safety measures. To prevent head, neck and spinal injuries, take the following steps:

- Know your risk. Be aware of your surroundings and wear appropriate safety equipment and protective devices such as padding, footwear, helmets and eye protection.
- Do not dive into a body of water if you are unsure of the depth.
- Wear your seat belt in a motor vehicle. Insist that passengers wear seat belts and *always* transport children in approved child safety seats in the back of the vehicle, according to state and local regulations.
- To prevent head and neck injuries in rear-end collisions, properly adjust your motor vehicle's



### CRITICAL FACTS

Backboards should be used only for extricating the patient from the scene and moving them to the ambulance, as evidence has shown that backboards are not beneficial for spinal cord injuries and can cause harm.



headrest. The top of the headrest should be as high as the top of your head and no more than 4 inches from the back of your head.

- To prevent falls, safety-proof your home and workplace. Ensure that hallways and stairways are well lit and stairways have handrails.
- Always use a stepstool or a stepladder to reach objects out of reach. Do *not* attempt to pull heavy objects that are out of reach over your head.
- Use good lifting techniques when lifting and carrying heavy objects.
- Use nonslip treads or carpet on stairways, and secure any area rugs with double-sided tape.
- Use nonslip mats in the bathtub, or install handrails.
- Know your risk for osteoporosis, a bone disease responsible for many spine, hip, wrist and other fractures. Make sure you have enough calcium in your diet, and engage in weight-bearing exercises like walking or weight training to increase bone density and stimulate new bone formation.

## PUTTING IT ALL TOGETHER

In this chapter, you learned how to recognize and care for serious head, neck and spinal injuries. To decide whether an injury is serious, you

must consider its cause. Often the cause is the best indicator of whether an injury to the head, neck or spine should be considered serious. You must also carefully assess the signs and symptoms. If you have any doubts about the seriousness of an injury, summon more advanced medical personnel.

Like injuries elsewhere on the body, injuries to the head, neck and spine often involve both soft tissues and bones. Control bleeding as necessary, usually with direct pressure on the wound. With scalp injuries, however, be careful *not* to apply pressure to a possible skull fracture. With eye injuries, remember *not* to apply pressure on the eyeball.

If you suspect that the patient may have a serious head, neck or spinal injury, minimize movement of the injured area when providing care. Minimizing movement is best accomplished by providing spinal motion restriction using manual stabilization (Skill Sheet 23-4). Apply a cervical collar and secure the patient to a backboard or other extrication device if you must move the patient from the scene to the ambulance, you are trained to do so and local protocols allow.

Many injuries are preventable if simple safety precautions are followed. Know your risks and mitigate your danger of injury.

## ▶ You Are the Emergency Medical Responder

As you assess the patient, you find that you cannot determine the status of the airway or breathing because of the patient's helmet. What injuries should you suspect? What can you do to access and assess the airway?

## Skill Sheet 23-1

# Controlling Bleeding from an Open Head Wound

**NOTE:** Always follow standard precautions when providing care, and summon more advanced medical personnel if necessary.

## STEP 1

Apply direct pressure.

- Place a sterile dressing or clean cloth over the wound and press gently against the wound with your hand.
- Do *not* put direct pressure on the wound if you feel a depression, spongy area or bone fragments.
- Press gently on the area *around* the wound.



## STEP 2

Elevate the body part.

- Elevate the head and shoulders *unless* you suspect an injury to the spine.

## STEP 3

Apply a pressure bandage.

- Using a roller bandage, cover the dressing completely, using overlapping turns.
- Tie or tape the bandage in place.
- If blood soaks through the bandage, leave the original dressing in place but remove and replace any additional dressings and bandages over the wound.



(Continued)

## Skill Sheet 23-1

# Controlling Bleeding from an Open Head Wound *Continued*

### **STEP 4**

If bleeding stops:

- Determine if further care is needed.

### **STEP 5**

If bleeding does *not* stop:

- Summon more advanced medical personnel.

## Skill Sheet 23-2

## Caring for Foreign Bodies in the Eye

**NOTE:** Tell the patient not to rub the eyes. Never touch the eye and always follow standard precautions when providing care.

**STEP 1**

Remove the foreign object from the eye.

- Tell the patient to blink several times.
- If the object is visible on the lower eyelid, pull the eyelid down and try to remove the object with the corner of a sterile gauze pad.

**NOTE:** Be careful not to touch the eyeball.

**STEP 2**

Gently flush the eye with water or irrigation/saline solution.

**STEP 3**

If the object is visible on the upper eyelid, gently roll the upper eyelid back over a cotton swab and attempt to remove the object with the corner of a sterile gauze pad, being careful *not* to touch the eyeball.

**NOTE:** If the object remains, the patient should receive advanced medical care. Cover the injured eye with an eye pad/shield.





## Skill Sheet 23-3

# Bandaging an Eye with an Injury from an Impaled Object

**NOTE:** Do not attempt to remove an object that is impaled in the eye. Keep the patient in a face-up position and enlist someone to help stabilize the patient's head. Always follow standard precautions when providing care.

**STEP 1**

Stabilize the object by encircling the eye with a gauze dressing or soft sterile cloth.

- Do not apply any pressure to the area.

**STEP 2**

Position bulky dressings around the impaled object, such as roller gauze, and then cover it with a shield such as a paper cup.

- The shield should *not* touch the object.

**NOTE:** Do not use Styrofoam®-type materials, as small particles can break off and get into the eye.

**STEP 3**

Bandage the shield and dressing in place with a self-adhering bandage and roller bandage covering the patient's injured eye to keep the object stable and minimize movement.

**STEP 4**

Comfort and reassure the patient.

**NOTE:** Do not leave the patient unattended.

## Skill Sheet 23-4

# Spinal Motion Restriction Using Manual Stabilization

**NOTE:** Call for more advanced medical personnel for a head, neck or spinal injury, while minimizing movement of the head, neck and spine. Always follow standard precautions when providing care.

**STEP 1**

Minimize movement by placing your hands on *both* sides of the patient's head.

**STEP 2**

Support the head in the position found.

**NOTE:** Do not align the head and neck with the spine if the head is sharply turned to one side, there is pain on movement or if you feel any resistance when attempting to align the head and neck with the spine. Instead, gently maintain the head and neck in the position found.

**STEP 3**

Maintain an open airway. Control any external bleeding and keep the patient from getting chilled or overheated.

**NOTE:** Gently position the patient's head in line with the body; if you cannot maintain an open airway, you need to remove a helmet or you need to apply a C-collar.

# ENRICHMENT

## Removing Helmets and Other Equipment

If you determine that it is necessary to remove a helmet from a patient to provide care, you must do so correctly to avoid causing further harm to the patient.

Helmets fall into multiple categories including sports helmets and motorcycle helmets. Sports helmets usually have an opening in front, which allows for easier access to the airway. You can usually remove the face mask on a football helmet by cutting the plastic clips with pruning shears or using a screwdriver to unscrew the clips. Avoid trying to unsnap or manipulate the clips as it may cause unnecessary movement of the head and neck. It is more difficult to access the airway with a motorcycle helmet in place, as they usually cover the full face and the airway.

The steps for a *non-athletic* helmet removal require two responders and are as follows:

1. If the patient is wearing glasses, remove them first before attempting helmet removal.
2. The first responder applies stabilization by holding both sides of the helmet, with fingers on the patient's lower jaw (Fig. 23-11, A). This will prevent the helmet from moving around if the strap is loose.
3. The second responder loosens the strap at the D-rings while the first responder maintains manual stabilization (Fig. 23-11, B).
4. The second responder then places one hand on the patient's mandible at an angle, with the thumb on one side, and the long and index fingers on the other. With the other hand, the second responder holds the back of the patient's head (occipital region).
5. The first responder then removes the helmet halfway, making sure to clear the ears, while the second responder readjusts hand position under the patient's head. The first responder then removes the helmet the rest of the way, making sure to tilt backward to avoid hitting the nose (Fig. 23-11, C).
6. The second responder maintains manual stabilization throughout, from below, preventing head tilt. After the helmet has been removed, the first responder replaces the hands over the ears, taking over responsibility for stabilization (Fig. 23-11, D).
7. The first responder maintains manual stabilization from above until a cervical collar can be applied (Fig. 23-11, E).

For an emergency medical responder (EMR), the removal of athletic equipment, such as football helmets, is usually more challenging than the removal of a motorcycle helmet. Unlike a motorcycle helmet, removal of a football, hockey or lacrosse helmet alone without removal of the athlete's shoulder pads increases the risk of cervical movement and further spinal injury. If an athlete is suspected of having a spinal injury, the helmet should *only* be removed when:

- The face mask cannot be removed after a reasonable period of time to gain access to the airway.
- The design of the helmet and chin strap, even in the absence of the face mask, does not allow for a controlled airway or adequate ventilation.
- The design of the helmet and chin straps do not hold the head securely in place (immobilization of the helmet does not also immobilize the head).
- The helmet prevents extrication of the patient for transport in an appropriate position.

The face mask *should* be removed after an athlete is suspected of having a spinal injury, even if the patient is still conscious. A face mask is held in place using four loop-straps, two on the top and one on either side. Each of these loop-straps must be removed by one EMR while a second responder minimizes neck movement and maintains the neck in a neutral position (Fig. 23-12, A). The loop-straps can be removed using a variety of tools such as a screwdriver, pruner shear and several other commercial devices designed specifically for this task (Fig. 23-12, B). However, this is a skilled task, requiring practice. The two side loop-straps are removed first, followed by the two top loop-straps (Fig. 23-12, C). *Never* use items such as razor blades, scalpels, or emergency medical technician (EMT) or trauma shears to remove the loop-straps, as these items increase the risk of injury to the athlete and the EMR and may delay removal of the face mask.

# ENRICHMENT

## Removing Helmets and Other Equipment *CONTINUED*



**Fig. 23-11, A–E:** Remove a helmet only if it is impeding care or blocking access to the airway or if the patient is in cardiac arrest.

To remove a helmet and shoulder pads, one EMR must provide manual stabilization while a second EMR cuts away the chin strap, shoulder pad straps and jersey. This is followed by removal of the internal cheek pads (using a tongue depressor) and deflating the helmet's air bladder system, if necessary (using a syringe or air pump), while another trained responder stabilizes the chin and back of the neck. Two to four other trained responders are placed at strategic locations along the body to support the shoulders, upper torso and other locations based on the size of the athlete. The athlete is lifted and the helmet is slid off the head by rotating the helmet in an anterior direction. Do *not* attempt to spread the helmet by the ear holes, as this will only tighten the

*Continued on next page*



# ENRICHMENT

## Removing Helmets and Other Equipment *CONTINUED*



**Fig. 23-12, A–C:** To remove a face mask: **(A)** One EMR should minimize neck movement, maintaining a neutral position for the neck. **(B)** A second EMR removes the loop-straps. **(C)** Once the loop-straps are removed, the face mask can be removed.

helmet on the head causing further spinal movement and possible injury. Once the helmet is off, the shoulder pads are immediately removed by spreading apart the front panels and pulling them around the head. Remove any clothing or equipment under the shoulder pads. Lower the athlete back to the ground.

Removal of protective equipment such as a football helmet and shoulder pads is a skilled technique, requiring hours of practice. It often requires a minimum of five responders trained in this skill. If this type of situation is encountered during an athletic event, look to the certified athletic trainer to assist in removal of the face mask, helmet and shoulder pads, as the necessary tools will be included in athletic emergency kits. Prior planning and interdisciplinary practice among the EMR, certified athletic trainer and emergency department personnel is recommended prior to the beginning of the athletic season, particularly for football.

# ENRICHMENT

## Cervical Collars and Backboarding

A **cervical collar** (also called a C-collar) is a rigid device positioned around the neck to limit movement of the head and neck (Fig. 23-13). Once you have spinal motion restriction (SMR), a rigid C-collar should be applied if local protocols and medical direction permit. This collar helps minimize movement of the head and neck and keeps the head in line with the body. Applying a C-collar requires two responders. While one responder maintains SMR, another carefully applies an appropriately sized C-collar. An appropriately sized collar is one that fits securely, with the patient's chin resting in the proper position and the head maintained in line with the body (Fig. 23-14). Some C-collars come with specific manufacturer's instructions for proper sizing. Do *not* apply a C-collar in a circumstance in which you would not want to align the head with the body.

Once a C-collar has been applied and SMR is maintained, the patient's entire body should be immobilized for extrication (see Skill Sheet 23-5). This can be done using the following equipment:

- A backboard
- Head immobilizer
- Straps

If you do not have a backboard or other extrication device available, support the patient in the position in which the patient was found until more advanced medical personnel arrive. Once a C-collar is in place, the patient is positioned on a backboard or other device, such as a scoop stretcher. This is done by "log rolling"



**Fig. 23-13:** Cervical collars (C-collars).



**Fig. 23-14:** A C-collar should fit securely, with the patient's chin resting in the proper position.

*Continued on next page*

# ENRICHMENT

## Cervical Collars and Backboarding *CONTINUED*

the patient onto the board. This technique keeps the head in line with the body. It requires a minimum of three responders: one to support the head and maintain SMR, and two others to position the backboard and roll the patient's body. However, it is highly preferable to have at least *four* responders available to perform this technique. One responder can provide SMR and the others can log roll the patient and position the backboard.

Once the patient is on the board, use several straps to secure the patient's body to the backboard. There are several ways to apply the straps used to secure the patient onto the board. A common way is to secure the chest by crisscrossing the straps. Regardless of which method is used, the straps should be snug but not so tight as to restrict movement of the chest during breathing. With the remaining straps, secure the patient's hips, thighs and legs. Secure the hands in front of the body.

Once the patient's body is secured to the backboard, secure the patient's head. If the patient's head does not appear to be resting in line with the body, you may need to place a small amount of padding, such as a small folded towel, to support the head. Normally, approximately 1 inch of padding is all that is needed to keep the head in line with the body and at the same time provide comfort for the patient. Next, use a commercially made head-immobilization device. Many of these devices use Velcro® straps to secure the head. You should follow the manufacturer's instructions when using these devices. Based on local protocols, patients may be removed from the backboard once they are placed on the ambulance stretcher. Remember that the purpose of the backboard is for extricating the patient from the scene and moving them to the ambulance. It is not for transportation to the hospital.

## Skill Sheet 23-5

# Immobilizing a Head, Neck or Spinal Injury

**NOTE:** Call for more advanced medical personnel for a head, neck or spinal injury, while minimizing movement of the head, neck and spine. Always follow standard precautions when providing care.

## STEP 1

Apply spinal motion restriction.

- Place your hands on *both* sides of the patient's head.
- Gently position the head in line with the body, if necessary.
- Support the head in that position.



**NOTE:** Do **not** align the head and neck with the spine if the head is sharply turned to one side, there is pain on movement or if you feel any resistance when attempting to align the head and neck with the spine. Instead, gently maintain the head and neck in the position found.

## STEP 2

Apply a cervical collar (C-collar).

- One responder maintains spinal motion restriction.
- A second responder applies appropriately sized C-collar (correct size as determined by manufacturer's instructions).



## STEP 3

Log roll the patient onto a backboard.

- One responder maintains spinal motion restriction of the head.
- Additional responders support patient's shoulders, hips and legs.
- Roll the patient in unison, keeping the patient's head and spine in alignment until the patient is resting on their side.
- Position the backboard.
- Log roll the patient onto the backboard.



(Continued)



## Skill Sheet 23-5

Immobilizing a Head, Neck or Spinal Injury *Continued***STEP 4**

Secure the patient's body.

- Secure the patient's chest.
- Secure the patient's arms, hips, thighs and legs with the remaining straps.
- If necessary, secure the patient's hands in front of the body.

**STEP 5**

Secure the patient's head.

- Place padding beneath the head if it is not resting in line with the body.
- If a commercial head immobilizer is not available, place a folded or rolled blanket around the head and neck.
- Secure the forehead.



# UNIT 7

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# 24

## CHILDBIRTH

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### ▶ You Are the Emergency Medical Responder

You are the lifeguard at a local pool and are working as the emergency medical responder (EMR) at that facility for the day. A young woman runs over to you and tells you that she thinks her older sister is in labor. How should you respond?



## KEY TERMS

**Abruptio placentae:** Placental abruption; a life-threatening emergency that occurs when the placenta detaches from the uterus.

**Amniotic fluid:** The fluid in the amniotic sac; bathes and protects the fetus.

**Amniotic sac:** “Bag of waters”; sac that encloses the fetus during pregnancy and bursts during the birthing process.

**APGAR score:** A mnemonic that describes five measures used to assess the newborn: Appearance, Pulse, Grimace, Activity and Respiration.

**Birth canal:** The passageway from the uterus to the outside of the body through which a baby passes during birth.

**Bloody show:** Thick discharge from the vagina that occurs during labor as the mucous plug (mucus with pink or light red streaks) is expelled; often signifies the onset of labor.

**Braxton Hicks contractions:** False labor; irregular contractions of the uterus that do not intensify or become more frequent as genuine labor contractions do.

**Breech birth:** The delivery of a baby’s feet or buttocks first.

**Bulb syringe:** Small nasal syringe to remove secretions from the newborn’s mouth and nose.

**Cervix:** The lower, narrow part of the uterus (womb) that forms a canal that opens into the vagina, which leads to the outside of the body; upper part of the birth canal.

**Cesarean section:** C-section; delivery of a baby through an incision in the mother’s belly and uterus.

**Contraction:** During labor, the rhythmic tightening and relaxing of muscles of the uterus.

**Crowning:** The phase during labor when the baby’s head is visible at the opening of the vagina.

**Dilation:** During the first stage of labor, refers to the opening of the cervix to allow the baby to be born.

**Dropping:** “Engagement” or “lightening”; when the baby drops into a lower position and is engaged in the mother’s pelvis; usually takes place a few weeks before labor begins.

**Eclampsia:** A complication during pregnancy in which the patient has convulsions or seizures associated with high blood pressure.

**Ectopic pregnancy:** A pregnancy outside of the uterus; most often occurs in the fallopian tubes.

**Embryo:** The term used to describe the early stage of development in the uterus, from fertilization to the beginning of the third month.

**Fetal monitoring:** A variety of tests used to measure fetal stress, either internally or externally.

**Fetus:** The term used to describe the stage of development in the uterus after the embryo stage, beginning at the start of the third month.

**Hemorrhagic shock:** Shock due to excessive blood loss.

**Implantation:** The attachment of the fertilized egg to the lining of the uterus, 6 or 7 days after conception.

**Labor:** The birth process, beginning with the contraction of the uterus and dilation of the cervix, and ending with the stabilization and recovery of the mother.

**Meconium aspiration:** Aspiration of the first bowel movement of the newborn; can be a sign of fetal stress and can lead to meconium aspiration syndrome.

**Miscarriage:** A spontaneous end to pregnancy before the 20th week; usually because of birth defects in the fetus or placenta; also called a spontaneous abortion.

**Mucous plug:** A collection of mucus that blocks the opening into the cervix and is expelled, usually toward the end of the pregnancy, when the cervix begins to dilate.

**Multiple birth:** Two or more births in the same pregnancy.

**Obstetric pack:** A first aid kit containing items especially helpful in emergency delivery and initial care after birth; items can include personal protective equipment, towels, clamps, ties, sterile scissors and bulb syringes.

**Placenta:** An organ attached to the uterus and unborn baby through which nutrients are delivered; expelled after the baby is delivered.

**Placenta previa:** Placental implantation that occurs lower on the uterine wall, touching or covering the cervix; can be dangerous if it is still covering part of the cervix at the time of delivery.

**Preeclampsia:** A type of toxemia that occurs during pregnancy; a condition characterized by high blood pressure and excess protein in the urine after the 20th week of pregnancy.

(Continued)



## KEY TERMS continued

**Premature birth:** Birth that occurs before the end of the 37th week of pregnancy.

**Prolapsed cord:** A complication of childbirth in which a loop of the umbilical cord protrudes through the vagina before delivery of the baby.

**Stabilization:** The final stage of labor in which the mother begins to recover and stabilize after giving birth.

**Stillbirth:** Fetal death; death of a fetus at 20 or more weeks of gestation.

**Toxemia:** An abnormal condition associated with the presence of toxic substances in the blood.

**Trimester:** A three-month period; there are three trimesters in a normal pregnancy.

**Umbilical cord:** A flexible structure that attaches the placenta to the fetus, allowing for the passage of blood, nutrients and waste.

**Uterus:** A pear-shaped organ in a woman's pelvis in which an embryo forms and develops into a baby; also called the womb.

**Vagina:** Tract leading from the uterus to the outside of the body; often referred to during labor as the birth canal.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Describe each trimester of pregnancy.
- Describe the four stages of labor.
- Describe how to help the mother with labor and normal delivery.
- Describe how to assess a newborn.
- Describe how to control bleeding after birth.
- Describe how to care for the newborn and mother.
- List complications during pregnancy.
- Describe complications during delivery.

## INTRODUCTION

Someday, you may be faced with a situation requiring you to assist with childbirth. If you have never seen or experienced childbirth, your expectations probably consist of what others have told you.

Terms such as exhausting, stressful, exciting, fulfilling, painful and scary are sometimes used to describe a planned childbirth, one that occurs in the hospital or at home under the supervision of a healthcare provider. If you find yourself assisting with the delivery of a baby, however, it is probably not happening in a planned situation. Therefore, your feelings, as well as those of the expectant mother, may be intensified by fear of the unexpected or the possibility that something might go wrong.

Take comfort in knowing that things rarely go wrong. Childbirth is a natural process. Thousands of children all over the world are born each day, without complications, in areas where no medical assistance is available during childbirth.

By following a few simple steps, you can effectively assist in the birth process. This chapter will help you better understand the birthing process, how to assist with the delivery of a baby, how to provide care for both the mother and newborn, how to recognize complications and what complications could require more advanced care.

## ANATOMY AND PHYSIOLOGY OF PREGNANCY

The developing fetus is contained in the uterus and surrounded by **amniotic fluid**. The **uterus** is made up of a special arrangement of smooth muscle and blood vessels that allow it to enlarge significantly during pregnancy and to forcibly contract during labor and delivery. The ability of the uterus to produce strong contractions helps pass the baby from the uterus into the **birth canal**. Strong contractions also help

the uterus constrict blood vessels, thus preventing hemorrhage, and help the uterus return to its previous size.

The **cervix** (or neck of the uterus) is the lower, narrow part of the uterus that forms a canal that opens into the **vagina**, which contains a mucous plug up to the time of labor. The **mucous plug** seals the uterine opening and prevents any contamination. Once labor begins and the cervix begins to dilate (widen), the mucous plug is expelled. The fetus is pushed through the cervix and vagina.

The **placenta**, or “organ of pregnancy,” begins to develop inside the uterus after the egg attaches itself to the uterine wall. It is rich in blood vessels, and its purpose is to deliver oxygen and nourishment to the fetus from the mother, and remove carbon dioxide and waste products.

## NORMAL PREGNANCY

The duration of a full-term pregnancy spans a 9-month period, or 38 weeks from the time in which the **embryo** becomes implanted into the woman’s uterus. The due date is usually calculated as 40 weeks from the woman’s last menstrual period (Fig. 24-1). Pregnancy is broken down into 3 **trimesters**, each lasting approximately 3 months.

### First Trimester

**Implantation** and rapid development of the embryo occur during the first trimester of pregnancy. Usually implantation takes place with no noticeable symptoms, although slight bleeding may occur in some women. The gradual appearance of morning sickness is common during the first trimester. Morning sickness occurs in 70 percent of pregnant women and usually disappears

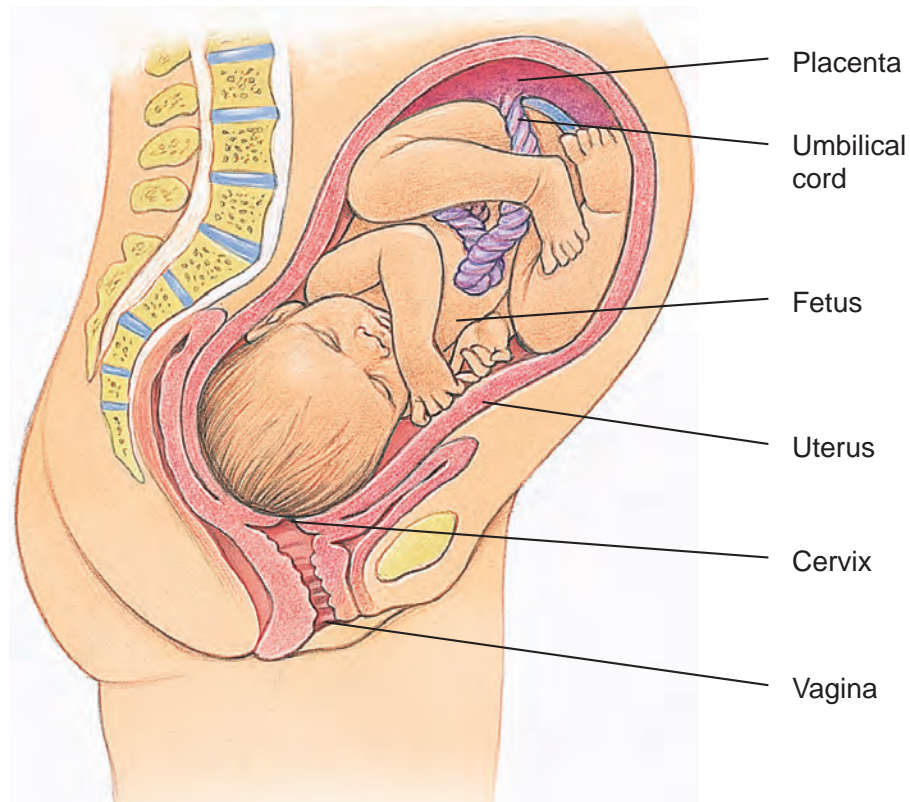


Fig. 24-1: Mother and fetus at 40 weeks.



### CRITICAL FACTS

The duration of a full-term pregnancy spans a 9-month period, or 38 weeks from the time in which the embryo becomes implanted into the woman’s uterus. The due date is usually calculated as 40 weeks from the woman’s last menstrual period. Pregnancy is broken down into 3 trimesters, each lasting approximately 3 months.

by the second trimester. Also, the first trimester is generally the time in which a miscarriage, also called a spontaneous abortion, might occur.

As the embryo grows, its organs and body parts develop. After about 8 weeks, the embryo is called a **fetus**. To continue developing properly, the fetus must receive nutrients, which it receives from the mother through the placenta. The placenta is attached to the fetus by a flexible structure called the **umbilical cord**.

## Second Trimester

Pregnant women commonly experience a feeling of re-energization during the second trimester. This is also when a woman will begin to “show,” putting on more weight with the growth of the fetus. The mother can now detect “quickenings,” or movement of the fetus. The fetus has begun to produce insulin and is urinating, and the placenta is fully developed. Teeth are visible inside the gums, and it is now possible to determine if the fetus is male or female.

## Third Trimester

The mother gains the most weight during the third trimester, when the fetus grows most rapidly. An expanding abdomen sometimes causes the mother’s navel to become convex. Growth of the baby can cause discomfort for the mother, including weak bladder control and backache. The size and movement of the baby may also cause pain or discomfort when pressure is applied to the woman’s ribs and spine. The baby moves into a head-down position in preparation for birth, which is known as **dropping**. Babies born during the third trimester, but prior to full term, have a good chance of surviving, due to ever-advancing technology and improved intensive care practices.

## BIRTH AND LABOR PROCESS

Pregnancy culminates in the birth process, or **labor**, during which the baby is delivered. Labor begins with rhythmic contractions of the uterus. This may follow or be accompanied by rupture of the **amniotic sac** (the “water breaking”) and a gush of clear fluid. As contractions continue, they dilate the cervix. When the cervix is sufficiently dilated, it allows the baby to travel from the uterus through the birth canal and into the outside world. For first-time mothers, this process normally takes between 12 and 24 hours. Subsequent deliveries usually require less time. The labor process has four distinct stages. The length and intensity of each stage vary.

### First Stage: Dilation

In the first stage of labor, the mother’s body prepares for the birth. This stage covers the time from the first contraction until the cervix is fully dilated. A **contraction** is a rhythmic tightening and relaxing of the muscles in the uterus. Like a wave, it begins gently, rises to a peak of intensity and then subsides. A break occurs between contractions, and a contraction usually lasts about 30 to 60 seconds. Contractions cause **dilation**, the process that allows the mother’s cervix to expand enough for the baby to pass through during the birth (Fig. 24-2, A).

During this stage of labor, the mucous plug may emerge. The release of the mucous plug, referred to as the **bloody show**, may also have occurred prior to labor. Before or during labor the amniotic sac will break, releasing the amniotic fluid. When this happens, people often say the woman’s “water has broken.” As the time for delivery approaches, the contractions occur closer together, last longer



### CRITICAL FACTS

Implantation and rapid development of the embryo occur during the first trimester of pregnancy.

Pregnant women commonly experience a feeling of re-energization during the second trimester. This is also when a woman will begin to “show,” putting on more weight with the growth of the fetus.

The mother gains the most weight during the third trimester, when the fetus grows most rapidly. An expanding abdomen sometimes causes the mother’s navel to become convex.

Pregnancy culminates in the birth process, or labor, during which the baby is delivered. Labor begins with rhythmic contractions of the uterus. This may follow or be accompanied by rupture of the amniotic sac (“water breaking”) and a gush of clear fluid. The labor process has four distinct stages. The length and intensity of each stage vary.

and feel stronger. Normally, when contractions are less than 3 minutes apart, delivery is near. The woman may be in considerable discomfort at this time. This stage is the longest, and may last for 18 hours or more, especially for a first delivery. For a woman who has already gone through labor, this stage may last only a few hours.

## Second Stage: Expulsion

The second stage of labor begins when the cervix is completely dilated, and includes the baby's movement through the birth canal and delivery (Fig. 24-2, B). During this stage of labor, the mother will experience enormous pressure, similar to the feeling she has to have a bowel movement. This sensation is an indication that it is time for her to push or "bear down," to help ease the baby through the birth canal. Considerable blood may come from the vagina at this time. Contractions are more frequent during this stage, and may last between 45 and 90 seconds each. In a normal delivery, the baby's head becomes visible as it emerges from the vagina. When the top of the head begins to emerge, called **crowning**, birth is imminent and you must be prepared to receive the baby (Fig. 24-3).

## Third Stage: Placental Delivery

Once the baby's body emerges, the third stage of labor begins. During this stage, the placenta usually separates from the wall of the uterus and exits from the birth canal (Fig. 24-2, C). This process normally occurs within 30 minutes of the delivery of the baby.

## Fourth Stage: Stabilization

The final stage of labor involves the initial recovery and **stabilization** of the mother after childbirth. Normally, this stage lasts approximately 1 hour. During this time, the uterus contracts to control bleeding, and the mother begins to recover from the physical and emotional stress that occurred during childbirth.

## Assessing Labor

If you are called to assist a pregnant woman, you will need to determine whether she actually is in labor. The woman may be experiencing **Braxton Hicks contractions**, or false labor contractions. During false labor, the contractions do *not* get closer together, do *not* increase in how long they last and do not feel stronger as time goes

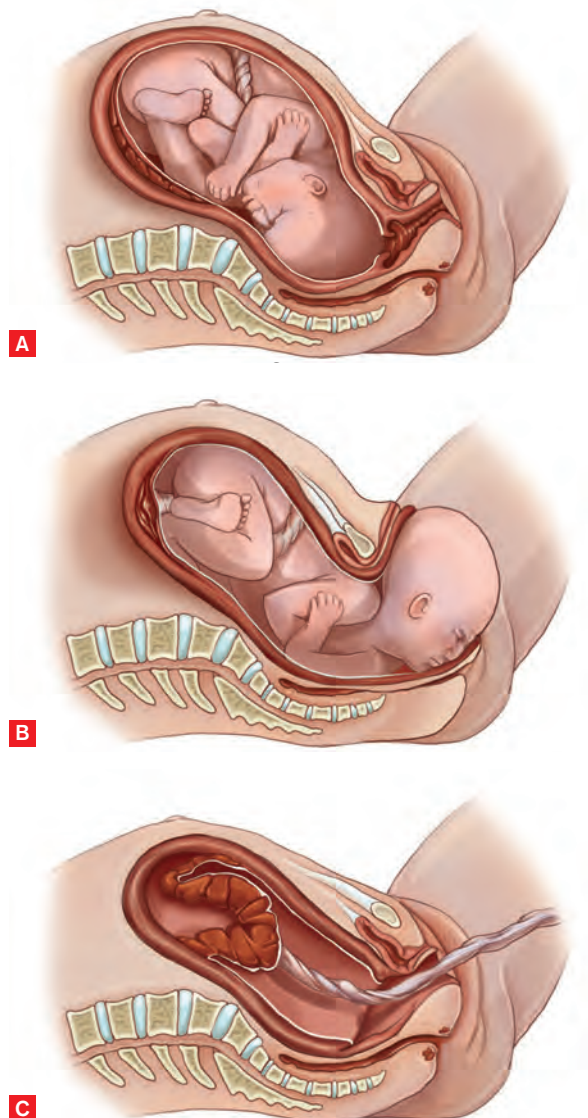


Fig. 24-2, A–C: The stages of labor include (A) dilation, (B) expulsion and (C) placental delivery.



Fig. 24-3: When crowning begins, birth is imminent.



on—as they would with true labor. Also, false labor contractions tend to be sporadic; true labor has regular intervals of contractions and they are accompanied by the water breaking. But because there is no real, safe way to determine if the labor is false, transporting the woman to a medical facility is a prudent decision.

If the woman is in labor, you should determine how far along she is in the pregnancy, including when the baby is due, and whether she expects any complications. You can determine these factors by asking a few key questions and making some quick observations.

To determine if the birth is imminent, ask the woman her due date. Time the contractions to determine how far apart they are. Take the following steps:

1. Feel the mother's abdomen with a gloved hand for involuntary tightening and relaxing of the uterine muscles (Fig. 24-4).
2. Time the length of the movements in seconds from the time the abdomen tightens to the time it relaxes.
3. Time the start of one contraction to the start of the next in minutes.

If the contractions are 5 minutes apart or longer, the woman should be transported to a medical facility if possible. If the contractions are 2 minutes apart or less, you will not have time to transport the woman because the birth is imminent.

Calm the mother and make her feel confident you are there to keep her and the baby safe. Continue with the following questions:

- Is there a chance of a **multiple birth**? Labor does not usually last as long in a multiple birth situation. Also, if you know it is a multiple birth, you can prepare what you will need to help in the delivery of more than one baby. Additional information on multiple births is presented later in this chapter.
- Is this a first pregnancy? The first stage of labor normally takes longer with first pregnancies than with subsequent ones, but not always.
- Is there a bloody discharge? A pink or light red, thick discharge from the vagina is the mucous plug that falls from the cervix as it begins to dilate, which also signals the onset of labor. This discharge is also referred to as the bloody show.
- Has the amniotic sac ruptured? When this happens, fluid flows from the vagina in a sudden gush or a trickle. Some women think they have lost control of their bladder. The breaking of the sac usually signals the beginning of labor. People often describe the rupture of the sac as “the water breaking.”
- Does she have an urge to bear down? If the expectant mother expresses a strong urge to push, labor is far along.
- Is the baby crowning? If the baby's head is visible, the baby is about to be born.



**Fig. 24-4:** To assess labor, feel the mother's abdomen for tightening and relaxing of the uterine muscles, known as contractions, and time how long they are and how far apart they are.

## PREPARING FOR DELIVERY

The realization that you are about to assist with childbirth can be as intimidating as it is exciting. Childbirth involves a discharge of watery, sometimes bloody fluid and other body fluids or substances, such as urine or feces, at stages one and two of labor, in addition to what appears to be a rather large loss of blood after stage two. Fluid discharge sometimes creates splashes, and it is important for the emergency medical responder (EMR) to follow standard precautions using appropriate personal protective equipment (PPE) (see Chapter 6). An **obstetric pack** is a first aid kit containing items especially helpful in emergency delivery and can include items such as PPE, towels, clamps, ties, sterile scissors and bulb syringes (Fig. 24-5). Try not to be alarmed at the loss of blood. It is a normal part of the birth process. Only bleeding that cannot be controlled after the baby is born is a problem. Take a deep breath and try to relax. Remember that you are only assisting in the process; the expectant mother is doing all the work.

### Helping the Mother with Labor and Delivery

As part of your primary assessment, check the woman's breathing and pulse. Check for a potentially closed airway. Breathing rate may be increased due



Fig. 24-5: Obstetric pack.

to pain, anxiety or blood loss. Heart rate may be increased, peripheral pulses may be weak or absent, skin may be cool and clammy, and shock is possible where there has been excessive bleeding. The woman's vital signs may show normal blood pressure; however, blood pressure will decrease in case of shock and increase in the case of preeclampsia. Your physical exam will include evaluating the contractions, inspecting for crowning and preparing for delivery.

If the woman is conscious and seems to be experiencing normal symptoms of labor, find out any other pertinent medical history.

Explain to the expectant mother that the baby is about to be born. Be calm and reassuring. A woman having her first child often feels fear and apprehension about the pain and the condition of the baby. Labor pain ranges from discomfort similar to menstrual cramps to intense pressure or pain. Many women experience something in between. Factors that can increase pain and discomfort during the first stage of labor include:

- Irregular breathing.
- Tensing up because of fear.
- Not knowing what to expect.
- Feeling alone and unsupported.

You can help the expectant mother cope with the discomfort and pain of labor. By staying calm, firm and confident, and offering encouragement, you can help reduce her fear and apprehension. Reducing fear will aid in reducing her pain and discomfort. Begin by reassuring her that you are there to help. Explain what to expect as labor progresses. Suggest specific physical activities that she can do to relax, such as regulating her breathing. Ask her to breathe slowly and deeply, in through the nose and out through the mouth. Ask her to focus on one object in the room while regulating her breathing.

Breathing slowly and deeply in through the nose and out through the mouth during labor can help the expectant mother in several ways because it:

- Aids muscle relaxation.
- Offers a distraction from the pain of strong contractions as labor progresses.
- Ensures adequate oxygen delivery to both the mother and the baby during labor.



#### CRITICAL FACTS

If you find yourself helping the mother with labor and delivery, check the woman's breathing and pulse as part of your primary assessment. Check for a potentially closed airway. Breathing rate may be increased due to pain, anxiety or blood loss.

Taking childbirth classes, usually offered at local hospitals, may help you become more competent in techniques to help an expectant mother relax.

Expect delivery to be imminent when you observe the following signs and symptoms:

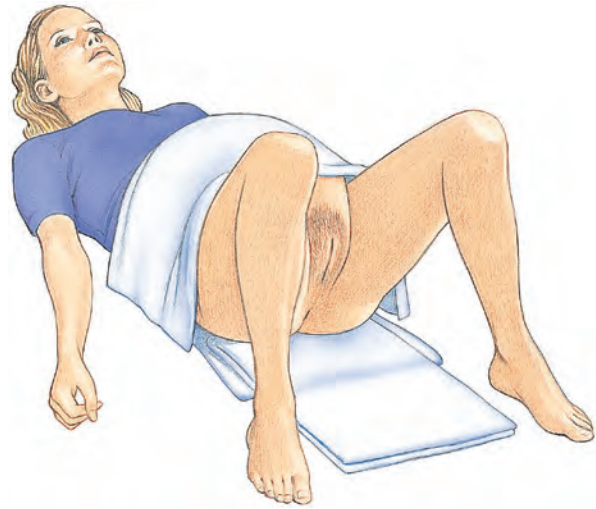
- Intense contractions are 2 minutes apart or less and last 60 to 90 seconds.
- The woman's abdomen is very tight and hard.
- The mother reports feeling the infant's head moving down the birth canal or has a sensation like an urge to defecate.
- Crowning occurs (the infant's head appears at the opening of the birth canal).
- The mother reports a strong urge to push.

If these signs and symptoms are present, contact medical direction for assistance. The decision will need to be made whether to deliver on-site. If an on-site delivery does not occur within 10 minutes, you will need medical direction's decision to transport.

## DELIVERY

Assisting with the delivery is often a simple process. The expectant mother does all the work; your job is to create a clean environment and to help guide the baby from the birth canal, minimizing injury to the mother and baby. Begin by positioning the mother. She should be lying on her back, with her head and upper back raised, *not* lying flat. Her legs should be bent, with the knees drawn up and apart (Fig. 24-6). Position the mother in a way that will make her more comfortable.

Establish a clean environment for delivery. Because it is unlikely that you will have sterile supplies, use items such as clean sheets, blankets, towels or clothes. To make the area around the mother as sanitary as possible, place these items over the mother's abdomen and under her buttocks and legs. Keep a clean, warm towel or blanket handy to wrap the newborn. Because you will be coming in contact with the mother's and baby's body fluids, be sure to wear disposable latex-free gloves. Wear protective eyewear and a disposable gown, if they are available, to protect yourself from splashing.



**Fig. 24-6:** To assist with delivery, begin by positioning the mother on her back, with her head and upper back raised, in a clean environment.

Other items that can be helpful include supplemental oxygen, a **bulb syringe** to suction secretions from the infant's mouth and nose, gauze pads or sanitary pads to help absorb secretions and vaginal bleeding, and a large plastic bag or towel to hold the placenta after delivery.

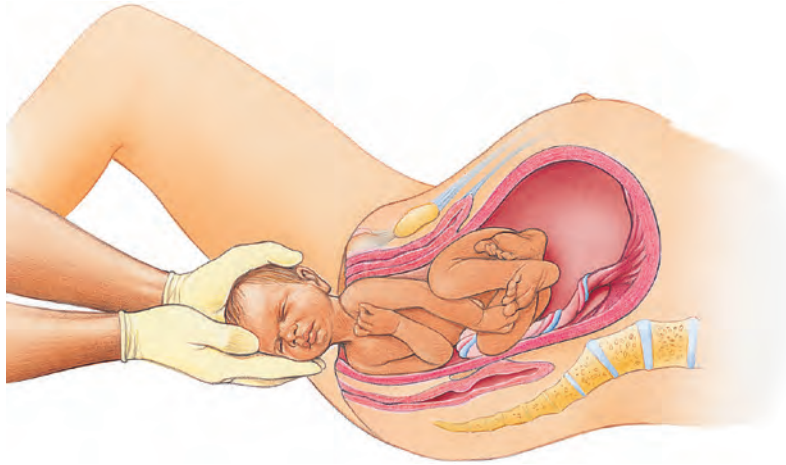
Continually check the mother for indications the baby is crowning. You may actually see the head of the baby appear, or the vagina may be bulging. Once crowning takes place, take the following steps to assist with delivery:

- As crowning occurs, place a hand on the top of the baby's head and apply light pressure. By doing so, you allow the head to emerge slowly, not forcefully. Gradual emergence will help prevent tearing of the vagina and injury to the baby.
- At this point, the expectant mother should stop pushing. Instruct the mother to concentrate on her breathing techniques. Have her pant. This technique will help her stop pushing and help prevent a forceful birth.
- You may have to puncture the amniotic sac with your fingers if the water has not yet broken.
- As the head emerges, the baby will turn to one side, which enables the shoulders and the rest of the body to pass through the birth canal (Fig. 24-7).



### CRITICAL FACTS

Assisting with the delivery is often a simple process. The expectant mother does all the work; your job is to create a clean environment and to help guide the baby from the birth canal, minimizing injury to the mother and baby.



**Fig. 24-7:** Support the head as it emerges and the baby turns, which allows the shoulders and rest of the body to pass through the birth canal.

- Check to see if the umbilical cord is looped around the baby's neck. If it is, gently slip it over the baby's head. If you cannot slip it over the head, slip it over the baby's shoulders as they emerge. The baby can slide through the loop.
- Guide one shoulder out at a time. Do *not* pull the baby.
- As the baby emerges, the baby will be wet and slippery. Use a clean towel to receive/hold the baby.
- Place the baby on its side, between the mother and you. By doing so, you can provide initial care without fear of dropping the newborn.
- If possible, note the time the baby was born.

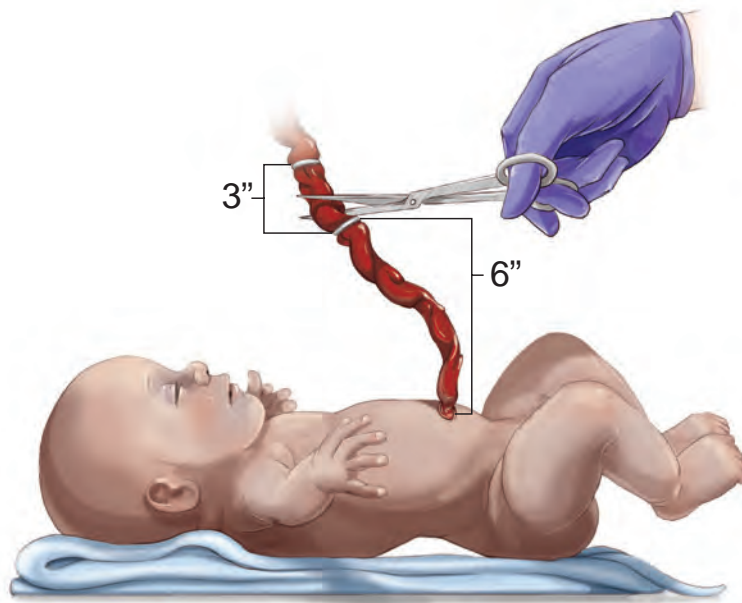
## CARING FOR THE NEWBORN AND MOTHER

An obstetric pack contains items useful for help in caring for the newborn after delivery.

### Caring for the Newborn

#### Cutting the Umbilical Cord

The umbilical cord will stop pulsating not long after the baby is born. When it does, clamp or tie the cord very securely with gauze in two places between the mother and child. The clamp closest to the newborn should be about 6 inches from the baby. There should only be about 3 inches between the two clamps (Fig. 24-8). Follow local protocols and medical direction for guidance on cutting the cord.



**Fig. 24-8:** Clamping the umbilical cord.



## Assessing the Newborn

The APGAR scoring system is the universally accepted method of assessing a newborn at 1 minute and again at 5 minutes after birth. However, if the baby is in distress and needs lifesaving care, the **APGAR score** is not a priority.

APGAR stands for Appearance, Pulse, Grimace, Activity and Respiration (Table 24-1). The baby is assigned a number from 0 to 2 for each part of the assessment, for a total possible score of 10.

Tally the five scores for a total score out of 10. Here are the guidelines for interpreting that score:

- 7 to 10 points: Active and vigorous newborn; ready for routine care.
- 4 to 6 points: Moderately depressed; provide stimulation and oxygen based on local protocols.
- 1 to 3 points: Severely depressed; provide extensive care including administering supplemental oxygen based on local protocols with bag-valve-mask ventilations and CPR. Also, stimulate the baby to encourage breathing by tapping the soles of the feet or rubbing the back.

Table 24-1:

## APGAR Scoring System

APGAR	SCORE
<b>Appearance</b>	
Cyanotic (blue) skin appearance all over	0
Cyanotic limbs but pink body	1
Pink body all over	2
<b>Pulse</b> (Count the heart rate for 30 seconds. If possible, use a stethoscope. If not, measure the pulse where the umbilical cord meets the abdomen or at the brachial artery.)	
No pulse	0
Pulse rate less than 100 beats per minute	1
Pulse rate more than 100 beats per minute	2
<b>Grimace (reflex irritability)</b> (Gently tap the soles of the newborn's feet, or observe during suctioning.)	
No activity or reflex	0
Some facial grimace	1
Grimace and cough, sneeze or cry	2
<b>Activity</b> (Observe movement/reflexes of the extremities or the degree of flexion of the extremities and the resistance to straightening them.)	
Limp, with no movement of extremities	0
Some flexion, without active movement	1
Actively moving around	2
<b>Respiration</b> (Observe for regular breathing and a vigorous cry. Poor signs include irregular, shallow, gasping or absent respirations.)	
No respiratory effort	0
Slow or irregular breathing effort with weak cry	1
Good respirations and strong cry	2

## Routine Care

When handling a newborn, *always* be sure to support the newborn's head. Newborns lose heat quickly; therefore, it is important to keep them warm and dry. Dry the newborn, particularly the head, and wrap the baby in a clean, warm towel or blanket. Place the dried and wrapped newborn on their side, with the head slightly lower than the trunk.

It is vital you ensure that you clear the nasal passages and mouth thoroughly. You can do this by using your finger, a gauze pad or a bulb syringe (Fig. 24-9). Squeeze a bulb syringe *before* insertion in the mouth and nose. Clear or suction the mouth before the nose. Repeat this until you are sure the



**Fig. 24-9:** A bulb syringe can be used to clear the newborn's mouth and nasal passages.

airway is clear. If the newborn does not breathe, you must begin giving ventilations.

Most newborns begin crying and breathing spontaneously. If the newborn has not made any sounds, stimulate a cry reflex by tapping your fingers on the soles of the feet.

## Resuscitation of the Newborn

Resuscitation of a newborn begins immediately if any of these conditions exist:

- Respirations fall to less than 30 respirations per minute or the newborn is gasping or not breathing normally.
- Pulse is less than 100 beats per minute.
- Cyanosis (bluish skin) around the chest and abdomen persists after administering supplemental oxygen.

If the newborn's respirations are low (less than 30 breaths per minute) and/or the pulse rate is below 100 beats per minute, provide positive-pressure ventilations.

If the newborn's respirations are less than 30 breaths per minute or the newborn is unresponsive:

- Tap the bottom of the foot to stimulate a reflex (Fig. 24-10, A).
- Rub the lower back, firmly but gently (Fig. 24-10, B).
- Clear the airway again, with a bulb syringe.
- Administer high-concentration oxygen based on local protocols (Fig. 24-11).

Remember that a newborn's lungs are very small and they need very small puffs of air. You may use a mask only if you have the appropriate size for a newborn. If the newborn's pulse drops to less than 60 beats per minute or does not rise to more than 60 beats per minute during ventilation and the newborn shows signs of poor perfusion, begin CPR.



### CRITICAL FACTS

The APGAR (appearance, pulse, grimace, activity and respiration) scoring system is the universally accepted method of assessing a newborn at 1 minute and again at 5 minutes after birth. However, if the baby is in distress and needs lifesaving care, the APGAR score is not a priority. The baby is assigned a number from 0 to 2 for each part of the assessment, for a total possible score of 10.

When handling a newborn, always be sure to support the newborn's head. Newborns lose heat quickly; therefore, it is important to keep them warm and dry.



## CRITICAL FACTS

Resuscitation of a newborn begins immediately if respirations fall to less than 30 respirations per minute or the newborn is gasping or not breathing normally, if pulse is less than 100 beats per minute or if cyanosis (bluish skin) around the chest and abdomen persists after administering supplemental oxygen.



A



B

**Fig. 24-10, A–B:** You may need to stimulate the newborn to breathe by (A) tapping the bottom of the foot or (B) rubbing the lower back.

## Caring for the Mother

### Delivery of the Placenta

Following delivery of the newborn, the placenta will still be in the uterus, attached to the baby by the umbilical cord. Uterine contractions usually expel the placenta within 10 minutes of delivery and almost always within 30 minutes. The mother may experience strong contractions, similar to childbirth, and you may have to tell her to bear down in order for the placenta to be expelled. When the placenta appears, slowly guide it out of the vagina (do *not* pull) and place it in a clean towel or container.



**Fig. 24-11:** Administering high-concentration oxygen to a newborn.

### Controlling Bleeding After Birth

Expect some additional vaginal bleeding when the placenta is expelled. Using gauze pads or clean towels, gently clean the mother. Place a sanitary pad or towel over the vagina; do *not* insert anything into the vagina. Instruct the mother to place her legs together.

Feel her abdomen for the uterus, which will feel like a grapefruit-sized mass in the lower sector. Massage the uterus to help expel large blood clots and to help the uterus contract. This should slow the bleeding. Watch for signs of shock from uncontrolled bleeding. If signs and symptoms of shock appear, care for the mother accordingly.

### Providing Care

After delivery, be sure to continue caring for the mother, both emotionally and physically. Keep her calm and comfortable, and continue to monitor

her vitals until more advanced medical care takes over. If available, offer her a cloth to dry her face, as well as a clean blanket if she is cold. Remove any bloody sheets, blankets and other supplies used for delivery from the immediate area.

## Caring for the Mother's Emotions with Stillborn/Aborted Fetuses

**Stillbirth**, or fetal death, is the term for the death of a fetus prior to delivery but at 20 or more weeks of gestation. The term **miscarriage** usually refers to a pregnancy lost *prior* to 20 weeks of gestation. Whether the loss occurs early in the pregnancy or at 40 weeks of pregnancy or beyond, it can be devastating.

The mother should have time to grieve. The bond a parent makes with the unborn fetus begins early on in the pregnancy, so it is normal to experience a powerful sense of loss when their baby dies. Sensitivity on the part of the EMR is of utmost importance. It may be helpful to suggest a referral to a counselor or clergy member who has experience dealing with this kind of loss. Some people find it helpful to join a support group of parents who have had a similar experience where they can share their feelings with others who understand what it is like. Encourage them to seek out a bereavement group in their area.

## COMPLICATIONS DURING PREGNANCY

Complications during pregnancy are rare.

### Spontaneous Abortion

A miscarriage, or spontaneous abortion, is the loss of a fetus due to natural causes before about 20 weeks of pregnancy. About 85 percent of

miscarriages occur during the first 12 weeks of pregnancy. During miscarriage, the woman will experience vaginal spotting, bleeding and discharge, as well as cramping. Miscarriage later in pregnancy is accompanied by severe cramping, resulting in the expulsion of the fetus. The blood lost in these cases often contains mucus or clots.

### Ectopic Pregnancy

In a normal pregnancy, the fertilized egg attaches itself to the lining of the uterus. With an **ectopic pregnancy**, the fertilized egg most commonly implants in one of the fallopian tubes, which carry eggs from the ovaries to the uterus. This type of ectopic pregnancy is known as a tubal pregnancy. Less commonly, an ectopic pregnancy occurs in the abdomen, ovary or cervix.

The fertilized egg of an ectopic pregnancy cannot survive, and the growing tissue may destroy various maternal structures. Therefore, if left untreated, life-threatening blood loss is possible. Early treatment of an ectopic pregnancy, in the form of termination, is necessary to preserve the chance for healthy pregnancies in the future.

Symptoms of an ectopic pregnancy include:

- Light vaginal bleeding (can be life threatening as it can lead to severe bleeding).
- Lower abdominal pain.
- Cramping on one side of the pelvis.

In the case of the fallopian tube rupturing, symptoms include:

- Sharp, stabbing pain in the pelvis, abdomen or even the shoulder and neck.
- Dizziness.
- Light-headedness.



### CRITICAL FACTS

Following delivery of the newborn, the placenta will still be in the uterus, attached to the baby by the umbilical cord. Uterine contractions usually expel the placenta within 10 minutes of delivery and almost always within 30 minutes.

Expect some additional vaginal bleeding when the placenta is expelled.

After delivery, be sure to continue caring for the mother, both emotionally and physically. Keep her calm and comfortable, and continue to monitor her vitals until more advanced medical care takes over.

Complications during pregnancy are rare.

A miscarriage, or spontaneous abortion, is the loss of a fetus due to natural causes before about 20 weeks of pregnancy.



## Preeclampsia (Toxemia) and Eclampsia

**Preeclampsia**, or **toxemia**, is a common problem during pregnancy and is sometimes referred to as pregnancy-induced hypertension. If left untreated, **eclampsia**, the final and most severe phase of preeclampsia, occurs. Eclampsia can cause coma and even death of the mother and baby, and can occur before, during or after childbirth.

The only cure for preeclampsia is delivery of the baby and, when it occurs near the end of pregnancy, delivery is advised. Signs and symptoms of preeclampsia include:

- High blood pressure.
- Excess protein in the urine after 20 weeks of pregnancy.
- Severe headaches.
- Changes in vision, such as temporary loss of vision, blurred vision or light sensitivity.
- Upper abdominal pain, usually under the ribs on the right side.
- Nausea or vomiting.
- Dizziness.
- Decreased urine output.
- Sudden weight gain, more than 2 pounds per week.
- Swelling (edema), particularly in the face and hands.
- Seizures, if eclampsia develops.

## Vaginal Bleeding in Pregnancy

Vaginal bleeding during the first trimester does *not* typically require treatment. Spotting, or light, irregular discharges of a small amount of blood, may be normal. More bleeding may indicate a problem that needs a healthcare provider's attention.

When the thick plug of mucus that seals the opening of the cervix is dislodged, a thick or stringy

discharge tinged with blood may appear. This "bloody show" is normal when it occurs near the end of pregnancy and indicates delivery may occur in a week or two.

Since the nature and extent of most complications related to pregnancy can only be determined by a medical professional through examination, you should *not* be concerned with trying to diagnose a particular problem. Instead, concern yourself with recognizing signs and symptoms that suggest a serious complication; two such symptoms are vaginal bleeding and abdominal pain. Any persistent or profuse vaginal bleeding, or bleeding in which tissue passes through the vagina during pregnancy, is abnormal, as is any abdominal pain.

When bleeding is accompanied by the following symptoms, immediate attention is required:

- Pain
- Cramping
- Fever
- Chills
- Contractions
- Passing tissue from the vagina

An expectant mother exhibiting these signs and symptoms needs to receive more advanced medical care quickly. While waiting for an ambulance or other transport vehicle, take steps to minimize shock. These include:

- Helping the woman into the most comfortable position.
- Controlling bleeding.
- Keeping the woman from getting chilled or overheated.
- Administering supplemental oxygen based on local protocols.



### CRITICAL FACTS

With an ectopic pregnancy, the fertilized egg most commonly implants in one of the fallopian tubes.

Preeclampsia, or toxemia, is a common problem during pregnancy and is sometimes referred to as pregnancy-induced hypertension. If left untreated, eclampsia, the final and most severe phase of preeclampsia, occurs.

Vaginal bleeding during the first trimester does not typically require treatment. Spotting, or light, irregular discharges of a small amount of blood, may be normal.

## Trauma During Pregnancy

Trauma during pregnancy can be caused by motor-vehicle collisions, falls, assaults or penetrating injuries. When the placenta peels away from the inner wall of the uterus before delivery, it is called **abruptio placentae**. This occurs in 1 to 5 percent of patients with minor trauma and 20 to 50 percent of patients with major trauma. Hemorrhage can occur from disruption of the placenta and spontaneous or traumatic uterine rupture. Pregnant women who have suffered an injury should be evaluated in the emergency department.

If the patient appears to be in shock, remember that the treatment of shock in a pregnant patient differs from the treatment of shock in other adults in two important respects. First, the organ systems change during pregnancy. Second, *two* patients are vulnerable: the mother *and* the fetus. Therefore, obstetric critical care involves simultaneous assessment and management of both the mother and fetus.

The management of **hemorrhagic shock** requires immediate administration of supplemental oxygen based on local protocols. **Fetal monitoring** should be performed to detect fetal distress or fetal hypoxia.

Pregnant patients in the third trimester should be placed on their *left* side to avoid compression of the inferior vena cava. If a spinal injury is suspected, the backboard or other extrication device should be tilted to the left after the patient is fully secured.

## COMPLICATIONS DURING DELIVERY

The vast majority of all births occur without complication, but this is only reassuring if the one you are assisting with is not complicated. For the few births that do have complications, delivery can be stressful and even life threatening for the expectant mother and the baby. All require the help of more advanced medical personnel.

## Hemorrhage

The most common complication of childbirth is persistent vaginal bleeding, known as postpartum hemorrhage. It is defined as the loss of more than 1 pint of blood following delivery of the placenta. It can occur right after delivery or as late as 1 month later. Hemorrhage can occur when the uterus fails to contract after delivery, as this contraction facilitates the closing of blood vessels that were opened during detachment of the placenta. It can also occur if the uterus was stretched too much during pregnancy or if a piece of placenta remains inside the uterus following delivery. It occurs more commonly following the birth of multiples, a prolonged or abnormal labor, or when a woman has been pregnant several times. Women who have bled excessively following labor in the past are at increased risk of reoccurrence.

In the case of hemorrhage, summon more advanced medical care and take steps to minimize shock. Massaging the lower abdomen and encouraging breastfeeding can also help stimulate the uterus to contract.

Other childbirth complications include a prolapsed cord, breech birth, limb presentation, multiple births, premature birth and **meconium aspiration**.

## Prolapsed Umbilical Cord

A **prolapsed cord** occurs when a loop of the umbilical cord protrudes from the vaginal opening while the baby is still in the birth canal (Fig. 24-12). This can threaten the baby's life, because as the baby moves through the birth canal, the cord will be compressed against the unborn child and the birth canal, cutting off blood flow. Without this blood flow, the baby will die within a few minutes from lack of oxygen.

If you notice a prolapsed cord, have the expectant mother assume a knee-chest position as shown in Fig. 24-13. This will help take the pressure off the cord. Cover any exposed cord with a moist,



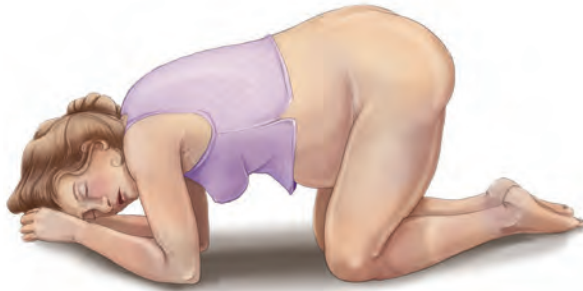
### CRITICAL FACTS

The vast majority of all births occur without complication. The few births with complications require the help of more advanced medical personnel.

The most common complication of childbirth is persistent vaginal bleeding, known as postpartum hemorrhage.



**Fig. 24-12:** A prolapsed cord can threaten the baby's life.



**Fig. 24-13:** If you notice a prolapsed cord or there is a limb presentation, place the mother in a knee-chest position.

sterile dressing. Never attempt to push the cord back into the vagina. Administer supplemental oxygen to the mother based on local protocols. Summon more advanced medical personnel, if they have not already been contacted.

## Breech Birth

Most babies are born headfirst. However, on rare occasions, the newborn is delivered feet- or buttocks-first. This condition is commonly called a **breech birth**. If you encounter a breech delivery, support the newborn's body as it leaves the birth canal while you are waiting for the head to deliver. Do not pull on the newborn's body. Pulling will not help deliver the head. Do *not*

attempt to push a protruding foot back up into the birth canal. If a single limb is presenting, you cannot successfully deliver the infant, and the mother must be transported to a hospital as quickly as possible. Call for more advanced medical personnel if they have not already been contacted. Place the mother in a head-down, hips-elevated position, and cover the presenting limb with a sterile towel. Do not attempt to push or pull on the protruding limb.

Because the weight of the unborn baby's head lodged in the birth canal will reduce or stop blood flow by compressing the umbilical cord, the unborn baby will be unable to get any oxygen. Should the unborn baby try to take a spontaneous breath, they will also be unable to breathe because the face is pressed against the wall of the birth canal. As a result, if the head has not been delivered after 3 minutes, you will need to help create an airway for the baby to breathe.

To help the baby breathe, place the index and middle fingers of your gloved hand into the vagina next to the baby's mouth and nose. Spread your fingers to form a V (Fig. 24-14). Though this will not lessen the compression on the umbilical cord, it may allow air to enter the baby's mouth and nose. You must maintain this position until the baby's head is delivered. Administer supplemental oxygen to the mother based on local protocols. Summon more advanced medical personnel, if they have not already been contacted. Should the unborn baby's head be delivered, check the infant for breathing. Be prepared to provide ventilations and perform CPR as necessary.

## Limb Presentation

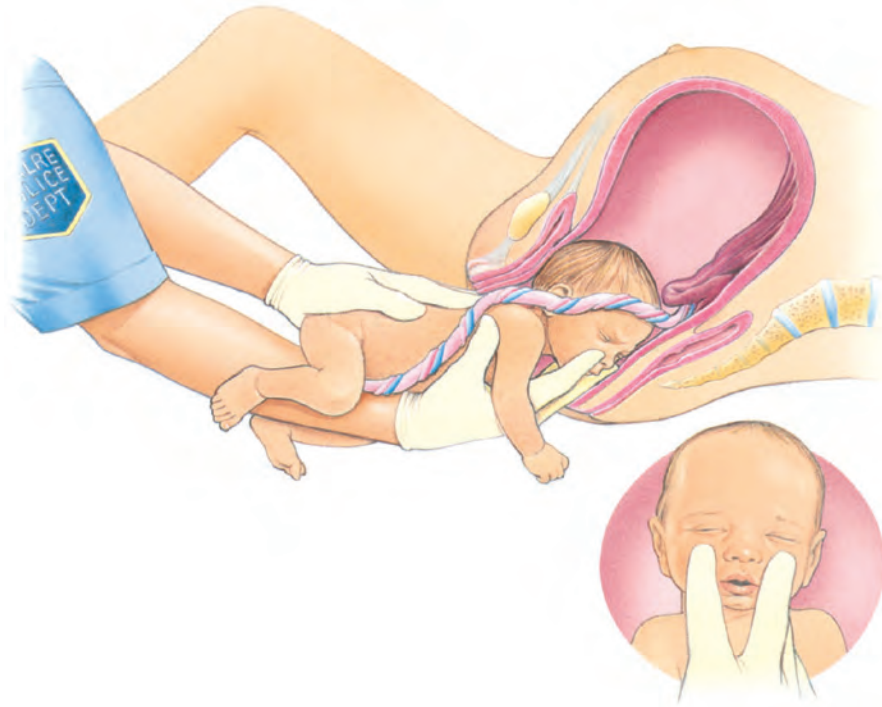
If the baby is delivered in an incomplete breech, or transverse lie (horizontal) position, the baby's foot (or feet), arm or shoulder will appear first. This is known as a limb presentation (Fig. 24-15). If you encounter this, do *not* attempt to deliver the baby in the field. The mother should be transported to a



### CRITICAL FACTS

A prolapsed cord occurs when a loop of the umbilical cord protrudes from the vaginal opening while the baby is still in the birth canal. It is life threatening to the baby.

Most babies are born headfirst but, on rare occasions, the baby is delivered feet- or buttocks-first. This is called a breech birth. In breech situations, support the body until the head delivers. Do not pull on the body.



**Fig. 24-14:** During a breech birth, position your index and middle fingers to allow air to enter the baby's mouth and nose.



**Fig. 24-15:** Limb presentation.

medical facility. *Never* pull on the limb. Avoid even touching the limb, as this can stimulate the baby to try to take a breath, which can result in aspirating amniotic fluid.

A **cesarean section** will be needed to deliver the baby safely. Summon more advanced medical personnel, if they have not already been contacted. Administer supplemental oxygen to the mother based on local protocols. Place her in a knee-chest position with her pelvis elevated. If she feels the need to push with contractions, have her pant, which can help ease the urge.

### Multiple Births

Although most births involve only a single baby, a few will involve delivery of more than one. If the mother has had proper prenatal care, she will probably be aware that she is going to have more than one baby. Multiple births should be handled in the same manner as single births. The mother will have a separate set of contractions for each child being born. There may also be a separate placenta for each child, though this is not always the case. Keep in mind that the risk of hemorrhage following delivery is higher after giving birth to multiples.



## Premature Birth

When a baby is born before the end of 37 weeks of pregnancy, it is called a **premature birth**. Premature babies require special care because they are not fully developed. They are at increased risk for such complications as lung and breathing problems, infections and digestive difficulties. They are also more vulnerable to hypothermia.

Premature infants can typically be identified by their small, thin appearance and red, wrinkled skin. They also typically have a single crease along the sole of the foot; fuzzy, fine scalp hair; and ears that are not fully developed.

After the delivery of a premature baby, dry the infant thoroughly and wrap the baby in blankets, preferably warmed, or in a plastic bubble-bag swaddle. Cover the head, leaving the face clear so the baby can breathe. Keep the baby in a warm place. Use a bulb syringe to gently suction away fluid from the baby's mouth and nose. Tie off the umbilical cord immediately, as a premature infant cannot tolerate even the smallest loss of blood. Administer supplemental oxygen by blowing oxygen across (not directly into) the baby's face based on local protocols. Reduce the risk of infection by minimizing the number of people who handle the child. Do *not* let anyone breathe into the baby's face.

## Meconium Aspiration

Meconium is the baby's first bowel movement. Amniotic fluid that is contaminated with

meconium will be greenish or brownish yellow instead of clear. The presence of meconium-stained amniotic fluid is an indication that the baby experienced a period of oxygen deprivation (hypoxia), which causes the baby to have a bowel movement. The primary danger is that the baby will aspirate the contaminated fluid, which can result in complications including a blocked airway or respiratory distress, pneumonia and infection.

If you observe meconium staining in the amniotic fluid, it is important that you clear the mouth and nose before the baby takes the first breath. Suction the baby's mouth and nose with a bulb syringe as soon as the baby emerges from the birth canal. Avoid stimulating the baby in any way before clearing the mouth and nose, as this can induce the baby to try to take a breath. Do *not* squeeze the baby's chest or put your finger in the baby's mouth to try to prevent meconium aspiration.

Administer supplemental oxygen to the baby based on local protocols. Summon more advanced medical personnel if they have not already been contacted. Keep the baby as warm and calm as possible and maintain the airway, if needed.

## PUTTING IT ALL TOGETHER

Ideally, childbirth should occur in a controlled environment under the guidance of healthcare professionals trained in delivery. In a controlled



### CRITICAL FACTS

If the baby is delivered in an incomplete breech, or transverse lie (horizontal) position, the baby's foot (or feet), arm or shoulder will appear first. This is known as a limb presentation. The mother must be transported to a medical facility. Never pull the limb. Avoid touching it.

Multiple births should be handled in the same manner as single births. The mother will have a separate set of contractions for each child being born.

When a baby is born before the end of 37 weeks of pregnancy, it is called a premature birth. Premature babies require special care because they are not fully developed.

Meconium is the baby's first bowel movement. Amniotic fluid that is contaminated with meconium will be greenish or brownish yellow instead of clear. If this contaminated fluid is aspirated, it can cause a blocked airway, respiratory distress, pneumonia and infection.

environment, the necessary medical care is immediately available for mother and baby, should any problem arise. However, unexpected deliveries do occur outside of the controlled environment and may require your assistance. By understanding the

four stages of labor and knowing how to prepare the expectant mother for delivery, assist in the delivery and provide proper care for the mother and baby, you will be able to successfully assist in bringing a new child into the world.

## **> You Are the Emergency Medical Responder**

While approaching the young woman who is in labor, her sister tells you that the patient is 26 years old. The pregnant woman is yelling, "The baby is coming!" She tells you that this will be her fourth child. What should you do?

# ENRICHMENT

## More Complications During Pregnancy and Delivery

### Placenta Previa

In most pregnancies, the placenta implants itself on the upper part of the uterine wall to establish its rich blood supply. In about one out of every 200 to 250 pregnancies, the placenta implants lower on the uterine wall, touching or covering the cervix, resulting in **placenta previa** (Fig. 24-16). The condition can be:

- Marginal: The placenta touches the edge of the cervix.
- Partial: The placenta covers part of the cervix.
- Total or complete: The placenta covers the cervix completely.

The danger occurs if the placenta pulls away from the uterine wall, causing bleeding of oxygen-rich blood. Causes of the placenta tearing away include:

- Labor.
- Dilation of the cervix.
- Fetal movement.

The initial and only symptom of placenta previa is painless vaginal bleeding. To provide care, arrange for immediate transport. Elevate the patient's legs and maintain body temperature.

### Abruptio Placentae

Abruptio placentae is a life-threatening emergency for both mother and child in which the placenta prematurely detaches from the uterus either partially or completely (Fig. 24-17). It occurs in about one out of every 120 to 150 pregnancies and can occur at any time after 20 weeks gestation. The chance of its occurrence rises if it occurred in a previous pregnancy. Abruptio placentae can occur spontaneously or as a result of hypertension or maternal injury (trauma).

Symptoms of abruptio placentae, also called placental abruption, are:

- Abdominal pain.
- Back pain.
- Rapid uterine contractions.
- Uterine tenderness.
- Vaginal bleeding.

Bleeding may not be apparent at first, as blood accumulates between the placenta and uterine wall. Therefore, the first signs of abruptio placentae may be pain, abdominal rigidity and shock. To provide care, arrange for immediate transport. Monitor vital signs and treat for shock if necessary.

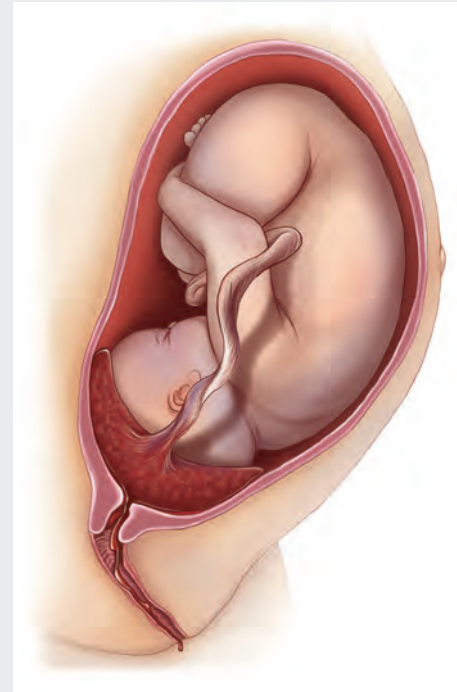


Fig. 24-16: Placenta previa.



Fig. 24-17: Abruptio placentae.

# ENRICHMENT

## More Complications During Pregnancy and Delivery *CONTINUED*

### Ruptured Uterus

Rupture of the uterus is rare, but its occurrence is associated with a high incidence of infant fatality, reportedly as high as 65 percent. Maternal mortality associated with a ruptured uterus is significantly lower, but it can occur if significant time passes between the event and medical intervention.

The uterine wall, which thins during pregnancy, can rupture spontaneously or as the result of an abdominal trauma (Fig. 24-18). Women who have had prior caesarian sections are at a higher risk of experiencing a ruptured uterus than women with first-time pregnancies or those who have delivered vaginally previously. Advanced maternal age is also a risk factor.

Signs and symptoms of a ruptured uterus are:

- Abdominal pain.
- Abnormal fetal heart pattern.
- Cessation of contractions.
- Deceleration of fetal heartbeat.
- Failure of labor to progress.
- Hyperstimulation of the uterus (excessive contractions).
- Signs of shock.
- Vaginal bleeding.

Once a uterine rupture is suspected, arrange for immediate transport. Stabilization of the mother and delivery of the fetus is imperative. The time available for intervention is only 18 minutes before the baby experiences significant hypoxia, and only 30 minutes until the baby suffers major neurological impairment.

### Shoulder Dystocia

Shoulder dystocia occurs when the fetus's shoulders are larger in width than the head. When the mother begins to deliver the baby, the head will emerge from the vagina, but a shoulder or both shoulders becomes caught between the maternal symphysis pubis (joint between the pubic bones) and the sacrum (base of the spine).

Other than a large fetus, often due to maternal diabetes, no risk factors for shoulder dystocia are recognized. If the fetal head emerges from the vagina and then retracts, it is considered a symptom of shoulder dystocia. This is often called the "turtle sign." Shoulder dystocia has no other recognized symptoms. The danger with shoulder dystocia lies with the umbilical cord being compressed between the fetus and the maternal pelvis.

Do *not* apply excessive force, as this is unlikely to free the fetus and may cause injury. The HELPERR mnemonic is a tool used by healthcare providers that describes a set of maneuvers for managing shoulder dystocia during childbirth.



Fig. 24-18: Ruptured uterus.

*Continued on next page*



# ENRICHMENT

## More Complications During Pregnancy and Delivery *CONTINUED*

These maneuvers are only performed by a healthcare provider and are presented here for information only, as EMRs do not perform them:

- **Help:** Request the appropriate personnel to respond.
- **Evaluate:** Evaluate for episiotomy (incision between the vaginal opening and anus to prevent a more extensive vaginal tear during delivery will not release the shoulder on its own, as shoulder dystocia is a bone impaction).
- **Legs:** Maneuver the mother's legs in the McRoberts maneuver (repositions the baby).
- **Pressure:** Apply suprapubic pressure (making a fist, placing it just above the maternal pubic bone and pushing the fetal shoulder in one direction or the other).
- **Enter:** Enter maneuvers (internal rotation of the fetus).
- **Remove:** Remove the posterior arm from the birth canal.
- **Roll:** Roll the patient onto an all-fours position, which may dislodge the impaction; gravity may also assist.

# 25 PEDIATRICS

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## ▶ You Are the Emergency Medical Responder

You are working as the camp health officer at a local summer camp when a young girl approaches you complaining that she has a rash. She says that she is allergic to certain things and may have come into contact with something that has now given her hives. How would you respond?



## KEY TERMS

**Adult:** For the purpose of providing emergency medical care, anyone who appears to be approximately 12 years old or older.

**Apparent life-threatening event (ALTE):** A sudden event in infants under the age of 1 year, during which the infant experiences a combination of symptoms including apnea, change in color, change in muscle tone and coughing or gagging.

**Child:** For the purpose of providing emergency medical care, anyone who appears to be between the ages of about 1 year and about 12 years; when using an automated external defibrillator (AED), different age and weight criteria are used.

**Child abuse:** Action that results in the physical or psychological harm of a child; can be physical, sexual, verbal and/or emotional.

**Child neglect:** The most frequently reported type of abuse in which a parent or guardian fails to provide the necessary, age-appropriate care to a child; insufficient medical or emotional attention or respect given to a child.

**Croup:** A common upper airway virus that affects children under the age of 5.

**Epidemiology:** A branch of medicine that deals with the incidence (rate of occurrence) and prevalence (extent) of disease in populations.

**Epiglottitis:** A serious bacterial infection that causes severe swelling of the epiglottis, which can result in a blocked airway, causing respiratory failure in children; may be fatal.

**Febrile seizures:** Seizure activity brought on by an excessively high fever in a young child or an infant.

**Fever:** An elevated body temperature, beyond normal variation.

**Infant:** For the purpose of providing emergency medical care, anyone who appears to be younger than about 1 year of age.

**Pediatric Assessment Triangle:** A quick initial assessment of a child that involves observation of the child's appearance, breathing and skin.

**Respiratory failure:** Condition in which the respiratory system fails in oxygenation and/or carbon dioxide elimination; the respiratory system is beginning to shut down; the person may alternate between being agitated and sleepy.

**Retraction:** A visible sinking in of soft tissue between the ribs of a child or an infant.

**Reye's syndrome:** An illness brought on by high fever that affects the brain and other internal organs; can be caused by the use of aspirin in children and infants.

**Seizure:** A disorder in the brain's electrical activity, sometimes marked by loss of consciousness and often by uncontrollable muscle movement; also called a convulsion.

**Shaken baby syndrome:** A type of abuse in which a young child has been shaken harshly, causing swelling of the brain and brain damage.

**Status asthmaticus:** A potentially fatal episode of asthma in which the patient does not respond to usual inhaled medications.

**Sudden infant death syndrome (SIDS):** The sudden death of an infant younger than 1 year that remains unexplained after the performance of a complete postmortem investigation, including an autopsy, an examination of the scene of death and a review of the care history.

**Thready:** Used to describe a pulse that is barely perceptible, often rapid and feels like a fine thread.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

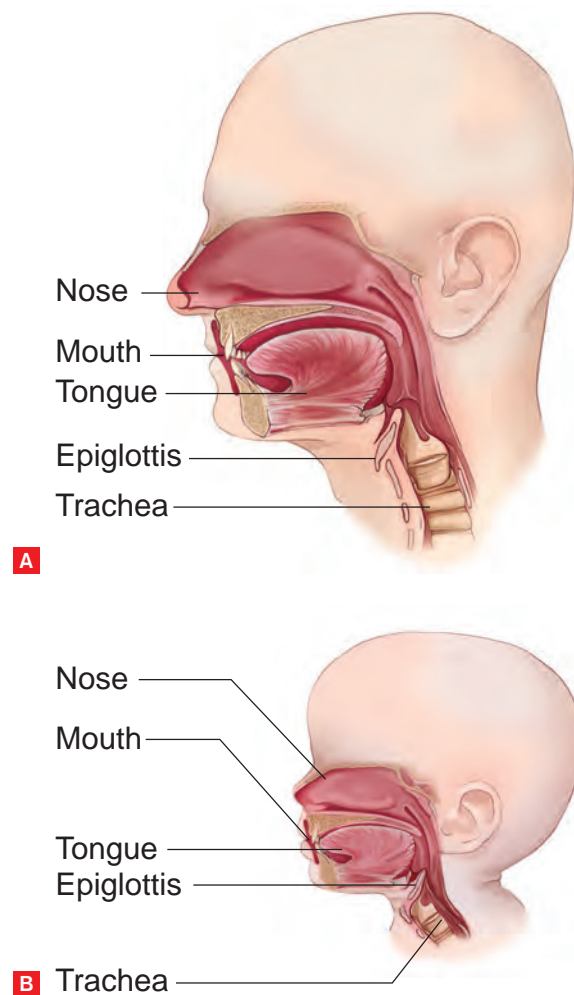
- Identify anatomical differences among adults, children and infants.
- Describe the general age groups for the purposes of emergency medical care.
- Describe the stages of child development.
- List the general considerations for assessing children and infants.
- Describe components of a pediatric assessment.
- Describe how to conduct a SAMPLE history for a pediatric patient.
- Identify common problems in pediatric patients.
- Describe common respiratory problems in children.
- Describe how to assess for and manage seizures in children.
- Describe considerations for children with special healthcare or functional needs.

## INTRODUCTION

In an emergency, you should be aware of the special healthcare or functional needs and considerations of children and infants. Knowing these needs and considerations will help you better understand the nature of the emergency and provide appropriate care. A young child may be scared or nervous due to the circumstances of the emergency, because they are being assessed by a stranger, a combination of those reasons or some other reason. Being able to communicate with and reassure children and infants can be crucial to your ability to care for these patients effectively.

## ANATOMICAL DIFFERENCES

It is important to be aware of the anatomical differences among adults, children and infants. The most significant of these differences involve the airway and breathing (Fig. 25-1, A–B).



**Fig. 25-1, A–B:** The most significant anatomical differences between (A) adults and (B) children involve the airway and breathing.

Children and infants have proportionately larger tongues than do adults, so it is easier for the tongue to block the airway. Placing pressure under the chin, which can occur during the head-tilt/chin-lift or jaw-thrust (without head extension) maneuvers, can cause the tongue to be pushed back and block the airway. Newborns and infants prefer to breathe through the nose and may *not* open their mouths when their nose is blocked, so they are more likely to develop respiratory distress if the nose is blocked.

Additionally, the epiglottis is much higher in children and infants than it is in adults. A newborn's trachea is also very narrow, only about 4 or 5 mm wide, so swelling, for example due to inhaling toxic fumes, can become life threatening very quickly.

Children and infants younger than age 5 also breathe at a rate two to three times faster than that of adults, and their breathing is shallower, as less volume and pressure are needed to ventilate the lungs.

## Determining the Age Group of the Patient for the Purpose of Providing Emergency Medical Care

At times, care must be provided according to the age of the patient and it is not always easy to determine exact age. The American Red Cross follows established age categories for emergency care that are based on epidemiological patterns of injury including care needed, while at the same time being easy to recognize based on the patient's appearance. Always follow local protocols and medical direction when deciding how to care for a child versus an adult.

In general, children and infants predominantly suffer respiratory emergencies, which, if untreated, can lead to cardiac emergencies. Adolescents and adults will often suffer primarily cardiac events. Lastly, an individual can generally look at a patient and determine if the patient is an adult, a child or an infant. At times, a small 13 month old may be categorized as an infant, or a small 13 year old as a child. However, the difference between the perceived age category and the actual age would not have any significant impact on care. Additionally, the easy recognition of a perceived age category helps to provide appropriate care quickly, a benefit that far outweighs any age discrepancy.



Based on this physiological, epidemiological and recognition approach, the following general age groups have been developed:

- **Infant**—Anyone who appears to be younger than about 1 year of age.
- **Child**—Anyone who appears to be between the ages of about 1 year and about 12 years. For automated external defibrillator (AED) purposes, based on U.S. Food and Drug Administration (FDA) approval of pediatric-specific devices, a patient who is between the ages of 1 and 8 or weighs less than 55 pounds is considered a child. If precise age or weight is not known, the responder should use best judgment and *not* delay care to determine age.
- **Adult**—Anyone approximately 12 years old or older.

## CHILD DEVELOPMENT

### Infants (Birth to 1 Year)

Infants' inability to do anything for themselves and their inability to communicate where there may be pain or discomfort makes them among the most vulnerable of children and patients. After the first few weeks of birth, an infant can usually recognize a parent's or caregiver's voice. After a few months, facial recognition becomes possible. The quality of crying usually differs according to the cause, but the subtleties of the differences may only be recognized by the parent or caregiver. Crying could be triggered by hunger, the need for diapers to be changed, pain, fear or for unknown reasons.

### Toddlers (1 to 3 Years)

Toddlers can readily recognize familiar faces and may be fearful of strangers (Fig. 25-2, A). They may not be cooperative when dealing with an unknown person, even if the parent or caregiver is in the room. Toddlers may also fear being separated from the people they know.

Crying makes it difficult for them to communicate. Some toddlers relate well to stuffed animals, to help them calm down and demonstrate what the problem may be. When dealing with an unknown emergency with a toddler, keep in mind that toddlers' curiosity about the world around them makes poison ingestion a common injury.

### Preschoolers (3 to 5 Years)

Preschoolers communicate their ideas more effectively than toddlers, but they may have difficulty with certain concepts (Fig. 25-2, B). They may have difficulty understanding complex sentences that contain more than one idea, so speak in simple terms. Children at this stage often feel that bad things are caused by their thoughts and behaviors. Their fears may seem out of proportion to the events. The sight of blood may be disturbing, but often a dressing or bandage can help calm the situation.

### School-Age Children (6 to 12 Years)

Children of school age have been exposed to more unfamiliar faces and are more likely to cooperate with strangers (Fig. 25-2, C). With reassurance from familiar faces (parents, caregivers, guardians, teachers), they are likely to understand the situation once it has been explained, and are able to cooperate with emergency responders. This age group is often fascinated with the topic of death and may have strong fantasies or imaginary ideas. Children of school age need continual reassurance.

### Adolescents/Teens (13 to 18 Years)

The characteristics of adolescents and teens vary quite a bit from the beginning of the age group (age 13) to the end (age 18) (Fig. 25-2, D). Thirteen year olds are just leaving the school-age



#### CRITICAL FACTS

It is important to be aware of the anatomical differences among adults, children and infants. The most significant of these differences involve the airway.

In general, children and infants predominantly suffer respiratory emergencies, which, if untreated, can lead to cardiac emergencies.

Anyone who appears younger than 1 year of age should be considered an infant, 1 to 12 years a child, and 12 and older an adult.



Fig. 25-2, A–D: (A) Toddler; (B) preschooler; (C) school-age child; (D) teen.

group, and 18 year olds are on the cusp of adulthood and already may have had to take on adult responsibilities. Generally, adolescents are more able to provide accurate information and cooperate with emergency responders. However, they may be apt to fall into mass hysteria, in which multiple adolescents feel they are all experiencing the same problems or symptoms. This requires understanding and tolerance on behalf of the emergency responder. Generally, this group is quite modest and will require privacy. They are also aware of the potential for fatality or permanent disability and often fear they will experience this.

## ASSESSING PEDIATRICS

### General Considerations

Assessing an injured or sick child is similar to assessing an adult, with a few differences. Primary assessments on a conscious child should be done unobtrusively, so the child has time to get used to you and feel less threatened. Try to carry out as many of the components of the initial evaluation by careful observation, without touching the child or infant. Approach the parent or caregiver, if possible, as the child will see you communicating with them and subsequently may feel more

comfortable with your exam and treatment. If appropriate, a parent or caregiver may hold the child during assessment and treatment.

Observe the young patient to assess for breathing, the presence of blood, movement and general appearance. If the child is showing signs or symptoms of a serious injury or illness, start the assessment using the head-to-toe approach. If the child is agitated or upset and there are no signs or symptoms of a serious injury or illness, the assessment can be done toe to head, which allows the patient to get used to you rather than have you in their face from the start. When treating children, remember that you are also treating their parent or caregiver as they, too, are likely to be scared or stressed. Reassess continuously as you wait for more advanced medical support to arrive. Document and report all your findings to more advanced medical personnel when they arrive.

## Scene Size-Up

Begin observing the scene from the moment you arrive. The big picture will allow you to assess the situation and may give clues to other issues, such as child abuse. As usual, also assess the scene for personal safety.

Be alert for any signs that may indicate poisoning (empty bottles, for example) and look for signs of child abuse. Are the adults responding in an appropriate manner? Are they appropriately concerned, or are they angry or indifferent? Does the child seem frightened of them and/or their reactions? Does the parent or caregiver answer your questions directly? Is the environment safe for a child? While noting how the patient was found

(position and location), keep in mind that the child may have been moved by well-meaning adults. Be sure to ask as part of your patient history. If you have confirmation that the patient has been moved, ask the adults where the child was and how the child was found.

## Assessment

### Pediatric Assessment Triangle

The **Pediatric Assessment Triangle** is a quick initial assessment of a child that takes between 15 and 30 seconds and provides a picture of the severity of the child's or infant's injury or illness. This is done during the scene size-up as part of forming your general impression and *before* beginning the primary assessment. It does *not* require touching the patient, just looking and listening.

You should observe three components in the child—appearance, work of breathing and skin:

- **Appearance:** Does the child appear to have normal muscle tone? Is the child crying, talking or moving about? Is the child able to interact with you or other adults in the area? Is the child able to make eye contact or be consoled?
- **Breathing:** Does the child appear to be breathing? Does breathing require great effort (flaring nostrils, indrawn area just below the throat or use of abdominal muscles)? Is the child leaning forward in an attempt to breathe? Is any noise coming from the child, such as wheezing or any other abnormal sound?
- **Skin (Circulation):** When looking at the child, is the skin pale, mottled or cyanotic (bluish)? Are any signs of trauma or bleeding present?



### CRITICAL FACTS

Assessing an injured or sick child is similar to assessing an adult, with a few differences. Primary assessments on a conscious child should be done unobtrusively, so the child has time to get used to you and feel less threatened. Try to carry out as many of the components of the initial evaluation by careful observation, without touching the child or infant.

Observe the young patient to assess for breathing, the presence of blood, movement and general appearance. Unless the child is agitated or upset, start the assessment using the head-to-toe approach.

The Pediatric Assessment Triangle is a quick initial assessment of a child that takes between 15 and 30 seconds and provides a picture of the severity of the child's or infant's injury or illness. This is done during the scene size-up and before beginning the primary assessment. It does not require touching the patient, just looking and listening.

## Equipment for Assessing and Caring for Children and Infants

As children come in all different sizes, so does the equipment used to assess them. A wide range of sizes should be available for assessing children, to provide optimal care.

Essential equipment and supplies include:

- Bag-valve-mask (BVM) resuscitators with oxygen reservoirs.
- Oxygen masks.
- Non-rebreather masks.
- Airway adjuncts.
- Bulb syringe.
- Portable suction unit with regulator.
- Suction catheters.
- Cervical immobilization devices.
- Backboard and other extrication devices.
- Extremity splints.
- Stethoscope for pediatrics.
- Blood pressure cuffs.
- Thermal blankets.
- Water-soluble lubricant.

A new, clean stuffed animal and references for the Glasgow Coma Scale and Pediatric Trauma Score are also recommended.

### Airway

An airway that is open, even if only partially open, will allow the child to cough, cry or breathe. Even with an open airway, the child should be observed closely for any change in status. A child whose airway becomes compromised or shows signs or symptoms of inadequate breathing or a lack of oxygen will need immediate care.

A child's airway can be blocked by anatomical or mechanical obstructions. For example, illness can cause constriction of the bronchi and upper airway as in **status asthmaticus** (asthma) or anaphylaxis (anatomical). Infection and trauma can also cause swelling and block the airway. Children are prone to airway obstruction caused by small objects as well as food (mechanical). Choking hazards among children include small objects such as coins, buttons, small toys and parts of toys and balloons, as well as certain food items. While hazardous for all children, these objects generally pose a larger threat to children under age 4.

If a solid object is blocking the child's upper airway, oxygen may not enter the lungs. This situation requires immediate care for a conscious choking

child or infant; a combination of skills may be needed to clear the airway including abdominal thrusts and back blows for a child, or back blows and chest thrusts for an infant. If secretions are blocking the airway, suctioning will help remove them. The suction may need to be repeated frequently to maintain an open airway, so the child should be monitored at all times.

### Ventilation/Oxygenation

A child who is in respiratory distress may be agitated or drowsy. Agitation results from trying to get air; drowsiness is the result of insufficient oxygenation. The breathing effort increases in many cases, but as **respiratory failure** sets in, the breathing effort may decline considerably as the child weakens. Additionally, a combination can occur; the child may breathe with great effort for periods, followed by declining efforts as the child tires.

If the child is not breathing adequately or is not breathing at all, ventilation and/or oxygenation will be required (Fig. 25-3). Signs of the need for this assistance would be agitation or drowsiness, limp muscles, inability to respond and a pale or cyanotic appearance.

### Circulation

Circulation in a child is similar to that of an adult, though the average child's pulse is more rapid than an adult's.

Observe the child for signs and symptoms of shock, which include restlessness; cold, clammy, pale or ashen skin; rapid or irregular breathing; falling blood pressure; altered mental status; rapid, weak or **thready** pulse; delayed capillary refill; and an absence of tears if the child or infant is crying. Place the child in the supine position (flat on their back).

A child who is in shock or is at risk of going into shock must be kept from getting chilled or overheated. Place a blanket over the child to help maintain the body temperature. Monitor the child closely for any changes in status.

### Determining the Level of Consciousness

Using the AVPU scale, you can start to determine the child's level of consciousness (LOC). The AVPU scale is a mnemonic that describes stages of awareness: **A**lert (the patient can respond to questions and is aware of the surroundings), **V**oice (the patient responds to verbal stimuli), **P**ain (the patient only responds to painful stimuli)





**Fig. 25-3:** If a child is not breathing adequately, give ventilations or administer supplemental oxygen, based on local protocols.

and **Unresponsive** (the patient does *not* respond to *any* stimuli). The AVPU scale is covered more thoroughly in Chapter 7.

Another way to determine the LOC is pupil assessment, which involves checking to see if the pupils react to light. Shine a flashlight or penlight quickly into and then out of the child's eye. In a normal reaction, the pupil constricts in response to the light and then dilates again after the light is removed.

Movement is another good indication of LOC. Observe the child. A fully alert child will have spontaneous movements and as LOC diminishes, so will the movement.

### Exposure

Despite the need to keep the child covered if you are concerned about shock, you must be able to assess the child properly and thoroughly, barring any life-threatening situation. Check the child for any other injuries or signs of trauma. You do *not* need to uncover the child completely. You may remove the top part of the blanket to examine the upper body, cover the child and then remove

the lower part of the blanket to examine the lower body.

Be swift and cover the child as quickly as possible. Because a large proportion of body heat is lost through the head and neck, cover the child's head to minimize the loss of body heat.

### SAMPLE History

When taking a child's **SAMPLE** (signs and symptoms, allergies, medications, pertinent medical history, last oral intake and events leading up to the incident) history, you will need the parent's or caregiver's cooperation (Fig. 25-4). Encourage this cooperation by remaining respectful and polite during the conversation, even if the adult is difficult or if you suspect child abuse or child neglect. Ask questions that require detailed answers, not yes-or-no questions. If the child is young but wants to participate, welcome this. An older child, particularly an adolescent, may want to speak with you privately. Keep this in mind if you must ask sensitive questions about topics such as sexual activity or drug use.



**Fig. 25-4:** When obtaining a SAMPLE history for a child, keep the child with the parent or caregiver.

If you are not sure that the answers you receive are accurate or contain enough information, try asking the question in another manner, using different phrasing. Use feedback, repeating the answers as you make note of them, to be sure you heard correctly.

### Symptoms and Duration

Ask the parent, caregiver, or child, if appropriate, about the symptoms, any changes (worsening or easing) and how long they have been present.

While obtaining a patient history, inquire about:

- Fever.
- Unusual activity level.
- History of eating, drinking and urine output.
- History of vomiting, diarrhea and abdominal pain.

### Allergies

Ask the parent, caregiver or child, if appropriate, if they have any allergies. While obtaining a patient history, inquire about allergies to:

- Medications.
- Food.
- Environmental elements, such as dust, pollen or bees.

### Medications

Ask the parent or caregiver about medications the child might take. Does the child take any prescription medications or has the parent or caregiver given any over-the-counter medications recently? Does the child have any allergies to medications? Could the child have gotten into someone else's medications?

### **CRITICAL FACTS**

You will need the parent's or caregiver's cooperation while taking a child's SAMPLE history. Be respectful and polite, even if you suspect child abuse or neglect. Avoid asking yes-or-no questions. Allow a child to participate; older children may want to talk privately, especially if you must ask sensitive questions concerning sexual activity or drug use.

## Pertinent Past Medical Problems or Chronic Illnesses

Ask the parent or caregiver if something like this has ever occurred before. If so, what caused it before and what happened in the long run? Does the child have any chronic illnesses, such as asthma or diabetes? Has the child been ill lately with any other type of illness?

## Last Oral Intake

Ask the parent or caregiver when the child last had something to eat or drink and what it was.

## Events Leading Up to the Injury or Illness

Ask the parent or caregiver what specifically was going on when the injury or illness was first noticed. What was the environment like (where did it happen)? What was the child doing? What was the child's reaction?

## Physical Exam

Conducting a physical exam of a child or an infant requires some special handling. Try to have only one individual deal with the child, to reduce the anxiety of being handled by multiple strangers. If you can, crouch down to the child's eye level. Speak calmly and softly and maintain eye contact. Be gentle and *never* lose your temper. Involve people who are familiar to the child, if possible. For preschoolers, save frightening tools like stethoscopes until the child has had a chance to get used to you.

When examining a child, the standard procedure is to go from head to toe. For a very agitated child, however, the exam may be more successful if it is performed toe to head.

A head-to-toe exam involves the following components:

- Head: Look for bruising or swelling.
- Ears: Look for drainage suggestive of trauma or infection.
- Mouth: Look for loose teeth, identifiable odors or bleeding.
- Neck: Look for abnormal bruising.
- Chest and back: Look for bruises, injuries or rashes.
- Extremities: Look for deformities, swelling or pain on movement.

## COMMON PROBLEMS IN PEDIATRIC PATIENTS

Certain problems are unique to children, such as specific kinds of injury and illness.

### Airway Obstructions

Some of the most common airway problems you may encounter with small children and infants are airway obstructions. Airway obstructions may be categorized as either partial or complete. Signs of a partial airway obstruction in a child or an infant who is alert and sitting up include:

- Abnormal high-pitched musical sounds, crowing or noisy respirations.
- **Retraction.**
- Drooling.
- Frequent coughing.

Keep the child or infant in a position of comfort, possibly sitting on a parent's or caregiver's lap. The child can stay there while you administer supplemental oxygen based on local protocols.

A complete airway obstruction is a life-threatening situation. A partial airway obstruction in a child or an infant who is showing signs of cyanosis should be treated as a complete airway obstruction. Signs of a complete airway obstruction include:

- Inability to cough, cry or speak.
- Cyanosis.
- Loss of consciousness.
- Altered mental status.

Care includes clearing the airway and attempting ventilation using the mouth-to-mask technique. For more information on clearing airway obstructions in children and infants, refer to Chapter 11.

### Breathing Emergencies

Respiratory distress is apparent when the child or infant begins to experience difficulty breathing. If uncorrected, respiratory distress can lead to respiratory failure.

### Anatomic and Physiological Differences in Children

Anatomical differences among adults, children and infants can change their susceptibility to respiratory difficulties and affect how to provide emergency care:

- In children and infants, the tongue is larger in relation to the space in the mouth than it is in



adults. This can increase the risk of the tongue blocking the trachea.

- In children, the airway is smaller, resulting in more objects, such as different types of solid foods, being a choking hazard. Their smaller airway can make children more prone to developing infections or amassing liquid secretions. This also affects the choice of ventilation equipment used.
- In children, the trachea is not as long as it is in adults, so any attempt to open the airway by tilting the child's head too far back will result in blocking the airway.
- Children breathe using their diaphragm, so ensure nothing is pressing on the abdomen to prevent this. Also, if possible, allow the child to sit up.
- Young children and infants do *not* usually breathe through their mouth; they breathe through their nose. Ensure that the nose is as clear as possible for breathing.

## Pathophysiology

The process of respiratory emergencies usually follows the pattern of respiratory distress, followed by respiratory failure, which is then followed by respiratory arrest if emergency interventions are not attempted or are not successful.

Respiratory distress occurs when the child is having trouble breathing but is visibly able to breathe. A child in respiratory distress may be mentally alert and/or agitated. The patient's breathing effort is increased and the skin color may be normal or pale.

Respiratory distress preceding respiratory failure is characterized by:

- In infants, a respiratory rate of more than 60 breaths per minute.
- In children, a respiratory rate of more than 30 breaths per minute.
- Flaring of the nostrils.
- Use of neck muscles and muscles between and below the margin of the ribs to aid in breathing.
- Abnormal, high-pitched sounds when breathing.

- Cyanosis.
- Altered mental status.
- Grunting.

Respiratory failure occurs when the respiratory system is beginning to shut down. The child may be sleepy and lethargic, or may alternate between being agitated and sleepy. Muscle tone is generally limp, breathing is usually visible, and breathing can decrease or alternate between increased and weak effort as the child becomes tired. The skin is usually pale, mottled or cyanotic.

Respiratory arrest occurs when the respiratory system shuts down. The child is unconscious and completely limp. Signs of breathing may be slight, but are most likely absent, and the skin color is cyanotic.

The importance of recognizing early signs of respiratory distress cannot be emphasized enough. Early recognition of respiratory emergencies can make the difference between life and death. More information on the recognition and care of breathing emergencies can be found in Chapters 10 and 11.

## Assessing Breathing Emergencies

The child's ability to breathe adequately must be assessed by checking the mental status, muscle tone, breathing movement, breathing effort and skin color. Once you have made your assessment, be sure to frequently perform follow-up assessments to note if there are any changes in the child's respiratory status.

## Common Respiratory Problems in Children

Although many types of breathing problems can affect children, some will be seen by emergency responders more often than others, such as croup, epiglottitis, asthma and choking on an obstruction.

**Croup** is a common upper airway virus that affects children younger than 5. The airway constricts, limiting the passage of air, causing the child to produce an unusual sounding cough that can range from a high-pitched wheeze to a barking



### CRITICAL FACTS

Certain problems are unique to children, such as specific kinds of injury and illness. Some of the most common airway problems the emergency responder may encounter with small children and infants are airway obstructions.

Anatomical differences among adults, children and infants can change their susceptibility to respiratory difficulties and affect how to provide emergency care.



cough. Croup occurs most often during the evening and night hours.

A child with croup may progress quickly from respiratory distress to respiratory failure. Children with croup may benefit from humidified oxygen. If you are transporting the child to the hospital, you may see an improvement in the child once exposed to cool air outdoors.

**Epiglottitis** is a bacterial infection that causes severe swelling of the epiglottis. While it is extremely rare, the symptoms may be similar to croup; it is a more serious illness and can result in death if the airway is blocked completely.

If the child is older, you may see the tripod position, where the child is sitting up and leaning forward, perhaps with the chin thrust outward (Fig. 25-5). Other signs are drooling, difficulty swallowing, voice changes and fever.

A child with epiglottitis can move from respiratory distress to respiratory failure very quickly without emergency care. With epiglottitis, keeping the child as calm as possible is vital. Do *not* examine the throat using a tongue depressor or place anything in the child's throat, as these can trigger a complete airway blockage.

Asthma is a common illness and can be triggered in many children by exposure to allergens. Air is drawn into the lungs, but as the bronchioles constrict during an asthma attack, they also may fill with mucus, blocking the air in the lungs from exiting. This blockage results in the characteristic wheeze when the patient exhales. Ask the parent or caregiver if the child is known to have asthma and, if so, if any rescue medications are available. If medications have been administered, find out

what has been taken and how often up to the time of your arrival.

The status of a child with asthma can change very quickly, so constant monitoring is necessary. The typical signs of asthma include rapid respirations that take effort as respiratory distress develops, but the breathing may seem to become less labored. This does not indicate improvement, but rather deterioration in respiratory status.

Choking is a common emergency in young children, particularly once they become mobile and are able to explore on their own. Your interventions will be based on your assessments as to whether the child has a partial or complete airway obstruction.

## Providing Care for Breathing Emergencies

Treatment of all respiratory emergencies is generally the same. Use equipment that is properly sized for the child, particularly if using an oxygen mask (Fig. 25-6). The mask should fit the child and should deliver the appropriate amount of oxygen. Monitor the airway and breathing continuously, and arrange for transport as quickly as possible.

## Circulatory Failure

As with adults, undetected and uncorrected circulatory failure in children and infants can cause cardiac arrest. Signs and symptoms of circulatory failure include:

- Increased heart rate (but can also be decreased).
- Unequal pulses (femoral compared with radial).
- Delayed capillary refill.
- Changes in mental status.



**Fig. 25-5:** An older child with epiglottitis may demonstrate the tripod position, in which the child sits up, leaning forward, possibly with the chin thrust outward.



**Fig. 25-6:** Equipment, particularly oxygen masks, should be properly sized for the child so that it fits correctly.

Unlike adults, children seldom initially suffer a cardiac emergency. Instead, they suffer a respiratory emergency that develops into a cardiac emergency. Motor-vehicle collisions, drowning, smoke inhalation, poisoning, airway obstruction and falls are all common causes of respiratory emergencies that can develop into a cardiac emergency. A cardiac emergency can also result from an acute respiratory condition, such as a severe asthma attack. *Always* be prepared for the possibility of circulatory failure when dealing with a respiratory emergency.

Care for circulatory failure includes identifying problems through assessment; assisting attempts to breathe by opening the airway, removing obstructions or providing ventilation; and observing for signs of cardiac arrest, performing CPR and using an AED. More information on the identification and care for circulatory failure can be found in Chapter 13.

## Seizures

A **seizure** is a disorder in the brain's electrical activity, sometimes marked by loss of consciousness and often by uncontrollable muscle movement; also called a convulsion. A chronic condition, such as epilepsy, or an acute event may cause seizures.

In children, **febrile seizures** are the most common type of seizure. These seizures occur with a rapidly rising or excessively high fever, higher than 102° F (38.9° C). Febrile seizures may have some or all of the following signs and symptoms:

- Sudden rise in body temperature
- Change in LOC
- Rhythmic jerking of the head and limbs
- Loss of bladder or bowel control
- Confusion
- Drowsiness
- Crying out
- Becoming rigid
- Holding the breath
- Rolling the eyes upward

## Assessing Seizures

When obtaining a history from the parent or caregiver, you need to know several things to assess what type of seizure the child may be having and what may have caused it. Ask questions such as:

- Has the child ever had seizures before? If so, does the child have medications for them? If not, is there a family history of seizures?
- Does the child have diabetes? If so, what type of insulin/medication is being used and when

was the last time it was given? Does the parent or caregiver monitor the blood sugar level? If so, what was the child's blood sugar level when it was most recently monitored?

- Has the child begun taking any new medications lately? If the child takes medications, is it possible there may have been an overdose? Could the child have taken someone else's medication?
- Did the child have access to anything poisonous?
- Has the child had an injury, particularly a head trauma, recently?
- Has the child seemed sick or had a high fever, stiff neck or recent headache?
- What did the seizure look like? Did it involve the child's whole body, or only one half of the body? Did it start in one area and progress to the rest? Did the child fall when the seizure began and if so, was it possible the child's head struck an object or the floor?

## Managing Seizures

The general principles of managing a seizure are to prevent injury, protect the child's airway and ensure that the airway is open after the seizure has ended. Call for more advanced medical personnel for a child or an infant who has had a seizure and for a young child or an infant who experienced a febrile seizure brought on by a high fever.

Do *not* put anything in the child's mouth and do *not* restrain the child. Ensure that the environment is as safe as possible to prevent injury to the child during the seizure by moving away any furniture or other objects. Place the child in a side-lying recovery position during the seizure, if it is possible and safe to do so.

After the seizure, ensure the child's airway is open and administer supplemental oxygen, based on local protocols. Suctioning the airway may be necessary to remove excessive fluids. Also, after the seizure, assess the patient for any injuries that may have been sustained as a result of the seizure. If you have not already done so, position the child or infant on their side so that fluids (saliva, blood, vomit) can drain from the mouth.

Care for a child or an infant who experiences a febrile seizure is much the same as for any other seizure. Most febrile seizures last less than 5 minutes and are not life threatening. However, immediately after a febrile seizure it is important to cool the body if a fever is present.

See Chapter 14 for more information on managing seizures.

## Fever

**Fever** is defined as an elevated body temperature. It signifies a problem and, in a child or an infant, can indicate specific problems. Often these problems are not life threatening, but some can be. A high fever in a child often indicates some form of infection. In a young child, even a minor infection can result in a rather high fever, which is often defined as a temperature higher than 102° F (38.9° C). If a fever is present, call for more advanced medical help at once.

Your initial care for a child with a high fever is to gently cool the child. Never rush cooling down a child. If the fever has caused a febrile seizure, rapid cooling could bring on another seizure. Parents or caregivers often heavily dress children with fevers. Remove the excess clothing or blankets. Do *not* use an ice water bath or rubbing alcohol to cool down the body. Both of these approaches are dangerous, and parents and caregivers should be discouraged from ever using them.

Do *not* give children or infants aspirin or products that contain aspirin when they show flu-like symptoms including fever, or if they may have a viral illness such as chicken pox, as this may result in an extremely serious medical condition called **Reye's syndrome**. Reye's syndrome is an illness that affects the brain and other internal organs. Ask the parent or caregiver what medications they may have given the child so you can inform more advanced medical personnel.

## Poisoning

Poisoning can cause many types of emergencies, from seizures to cardiac arrest. Unintentional poisoning is a leading cause of unintentional death in the United States for adolescents, children and infants. Just under half of exposure cases managed by Poison Control Centers involve children younger than 6. Children in this age group often become poisoned by ingesting medications (typically those intended for adults) and household products, such as laundry detergent pods and solid objects, like batteries, particularly the watch-sized batteries found in many children's toys.

## Shock

Shock is the body's reaction to a physical or emotional trauma in both adults and children. Physical trauma could include loss of blood. In small children, the loss of blood may be much more significant than in adolescents or adults. This adds to the increased risk of shock and

the speed with which it may develop. Children can go into shock very quickly, regardless of the cause, and may go into cardiac arrest much faster than adults.

## Causes of Shock in Children

In addition to trauma, shock may also be caused by infection. Infections can send the body into shock because of the body's reaction to the infection. The risk of shock increases with the severity and centrality of the infection.

Among children, the most common cause of shock is vomiting or diarrhea. As they lose fluid from the vomit and/or diarrhea, their body fluid volume becomes depleted and their blood pressure drops.

## Assessing Shock

When assessing shock, watch the child's mental status, including any changes that have occurred since you arrived on the scene. Some children may experience a change in mental status so pronounced that it makes them unable to recognize their parent or caregiver. This altered mental status is a strong indicator that shock is developing quickly and may result in cardiac arrest.

Other signs and symptoms of shock include:

- Cold, clammy, pale or ashen skin, particularly in infants, as they are less capable of regulating body temperature.
- Rapid, weak or thready pulse.
- Rapid or irregular breathing.
- Lack of tears when crying.
- Low or lack of urine output.
- Falling blood pressure.

## Providing Care for Shock

Lay the child flat if possible, but do not force it if the child is too agitated or upset. Constantly monitor the child's respiratory and circulatory status. Have equipment available should the child go into cardiac arrest.

## Altered Mental Status

Altered mental status in children and infants is another medical condition you may encounter. This can be caused by low blood sugar, poisonings or overdoses, seizures, infections, trauma, decreased level of oxygen and the onset of shock. When assessing altered mental status, use the AVPU scale, which is covered more thoroughly in Chapter 7.

When arriving on the scene, determining the cause of the alteration in mental status right away is not essential. Your role is to support the patient by maintaining an open airway and administering supplemental oxygen based on local protocols. Any information you can gather from the parent, caregiver or bystanders will help you care for the patient.

## Trauma

Injury is the number-one cause of death for children in the United States. Many of these deaths are the result of motor-vehicle collisions. The greatest dangers to a child involved in a motor-vehicle crash are airway obstruction and bleeding. Ensure an open airway and control severe bleeding as quickly as possible. A relatively small amount of blood lost by an adult is a large amount for a child or an infant.

Because a child's head is large and heavy in proportion to the rest of the body, the head is the most frequently injured part of the child's body. A child injured as the result of force or a blow may also have sustained damage to the organs in the abdomen and chest. Because children have very soft, pliable ribs, such damage can cause severe internal bleeding. Care for a child with a chest injury involves keeping an open airway, assessing the chest for rise and fall, and administering supplemental oxygen based on local protocols.

In a car crash, a child only secured by a lap belt may have serious abdominal or spinal injuries. You may need to rely on bystanders' reports of what

happened, as a severely injured child may not immediately show signs of injury.

Laws requiring children to ride in safety seats or wear safety belts have been enacted to stop some of the needless deaths of children associated with motor-vehicle crashes. As a result, children's lives are being saved. However, you may have to check and care for an injured child or infant while the child is in a safety seat (Fig. 25-7). A safety seat does not normally pose any problems when checking a child or an infant. Leave the child or infant in the seat if the seat has not been damaged. If the child or infant is to be transported to a medical facility for examination, the child can often be safely secured in the safety seat for transport.

Care for extremity injuries in a child or an infant in the same way as for adults. When providing care for an injured child or infant, use equipment of the proper size. If equipment of the proper size is not available, manually stabilize extremity injuries until additional help arrives. Information on the general management of extremity injuries can be found in Chapter 22.

Try to comfort, calm and reassure the child and family members while waiting for additional emergency medical services (EMS) resources.

## Child Abuse and Neglect

You may at some point encounter a situation involving an injured child in which you believe or have reason to suspect child abuse or neglect is involved.



**Fig. 25-7:** If the safety seat has not been damaged, leave the child in it while you are checking and caring for the child.



## Types of Abuse

**Child abuse**, or non-accidental trauma, is the physical, psychological or sexual assault of a child resulting in injury and emotional trauma. Child abuse involves an injury or pattern of injuries that do *not* result from a mishap. You might suspect child abuse if the child's injuries cannot be logically explained or a caregiver or parent gives an inconsistent or suspicious account of how the injuries occurred. Perpetrators of child abuse may often be evasive or volunteer very little information.

One type of abuse is **shaken baby syndrome**, which is the result of a young child being shaken harshly—hard enough to cause brain swelling and damage. Signs and symptoms of shaken baby syndrome include unconsciousness, lethargy/ decreased muscle tone, extreme irritability, difficulty breathing, seizures, inability to lift head, inability of eyes to focus and decreased appetite.

**Child neglect** is insufficient attention given to or a lack of respect shown to a child who has a claim to that attention. Neglect is the most common type of child abuse reported. Signs and symptoms include:

- Lack of adult supervision.
- A child who appears underfed or malnourished.
- An unsafe living environment.
- Untreated chronic illness; for example, a child with asthma who has no medications available despite being issued a prescription.

## Epidemiology of Child Abuse and Neglect

**Epidemiology** studies show that child abuse is not limited to a certain sector of society but may occur in any part. Every year in the United States, almost 700,000 children are victims of child abuse and neglect, and more than 1,600 children die from the abuse and neglect at a rate of 2.25 per 100,000 children. Of those, 75.3 percent were neglected, 17.2 percent were physically abused and 8.4 percent were sexually abused.

## Assessing Child Abuse and Neglect

Upon arriving on the scene, note anything in the child's history or at the scene that causes concern or suspicion of abuse or neglect. Watch the caregiver's behavior, which may be evasive; the caregiver (usually a parent) may not volunteer much information or may contradict information already given. Also observe for particular physical signs and symptoms:

- Injury that does not fit the description of what caused it

- Patterns of injury that include cigarette burns, whip marks and handprints (Fig. 25-8, A–B)
- Obvious or suspected fractures in a child younger than 2 years of age
- Any unexplained fractures
- Injuries in various stages of healing, especially bruises and burns (Fig. 25-8, C)
- Unexplained lacerations or abrasions, especially to the mouth, lips and eyes (Fig. 25-8, D)
- Injuries to the genitalia
- Pain when the child sits down
- More injuries than are common for a child of that age
- Repeated emergency calls to the same address

## Managing Child Abuse and Neglect

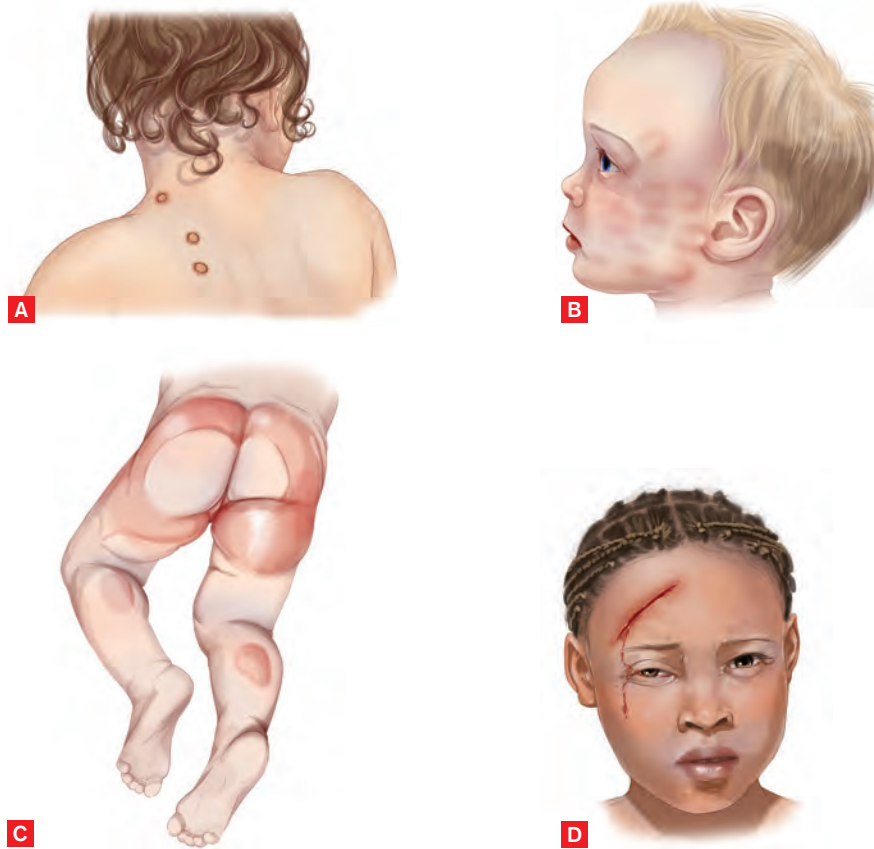
When caring for a child who may have been abused, your first priority is to care for the child's injuries or illness. An abused child may be frightened, hysterical or withdrawn. Abused children may also be unwilling to talk about the incident in an attempt to protect the abuser or for self-protection. If you suspect abuse, explain your concerns to the responding police officers or emergency medical technicians (EMTs), if possible.

When answering a call where you suspect abuse, you must ensure your own safety. Do *not* place the child in the awkward position of having to tell you things that may cause tension with a parent or caregiver. Focus on treating the child and making your assessments. *Never* confront the parent or caregiver about your suspicions, as this could put you and/or the child at risk. If you need to transport the child out of the environment, the parent's or caregiver's support is essential.

## Legal Aspects of Child Abuse and Neglect

If you have reasonable cause to believe that abuse has occurred, you can report your suspicions to a community or state agency, such as the Department of Social Services, the Department of Children and Family Services, or Child Protective Services. You may be afraid to report suspected child abuse because you do not wish to get involved or are afraid of getting sued.

You do *not* need to identify yourself when you report child abuse, although your report will have more credibility if you do. In some areas, certain professions are *legally obligated* to report suspicions of child abuse as a mandated reporter.



**Fig. 25-8, A–D:** When you arrive on the scene, observe for particular physical signs of child abuse or neglect. These include **(A)** cigarette burns, **(B)** handprints, **(C)** burns and **(D)** unexplained lacerations.

## Documenting Child Abuse and Neglect

As with all emergency calls, you must document your observations and actions and the patient's response objectively. When dealing with suspected child abuse or child neglect, remain objective in your documentation. Do *not* write any supposition or theories. If there is later legal action, your notes may be used in court. Your notes have a better chance of being useful if they are thorough and objective.

## Sudden Infant Death Syndrome

**Sudden infant death syndrome (SIDS)**, which used to be called crib death, is the unexplained sudden death of an infant younger than 1, but it occurs most often between the ages of 4 weeks and 7 months. SIDS almost always occurs while the infant is sleeping. This condition does not seem to be linked to any disease. Because the cause or causes of SIDS are not yet understood, parents do not know if their child is at risk. SIDS is sometimes mistaken for child abuse because

of the unexplained death of an otherwise healthy child and the presence of bruise-like blotches that sometimes appear on the infant's body. However, SIDS is not related to child abuse. SIDS is also not believed to be hereditary, but it does tend to recur in families.

## Epidemiology and Risk Factors

The rate of SIDS occurrence is significantly lower now than prior to 1992, when parents and caregivers were first told to put infants to sleep on their back or side. Even so, unfortunately, SIDS still causes a significant number of deaths in infants younger than 1, and thousands of babies die of SIDS in the United States each year.

Parents and caregivers should *not* place anything in the crib, including pillows, blankets or toys, and should try to ensure that the infant is *not* exposed to any secondhand smoke. Babies who die of SIDS are most often reported to have been perfectly healthy, although some reports indicate some infants had a cold prior to their death.

## Lowering the Risk for SIDS

Because it cannot be predicted or prevented, SIDS makes many new parents feel anxious. However, there are several things they can do to lower the risk for SIDS. The American Academy of Pediatrics has guidelines for safe sleep, which include the following for the first year of an infant's life:

- Always place an infant on their back for every sleep time including naps.
- Always use a firm sleep surface. Car seats and other sitting devices are not recommended for routine sleep.
- The infant should sleep in the same room as the parents or caregivers, but not in the same bed.
- Bed sharing is not recommended for any infants.
- Keep all soft objects or loose bedding out of the crib. This includes pillows, blankets, bumper pads and toys.
- Wedges and positioners should not be used.
- Do not smoke during pregnancy or after birth.
- Offer a pacifier at nap time and bedtime.
- Avoid covering the infant's head or allowing the infant to become overheated.
- Do not use home monitors or commercial devices marketed to reduce the risk of SIDS.
- Supervised, awake tummy time is recommended daily to facilitate development and minimize the occurrence of positional plagiocephaly (flat head).
- Make sure an infant has received all recommended vaccinations. Evidence suggests that immunization reduces the risk for SIDS by 50 percent.
- Breastfeeding is associated with a reduced risk for SIDS and is recommended.

For more information on the guidelines for sleep position for infants and reducing the risk for SIDS, visit [healthychildren.org/safesleep](http://healthychildren.org/safesleep). Additional information can be found on the National Institutes of Health website at [nichd.nih.gov/sids/](http://nichd.nih.gov/sids/).

*Source:* American Academy of Pediatrics: *Ages & stages: Reduce the risk of SIDS*. [healthychildren.org/safesleep](http://healthychildren.org/safesleep). Accessed December 2016.

## Assessing and Managing SIDS

When called for a SIDS death, unless the infant is very obviously dead (rigor mortis has set in), attempt resuscitation with CPR as per infant protocols. Follow local EMS protocols for death in the field, and notify the appropriate authorities.

If possible, try to obtain the following information:

- When was the infant last checked on or put to bed and seen to be breathing?
- Who discovered the infant and what brought the person into the room (concern of infant sleeping too long, time to get up, etc.)?
- How was the infant lying in the crib, in what position?
- Was anything else in the crib?
- Were any other adults or children in the house while the infant was sleeping?
- What was the infant's state of health?
- Did the infant seem different, uncharacteristically quiet or cranky, for example, when last put in the crib?
- Did the infant have any illnesses or allergies?
- Was the infant given any medications?
- Were any medications or toxic substances nearby?
- How warm was the bedroom?

By the time the infant's condition is discovered, the infant will likely be in cardiac arrest. Ensure that someone has called more advanced medical personnel, or call for help yourself. Give the infant CPR until more advanced medical personnel take over.

## Support for SIDS

Because of the circumstances of the death, the parents, caregivers and possibly siblings may be your patients as much as the infant. Shock can result from a severe emotional trauma, so observe the parent or caregiver closely for signs and symptoms of shock.

When more advanced emergency personnel take over the infant's care, you can focus on the family. Encourage them to accompany the infant. If they are concerned about leaving other children behind, see if a neighbor or friend is able to stay with their children.

## Apparent Life-Threatening Events

An **apparent life-threatening event (ALTE)** is a sudden event in infants younger than 1, characterized by apnea, change in

color, change in muscle tone, and coughing or gagging. About half the time, ALTE is linked to an underlying digestive, neurologic or respiratory health problem, but it remains unexplained in half of all cases. When linked to certain other conditions, ALTE is thought to be a risk factor for SIDS. At one time it was believed these two conditions were more strongly linked and it was questioned whether ALTE was simply a “near-miss” case of SIDS, but experts no longer believe this is the case.

## Considerations for Children with Special Healthcare or Functional Needs

In addition to the more common problems any child may have, a child with special healthcare or functional needs may have additional health concerns. When called to a scene with a child with special healthcare or functional needs, the parent or caregiver can generally provide you with the most information, because they are the most familiar with the medical equipment the child may use. Pieces of equipment may include:

- Power wheelchairs.
- Ventilators.
- Communication systems.
- Feeding apparatus.

While making your assessments, the parent or caregiver can provide valuable insight into the problem. They may suspect a specific issue, or perhaps a similar situation occurred previously.

While assessing breathing and pulse, take into account that if a child is on a respirator or ventilator, the problem may not be with the child, but with the machine. You may need to manually give ventilations with a BVM or other device while the machine is being checked.

When caring for children, you depend on your assessment skills to determine the child’s age and maturity level. When dealing with children who have special healthcare or functional needs, the child’s age and maturity level may not be as straightforward, depending on the child’s disability. Do *not* assume a child’s mental capacity if the child is unable to express thoughts or words. Ask the parent what the child is capable of understanding, and speak directly to the child as you would to any other child. Do *not* speak to the parent or caregiver as if the child is not in the room.

## THE EMERGENCY MEDICAL RESPONDER’S NEEDS

Dealing with emergency situations can be difficult for many emergency medical responders (EMRs). The difficulty can be compounded when the emergencies include children, particularly if they involve suspected child abuse or SIDS. The death of a child, especially if declared on the scene of an incident, can be very difficult for any responder.

While you are on scene, caring for the child and interacting with the parent, caregiver and/or bystanders, maintain a professional demeanor and control your emotions. This is easiest if you focus on the task at hand and *only* the task. However, once you are away from the scene, your professional “mask” may be removed as you deal with your own thoughts and emotions.

As a person, you are entitled to your own thoughts and emotions, be they anger, pain or sorrow. Feeling anxious and helpless is common and normal after such events. However, these feelings must be put in context so they do not overwhelm you and interfere with your professional and personal life.

Most emergency response teams have resources available to help responders following a critical event. More information on this topic can be found in Chapter 2.

## PUTTING IT ALL TOGETHER

Caring for children is similar in many ways to caring for adults, but differences exist, both physical and emotional. Caring for a child often also means providing support and care to the parent or caregiver, who are often stressed and anxious.

Assessing breathing and pulse in children is, for the most part, the same as assessing the same things in adults. For both adults and children, breathing and pulse are your priority and must be assessed before all else. Although the airway must be patent in both adults and children, it is smaller and shorter in children, and their respirations are generally more rapid than those of an adult. When assessing circulation, a child who is bleeding may go into shock more rapidly than an adult because of the lower quantity of blood circulating in a child’s body.

Caring for children may also involve potentially anxiety-provoking situations, such as child abuse or neglect. If you suspect child abuse or neglect, you must perform your duties as a professional, and keep your personal feelings to yourself.



You are not, however, helpless; you can report concerns of child abuse if you feel they are warranted.

Finally, as an EMR, you will likely face death on occasion, and dealing with a child's death may have an especially strong impact. Although you

must remain professional while on the job, you also must recognize that—as a person—you have the right to feel upset, anxious, angry or any other emotion. Take care of yourself so that these emotions do not overcome you and affect your life.

## **> You Are the Emergency Medical Responder**

As you continue to monitor the child's condition, you notice that the hives have spread beyond the affected area. What care should you provide?

# OLDER ADULTS AND PATIENTS WITH SPECIAL HEALTHCARE OR FUNCTIONAL NEEDS

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## ▶ You Are the Emergency Medical Responder

Your police unit responds to a scene where an older man appears lost and disoriented. He does not know where he is, how he got there or how to get home. When you ask him what his name is, he cannot remember. How would you respond?



## KEY TERMS

**Alzheimer's disease:** The most common type of dementia in older people, in which thought, memory and language are impaired.

**Asperger syndrome:** A disorder on the autism spectrum; those with Asperger syndrome have a milder form of the disorder.

**Autism spectrum disorder (ASD):** A group of disorders characterized by some degree of impairment in communication and social interaction as well as repetitive behaviors.

**Bereavement care:** Care provided to families during the period of grief and mourning surrounding a death.

**Catastrophic reaction:** A reaction a person experiences when the person has become overwhelmed; signs include screaming, throwing objects and striking out.

**Chronic diseases:** Diseases that occur gradually and continue over a long period of time.

**Cognitive impairment:** Impairment of thinking abilities including memory, judgment, reasoning, problem solving and decision making.

**Deafness:** The loss of the ability to hear from one or both ears; can be mild, moderate, severe or profound, and can be inherited, occur at birth or be acquired at a later point in life, due to illness, medication, noise exposure or injury.

**Dementia:** A collection of symptoms caused by any of several disorders of the brain; characterized by significantly impaired intellectual functioning that interferes with normal activities and relationships.

**Edema:** Swelling in body tissues caused by fluid accumulation.

**Hard of hearing:** A degree of hearing loss that is mild enough to allow the person to continue to rely on hearing for communication.

**Hospice care:** Care provided in the final months of life to a terminally ill patient.

**Mental illness:** A range of medical conditions that affect a person's mood or ability to think, feel, relate to others and function in everyday activities.

**Service animal:** A guide dog, signal dog or other animal individually trained to provide assistance to a person with a disability.

**Sundowning:** A symptom of Alzheimer's disease in which the person becomes increasingly restless or confused as late afternoon or evening approaches.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Describe physical and mental differences that are important in older adult patients.
- Describe how to assess an older adult patient.
- Describe how to provide care for an older adult patient.
- Describe common problems in older adult patients.
- List the types of elder abuse.
- List risk factors for elder abuse.
- List signs and behaviors of elder abuse.
- Identify and describe chronic diseases and disabilities.
- Describe considerations for providing care to patients with special healthcare or functional needs.

## INTRODUCTION

When responding to older adult patients, remember that patience, kindness and respect will help you care for the patient in the most effective manner. Misconceptions about older adult patients, such as that they are all weak or sickly, hard of hearing and have difficulty learning new things, can often lead to older adults being treated like children and not like responsible adults. Explaining the steps you are taking to treat and care for them, and using the same kind and respectful manner you would use with younger adult patients, will prove to be successful with older adult patients.

This chapter will provide you with the information needed to assist older adult patients and identify and deal with any special healthcare or functional needs they may have, such as dementia, including Alzheimer's disease.

You will also learn about patients with special healthcare or functional needs, such as those with mental illness, intellectual disabilities and

other special needs, such as visual impairment or deafness. Special healthcare or functional needs also exist for the physically challenged, as well as for those suffering from **chronic diseases**. In this section, you will learn about important factors to take into account when caring for patients with conditions such as arthritis, cancer, cerebral palsy and multiple sclerosis.

## OLDER ADULT PATIENTS

The older adult population, those aged 65 years and older, is the fastest-growing age group in the United States (Fig. 26-1). Because people are living longer, older adults make up a large proportion of the population and, thus, make up a greater segment of those requiring care. Older adult patients are, in many ways, no different from younger adult patients, but everyone undergoes some changes in their physical and mental health as they age, and these changes need to be considered when providing care.



**Fig. 26-1:** The older adult population includes those aged 65 years and older.



### CRITICAL FACTS

As people age, normal changes in physical and mental functioning occur. These changes occur in all body systems, including nervous, digestive, respiratory, circulatory, musculoskeletal, integumentary, genitourinary and endocrine.



## Physical and Mental Differences to Consider in Older Adults

As people age, normal changes in physical and mental functioning occur. These changes occur in all body systems, including nervous, digestive, respiratory, circulatory, musculoskeletal, integumentary, genitourinary and endocrine.

### Sensory Changes in Older Adults

Aging patients often have decreased sharpness of the senses, and this loss of sensory awareness brings possible risks that are unique to this age group.

#### Vision

Because vision in older adults may be poor due to problems such as decreased night and peripheral vision, farsightedness, cataracts and decreased tolerance to glare, incidents are more likely to occur. Misreading instructions for medication, falls and motor-vehicle crashes are common among older adults, and may be due, in part, to vision problems (Fig. 26-2).

#### Hearing

The ability to hear gradually diminishes with age, especially for higher frequency sounds. Hearing loss can be an indirect cause of injury; for example, an older adult might have trouble hearing a warning alarm or siren.

#### Sense of Touch and Pain

Diminished pain sensation can also prove dangerous for older adults, as they may not be aware of an injury or of the seriousness of an injury.

#### Diminished Taste and Smell

A decrease in sense of taste and/or smell can lead to health problems such as poor nutrition, decreased appetite and even food poisoning, if an older adult is unable to detect that food has gone bad. A decrease in the ability to smell can also be a safety concern, as odors such as natural gas, propane or gasoline may not be easily detected.

#### Heart/Blood Vessels

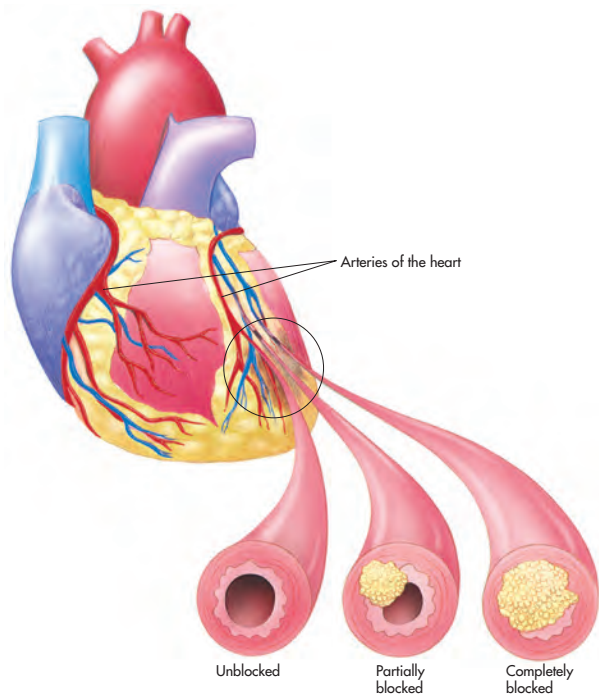
Aging causes the heart to work harder. The heart muscle thickens and becomes less elastic, and arteries stiffen, which makes it harder for blood to flow through them.

Over the years, plaque can build up within the arteries and restrict or block blood flow in a condition called atherosclerosis. Blood clots can also form and further restrict blood flow, factors which can lead to heart attack or stroke (Fig. 26-3).

Heart failure also develops when the heart cannot pump enough blood to meet the body's demand. Valve problems, including narrowing or leaking of the aortic or mitral valve, are also common in older adults.



**Fig. 26-2:** Poor vision in older adults may result in an increased likelihood for misreading medication instructions.



**Fig. 26-3:** Buildup of plaque on the inner walls of the arteries reduces blood flow to the heart muscle and may cause a heart attack.

Arrhythmias are usually categorized according to the affected part of the heart—the atrial (upper) part, or the ventricular (lower) part of the heart—as well as by the change in rhythm. An aneurysm is a widening or ballooning out of a major artery that develops in the aorta or one of the other major arteries in the chest or abdomen. Aneurysms are common in older adults, especially those with high blood pressure or coronary artery disease.

### Lungs and Breathing

Aging also affects the lungs, which become stiffer and less elastic, shrinking the airways and weakening the chest muscles. This causes the total flow of air into and out of the lungs to decrease, and increases the chances of developing breathing problems. Older people are also more prone to lung infections, such as pneumonia, due to changes in the lungs and immune system.

### Stomach and Intestines

With aging, the digestive tract becomes stiffer, and the contractions that allow food to move effectively through the digestive system decrease. Older adults may also suffer from conditions and diseases, such as hardening of the arteries and diabetes, which can upset the function of the intestines and lead to symptoms and complications. Medications commonly prescribed for older adults can also cause problems in the digestive tract.

Problems in various digestive organs can cause different symptoms, such as difficulty swallowing, stomachache, nausea, diarrhea and constipation. This often affects appetite and nutrition, leading to fatigue and weight loss.

### Nervous System

The majority of middle-aged and older adults retain their abilities to learn, remember and solve problems. However, **cognitive impairment**, exhibited by memory loss and other problems, such as issues with perception, balance, coordination, reasoning, judgment and sleep, can occur and are *not* a normal part of aging. They can be the result of reversible causes, such as acute illness, or the side effects of medication. Cognitive impairment also can be the result of certain neurological disorders including a range of dementias. Some changes also may be due to clinical depression, which is more common in older adults.

### Muscles and Bones

Problems of the musculoskeletal system are common in older adults and can range from minor sprains or inflammation to fractures, arthritis or cancer. Bones become less dense over time, especially in women, and this can lead to fractures. Musculoskeletal problems can also lead to a more sedentary lifestyle, and the inactivity itself can lead to a further decline in function.

### Other

Other common health issues for older patients include urinary problems, skin diseases, decreased ability to fight off illness and nutritional problems.

## Assessing and Caring for the Older Adult Patient

### Assessing the Older Adult Patient

When assessing an older adult patient, follow the same care and procedures, including checking breathing and pulse, as you would for a younger adult. However, you should keep the following points in mind when providing care.

Patients who appear untidy and uncared for may not be taking good care of themselves and might have been neglectful in tending to their own medical needs. Whenever possible, speak to the patient's family or caregivers to identify the patient's usual behavioral patterns and whether the patient is behaving normally or has changed in response to an emergency.



**Fig. 26-4:** Speak with older adult patients at eye level, and speak slowly and clearly, allowing time to ensure they understand.

When speaking with older adult patients, speak a little more slowly and clearly, and allow time to ensure they understand, unless the situation appears urgent. Speak to the patient at eye level, and turn lights on to make it easier for the patient to see you (Fig. 26-4).

When obtaining the SAMPLE history from the patient, consider the following:

- The patient may become tired easily.
- You will need to clearly explain what you are doing before beginning the examination.
- The patient may downplay symptoms due to fear of institutionalization or losing independence.
- It may be difficult to assess peripheral pulses.
- Some signs and symptoms you observe may be a part of normal aging; distinguish these from any that may be related to the emergency.

Due to many factors, including diminished senses, an older adult may not show severe symptoms, even if very ill. Continue to reassess the patient's condition, as it may deteriorate quickly.

Some older patients may be participants in the Vial of Life program, which was designed to allow patients to provide medical information to emergency

medical services (EMS) personnel. The Vial of Life kit is offered to patients across North America and is kept on the patient's refrigerator to alert responders to the patient's health conditions, medications and any other medical information the patient wishes to supply (Fig. 26-5). The kit includes a form, a plastic bag to store the form and decals to inform responders that the information is available. One decal is kept on the patient's front door and the other is on the bag. The kit is ideal for a situation in which a patient is unconscious, home alone and unable to provide vital information. Check the patient's door and refrigerator to see if the patient is a participant in the program.

### Caring for the Older Adult Patient

Some key considerations exist in the care of an older adult patient:

- Explain everything you are doing, calmly and slowly.
- Handle the patient's skin with special care, as it can tear easily.
- If the patient is responsive and a stroke is suspected, the patient may have difficulty chewing, swallowing and clearing the airway of secretions.
- Dentures and other dental devices can cause airway obstruction.



#### **CRITICAL FACTS**

When assessing an older adult patient, follow the same care and procedures, including checking breathing and pulse, as you would for a younger adult.



Fig. 26-5: Vial of Life kit.

- If artificial ventilation is required and the patient is wearing dentures, it may be easier to leave the dentures in place.
- If it is difficult to tilt the patient's head back due to conditions such as a curvature of the spine, perform a jaw-thrust (without head extension) maneuver.
- Blood-thinning medications and aspirin may make any bleeding more difficult to control.
- If the patient's mental status changes and the patient is unable to maintain the airway, consider inserting an oropharyngeal airway (OPA). OPAs should *only* be used on unconscious patients with *no* gag reflex.
- Be prepared to assist with ventilation, but do *not* apply too much pressure, as this could result in chest injury.
- Continue to re-evaluate during transport.

Consider the following conditions when positioning a patient for transport:

- If the patient is responsive and able to breathe, place the patient in the Fowler's position (Fig. 26-6).
- If the patient has an altered mental status and you cannot protect the airway, place the patient in a side-lying recovery position.
- If a spinal injury is suspected, a patient with a curvature of the spine could be injured if placed on a backboard. Use blankets or another extrication device such as a scoop stretcher for immobilization.



Fig. 26-6: Place the patient in the Fowler's position for transport if they are responsive and breathing.

- As a precaution, immobilize unresponsive patients during extrication from the scene to the ambulance, based on local protocols.

## Common Problems in the Older Adult

### Dementia

Older adult patients can become confused when their cognitive functions decrease. Confusion is a symptom of memory loss, and can be a sign of cognitive impairment. Some types of cognitive impairment are chronic and cannot be reversed; these are referred to as dementias. **Dementia** is a set of symptoms characterized by problems with memory, reasoning, orientation and personal care. A patient with dementia may behave oddly and become anxious or aggressive. As people with dementia become increasingly unaware of their surroundings, they ultimately become unable to perform normal tasks. Dementia is not caused by stress or a crisis, but often during a time of crisis others may notice something is wrong, as the person becomes increasingly confused. About 50 percent of all people admitted to nursing homes suffer from some type of dementia.

### Alzheimer's Disease

**Alzheimer's disease** is the most common type of dementia among older adults. Those with the disease have the same basic needs as other patients. Alzheimer's dementia is not a normal part of growing older, but it is estimated that of



### CRITICAL FACTS

There are several considerations when caring for an older adult. These include working calmly, slowly and with extra care; being aware of dentures and how to deal with them; being aware of blood-thinning medications and aspirin; and knowing what care procedures are appropriate for an older adult, such as being aware of the amount of pressure you use when assisting with ventilation to avoid chest injury.



the 5.5 million Americans living with dementia, an estimated 5.3 million are age 65 and older. This means approximately 1 in 10 people (or 10 percent) age 65 and older has Alzheimer's dementia. Witnessing a patient behaving dysfunctionally can be frustrating, but try to focus on the patient and their attempts to tell you something is wrong. Your job is to find out what the patient is trying to communicate, so that you can provide appropriate care.

A person with Alzheimer's disease may demonstrate some common patterns such as:

- Putting up a social facade by pretending not to know or remember a certain situation.
- Pacing and wandering.
- Rummaging and hoarding.
- Extreme **catastrophic reactions**, such as screaming, throwing objects or striking out.
- Sundowning (restlessness and confusion in the evening).
- Speaking nonsense.
- Hallucinating or believing things that are not true.
- Exhibiting depression, anger or suspicion.

If you know how to respond to these behaviors, you can provide better care and treat the patient with dignity and respect. If you encounter a patient who is walking aimlessly and then walking away, ask if you may walk with them, and use this as a way to guide the patient back to the appropriate place. Talk to the patient and listen carefully to what the patient has to say. Take steps to prevent the patient from leaving.

In the case of a catastrophic reaction, reassure the patient that you are not going to cause any harm and that you also will not allow them to hurt anyone. Let the patient know the limits by saying something such as, "It's not okay to hit someone."

A person with Alzheimer's disease may become increasingly restless or confused as late afternoon or evening approaches, becoming more demanding, upset, suspicious or disoriented. This type of behavior is called **sundowning** and is common in people with Alzheimer's disease.

These patients may exhibit the following types of behavior:

- Restlessness, anxiety
- Worried expression
- Reluctance to enter their own room
- Reluctance to enter brightly lighted areas
- Crying
- Wringing hands
- Pushing others away
- Gritting teeth
- Taking off clothing

These behaviors may represent real physical needs, such as needing to use the bathroom or being hungry, uncomfortable or in pain. Responding in a kind, gentle manner will help calm the patient so you can discover what the problems are.

## Elder Abuse

Elder abuse occurs when someone does something that harms or threatens the health and welfare of an older adult, or when a caregiver fails to provide adequate care for an older adult.

Research suggests that 4 percent of adults older than 65 are subjected to elder mistreatment in the United States. This mistreatment can occur within the family, in formal care settings, or in the community or society at large. Elder abuse within the family is often the result of a caregiver being overwhelmed or not knowing what is needed when providing care for an older adult. Reluctance to provide care can also lead to mistreatment. Mistreatment in a formal care setting is often attributable to staff who have not had adequate training in providing direct patient care.

Elder abuse can include:

- Physical abuse.
- Emotional abuse.
- Neglect (intentional or unintentional).
- Financial exploitation.
- Abandonment.
- Any combination of the above.



### CRITICAL FACTS

Older adults can become confused when their cognitive functions decrease. Confusion is a symptom of memory loss, and can be a sign of cognitive impairment. Some types of cognitive impairment are chronic and cannot be reversed; these are referred to as dementias.

Alzheimer's disease is the most common type of dementia among older people.

## Fading Memories

According to the Alzheimer's Association, Alzheimer's disease affects an estimated 5.5 million Americans, making it the only disease among the top 10 causes of death without prevention, a cure or a way to slow its progression. While most people with the disease are older than 65, Alzheimer's disease can strike people in their 40s and 50s. Men and women are affected almost equally. At this time, scientists are still looking for the cause.

Signs and symptoms of Alzheimer's disease develop gradually and include confusion; progressive memory loss; and changes in personality, behavior, and the ability to think and communicate. Eventually, people with Alzheimer's disease become totally unable to care for themselves. While there are no treatments to stop or reverse a person's mental decline from Alzheimer's disease, several drugs are now available to help manage some of these symptoms. In addition, because a number of disorders have signs and symptoms similar to those of Alzheimer's disease, and can be treated, it is very important for anyone who is experiencing memory loss or confusion to have a thorough medical examination.

Most people with illnesses such as Alzheimer's disease are cared for by their families for much of their illness. Giving care at home requires careful planning. The home has to be made safe, and routines must be set up for daily activities, such as mealtimes, personal care and leisure.

It is important for anyone caring for a person with Alzheimer's disease or a related problem to realize that they are not alone. There are people and organizations that can help them and the person with Alzheimer's disease. For healthcare services, a physician—perhaps their family physician—or a specialist can give them medical advice, including help with difficult behavior and personality changes.

When caring for a person with Alzheimer's disease living at home, people may also

need help with basic services such as nutrition and transportation. A visiting nurse or nutritionist and volunteer programs such as Meals on Wheels may be helpful, and volunteer or paid transportation services may be available.

Visiting nurses, home health aides and homemakers can come to their home and give help with healthcare, bathing, dressing, shopping and cooking. Many adult day care centers provide recreational activities designed for people with Alzheimer's disease. Some hospitals, nursing homes and other facilities may take in people with Alzheimer's disease for short stays.

For persons with Alzheimer's disease who can no longer live at home, group homes or foster homes may be available. Nursing homes offer more skilled nursing care, and some specialize in the care of those with Alzheimer's or similar diseases. A few hospice programs accept persons with Alzheimer's disease who are nearing the end of their lives. Caregivers may need to search to find out which, if any, services are covered by Medicare, Medicaid, Social Security, disability or veterans' benefits in their state. A lawyer or a social worker may be able to help them.

To locate services that can help the caregiver, the person with Alzheimer's disease and other family members, individuals can search for social service organizations and state and local government listings on the Internet or in the phone book. They can also contact their local health department, area office on aging or department of social services. Senior centers, as well as churches, synagogues and other religious institutions, may also have information and programs. Another great resource is the Alzheimer's Association. To locate the chapter nearest to them, individuals can call the association's 24-hour, toll-free number: 800-272-3900 or log onto [alz.org](http://alz.org).

*Source: Alzheimer's Association. [alz.org](http://alz.org). Accessed April 2017.*

Risk factors for elder abuse include:

- Mental impairment in the dependent person or caregiver (or both).
- Isolation of the dependent person or the caregiver (or both).
- Inadequate living arrangements for the dependent person.
- Inability to perform daily functions.
- Frailty.
- Family conflict.
- Family history of abusive behavior, alcohol or drug abuse, mental illness or intellectual disability.
- Stressful family events.
- Poverty.
- Financial stress, especially related to healthcare needs.

In situations where frail or debilitated older people cannot help themselves at all, they may need more care than the caregiver is able to provide. Mentally ill people who hit, spit or scream can cause stress to the caregiver, causing the caregiver to respond with some form of elder mistreatment.

Watch for visible signs and certain behaviors by either the older adult patient or the caregiver that may provide clues that elder abuse has occurred. Some signs that may raise suspicion of elder abuse include:

- A person who is frequently left alone.
- A history of frequent trips to the emergency department.
- Old and new fractures or bruises, especially bruises on both sides of the inner arms and thighs.
- Repeated falls.
- Unexplained hair loss, skin rashes, irritation or skin ulceration.
- Inappropriate dress.

- Malnourishment.
- Lack of energy or spirit.
- Poor hygiene.
- Reports of the patient being left in unsafe situations or having an inability to get needed medication.

Maintain a proper perspective if you suspect an abusive situation. Do *not* confront the suspected abuser. Take note of any inconsistencies between the reports received from the patient and the suspected abuser. Follow local protocols in relation to elder abuse and the legal obligations to report suspected elder abuse. Document your findings as per local protocols and report your suspicions to the hospital upon arrival.

## PATIENTS WITH SPECIAL HEALTHCARE OR FUNCTIONAL NEEDS

### Mental Illness

**Mental illness** is a broad term that describes a range of medical conditions that affect a person's mood or ability to think, feel, relate to others and function in everyday activities. About one-quarter of Americans suffer from a diagnosable mental disorder in a given year, though some of these are temporary conditions. About 6 percent of Americans suffer from serious mental illnesses, such as schizophrenia, major depression, panic disorder, bipolar disorder or personality disorder, although many are treatable with medication and psychosocial treatment.

The National Institute of Mental Health describes several types of mental illnesses:

- Mood disorders; for example, major depression and bipolar disorder
- Schizophrenia



### CRITICAL FACTS

Elder abuse takes many forms: physical, emotional, neglect, financial exploitation, abandonment or any combination of these.

Risk factors of elder abuse include mental impairment or isolation of the patient and/or caregiver, inadequate living situation, inability to perform daily functions, frailty, family conflict, abuse or stress or history of these, poverty and financial stress.

Signs of possible elder abuse include a patient who is frequently left alone, a history of emergency department visits, old and new injuries, unexplained skin problems or hair loss, inappropriate dress, poor hygiene, malnourishment and a lack of energy or spirit.

- Anxiety disorders; for example, panic disorder, obsessive-compulsive disorder and posttraumatic stress disorder
- Eating disorders
- Attention-deficit/hyperactivity disorder (ADHD)
- Autism
- Alzheimer's disease

## Intellectual Disabilities

Patients with an intellectual disability have a significantly below-average score on a test of mental ability or intelligence. Their ability to function in areas of daily life, such as communication, self-care, and getting along in social situations and school activities, is also limited. Different degrees of intellectual disability exist, and a person's level can be defined by the intelligence quotient (IQ), or on how dependent the person is on others to perform daily needs.

## Down Syndrome

Down syndrome is a genetic condition that results from having an extra copy of chromosome 21. Both mental and physical symptoms will be evident, although the symptoms can range from mild to severe. Individuals with Down syndrome have mild-to-moderate intellectual impairment. Additionally, other health problems, such as heart disease, dementia, hearing loss, and problems with the intestines, eyes, thyroid and skeleton, are common in people with Down syndrome. It is not uncommon for people with Down syndrome to live productive lives well into adulthood.

## Visually Impaired

When a person is visually impaired, their eyesight cannot always be corrected to a "normal" level. Types of visual impairments include a loss of visual acuity, where the eye does not see objects as clearly as normal, or a loss of visual field, where the eye cannot see as wide an area as normal without moving the eyes or turning the head.

When approaching patients, look for signs of visual impairment, such as glasses or a white cane. When approaching someone you know has a visual impairment, announce that you are approaching, who you are and why you are there so that the patient is not frightened. Ask if the person can see. Keep in mind that some blind patients are able to use other senses to compensate for their lack of sight. Especially at an incident scene, these patients may find the

unfamiliar sights and sounds disorienting and may be frightened. Explain what is happening at the scene, what the sounds and smells are, and what may happen at the scene such as additional loud sounds caused by equipment or traffic.

If a patient wears glasses, try to find them at the scene or in the home. This is especially important for older adults, who may try to hide the fact that they are visually impaired. As with all patients, reassure them, explain what you are doing and use a gentle touch to keep them calm. Explain what is happening at each step so the patient feels more in control. Nearly two-thirds of children with visual impairment also have one or more other disabilities, such as intellectual disability, cerebral palsy, deafness or epilepsy. Children with more severe visual impairment are more likely than children with milder visual impairment to have additional disabilities.

## Deaf and Hard of Hearing

**Deafness** is the loss of the ability to hear from one or both ears. It can be inherited, occur at birth, or be acquired at a later point in life due to illness, medication, noise exposure or injury. The severity of the deafness can be mild, moderate, severe or profound. Two main types of deafness exist, and they are defined by the location of the problem. A conductive hearing loss occurs when there is a problem with the outer or middle ear; a sensorineural hearing loss is due to a problem with the inner ear and possibly the nerve that goes from the ear to the brain. Some people have both types of deafness.

The term "deaf" describes someone who is unable to hear well enough to rely on hearing as a means of communication. The term **hard of hearing** can be used to describe people who have a less severe hearing loss and are still able to rely on their hearing for communication.

Hearing loss is a disability that may not be immediately obvious to you when approaching a patient. Be certain a patient can hear you, especially when treating older adults. Identify yourself, and speak slowly and clearly, but do not shout. Ask if the patient can hear you. Position yourself so the patient can hear you better by facing the patient; some patients who are hard of hearing can read lips. You can also try speaking directly into the person's ear. If possible, turn off background noise, such as a television or radio. If this does not work, write down your questions.



## Physically Challenged

A person who is physically challenged may have been born with the condition or may have acquired it later in life. The person may have a general diminished ability to move due to injury or illness, and may use a mobility aid, such as a walker, wheelchair or cane (Fig. 26-7, A–B). If you are aware that someone is physically challenged, ask what help the patient needs, for example to transfer from one surface to another (bed to chair) or to walk.

## Traumatic Brain Injury

Someone who has suffered a traumatic brain injury may have been involved in a motor vehicle collision, suffered a fall or been the victim of an assault. Someone who has survived a traumatic brain injury may have permanent cognitive and physical problems. Cognitive impairment often includes difficulty with attention, memory, judgment, reasoning, problem solving and decision making. Physical problems can range from mild to severe and may result in the person moving slowly or relying on a mobility aid, such as a walker or wheelchair.

## Chronic Diseases and Disabilities

Illnesses that occur gradually and continue over a long period of time are referred to as chronic conditions. Often, a chronic condition lasts throughout the person's life. Chronic conditions include heart disease, diabetes and arthritis. Patients with some chronic conditions, such as multiple sclerosis, can live for years with few symptoms and then suddenly experience a flare-up with many symptoms appearing at once. In such an acute phase, the patient will often consult a physician and, following treatment, the acute phase may be resolved. However, the patient will continue to live with the effects of the chronic condition.

## Arthritis

Arthritis is a condition that causes joints to become inflamed, swollen, stiff and painful. A few or many joints may be affected as the smooth tissues that cover the ends of bones become rough or wear away, causing painful friction between bones upon movement. Because of this friction, tissues around the joints swell, leading to stiffness, which makes normal movement difficult.

When providing care for a patient with arthritis, keep the following in mind:

- Assure the patient that you are aware that movement is painful, and that you are there to help.



**Fig. 26-7, A–B:** A person who is physically challenged may use a mobility aid, such as **(A)** a walker or **(B)** a cane.

## Service Animals

A service animal is any guide dog, signal dog or other animal individually trained to provide assistance to an individual with a disability. These animals are considered service animals under the Americans with Disabilities Act (ADA), whether or not they have been licensed or certified by a state or local government.

Service dogs perform some of the functions and tasks that the individual with a disability cannot perform independently. These dogs receive special training to help assist patients with many different types of disabilities, such as visual impairment, limited mobility, balance problems, autism, seizures, or other medical problems like low blood sugar or psychiatric disabilities. Services include retrieving objects, pulling wheelchairs, opening and closing doors, turning light switches off and on, barking when help is needed, finding another person, leading the person to the handler, assisting with balance and counterbalance, providing deep pressure and many other individual tasks.

A service animal is not a pet and can be identified by either a backpack or special harness. By law, service animals must be allowed into most establishments. EMRs should not handle the service animal unless absolutely required. Never separate the patient from the service animal, as this could cause stress, agitation and anxiety to both parties which can complicate patient care. It could also become a safety issue.



**A service animal has been individually trained to provide assistance to an individual with a disability. Never separate an individual from their service animal.**

- *Never* move a joint that is painful, red or swollen.
- Handle the patient's joints carefully, supporting the areas above and below the joint when you move them.

## Cancer

Cancer is the abnormal growth of new cells that can spread and crowd out or destroy other body tissues in the form of a malignant tumor, which is a solid mass or a growth of abnormal cells that can grow anywhere in the body. Malignant tumors can spread to other parts of the body, growing quickly and invading and destroying other body tissue.

Typically, cancer is treated according to the type and location of the cancer, and whether or not it has spread. The three most common approaches to treatment are surgery, chemotherapy and radiation. Common side effects of chemotherapy include nausea, diarrhea, loss of hair and extremely dry skin. Many people will experience skin burns, fatigue, and possibly nausea and vomiting with radiation treatment; others may experience hair loss as a result of the radiation treatment.

When providing care for a person being treated for cancer, infection control is important because chemotherapy and radiation affect a person's immune system. Strict hand-washing guidelines and standard precautions must be taken. *Never* provide care for a patient who is receiving cancer treatment if you have a cold or flu.

A patient receiving chemotherapy or radiation treatment may feel tired. Skin changes and rashes from some drugs or burns from radiation treatment are common, so be gentle.

## Cerebral Palsy

Cerebral palsy is the name given to a group of disorders affecting a person's ability to move and maintain balance and posture. It does not get worse over time, although symptoms can change over a patient's lifetime.

Cerebral palsy causes damage to the part of the brain that controls the amount of resistance to movement in a muscle (muscle tone), which allows you to keep your body in specific postures or positions.

## Cystic Fibrosis

Cystic fibrosis (CF) is an inherited disease of the mucous and sweat glands, affecting the lungs, pancreas, liver, intestines, sinuses and sex organs. CF causes mucus to become thick and sticky,



## CRITICAL FACTS

Illnesses that occur gradually and continue over a long period of time (even lifetime) are referred to as chronic conditions. Chronic conditions include heart disease, diabetes and arthritis. Patients with some chronic conditions, such as multiple sclerosis, can live for years with few symptoms and then suddenly experience a flare-up with many symptoms appearing at once.

blocking the airways. This makes it easy for bacteria to grow, which leads to repeated serious lung infections. These infections can cause serious damage to the lungs. Mucus can also block tubes, or ducts, in the pancreas, so that digestive enzymes cannot reach the small intestine. Without these, the intestines cannot absorb fats and proteins fully.

The most common symptoms of CF include:

- Frequent coughing that brings up thick sputum, or phlegm.
- Frequent bouts of bronchitis and pneumonia that can lead to inflammation and permanent lung damage.
- Salty-tasting skin.
- Dehydration.
- Infertility (mostly in men).
- Ongoing diarrhea or bulky, foul-smelling and greasy stools.
- Huge appetite but poor weight gain and growth.
- Stomach pain and discomfort caused by gas.

## Multiple Sclerosis

Multiple sclerosis (MS) is a chronic disease that destroys the coating on nerve cells in the brain and spinal cord, interfering with the nerves' ability to communicate with each other. MS is more common in females than in males, and the onset typically occurs as early as the teen years and as late as age 50. Symptoms usually appear and disappear over a period of years and can include:

- Feelings of numbness, tingling and burning.
- Overwhelming fatigue at all times.
- Vision problems.
- Insomnia.
- Speech problems.
- Bowel and bladder problems.
- Fits of anger or crying.
- Paralysis.
- Forgetfulness and slowness in understanding.
- **Edema** and cold feet due to lack of circulation.

When treating patients with MS, help them focus on what they *can* do.

## Muscular Dystrophy

Muscular dystrophy is a group of genetic disorders in which patients suffer progressive weakness and degeneration of the muscles. About a quarter of a million children and adults are living with the disease in the United States. In the most common form, Duchenne muscular dystrophy, the disease begins in early childhood; in other forms, it begins later in life. People with muscular dystrophy may have mild-to-severe muscle weakness, depending on the type. Although the disorder primarily affects the skeletal muscles—the muscles that allow you to move—some types of muscular dystrophy affect cardiac muscles. In the later stages of the disease, patients with muscular dystrophy often develop respiratory problems and may require assisted ventilation.

## Autism

**Autism spectrum disorder (ASD)** consists of a range of developmental disorders, including autism at the more severe end of the spectrum and **Asperger syndrome** at the less severe end. The diagnosis of autism seems to have become more common in recent years. The Centers for Disease Control and Prevention reports that the rate of ASD is 14.6 per 1000 for children 8 years of age, and that in this age group, males are 4.5 times more likely to have ASD than females.

Children with ASD have deficits in social interaction and communication, and exhibit repetitive behaviors and interests. Some may also have sensory disturbances. People with these disorders interpret the world only through verbal reasoning.

Children with autism exhibit unusual behaviors that are usually noticed first by the parents. A baby may seem unresponsive to people or focus intently on one item for long periods of time. However, symptoms can also appear in older children who have been developing normally. A normal child who has shown affection and spoken as a toddler can become silent, withdrawn, self-abusive or indifferent to social overtures.

Remember that patients with autism might not look at you directly and physical touch may be disturbing to them. Avoid interpreting these



mannerisms or responses as being unsociable. When communicating with patients with autism, it may help to use verbal explanations of emotions.

## Hospice Care

**Hospice care** is the care provided to a terminally ill patient in the final 6 months of life, consisting of a group of caregivers who offer medical, mental, physical, social, economic and spiritual support. Central to the hospice way of thinking are the ideas that the dying person is an individual who should not be separated from the family or support system, and that dying is a normal and expected part of the life cycle. The family is encouraged and trained to participate in the care.

The focus of hospice care is on keeping the person as comfortable and pain-free as possible, because the fear of pain greatly contributes to the person's stress, as well as that of the family and caregivers. The emphasis is not on curing the illness, but rather on providing physical, emotional, social and spiritual comfort to the dying person. The hospice philosophy also provides practical assistance, emotional support and **bereavement care** to the dying person's family. Pain relief is administered without the use of needles; instead, caregivers use oral medications, pain-relieving patches and pills that can be given between the cheek and gums.

Emergency medical responders (EMRs) are usually not required during hospice care. However, you may sometimes be called in by a family member

or other caregiver when, for example, a patient becomes short of breath. You may be required to attend to a patient who has made special arrangements regarding their treatment or care in an emergency, such as the patient's wishes regarding resuscitation. You must understand the type of hospice you are being called to and any living wills or advance directives that may be in place. You may require official forms, such as do not resuscitate (DNR) orders, as confirmation regarding a living will.

## PUTTING IT ALL TOGETHER

In this chapter, you have learned the importance of treating all patients with respect, regardless of age, health condition, mental status or physical ability. You have learned about common issues the older adult may face and how to deal with challenges such as hearing loss, loss of sensory acuity and other health conditions. You are now aware of the different types of dementias you may encounter with older adult patients, including Alzheimer's disease, and the importance of recognizing that not all older adults have diminished cognitive abilities.

Along with the challenges the older adult faces, you have also learned about dealing with different chronic illnesses and the importance of dealing with patients on an individual basis in accordance with their specific symptoms and difficulties. All patients require clear communication and respect during assessment and treatment.

## ▶ You Are the Emergency Medical Responder

As you continue your care, the man begins to remember small bits of information, but still does not remember where he lives or where he is. He becomes agitated at the help being provided, saying he does not need any help. How should you continue to provide care for the patient?



# UNIT 8

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## EMS Operations

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# 27

## EMS SUPPORT AND OPERATIONS

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### ▶ You Are the Emergency Medical Responder

You are an emergency medical responder (EMR) approaching the scene of a two-car collision at a busy intersection. It is rush hour, and traffic is heavy. One of the involved cars is situated on the median strip, and the other is off the road on the shoulder, just past the intersection. There are multiple occupants in each vehicle. How would you respond? What should you consider when you size up the scene?

## KEY TERMS

**Air medical transport:** A type of transport to a medical facility or between medical facilities by helicopter or fixed-wing aircraft.

**Audible warning devices:** Devices in an emergency vehicle to warn oncoming and side traffic of the vehicle's approach; includes both sirens and air horns.

**Emergency medical dispatcher (EMD):**

A telecommunicator who has received special training for triaging a request for medical service and allocating appropriate resources to the scene of an incident, and for providing prearrival medical instructions to patients or bystanders before more advanced medical personnel arrive.

**Jump kit:** A bag or box containing equipment used by the emergency medical responder (EMR) when responding to a medical emergency; includes items such as resuscitation masks and airway adjuncts, disposable latex-free gloves, blood pressure cuffs and bandages.

**Landing zone (LZ):** A term from military jargon used to describe any area where an aircraft, such as an air medical helicopter, can land safely.

**Packaging:** The process of getting a patient ready to be transferred safely from the scene to an ambulance or a helicopter.

**Transferring:** The responsibility of transporting a patient to an ambulance, as well as transferring information about the patient and incident to advanced medical personnel who take over care.

**Trauma alert criteria:** An assessment system used by emergency medical services (EMS) providers to rapidly identify those patients determined to have sustained severe injuries that warrant immediate evacuation for specialized medical treatment; based on several factors including status of airway, breathing and circulation, as well as Glasgow Coma Scale score, certain types of injuries present and the patient's age; separate criteria for pediatric and adult patients.

**Visual warning devices:** Warning lights in an emergency vehicle that, used together with audible warning devices, alert other drivers of the vehicle's approach.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Describe the roles of traditional and nontraditional emergency medical responders (EMRs).
- Explain all phases of an emergency medical services (EMS) response and associated responsibilities of an EMR.
- Identify the basic equipment used by an EMR.
- Define air medical transport and the criteria for when it should be requested.
- Discuss safety issues related to air medical transport and landing zones (LZs).
- Discuss emergency vehicle safety and other safety issues during response.
- Identify and describe high-risk situations.
- Summarize patient care issues in the ambulance.

## INTRODUCTION

In earlier chapters, you learned how to care for persons who are injured or ill. Although these skills are important for emergency medical responders (EMRs) to learn, certain nonmedical operational skills are just as important. In this chapter, you will learn about emergency medical services (EMS)

support and operations, including the phases of an ambulance or other transport vehicle call and air medical response. As an EMR, you may never be involved in all of these situations but, as a functioning part of the EMS system, you should have a brief overview of some of the aspects of out-of-hospital care.

## ROLES OF THE EMR IN THE EMS SYSTEM

The term EMR can mean different things to different people. In general, EMRs are individuals who have been trained to provide a minimum standard of care according to the current national scope of practice and EMS educational standards. While EMRs may function as regular members of an ambulance crew in some states, in other states and areas they have other roles. There are also several types of EMRs, ranging from those who stabilize and transport patients to those who can provide prehospital medical care in the field, but do not transport.

### Traditional EMRs

When we talk about traditional EMRs, we generally refer to people who function within the 9-1-1 system. These traditional EMRs are usually affiliated with a service, such as EMS systems, law enforcement, fire rescue, search and rescue or sometimes lifeguarding and ski patrol. Another area in emergency medical response is hazardous material (HAZMAT) or hazardous waste operations and emergency response (HAZWOPER).

### Nontraditional EMRs

Nontraditional EMRs have had the same training as traditional EMRs but work in less traditional settings. These people include athletic trainers, park rangers, trip leaders and others. You also find these EMRs working as members of industrial medical emergency response teams (MERTs), or those involved in rope rescue, specialized trench rescue or confined space rescue. Any EMR, traditional or nontraditional, should be familiar with the EMS system and their role in it.

## PHASES OF A RESPONSE

A typical EMS response has nine phases. They are:

1. Preparation for an emergency call.
2. Dispatch.
3. En route to the scene.
4. Arrival at the scene and patient contact.

5. Transferring the patient to the ambulance.
6. En route to the receiving facility.
7. Arrival at the receiving facility.
8. Clear medical facility.
9. Available for next emergency call.

### Phase 1: Preparation for an Emergency Call

To be ready to respond to a scene, it is important to spend time preparing yourself, your equipment and your vehicle. As an EMR, you have a responsibility to keep yourself physically fit and mentally prepared for the challenges of responding to an emergency. Part of preparing for the call involves the initial training you receive as an EMR. It is important to remember that the end of your EMR training is the beginning of having a duty to respond to emergencies. You have a responsibility to continue your training through refresher, national competency and continuing education programs. Some EMRs take more advanced training to become emergency medical technicians (EMTs) and then perhaps advanced emergency medical technicians (AEMTs) or paramedics.

In preparing to respond to an emergency, you should have basic medical equipment on hand.

**Jump kits** come in a variety of sizes and shapes and are commercially available. The contents may be regulated by a certifying agency or by your unit. In either case, be familiar with the contents and layout of the jump kits used by your unit or organization.

In some areas, EMRs work in a system in which they may be involved in transporting the patient to the receiving facility. If this is the case, the EMR will have to prepare and inspect the ambulance or transport vehicle before every shift. Local EMS systems and state regulations determine what equipment and supplies must be in the vehicle, and any vehicle safety and readiness inspections required.

In other areas or circumstances, EMRs may be the only emergency personnel responding to a scene. You should review state and local policies, rules and regulations regarding the minimum staffing requirements in your area.



#### CRITICAL FACTS

A typical EMS response has nine phases, from preparation for an emergency call to availability for the next emergency call.



## Phase 2: Dispatch

In many areas of the country, a communications center/public safety answering point (PSAP) has a central access number such as 9-1-1 for ambulance, police or fire rescue personnel. Specially trained personnel, known as **emergency medical dispatchers (EMDs)**, often staff these communications centers and are available on a 24-hour basis. They assist by obtaining the caller's location and information critical to dispatching the appropriate personnel and equipment. They are specially trained to help the caller care for patients until emergency personnel arrive.

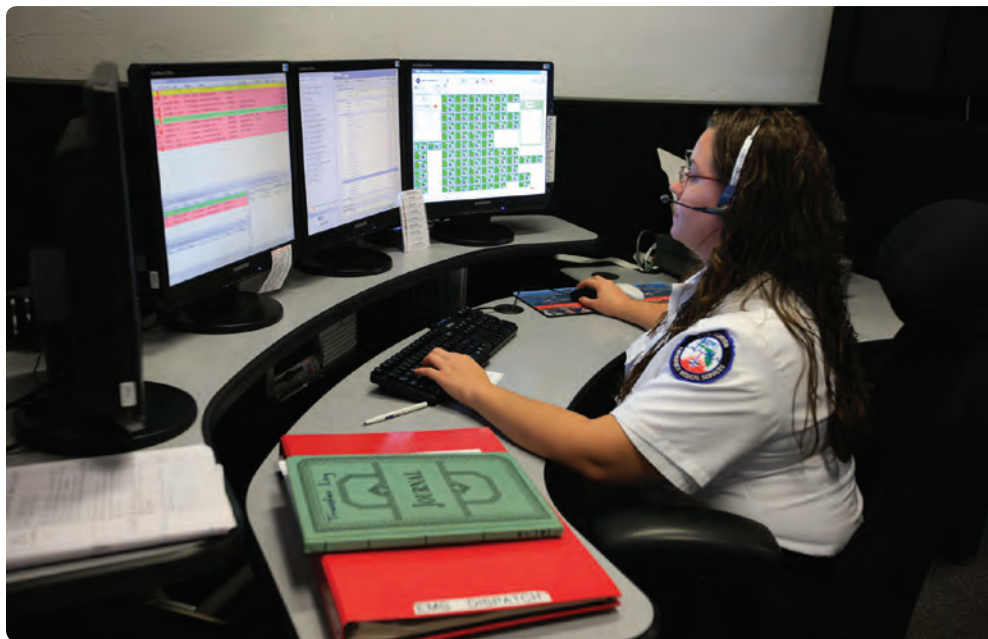
During the call, the EMD will ask the caller specific questions that will determine the appropriate emergency personnel to dispatch. The EMD will ask the nature of the emergency and the mechanism of injury (MOI) or nature of illness. The EMD will ask for the caller's name, location and call-back number. Additional information, such as the exact location of the patient (e.g., second floor, back apartment), number of patients and the severity of the injuries, can be relayed to those responding to the emergency after the initial dispatch has been issued. Also, the EMD will obtain information from the caller relating to unusual situations, conditions or problems

at the scene. This will ensure that the appropriate personnel arrive at the scene as quickly and safely as possible. In cases of possible cardiac arrest, the EMD will ask if an automated external defibrillator (AED) is available and being used.

A call taker is used by most communications centers that handle many calls. The call taker processes the information from the caller and provides the EMD information. The information is then transferred to the dispatcher, who transmits the data to the appropriate units. The call taker stays on the phone, providing prearrival information and gathering further information as the situation unfolds (Fig. 27-1). Environments in which a call taker and dispatcher perform identical functions include rural areas or a communications center with a minimal call load.

## Phase 3: En Route to the Scene

To help a patient, you must be able to reach the scene safely. The most important skill to use at this time is common sense. Walk with purpose—do *not* run—to any emergency scene or your vehicle. Pacing yourself allows you to think clearly, survey the area and plan for arrival at the scene. It also reduces the risk of injuries from tripping and falling.



**Fig. 27-1:** A call taker in a communications center processes information from the caller and relays it to the EMD, then stays on the phone to provide further information as the situation unfolds.



### CRITICAL FACTS

In many areas of the country, a communications center/PSAP has a central access number such as 9-1-1 for ambulance, police or fire rescue personnel.

If you are in a vehicle, whether a personal or emergency vehicle, you must always use a safety belt. Some areas require all personnel working in the EMS system to attend an emergency vehicle operator-training program. If you function in an EMS system that requires response in a private vehicle, become aware of the state and local laws and regulations that govern operation of private vehicles as emergency vehicles in that area. In all cases, when responding to an emergency, EMRs should use appropriate driving behavior, including consideration for the safety of others. Emergency response to the scene does not exempt any emergency personnel from traffic laws. The driver must know the traffic laws that govern the use of lights, sirens and intersection procedures.

### Phase 4: Arrival at the Scene and Patient Contact

In this phase of response, you should be slow and cautious in your approach (Fig. 27-2). If you have access to the appropriate communications equipment, notify the EMD of your arrival. As you enter the area, size up the scene and the situation. If the scene is not safe, notify dispatch to send personnel from the agencies necessary to make it safe. Never endanger your life or the life of anyone else responding or already at the scene.

When approaching the scene, follow standard precautions before making any contact with the patient. Use disposable latex-free gloves, gown, mask and protective eyewear when appropriate. Be sure to ask yourself critical questions. Is the scene safe? Are there any hazards to the

responders or the patients? Look up, look down and look all around. What was the MOI or nature of illness? Is there any severe, life-threatening bleeding? How many patients are there? Do you need any additional help?

Safety issues may necessitate assistance from law enforcement with crowd control. Assess as much as possible from inside your vehicle. Ensure your vehicle can leave the scene quickly if needed. For example, have your vehicle pointing toward the exit of a dead-end street, so you do not waste time leaving a dangerous situation.

There may be local protocols for when you should leave your vehicle given certain circumstances. If protocols indicate you should wait for law enforcement personnel to arrive, do not exit the vehicle before their arrival.

After the scene size-up has been completed, primary, secondary and ongoing patient assessments will begin. Additionally, history taking, including baseline vital signs and initial care, will be provided to stabilize the patient(s) prior to transport.

### Phase 5: Transferring the Patient to the Ambulance

Though transport is not a traditional role for an EMR, at times you may be part of the ambulance crew or be asked to help transfer a patient to the ambulance (Fig. 27-3). By the time the ambulance arrives, you may have completed the primary assessment, the physical exam, the patient's history and begun care. You may have recorded the vital signs and started packaging the patient for



**Fig. 27-2:** Size up the scene to ensure your safety before approaching patients. *Photo: courtesy of Ted Crites.*



**Fig. 27-3:** At times, you may be asked to help transfer a patient to the ambulance. *Photo: courtesy of Terry Georgia.*

transfer. **Packaging** refers to getting the patient ready for transport, and moving the patient onto the stretcher to support the patient during transport. **Transferring** the patient means more than moving the patient to the ambulance. You also have a responsibility to transfer information about the patient and the incident to more advanced medical personnel who take over care.

### Phase 6: En Route to the Receiving Facility

Once the patient is loaded into the ambulance, all personnel should wear safety belts or safety restraints. The communications center is notified, and the crew member in charge of caring for the patient determines whether the trip to the receiving facility will be fast, at a normal speed or slow (Fig. 27-4).



**Fig. 27-4:** Once the patient is loaded into the ambulance, notify the communications center.

The transport crew members provide ongoing medical care and psychological support for the patient until arrival at the hospital. They may ask additional questions, document the history and care of the patient, and continue to monitor vital signs.

As soon as possible, the transport crew notifies the receiving facility about the patient and the expected time of arrival. The receiving facility is informed if there are any changes in the patient's status or condition. The driver may have to adjust the driving speed to meet what the crew member in charge says about the patient's needs.

### Phase 7: Arrival at the Receiving Facility

During this phase, transport crew members transfer the patient to the care of the nurses and physicians at the receiving facility (Fig. 27-5). Crew members never leave patients unattended during a call or during the transfer of care. At the hospital, crew members give information about the scene and the patient. They also complete whatever documentation is necessary to meet local and state standards and their organization's protocols. If necessary, crew members begin some of the post-run responsibilities such as exchanging or restocking medical supplies. The cleaning of the ambulance is also performed during this phase. Personnel should wear disposable latex-free gloves and follow local procedures for disposal of soiled linen and supplies. The ambulance stretcher should be cleaned and made ready for the next call. Members of the crew should wash their hands thoroughly after every response.





**Fig. 27-5:** Upon arrival at the hospital, the patient is in the care of the nurses and physicians.

## Phases 8 and 9: Clear Medical Facility and Available for Next Emergency Call

When returning to the station (phase 8), the operator of the vehicle should notify the communications center. During the ride back to the station, personnel should take the opportunity to review details of the run and discuss how things could have been done differently or more efficiently. The ride back provides opportunities for crew members to air concerns or diffuse any stress that may have developed during the response. Doing these things helps the crew to prepare physically and emotionally for the next response.

In the last phase of response (phase 9), the emergency vehicle should be refueled if necessary and any repairs or adjustments should be made (Fig. 27-6). Fuel tanks should never be allowed to get below half full. If necessary, restock any disposable items in the vehicle's medical supplies. Reports and any unfinished paperwork should be completed, and the communications center should be notified that the unit is back in service and ready for another call. Always follow local procedures established by your service or organization.

Once back at the station, crew members should also prepare themselves for the next response. Preparation may include removing and laundering contaminated clothing as soon as possible.



**Fig. 27-6:** Once back at the station, the emergency vehicle and equipment are prepared for the next response. *Photo: courtesy of Terry Georgia.*

Uniforms or clothing soiled with the patient's blood or OPIM should not be taken home to be laundered; they should be laundered by a laundry service that deals with contaminated clothing or as specified in the organization's protocols.



## AIR MEDICAL TRANSPORT CONSIDERATIONS

In certain situations, it is sometimes best for the patient to be transported to the receiving medical facility by helicopter (Fig. 27-7). This type of transport enables severely injured or ill persons to be transported quickly to specialty centers and large treatment facilities. Geography and other circumstances play a large role in this type of transport decision, and emergency personnel should follow local and state protocols.

### When to Request Air Medical Transport

In most situations where **air medical transport** is requested, it is needed because one or more patients is in critical condition. During air medical operations you must always keep the safety of everyone present the top priority.

Trauma alerts and air medical transport may be required for a number of different MOIs and natures of illness. Specific **trauma alert**

**criteria** vary from state to state and are driven by local protocols. Also, the Centers for Disease Control and Prevention (CDC) has published national guidelines for field triage of trauma patients that should be used as part of the decision-making process. The guidelines call for patients to be transported to the highest level of care within the system. These include patients who fit at least one of the criterion in each of the following two areas:

- Vital signs and level of consciousness:
  - Glasgow Coma Scale  $\leq 13$
  - Systolic blood pressure of  $< 90$  mmHg
  - Respiratory rate of  $< 10$  or  $> 29$  breaths per minute ( $< 20$  in infants aged  $< 1$  year) or a need for ventilatory support
- Anatomic:
  - All penetrating injuries to the head, neck, torso and extremities proximal to the elbow or knee
  - Chest wall instability or deformity (e.g., flail chest)



**Fig. 27-7:** Transport by helicopter allows severely injured or ill patients to be transported quickly. *Photo: courtesy of Ted Crites.*



#### CRITICAL FACTS

Helicopters can be the best transportation choice when dealing with severely injured or ill persons who need quick transport to specialty centers or large treatment facilities. Geography and circumstances play a role in the decision, and local and state protocols should always be followed.

- Two or more proximal long-bone fractures
- Crushed, de-gloved, mangled or pulseless extremity
- Amputation proximal to the wrist or ankle
- Pelvic fractures
- Open or depressed skull fractures
- Paralysis

Patients who fit one of the following MOI criteria should be transported to a trauma center, but it need not be the highest level of care:

- Falls:
  - Adults: > 20 feet (one story = 10 feet)
  - Children: > 10 feet or two to three times the height of the child
- High-risk motor-vehicle crash:
  - Intrusion, including roof: > 12 inches occupant site; > 18 inches any site
  - Ejection (partial or complete) from motor vehicle
  - Death in the same passenger compartment
  - Vehicle telemetry data consistent with a high risk for injury
- Automobile versus pedestrian/bicyclist thrown, run over or with significant (> 20 mph) impact
- Motorcycle crash > 20 mph

Additionally, the following special patients, along with system considerations, should be considered for transport to a trauma center for evaluation and initial management:

- Older adults:
  - Risk for injury/death increases after age 55
  - Systolic blood pressure < 110 mmHg might represent shock after age 65
  - Low-impact mechanisms (e.g., ground-level falls) might result in severe injury
- Children:
  - Should be triaged preferentially to pediatric-capable trauma centers
- Anticoagulants and bleeding disorders:
  - Patients with a head injury are at high risk for rapid deterioration
- Burns:
  - Without other trauma mechanism: triage to burn facility
  - With trauma mechanism: triage to trauma center
- Pregnancy > 20 weeks
- EMS provider judgment

Air medical transport should also be considered for the following:

- A situation where there are multiple injured or ill people
- Critical stroke and cardiac alert patients, if ground transport by ambulance exceeds 45 minutes to the receiving facility
- Critical trauma patients, who should be transported by air transport if ambulance transport to the trauma center exceeds 30 minutes

The distance to be traveled and the time it will take to transport the patient(s) must be considered. Patients with conditions that are time-critical include those with chest or abdominal injuries with signs of respiratory shock or distress; patients in shock or experiencing an acute stroke; patients who have sustained any serious injury and show altered vital signs; patients with head injuries with altered mental status; and those patients with a penetrating injury or in any other situation where time is obviously critical (such as a severe poisoning [e.g., carbon monoxide], heart attack, stroke or amputation).

Requesting air medical transport is reasonable when:

- It will take more than 30 minutes by ambulance to transport the patient to a trauma center.
- It will take longer to transport the patient to a trauma center by ambulance than by air transport.
- The patient's transport will be delayed by more than 30 minutes because of the need for extrication.
- The patient will require rapid transport to a specialty center. This could include a burn center or pediatric, comprehensive stroke or trauma center.

## Advantages

In some situations, you may need to request air transport for your patient because they are unstable and the length of time for ground transport would lower the chances of survival. If the helicopter is carrying a medical crew, air transport allows for quicker access to more advanced emergency care. The medical crews on air transport are highly trained and can include nurses, paramedics and/or physicians. There is also specialized equipment that the medical crews are trained to use, including monitoring devices, intubation and advanced airway equipment, and chest decompression kits. Collisions or crashes

that occur off-road or in remote areas may not be accessible by road vehicles; use of a helicopter allows for patient evacuation. Another advantage of using air transport is that many large hospital centers and trauma centers have helipads to allow for helicopter landings.

## Disadvantages

Helicopter transport is affected by weather conditions. If conditions are unfavorable, such as high winds or low visibility, the patient cannot be transported. The altitude available for a safe rescue may be vital in determining whether the rescue is feasible. If there is not enough room for the helicopter to hover or land safely, the rescue is not possible. There may be airspeed restrictions imposed by air control authorities in certain designated areas that could impede the aircraft's arrival at the receiving medical facility. Another possible disadvantage is that helicopter size varies considerably, depending on the model. Smaller helicopters may not be able to accommodate patients and responders, as well as necessary equipment. Landing in mountainous terrain or among forested areas can be very difficult for a helicopter pilot. The area must be safe and there must be a viable landing site. Air transport is also significantly more costly than ground transportation.

## Activation

Air medical activation must follow local and state guidelines. There are also state statutes, which vary across the country. It is essential that you review your state's protocols for activation of the helicopter emergency medical system (HEMS). In addition, rules vary according to institution, locale and state. There are also ordinance standards for each city, county and/or district. However, resources should be consistent with the standards developed by the Commission for the Accreditation of Medical Transport Systems.

## Indications for Patient Transport

In general, air medical transport is used for several reasons including medical (e.g., stroke or cardiac alert) and trauma. With these types of emergencies, time is of the essence. This type of transport may be needed in situations involving spinal injuries, burns, organ procurement, high-risk obstetrics and premature babies. Helicopters are also used in the field in search and rescue missions. They are able to cover more terrain than land vehicles and can be used to rescue patients from inaccessible locations.

## Considerations with Air Medical Transport

### Types

There are two main types of air medical transport, rotorcraft and fixed-wing. Rotorcrafts (e.g., helicopters) are used to get into areas that are not accessible to any other type of rescue craft. Their maneuverability allows them to move up and down and side to side as needed, allowing for special rescue procedures such as hoisting. Fixed-wing crafts (e.g., planes, jets) are used to transport over long distances, usually between medical facilities.

### Weather

Weather plays a significant role in the use of aircraft for rescue and transport. Pilots must have a minimum amount of visibility, and air temperature affects the altitude at which the helicopter can hover.

### Space and Load

The amount of space available in a helicopter depends on the type of helicopter and its maximum takeoff and landing weights. When calculating space, responders must take into account how many patients require transport, the responders who must accompany the patient(s) and any essential lifesaving equipment. In calculating weight, the pilot must take into account not only the passengers and equipment, but the fuel load as well.

### Control Systems

Flying helicopters is an extremely demanding task because of their complex function. The pilot must coordinate the lift of the vehicle with the forward or side-to-side movement, if any, or the altitude and air temperature if attempting to hover. Because of the design of the vehicle, the pilot cannot see below the helicopter, which is why guidance is always needed.

### Landing Zones

Choosing a safe **landing zone (LZ)** for a helicopter is paramount (Fig. 27-8). The pilot cannot see the area directly below the aircraft and must be guided. The pilot must also have a visual reference point at all times. Ideal conditions for LZs include:

- A minimum 10,000-square-foot area (100 feet by 100 feet). Some pilots prefer a rectangular landing area to allow for a 45-degree approach. Some aircraft may need a larger area.
- Flat land.





**Fig. 27-8:** A safe landing zone is paramount to the safety of a helicopter transport.

- Firm land. Avoid dusty ground or powdery snow if possible, as these conditions can impair vision as the helicopter rotors churn up the wind. Also, loose rocks can become dangerous projectiles when a helicopter lands or takes off. There is no guarantee that ice on a body of water would ever be strong enough for a helicopter landing.
- An area clear of any obstacles, such as trees or utility poles.
- An area clear of any type of vehicular traffic or pedestrians.

One person should be in charge of the LZ, coordinating the scene. To prevent distraction or confusion, this is the only person who should be communicating with the pilot. The coordinator should ensure that the LZ is well marked with cones or a flameless light source in all four corners. Nighttime landings can be guided with vehicle lights or any other *nonflame* light source, but the lights should always remain at ground level, never directed toward the pilot.

To help with the helicopter landing, the coordinator should be protected with a fastened helmet, hearing and eye protection, long sleeves and pants. The coordinator is then stationed outside the landing perimeter, usually with their back to the wind unless the pilot instructs an alternate landing approach. If possible, people should also be stationed at the left and the right outside the landing perimeter. Any bystanders not involved in the landing should be kept a minimum of 200 feet away from the site.

## Patient Transfer

### Interacting with Flight Personnel

If you are transferring a patient to the care of flight personnel, you will have to provide all the information you have obtained about the situation. This includes patient history, injury or illness history, presentation of the patient when you came upon the scene, any changes while waiting for the helicopter, and status and vital signs (Fig. 27-9).



**Fig. 27-9:** Provide all information on a patient to flight personnel.  
Photo: courtesy of Ted Crites.



## Patient Packaging and Preparation

Preparation for transport may include securing the patient's airway, immobilizing, splinting and the completion of emergency care procedures necessary for safely transferring a patient from the scene to an ambulance or helicopter.

## Scene Safety

It is essential that no loose objects be allowed within the LZ. They may become projectiles, causing damage or injury. Objects such as medical equipment, linens or sheets, bags and other loose objects can become airborne from the rotary winds (rotor wash) and may strike the rotor blades or get sucked up into engine intakes causing a breakdown or injuries. Secure everything that can be secured and move anything else as far away as possible from the LZ. If the land is sandy or dusty, it should be wet down to limit the amount of dirt and dust churned up by the rotor wash.

Only those personnel who must approach the aircraft should be permitted within the LZ, and only after the pilot has signaled that it is safe to approach. *Make eye contact with the pilot* to confirm your permission to approach, and *maintain eye contact* until you have arrived at the door of the helicopter.

Tail rotors are very dangerous, and a person assigned as a tail rotor guard may be posted to prevent people from coming near or approaching the aircraft from the rear. Allow the medical crew from the aircraft to approach you instead. Approaching from the front or side allows the pilot to see the responders (Fig. 27-10).

Your posture should be crouched over somewhat and, if there is an incline of any sort, you must approach from the lowest point and always from the side or front, never the rear. Even if approaching from the side, you must remain in the pilot's view. You should not be wearing a hat of any type; only a fastened helmet is permitted. Do not wear billowing clothing. If carrying equipment, such as an IV pole, this must be kept low and parallel to the ground so it does not get struck by the blades.

## Special Tactics

Responders may be called to participate in rescues using mechanical hoists or special insertion and extrication (SPIE) lines. Because these responders have special training, your role would be to ensure that the area is as safe as possible for the specialty team.



**Fig. 27-10:** Tail rotors are dangerous. Approach only if given permission by the pilot and only from the front or side so the pilot sees you. Photo: courtesy of Ted Crites.

## EMERGENCY VEHICLE SAFETY

### Apparatus Preparedness

Part of being prepared to respond to emergencies is being able to depend on your equipment and transportation. This means performing regular daily checks, more often if the situation warrants it. While checking for adequate tire inflation, also check the tires for wear and tear as well as anything unusual, like nails or debris in the tire. Ensure that warning devices (lights, siren, horn) are in working order.

Check with your employer and/or state regarding checklists for required vehicle maintenance. Such checklists should include items such as checking the fluid circulation system and wiper fluid levels.

### Equipment Preparedness

You should also ensure that the appropriate safety equipment is available and in working order. Personal protective equipment (PPE) must be in full working condition for you to do your job effectively and safely. Depending on what is required in your situation, PPE may include helmets, work gloves, steel-tipped boots and structural firefighting protective clothing. It also includes protective eyewear, hearing protection, appropriate outerwear for the season and the task, portable radio and body armor if considered necessary.

Rescues often take place in the dark or in inclement weather, where visibility may be poor. It is important for you to wear reflective clothing, ideally a reflective safety vest, but reflective tape on your clothing and other gear also works well (Fig. 27-11).



**Fig. 27-11:** Wear reflective clothing, such as a safety vest, or reflective tape to increase your visibility during rescues, especially when it is dark or in inclement weather. Photo: courtesy of Captain Phil Kleinberg, EMT-P.

## Safety Issues During Response

During a response, safety is paramount. All personnel must be properly seated and use safety belts. All equipment in the cab area, rear of ambulance and any compartment areas should be appropriately secured.

### Consideration of Use of Lights and Sirens

Emergency response to a scene does *not* exempt any emergency personnel from traffic laws. It is the driver's responsibility to make sure they know the traffic laws that govern the use of lights, sirens and intersection procedures.

### Risk/Benefit Analysis

Use of lights and sirens is becoming increasingly questioned in emergency rescue services.

Numerous studies have been conducted about the effectiveness versus the safety aspect of the practice. Learn your agency's protocols for when the patient's condition and situation warrants use of lights and sirens.

### Audible Warning Devices

**Audible warning devices** include both the siren and the air horn. You should be familiar with your agency's requirements concerning the use of both.

The purpose of using your siren is to warn traffic in front of you that you are approaching and to warn oncoming and side traffic of your presence. It is also used to ask for the right of way. Because today's vehicles are better insulated from outside noise and because many drivers and passengers listen to loud music or have loud conversations inside, do *not* assume they can hear you approach. The outside environment may also be noisy and affect their ability to hear a siren. Alternatively, they may hear you but not fully realize from which direction you are coming. If you feel that your siren was not heard, do *not* come up behind a vehicle and turn your siren on suddenly, as this may startle the driver and cause a crash. Also, be aware that the siren can have an effect on you in the ambulance. There can be a hypnotizing effect that may make you pay less attention to your surroundings and your driving.

Your air horn can be used to clear traffic in a single situation, like an intersection. Like the siren, do *not* use the air horn behind or close to another vehicle as it may startle the driver into losing control. Do *not* use it continuously, but it can be used with or without your siren, depending on what the local and state laws are for your area.

## **Visual Warning Devices**

Using **visual warning devices**, such as warning lights and emergency lights, depends on local and state laws. It is highly recommended that you do *not* use emergency lights without your siren; they should be used together or not at all. Headlights should be on, day or night, but high beams should *not* be used as emergency lights as they can blind oncoming drivers, as well as drivers in front of you through their rearview mirror.

If using a siren and/or lights, many drivers choose to turn them off a few blocks before the destination to avoid attracting attention.

## **Respond with Due Regard**

Rescue vehicle drivers should obey traffic laws, be careful at intersections and only drive in emergency mode when lights and sirens are employed. Factors such as weather, road conditions and traffic must be taken into consideration when making driving decisions.

## **High-Risk Situations**

### **Intersections**

Collisions at intersections can occur when the rescue driver has a green light and does not expect a driver to run a late yellow light or a red light, or when a pedestrian or cyclist may be crossing and not be visible to the driver due to other vehicles. Slow down and come to a complete stop at intersections, and ensure that all drivers are aware of your presence before proceeding. Another dangerous situation arises when more than one emergency vehicle is responding, either in the same direction or from different directions. Ensure that all emergency vehicles are obvious to all motorists and to people around the intersections, so they know to expect more than one emergency vehicle.

### **Highway Access**

Always use caution when entering roads or highways. Be especially careful when using the shoulder in rush hour or gridlock situations. Follow the rules of the road and do not assume other drivers are aware of your presence. State laws differ in regards to how other drivers should respond when emergency vehicles are approaching. For example, some states require that drivers pull to the right to allow the emergency vehicle to pass without a problem, while other states do not require drivers to pull to the right.

Know your state's laws to ensure your safety and the safety of those around you.

## **Speed Considerations**

You should only travel at increased speed, beyond posted speed limits, when using lights and sirens, and only if permitted by local and state laws. If driving at a high speed, weather and road conditions must also be taken into consideration, and extra caution should be taken when going around curves, going over hills, going down hills, turning corners and braking.

## **Driving Distractions**

Be sure to eliminate all possible distractions, as your ability to concentrate and drive safely is of utmost importance. Typical distracting factors include mobile computers, Global Positioning Systems (GPSs), mobile radios, vehicle stereo, wireless devices, and eating and drinking.

## **Inclement Weather**

Driving in inclement weather can make emergency response more stressful. Be sure to leave extra distance between you and the car in front of you—especially on wet pavement, which usually requires double the normal distance to ensure enough braking room. If driving on ice or snow, count on about five times the normal distance needed.

Most drivers are aware of the risk of skidding on ice, but hydroplaning—riding on a film of water—is a very real risk in rain. If you do begin to hydroplane, corrective actions are similar to those of skidding on ice: take your foot off the accelerator and, unless you have an anti-lock braking system (ABS), pump the brake gently. Do *not* try to turn out of the hydroplane.

When driving in fog or any other situation where vision is greatly diminished, you must slow down; do *not* brake suddenly in case someone is following too closely behind you. Use your headlights, but not your high beams. If legal in your locale or state, use your four-way flashers/hazard lights if driving slower than the posted limit. If about to use your brake, warn those behind you by tapping your brake, activating your brake lights.

## **Aggressive Drivers**

Aggressive drivers can be found anywhere, at any time. They have less concern for other drivers and are generally frustrated. An aggressive driver is someone who not only threatens other drivers



verbally or with gestures, but who also ignores traffic laws such as running stop signs and red lights, making unsafe lane changes, weaving in and out of traffic and tailgating other drivers. Aggressive drivers may disregard ambulances and other emergency vehicles. Be cautious when confronted with an aggressive driver and do not react to the driver's behavior or actions. Back off if needed and do not assume an aggressive driver will obey the rules of the road. When encountering an aggressive driver, notify law enforcement immediately. Obtain a tag number and vehicle description, if it is safe to do so.

## Unpaved Roadways

Unpaved roadways, such as dirt roads or gravel-covered surfaces, can pose unsafe driving conditions that include marginal traction; muddy, slick conditions during rainy weather; and uneven surfaces. Always drive with extra caution on unpaved roads, and never drive faster than conditions safely permit when driving on any road surface.

## Responding Alone

In many traffic-related emergencies requiring fire rescue units to respond, they will position their larger vehicles in such a way as to protect the scene and allow for emergency care. When responding alone, or when you are first on scene, be especially careful when approaching and when exiting your vehicle. Check your mirrors, look back for traffic and open your door slowly especially if it opens toward traffic. Wear proper reflective gear. Request assistance from law enforcement personnel to assist with traffic control.

## Fatigue

There may be times when an EMS vehicle driver feels sleepy while driving, especially on long transports. This may be especially true on longer shifts. Avoid caffeine and sugar; they may provide energy in the short term, but cause a rebound drop in energy a few hours later, which can make you feel even more sleepy as well as disturb sleep. Fresh air is a better alternative, as is 10 minutes of deep breathing. Open the vehicle's window or get out of the vehicle if you can for a few minutes. Stretching also helps. If you take prescribed medications that cause sleepiness and impair your ability to perform your job safely, seek help and avoid driving when the medication is interfering. If you are using antihistamines, choose ones that cause less drowsiness.

## 360-Degree Assessment

When approaching an emergency, dangers can be present all around you. Be sure to scan up, down and behind you, as well as looking forward and side-to-side as you size up the scene (Fig. 27-12). This will help you more thoroughly assess the entire situation.

## Downed Electrical Lines

When a vehicle is in contact with an electrical wire, consider the wire energized (live) until you know otherwise. Water is an effective conductor of electricity, so be especially careful of downed electrical wires in a wet or rainy environment. When you arrive at the scene, your first priority is to ensure your safety and that of others in the immediate area. A safety area should be established at a point twice the length of the span (distance between the poles)



**Fig. 27-12:** Dangers or unsafe conditions can be present all around you. Assess the scene from all angles. Photo: courtesy of Captain Phil Kleinberg, EMT-P.





**Fig. 27-13:** Downed electrical wires are extremely dangerous and require that a safety area is established. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*

of the wire (Fig. 27-13). Attempt to reach and move patients *only* after the power company has been notified and has secured any electrical current from reaching downed wires or cables. Tell occupants inside an involved vehicle to *remain in the vehicle*. If needed, you may be able to give them instructions on how to provide some basic first aid care for any injured patients in the vehicle until they can be safely reached by professional responders. Do *not* attempt to deal with any electrical hazards unless you are specifically trained to do so and have the proper equipment. Once the current has been shut down, the vehicle can be safely approached.

### Leaking Fuel or Fluids

Check to see if there is any fuel or fluid leaking from the vehicle. Check for a source that could ignite a fire. If there is a source, the fire department must be notified if you have not done so already.

### Smoke or Fire

If smoke or fire is present, the fire department must be notified if you have not already done so. If you attempt a rescue, approach the vehicle from the side only, to lessen the risk should explosion occur.

### Broken Glass

Broken glass from windows or windshields can be anywhere on the scene. If it poses a risk and cannot be avoided, covering it may reduce the chances of injury.

### Trapped or Ejected Patients

As you size up the scene, check for trapped patients. If a patient is trapped in a vehicle, the fire and rescue department may have specialized extrication equipment to help get the patient safely out of the vehicle. Also, look around the area to see if any patients were ejected from the vehicle upon impact.

### Mechanism of Injury/Nature of Illness

As you approach the patient, consider the MOI or nature of illness. Doing so involves trying to find out what happened. Look around the scene for clues as to what caused the emergency and the extent of the damage. Consider the force that may have been involved in creating an injury. This will cause you to think about the possible type and extent of the patient's injuries. Take in the whole picture. How a motor vehicle is crushed or nearby objects such as shattered glass, a fallen ladder or a spilled medicine container may suggest what happened. If the patient is unconscious, considering the MOI or nature of illness may be the only way you can determine what happened.

### Patient Care in the Ambulance

All personnel, including the driver and others riding in the ambulance, must be properly seated and secured with safety belts for their own safety as well as for the safety of others in the vehicle, unless they are moving about for essential tasks



**Fig. 27-14:** Patients in an ambulance should always be properly secured, and all personnel should be cautious when moving to provide care. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*

in the patient compartment (Fig. 27-14). Do not remove your safety belt just before arrival to save time, as research shows the last few minutes of the emergency response drive are the most dangerous to team members.

If safety belts must be removed while you are in the patient compartment to provide care to the patient, precautions must be taken regarding how you position yourself and how you move. Always hold on to something secure inside the compartment when moving about unsecured.

Patients should *a/ways* be properly secured while in the patient compartment. All stretcher straps are to be appropriately in place and tightened.

Patient care in the ambulance can be hazardous because of the movement necessary by the responder. While remaining as safe as possible, the responder must be able to carry out certain procedures. Check the protocols in your local area or state regarding which procedures these might be, as they may require that the ambulance not be in motion at that time.

Move deliberately and slowly, keeping your feet well placed, shoulder width apart, on the floor to maintain stability. Responders should practice the idea that three of five essential body parts should be safely “hugging” the ambulance at all times. The five body parts are the two hands, two feet and backside, which should be seated as much as possible during

ambulance movement. If you hook your foot around the stretcher bar as you are seated, this gives an extra measure of safety and security.

CPR may be necessary en route to the hospital. This requires extra care for the responder. Maintain balance as much as possible and have the driver call out if any bumpy areas (e.g., railroad tracks or potholes) or severe turns are coming up, so that you may brace yourself.

While performing CPR, spread your feet to shoulder width to maintain a more secure stance and bend your knees to lower your center of gravity. If possible, have someone help you by holding on to your belt to stabilize you. That other person should be secured with a seat belt.

### Securing Equipment

All moveable equipment in the cab must be secured for your safety. In the event of a motor-vehicle collision, all unsecured items have the potential of becoming life-threatening projectiles. This includes personal items left on the dashboard, such as pens and notebooks.

Unless using a piece of equipment, it must be securely stored to prevent injury in the case of a sudden stop, swerve or motor-vehicle crash. This includes everything from heavier monitoring equipment and AEDs to lighter clipboards and cups.

## LEAVING THE SCENE

Before you leave the scene, ensure all hazards have been mitigated. Pick up and dispose of all equipment and trash properly. All used sharps must be placed in a closed, puncture-resistant, leak-proof, tamper-proof biohazard sharps container. All contaminated clothing, products or material must be placed in a biohazard container. All containers must be stored in a safe manner and, if leakage occurs, they must be placed in a second leak-proof container. Check with your local and state laws about proper disposal of these contaminated items.

All reusable equipment must be collected from the scene for cleaning and restocking. All disposable equipment must be discarded in appropriate containers and replaced with new equipment after the emergency.

Turn the scene over to the appropriate authority prior to leaving. There may be situations when EMRs must turn over care of their patient to other emergency personnel, including law enforcement, fire suppression, highway department and other personnel. The names of the initial responders should be given to the crew taking over care

and should be recorded on the prehospital care report for any possible follow ups. While generally one only transfers care to a higher-level certified emergency responder, there may be situations that necessitate turning over care to a lower certified responder. For example, in a multi-casualty incident (MCI), responders may be required to move on to the next patient for assessment, leaving the patient with a lower certified responder, after an appropriate briefing.

## EMS EQUIPMENT

Maintaining equipment readiness is essential. If you are involved in transporting patients to the receiving facility, you will have to prepare and inspect the ambulance before every shift. Local EMS systems and state regulations determine what equipment and supplies must be in the vehicle.

### Jump Kit

In preparing to respond to an emergency, you should have basic medical equipment on hand. Always have a jump kit fully stocked and ready to go should an emergency occur (Fig. 27-15). Do not overfill the jump kit, but minimum supplies should include:



Fig. 27-15: Jump kit.



### CRITICAL FACTS

Jump kits should always be on hand and fully stocked. Supply essentials include oral airways, suction equipment, artificial-ventilation devices, and supplies for basic wounds and severe, life-threatening bleeding.



- Airways (oral).
- Suction equipment.
- Artificial-ventilation devices (e.g., resuscitation mask or bag-valve-mask [BVM] resuscitator).
- Basic wound supplies (e.g., dressings and bandages).
- Supplies for severe, life-threatening bleeding (tourniquets, pressure dressings and hemostatic dressings).

Other supplies to include are:

- PPE, such as disposable latex-free gloves, protective eyewear, masks and face shields.
- Maps.
- Scissors.
- Blood pressure cuff.
- Stethoscope.
- Flashlight.
- Note pad and pen.
- Hand sanitizer.
- Any other equipment required by local or state standards.

## PUTTING IT ALL TOGETHER

EMRs are individuals who have been trained to a minimum standard of care according to the current national scope of practice and EMS educational standards. They may function in traditional roles

as regular members of an ambulance crew in some states, while in others they may work in nontraditional settings as trip leaders or athletic trainers. There are also several types of EMRs, including those with additional training who are able to transport patients as well as provide advanced, prehospital medical care.

A typical EMS response has nine phases: preparation for an emergency call, dispatch, en route to the scene, arrival at the scene and patient contact, transferring the patient to the ambulance, en route to the receiving facility, arrival at the receiving facility, clear medical facility and available for next emergency call.

In certain situations, it may be best for patients to be transported to a medical facility by air. This method enables severely injured or ill persons to be transported quickly to specialty centers and large treatment facilities. Geography and other circumstances play a large role in this type of transport decision, and emergency personnel should follow local and state protocols.

To be prepared to answer emergencies, EMRs must be able to depend on their equipment and transportation. This means performing regular checks of the vehicle's tires and audible and visual warning devices to make sure everything is in working order, and ensuring that all necessary equipment and supplies are on hand.

## ► You Are the Emergency Medical Responder

Additional fire rescue, police and EMS units arrive. You see that one of the occupants of the vehicle that is on the shoulder of the road apparently was not wearing a seat belt, was ejected from the vehicle and is not moving. The driver of the car on the median strip is conscious, but because of traffic you cannot get to that vehicle. What are some safety considerations and issues with this situation? With heavy traffic backing up in all directions, and one patient with severe trauma, what transport options should be considered?



# ENRICHMENT

## Operational Safety and Security Measures

### Personnel

The beginning of each shift should involve a briefing, either in person or through written notes, about any issues involving crew safety. These issues could involve personal threats against the unit or specific responders, or be general threats. Security measures should have been discussed previously in training and reviewed as needed.

### Vehicles

The threat of stolen vehicles is very real. Under no circumstances should an ambulance or rescue vehicle be left running or unattended with the key in the ignition.

All vehicles must be monitored, whether in or out of service. Any vehicles that are no longer to be used for emergency or rescue purposes must be stripped of all emergency equipment, lights, sirens and markings.

All use of ambulances and rescue vehicles must be tracked to avoid unauthorized use. If ambulances or rescue vehicles need repair or servicing outside of authorized areas, they must be secured in such a way that they cannot be used by unauthorized personnel.

# 28

## ACCESS AND EXTRICATION

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### ▶ You Are the Emergency Medical Responder

You are an emergency medical responder (EMR) and a member of a rural volunteer rescue squad. There has been a motor-vehicle crash on a main county road in which the driver apparently lost control of his car on a curve and struck a large tree. There is major damage to the car. The driver (and sole occupant) most likely impacted the steering wheel with his upper body. He appears to be pinned. Fire rescue personnel are on scene. As you size up the scene, with the car tilted along the shoulder, you notice that fluids are leaking from the vehicle and there is a steady flow of traffic on the road. What potential safety issues should be considered? How might your ability to provide emergency medical care be affected by this situation?



## KEY TERMS

**Access:** Reaching a patient who is trapped in a motor vehicle or a dangerous situation, for the purpose of extrication and providing medical care.

**Complex access:** In an extrication, the process of using specialized tools or equipment to gain access to the patient.

**Cribbing:** A system using wood or supports, arranged diagonally to a vehicle's frame, to safely prop it up, creating a stable environment.

**Extrication:** The safe and appropriate removal of a patient trapped in a motor vehicle or a dangerous situation.

**“Rule of thumb”:** A guideline for positioning oneself far enough away from a scene involving hazardous material (HAZMAT): one's thumb, pointing up at arm's length, should cover the hazardous area from one's view.

**Simple access:** In an extrication, the process of getting to the patient without the use of equipment.

**Vehicle stabilization:** Steps taken to stabilize a motor vehicle in place so that it cannot move and cause further harm to patients or responders.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Have a basic understanding of access and extrication.
- Explain the role of the emergency medical responder (EMR) in an extrication operation.
- List basic extrication equipment.
- Describe basic personal protective equipment used in extrication operations.
- Describe steps necessary to ensure patient safety during extrication.
- List the reasons for controlling traffic at an emergency scene.
- Describe unique hazards that may exist at an emergency scene.
- Define hazardous material (HAZMAT).
- List basic safety procedures associated with a HAZMAT situation.
- Describe the importance of vehicle stability.
- List the general steps to stabilize a vehicle.
- Know the difference between simple access and complex access.
- Know how to provide care to patients who require extrication at the scene.

## INTRODUCTION

One of your primary responsibilities as an emergency medical responder (EMR) is to provide care for an injured or ill patient. Sometimes, however, providing care is not possible because you cannot reach the patient. One example is a situation in which someone is able to call 9-1-1 or the designated emergency number for help but is unable to unlock the door of a home or office to let responders inside. This situation also occurs in a large number of motor-vehicle collisions, with locked or crushed vehicle doors, tightly rolled up windows or unstable vehicles. In other instances, fire, water, fuel leaks or other elements may prevent you from reaching the patient.

In these cases, you must immediately think of how you can safely gain **access** to the patient. If you cannot reach the patient, you cannot provide medical care. Always remember, when attempting to reach someone, your safety is the most important consideration. Protect yourself and the patient by doing only what you are trained to do, using equipment you are trained to use and wearing clothing appropriate for the situation. Items such as helmets, face shields, protective eyewear and heavy-duty gloves will help keep you safe as you attempt to gain access to a trapped patient. Simple tools can also be helpful.

# FUNDAMENTALS OF EXTRICATION AND RESCUE OPERATIONS

## Role of the EMR

**Extrication** is the safe and appropriate removal of a patient trapped in a motor vehicle or a dangerous situation. At times, an EMR may be called upon to help care for someone in this type of situation. It will be your role to administer the necessary care to the patient before extrication and ensure that the patient is removed in a way that minimizes further injury. Providing care for the patient may come before the extrication process; however, in many instances, patient care will occur simultaneously with the extrication process. During any extrication, it is critical that those providing medical care and those who are performing extrication are in constant communication with each other to maintain safety and avoid aggravating the patient's injuries or causing further pain.

Although fire rescue workers, emergency medical technicians (EMTs) and other specially trained personnel will perform most extrication procedures, when EMRs are involved in this type of rescue, they should work closely with other responders to protect the patient. A chain of command through the incident command system should also be established to ensure that the scene is well managed and the patient's care remains a priority.

## Additional Resources

Basic extrication equipment includes crowbars, screwdrivers, chisels, hammers, pliers, work gloves and goggles, wrenches, shovels, car jacks, tire irons, knives, and ropes or chains.

Many emergency scenes draw crowds of onlookers and individuals wishing to help. Law enforcement personnel will play a major role in helping to secure the scene and control the crowd while the extrication is in progress.

Also, consider the need for specialists to handle or help control any hazards present. This could include representatives from utility providers, such

as the natural gas company or the power company, or could include hazardous material (HAZMAT) responders. HAZMAT responders provide medical care and extrication of patients from a hot zone (area with the highest degree of danger in a HAZMAT emergency scene), where potentially hazardous chemical spills are involved. In the case of fuel spills or other potential hazards associated with extrication, the fire department may deploy a charged hose line to protect the scene, the patient and rescue personnel.

Depending on the severity of the injuries and location of the scene, patient transportation by an air medical service may be required. Other activities, such as patient decontamination, may be required prior to transport by ground ambulance or other ground transport vehicle, or by air medical services.

## Scene Safety

### Personal Safety

The first priority for all EMRs is their own safety. All personnel involved at the scene should wear protective clothing and follow guidelines set up by state and local protocols. The National Fire Protection Association (NFPA) and the Occupational Safety and Health Administration (OSHA) have guidelines to follow when considering the purchase of safety clothing. At a minimum, when responding to a motor-vehicle collision or other extrication situation, EMRs should have the following equipment:

- Protective helmet with chin strap
- Protective eyewear
- Puncture- and flame-resistant outerwear (turnout gear)
- Heavy, protective gloves
- Boots with steel toes and insoles

As with any emergency, begin by sizing up the scene to see if it is safe. If it is not safe, determine whether you can make it safe so you can attempt to gain access to the patient. Well-intentioned EMRs and others are injured or killed each year while attempting to help patients involved in motor-vehicle collisions. Such unfortunate instances are



### CRITICAL FACTS

Extrication is the safe and appropriate removal of a patient trapped in a motor vehicle or a dangerous situation.

Basic extrication equipment includes crowbars, screwdrivers, chisels, hammers, pliers, work gloves and goggles, wrenches, shovels, car jacks, tire irons, knives, and ropes or chains.



preventable by taking adequate measures to make the scene safe before trying to gain access and provide care.

## Patient Safety

Once you have obtained safe access to a trapped patient, provide the same care you would to any trauma patient. Ensure you maintain spinal motion restriction, complete the primary assessment and provide critical interventions as necessary. Patients will require protection from the debris created by the extrication process. Cover patients with tarps or blankets to protect them from broken glass, sharp metal and other hazards, including the environment. Lessen their fears by explaining what you will do and any noise that may occur in the process. Establishing a rapport with patients will help them focus on your support and listen to your instructions and guidance throughout the extrication. Asking

patients if they are prepared as each step takes place will also help them feel more in control of the situation and less panicked or frightened.

It is also important to continue to monitor patients throughout the process and, if their condition changes, immediately inform the rescue crew of any growing danger.

Caution bystanders in the area to stay away from the scene. Their presence can cause additional confusion and increase the risk of injury.

Ensure spinal motion restriction, if possible, before removing the patient from the vehicle (Fig. 28-1). The only time you should consider an emergency move without spinal motion restriction is in an emergency when there is an immediate threat to life, such as from cardiac arrest, fire or other critical situation.



**Fig. 28-1:** Ensure spinal motion restriction, if possible, before removing the patient from the vehicle. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*



### CRITICAL FACTS

Protective clothing is essential on the scene. Follow state and local protocols and familiarize yourself with guidelines put forth by NFPA and OSHA. Minimum equipment when dealing with collisions and extrications includes protective helmets and eyewear, turnout gear, protective gloves, and boots with steel toes and insoles.

Once you have obtained safe access to a trapped patient, provide the same care you would to any trauma patient. Ensure you maintain spinal motion restriction, complete the primary assessment and provide critical interventions as necessary.

## Scene and Traffic Control

There are several important reasons to control traffic at the scene: to protect the scene from further potential collisions, prevent injury to the rescue team, ensure minimal disruption and allow emergency vehicles to reach the scene. On arrival, request the assistance of additional law enforcement and fire services personnel to help control the scene and assign a scene safety officer.

Emergency vehicles should be placed in optimal positions for safety and for easy patient loading. Blocking is a technique of positioning emergency vehicles at an angle to traffic lanes (Fig. 28-2). This creates a physical barrier between the work area and traffic flowing toward the emergency scene. The scene should be protected with the first-arriving apparatus; block off at least one additional lane. Ambulances should park within the “shadow” created by the larger apparatus. The apparatus should also “block to the right” or “block to the left,” so as not to obstruct the loading doors of ambulances. The ambulance patient loading area should be facing away from the closest lane of moving traffic. All patient loading into ambulances is carried out from within the protected work zone that is created by the positioning of the other rescue apparatus.

Establish advance warning for vehicles by using traffic cones or flares. Place these at 10- to 15-foot intervals, to create a safe zone in a radius of at least 50 feet around the scene. If using flares, be sure there are no fluid leaks.

## Unique Hazards

### Alternative-Fueled Vehicles

It is important to understand the differences between gasoline- and alternative-fueled vehicles, especially hybrid and electric vehicles. Many people are concerned about the risk of electrocution. Following safety precautions and the manufacturer’s recommendations reduces the risk of injury to responders and vehicle occupants.

As with any conventional vehicle, removing the ignition key and disconnecting the battery will disable a hybrid’s high-voltage controller. Keep in mind that some hybrid vehicles do not have an ignition key, but do have an on/off switch that must be pressed before disconnecting the battery. However, some models may remain “live” for up to 10 minutes after the vehicle is shut off or disabled. Responders must always follow the manufacturer’s emergency response guidelines for the specific make and model of the vehicle.



**Fig. 28-2:** Blocking is a method of controlling traffic in which emergency vehicles are positioned to create a physical barrier between the emergency scene and the flow of traffic. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*



### CRITICAL FACTS

Blocking is a positioning technique that creates a physical barrier between the work area and traffic flowing toward the emergency scene. It creates a safer environment and provides an optimal position for patient loading.



One important difference is that a hybrid vehicle can remain silent and still be operational if the collision is minor and/or did not activate any of the collision sensors. Therefore, it is essential that responders chock or block the wheels to prevent the vehicle from moving under power or by gravity. Be careful not to place cribbing under any high-voltage (usually *orange* in color) cabling.

Hybrid and electric automobile manufacturers publish emergency response guides for each model of vehicle they produce. Responders should be familiar with the safety procedures provided in these resources.

### Undeployed Vehicle Safety Devices

In some collisions, air bags may not have deployed and may present a hazard during extrication. The force of a deploying air bag can turn access and extrication tools into destructive missiles that can cause serious injury to responders and patients. Air bags can be found in several locations throughout a vehicle and can number as many as a dozen separate units depending on the vehicle make and model. If a patient is pinned directly behind an undeployed air bag, both battery cables should be disconnected, following established safety protocols. Ideally, wait for deactivation of the system before attempting to extricate the patient. Do not mechanically cut through or displace the steering column until after deactivation of the

system. Do not cut or drill into the air bag module. Also, do not apply heat to the area of the steering wheel hub, as an undeployed air bag inflates in a normal manner if the chemicals sealed inside the air bag module reach a temperature above 350° F (177° C).

### HAZMAT

As an EMR, you may find yourself involved in a situation in which there are chemical or other harmful or toxic substances. EMRs must be trained to quickly identify such situations and access specially trained personnel to deal with the situation.

A hazardous material is any chemical substance or material that can pose a threat to the health, safety and property of an individual. A HAZMAT incident is any situation that deals with the release of hazardous material. When dealing with a HAZMAT situation, work within a structured system that provides guidance in managing this type of scene.

Unless you have received special training in HAZMAT handling and have the necessary equipment to do so without danger, stay well away from the area or in the designated cold zone (support area in the outer perimeter of a HAZMAT emergency scene) (Fig. 28-3). While en route to a potential HAZMAT scene, obtain as much prearrival information as possible from dispatch. Stay out of low areas where vapors and liquids



**Fig. 28-3:** Unless you have received special training in HAZMAT handling, stay away from the area. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*

may collect, and stay upwind and uphill of the scene. Be alert for wind changes that could cause vapors to blow toward you. Do not attempt to be a hero. It is common for responding ambulance crews approaching the scene to recognize a HAZMAT placard and immediately move to a safe area and summon more advanced help. When approaching the scene, use binoculars from a safe distance to look for potential hazards and to obtain the placard number. Refer to the Department of Transportation's *Emergency Response Guidebook* for detailed information.

Many fire departments have specially trained HAZMAT teams to handle incidents involving these materials. While awaiting help, keep people away from the danger zone. One easy method to determine the danger zone area is called "**rule of thumb**." The "rule of thumb" states that, to be safe, position yourself far enough away from the scene that your thumb, pointing up at arm's length, covers the hazardous area from your view.

When approaching any scene, be aware of dangers involving chemicals. Whether a motor-vehicle collision or an industrial emergency is involved, you should be able to recognize clues that indicate the presence of hazardous materials. These include signs (placards) on vehicles or storage facilities identifying the presence of these materials, evidence of spilled liquids or solids, unusual odors, clouds of vapor and leaking containers.

## VEHICLE STABILIZATION

Any movement of the vehicle during patient care or extrication can prove dangerous or even deadly to patients with severe spinal injuries, or could result in injury to the rescue team. Local fire department and rescue squad personnel specially trained in **vehicle stabilization** and extrication will respond to the scene when requested.

To make the scene as safe as possible, it is important to ensure that the motor vehicle is stable. You can assume a vehicle is unstable if:

- It is positioned on a tilted surface.
- It is stacked on top of another vehicle, even partly.

- It is on a slippery surface.
- It is overturned or on its side.

Stabilizing an upright vehicle is a relatively simple task. Placing blocks or wedges against the wheels of the vehicle will greatly reduce the chance of the vehicle moving. This process is called chocking (Fig. 28-4). You can use items such as rocks, logs, wooden blocks and spare tires. If a strong rope or chain is available, attach it to the frame of the car and then secure it to strong anchor points, such as large trees, guardrails or another vehicle. Letting the air out of the car's tires also reduces the possibility of movement.

To stabilize a vehicle, take the following steps:

- Put the vehicle in "park," or in gear (if a manual transmission).
- Set the parking brake.
- Turn off the vehicle ignition and remove the key.
- If there are no patients in the seats, move the seats back and roll down the windows.
- Disconnect the battery or power source.
- Identify and avoid hazardous vehicle safety components such as seat-belt pretensioners, undeployed air bags, integrated child booster seats, and a lower anchors and tethers for children (LATCH) system.

Depending on the condition and positioning of the vehicle, further steps must be taken to ensure the vehicle cannot fall or roll. **Cribbing** is a system that creates a stable environment for the vehicle.



Fig. 28-4: Chocking. Photo: courtesy of Ted Crites.



### CRITICAL FACTS

A hazardous material is any chemical substance or material that can pose a threat to the health, safety and property of an individual.



It uses wood or supports, arranged diagonally to the vehicle's frame, to safely prop up a vehicle (Fig. 28-5). Cribbing should not be used under tires because it tends to cause rolling. There should never be more than 1 to 2 inches between the cribbing and vehicle.

For vehicles remaining upright, use blocks or wedges to prevent rolling. When possible, position the wheels against the curb. The tire valve stem may also be cut so the car rests safely on its rims. The rims should also be chocked as a precaution.

Overturned vehicles must have a solid object such as a wheel chock, timber, spare tire or cribbing between the roof and roadway. A jack can be used to angle the vehicle against the object. Hook a chain to the axle, and loop the chain to a tree or post.



**Fig. 28-5:** 6" × 7" × 24" super crib with lanyards. Photo: courtesy of Turtle Plastics.

## GAINING ACCESS

### Simple Access

The term **simple access** describes the process of getting to a patient without the use of equipment. Although simple access does not require the use of equipment, the EMR should remember to wear protective equipment and use standard precautions as appropriate. Methods of simple access include:

- Trying to open each door.
- Trying to open the windows.
- Having the patient(s) unlock the doors or open and roll down the windows.

When you arrive on the scene, if specialized equipment and personnel are necessary to access patients, call to have these units dispatched. If after accessing the patients you realize that the additional personnel and equipment are not necessary, you can easily cancel them.

### Complex Access

**Complex access** describes the process of using specialized tools or equipment to gain access to a patient (Fig. 28-6). Several types of rescue training courses are available that deal with vehicle and rope rescue. Other types of programs provide training in trench, high-angle and water rescue. As an EMR, you may encounter situations in which you will use basic equipment and techniques to gain access to a patient.

### Tools

There are different types of extrication tools used to access patients (Fig. 28-7). Hand tools might include a "come-along," a ratcheting cable device



#### CRITICAL FACTS

A vehicle should be considered unstable if it is on a tilted or slippery surface, completely or partly on top of another vehicle, or overturned or on its side.

To stabilize a vehicle, take the following steps:

- Put the vehicle in "park," or in gear (if a manual transmission).
- Set the parking brake.
- Turn off the vehicle ignition and remove the key.
- If there are no patients in the seats, move the seats back and roll down the windows.
- Disconnect the battery or power source.
- Identify and avoid hazardous vehicle safety components.



**Fig. 28-6:** Complex access requires the use of specialized tools or equipment to gain access to a patient. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*



**Fig. 28-7:** Extrication tools used to access patients include hand tools, pneumatic tools, hydraulic tools, cutters and rams. *Photo: courtesy of Ted Crites.*

used for pulling. Pneumatic tools might include air bags, which can be used to aid with lifting.

The most commonly used extrication tool is the power hydraulic tool, such as the Hurst Jaws of Life®. This tool uses anywhere from 20,000 to 40,000 pounds per square inch (psi) to spread apart metal, and is most commonly used to remove the doors from a vehicle. However, it can also be beneficial for crushing and pulling or pushing the

dash area forward. Hydraulic tools, such as a jack, may also be used to lift the vehicle.

Other frequently used tools are cutters, which can employ 30,000 to 60,000 psi. Cutters do as their name suggests—cut. Most often, they are used to cut the posts that hold up the roof of a motor vehicle. There are also hydraulic tools that combine cutters and jaws into one tool.

A third type of extrication tool is the ram, which uses its force to spread. This is in similar fashion to the action of a jaws tool but with a much straighter and wider spread. Often the ram is used to push the dash area away from the front passenger compartment of a vehicle.

## EXTRICATION

### Role of the EMR

During extrication, ensure your own safety. Contact the communications center immediately and request that fire and law enforcement personnel respond to the scene. Information regarding number of vehicles, number of patients and the presence of any hazardous substances is very important.

Wearing the proper equipment is essential to ensure your safety; however, this is not enough in the case of some incident scenes. Ensure the scene is safe before approaching a patient. Once the scene is secure and the vehicle stable, attempt to reach the patient and complete the primary assessment. Together with other rescue personnel, establish a chain of command to ensure the utmost safety and care for patients and rescue team members.

### Extrication Tools

It is important to be prepared in case the local rescue squad cannot make it to the scene as quickly as necessary. In these situations, the following tools and equipment are key to assisting in the safe extrication of a patient as quickly as possible:

- Hammer
- Screwdriver
- Chisel
- Crowbar
- Pliers
- Work gloves and goggles

- Shovel
- Tire irons
- Wrenches
- Knives, including linoleum knives
- Car jacks
- Ropes or chains

### Extricating the Patient

Extricating the patient is a task carried out by specially trained personnel. Of primary concern is preventing further harm to the patient. The most important factor in achieving this is proper training of personnel, so that everyone is familiar with extrication procedures and team members communicate effectively.

Every extrication is different, and some can be quite complex. In some situations, the patient may be trapped in the car seat or partially trapped under the seat. When this happens, it may be possible to alleviate the situation by using the car's seat adjustment lever. If this is insufficient, the seat can be taken out by removing the nuts securing the seat or by forcing the seat using portable rams, spreaders or come-alongs. This latter option may involve rough movement, which may not be a viable option, depending on the patient's condition.

### Providing Care

It is important to have a sufficiently large number of skilled personnel available during extrication, as there are multiple tasks to look after at the same time. Always try to move the device, not the patient, during extrication. At all times, maintain spinal motion restriction. Use the path of least resistance when making decisions regarding equipment and moving the patient.

Once you have gained access to the patient, follow procedures for suspected head, neck and spinal injuries. Complete the primary assessment and provide the appropriate care.



#### CRITICAL FACTS

The term simple access describes the process of getting to a patient without the use of equipment. Complex access describes the process of using specialized tools or equipment to gain access to a patient.



## **CRITICAL FACTS**

Extricating the patient is a task reserved for specially trained personnel. Preventing further harm to the patient is a primary concern in extrication.

Be sure to stay with the extricated patient at all times. Continually monitor their condition.

Stay with the patient at all times and continually monitor their condition. If it worsens, communicate this to the rest of the team members, as they may wish to change the method to a more rapid type of extrication.

## **PUTTING IT ALL TOGETHER**

There are times when an EMR may not be able to provide immediate care for an injured or ill person because the EMR cannot reach the person. This can happen as a result of motor-vehicle collisions, fire, water or other elements.

While fire rescue personnel and others have special training and equipment, an EMR may be called upon to assist in vehicle extrication. Vehicle extrication involves multiple steps—stabilizing

the vehicle, attempting to gain access to patients inside the vehicle and, if unable to do so, carrying out the steps involved in extricating the patients from the vehicle in the safest manner possible.

All steps in the vehicle extrication process require specialized training and must be carried out by a team of rescue personnel. During the procedure, it is critical that EMRs take steps to ensure their own safety. Sadly, some EMRs and others are injured or killed each year when struck by an oncoming vehicle while attempting to help patients involved in motor-vehicle collisions. Be sure to take adequate measures to make the scene safe before trying to gain access and provide care. When providing care, responders should take steps to protect the patient's head, neck and spine.

## **> You Are the Emergency Medical Responder**

As you perform the primary assessment, the patient complains of numbness and tingling in his hands. What type of injury do you suspect the patient may have and what other steps would you take as you provide care for this patient?



# HAZARDOUS MATERIALS EMERGENCIES

## ▶ You Are the Emergency Medical Responder

You are the first emergency medical responder (EMR) to arrive at the scene of a freight train derailment. According to the train's placards and signage, several of the cars are carrying liquefied chlorine gas. At least two cars are leaking, and there is a yellowish cloud hanging low over the area. The winds are light, about 5 to 10 miles per hour (mph), and are coming from the northeast. Would you know how to respond? What would you do?



## KEY TERMS

**Cold zone:** Also called the support zone, this area is the outer perimeter of the zones most directly affected by an emergency involving hazardous materials.

**Emergency Response Guidebook:** A resource available from the U.S. Department of Transportation (DOT) to help identify hazardous materials and appropriate care for those exposed to them.

**Flammability:** The degree to which a substance may ignite.

**Hazardous material (HAZMAT) incident:** Any situation that deals with the unplanned release of hazardous material.

**Hot zone:** Also called the exclusion zone, this is the area in which the most danger exists from a HAZMAT incident.

**Reactivity:** The degree to which a substance may react when exposed to other substances.

**Safety Data Sheet (SDS):** A sheet (provided by the manufacturer) that identifies the substance, physical properties and any associated hazards (e.g., fire, explosion and health hazards) for a given material, as well as emergency first aid; formerly called a Material Safety Data Sheet (MSDS).

**Shipping papers:** Documents drivers must carry by law when transporting hazardous materials; list the names, possible associated dangers and four-digit identification numbers of the substances.

**Staging area:** Location established where resources can be placed while awaiting tactical assignment.

**Toxicity:** The degree to which a substance is poisonous or toxic.

**Warm zone:** Also called the contamination reduction zone; the area immediately outside the hot zone.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Define hazardous materials (HAZMATs).
- Describe the basic response to a HAZMAT incident.
- Know where to find available resources regarding training and response to HAZMAT incidents.
- Have a basic understanding of placards and the *Emergency Response Guidebook*.
- List basic personal protective equipment (PPE) necessary for responding to a HAZMAT incident.
- Know other resources available to respond to HAZMAT incidents.
- Understand the principles of decontamination and providing care during a HAZMAT incident.

## INTRODUCTION

As an emergency medical responder (EMR), you may find yourself involved in a situation in which there are chemical or other harmful or toxic substances. EMRs must be trained to quickly identify such situations and activate specially trained personnel to deal with them.

The possibility of being involved in a hazardous material (HAZMAT) incident should be an everyday concern of all personnel involved in the emergency medical services (EMS) system. Most people think that a HAZMAT incident only involves train and truck crashes, but hazardous materials can also be found in the home, school, industry

and various public places. Whenever there is any leaking or spilling of chemicals, the potential of a HAZMAT incident exists.

## HAZARDOUS MATERIALS

### What are Hazardous Materials?

Hazardous materials are everywhere. A hazardous material (HAZMAT) is any chemical substance or material that can pose a threat to the health, safety and property of an individual (Fig. 29-1). These materials are wastes, chemicals and other dangerous products, including explosives, poisonous gases, corrosives, radioactive materials, compressed gases,



**Fig. 29-1:** Any chemical substance or material that poses a health, safety or property threat is a hazardous material. Photo: courtesy of Captain Phil Kleinberg, EMT-P.

oxidizers, and flammable solids and liquids. For example, hospitals may have radioactive materials if they practice nuclear medicine. Farms and lawn and garden companies stock fertilizers, insecticides and pesticides. Various waste products from any number of manufacturers may also be considered toxic or hazardous.

If you work as part of an EMS system, you should participate in a First Responder/Emergency Medical Responder Awareness Level Hazardous Materials training program. This program provides training in recognizing a HAZMAT incident and how to approach it safely.

Terms you should familiarize yourself with when dealing with a HAZMAT incident include:

- **Flammability.** The degree to which a substance may ignite.
- **HAZMAT.** Any chemical substance or material that can pose a threat or risk to life, health, safety or property if not properly handled or contained.

- **Safety Data Sheets (SDSs).** Sheets (provided by the manufacturer) that identify the substance, physical properties and any associated hazards (e.g., fire, explosion and health hazards) for a given material, as well as emergency first aid.
- **Reactivity.** The degree to which a substance may react when exposed to other substances.
- **Shipping papers.** Documents drivers must carry by law when transporting hazardous materials; the papers list the names, associated dangers and four-digit identification numbers of the substances.
- **Staging area.** The location established where resources can be placed while awaiting tactical assignment.
- **Toxicity.** The degree to which a substance is poisonous or toxic.

## Identifying Hazardous Materials Resources

In addition to Safety Data Sheets provided by manufacturers, the U.S. Department of Transportation (DOT) has several books available to help identify hazardous materials and appropriate care procedures. The **Emergency Response Guidebook** is one such reference book (Fig. 29-2). The guidebook is available in English and Spanish and can be downloaded to mobile devices for easy and quick access to information on handling hazardous materials. The Chemical Transportation Emergency Center (CHEMTREC) can provide further information and guidance on hazardous materials. The CHEMTREC 24-Hour HAZMAT Communications Center toll-free phone number is 800-424-9300.

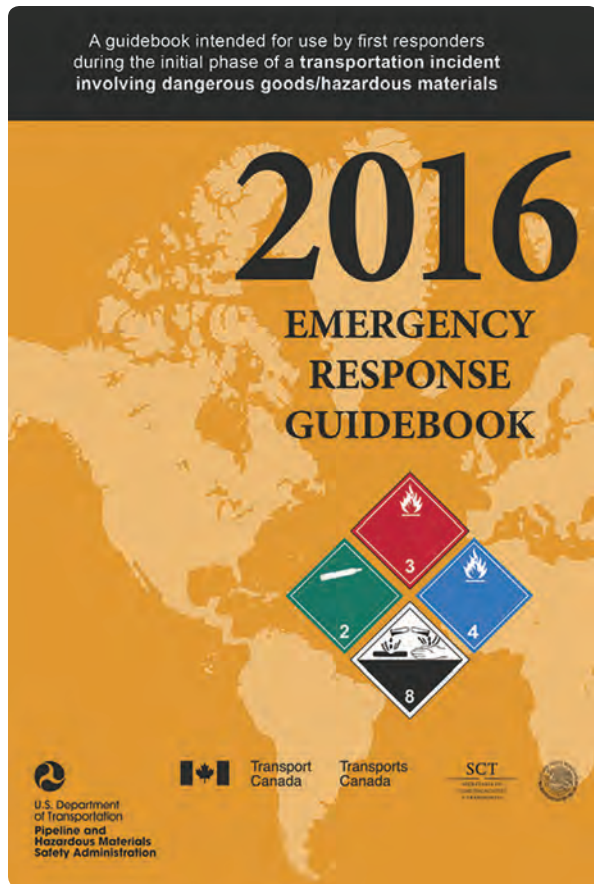
CAMEO® is an online library of more than 6000 data sheets containing response-related information and recommendations for hazardous materials that are commonly transported, used and/or stored in the United States. It is designed to plan for and respond to chemical emergencies and was developed by the Environmental Protection Agency's (EPA's) Office of Emergency Management (OEM) and the National Oceanic and Atmospheric Administration's (NOAA's) Office of Response and Restoration (OR&R).



### CRITICAL FACTS

A HAZMAT is any chemical substance or material that can pose a threat to the health, safety and property of an individual.





**Fig. 29-2:** Several books available from the DOT, such as the *Emergency Response Guidebook*, help identify hazardous materials and appropriate care procedures.

The National Institute for Occupational Safety and Health (NIOSH) is the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. NIOSH provides free resources on various chemicals and also publishes a pocket guide to chemical hazards.

### Regulatory Requirements

EMRs should review the Occupational Safety and Health Administration (OSHA) and EPA safety guidelines as well as the National Fire Protection Association (NFPA) HAZMAT requirements for EMS providers.

### Placards and Shipping Papers

Placards, or signs, are required by federal law to be placed on any vehicles that contain specific quantities of hazardous materials. In addition, manufacturers and others associated with the production and distribution of these materials are required by law to display the appropriate placard.

Placards often clearly identify the danger of the substance. Terms such as “explosive,” “flammable,” “corrosive” and “radioactive” are frequently used. Universally recognized symbols are also used. Fig. 29-3 shows some common labels and placards for identifying hazardous materials. Shipping papers, also called manifests or waybills, are a means of identifying hazardous substances being transported from one location to another.

## HAZMAT INCIDENTS

### **A hazardous material (HAZMAT) incident**

is any situation that deals with the release of hazardous material. When dealing with a HAZMAT incident, you work within a structured system that provides guidance in managing this type of scene.

### Preparing for a HAZMAT Incident and Activating the Plan

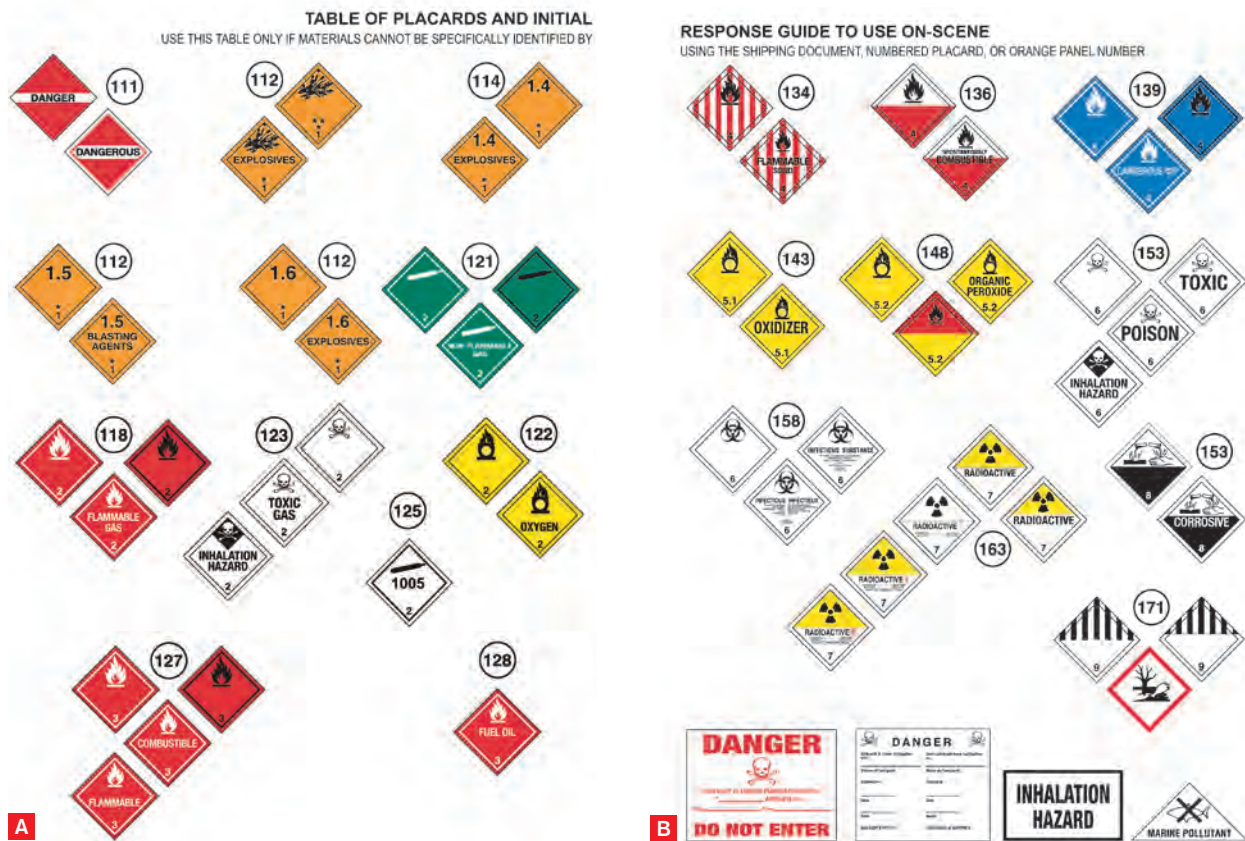
Establishing command at a HAZMAT incident may be your responsibility as an EMR. The following steps should be taken in preparation for the worst-case scenarios developing at the scene:

- Establish a clear chain of command.
- A single command officer must be assigned to maintain control of the situation and to make decisions at every stage of the rescue. The rescue team must be aware of who is in command and when decision-making powers are transferred to another officer.
- Establish a system of communication that is accessible and familiar to all responders.
- Establish a receiving facility that is as close to the scene as possible, and that is able to receive and handle the number of patients and continued decontamination processes required.

Once the plan has been established, the EMR must stay in command until relieved by someone higher in the chain of command. The following information must be transferred to the new command officer:

- Nature of the substance and problems
- Identity of the hazardous materials
- Kind of containers and their condition
- Weather conditions, especially wind direction
- Time since the emergency occurred
- Stage of the rescue and what steps are already in place
- Number of patients involved
- Possibility of additional patients





**Fig. 29-3, A–B:** Universally recognized symbols are used to identify the dangers of hazardous materials.

## Recognizing a HAZMAT Incident

When approaching any scene, you should be aware of dangers involving chemicals. Whether a motor-vehicle collision or an industrial emergency, you should be able to recognize clues that indicate the presence of hazardous materials (Fig. 29-4). These include:

- Signs (placards) on vehicles or storage facilities.
- Spilled liquids or solids.
- Unusual odors.
- Clouds of vapor, including colored vapor.
- Smoking or burning materials.
- Boiling or spattering of materials.
- Unusual condition of containers (e.g., unexpected peeling or deterioration).
- Leaking containers with possible frost near the leak.



**Fig. 29-4:** Unusual placement or conditions and leaking containers are indications of the presence of hazardous materials. Photo: courtesy of Capt. Tony Duran, Los Angeles County Fire Department.



### CRITICAL FACTS

Indications of the presence of hazardous materials include placards; spilled, splattered or boiling materials; unusual odors; vapor clouds; and containers that are leaking, in deteriorating condition or are otherwise atypical.

Also, observe for clues of possible terrorism. In some cases, such as a nuclear attack or explosion, the possibility that a terrorist attack has taken place will be more obvious. However, when dealing with a chemical or biological attack, it may be more difficult to confirm your suspicions. There are some general clues you can use when approaching a disaster scene:

- When called to an incident at well-populated areas such as airports, subways, government buildings, schools or large public gatherings, always use caution and suspect the possibility that terrorism exists.
- When called to a scene where numerous patients are suffering from an unidentifiable illness, the possibility you are entering a potentially dangerous environment is also high.
- When called to a scene where animals in the area are dead or appear incapacitated, the possibility of chemical exposure may exist. This includes the presence of odors resembling those of bitter almonds, peaches, mustard, freshly cut grass, garlic, or pungent or sweet odors.

Unfortunately, in those cases where biological agents have been released, it is not always obvious there is danger. Pathogens can enter a person's system and not be evident until symptoms become evident, sometimes days after exposure. Often it becomes difficult to contain the spread of an outbreak, particularly through the community of caregivers who may be infected in the vicinity of the attack.

When called to a HAZMAT incident, it may be your responsibility as an EMR to help lay the groundwork for the rescue scene. As a responder you should:

- Be able to identify the unsafe materials and the scene as a HAZMAT incident.
- Help establish or assign a safe location to position yourself and the rescue team.
- Always approach a suspected or real HAZMAT incident from upwind and uphill.
- Help establish the command and control zones as well as a medical treatment area.
- Always ask yourself:
  - What has been done?
  - What is being done?
  - What actions need to be taken next?

## Identifying the Hazardous Substance

Once a HAZMAT incident has been identified, and you are in a safe position, try to identify the hazardous substances and the seriousness of the incident. Look for placards; NFPA numbers; warning signs like “flammable,” “explosive,” “corrosive” or “radioactive”; shipping papers; or areas where materials or containers are held or stored (Fig. 29-5). By law, any business holding materials considered hazardous must have permits to hold or contain those materials. Containers should be identified in order to assess the danger level of leaks or further contamination. Containers can include:

- Rooms, buildings or outside areas.
- Aboveground tanks and vats.
- Individual containers, cartons and packages.

As already mentioned, placards will identify the exact substances in question. When dealing with a vehicular incident, shipping papers will be held by the driver as reference to the substances involved.

When in doubt, remember that the *Emergency Response Guidebook*, CHEMTREC, CAMEO and NIOSH resources are available to you as well. The HAZMAT team ultimately will be responsible for identifying the substance, but in your role as an EMR you could be able to provide the initial identification. If arriving on the scene, collect the information and report to dispatch.



**Fig. 29-5:** By law, specific types of placards must indicate the presence of hazardous materials.



### CRITICAL FACTS

Stay away from a HAZMAT scene unless you are properly trained and have the proper equipment.



## SCENE SAFETY AND PERSONAL PROTECTIVE EQUIPMENT

Unless you have received special training in handling hazardous materials and have the necessary equipment to do so without danger, you should stay well away from the area. While en route to a potential HAZMAT incident, obtain as much prearrival information as possible from dispatch. When on the scene, stay out of low areas where vapors and liquids may collect, and always stay upwind and uphill of the scene. Be alert for wind changes that could cause vapors to blow toward you and other responders. Do not attempt to be a hero. It is not uncommon for responding ambulance crews approaching the scene to recognize a HAZMAT placard and immediately move to a safe area and call for additional resources.

Many fire departments have specially trained teams to handle incidents involving hazardous materials.

While awaiting help, you may be tasked to keep people away from the danger zone.

Especially in the case of radiation exposure, the following safety precautions must be taken to ensure scene safety:

- From a distance, survey the area for the radiation symbol on vehicles, buildings or containers.
- Determine the source of the radiation without moving closer to the scene.
- Position your vehicle upwind and uphill of the leak.
- Do not park near liquid spills or containers that may be cracked or leaking.
- Be aware of the possibility of contamination from other substances.
- When radiation is suspected, immediately don a positive-pressure self-contained breathing apparatus (SCBA) and protective clothing (Fig. 29-6, A–B). Seal off all openings with



**Fig. 29-6, A–B:** (A) Protective clothing and (B) an SCBA can help protect you in cases of radiation. *Photos: courtesy of Ted Crites.*

duct tape. Wear double gloves and two pairs of paper shoe covers under heavy rubber boots.

- If radiation is suspected, do not attempt a rescue. Radiation cannot be felt, smelled or heard. EMRs could be exposed to lethal doses without any immediate signs or symptoms.

For your own personal protection consider:

- The time you have been exposed to the radiation source.
- The distance between you and the source.
- The density of your protective clothing.
- The amount of radioactive material you and the patient have been exposed to.

Whenever possible, remove yourself and the patient from the contaminated area or the contaminated material from the patient. The longer the time, the closer the distance and the more materials you are exposed to, the worse the situation and the more protection you will require to decrease your risk of exposure.

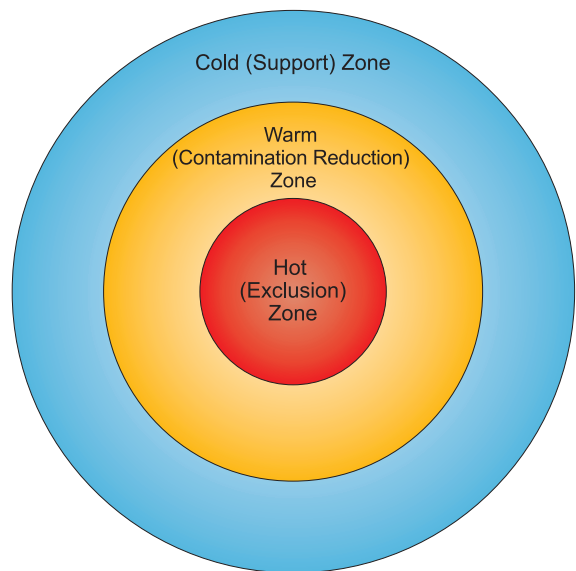
Some hazardous materials, such as natural gas, are flammable and can cause an explosion. Even turning on a light switch or using a telephone or radio may create a spark that sets off an explosion. When you call for additional resources, use a telephone or radio well away from the scene.

In certain situations, you may come across methamphetamine (meth) labs. Meth labs are very hazardous due to inhalation hazards and the possibility of absorption of dangerous compounds to all exposed. An even greater hazard is the instability and highly explosive nature of these labs. Meth labs can be set up in homes, trailers and even the trunks of cars. Even a small electrical spark, such as the flick of a light switch, near the types of compounds found in these locations could cause a significant explosion. Always use caution if you suspect that there might be a meth lab at the location you are attempting to access.

## Establishing Safety Zones

To decrease the risk of the HAZMAT incident expanding, it is necessary to establish a safety zone. Three control zones are created in these situations, including (Fig. 29-7):

- The **hot zone** or exclusion zone. This is the area in which the most danger exists. Entry is only allowed with the proper PPE. The only reason to be inside the hot zone is for rescue, treatment for any conditions that are life threatening and initial decontamination.
- The **warm zone** or contamination reduction zone. This is the area immediately outside the hot zone. PPE is necessary here as well. This is where complete decontamination of the patient takes place. The purpose of this zone is for lifesaving emergency care—for example, airway management and immobilization.
- The **cold zone** or support zone. This the outer perimeter; entry into this area is not permitted unless all contaminated PPE and equipment are removed.



**Fig. 29-7:** In HAZMAT situations, three control zones are designated, from most to least dangerous: hot, warm and cold.



### CRITICAL FACTS

If you must work near a radiation source, think about your personal protection as well as your patient's. Consider how much time you have spent near the source, the distance between you and the source, the density of your PPE, and the amount of radioactive material you and the patient are exposed to.

In HAZMAT situations, three control zones are designated, from most to least dangerous: hot, warm and cold.



Entry into these zones is established by the amount of training a responder or member of the rescue team has completed. The warm and hot zones can only be entered by those who have received OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training at the first responder awareness level and who are dressed in appropriate PPE and SCBA.

## HAZMAT—Recognition, Identification and Determination

Hazardous materials are often present at incident sites and in emergency settings. An EMR who is first on scene to a possible hazardous materials spill should follow these three steps: recognition, identification and determination.

The first and most basic issue is recognition of the presence of a hazardous material. Prompt recognition and awareness of hazardous materials is very important to the safety of the public and for the safety of the responders. Contact dispatch and report specific details of the scene.

Once the presence of a hazardous material has been determined, its specific identity and characteristics can be established. This is known as identification. The EMR should relay information regarding placard colors and numbers, and any label information. Shipping papers that include SDSs will also help to identify the hazardous material(s).

Determination of the extent of involvement a hazardous material plays in an incident is necessary to determine if it is responsible for injuries or damage at the scene of the incident. Often, hazardous materials may be present but pose no immediate, serious threat.

It cannot be overemphasized that until it has been determined that hazardous materials are not responsible for injuries or damage at an incident, EMRs should take every precaution to protect themselves and the public from exposure.

## CONTAMINATION AND DECONTAMINATION

### Contamination and Routes of Exposure

A patient may have suffered from contamination via several possible routes, including topical (through the skin), respiratory (inhaled), gastrointestinal (ingested) or parenteral (intramuscular [IM], intravenous [IV] or subcutaneous [sub-Q]). Potential signs and symptoms for each are as follows:

- **Cardiovascular:** Abnormally rapid heart rhythms, specifically in the lower chambers of the heart (ventricular arrhythmias), including rapid or irregular heartbeats. Both are life threatening. Blood pressure lower than 90/60 mmHg (hypotension).
- **Respiratory:** Swelling and/or fluid accumulation in the lungs (acute pulmonary edema) or larynx (laryngeal edema), which can lead to impaired gas exchange and respiratory failure. Abnormal contraction of the smooth muscle of the bronchi, causing an acute narrowing and obstruction of the respiratory airway (bronchospasm) or a high-pitched, whistling breathing caused by a blockage in the throat or larynx (stridor), cough, dyspnea and chest pain. Respiratory symptoms may be delayed.
- **Central nervous system:** Stupor, lethargy, coma and the possibility of seizures.
- **Gastrointestinal (GI):** GI bleeding due to liquefaction necrosis (irreversible death of cells) of the GI tract.
- **Eye:** Vapor contamination can result in chemical conjunctivitis. Necrosis and blindness can result from exposure to liquids and anhydrous (ammonia) gas.

### Decontamination

There are several methods of decontamination, including gross, dilution, absorption, neutralization and isolation/disposal. Initial or “gross” decontamination is performed as the person enters the warm zone. Any immediate life-threatening conditions are addressed during this stage. Soap and copious amounts of water are used, and any clothing, equipment and tools must be left in the hot zone (Fig. 29-8). At this point, a primary assessment is carried out. Dilution refers to the method of reducing the concentration of a contaminant to a safe level. Isolation/disposal refers to the method of decontamination in which



## CRITICAL FACTS

Possible routes of exposure and contamination include topical, respiratory, gastrointestinal and parenteral.

Methods of decontamination include gross, dilution, absorption, neutralization and isolation/disposal.



**Fig. 29-8:** During initial decontamination, soap and copious amounts of water are used to address any immediate life-threatening situations. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*

contaminated equipment and materials are bagged or covered and set aside, usually for subsequent shipment to an approved landfill for disposal. Absorption is the process of using material that will absorb and hold contaminants such as corrosive and liquid chemicals. Neutralization involves chemically altering a substance to render it harmless or make it less harmful.



## CRITICAL FACTS

When assessing and treating a patient in a HAZMAT incident, it is important to concentrate on the life-threatening signs and symptoms as opposed to strictly dealing with the contamination and exposure itself.

## Emergency Medical Treatment Establishing a Location

Establishing a clear perimeter between zones is of critical importance to prevent the spread of contamination. When selecting the location for the command post and staging area, it is necessary to position support equipment upwind and uphill of the hot zone. Equipment that may be required during the rescue process should be kept in the staging areas beyond the crowd control line. Access to the different zones must be safely controlled, limiting access as much as possible.

## Providing Care

When you arrive at the scene, park upwind and uphill from the scene at a safe distance. Keep bystanders and any other unnecessary people away from the scene. Isolate the scene and establish hot, warm and cold zones, keeping people out of areas accordingly. Do not enter these zones unless you are trained to an OSHA HAZWOPER first responder awareness level or higher, and you have appropriate PPE and SCBA. Avoid any contact with the hazardous material. If there is no risk to EMS personnel, HAZMAT teams should move patients to a safe zone.

Determine the number of patients involved in the incident and evaluate the need for additional resources. Follow safety practices that minimize your exposure and that of other people at the scene.

When assessing and treating a patient in a HAZMAT incident, it is important to concentrate on the life-threatening signs and symptoms as opposed to strictly dealing with the contamination and exposure itself. Removing the patient from a scene involving hazardous materials should be done as quickly as possible to decrease exposure. Assessment and management of the patient

should then be carried out as you would normally. When radiation is a concern, contact the national Poison Help line at 800-222-1222 or consult with medical direction.

## **PUTTING IT ALL TOGETHER**

Hazardous materials are everywhere around us and there is always a possibility of a HAZMAT incident. As an EMR, you may find yourself involved in a situation in which there are chemical or other harmful or toxic substances. EMRs must be trained to quickly identify such situations and activate specially trained personnel to deal with the situation.

A HAZMAT incident is one in which dangerous chemicals have somehow been released and pose a threat to life. When dealing with a HAZMAT incident, work within a structured system that provides guidance in managing this type of scene.

Several available resources can assist you in identifying hazardous materials and the steps involved in providing care. In a HAZMAT incident, your priorities are to protect the safety of responders and patients at the scene by providing care and assisting with decontamination. Planning for HAZMAT incidents is essential for an effective response.

## **▶ You Are the Emergency Medical Responder**

Since you recognize the scene as a HAZMAT incident, what questions should you ask yourself immediately? What initial actions should you take and why?

# 30 INCIDENT COMMAND AND MULTIPLE-CASUALTY INCIDENTS

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## ▶ You Are the Emergency Medical Responder

A school bus carrying 30 students is involved in a collision and is severely damaged near the front of the bus. The students are scared, and some are injured. People are starting to crowd around the area, and the local fire department already is on scene. As an emergency medical responder (EMR) on scene, what should you do?



## KEY TERMS

**Deceased/non-salvageable/expectant (Black):**

A triage category of those involved in a multiple- (or mass-) casualty incident (MCI) who are obviously dead or who have suffered non-life-sustaining injuries.

**Delayed care (Yellow):** A triage category of those involved in an MCI with an injury, but whose chances of survival will not be reduced by a delay.

**Immediate care (Red):** A triage category of those involved in an MCI whose needs require urgent lifesaving care.

**Incident command system (ICS):** A standardized, on-scene, all-hazards incident management approach that allows for the integration of facilities, equipment, personnel, procedures and communications operating within a common organizational structure; enables a coordinated response among various jurisdictions and functional agencies, both public and private; and establishes common processes for planning and managing resources.

**Incident commander:** Through delegated authority of a local government, the incident commander (IC) is responsible for establishing the incident objectives and managing resources, including assessing the situation, deciding what calls to make and what tasks need to be done, and assigning those tasks to appropriate personnel.

**Multiple- (or mass-) casualty incident (MCI):**

An incident that generates more patients than available resources can manage using routine procedures.

**National Response Framework (NRF):** The guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies—from the smallest incident to the largest catastrophe. The Framework establishes a comprehensive, national, all-hazards approach to domestic incident response.

**Simple Triage and Rapid Transport (START):**

A method of triage that allows quick assessment and prioritization of injured people.

**Triage:** A method of sorting patients into categories based on the urgency of their need for care.

**Triage tags:** A system of identifying patients during an MCI; different colored tags signify different levels of urgency for care.

**Walking wounded (Green):** A triage category of those involved in an MCI who are able to walk by themselves to a designated area to await care.

## LEARNING OBJECTIVES

After reading this chapter, you will have the information needed to:

- Describe the purpose of the National Response Framework (NRF).
- Describe the purpose and functional positions of the incident command system (ICS).
- Explain the role of the emergency medical responder (EMR) in the ICS.
- Define multiple-casualty incidents.
- Explain the principles of triage.
- Conduct a triage assessment.
- Understand different triage systems and pediatric variations.
- Understand the stressors associated with multiple-casualty incidents (MCIs).

## INTRODUCTION

As an emergency medical responder (EMR), you are likely to be required to assist with an emergency with multiple victims, and to do so you need a plan of action to enable you to rapidly determine what additional resources are needed and how best to manage them. During a serious incident, you may be on the scene for 15 minutes or longer before adequate resources are available to care for a large number of injured people.

Management of an appropriate initial response can eliminate potential problems for arriving personnel and possibly save the lives of several injured people. To accomplish this, you must be able to make the scene safe for you and others to work, delegate responsibilities to others, manage available resources, identify and care for the patients most in need of care, and relinquish command as more highly trained and qualified personnel arrive.

## NATIONAL INCIDENT MANAGEMENT SYSTEM

According to the Federal Emergency Management Agency (FEMA), “The National Incident Management System (NIMS) provides a systematic, proactive approach to guide departments and agencies at all levels of government, nongovernmental organizations and the private sector to work seamlessly to prevent, protect against, respond to, recover from and mitigate the effects of incidents, regardless of cause, size, location or complexity, in order to reduce the loss of life and property and harm to the environment.”

“NIMS works hand in hand with the **National Response Framework (NRF)**. NIMS provides the template for the management of incidents, while the NRF provides the structure and mechanisms for national-level policy for incident management.”

### The National Response Framework

The NRF (or Framework) is a guide to how the nation conducts all-hazards response. It is built upon scalable, flexible and adaptable coordinating structures to align key roles and responsibilities *across the nation*. It describes specific authorities and best practices for managing incidents that range from the serious but purely local, to large-scale terrorist attacks or catastrophic natural disasters.

## Incident Command System

To effectively manage an emergency situation and to provide appropriate care, an **incident command system (ICS)** must be established, organizing who is responsible for overall direction, the roles of other participants and the resources required. Although the ICS is capable of providing a management structure for incidents both large and small, it is scalable based on incident requirements. Establishing the ICS is particularly important in a **multiple- (or mass-) casualty incident (MCI)** to effectively manage many resources. The EMR is highly encouraged, and in some cases, mandated by local and state regulations to take the following independent-study, interactive web-based ICS courses:

- ICS-100: Introduction to the Incident Command System
- ICS-700: National Incident Management System: An Introduction
- IS-800: National Response Framework: An Introduction

The ICS is a management system, originally developed in the early 1970s in California to help manage the process of fighting forest fires, that has since evolved into an all-hazards incident management system. It has proven especially effective as a strategy in emergencies involving multiple patients because of its ability to manage many functions and resources.

To understand the ICS, think of it as an organization composed of responders working together to achieve a common goal. The **incident commander (IC)**, through delegated authority of a local government, is tasked with the responsibility of establishing the incident objectives and managing resources. The IC supervises these resources utilizing the ICS. Also, depending on the size of the incident, the IC may need to establish branches for logistics, finance/administration, operations and planning as part of the IC structure.

### EMS Roles in the ICS

In any emergency, the incident commander is responsible for assessing the situation, deciding what calls to make and what tasks need to be done, and assigning those tasks to appropriate personnel (Fig. 30-1). The responder who assumes the role as

incident commander remains in that role until a more senior or experienced person arrives on the scene and assumes command, or until the incident is over.

When transitioning command to a more senior person, the outgoing incident commander must ensure that everything necessary has been done before leaving the scene or accepting another assignment.



**Fig. 30-1:** In an emergency, the incident commander is responsible for assessing the situation, deciding what calls to make and what tasks need to be done, and assigning the tasks to appropriate personnel. *Photo: courtesy of Ted Crites.*

If the incident is small and contained, it is likely that one person in the incident commander role may handle all aspects of directing care. However, in situations with multiple casualties and/or events, the incident commander must delegate a variety of roles to other responders. While not all of these functional positions may be necessary, these are the ones most often required—the larger the incident, the more functional positions are required:

- The triage officer supervises the initial triage, tagging and moving of patients to designated treatment areas.
- The treatment officer sets up a treatment area and supervises medical care, ensuring triage order is maintained and changes the order if patients deteriorate and become eligible for a higher triage category.
- The transportation officer arranges for ambulances or other transport vehicles while tracking priority, identity and destination of all injured or ill people leaving the scene.
- The staging officer releases and distributes resources as needed to the incident and works to avoid transportation gridlock.
- The safety officer maintains scene safety by identifying potential dangers and taking action to prevent them from causing injury to all involved.

Other roles that may need to be filled include:

- Supply.
- Mobile command/communications.
- Extrication.
- Rehabilitation.
- Morgue.
- Logistics.

### **CRITICAL FACTS**

As an EMR, you are likely to be required to assist with an emergency with multiple victims, and to do so you need a plan of action to enable you to rapidly determine what additional resources are needed and how best to manage them.

The ICS is a management system, originally developed in the early 1970s in California to help manage the process of fighting forest fires, that has since evolved into an all-hazards incident management system. In any emergency, the incident commander is responsible for assessing the situation, deciding what calls to make and what tasks need to be done, and assigning the tasks to appropriate personnel.

If you are the first and most senior EMR on the scene, you are the incident commander until someone more experienced arrives. As incident commander, it is your responsibility to identify a scene as an MCI, assess the scene safety and determine if any action is required to secure the scene.

## The Role of the Emergency Medical Responder

Your role as an EMR is to fit into the team wherever you are assigned by the IC or their designee. You may find yourself acting as incident commander until someone more experienced arrives. If you are with a partner or co-worker, the most senior person takes on the role of incident commander. Your responsibility is to identify if this is an MCI and assess the scene's safety to determine if any action must be taken to secure the scene to prevent further injury.

After assessing safety, as incident commander, you must account for the number of patients, including those who may not appear to be injured, determine whether anyone needs rescuing (extrication), determine the number of ambulances required, and indicate the number of functional positions and extra personnel required. You must also ensure access to areas to stage resources and make note of any situations that may affect the scene, including weather, difficulty accessing the site and the terrain.

You must be easily identifiable as the incident commander to prevent confusion. Determine local protocols in effect for identifying yourself as the officer-in-charge and your vehicle as the initial command post (vests or a green light on the command vehicle are common procedures). Be sure to report all issues and necessary information—do not go into detail during radio transmission. This is the time for short, concise, accurate and pertinent bits of information.

When someone with more experience or seniority relieves you, be sure to relay all important and pertinent information verbally, including what has been recorded. The person taking over will need to know information such as when the incident began, when you arrived on the scene, how many people are injured, how many people are acting as responders, any potential dangers, what has been done since the beginning of the rescue and objectives that need to be accomplished.

If you arrive on the scene *after* someone has already taken command, identify yourself to the incident commander and report to the staging

officer. You will then be tasked to a detail where you are most needed, based on your experience and capability. This could be assisting medical personnel, aiding in crowd or traffic control, helping to maintain scene security or helping to establish temporary shelter. By using the ICS in numerous emergencies, the tasks of reaching, caring for and transporting injured or ill people are performed more effectively, thereby saving more lives. Since there are variations in the plan for managing MCIs with ICS throughout the country, you should become familiar with the MCI plan for your location.

## MULTIPLE-CASUALTY INCIDENTS

An MCI is an incident that generates more patients than available resources can manage using routine procedures. As the term implies, an MCI refers to a situation involving two or more people. You are most likely to encounter MCIs involving injury to small numbers of people, such as a motor-vehicle crash involving the driver and a passenger. But MCIs can also be large-scale events, such as those caused by natural disasters or those from materials/structures made by humans. Examples include:

- Transportation incident.
- Flood.
- Fire.
- Explosion.
- Structure collapse.
- Train derailment (Fig. 30-2, A–B).
- Airliner crash.
- Hazardous material (HAZMAT) incident.
- Earthquake.
- Tornado (Fig. 30-3).
- Hurricane.

Some incidents can result in hundreds or even thousands of injured or ill people. Whether small or large scale, MCIs can strain the resources of a local community. Coping effectively with an MCI requires a plan that enables you to acquire and manage additional personnel, equipment and supplies.



### CRITICAL FACTS

An MCI is an incident that generates more patients than available resources can manage using routine procedures.





**Fig. 30-2, A–B:** Large-scale events involving human-made structures or materials, such as a train derailment, can result in an MCI. Photos: courtesy of Capt. Tony Duran, Los Angeles County Fire Department.



**Fig. 30-3:** Natural disasters, such as tornadoes, can result in MCIs. Photo: courtesy of Captain Phil Kleinberg, EMT-P.

## TRIAGE

In an MCI, you must modify your assessment skills and technique for checking injured or ill people. This requires you to understand the priorities of treatment and transportation. It also requires you to accept death and dying because some patients, such as those in cardiac arrest who would normally receive CPR and be a high priority, will be beyond your ability to help in this situation.

To identify which patients require urgent care in an MCI, you use a process known as **triage**. Triage is a French term derived from “trier,” meaning “to sort,” and was first used to refer to the sorting and treatment of those injured in battle.

## The Triage Officer

The first step is to identify and assign a triage officer. This is a responsibility of the incident commander. The triage officer is an integral position of the ICS in MCI management. If you are the only person on the scene, the role falls on you until you receive help. The triage officer remains in that role until all patients are triaged and until relieved or reassigned by the IC. The triage officer determines the requirements for additional resources (to perform triage), performs triage of all patients, and assigns personnel and equipment to the highest-priority patients in the triage area.



**Fig. 30-4:** Triage is used on the scene to rapidly categorize the condition of patients. Photo: courtesy of Captain Phil Kleinberg, EMT-P.

## Primary and Secondary Triage

Primary triage is used on the scene to rapidly categorize the condition of patients (Fig. 30-4). When performing your first assessment, note the approximate number and location of patients and what the transportation needs are going to be, such as stretchers, litters or special extrication equipment.

Keep in mind that these are just primary assessments and patients may be re-triaged later; their status may change accordingly. Using the methods outlined by your locality, ensure that all patients have the appropriate color tape or card attached in a visible fashion. According to Simple Triage and Rapid Transport (START) principles, it should take no longer than 30 seconds per patient to do your assessment and tagging.

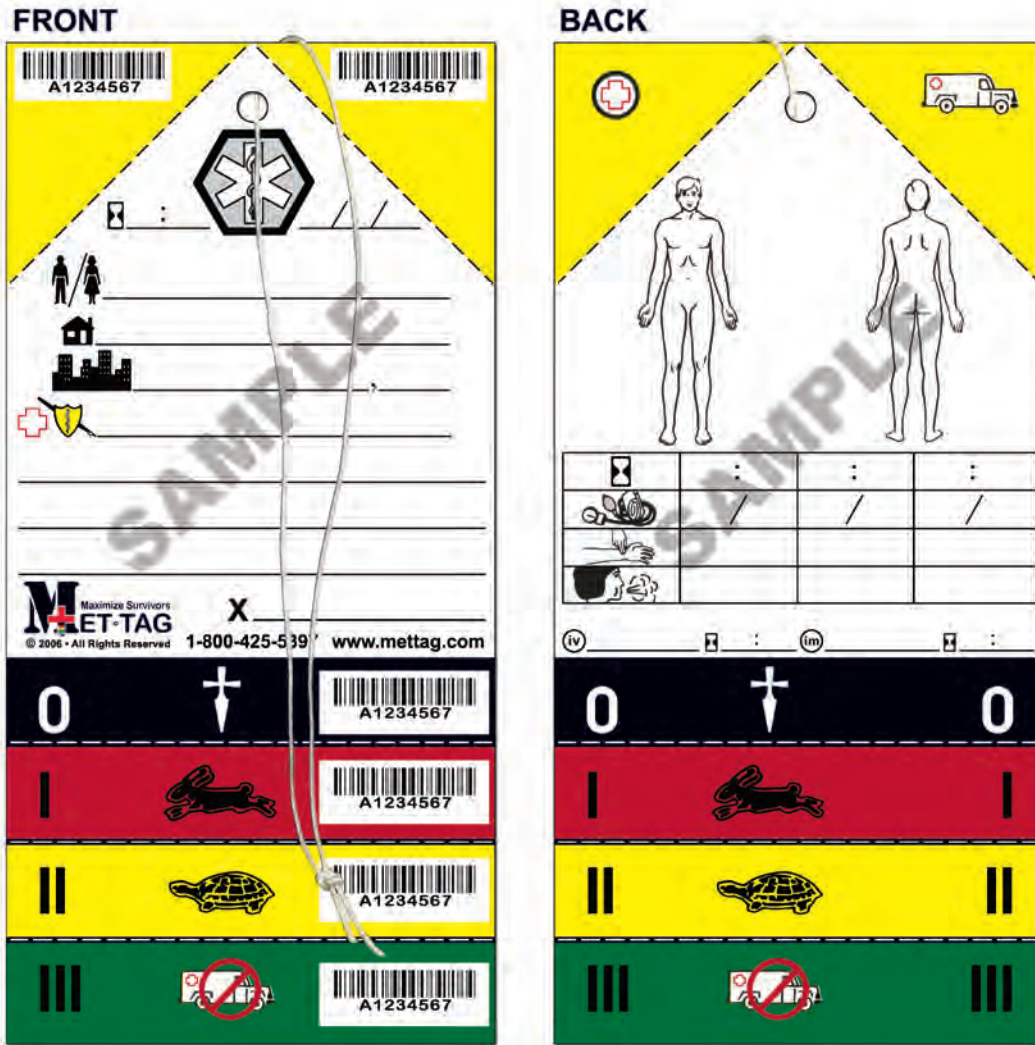
Patient status can change quickly. If it is necessary and there is time and space, a secondary triage may be performed after the primary triage. This is often performed after patients are moved to the treatment area or at a funnel point just before they enter the treatment area. If the status of a patient changes, leave the first tag in place and draw a bold line through it. Then, add the second, most up-to-date assessment tag.

Note that slots on tags do not necessarily need to be completely filled out at once. As new information becomes available, add that information to the **triage tag** (Fig. 30-5).



**Fig. 30-5:** Triage tags are used to note the status of patients in an MCI. Photo: courtesy of Terry Georgia.





**Fig. 30-6:** The METTAG™ patient identification system uses symbols, rather than words, to allow responders to quickly identify patient status.

## Triage Tagging Systems

There are a variety of triage tags you may use or encounter in a triage area. Because large disasters can bring responders in from a wide area, internationally understood methods of communication are essential. Thus, the colors green, red, yellow and black are commonly used for the triage tagging system.

The METTAG™ patient identification system uses symbols, rather than words, to allow responders to quickly identify patient status (Fig. 30-6). The rabbit means urgent, the turtle means can be delayed, the ambulance with a bold line through it means that no urgent transport is needed, and a shovel and cross symbol is used for the dead.

Another option is the Smart Tag™, adopted by certain U.S. cities and states (Fig. 30-7). This tag features a folding design for ease of use.



**Fig. 30-7:** The Smart Tag™ features a folding design for ease of use. All intellectual property rights of the items shown in this image are the property of TSG Associates LLP. Written permission is required before use by any third party.



**Fig. 30-8:** Some states choose to customize their tag designs, while some response systems use colored flagging tape. Photo: courtesy of Captain Phil Kleinberg, EMT-P.

Additionally many states have adopted the START tag or adaptations of it. Some states choose to customize their tag designs, while some response systems simply use colored flagging tape (Fig. 30-8).

## The START System

The **Simple Triage and Rapid Transport (START)** system is one of several triage methods and is a simple way to quickly assess and prioritize injured or ill people. It requires you to check only three items: breathing, circulation and level of consciousness (LOC) (Fig. 30-9). As you check

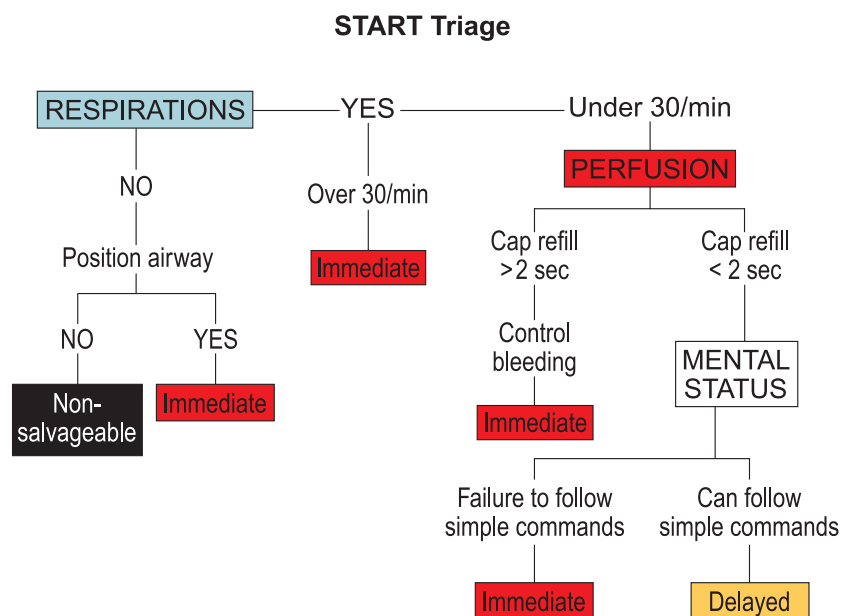
these items, classify injured or ill people into one of four levels that reflect the severity of their injury or illness and the need for care. These levels are “minor/walking wounded,” “delayed,” “immediate” and “deceased/non-salvageable.” Some advanced triage systems also include a fifth category, “hold,” to indicate patients with minor injuries who do not require a physician’s care.

### Ambulatory (Walking Wounded)

The first step is to sort those who can walk on their own, the ambulatory or **walking wounded (Green)**. To do this, use a public address (PA) method if possible. Get their attention and direct these patients to move on their own to a designated area. This allows you to find out quickly who is not in grave danger and clears the emergency area of those who do not need to be there. Ambulatory patients are tagged as Green.

### Immediate

The first of the other categories is **immediate care (Red)**. This categorization means that the patient needs immediate care and transport to a medical facility. Patients are considered immediate if they are unconscious or cannot follow simple commands, require active airway management, have a respiratory rate of greater than 30, have a delayed (more than 2 seconds) capillary refill or



**Fig. 30-9:** The START triage system uses an assessment of breathing, circulation and LOC to prioritize injured or ill patients.



### CRITICAL FACTS

The START system is a simple way to quickly assess and prioritize injured or ill people. It requires you to check only three items: breathing, circulation and LOC.



absent radial pulse, or require bleeding control for severe hemorrhage from major blood vessels. Immediate patients are tagged Red.

## Delayed

The second category is **delayed care (Yellow)**, meaning patients who may be suffering severe injuries but a delay in their treatment will not reduce their chance of survival. Those tagged delayed are non-ambulatory and are breathing, have a pulse and their LOC is within normal limits. While they do not have life-threatening injuries, they may have back injuries with or without spinal cord damage, major or multiple bone or joint injuries, or burns without airway problems. However, the following types of burns need immediate, advanced care: flame burns that occurred in a confined space; burns covering more than one body part; burns to the head, neck, hands, feet or genitals; any partial-thickness or full-thickness burns to a child or an older adult; or burns resulting from chemicals, explosions or electricity. Delayed patients are tagged Yellow.

## Deceased

The third category, **deceased/non-salvageable/expectant (Black)**, is assigned to those individuals who are obviously dead or who have mortal injuries. Patients who are not breathing and who fail to breathe after attempts to open and clear the airway (even if they have a pulse) are classified as deceased/non-salvageable/expectant. This classification also applies to obvious mortal injuries such as decapitation. Deceased patients are tagged Black.

## Hold

Some advanced triage systems also include a hold category, to indicate patients with minor injuries who do not require a physician's care, such as minor painful, swollen, deformed extremities or minor soft tissue injuries. These patients may be tagged White and dismissed, with a recommendation to obtain basic first aid care at home or elsewhere.

## Assessment in Triage

The START system is a popular method that is simple and depends on condition-based classification. You determine the different levels by assessing four aspects that can be recalled with the acronym ARPM. ARPM stands for:

- **A**bility to get up and walk (ambulatory).
- **R**espiratory status.
- **P**erfusion status.
- **M**ental status.

Once ambulatory patients are out of the area, you will need to check respiratory status of the remaining patients. If there are no respirations, clear the mouth of any foreign objects and make sure the airway is open. If there are still no respirations and the patient does not begin breathing independently, even with the airway open, the patient is classified as “deceased/non-salvageable.” There is no need to check the pulse. Place the appropriate tag on the patient and move on.

If the patient begins to breathe independently when you open the airway, classify the patient as needing immediate care and tag appropriately. Any individual who needs help maintaining an open airway is a high priority. Position the patient in a way that will maintain an open airway, place the appropriate tag on the person and move on to the next patient. Once triage of all injured or ill people is complete, you may be able to come back and assist with care.

If the patient is breathing when you arrive, check the rate of the patient's breathing. Someone breathing more than 30 times a minute should be classified as immediate care.

The third step is to determine the perfusion status. This is done by checking capillary refill and radial pulse, with the pulse being the more reliable measure, as capillary refill is dependent on multiple factors. If you cannot find the radial pulse in either arm, then the patient's blood pressure is substantially low. Control any severe bleeding by using direct pressure and applying a bandage, tourniquet or hemostatic dressing, based on your available resources and local protocols. A large-scale incident with limited resources may require the use of a tourniquet as the first option to control severe, life-threatening bleeding, as maintaining direct pressure may not allow the responder to continue to triage and care for other patients. If this is the case, classify the patient as requiring immediate care and move on to the next patient.

The fourth step is to determine the patient's LOC, by using the AVPU (Alert, Voice, Pain, Unresponsive) scale. A patient who is alert and responds appropriately to verbal stimuli is classified as delayed care. This patient has some injury that prevents them from moving to safety, but the condition is not life threatening. Someone who remains unconscious and responds only to painful stimuli or responds inappropriately to verbal stimuli is classified as immediate care.

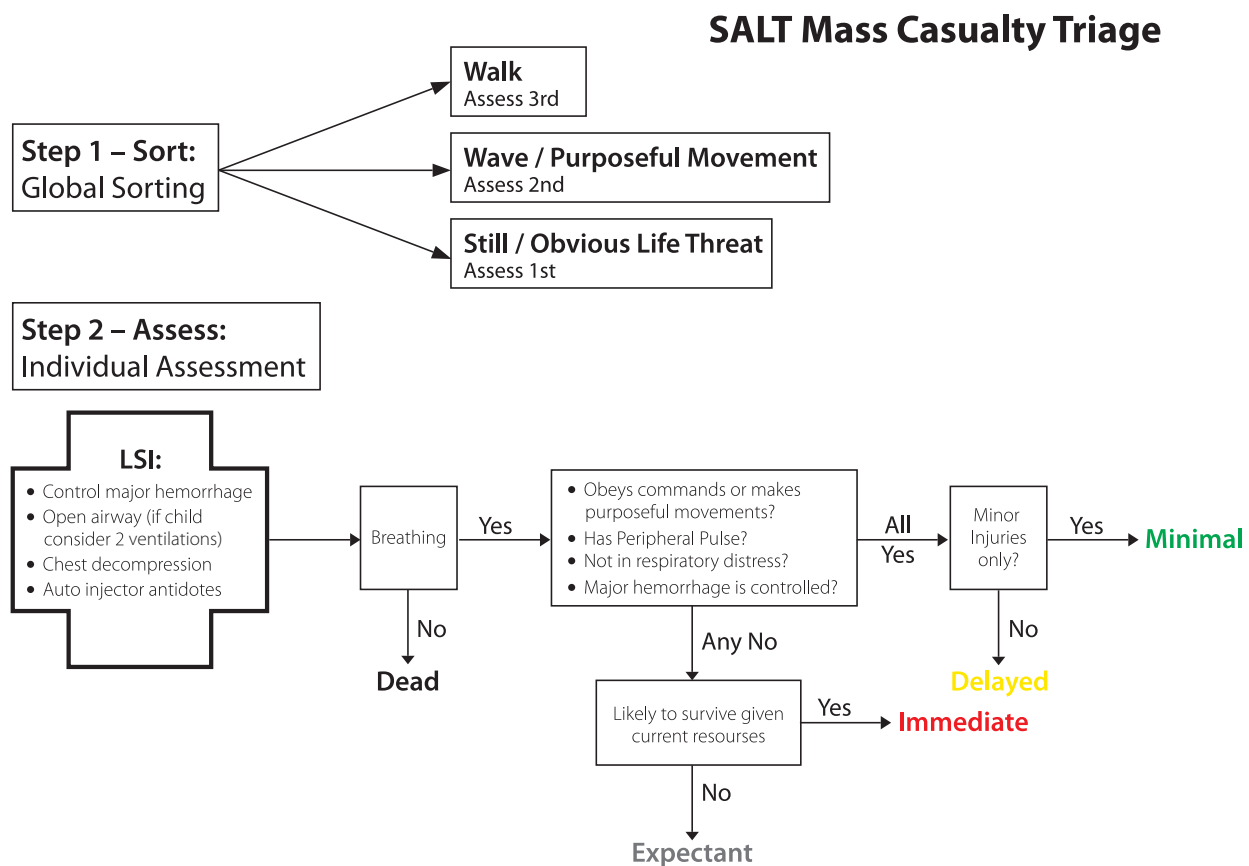
## Other Methods of Triage

Besides the START triage system, there are others, such as the Sort-Assess-Lifesaving Interventions-Treatment and/or Transport (SALT) Mass Casualty Triage (Fig. 30-10). The SALT Mass Casualty Triage was developed using all existing triage systems, and is meant for all patients involved, even special populations and children. It sorts patients into three priorities: Priority 1: Still/obvious life threat; Priority 2: Waving/purposeful movement; and Priority 3: Walking. It then goes on to include individual assessments, beginning with limited, rapid lifesaving interventions (LSIs), such as controlling severe bleeding; opening and clearing the airway; or giving 2 ventilations if the patient is a child, chest compressions or auto-injector

antidotes. At this point, you would prioritize patients for treatment and/or transport by assigning them to one of five categories: Immediate, Expectant, Delayed, Minimal or Dead.

## Treatment

Following triage, patients must be processed through the treatment area (Fig. 30-11). The treatment officer is appointed by the IC and is responsible for identifying a treatment area of sufficient space and with adequate ingress and egress for ambulances. The treatment officer ensures the appropriate medical care of all patients, directs re-triage if indicated, and communicates with the transportation officer regarding the transportation of the patients and



**Fig. 30-10:** The SALT Mass Casualty Triage system sorts patients into three priorities: still/obvious life threat, waving/purposeful movement and walking.



### CRITICAL FACTS

Besides the START triage system, there are others, such as the SALT Mass Casualty Triage.

The JumpSTART triage method should be used on anyone who appears to be a child, regardless of actual chronological age, but is not used on infants younger than 12 months old. Always remember that a multiple-casualty incident involving children is handled differently than one involving adults.

appropriate destination hospital requirements (trauma center consideration) in the correct order, according to triage. Patients tagged as immediate have priority and should be treated to correct any life-threatening conditions. They should be transported by the most appropriate means to the various hospitals according to the local MCI plan.

## Pediatric Considerations

### JumpSTART Pediatric Triage

An emergency that involves children must be handled differently from the way you would an emergency with adults. The psychological differences between adults and children could cause errors in tagging children. The JumpSTART triage method should be used on anyone who appears to be a child, regardless of actual chronological age, but is not used on infants younger than 12 months old (Fig. 30-12).

Using the same START steps outlined previously, you would assess whether the child is ambulatory, the respiratory status, whether there is any major bleeding and the mental status.

Children who are ambulatory should be tagged accordingly and escorted to the proper area; do *not* send them alone. Children who are breathing must be monitored for the rate. It should be between 15 and 45 breaths per minute. If it is any lower or higher, or if they begin breathing spontaneously after you open the airway, they should be tagged as immediate care. A child who does *not* breathe after the airway has been cleared and does *not* have a peripheral pulse should be tagged as deceased/non-salvageable. However, if a pulse is present, even if there is no breathing after the airway is cleared, you should give 5 ventilations before determining the child's status.

For circulation, or perfusion, check the child's peripheral pulse. If there is none present, the child should be tagged for immediate care. Finally, for mental status, see if the child responds to your voice. Code the child as delayed care if there is no response to all stimuli. If the child does respond to pain but only with sounds, the tag should be for immediate care.

While patients are waiting for transport, they should be continually monitored for changes in status. For example, it is always possible that a patient tagged as delayed may experience deterioration in condition and need to be tagged as immediate.



**Fig. 30-11:** Following triage, patients are processed through the treatment area, where patients are cared for, re-triaged or transported according to need. *Photo: courtesy of Terry Georgia.*

## Staging

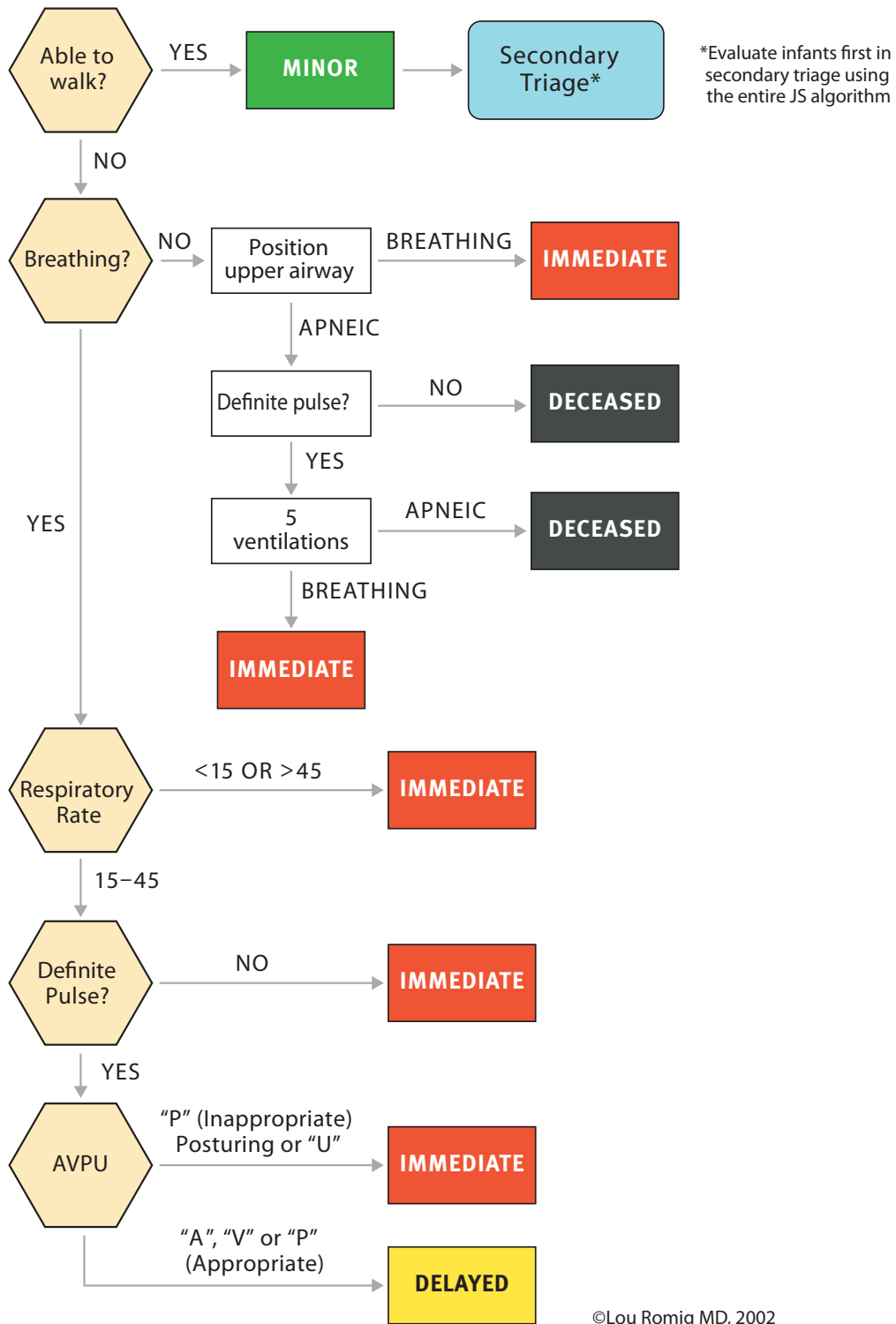
The staging officer should be one of the first officers assigned by the IC. It is important that the staging officer establish an area suitable to park multiple units in an organized fashion. This officer must maintain accountability of all units assigned for immediate release to the transportation officer.

## Transportation

The transportation officer is assigned by the IC. The major responsibility of the transportation officer is patient accountability. This is a documentation-rich position, and aide(s) are often required based on the scope and complexity of the incident. The transportation officer communicates with receiving hospitals, units assigned by the staging officer, the staging officer and the treatment officer. The transportation officer is responsible for assigning patients to ambulances, helicopters and buses, assigning destination hospitals and maintaining patient tracking records.

The ambulances, helicopters and buses will be instructed which hospital is accepting their patient

# JumpSTART Pediatric MCI Triage<sup>®</sup>



**Fig. 30-12:** The JumpSTART triage method, used on children older than 12 months of age, uses the same START steps to assess children.



or patients. They then radio ahead to the hospital, notifying hospital personnel of their impending arrival. This is the time when appropriate advance information is given, such as the injuries involved and estimated time of arrival.

Once all the immediate and delayed patients have been transported, the ambulatory patients also may be transported. Essential emergency equipment and EMRs should be on the transport, in case a patient deteriorates from ambulatory to delayed, or even immediate, care.

## STRESS AT AN MCI

### Patient Stress

The impact of an MCI can reach far beyond visible injuries. The stress of living through such an event can result in cognitive, emotional, physical and behavioral responses. Some may occur right away, others may only appear days after the event.

Patient stress can be the result of individual injuries, but also concern over loved ones who may have been involved in the MCI (Fig. 30-13). Not knowing what is happening is very stressful and frightening, and can interfere with the physical care of the patient.



**Fig. 30-13:** Patient stress can be the result of individual injuries or concern over loved ones. *Photo: courtesy of Ted Crites.*

Some people are at greater risk of severe stress reactions. Children may react strongly, experiencing extreme fears of further harm. Older adult patients and those who already suffer from health problems, either physical or emotional, may also be at increased risk.

### Responder Stress

After each call, there should be opportunity to discuss how the call went, as well as any feelings or issues that may have resulted. This is particularly important following an MCI, which can often seem overwhelming and difficult to handle. Trained counselors may help lead the discussion and reduce the risk of post-traumatic stress.

Reducing stress *during* the MCI is also important. This can be done by ensuring that responders know exactly what is expected of them. If they do not understand their roles or duties, frustration and stress may result. If responders are in roles that match their specific strengths, this helps in reducing stress.

Ensure that responders get adequate rest, according to the protocols for your organization. Rest and downtime are essential, regardless of the situation. This time can be used for the responders to eat and drink (no alcohol), close their eyes or talk. If possible, counselors on the scene can help at this point.

Keep an eye on the responders. Even though they may feel they are coping well, if you are on the lookout for exhaustion or stress, you may be able to intervene and provide rest and support.

Encourage responders to talk among themselves, though their conversation must be kept professional to avoid misunderstandings from other workers or the patients.

### Managing and Reducing Stress

Whenever possible, reunite family members. The goal is to reduce their stress and fear, but this can also be helpful for responders, since family members can provide missing information and can support each other.

Limit the information that may be getting out of the scene. Only designated authorities should be speaking to members of the media, and those responders who are working on the scene should not discuss individual patients with anyone other than immediate family members who are on hand.



## CRITICAL FACTS

Communication is a vital link to manage an MCI smoothly. However, if you find yourself in a situation where communication is not ideal, remember that your first priority is your patients and the care you are there to provide. Do *not* let the frustration of difficulties with communication affect your work.

Be honest. Tell patients what is happening in terms they can understand. Limit the use of official or medical language, as it can seem confusing and frightening if misunderstood.

If possible, for those who are able, assign tasks to help others. This can help reduce stress and make them feel useful. If patients are reluctant to receive help, encourage them to accept it, so that perhaps they may return the favor at some point by helping someone else.

Encourage questions and discussion. Fear of the unknown is often worse than reality. Be careful not to offer false hope; if you cannot answer a question, say so and see if you can determine the answer from the right sources.

## COMMUNICATION

Communication is a vital link in the smooth running of an MCI. However, it is important that responders understand that communication is not always as smooth and effective as would be desired. If you find yourself in a situation where communication is not ideal, remember that your first priority is your patients and the care you are there to provide. Do *not* let the frustration of difficulties with communication affect your work.

To help communication run smoothly, remember to always speak as clearly as possible—do not rush your speech—because being asked to repeat or being misunderstood can cause a delay in care or transport. Use simple, clear language. Use communication tools such as radio communications only when necessary, so as not to clutter the airwaves. For obvious reasons, face-to-face communication is usually the easiest means of communication.

## ▶ You Are the Emergency Medical Responder

A number of students from the bus are yelling at you to help them, and one of the firefighters asks you to come over and check the coach, whose pain in his abdomen and chest seems to be getting worse. What should you do?

## PUTTING IT ALL TOGETHER

As an EMR, you may need to assist with an emergency involving multiple people. To do so effectively requires a plan of action so that you can rapidly determine what additional resources are needed and how best to use them. An appropriate initial response can eliminate potential problems for arriving personnel and possibly save the lives of several injured people. You will need to be able to make the scene safe for you and others to work, delegate responsibilities to others, manage available resources, identify and care for the patients most in need of care, and relinquish command as more highly trained personnel arrive.

MCIs can be stressful and challenging for EMRs. By following set protocols for establishing priority care, confusion can be minimized for both responders and patients.

The two most important issues to remember are assessment and communication. For patients in an MCI, your assessments differ from those of one-on-one situations. In an MCI, you must be able to provide care to as many patients as possible, so you must focus on those who can be saved or helped.

Communication between you and your colleagues is vital in maintaining control of the situation, minimizing stress and providing quality care. Communication with the patients and their loved ones will help keep them from panicking and help them listen to instructions.

Finally, equally important to caring for your patients is caring for yourself. Be sure that you and your colleagues get enough rest and support during and after the MCI.

# 31

## RESPONSE TO DISASTERS AND TERRORISM

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### ▶ You Are the Emergency Medical Responder

You are an emergency medical responder dispatched to the scene of an explosion. On arrival you are staged with other emergency vehicles a safe distance away. You are told that police suspect that a building was targeted by an extremist group and it is thought there were no injuries from the blast. What should concern you at this time? How would you respond? What should you consider when you size up the scene?





## KEY TERMS

**All-hazards approach:** An approach to disaster readiness that involves the capability of responding to any type of disaster with a range of equipment and resources.

**Asymptomatic:** A situation in which a patient has no symptoms.

**Atropine:** An anticholinergic drug with multiple effects; used in antidotes to counteract the effects of nerve agents and to counter the effects of organophosphate (chemical compounds found in many common insecticides and used to produce toxic nerve agents, such as sarin) poisoning.

**Bioterrorism:** The deliberate release of agents typically found in nature, such as viruses, bacteria and other pathogens, to cause illness or death in people, animals or plants.

**Blast lung:** Sometimes referred to as lung blast; the most common fatal primary blast injury, describing damage to the lungs caused by the over-pressurization wave from high-order explosives.

**B NICE:** An acronym for the five main types of terrorist weapons: biological contamination, nuclear detonation, incendiary fires, toxic chemical release and conventional explosions.

**CBRNE:** The current acronym used by the Department of Homeland Security to describe the main types of weapons of mass destruction: chemical, biological, radiological/nuclear and explosive.

**DuoDote™:** A kit with pre-measured doses of antidote used to counteract the effects of nerve agents.

**High-order explosives (HE):** Explosives such as TNT, nitroglycerin, etc., that produce a defining supersonic over-pressurization shockwave.

**Incendiary weapons:** Devices designed to burn at extremely high temperatures, such as napalm and white phosphorus; mostly designed to be used against equipment, though some (e.g., napalm) are designed to be used against people.

**Low-order explosives (LE):** Explosives such as pipe bombs, gunpowder, etc., that create a subsonic explosion.

**Morbidity:** Illness; effects of a condition or disease.

**Mortality:** Death due to a certain condition or disease.

**Nerve agents:** Toxic chemical warfare agents that interrupt the chemical function of nerves.

**Pralidoxime chloride (Protopam Chloride; 2-PAM Cl):** A drug contained in antidote kits used to counteract the effects of nerve agents; commonly called 2-PAM chloride.

**Primary effects:** In referring to explosive and incendiary devices, the effects of the impact of the over-pressurization wave from HE on body surfaces.

**Secondary effects:** In referring to explosive and incendiary devices, the impact of flying debris and bomb fragments against any body part.

**Tertiary effects:** The results of individuals being thrown by the blast wind caused by explosive and incendiary devices; can involve any body part.

**WMD:** Weapons of mass destruction.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Have a basic understanding of emergency medical services (EMS) operations during terrorist, public health, weapon of mass destruction (WMD) and disaster emergencies.
- Describe the National Incident Management System (NIMS) and the National Response Framework (NRF).
- Discuss basic elements of preparation and planning for disaster and chemical, biological, radiological/nuclear and explosive (CBRNE)/WMD response.
- Describe general steps of disaster response.
- Describe general steps of a CBRNE/WMD response.
- List different types of WMD.
- Describe the roles of emergency medical responders (EMRs) during a natural, human-caused or biological disaster.
- Describe how to provide emergency medical care during disaster or CBRNE/WMD response.
- Identify the basic equipment needed by EMRs for a CBRNE/WMD response.
- List the steps to provide self-care and peer care in response to nerve agent poisoning.



## INTRODUCTION

The reality of potential terrorist attacks has grown progressively since the Oklahoma City bombing in 1995, but nothing has ever shown more powerfully or more poignantly how quickly a terrorist attack can take place, and how devastating its effects, than the September 11, 2001, attacks on the World Trade Center and the Pentagon.

Terrorism is not a new phenomenon. The United States has witnessed a number of acts of terrorism over the years: the 1993 World Trade Center bombing; the 1998 bombings of U.S. embassies in several East African countries; the USS Cole suicide bombing in 2000 in Yemen; the Boston Marathon bombing in 2013; and the attacks in San Bernardino (2015), the Orlando nightclub (2016) and the Fort Lauderdale airport (2017), to name a few.

Not all disasters that have affected U.S. citizens were caused by terrorists. Some of the more destructive are natural disasters, such as hurricanes, floods, earthquakes, wildland fires and tornadoes. Disasters can also be the result of outbreaks of communicable diseases/pandemics or contamination of food or water supply. Biological disasters can result from naturally occurring outbreaks or because of bioterrorism.

With the growing threat of natural, biological and human-caused disasters, the knowledge of how to deal with such tragedies is just as important to responders as any other rescue call you may receive. The goal of this chapter is to ensure you are able to deal successfully with such events through careful preparation, ensuring safety for yourself and others, and understanding the nature of and appropriate response to disasters.

## PREPARING FOR DISASTERS AND TERRORIST INCIDENTS

Preparedness for disasters and terrorist incidents involves many different agencies working together in a coordinated effort, to meet a common goal. This is true at the local level, with police, fire, emergency medical services (EMS) personnel, public health, transportation and other town or

county agencies; it is also true of organizations at the regional, federal and private levels.

The organizational structure and roles each of these agencies plays in disaster response are ultimately coordinated at the federal level by the Federal Emergency Management Agency (FEMA). FEMA coordinates the response to and recovery from disasters in the United States when the disaster is large enough to overwhelm local and state resources. FEMA also works collaboratively with other organizations such as state and local emergency management agencies and federal agencies and emergency response organizations such as the American Red Cross.

In 2008, FEMA developed and introduced the National Response Framework (NRF), which guides all organizations involved in disaster management on how to respond to disasters and emergencies. The NRF identifies the National Disaster Medical System (NDMS) as the system to augment the nation's medical response capabilities.

The NDMS is a system that supports federal agencies in managing and coordinating medical response to major emergencies and disasters. One responsibility of the NDMS is to oversee several different types of disaster medical teams, including Disaster Medical Assistance Teams (DMATs). DMATs are groups of professional and paraprofessional medical as well as administrative and logistical personnel who provide medical care during a disaster.

## INCIDENT MANAGEMENT

The National Incident Management System (NIMS) is a comprehensive national framework for managing incidents. It outlines the structures for response activities for command and management. NIMS provides a consistent, nationwide response at all levels: federal, state, tribal and local governments; the private sector; and nongovernmental organizations (NGOs). With this structure, agencies at all levels can work together in a consistent manner, to respond to incidents of any type or size.



### CRITICAL FACTS

Preparedness for disasters and terrorist incidents involves many different agencies working together in a coordinated effort to meet a common goal. In 2008, FEMA introduced the NRF, which guides all disaster management organizations in proper response. The NDMS is the system that augments the nation's medical response capabilities.

NIMS provides a core set of common concepts, principles, terminology and technologies in these areas:

- Incident command system (ICS)
- Multiagency coordination system (MACS)
- Unified command
- Training
- Identification and management of resources
- Mutual aid and assistance
- Situational awareness
- Qualifications and certification
- Collection, tracking and reporting of incident information
- Crisis action planning
- Exercises

One of these components, the ICS, is a management system that allows effective incident management by bringing together facilities, equipment, personnel, procedures and communications within a single organizational structure, so that everyone involved in a disaster has an understanding of their roles and is able to respond effectively and efficiently. This system is used by all levels of government, as well as many NGOs and private organizations.

Incident command is structured in five main functional areas:

- Command
- Operations
- Planning
- Logistics
- Finance/administration

Among other roles within the ICS is the incident commander, who is responsible for all activities including resources and operations at the incident site. The incident commander also delegates duties to other responding staff. (See Chapter 30 for further information about the ICS.) All emergency medical responders (EMRs) are required by Homeland Security Presidential Directive-5 (HSPD-5) to complete specific ICS training. For more information, please visit [training.fema.gov/IS/crslist.asp](http://training.fema.gov/IS/crslist.asp).

## Warning Systems and Disaster Communications Systems

During a disaster, one of the most critical aspects of response is the capability to communicate information about the disaster to the public. The Emergency Alert System (EAS) is a nationwide public warning system to alert and warn the public. It requires all broadcasters (cable television systems, wireless cable systems, satellite radio services, etc.) to direct the communications to the president, so that the president is able to address the American public during a national emergency. State and local authorities may also use the system for critical emergency information such as America's Missing: Broadcast Emergency Response (AMBER) alerts and weather information targeted to a specific area.

Once the president has been informed, as well as other officials at the federal, state and local levels, the public is made aware of the disaster. The EAS is administered by the Department of Homeland Security (DHS) through the Federal Emergency Management Agency (FEMA) and the National Oceanic and Atmospheric Administration's National Weather Service (NWS). It is regulated through the Federal Communications Commission (FCC).

Once communications reach those authorized in the federal government, national alerts and warnings to the public are communicated through the EAS to state and local governments, so that emergency management officials can alert the public at the local level and mobilize the necessary responding agencies.



### CRITICAL FACTS

NIMS is a comprehensive national framework for managing incidents. It outlines the structures for response activities for command and management. NIMS provides a consistent, nationwide response.

Also within the structure of NIMS are 16 emergency support functions (ESFs), mechanisms for grouping the functions most frequently used to provide emergency management support during emergency/disaster incidents and planned events. Additional ESFs may be part of the Communities Comprehensive Emergency Management Plan that could include Animal Services, Special/Functional Needs, Damage Assessment, as well as Business and Industry. Following is a list of the ESFs:

- **ESF #1—Transportation:** Aviation/airspace management and control; transportation safety; restoration/recovery of transportation infrastructure; movement restrictions; damage and impact assessment
- **ESF #2—Communications:** Coordination with telecommunications and information technology industries; restoration and repair of telecommunications infrastructure; protection, restoration and sustainment of national cyber and information technology resources; oversight of communications within the federal incident management and response structures
- **ESF #3—Public Works and Engineering:** Infrastructure protection and emergency repair; infrastructure restoration; engineering services and construction management; emergency contracting support for lifesaving and life-sustaining services including water supplies
- **ESF #4—Firefighting:** Coordination of federal firefighting activities; support to wildland, rural and urban firefighting operations
- **ESF #5—Emergency Management Information and Planning:** Coordination of incident management and response efforts; issuance of mission assignments; resource and human capital; incident action planning; financial management
- **ESF #6—Mass Care, Emergency Assistance, Housing and Human Services:** Mass care; emergency assistance; disaster housing; human services
- **ESF #7—Logistics Management and Resource Support:** Comprehensive, national incident logistics planning, management and sustainment capability; resource support (facility space, office equipment and supplies, contracting services, etc.)
- **ESF #8—Public Health and Medical Services:** Public health; medical; mental health services; mass fatality management
- **ESF #9—Search and Rescue:** Lifesaving assistance; search and rescue operations
- **ESF #10—Hazardous Materials Response:** Hazardous materials (chemical, biological, radiological, etc.) response; environmental short- and long-term cleanup
- **ESF #11—Agriculture and Natural Resources:** Nutrition assistance; animal and plant disease and pest response; food safety and security; natural and cultural resources and historic properties protection and restoration; safety and well-being of household pets
- **ESF #12—Energy:** Energy infrastructure assessment, repair and restoration; energy industry utilities coordination; energy forecast
- **ESF #13—Public Safety and Security:** Facility and resource security; security planning and technical resource assistance; public safety and security support; support for access, traffic and crowd control
- **ESF #14—Long-Term Community Recovery:** Social and economic community impact assessment; long-term community recovery assistance to states, local governments and the private sector; analysis and review of mitigation program implementation
- **ESF #15—External Affairs:** Emergency public information and protective action guidance; media and community relations; congressional and international affairs; tribal and insular affairs
- **ESF #16—Law Enforcement:** Establishment of procedures for the command, control and coordination of all state and local law enforcement personnel and equipment to support impacted local law enforcement agencies

EMRs typically are supported by ESF #8 (Public Health and Medical Services) but may also coordinate with ESFs #4 and #9 (Firefighting and Search and Rescue), depending on the complexity



### **CRITICAL FACTS**

If you are the first responder on the scene of a disaster, you may be called upon to assume a leadership role. If someone else has assumed this role, it is your responsibility to assist the leader or assume another role. It may be triaging patients, providing medical care, providing patient reception at staging facilities or preparing patients for evacuation.



**Fig. 31-1:** If you are the first responder on the scene, you may have to assume a leadership role.  
 Photo: courtesy of Captain Phil Kleinberg, EMT-P.

of the incident or event. The American Red Cross is the primary agency for ESF #6 (Mass Care, Emergency Assistance, Housing and Human Services). It also acts as a support agency for ESFs #3, 5, 8, 11, 14 and 15, and as a cooperating agency for several of the support and incidents annexes (components of individual ESFs).

## THE ROLE OF THE EMERGENCY MEDICAL RESPONDER

At the scene of a disaster, if you are the first responder on the scene, you may be called upon to assume a leadership role (Fig. 31-1). If someone else has assumed this role, it is your responsibility to assist the leader or assume another role, usually in triaging patients, providing medical care, providing patient reception at staging facilities or preparing patients for evacuation.

Upon arriving on the scene, assess for scene hazards, the number of patients, patient priorities, the need for extrication, the number of ambulances or other transport vehicles needed, and any other factors that affect the scene, as well as the need for resources and where to stage those resources. Radio your report with a request for any additional resources needed and then set up functions to accommodate resources as they arrive, including staging, supply, extrication, triage, treatment, transportation and rehab.

## DISASTER RESPONSE

Responding to a disaster call may prove to be the most challenging and mentally stressful scene you ever attend. Every incident is different, and it is impossible to cover all of the specific steps and considerations for a specific scene. You will need to be prepared to address various issues and precautions simultaneously. The types of disasters you may respond to are varied, but fall into three main categories: natural disasters, human-caused disasters and biological disasters.

### Mutual Aid

Mutual aid is a formal agreement among emergency responders to lend assistance across the various jurisdictions of public services such as fire departments, EMS operations and law enforcement during an emergency situation or disaster that exceeds local resources. Aid must be requested. The following general information must be supplied by the requesting community:

- A description of the personnel, equipment and other resources required
- The estimated length of time resources may be required
- The areas of experience, training and abilities of the personnel, and the capabilities of the equipment to be furnished

*(Continued)*



## Mutual Aid continued

The person, service or agency receiving the request must then let the community in which the disaster took place know the estimated time when assistance can arrive at the designated location, as well as the names of the people designated as supervisory personnel.

The following rules will apply during the rescue efforts:

- The personnel and equipment of the assisting team are under the direction and control of the requesting community while at the disaster site.
- Emergency personnel continue under the command and control of their regular leaders, but the organizational units come under the operational control of the emergency services authorities of the community receiving assistance. The receiving party is responsible for informing the responding party when their services will no longer be required.
- All equipment and personnel provided by the assisting team while at the site of an emergency remain under the control and direction of its own designated representative, who can remove any or all equipment or personnel from the site at any time the representative deems it appropriate.
- An assisting team's priority lies with its own jurisdiction, and the team must continue to offer reasonable protection and services. Therefore, the assisting team has the right to withdraw any and all aid provided, after giving the disaster area notification of the need to do so.

## Natural Disasters

The devastating effects of natural disasters have been felt worldwide. Damage caused by earthquakes, hurricanes/tropical storms, landslides, thunderstorms, tsunamis, winter storms, tornadoes, heat waves, floods, wildfires and volcanic eruptions can leave entire communities completely incapacitated, with large numbers of people seriously injured (Fig. 31-2, A–D). Massive infrastructure damage may occur, resulting in entire communities seeking shelter, food and other assistance.



**Fig. 31-2, A–D:** Natural disasters, such as (A) wildfire (photo: courtesy of Jeff Zimmerman, Zimmerman Media LLC), (B) flood (photo: courtesy of Robert Baker), (C) earthquake (photo: courtesy of Chris Helgren) or (D) tornado (photo: courtesy of Joseph Songer), can leave entire communities incapacitated and large numbers of people seriously injured.



**Fig. 31-3:** Human-caused disaster. Photo: courtesy of Captain Tony Duran, Los Angeles County Fire Department.

## Human-Caused Disasters

Human-caused disasters include terrorist attacks using chemical, biological, radiological/nuclear and explosive weapons; fire (residential or environmental); hazardous material (HAZMAT) incidents; as well as large-scale multiple-casualty incidents (MCIs) such as transportation mishaps (Fig. 31-3).

## Biological Disasters

Biological disasters are not just the creative writing of science fiction. One need only look back at the flu epidemic of 1918 to be reminded of how real they are. In that epidemic, as many as 600,000 Americans lost their lives, as did some 40 million people worldwide. We have a lot more knowledge about dealing with a biological disaster today, but as we are warned by the World Health Organization, other epidemics such as the avian flu or the next flu pandemic could be only months away (Fig. 31-4). Outbreaks of communicable diseases/pandemics, as well as contamination of

food or water supply by pathogens, are all very real possibilities. In addition to the threat of naturally occurring outbreaks, biological disasters can also be the result of bioterrorism.



**Fig. 31-4:** Immunizations provide some element of protection against biological disasters. Photo: courtesy of Captain Phil Kleinberg, EMT-P.

## Evacuations

In the case where a disaster has been predicted, such as a wildland fire, hurricane or flood, steps must be taken to evacuate a community. Local and state emergency management offices have the authority to order and implement evacuations. The keys to a successful evacuation are communication and organization to avoid panic and the possibility of injury to people and property. Therefore, alerts regarding the evacuation must be made often and with clarity to residents who are affected by the need to leave their homes. There may be some who will not believe the level of danger the impending disaster may have on them or their property, and who may wish to remain in their homes. This reaction is normal, but it is imperative to maintain communication with these people and convince them of the level of danger they will face if they remain.

Evacuation warnings should communicate the following points:

- The nature of the disaster and the estimated time until it will impact the area
- The level of devastation the disaster is expected to cause, to help convince people to leave
- The routes assigned as safe for their evacuation
- The appropriate destinations where food, shelter and water are available

All possible means of communication should be used, including Mass Notification Systems, Reverse 9-1-1, radio, television, loudspeakers and public address systems in buildings, etc. Again, the sense of urgency and clarity are the deciding factors for whether people choose to flee or not.

## EMS Operations During Terrorist Attacks, Public Health Emergencies, WMD Incidents and Disaster Events

In any kind of large-scale disaster, it is important to use an **all-hazards approach**, which means being prepared with the equipment and resources needed to respond to many different types of disasters.

Regardless of the type of disaster, until you are aware of the specific hazards involved, distance yourself from the scene and only approach when it is safe to do so. Continue to monitor the scene, as there may be secondary explosions, for example, or traps meant to injure and possibly kill responders. If you are arriving on the scene of an armed attack, communicate immediately with law enforcement.

Initiate incident command or, if it has already been initiated, expand as assigned and communicate your findings to the ICS. Within the ICS, the necessary emergency services are called and responsibility for different sections can be assigned to the appropriate personnel as they arrive.

Establish a perimeter around the area in order to protect yourself and other responders as well as the public from injury. If you are at the scene of a terrorist incident, establish an escape plan and a mobilization point. Designate the role of incident safety officer and assess command post security.

## WMD (CHEMICAL, BIOLOGICAL, RADIOLOGICAL/NUCLEAR AND EXPLOSIVE INCIDENTS)

Terrorism has been around for many years, yet the threat of terrorism is something increasingly on the minds of Americans in recent years. The FBI defines terrorism according to the U.S. Code of Federal Regulations (CFR):



### CRITICAL FACTS

In any kind of large-scale disaster, it is important to use an all-hazards approach, which means being prepared with the equipment and resources needed to respond to many different types of disasters.



*“Terrorism includes the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.”*

While these terrible crimes seem senseless, the terrorists who commit them have specific goals they are trying to achieve. They seek to incite fear, confusion and panic, as well as to inflict destruction on both physical and political infrastructure, and through these actions cause intimidation to those in authority and others. Terrorists may be motivated to inflict such destruction and fear for different reasons, including political and religious beliefs, environmental causes, racial bias or a desire for revenge.

When terrorists strike, their most likely weapons of choice are guns and explosives, as these are relatively inexpensive, easy to obtain and use, and easy to transport. Less often, they may turn to weapons of mass destruction (**WMD**), which, by their nature, cause widespread fear and destruction.

EMRs need to be aware of public reaction when faced with WMD. While this type of weapon is used less frequently, their power lies in their ability to inflict significant fear and panic.

These weapons are commonly classified by the acronym **CBRNE**:

- **C**hemical
- **B**iological
- **R**adiological/**N**uclear
- **E**xplosives

This terminology is used by the Department of Homeland Security and understood internationally. Another system of classifying WMD is **B NICE**, which stands for biological, nuclear, incendiary, chemical and explosive. This system of classification is similar to CBRNE, but it includes **incendiary weapons** (e.g., napalm, magnesium, phosphorous, etc.) as a separate type, whereas these devices are included under the term “explosives” under CBRNE. The terms are, in general, used interchangeably.

## Chemical Weapons

A chemical emergency occurs when a hazardous chemical has been released and the release has the potential for harming people’s health. In the case of a terrorist attack, the chemicals are released with the deliberate purpose of causing harm.

Chemical agents are difficult to turn into weapons, as they disperse easily in open environments. This can reduce their destructive power. However, the public perceives chemical weapons as highly effective, thus terrorists achieve their goal. The other major characteristic of chemical agents is that they affect the body quickly, with symptoms often appearing immediately, which is different from the impact of biological or nuclear agents, which may not occur until days after the event.

## Providing Care

Steps to provide care for patients exposed to chemical weapons vary according to the type of chemical. This is one of the great challenges in responding to a chemical incident; symptoms are not always obvious, and identifying the substance is not always possible.

If you are unable to identify the chemical, prepare yourself for the worst-case possibilities concerning toxicity when selecting personal protective equipment (PPE) and decontamination procedures. Assess the patient for traditional challenges such as airway and circulation concerns, and check for obvious symptoms such as neuromuscular, dermatological and vascular findings. If necessary, maintain spinal motion restriction and apply a cervical collar. Administer supplemental oxygen based on local protocols, and assist ventilation with a bag-valve-mask (BVM) resuscitator if necessary.

Prior to transportation, report the patient’s condition, treatment and estimated time of arrival to the base station and receiving medical facility. If a chemical has been ingested, have several towels and open plastic bags ready to quickly clean up and isolate the patient’s toxic vomit. Consult with the base station physician or regional Poison Control Center for advice regarding triage of



### CRITICAL FACTS

The FBI defines terrorism as “the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population or any segment thereof, in furtherance of political or social objectives.”

There are four classifications of WMD: chemical, biological, radiological/nuclear and explosives. The common acronym for these classifications is CBRNE.



multiple patients. **Asymptomatic** patients who are discharged should be advised to seek medical care promptly if symptoms develop.

Chemical agents can be categorized into five types: nerve agents, blister agents, blood agents, pulmonary agents and incapacitating agents.

## Nerve Agents

**Nerve agents**, such as tabun (GA) and methylphosphonothioic acid (VX), are particularly toxic chemical agents that disrupt the chemical recovery phase following a neuromuscular signal. Nerve agents are liquid when at normal temperatures but turn into a combination vapor/liquid when dispersed. They are usually odorless, although they may smell like fruit or fish.

Symptoms vary depending on the dose. A strong dose can cause death within minutes, if inhaled or absorbed into the skin. Signs and symptoms include runny nose, watery eyes, twitching, pinpoint pupils, painful eyes, blurred vision, drooling, excessive sweating, coughing, weakness, drowsiness, headache, nausea, vomiting, abdominal pain, slow or fast heart rate, abnormally high or low blood pressure and more. Exposure causes irritation or severe damage to the eyes and respiratory tract, and may cause redness or severe blistering of the skin with larger doses. The blisters are similar to those caused by second-degree burns. These signs do not appear immediately but arise after several hours or a day, depending on the dose.

When a patient has been exposed to a nerve agent, in general the priorities are to decontaminate, ventilate (expose to fresh air), administer antidotes, administer valium (to prevent seizures) and provide supportive therapy. Depending on the type of agent, different antidotes are available.

## Blister Agents

Blister agents, also called vesicants, include sulfur mustard (HD) and phosgene oxime (CX). These agents cause the skin and mucous membranes to form blisters on contact. Sulfur mustard can sometimes be detected by its odor of garlic, onions or horseradish, but it can be difficult to detect because the smell is faint.

When exposed to sulfur mustard, either in liquid or vapor form, patients experience irritation or severe damage to the eyes and respiratory tract. Sulfur mustard may cause redness or severe blistering of the skin with larger doses. As with the blisters from nerve agents, these blisters resemble second-degree burns. Also, as with nerve agents, signs

appear from several hours to a day after exposure, depending on the dose. If the patient has had a significant exposure, there may also be systemic effects that cause damage to bone marrow and the epithelial lining of the gastrointestinal (GI) tract.

There are no known antidotes or treatments for exposure to blister agents; treatment of both the blisters and respiratory effects is supportive and nonspecific. Care includes decontamination by discarding contaminated clothing, and cleaning equipment with soap, water and diluted bleach (0.5–1.0 percent). Do *not* use bleach on patients.

## “Blood” Agents

Blood agents, such as cyanide, attack the body’s cellular metabolism. They do not actually affect the blood, as was once thought, but disrupt cellular respiration. Cyanide can enter the body by being ingested, injected or inhaled, but not by being absorbed into the skin. Despite its devastating effects, if it dissipates into the air, it rapidly becomes harmless. Cyanide can be recognized by its odor of bitter almonds, though not everyone is able to detect it.

Cyanide’s effect of poisoning the cells prevents them from taking up oxygen, which in turn leads to asphyxia and cyanosis (blue tinge to the skin caused by a lack of oxygen). Cyanide is a quick-acting agent, and can cause death within 5 to 8 minutes if the exposure is severe.

Treatment for cyanide poisoning is by antidote, using a Cyanokit® (hydroxocobalamin), sodium nitrite or sodium thiosulfate, all of which must be administered immediately and intravenously.

## Pulmonary Agents

Pulmonary agents include phosgene (CG), which causes lung injury by forming hydrochloric acid (HCl) when it contacts mucous membranes, thereby irritating and damaging lung tissue. When phosgene explodes, it turns into a colorless, watery vapor with a smell that has been described as that of new-mown hay.

Signs and symptoms are severe illness and even death from pulmonary edema and acute respiratory distress syndrome.

There is no specific antidote for phosgene. The only way to provide care is to remove the person from the agent and resuscitate. EMRs should take measures to protect themselves in a situation where phosgene may be present, by using a chemical protective mask with a charcoal canister.

## Incapacitating Agents

An incapacitating agent is defined by the Department of Defense (DOD) as “an agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort in the performance of their assigned duties” (Source: *University of Albany*).

These agents, which include MACE, tear gas and pepper spray, contain a hallucinogenic agent, 3-quinuclidinyl benzilate, also referred to as BZ or QNB. They are usually nonlethal and generally not used by terrorists, but may be used, for example, by law enforcement authorities to control a violent crowd. The BZ may be dispersed as a fine aerosol or dissolved in dimethyl sulfoxide (DMSO) and absorbed into the skin.

Effects may be delayed for 30 minutes to 24 hours. Effects are both peripheral (external) and systemic (throughout the body). Peripheral effects include pupil dilation, dry mouth and skin, and flushing of the skin, particularly the face and neck. Symptoms may appear similar to those seen in someone exposed to certain nerve agents and then treated with an excess of **atropine**. Systemic effects include disturbances to consciousness, delusions and hallucinations, impaired memory and poor judgment, disorientation and ataxia (uncoordinated gait or manner of walking). Overall, effects depend on the dose and may last for up to 4 days.

Monitor the patient who has been incapacitated by one of these agents and take precautions to prevent yourself from being exposed.

## Biological Weapons

**Bioterrorism** is the deliberate release of agents typically found in nature, such as viruses, bacteria or other pathogens (agents), for the purpose of causing illness, disease or death in people, animals or plants. Often these agents can be changed, increasing their potency and making them resistant to current medications, or even increasing their ability to be spread into the environment.

### Types of Biological Agents/Diseases

Many diseases and biological agents have been determined to be a threat. These are categorized into three groups according to their level of threat, from highest to lowest:

- Class A biological agents/diseases include anthrax, plague, smallpox, tularemia, viral hemorrhagic fevers (e.g., Ebola) and botulism.

These agents and diseases pose the greatest threat to public health and national security, as they can be easily spread from person to person and result in high **mortality** (death) rates.

- Class B biological agents/diseases include brucellosis, Q fever, glanders, alphaviruses, food pathogens (e.g., salmonella, *Shigella*, *E. coli*), water pathogens (e.g., *Vibrio cholerae* and *Cryptosporidium*), Ricin toxin, staphylococcal enterotoxin B and epsilon toxin of *Clostridium perfringens*. This class of agents and diseases poses a moderate level of risk, as they are moderately easy to spread and result in moderate **morbidity** (illness) rates and low mortality rates.
- Class C biological agents/diseases are those considered to be emerging infectious diseases, such as hantavirus, Nipah virus, yellow fever, multidrug-resistant tuberculosis and tickborne viruses. These agents have the potential to be engineered for mass dissemination. They are easy to spread and have the potential for high mortality and morbidity rates.

When a bioterrorism event has occurred, often there is a single suspected case of an uncommon disease or there are single or multiple suspected cases of a common disease or syndrome that do not respond to treatment as expected. Clusters of a similar illness may occur in the same timeframe in different locales. There may be unusual clinical, geographical, seasonal or temporal presentations of a disease and/or unusual transmission routes; an unexplained increase in the incidence of an endemic disease; or an unusual illness that affects a large, disparate population or is unusual for a population or age group. You may see an unusual pattern of illness or death among animals or humans, or a sudden increase in nonspecific illnesses such as pneumonia, bleeding disorders, unexplained rashes and mucosal or skin irritation (particularly in adults), neuromuscular symptoms (such as muscle weakness and paralysis) or diarrhea.

For most of these diseases/agents, patients initially experience flu-like symptoms such as fever, aches and listlessness or fatigue.

### Providing Care

While the early signs and symptoms may be similar for different diseases/agents, treatment will depend on the nature of the agent. For example, those caused by a virus *cannot* be treated with antibiotics, while those caused by a bacterium may be treated with antibiotics.

Often, though, when these illnesses/diseases are caused by a terrorist act, you will not know the cause right away. While it is essential to take steps to recognize the specific agent, provide supportive care right away, including assessing the patient for traditional challenges such as airway and circulation concerns, and checking for obvious symptoms such as neuromuscular, dermatological and vascular findings. Once examined by a physician, the patient will likely be given specific antibiotics or antitoxins. Immunizations may also be given as a preventative measure for certain agents.

Although most biological agents are not highly contagious, a few are, so it is essential to isolate the patient, protect yourself with the proper PPE, and use standard exposure control procedures including high efficiency particulate air (HEPA) filter mask and gloves (Fig. 31-5).

## Radiological/Nuclear Weapons

The effects of a nuclear weapon detonation depend on the yield and success of the detonation. For example, a poorly maintained or manufactured bomb might produce no explosion, yet still spread radioactive material. Or the device could have a partial nuclear detonation, which would have a much greater impact than, for example, the explosive that destroyed the Oklahoma City Federal Building in 1995.

The detonation of a nuclear device, regardless of size, could prove catastrophic. A nuclear explosion has several damaging effects, caused by the air blast, heat, ionizing radiation, ground shock and secondary radiation.

There are four types of radiation exposure. These include patients who:

1. Received a significant dose from an external source, including large radiation sources over a short period of time, or smaller radioactive sources over a long period of time.
2. Received internal contamination from inhalation and/or ingestion of radioactive material.
3. Have external contamination of the body surface and/or clothing by liquids or particles.
4. Were exposed through a combination of the above.

In general, determining that someone has been exposed to radiation can be difficult. However, acute radiation syndrome follows a predictable pattern that unfolds over several days or weeks after substantial exposure or catastrophic events. Patients may present individually over a longer period of time after exposure to unknown radiation sources. Specific symptoms of concern, especially following a 2- to 3-week period with nausea and vomiting, are thermal burn-like skin lesions without documented heat exposure, a tendency to bleed



**Fig. 31-5:** Always protect yourself from hazards by using appropriate PPE and following standard exposure control procedures. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*



(nosebleeds, gingival [gum] bleeding, bruising) and hair loss. Symptom clusters, as delayed effects after radiation exposure, include headache, fatigue, weakness, partial- and full-thickness skin damage, hair loss, ulceration, anorexia, nausea, vomiting, diarrhea, reduced levels of white blood cells, bruising and infections.

## Providing Care

Assess and treat life-threatening injuries immediately. Move patients away from the hot zone (the area in which the most danger exists) using proper patient transfer techniques to prevent further injury (Fig. 31-6). Stay within the controlled zone if contamination is suspected.

Expose wounds and cover with sterile dressings, decontaminating open wounds as required. Patients should be monitored at the control line for possible contamination only after they are medically stable. Remove contaminated clothing only if removal can be accomplished without causing further injury.

Contaminated patients who do not have life-threatening or serious injuries may be decontaminated on site, starting with the

removal of their clothing. Do not remove patients from a backboard or other extrication device if one was used when packaging for transport.

It is essential to use standard precautions to help prevent the spread of contamination from injured patients to yourself or other emergency personnel. Notify proper authorities and the hospital of all pertinent information about patients and the scene. Ask for any special instructions the hospital may have, such as using an entrance other than the routine emergency department entrance for the purposes of radiological contamination control.

## Explosives and Incendiary Weapons

Traditional weapons and explosives still present a very real threat for use in terrorist attacks on the United States. As an EMR, understanding the unique types of injuries associated with explosives is imperative to ensure appropriate treatment and handling of patients at a blast site.

There are two major types of explosives:

- **High-order explosives (HE)**, e.g., TNT, C-4, Semtex, nitroglycerin, dynamite and ammonium



**Fig. 31-6:** When providing care in a situation of radiation exposure, move patients away from the hot zone using proper patient transfer techniques. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*



nitrate fuel oil (ANFO), which produce a defining supersonic over-pressurization shock wave

- **Low-order explosives (LE)**, including pipe bombs, gunpowder and most pure petroleum-based bombs such as Molotov cocktails or aircraft improvised as guided missiles, which create a subsonic explosion

Blasts can also be caused by explosive and incendiary (fire) bombs, which are characterized based on their source. Manufactured weapons are military issued, mass produced and quality tested, and are exclusively HE. Improvised weapons are produced in small quantities, or use a device outside its intended purpose, such as converting a commercial aircraft into a guided missile.

There are three basic mechanisms of blast injury:

- **Primary effects** are unique to HE, and result from the impact of the over-pressurization wave on body surfaces. The most common injuries are to the lungs, GI tract, eyes, head and middle ear.
- **Secondary effects** are caused by flying debris and bomb fragments; any body part may be affected.
- **Tertiary effects** may occur from individuals being thrown by the blast wind, and also can involve any body part.

Injury patterns will depend on whether you are dealing with HE or LE blasts as well as on the position of the body when the blast occurs. Patients who are standing or lying perpendicular to the blast will suffer greater injuries compared with those who are lying directly toward or away from the blast.

Lung injuries include **blast lung**, the most common fatal primary blast injury. Blast lung is caused by the HE over-pressurization wave. Middle ear injury most commonly includes tympanic membrane (eardrum) perforation. Abdominal injuries include bowel perforation, hemorrhage, mesenteric shear injuries, solid organ lacerations and testicular rupture. Injuries to the head include concussion or mild traumatic brain injury (MTBI). Other injuries include air embolism, compartment syndrome, rhabdomyolysis (skeletal muscle tissue damage) and acute renal failure. Also consider the possibility of exposure to inhaled toxins and poisonings (e.g., carbon monoxide [CO], cyanide [CN], methemoglobin [MetHgb]) in both industrial and criminal explosions. Wounds can also be contaminated, as with tetanus.

## Providing Care

After performing a preliminary evaluation and establishing scene safety, EMRs should initiate rescues of severely injured and/or trapped patients, evacuate ambulatory patients, perform triage and treat life-threatening injuries. Leave fatalities and their surroundings undisturbed, and avoid disturbing areas not directly involved in rescue activities. Initiate documentation of the scene as soon as conditions permit. The site of a bomb blast is a crime scene and, as an EMR, although your primary responsibility is to rescue living people and provide treatment for life-threatening injuries, it is also important to preserve evidence and avoid disturbing areas not directly involved in the rescue activities, including those areas containing fatalities.

## RESPONSE TO A CBRNE WMD INCIDENT

### Preparation

Planning for a WMD incident involves several aspects of preparation, including medical direction, personal preparation, equipment, transportation and communications.

Medical direction will be provided on a massive scale during a WMD incident. Your EMS system needs to include a larger number of care providers from within your region as well as medical control systems from different areas. Disrupted communications systems can make it difficult to activate and summon appropriate medical services; therefore, preparing emergency measures as standing orders is the most effective manner in which to activate a plan. This leaves communication channels available for scene updates, incoming patient reports and the essential communications required in extraordinary circumstances.

In all WMD case scenarios, the massive numbers of responders involved could lead to scene confusion. It is imperative, especially in cases where interagency coordination is required, that all levels of support services define their respective roles and responsibilities at the scene and are managed by the ICS. Regional pre-planning, coordination and rehearsal are recommended in order to ensure all involved services are familiar with their roles and arrive at the scene prepared to perform those services without conflict or delay. Planning must include an assessment of hazards, exposure potential, respiratory protection needs, entry conditions, exit routes and decontamination strategies.

The types of weapons used at a CBRNE incident cover a broad spectrum of dangers, including the possibility of exposure to pathogens, chemicals and radiation. Because of this, it is important for EMRs to understand the threats at the scene and why it is critical to take proper precautions first. For example, it is critical to have necessary antidotes ready if there is a risk of exposure to nerve agents.

## Equipment and Supplies

Inventory of equipment and supplies will vary depending on the type of WMD used in an attack. In order to be able to respond as quickly as possible with the appropriate equipment, medications and personnel, lists of locations of traditional storage areas must be kept and remain accessible to neighboring communities, to allow the dispatch center to quickly access the resources regionally, statewide or nationwide.

In a large-scale incident, it is necessary to rely on other services to supply the proper equipment and, in most cases, knowledge, to CBRNE calls. Nerve agents require large amounts of certain drugs as well as ventilators. If you are called to the site of a chemical incident, you may require specialized PPE such as self-contained breathing apparatus (SCBA) or HAZMAT suits. If you are responding to the scene of a large explosion, you may require heavy rescue equipment, search and rescue units, devices for electronic detection and trained search dogs. The proper protocols and procedures regarding mutual assistance setups and the deployment of equipment must be followed in accordance with your community's plan.

## Arrival on Scene

On-site incident management allows responders to work together as effectively as possible. As a responder, the responsibility for preparing the site for rescue efforts may fall on you. If you are among the first to arrive on the scene of a WMD incident, your speedy and accurate assessment of the scene and the actions you take to establish incident command as quickly and efficiently as possible are the most important steps you can take in saving lives and helping the injured. Your instincts as an EMR will be to help patients first. However, your scene size-up to measure the scope of the disaster, and the information you collect to identify the appropriate resources, are your first priorities.

When approaching the scene, consider the time since the incident, your distance from it and any necessary shielding. Remember, EMRs may

be targets, so you must be wary of potential secondary attacks.

Provide an initial on-scene report to dispatch, with a description of the incident along with the need for specialized resources, initial actions taken, number of injured, and the nature and quantity of additional resources required.

Look for outward signs and characteristics of terrorist incidents, such as mass casualties presenting with identical symptoms that have no identifiable cause. Attempt to identify the weapon used by looking for outward signs of the use of WMD, such as strange odors like bitter almond, peaches or fresh-cut grass. Consider the necessary protective actions according to the type of weapons: CBRNE.

Determine the number of people involved and implement local protocols for mass casualty incidents as necessary. As part of your assessment, evaluate the need for additional resources. Evaluate and alter plans as necessary, including consideration of changing weather and a change to incidents occurring at the site such as secondary attacks or injuries to responders.

## Search and Rescue

A variety of specialized services can be used when a search and rescue mission is required following a disaster. This may include building collapse, avalanche or ships lost at sea.

Search and rescue capabilities include distress monitoring, communications, location of distressed personnel, coordination and execution of rescue operations including extrication or evacuation, along with the provisioning of medical assistance and civilian services through the use of public and private resources to assist persons and property in potential or actual distress.

Emergency support function #9 (ESF #9) provides the following specialized search and rescue services during incidents or potential incidents requiring a coordinated federal response:

- Structure Collapse (Urban) Search and Rescue (US&R)
- Waterborne Search and Rescue
- Inland/Wilderness Search and Rescue
- Aeronautical Search and Rescue

## Scene Safety

Identifying the weapon involved is a major part of responding to a WMD scene. Once you are aware of the hazards you are responding to, you can protect yourself, fellow responders and the public effectively.

Approach the scene from upwind and uphill if chemical, biological or nuclear weapons are suspected. Avoid confined spaces where chemical or biological agents may be trapped due to poor ventilation. Be suspicious of a potential terrorist attack when called to a well-populated area, as these are typical targets for attacks.

The possibility that secondary devices may have been planted at the scene is a real and serious threat to the teams responding to a CBRNE call. With this in mind, as with all calls, your own safety must be your top priority. Remain aware of the dangers to your health when you are entering a scene and while you are offering assistance to patients. Establishing what substances have been released, how and where, will help to best ascertain the proper PPE required, procedures to follow and the appropriate patient treatment.

Unlike other EMS calls, if terrorists are involved, it is possible they will try to sabotage your efforts to respond. Therefore, hospital facilities must take security measures to limit the traffic in and out of the area, setting safe perimeters around the hospital and allowing access only to those with proper authorization. Secondary devices may be used by terrorists to keep EMRs from responding, making it advisable for all units and agencies involved to be familiar with and able to operate under the ICS.

Ascertain the proper PPE needed to enter the scene, using an all-hazards safety approach. If you are approaching a patient who is suspected of having a communicable disease, make sure to use a HEPA or N95 mask, gloves, eye protection and gown for personal protection. This information must also be conveyed to the medical facility to which the patient is being transported, so that they may prepare for appropriate isolation.

## Providing Care

As you provide care, make sure to keep patients informed of your actions and protect them from further harm. Be alert to specific signs and symptoms associated with the different types of

weapons. Because of the potentially large numbers of patients who will need care in a short span of time, you may quickly be in a situation where the ratio of patients to providers is much higher than to which you are accustomed.

In the case of mass casualties at a CBRNE scene, you may be faced with multiple scenarios. Each scenario, be it chemical, biological, radiation/nuclear or explosive, will require a different approach to treatment, potential for contamination and other considerations. Treating patients at such a scene is different from any other scene to which you may be called.

Written protocols will address the signs and symptoms associated with each type of WMD and instruct you on the recommended treatment. You must understand the danger each presents and then follow the recommended precautions before entering the scene, as well as how to provide care during and following the response.

You may find that the types of injuries and patients you encounter are similar in nature, due to the effects of the incident. Massive soft tissue wounds and burns are common injuries resulting from explosions or nuclear ignition. Medications may be required to treat patients who have been affected by chemical dispersal.

You may also face unique patient care challenges you would not normally encounter in other emergency situations. For example, you may need to administer high-dose atropine for nerve agents. Also different from usual routines is that patients may remain in your care for much longer than you are used to, and you may need to address their overall needs (nutrition, hydration and personal hygiene).

You may also find it especially difficult to attend to so many patients who are expected to die. While this may not be unusual for EMRs, the difference in the WMD situation is that you may be with patients longer and witness their conditions worsening to the point of death in front of you, without being able to do anything to prevent their deaths. When patients die, you also need to provide isolation and storage until other, living patients have been evacuated from the area.

When carrying out triage, the concept of “greater good” applies. This means that you must treat everyone according to their injury or illness, and not according to who they are; this includes terrorists or criminals.

## PROVIDING SELF-CARE AND PEER CARE FOR NERVE AGENTS

### Poisoning by Nerve Agents

Nerve agents are the most toxic of chemical agents and are hazardous in both their liquid and vapor states. They are potent enough to cause death within minutes after exposure. The clinical effects from nerve agent exposure are caused by excess acetylcholine, a chemical in the brain.

The initial effects of exposure to a nerve agent depend on the dose and route. The routes include inhalation via gas, absorption through the skin, and ingestion from liquids or food. The dose and amount of exposure to the agent work together to cause varying effects.

#### Nerve Agents—Liquid

Exposure to a small droplet of liquid on the skin may produce few physical findings, whereas a large amount causes effects within minutes. Sweating, blanching (whitening of the skin) and occasional muscle twitching at the site may be present soon after exposure of a small amount, but may no longer be present at the onset of GI effects. Signs of a large amount of exposure are the same as after vapor exposure, and these appear within minutes. Commonly there is an asymptomatic period of 1 to 30 minutes before symptoms appear, including loss of consciousness, seizure activity, apnea (periods when breathing stops) and muscular flaccidity (loss of tone). Effects can be delayed for as long as 18 hours after contact with small amounts, and are initially GI related and not life threatening. Generally, the longer symptoms are delayed, the less likely it is that effects from exposure are severe.

#### Nerve Agents—Vapor

Effects from nerve agent vapor begin within seconds to several minutes after exposure. After exposure to a very low amount of vapor, miosis (constriction of the pupil of the eye) and other effects may not begin for several minutes, and miosis may not end for 15 to 30 minutes after the patient is removed from the vapor. Effects may continue to progress for a period of time, but usually not for more than a few minutes after exposure stops. The effects caused by a mild vapor exposure may be easily confused with an upper respiratory illness or even allergies. Miosis, if present, will help to distinguish these. Likewise,

GI symptoms from another illness may be confused with those from nerve agent effects.

When assessing someone who has been exposed to a nerve agent, several potential findings will help you deduce required treatment. Triage as “immediate” if the patient is unconscious, convulsing, breathing with difficulty or has apnea, and is possibly flaccid. Consider a patient “expectant” if the patient shows all of the above symptoms, but has no pulse or blood pressure and is therefore not expected to survive. Categorize as “minimal” a patient who is walking, talking, breathing and whose circulation is intact. Consider the person “delayed” if further medical observation, large amounts of antidotes or artificial ventilation is required after triage.

#### Providing Care

Ventilation is required when patients demonstrate obvious symptoms. In this situation, remove secretions, maintain an open airway, use artificial ventilation if necessary and possible, and repeat atropine immediately as directed.

The means of ventilation depends on the equipment available at the scene. As these patients generally experience bronchoconstriction and lots of secretions, expect high airway resistance (50 to 70 cm of water), which make initial ventilation difficult. Expect a noticeable decrease in resistance after atropine has been administered. Secretions may thicken with atropine and may make ventilation efforts difficult. If this occurs, frequent suctioning is required for up to 3 hours.

Patients whose skin or clothing is contaminated with a liquid nerve agent can contaminate you by direct contact or through off-gasing vapor. Decontamination of the skin is not required after exposure to vapor alone, but clothing should be removed because it may contain “trapped” vapor.

Atropine and **pralidoxime chloride (Protopam Chloride; 2-PAM Cl)** are antidotes for nerve agent toxicity. Pralidoxime must be administered within a short time—between minutes and a few hours following exposure (depending on the specific agent) to be effective.

When the nerve agent has been ingested, exposure may continue for some time, due to slow absorption from the lower bowel, which can result in fatal relapses despite what appears to be an



initial improvement. Continued medical monitoring and transport are mandatory for patients who have ingested a nerve agent.

Decontamination is critical for skin exposure and should be done with standard decontamination procedures. Patient monitoring should be directed to the same signs and symptoms as with all nerve agent exposures. Keep a record of any medications used.

## Nerve Agent Antidote Auto-Injector Kit

There is currently one main nerve agent antidote kit: the DuoDote™. **DuoDote™** is an auto-injector that provides simple, accurate drug administration of a premeasured, controlled dose of medication used to relieve, counteract or reverse the effects of poisons or drugs such as nerve agents.

In 2007, the U.S. Food and Drug Administration (FDA) approved DuoDote™ for use by trained EMS personnel to treat civilians exposed to nerve agents. It contains both atropine and 2-PAM chloride in one auto-injector syringe.

Atropine increases heart rate, dries secretions, decreases gastric upset and dilates pupils. 2-PAM chloride reverses some effects of nerve agent poisoning such as muscle twitching and difficulty breathing.

If you or a peer show signs or symptoms that indicate the presence of nerve agent poisoning, and if you are authorized to do so by medical direction, administer a nerve agent auto-injector kit. If you self-administer the antidote and there is no improvement in 10 minutes, look for a fellow EMR or caregiver at the site to assist in evaluating your condition before further antidote is given. If you are severely ill (e.g., gasping respirations, twitching, etc.), a fellow caregiver should administer the antidote immediately.

Always follow medical direction and the manufacturer's instructions for use of any nerve agent antidote auto-injector.

## Administration of DuoDote™ Kit

1. Tear open the plastic pouch at any of the notches.
2. Remove the DuoDote™ Auto-Injector from the pouch.
3. Place the DuoDote™ Auto-Injector in your writing hand.
4. Firmly grasp the center of the DuoDote™ Auto-Injector with the *green* tip (needle end) pointing down. Do *not* touch the green end.
5. Pull off the *gray* safety release.
6. Quickly and firmly push the green tip straight down (at a 90-degree angle) against the mid-outer thigh. The DuoDote™ Auto-Injector can inject through clothing, but pockets must be empty.
7. Continue to push firmly until you feel the DuoDote™ Auto-Injector trigger.
8. Remove the DuoDote™ Auto-Injector from the thigh and look at the *green* tip. If the needle is *not* visible, the injection has not been made. Check to be sure the *gray* safety release has been removed, and repeat from step 4. You must press hard enough to ensure that the injection has been made.
9. Push the needle against a hard surface to bend the needle back against the DuoDote™ Auto-Injector.
10. Put the used DuoDote™ Auto-Injector back into the plastic pouch. Keep the DuoDote™ Auto-Injector with the patient.

## PUTTING IT ALL TOGETHER

One of the most challenging roles for an EMR is to be called to respond to a disaster, whether an intentional one such as a terrorist attack, possibly using WMD, or a manmade disaster like a hurricane. The only way to respond to such catastrophic events is to be properly trained and prepared to respond.

WMD can be divided into five major categories, collectively referred to as CBRNE: chemical,



### CRITICAL FACTS

If you or a peer show signs or symptoms that indicate the presence of nerve agent poisoning, and if you are authorized to do so by medical direction, administer a nerve agent auto-injector kit.

biological, radiological/nuclear and explosive. Each of these types of weapons has unique characteristics in the nature of the damage it can inflict, the hazards with which they are associated, the signs and symptoms of exposure, and the specific care required to help people involved in the disaster.

In any wide-scale disaster such as these, it is critical to be prepared with sufficient appropriately

trained personnel, equipment and supplies, communication systems and the appropriate protocols, so that all personnel know what to do.

It is important to understand the nature of nerve agents, how they enter the body, and the signs and symptoms they produce. In the event of exposure to poisoning by a nerve agent, you may be required to provide self-care or care to a peer.

## **▶ You Are the Emergency Medical Responder**

There is some question about the cause of the explosion, but police strongly suspect that it was a terrorist act using a WMD, most likely a high-order explosive. While waiting at the staging area, you notice a large trash bag near a dumpster in close proximity to staged apparatus. You should be alert for what other types of situations, and how would you react upon their discovery?

# ENRICHMENT

## Preparing for a Public Health Disaster— Pandemic Flu

Pandemic influenza (or pandemic flu) is virulent human influenza A virus that causes a global outbreak of serious illness in humans. As there is little natural immunity, the disease spreads easily and is sustainable from person to person. In situations where the fatality rate is higher than expected during a normal flu season, this type of influenza virus can seriously impact the nation, affecting and even halting its healthcare delivery system, transportation system, economy and social structure.

As an EMR, your services are in high demand during a public health disaster. Yet you and your unit may be faced with some of the same challenges many businesses and organizations do during such times, such as increased employee absenteeism, disruption of supply chains, and increased rates of illness and death. Both 9-1-1 systems and EMS personnel are well integrated into the nation's pandemic influenza planning, and response is essential to the nation's health and safety in the event of a pandemic.

The National Strategy for Pandemic Influenza identifies responsibilities for federal, state and local governments as well as nongovernmental organizations, businesses and individuals, and is built on three pillars:

- Preparedness and communication: Acts taken before a pandemic to ensure preparedness, and the communication and coordination of roles and responsibilities to all levels of government, segments of society and individuals
- Surveillance and detection: Domestic and international systems set up to detect the earliest warning possible to protect the population
- Response and containment: Actions to limit the spread of the outbreak and to mitigate the health, social and economic impacts of a pandemic

Both EMS and 9-1-1 system planning for pandemic influenza should be carried out in the context of the following phases of pandemic influenza identified by the World Health Organization (WHO) and the U.S. government:

- Early detection
- Treatment with antiviral medications
- The use of infection control measures to prevent transmission
- Vaccination

Interventions used to help contain the spread of the virus include the following:

- Treatment with influenza antiviral medications and isolation of all persons with confirmed or probable pandemic influenza
- Voluntary home quarantine of members of households with confirmed or probable influenza case(s)
- Dismissal of students from school and school-based activities, and closure of childcare programs, coupled with protecting children and teenagers through social distancing in the community
- Use of social distancing measures to reduce contact between adults in the community and workplace, including cancellation of large public gatherings and alteration of workplace environments and schedules to offer a healthy workplace without disrupting essential services

Disease surveillance plays an important role in pandemic influenza mitigation, and both EMS and 9-1-1 systems play a large part in maintaining and collecting patient information such as fever, reporting updated information on an emerging pathogen (e.g., during the SARS epidemic, questions pertaining to foreign travel were pertinent), and identifying probable signs and symptoms of an emerging viral strain.

# ENRICHMENT

## Personal Preparedness

In a disaster or emergency situation, EMRs are likely to be concerned with the well-being of their own families and friends. It is important for their own reassurance, and for the purposes of educating the public, that responders understand how to prepare on an individual basis for disasters. The American Red Cross suggests three basic steps to prepare to respond to a disaster or life-threatening emergency:

1. Get a kit.
2. Make a plan.
3. Be informed.

### Get a Kit

When assembling or restocking your kit, store at least 3 days' worth of food, water and supplies in an easy-to-carry preparedness kit. Keep extra supplies on hand at home in case you cannot leave the affected area. Keep your kit where it is easily accessible. Remember to check your kit every 6 months and replace expired or outdated items.

Whether you purchase an official Red Cross preparedness kit or assemble your own, you should include what you need to provide comfort for everyday scrapes or life-threatening emergencies. A standard preparedness kit should include water, food, medications, radio, first aid kit, personal documents, contact information, map, money, clothing, sanitary supplies, pet supplies and tools.

### Make a Plan

When preparing for a disaster, always talk with your family, plan, and learn how and when to turn off utilities and use lifesaving tools such as fire extinguishers. Tell everyone where emergency information and supplies are stored. Provide copies of the family's preparedness plan to each member of the family. Ensure that information is always up-to-date, and practice evacuations, following the routes outlined in your plan. Identify alternative routes and make sure to include pets in your evacuation plans.

As an element of your preparedness plan, choose an out-of-area contact to call in case of an emergency. Tell all family and friends that this out-of-area contact is the person they should all phone to relay messages. Your contact should live far enough away that the person will not be affected by the disaster. You should also predetermine two meeting places, to save time and minimize confusion: 1) right outside your home, e.g., in cases such as a home fire; and 2) outside your neighborhood or town, for when you cannot return home or you must evacuate.

### Be Informed

In addition to preparing a kit and making a plan, you should also know different ways to get informed, including ways you and your family would get information during a disaster or emergency, learning about the disasters that may occur in your area by knowing your region and learning first aid. Visit the Red Cross website ([redcross.org/get-help/how-to-prepare-for-emergencies](http://redcross.org/get-help/how-to-prepare-for-emergencies)) for information on how to prepare for emergencies.



# 32

## SPECIAL OPERATIONS

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### ▶ You Are the Emergency Medical Responder

You are the emergency medical responder (EMR) at the scene of a construction site cave-in. On arrival, you find a man who was working in an open trench that has collapsed around him to mid-chest level. How would you respond? What are your immediate concerns?



## KEY TERMS

**Confined space:** Any space with limited access that is not intended for continuous human occupancy; has limited or restricted means of entry or exit.

**Distressed swimmer:** A swimmer showing anxiety or panic; often identified as a swimmer who has gone beyond their swimming abilities.

**Drowning:** An event in which a victim experiences respiratory impairment due to submersion in water. Drowning may or may not result in death.

**Drowning victim—active:** Someone who is vertical in the water but has no supporting kick, is unable to move forward and cannot call out for help.

**Drowning victim—passive:** Someone who is not moving and is floating either face-up or face-down, on or near the surface of the water, or is submerged.

**Litter:** A portable stretcher used to carry a patient over rough terrain.

**Non-swimming rescues and assists:** Rescues and assists that can be performed from a pool deck, pier or shoreline by reaching, by using an extremity or object, by throwing a floating object or by standing in the water to provide either of these assists; performed instead of swimming out to the person in distress.

**Rappelling:** The act of descending (as from a cliff) by sliding down a rope passed under one thigh, across the body and over the opposite shoulder or through a special friction device.

**Reaching assist:** A method of rescuing someone in the water by using an object to extend the responder's reach or by reaching with an arm or leg.

**Throwing assist:** A method of rescuing someone in the water by throwing the person a floating object, with or without a line attached.

**Wading assist:** A method of rescuing someone in the water by wading out to the person in distress.

## LEARNING OBJECTIVES

After reading this chapter, and completing the class activities, you will have the information needed to:

- Have a basic understanding of specialized rescue units.
- Recognize the signs of distressed swimmers or drowning victims.
- Be familiar with non-swimming rescues and assists.
- Have a basic understanding of special rescue situations such as ice rescues, hazardous terrain, confined space rescues, cave-ins, crime scenes, fireground operations and special events.

## INTRODUCTION

As an emergency medical responder (EMR), you may be involved in rescues that find you in some precarious and dangerous situations. These situations will require special operations units to assist in the rescue efforts. These units may include:

- The Tactical Emergency Medical Services (EMS) Unit: for situations such as hostage barricades, active shooters, high-risk warrants and other situations requiring a tactical response team.
- The Hazardous Materials (HAZMAT) EMS Response Unit: for situations involving weapons of mass destruction (WMD) and HAZMAT incidents, to provide EMS care to patients in the warm zone, the area immediately outside the hot zone (the area in which the most danger exists).
- The Fire Rehabilitation Unit: to provide “rest, rehydration, nourishment and medical evaluation to members (firefighters) who are involved in extended or extreme incident scene operations” (Source: NFPA 1584).
- The Disaster/Multiple-Casualty Incident (MCI) Response Unit: to support responders at MCIs, major incidents and those responding to other disasters with basic MCI equipment such as caches of backboards, splinting equipment, wound care supplies and IV administration supplies. Equipment also may include multi-patient oxygen delivery systems. This unit also provides services for managing large-scale or special rescue situations.
- The Search and Rescue (SAR) Unit: to support search and rescue operations.

- The Specialized Vehicle Response Unit: to support operations involving all-terrain response vehicles required for difficult-to-reach or hazardous terrains.

## Water Rescue

Some people who drown never intended to be in the water. They may have simply slipped in and did not know what to do. **Drowning** is the fifth most common cause of death from unintentional injury in the United States among all ages, and it rises to the second leading cause of death among those 1 to 14 years of age. More than 3500 Americans die annually from drowning. Children with seizure disorders are 13 times more likely to drown than those without such disorders. Males are more than three times more likely to drown than females.

Younger children can drown at any moment, even in as little as an *inch* of water. Young children commonly drown in home pools. But, children can also drown in many other types of water settings, including drainage canals, irrigation ditches, and even bathtubs, large buckets and toilets.

Alcohol and water do not mix. Drinking alcohol in, on or around water is dangerous. The U.S. Coast Guard reports that more than half of boating-related drowning deaths involve alcohol.

Being able to recognize that an individual is having trouble in the water may help save that person's life. Most people who are drowning cannot or do not call for help. They spend their energy trying to keep their mouth and nose above the water to breathe. They might slip underwater quickly and never resurface. There are two kinds of water emergency situations—a swimmer in distress and a drowning person.

A **distressed swimmer** may be too tired to get to shore or to the side of the pool, but is able to



**Fig. 32-1:** A distressed swimmer is able to stay afloat and breathe, but may be too tired to get to shore or to the side of the pool.

stay afloat and breathe and may be calling for help (Fig. 32-1). The person may be floating, treading water or clinging to an object or a line for support. Someone who is trying to swim but making little or no forward progress may be in distress. Without assistance, a person in distress may lose the ability to float and begin to drown.

A **drowning victim—active** could be at the surface or sinking. They could also be positioned vertically in the water and leaning back slightly. This victim is unlikely to have a supporting kick or the ability to move forward. The person's arms are at the sides, pressing down in an attempt to keep the mouth and nose above water to breathe. All energy is going into the struggle to breathe, and the person cannot call out for help.

A **drowning victim—passive** may have a limp body or convulsive-like movements. They could be floating face-up or face-down on or near the surface, or may be submerged (Fig. 32-2). Table 32-1 shows characteristics of drowning persons.

### **CRITICAL FACTS**

Drowning is the fifth most common cause of death from unintentional injury in the United States among all ages, and it rises to the second leading cause of death among those 1 to 14 years of age. Males are more than three times more likely to drown than females. A victim may have never intended on even being in the water.

Younger children can drown at any moment, even in as little as an *inch* of water. Young children commonly drown in home pools. Children with seizure disorders are 13 times more likely to drown than those without such disorders.

Most people who are drowning spend their energy trying to keep their mouth and nose above the water. Recognizing someone who seems to be having trouble in the water, but is not calling out for help, may help save their life.





**Fig. 32-2:** A drowning victim who is passive is not moving and will be floating face-up or face-down on or near the surface of the water, or may be submerged.

You should not attempt a swimming rescue unless you are trained to do so. Following these steps will help to reduce your risk of drowning:

- Look for a lifeguard to help before attempting a rescue.
- Make sure you have appropriate equipment for your own safety and that of the drowning person.
- Call for additional resources immediately if proper equipment is not available.
- Never swim out to a person unless you have the proper training, skills and equipment.

To be prepared for an aquatic emergency, it is important to understand the environment. Pay attention to the potential hazards that exist and the conditions of the water. Familiarize yourself

Table 32-1:

## Behaviors of Distressed Swimmers and Drowning Victims Compared with Swimmers

	SWIMMER	DISTRESSED SWIMMER	DROWNING VICTIM—ACTIVE	DROWNING VICTIM—PASSIVE
<b>Breathing</b>	Rhythmic breathing	Can continue breathing and might call for help	Struggles to breathe; cannot call out for help	Is not breathing
<b>Arm and Leg Action</b>	Relatively coordinated	Floating, sculling or treading water; might wave for help	Holds arms to sides, alternately moving up and pressing down; has no supporting kick	None
<b>Body Position</b>	Horizontal	Horizontal, vertical or diagonal, depending on means of support	Vertical	Horizontal or vertical; face-up, face-down or submerged
<b>Locomotion (ability to move from place to place)</b>	Recognizable	Makes little or no forward progress; less and less able to support self	None; has only 20 to 60 seconds before submerging	None



### CRITICAL FACTS

There are three types of water-related victims: a distressed swimmer who is too tired to continue but afloat; a drowning victim who is active, vertical but not moving forward; and a drowning victim who is passive, floating or submerged and not moving.

Only those trained in swimming rescues should enter the water to assist with drowning emergencies. For your safety, look for a lifeguard before attempting a rescue, have the appropriate safety equipment, call for additional resources immediately if you do not have that equipment, and only swim out if you have the proper training, skills and equipment.



with the common recreational activities in your area and the potential hazards. Consider the age, ability and physical challenges of participants in those activities, and learn what kinds of local water incidents and injuries are common in your area.

As in any emergency situation, proceed safely. Make sure the scene is safe. If the person is in the water, decide first whether help is needed in order for the person to get out, and then act based on your training. Look for anyone else who may be in trouble. Look for bystanders who can call for help or help you provide first aid.

During the emergency situation, your preparation will allow you to respond quickly; you may only have seconds to act. Your first goal is to stay safe. Rushing into the water to help someone may put you at risk of drowning, too. Once you ensure your own safety, your goal is to help get the person out of the water. If the person is unconscious, send someone to call for more advanced medical personnel while you start the rescue. If the person is conscious, first get the person out of the water and then determine whether more advanced medical personnel are needed.

You can help a person in trouble in the water by using reaching assists, throwing assists or wading assists. Whenever possible, start the rescue by talking to the person. Let the person know help is coming. If noise is a problem or if the person is too far away to hear you, use nonverbal communication strategies. Tell the person what to do to help with the rescue, such as grasping a line, ring buoy or other object that floats. Ask the individual to move toward you, such as by using the back float with slight leg movements or small strokes. Some people reach safety by themselves with the calm and encouraging assistance of someone calling to them.

**Non-swimming rescues and assists** include:

- **Reaching Assists.** Firmly brace yourself on solid ground, such as a pool deck, pier or shoreline, and reach out to the person with any object that will extend your reach, such as a pole, oar or paddle, tree branch, shirt, belt or towel (Fig. 32-3). If no equipment is available, you can still perform a reaching assist by lying down and extending your arm or leg for the person to grab.



**Fig. 32-3:** To perform a reaching assist, firmly brace yourself on solid ground and reach out to the person in need of help with an object that will extend your reach.



**Fig. 32-4:** To perform a throwing assist, throw a floating object with a line out to the person in need of help and pull the individual to safety once they have grasped the object.

- **Throwing Assists.** An effective way to rescue someone beyond your reach is to throw a floating object with a line attached out to the person (Fig. 32-4). Once the person grasps the object, pull the individual to safety. Throwing equipment includes heaving lines, ring buoys,



**CRITICAL  
FACTS**

Non-swimming rescues and assists include reaching, throwing and wading assists. The distance of the victim and the conditions of the water will dictate which method is best.

throw bags or any floating object available, such as a picnic jug, small cooler, buoyant cushion, kickboard or extra life jacket.

- **Wading Assists.** If the water is safe and shallow enough (not over your chest), you can wade in to reach the person. If a current or soft or unknown bottom makes wading dangerous, do *not* go in the water. If possible, wear a life jacket and take something with you to extend your reach such as a ring buoy, buoyant cushion, kickboard, life jacket, tree branch, pole, air mattress, plastic cooler, picnic jug, paddle or water exercise belt.

When the emergency is over, you may need to assist with follow-up procedures that may include:

- Confirming and documenting witness interviews.
- Reporting the incident to the appropriate individuals.
- Filling out proper report forms to document injuries for use in court or for insurance purposes.
- Contacting the patient's family or legal guardian.
- Dealing with the media.
- Assessing what happened and evaluating the actions taken.

Critical incident stress may follow an incident in which a serious injury or death occurs. The stress of the experience may overcome your ability to cope, and some effects of critical incident stress may appear right away while others may follow days, weeks or even months after the incident. Consider seeking professional help in these cases to prevent posttraumatic stress disorder.

## Ice Rescue

In icy water, a person's body temperature begins to drop almost as soon as the body hits the water. The body loses heat in water 32 times faster than it does in the air. Swallowing water accelerates this cooling. As the body's core temperature drops, the metabolic rate drops. Activity in the cells comes to almost a standstill, and the person requires very little oxygen. Any oxygen left in the blood is diverted from other parts of the body to the brain and heart.

If a person falls through the ice, do *not* go onto the ice to attempt a rescue, as it may be too thin to support you. It is your responsibility as a responder to call for an ice rescue team immediately. In the case of a drowning person, always attempt to rescue the person using reaching and throwing assists (Fig. 32-5). Continue talking to the person until the ice rescue team arrives. If you are able to pull the person from the water, provide care for hypothermia.

## HAZARDOUS TERRAIN

Nature can offer many challenges to the EMR when faced with a rescue in hazardous terrain. Whether it is challenging weather conditions or dangerous, rough terrain, special procedures must be in place to help provide safety for both the responder and patient (Fig. 32-6).

One of the challenges you may face is evacuating a patient from a dangerous area where the terrain is rough and difficult to maneuver over. The most common equipment used for this type of rescue is the **litter**, or portable stretcher. Part of the challenge offered by rough terrain evacuation is



**Fig. 32-5:** Use reaching and throwing assists to rescue a drowning person who has fallen through the ice.



**Fig. 32-6:** A rescue in hazardous terrain poses many challenges, and special procedures must be in place to help provide safety for both the responder and patient. *Photo: courtesy of University of Utah, Remote Rescue Training.*



that it takes 18 to 20 people to carry a patient over 1 mile of rough terrain. This is why teams must be selected in groups of four, and to ensure equal balance of the litter, team members should be as close in height as possible. The reason 18 to 20 people are required is to ensure no one on the team overtires. After a short distance, teams should rotate positions, changing sides and positions after each progression. It is then advised that teams alternate, giving each team a chance to rest. This will ensure a safe rescue, without anyone becoming exhausted and unable to complete the evacuation.

Another factor during a hazardous terrain rescue is the position of the patient in relation to the terrain: the more drastic the angle of the terrain, the more risky the rescue. To avoid dropping the patient or falling during the rescue, a rope system can be used to lift or lower the patient on the litter. A high-angle rescue, such as from a cliff, gorge or side of a building, would entail lifting or lowering a patient with these ropes. In severe cases, a high-angle rescue team may be required. These scenarios may include:

- A slope of more than 40 degrees.
- Terrain below and around the slope that poses serious danger for slips and falls.
- Terrain that requires rescue teams to approach and evacuate using a secured rope (**rappelling**).

In the case of a low-angle rescue, a rope may *not* be required. These scenarios would include situations where:

- The slope is less than 40 degrees.
- Approaching or evacuating the patient, hands are *not* required to provide balance.
- Slips or falls would *not* prove life threatening or result in serious injury.

As with any emergency scene, it is your responsibility as a responder to assess the situation and call for the proper rescue team. While waiting for the team to arrive, follow proper procedures, including assessment of the patient as appropriate.

## CONFINED SPACE

Any space with limited access that is not intended for continuous human occupancy is considered a **confined space** (Fig. 32-7). Rescues in confined spaces are usually for falls, explosions, asphyxia, medical problems or machinery entrapment. Confined spaces may be at ground level, above ground or below ground.

Silos used to store agricultural materials are often designed to limit oxygen and, therefore, present the hazard of poisonous gases caused by fermentation



**Fig. 32-7:** Confined spaces include any space with limited access that is not intended for continuous human occupancy. Photo: courtesy of Chief Carle L. Bishop, Clermont Fire Department.



### CRITICAL FACTS

Any space with limited access that is not intended for continuous human occupancy is considered a confined space. Rescues in confined spaces are usually for falls, explosions, asphyxia, medical problems or machinery entrapment. Confined spaces may be at ground level, above ground or below ground.

as well as the danger of engulfment by the contained product in the silo. Grain bins and grain elevators pose the same dangers as silos.

Low oxygen levels in these spaces pose a significant risk, as do poisonous gases such as carbon monoxide, hydrogen sulfide and carbon dioxide. Atmospheres containing other gases also may be explosive.

Below-ground confined spaces, such as underground vaults or utility vaults for water, sewers or electrical power, also can pose situations in which poisonous gases may be present. Electrical vaults pose the added danger of possible electrocution. Wells, culverts and cisterns containing water may also present a high risk of drowning.

Upon arrival at the scene, determine the nature of the emergency and find out if there are any permits for the site so that you can determine the type of work being done. Without entering the site, try to determine how many workers are involved and whether there are any hazards present. Next, call for a specialized rescue team and establish a safe perimeter around the area, preventing anyone from entering. Do *not* enter the scene unless you are sure it is safe. When able, assist in the rescue and offer medical assistance if appropriate.

There are specific safety precautions dictated by the Occupational Safety and Health Administration (OSHA). These guidelines are intended to protect workers who must access confined spaces to perform specific jobs. These safety precautions include requirements for proper ventilation and monitoring for poisonous gases, safely locked electrical systems, dissipated stored energy and disconnected pipes. They also address the use of appropriate respiratory protection for responders, including self-contained breathing apparatus (SCBA) or supplied air breathing apparatus (SABA).

## Cave-Ins

Cave-ins from a trench are associated with particular risk. To prevent cave-ins, OSHA has rules about shoring or making a “trench box” in any

trench deeper than 5 feet, to prevent walls from giving way. If a worker is involved in a cave-in, the person may be buried either completely or partially. If a second worker jumps in to save that person, the worker may cause a secondary collapse and become buried as well.

It is easy to underestimate the danger of being covered in soil, but it weighs about 100 pounds per cubic yard. Buried under only 2 feet of soil may mean a worker is under about 1000 pounds of weight, which can cause respiratory problems if the soil is covering the person’s chest. It is imperative to call a specialized trench team for rescue at a cave-in. Do *not* let anyone enter the trench or the area immediately around it; once there has been a cave-in, the likelihood of a secondary one is increased.

## CRIME SCENE

Law enforcement officers are in charge of a crime scene. It is your responsibility to keep in mind the importance of maintaining the integrity of evidence that can be compromised or destroyed when you enter a crime scene. *Always* consult with police officers before disturbing items that may be evidence of a crime. You must take precautions to avoid disturbing crime scene evidence (e.g., weapons, bloodstains, vehicles, skid marks) or other evidence that can be vital to investigators to reconstruct the crime or incident scene. It is also important not to introduce evidence *into* a crime scene. In all such cases, direction will be provided from the officer in charge and EMRs should *not* take action without permission from law enforcement that it is clear for you to enter, usually with an appropriate escort.

You may be called to one of four types of crime scene situations:

- A closed access to an unsecured crime scene means that a hazard still exists, such as in a hostage situation, when the suspect(s) is still on the scene or environmental hazards are still present.



### CRITICAL FACTS

Cave-ins from a trench are associated with particular risk. To prevent cave-ins, OSHA has rules about shoring or making a “trench box” in any trench deeper than 5 feet, to prevent walls from giving way.

Law enforcement officers are in charge of a crime scene. It is your responsibility to keep in mind the importance of maintaining the integrity of evidence that can be compromised or destroyed when you enter a crime scene.



- A limited-access crime scene means that critical evidence could be destroyed or compromised on the scene and that hazards may still be present, including environmental hazards.
- An open-access crime scene still has evidence to be collected. However, personnel have access to the entire area. It is still necessary to consult with police before disturbing anything, as critical evidence could still be destroyed or compromised.
- A cold crime scene no longer has evidential concerns or hazards present.

As a responder, when you arrive at a scene where criminal activity is suspected, take the following steps:

- Notify law enforcement personnel if they are not already at the scene.
- Take precautions *not* to remove or disturb anything at the scene unless it is absolutely necessary to perform critical patient care.
- Document any situations in which you need to disturb the scene in the interest of patient care.
- In situations where sexual assault is suspected or alleged by the patient, notify law enforcement personnel and do *not* allow the patient to wash, shower or change clothing.
- When removing clothing following gunshot wounds, stabbing or other assaults, if at all possible, do *not* cut clothing through or near the bullet or stab wound holes.
- Allow bloody clothing to dry.
- Avoid allowing blood or debris to contaminate another area or clothing.
- Do *not* roll clothes up in a ball.
- *Never* put wet or bloody clothes in plastic bags.
- Handle clothing as little and as carefully as possible, as powder flakes from gunshot wounds may be present and this may decrease the value of powder-deposit examination.
- Consider bagging the patient's hands if the situation permits, and if required by local protocols.
- Minimize the introduction of evidence into a crime scene. Communicate with law enforcement concerning any items you left behind (such as medical supplies) and if you disturbed anything (such as moving furniture to access a patient).
- Yield to the primary investigative agency on the scene.

## FIREGROUND OPERATIONS

Any fire can be dangerous. Make sure that the local fire department has been summoned. Only firefighters, who are highly trained and use equipment that protects them against fire and smoke, should approach a fire. Do *not* let others approach. Gather information to help the responding fire and EMS units. Find out the possible number of people trapped, their location, the fire's cause and whether any explosives or chemicals are present. Give this information to emergency personnel when they arrive. If you are not trained to fight fires or lack the necessary equipment, follow these basic guidelines:

- Do *not* approach a burning vehicle.
- *Never* enter a burning or smoke-filled building.
- If you are in a building that is on fire, *always* check doors before opening them. If a door is hot to the touch, do *not* open it.
- Since smoke and fumes rise, stay close to the floor (Fig. 32-8).
- *Never* use an elevator in a building that may be burning.



**Fig. 32-8:** If you are in a burning or smoke-filled building, check all doors before opening them. If a door is hot to the touch, do not open it. Stay close to the floor.

As with a crime scene situation and law enforcement personnel, fireground operations always yield to the fire services department to lead and coordinate operations.

Fire departments are uniquely equipped to simultaneously address patients' needs at a fire, including:

- Physical rescue of patients.
- Protection from the dangers posed by a fire.
- Creation of a safe physical environment.

As always, scene safety is the primary objective at every fire rescue. The rapid response times of the fire department offer a crucial advantage to fire-related emergency situations. Most fire departments are equipped with automated defibrillators. They are also equipped to perform rapid multi-faceted response, rapid identification and triage to the appropriate facility.

## SPECIAL EVENTS AND STANDBY

You may be assigned to a special event or be on standby in case there is a need for emergency medical attention. Such events could include major sporting events like the Super Bowl or concerts, large-scale conventions or other national security events (Fig. 32-9). The following general guidelines are for awareness purposes and may vary by state or EMS jurisdiction.

An individual, agency or organization may submit a request for an EMS team to be present at a special event by providing a plan outlining the following information to the appropriate agency:

- The nature of the event and its location, length and anticipated attendance
- The sponsor of the event
- The qualifications of the special event supervisory physician and the special event EMS incident commander, as well as their names
- The number of emergency medical personnel involved and their qualifications
- The type and quantity of emergency medical vehicles, equipment and supplies required, in accordance with the anticipated number of participants or spectators
- A description of the on-site treatment facilities, including maps of the special event site
- The level of care to be provided: basic life support (BLS), advanced life support (ALS) or both
- Patient transfer protocols and agreements
- A description of the special event emergency medical communications capabilities
- Plans for educating event attendees regarding EMS system access, specific hazards or severe weather
- Measures that will be taken to coordinate EMS care for the special event with local emergency services and public safety agencies



**Fig. 32-9:** As an EMR, you may be assigned to be on standby at a special event in case there is a need for emergency medical attention. *Photo: courtesy of Captain Phil Kleinberg, EMT-P.*

A special event EMS incident commander must be assigned at a special event to supervise the EMS team during the event. The director's responsibilities include:

- Preparation of the plan.
- Management of the delivery of special event EMS care.
- Ensuring implementation and coordination of details contained in the special event EMS plan.

The special event EMS incident commander must be experienced in the administration and management of prehospital care at the BLS or ALS level. This person must possess experience in the medical supervision of prehospital care at the BLS or ALS level.

The required staff, qualifications and equipment for a special event are as follows:

- Special event emergency medical staff shall be certified at BLS or ALS levels.
- The number of staffed, licensed ambulances or other transport vehicles required to be stationed on-site are as follows:
  - One ambulance for known or expected populations of 5000 to 25,000 participants
  - Two ambulances for more than 25,000 but less than 55,000 participants
  - Three ambulances for more than 55,000 participants
  - Personnel must be available to care for special event spectators or participants within 10 minutes of notification of the need for emergency care.
  - EMS personnel must be currently certified at the ambulance attendant, emergency medical responder, emergency medical technician (EMT), advanced EMT, paramedic or healthcare provider level.

A special event where more than 25,000 participants or spectators are expected requires an on-site treatment facility, providing protection from weather or other elements to ensure patient safety and comfort. Beds and equipment for at least four simultaneous patients must be provided for evaluation and treatment, with adequate lighting and ventilation. A special event EMS system must also have on-site communication capabilities, to ensure uniform access to care for patients in need of EMS care; on-site coordination of the activities of EMS personnel; communication with existing community public safety answering

points (PSAPs); and interface with other involved public safety agencies. Receiving facilities and ambulances providing emergency transportation must also be ensured.

The sponsoring agency is responsible for the implementation of the plan and must ensure participants and spectators are aware of the following:

- The location of EMS providers at the special event
- How to obtain emergency medical care at the special event
- The procedure in the case of specific hazards or serious changing conditions, such as severe weather

## PUTTING IT ALL TOGETHER

As with all calls, the main focus of a special operations situation is to remember your safety and the safety of the patient. Calling the proper service to assist in the rescue will contribute to the success of the rescue efforts.

Use reaching and throwing assists when attempting to retrieve a patient from water. Remember *never* to enter fast-moving water, and to tether yourself or any rescue craft you may be using in the rescue attempts. Watch for signs of a distressed swimmer and an actively or a passively drowning victim when sizing up the scene. When attempting ice rescues, remember the dangers thin ice can pose and the added consideration of how hypothermia can affect a person's ability to grasp rescue equipment.

Confined space situations pose different dangers during a rescue. The presence of gases, engulfment and possible drowning or electrocution can all be factors, depending on the nature of the space.

The physical demands of litter rescue from hazardous terrain can require as many as 20 responders to ensure the safe evacuation of a patient. The slope of the area can also pose challenges and, in high-angle situations, a special team is required to evacuate patients.

When approaching a crime scene, remember that law enforcement personnel on the scene are in charge. *Always* obtain permission to enter the scene and, when attending to victims of a crime, ensure that the scene is left as undisturbed as possible. If

you are first on the scene, call for assistance and attend to the patient as best you can.

Management of fireground operations must be passed on to the fire rescue team. *Never* enter a burning structure or vehicle. *Always* call for the fire department when danger of fire exists, or whenever a team has not already been called.

Finally, when attending a special event, remember to receive direction from the special event EMS director and keep in mind that a special event emergency supervisory physician will be present to assist in case of a serious medical emergency. The number of staffed, licensed ambulance requirements stationed on-site is dictated by the number of spectators or participants at the event.

## **You Are the Emergency Medical Responder**

You find that the patient is conscious but appears to be in respiratory distress from the compression of the soil surrounding him. What are your treatment priorities? What kind of additional support will you need, and what are some special safety considerations you must consider in order to rescue this patient?



# Glossary

**Abandonment:** Ending the care of an injured or ill person without obtaining that patient's consent or without ensuring that someone with equal or greater training will continue care.

**Abrasion:** The most common type of open wound; characterized by skin that has been rubbed or scraped away.

**Abruptio placentae:** Placental abruption; a life-threatening emergency that occurs when the placenta detaches from the uterus.

**Absence seizure:** A type of generalized seizure in which there are minimal or no movements; patient may appear to have a blank stare; also known as a petit mal or nonconvulsive seizure.

**Absorbed poison:** A poison that enters the body through the skin.

**Access:** Reaching a patient who is trapped in a motor vehicle or a dangerous situation, for the purpose of extrication and providing medical care.

**Acute:** Having a rapid and severe onset, then quickly subsiding.

**Acute abdomen:** The sudden onset of severe abdominal pain that may be related to one of many medical conditions or a specific injury to the abdomen.

**Acute coronary syndrome (ACS):** Term that describes a range of clinical conditions, including unstable angina and myocardial infarction, that are due to insufficient blood supply to the heart muscle resulting from coronary heart disease (CHD).

**Acute myocardial ischemia:** An episode of chest pain due to reduced blood flow to the heart muscle.

**Adaptive immunity:** The type of protection from disease that the body develops throughout a lifetime as a person is exposed to diseases or immunized against them.

**Addiction:** The compulsive need to use a substance; stopping use would cause the user to suffer mental, physical and emotional distress.

**Adult:** For the purpose of providing emergency medical care, anyone who appears to be approximately 12 years old or older.

**Adult respiratory distress syndrome (ARDS):** A lung condition in which trauma to the lungs leads to inflammation, accumulation of fluid in the alveolar air sacs, low blood oxygen and respiratory distress.

**Advance directive:** A written instruction, signed by the patient and a physician, that documents a patient's wishes if the patient is unable to communicate their wishes.

**Advanced emergency medical technician (AEMT):** A person trained to give basic and limited advanced emergency medical care and transportation for critical and emergent patients who access the emergency medical services (EMS) system.

**Agonal breaths:** Isolated or infrequent gasping in the absence of normal breathing in an unconscious person; can occur after the heart has stopped beating. Agonal breaths are not normal breathing and are considered a sign of cardiac arrest.

**AIDS:** A disease of the immune system caused by infection with HIV.

**Air medical transport:** A type of transport to a medical facility or between medical facilities by helicopter or fixed-wing aircraft.

**Air splint:** A hollow, inflatable splint for immobilizing a part of the body.

**Airway:** The pathway for air from the mouth and nose through the pharynx, larynx and trachea and into the lungs.

**Airway adjunct:** A mechanical device used to help keep the tongue from obstructing the airway; can be either nasal or oral.

**All-hazards approach:** An approach to disaster readiness that involves the capability of responding to any type of disaster with a range of equipment and resources.

**Altered mental status:** A disturbance in a patient's level of consciousness (LOC) including confusion and delirium; causes include injury, infection, poison, drug abuse and fluid/electrolyte imbalance.

**Alzheimer's disease:** The most common type of dementia in older people, in which thought, memory and language are impaired.

**Amniotic fluid:** The fluid in the amniotic sac; bathes and protects the fetus.

**Amniotic sac:** “Bag of waters”; sac that encloses the fetus during pregnancy and bursts during the birthing process.

**Amputation:** The complete removal or severing of an external body part.

**Anabolic steroid:** A drug sometimes used by athletes to enhance performance and increase muscle mass; also has medical use in stimulating weight gain for people unable to gain weight naturally.

**Anaphylaxis:** A form of distributive shock caused by an often sudden severe allergic reaction, in which air passages may swell and restrict breathing; also referred to as anaphylactic shock.

**Anatomic splint:** A splint formed by supporting an injured part of the body with an uninjured, neighboring body part; for example, splinting one finger against another; also called a self-splint.

**Anatomy:** The study of structures, including gross anatomy (structures that can be seen with the naked eye) and microscopic anatomy (structures seen under the microscope).

**Aneurysm:** An abnormal bulging of an artery due to weakness in the blood vessel; may occur in the aorta (main artery of the heart), brain, leg or other location.

**Angina pectoris:** Pain in the chest that comes and goes at different times; caused by a lack of oxygen reaching the heart; can be stable (occurring under exertion or stress) or unstable (occurring at rest, without reason).

**Angulation:** An angular deformity in a fractured bone.

**Ankle drag:** A method of moving a patient by grasping the patient’s ankles; also known as the foot drag.

**Antibodies:** A type of protein found in blood or other bodily fluids; used by the immune system to identify and neutralize pathogens, such as bacteria and viruses.

**Antidote:** A substance that counteracts and neutralizes the effects of a poison.

**Antihistamine:** A type of drug taken to treat allergic reactions.

**Anti-inflammatory drug:** A type of drug taken to reduce inflammation or swelling.

**Antivenom:** A substance used to counteract the poisonous effects of venom.

**Anxiety disorder:** A condition in which normal anxiety becomes excessive and can prevent people from functioning normally; types include generalized anxiety disorder, obsessive-compulsive disorder, panic disorder, post-traumatic stress disorder, phobias and social-anxiety disorder.

**APGAR score:** A mnemonic that describes five measures used to assess the newborn: Appearance, Pulse, Grimace, Activity and Respiration.

**Aphasia:** A disorder characterized by difficulty or inability to produce or understand language, caused by injury to the areas of the brain that control language.

**Apnea:** A condition that causes breathing to stop periodically or be significantly reduced.

**Apparent life-threatening event (ALTE):** A sudden event in infants under the age of 1 year, during which the infant experiences a combination of symptoms including apnea, change in color, change in muscle tone and coughing or gagging.

**Applied ethics:** The use of ethics in decision making; applying ethical values.

**Arrhythmia:** Electrical disturbances in the regular rhythmic beating of the heart.

**Arterial gas embolism:** A condition in which air bubbles enter the bloodstream and subsequently travel to the brain; results from a rapid ascent from deep water, which expands air in the lungs too quickly.

**Arteries:** Large blood vessels that carry oxygen-rich blood from the heart to all parts of the body, except for the pulmonary arteries, which carry oxygen-poor blood from the heart to the lungs.

**Artificial ventilation:** A mechanical means used to assist breathing, such as with a bag-valve-mask (BVM) resuscitator or resuscitation mask.

**Asperger syndrome:** A disorder on the autism spectrum; those with Asperger syndrome have a milder form of the disorder.

**Aspiration:** To take, suck or inhale blood, vomit, saliva or other foreign material into the lungs.

**Assault:** A crime that occurs when a person tries to physically harm another in a way that makes the person under attack feel immediately threatened.

**Asthma:** An ongoing condition in which the airways swell; the air passages can become constricted or blocked when affected by various triggers.

**Asthma attack:** The sudden worsening of asthma signs and symptoms, caused by inflammation of the airways and the tightening of muscles around the airways of a person with asthma, making breathing difficult.

**Asthma trigger:** Anything that sets off an asthma attack, such as animal dander, dust, smoke, exercise, stress or medications.

**Asymptomatic:** A situation in which a patient has no symptoms.

**Asystole:** A condition where the heart has stopped generating electrical activity.

**Atherosclerosis:** A condition in which deposits of plaque, including cholesterol (a fatty substance made by the liver and found in foods containing animal or animal products) build up on the inner walls of the arteries, causing them to harden and narrow, reducing the amount of blood that can flow through; develops gradually and can go undetected for many years.

**Atrial fibrillation:** Irregular and fast electrical discharges from the left or right atrium of the heart that lead to an irregular heartbeat; one of the most common types of abnormal cardiac rhythm.

**Atrioventricular (AV) node:** A cluster of cells in the center of the heart, between the atria and ventricles; serves as a relay to slow down the signal received from the sinoatrial (SA) node before it passes through to the ventricles.

**Atropine:** An anticholinergic drug with multiple effects; used in antidotes to counteract the effects of nerve agents and to counter the effects of organophosphate (chemical compounds found in many common insecticides and used to produce toxic nerve agents, such as sarin) poisoning.

**Audible warning devices:** Devices in an emergency vehicle to warn oncoming and side traffic of the vehicle's approach; includes both sirens and air horns.

**Aura phase:** The first stage of a generalized seizure, during which the patient experiences perceptual disturbances, often visual or olfactory in nature.

**Auscultation:** Listening to sounds within the body, typically through a stethoscope.

**Autism spectrum disorder (ASD):** A group of disorders characterized by some degree of impairment in communication and social interaction as well as repetitive behaviors.

**Automated external defibrillator (AED):** A portable electronic device that analyzes the heart's electrical rhythm and, if necessary, can deliver an electrical shock to a person in cardiac arrest.

**AVPU:** Mnemonic describing the four levels of patient response: Alert, Verbal, Painful and Unresponsive.

**Avulsion:** An injury in which a portion of the skin, and sometimes other soft tissue, is partially or completely torn away.

**Backboard:** A piece of equipment used to secure a patient when extricating them from the scene and moving them to a stretcher for transport.

**Bacteria:** One-celled organisms that can cause infection; a common type of pathogen.

**Bag-valve-mask (BVM) resuscitator:** A handheld breathing device consisting of a self-inflating bag, a one-way valve and a face mask; can be used with or without supplemental oxygen.

**Bandage:** Material used to wrap or cover a part of the body; commonly used to hold a dressing or splint in place.

**Bandage compress:** A thick gauze dressing attached to a gauze bandage.

**Barotrauma:** Injury sustained because of pressure differences between areas of the body and the surrounding environment; most commonly occurs in air travel and SCUBA diving.

**Battery:** A crime that occurs when there is unlawful touching of a person without the person's consent.

**Behavior:** How people conduct themselves or respond to their environment.

**Behavioral emergency:** A situation in which a person exhibits abnormal behavior that is unacceptable or intolerable, for example violence to oneself or others.

**Bereavement care:** Care provided to families during the period of grief and mourning surrounding a death.

**Binder:** A cloth wrapped around a patient to securely hold the arm against the patient's chest to add stability; also called a swathe.

**Biohazard:** A biological agent that presents a hazard to the health or well-being of those exposed.

**Bioterrorism:** The deliberate release of agents typically found in nature, such as viruses, bacteria and other pathogens, to cause illness or death in people, animals or plants.

**Bipolar disorder:** A brain disorder that causes abnormal, severe shifts in mood, energy and a person's ability to function; the person swings from the extreme lows of depression to the highs of mania; also called manic-depressive disorder.

**Birth canal:** The passageway from the uterus to the outside of the body through which a baby passes during birth.

**Blanket drag:** A method of moving a patient, using a blanket, in an emergency situation where equipment is limited and the patient is suspected of having a head, neck or spinal injury.

**Blast injury:** An injury caused by an explosion; may occur because of the energy released, the debris, or the impact of the person falling against an object or the ground.

**Blast lung:** Sometimes referred to as lung blast; the most common fatal primary blast injury, describing damage to the lungs caused by the over-pressurization wave from high-order explosives.

**Bleeding:** The loss of blood from arteries, veins or capillaries.

**Bloodborne:** Used to describe a substance carried in the blood (e.g., bloodborne pathogens are pathogens carried through the blood).

**Bloodborne pathogens:** Infectious microorganisms that are present in human blood or other potentially infectious materials (OPIM) and can cause disease in humans.

**Blood glucose level (BGL):** The level of glucose circulating in the blood; measured using a glucometer.

**Blood pressure (BP):** The force exerted by blood against the blood vessel walls as it travels throughout the body.

**Blood volume:** The total amount of blood circulating within the body.

**Bloody show:** Thick discharge from the vagina that occurs during labor as the mucous plug (mucus with pink or light red streaks) is expelled; often signifies the onset of labor.

**Blunt trauma:** An injury in which a person is struck by or falls against a blunt object such as a steering wheel or dashboard, resulting in an injury that does not penetrate the body, may not be evident, and may be more widespread and serious than suspected.

**B NICE:** An acronym for the five main types of terrorist weapons: biological contamination, nuclear detonation, incendiary fires, toxic chemical release and conventional explosions.

**Body mechanics:** The field of physiology that studies muscular actions and the function of the muscles in maintaining posture.

**Body substance isolation (BSI) precautions:** Protective measures to prevent exposure to communicable diseases; these precautions define all body fluids and substances as infectious.

**Body system:** A group of organs and other structures that works together to carry out specific functions.

**Bone:** A dense, hard tissue that forms the skeleton.

**Brachial artery:** The main artery of the upper arm; runs from the shoulder down to the bend of the elbow.

**Braxton Hicks contractions:** False labor; irregular contractions of the uterus that do not intensify or become more frequent as genuine labor contractions do.

**Breathing emergency:** An emergency in which breathing is impaired; can become life threatening; also called a respiratory emergency.

**Breathing rate:** Term used to describe the number of breaths per minute.

**Breech birth:** The delivery of a baby's feet or buttocks first.

**Bulb syringe:** Small nasal syringe to remove secretions from the newborn's mouth and nose.

**Burn:** An injury to the skin or other body tissues caused by heat, chemicals, electricity or radiation.

**Cannabis products:** Substances such as marijuana and hashish that are derived from the *Cannabis sativa* plant; can produce feelings of elation, distorted perceptions of time and space, and impaired motor coordination and judgment.



**Capillaries:** Tiny blood vessels linking arteries and veins that transfer oxygen and other nutrients from the blood to all body cells and remove waste products.

**Capillary refill:** A technique for estimating how the body is reacting to injury or illness by checking the ability of the capillaries to refill with blood.

**Carbon monoxide (CO):** An odorless, colorless, toxic gas produced as a byproduct of combustion.

**Cardiac arrest:** A condition in which the heart has stopped or beats too irregularly or weakly to pump blood effectively.

**Cardiac Chain of Survival:** A set of five critical steps that, when performed in rapid succession, increase the patient's chance of surviving cardiac arrest; each link of the chain depends on, and is connected to, the other links.

**Cardiac muscle:** A specialized type of muscle found in the heart.

**Cardiogenic shock:** The result of the heart being unable to supply adequate blood circulation to the vital organs, resulting in an inadequate supply of nutrients; caused by trauma or disease.

**Cardiopulmonary resuscitation (CPR):** A technique that combines chest compressions and ventilations to circulate blood containing oxygen to the brain and other vital organs for a person whose heart and normal breathing have stopped.

**Cardiovascular disease:** A disease affecting the heart and blood vessels.

**Carotid artery:** The major artery located on either side of the neck that supplies blood to the brain.

**Catastrophic reaction:** A reaction a person experiences when the person has become overwhelmed; signs include screaming, throwing objects and striking out.

**CBRNE:** The current acronym used by the Department of Homeland Security to describe the main types of weapons of mass destruction: chemical, biological, radiological/nuclear and explosive.

**Cells:** The basic units that combine to form all living tissue.

**Cerebrospinal fluid:** A clear fluid that flows within the ventricles of the brain, and around the brain and spinal cord.

**Certification:** Certification is achieved by obtaining and maintaining the National EMS Certification (or state certification), taking an approved EMS course and meeting other requirements; this does not grant the right to practice as licensure may in some states.

**Cervical collar:** A commercially produced rigid device that is positioned around the neck to limit movement of the head and neck; also called a C-collar.

**Cervix:** The lower, narrow part of the uterus (womb) that forms a canal that opens into the vagina, which leads to the outside of the body; upper part of the birth canal.

**Cesarean section:** C-section; delivery of a baby through an incision in the mother's belly and uterus.

**Chemical burn:** A burn caused by strong, caustic chemicals damaging the skin.

**Chest compressions:** A technique used in CPR in which external pressure is placed on the chest to help circulate oxygen-rich blood through the arteries and to the vital organs.

**Chest tube:** A tube surgically inserted into the chest to drain blood, fluid or air, and to allow the lungs to expand.

**Chief complaint:** A brief description, usually in the patient's own words, of why emergency medical services (EMS) personnel were called to the scene.

**Child:** For the purpose of providing emergency medical care, anyone who appears to be between the ages of about 1 year and about 12 years; when using an automated external defibrillator (AED), different age and weight criteria are used.

**Child abuse:** Action that results in the physical or psychological harm of a child; can be physical, sexual, verbal and/or emotional.

**Child neglect:** The most frequently reported type of abuse in which a parent or guardian fails to provide the necessary, age-appropriate care to a child; insufficient medical or emotional attention or respect given to a child.

**Chocking:** The use of items such as wooden blocks placed against the wheels of a vehicle to help stabilize it.

**Cholesterol:** A fatty substance made by the liver and found in foods containing animal or animal products; diets high in cholesterol contribute to the risk of heart disease.

**Chronic:** Persistent over a long period of time.

**Chronic diseases:** Diseases that occur gradually and continue over a long period of time.

**Chronic obstructive pulmonary disease (COPD):** A progressive lung disease in which the patient has difficulty breathing because of damage to the lungs; airways become obstructed and the alveolar sacs lose their ability to fill with air.

**Circulatory system:** A group of organs and other structures that carries oxygen-rich blood and other nutrients throughout the body and removes waste.

**Circumferential splint:** A type of splint that surrounds or encircles an injured body part.

**Clinical depression:** A mood disorder in which feelings of sadness, loss, anger or frustration interfere with everyday life for an extended period of time.

**Clonic phase:** The third phase of a generalized seizure, during which the patient experiences the seizure itself.

**Closed fracture:** A type of fracture in which the skin over the broken bone is intact.

**Closed-loop communication:** A communication technique in which the listener repeats orders word for word to ensure the message was heard and understood accurately.

**Closed wound:** A wound in which soft tissue damage occurs beneath the skin and the skin is not broken.

**Clothes drag:** A type of emergency move that uses the patient's clothing; used for a patient suspected of having a head, neck or spinal injury.

**Clotting:** The process by which blood thickens at a wound site to seal an opening in a blood vessel and stop bleeding.

**Cognitive impairment:** Impairment of thinking abilities including memory, judgment, reasoning, problem solving and decision making.

**Cold zone:** Also called the support zone, this area is the outer perimeter of the zones most directly affected by an emergency involving hazardous materials.

**Comotio cordis:** Sudden cardiac arrest from a blunt, non-penetrating blow to the chest, of which the basis is ventricular fibrillation (V-fib) triggered by chest wall impact immediately over the heart.

**Communications center (dispatch):** The point of contact between the public and responders (also known as a public safety answering point, or PSAP); responsible for taking basic information from callers and dispatching the appropriate personnel; in some communities it may also provide prearrival instructions to the 9-1-1 caller.

**Compartment syndrome:** Condition in which there is swelling and an increase in pressure within a limited space that presses on and compromises blood vessels, nerves and tendons that run through that limited space; usually involves the leg, forearm, arm, thigh, shoulder or buttock.

**Competence:** The patient's ability to understand the emergency medical responder's (EMR's) questions and the implications of decisions made.

**Complex access:** In an extrication, the process of using specialized tools or equipment to gain access to the patient.

**Complex partial seizure:** A type of partial seizure in which the patient may experience an altered mental status or be unresponsive.

**Concussion:** A temporary loss of brain function caused by a blow to the head; considered a traumatic brain injury (TBI).

**Conduction:** One of the ways the body loses or gains heat; occurs when the skin is in contact with something with a lower or higher temperature.

**Confidentiality:** Protection of a patient's privacy and personal information.

**Confined space:** Any space with limited access that is not intended for continuous human occupancy; has limited or restricted means of entry or exit.

**Congestive heart failure:** A chronic condition in which the heart no longer pumps blood effectively throughout the body.

**Consent:** Permission to provide care; given by an injured or ill person to a responder.

**Contraction:** During labor, the rhythmic tightening and relaxing of muscles of the uterus.

**Contusion:** An injury to the soft tissues that results in blood vessel damage (usually to capillaries) and leakage of blood into the surrounding tissues; caused when blood vessels are damaged or broken as the result of a blow to the skin, resulting in swelling and a reddish-purple discoloration on the skin; commonly referred to as a bruise.

**Convection:** One of the ways the body loses or gains heat; occurs when air moves over the skin and carries away or increases heat.

**Core temperature:** The temperature inside the body.

**Coronary heart disease (CHD):** A disease in which cholesterol and plaque build up on the inner walls of the arteries that supply blood to the heart; also called coronary artery disease (CAD).

**CPR breathing barrier:** Device that allows for ventilations without direct mouth-to-mouth contact between the responder and the patient; includes resuscitation masks, face shields and bag-valve-mask (BVM) resuscitators.

**Crackles:** An abnormal fine, crackling breath sound on inhalation that may be a sign of fluid in the lungs; also known as rales.

**Cravat:** A folded triangular bandage used to hold splints in place.

**Crepitus:** A grating or popping sound under the skin that can be due to a number of causes, including two pieces of bone rubbing against each other.

**Cribbing:** A system using wood or supports, arranged diagonally to a vehicle's frame, to safely prop it up, creating a stable environment.

**Cricoid:** A solid ring of cartilage just below and behind the thyroid cartilage.

**Critical burn:** Any burn that is potentially life threatening, disabling or disfiguring; a burn requiring advanced medical care.

**Critical incident stress:** Stress triggered by involvement in a serious or traumatic incident.

**Croup:** A common upper airway virus that affects children under the age of 5.

**Crowning:** The phase during labor when the baby's head is visible at the opening of the vagina.

**Crush injury:** An injury to a body part, often an extremity, caused by a high degree of pressure; may result in serious damage to underlying tissues and cause bleeding, bruising, fracture, laceration and compartment syndrome.

**Cyanosis:** A condition in which the patient's skin, nail beds and mucous membranes appear a bluish or greyish color because of insufficient levels of oxygen in the blood.

**Cyanotic:** Showing bluish discoloration of the skin, nailbeds and mucous membranes due to insufficient levels of oxygen in the blood.

**DCAP-BTLS:** A mnemonic to help remember the signs to look for during a physical exam, which is often done during the secondary assessment; the initials stand for deformities, contusions, abrasions, punctures/penetrations, burns, tenderness, lacerations and swelling.

**Deadspace:** The areas within the respiratory system between the pharynx and the alveoli that contain a small amount of air that does not reach the alveoli.

**Deafness:** The loss of the ability to hear from one or both ears; can be mild, moderate, severe or profound, and can be inherited, occur at birth or be acquired at a later point in life, due to illness, medication, noise exposure or injury.

**Deceased/non-salvageable/expectant (Black):** A triage category of those involved in a multiple- (or mass-) casualty incident (MCI) who are obviously dead or who have suffered non-life-sustaining injuries.

**Decompression sickness:** A sometimes fatal disorder caused by the release of gas bubbles into body tissue; also known as "the bends"; occurs when SCUBA divers ascend too rapidly, without allowing sufficient time for gases to exit body tissues and be removed through exhalation.

**Defibrillation:** An electrical shock that disrupts the electrical activity of the heart long enough to allow the heart to spontaneously develop an effective rhythm on its own.

**Dehydration:** Inadequate fluids in the body's tissues.

**Delayed care (Yellow):** A triage category of those involved in an MCI with an injury, but whose chances of survival will not be reduced by a delay.

**Dementia:** A collection of symptoms caused by any of several disorders of the brain; characterized by significantly impaired intellectual functioning that interferes with normal activities and relationships.

**Dependency:** The desire or need to continually use a substance.

**Depressant:** A substance that affects the central nervous system and slows down physical and mental activity; can be used to treat anxiety, tension and high blood pressure.

**Dermis:** The deeper layer of the skin; contains the nerves, sweat glands, oil glands and blood vessels.

**Designer drugs:** Potent and illegal street drugs formed from a medicinal substance whose drug composition has been modified (designed).

**Detailed physical exam:** An in-depth head-to-toe physical exam; takes more time than the rapid assessment, and is only done when time and the patient's condition allow.

**Diabetes mellitus:** A disease in which there are high levels of blood glucose due to defects in insulin production, insulin action or both.

**Diabetic coma:** A life-threatening complication of diabetes in which very high blood sugar causes the patient to become unconscious.

**Diabetic emergency:** A situation in which a person becomes ill because of an imbalance of insulin and sugar in the bloodstream.

**Diabetic ketoacidosis (DKA):** An accumulation of organic acids and ketones (waste products) in the blood; occurs when there is inadequate insulin and high blood sugar levels.

**Diastolic blood pressure:** The force exerted against the arteries when the heart is between contractions, or at rest.

**Digestive system:** A group of organs and other structures that digests food and eliminates wastes.

**Dilation:** The process of enlargement, stretching or expansion; used to describe blood vessels. During the first stage of labor, refers to the opening of the cervix to allow the baby to be born.

**Direct carry:** A method of moving a patient from a bed to a stretcher or vice versa; performed by two responders.

**Direct contact:** Mode of transmission of pathogens that occurs through directly touching infected blood or OPIM, or other agents such as chemicals, drugs or toxins.

**Direct force:** A force that causes injury at the point of impact.

**Direct ground lift:** A nonemergency method of lifting a patient directly from the ground; performed by several responders.

**Direct medical control:** A type of medical direction, also called "on-line," "base-station," "immediate" or "concurrent medical control"; under

this type of medical direction, the physician speaks directly with emergency care providers at the scene of an emergency.

**Direct pressure:** Pressure applied on a wound to control bleeding.

**Disease-causing agent:** A pathogen or germ that can cause disease or illness (e.g., a bacterium or virus).

**Dislocation:** The displacement of a bone from its normal position at a joint.

**Dispatcher:** Personnel trained in taking critical information from emergency callers and call takers and relaying it to the appropriate rescue personnel.

**Distressed swimmer:** A swimmer showing anxiety or panic; often identified as a swimmer who has gone beyond their swimming abilities.

**Distributive shock:** A type of shock caused by inadequate distribution of blood, either in the blood vessels or throughout the body, leading to inadequate volumes of blood returning to the heart.

**Do no harm:** The principle that people who intervene to help others must do their best to ensure their actions will do no harm to the patient.

**Do not resuscitate (DNR) order:** A type of advance directive that protects a patient's right to refuse efforts for resuscitation; also known as a "do not attempt resuscitation (DNAR) order."

**DOTS:** A mnemonic to help remember what to look for during the physical exam; the initials stand for deformities, open injuries, tenderness and swelling.

**Draw sheet:** A method of moving a patient from a bed to a stretcher or vice versa by using the stretcher's bottom sheet.

**Dressing:** A pad placed directly over a wound to absorb blood and other body fluids and to prevent infection.

**Droplet transmission:** Mode of transmission of pathogens that occurs when a person inhales droplets from an infected person's cough or sneeze; also known as respiratory droplet transmission.

**Dropping:** "Engagement" or "lightening"; when the baby drops into a lower position and is engaged in the mother's pelvis; usually takes place a few weeks before labor begins.



**Drowning:** An event in which a victim experiences respiratory impairment due to submersion in water. Drowning may or may not result in death.

**Drowning victim—active:** Someone who is vertical in the water but has no supporting kick, is unable to move forward and cannot call out for help.

**Drowning victim—passive:** Someone who is not moving and is floating either face-up or face-down, on or near the surface of the water, or is submerged.

**Drug:** Any substance, other than food, intended to affect the functions of the body.

**DuoDote™:** A kit with pre-measured doses of antidote used to counteract the effects of nerve agents.

**Durable power of attorney for healthcare:** A legal document that expresses a patient's specific wishes regarding their healthcare; also empowers an individual, usually a relative or friend, to speak on behalf of the patient should they become seriously injured or ill and unable to speak for themselves.

**Duty to act:** A legal responsibility of some individuals to provide a reasonable standard of emergency care.

**Eclampsia:** A complication during pregnancy in which the patient has convulsions or seizures associated with high blood pressure.

**Ectopic pregnancy:** A pregnancy outside of the uterus; most often occurs in the fallopian tubes.

**Edema:** Swelling in body tissues caused by fluid accumulation.

**Elastic bandage:** A bandage designed to keep continuous pressure on a body part; also called an elastic wrap.

**Elder abuse:** Action that results in the physical or psychological harm of an older adult; can be physical, sexual, verbal and/or emotional, usually on someone who is disabled or frail.

**Elder neglect:** A type of abuse in which a caregiver fails to provide the necessary care to an older adult.

**Electrical burn:** A burn caused by contact with an electrical source, which allows an electrical current to pass through the body.

**Electrocardiogram (ECG or EKG):** A diagnostic test that measures and records the electrical activity of the heart.

**Electrolytes:** Substances that are electrically conductive in solution and are essential to the regulation of nerve and muscle function and fluid balance throughout the body; include sodium, potassium, chloride, calcium and phosphate.

**Embolism:** A blockage in an artery or a vein caused by a blood clot or fragment of plaque that travels through the blood vessels until it gets stuck, preventing blood flow.

**Embryo:** The term used to describe the early stage of development in the uterus, from fertilization to the beginning of the third month.

**Emergency medical dispatcher (EMD):** A telecommunicator who has received special training for triaging a request for medical service and allocating appropriate resources to the scene of an incident, and for providing prearrival medical instructions to patients or bystanders before more advanced medical personnel arrive.

**Emergency medical responder (EMR):** A person trained in emergency care who may be called on to give such care as a routine part of their job (paid or volunteer) until more advanced emergency medical services (EMS) personnel take over; EMRs are often the first trained professionals to respond to emergencies.

**Emergency medical services (EMS) system:** A network of community resources and medical personnel that provides emergency medical care to people who are injured or suddenly fall ill.

**Emergency medical technician (EMT):** A person who gives basic emergency medical care and transportation for critical and emergent patients who access the EMS system; EMTs are typically authorized to function after completing local and state certification requirements; formerly referred to as EMT-Basic.

**Emergency Response Guidebook:** A resource available from the U.S. Department of Transportation (DOT) to help identify hazardous materials and appropriate care for those exposed to them.

**Emphysema:** A chronic, degenerative lung disease in which there is damage to the alveoli.

**Endocrine system:** A group of organs and other structures that regulates and coordinates the activities of other systems by producing chemicals (hormones) that influence tissue activity.

**Engineering controls:** Control measures that eliminate, isolate or remove a hazard from the workplace; things used in the workplace to help reduce the risk of an exposure.

**Epidemiology:** A branch of medicine that deals with the incidence (rate of occurrence) and prevalence (extent) of disease in populations.

**Epidermis:** The outer layer of the skin; provides a barrier to bacteria and other organisms that can cause infection.

**Epiglottitis:** A serious bacterial infection that causes severe swelling of the epiglottis, which can result in a blocked airway, causing respiratory failure in children; may be fatal.

**Epilepsy:** A brain disorder characterized by recurrent seizures.

**Ethics:** A branch of philosophy concerned with the set of moral principles a person holds about what is right and wrong.

**Evaporation:** One of the ways the body loses heat; occurs when the body is wet and the moisture evaporates, cooling the skin.

**Evisceration:** A severe injury that causes the abdominal organs to protrude through the wound.

**Exercise-associated muscle cramps:** Formerly known as heat cramps, these muscle spasms can be intense and debilitating and typically occur in the legs, arms and abdomen; painful involuntary muscle spasms occur during or after physical exertion, particularly in high heat and humidity, possibly due to loss of electrolytes and water from perspiration; not associated with an increase in body temperature.

**Exertional heat exhaustion (EHE):** An inability to cope with heat and characterized by fatigue, nausea and/or vomiting, loss of appetite, dehydration, exercise-associated muscle cramps, dizziness with possible fainting, elevated heart and respiratory rate, and skin that is pale, cool and clammy or slightly flushed; if a core body temperature can be obtained, it is typically higher than 104° F (40° C). The person may be weak and unable to stand but has normal mental status; often results from strenuous work or wearing too much clothing in a hot, humid environment, and may or may not occur with dehydration and electrolyte imbalance.

**Exertional heat stroke (EHS):** The most serious form of heat-related illness; life threatening and

develops when the body's cooling mechanisms are overwhelmed and body systems begin to fail. People with EHS have exaggerated heat production and an inability to cool themselves.

**Exposure:** An instance in which someone is exposed to a pathogen or has contact with blood or OPIM or objects in the environment that contain disease-causing agents.

**Exposure control plan:** Plan in the workplace that outlines the employer's protective measures to eliminate or minimize employee exposure incidents.

**Expressed consent:** Permission to receive emergency care granted by a competent adult verbally, nonverbally or through gestures.

**External bleeding:** Bleeding on the outside of the body; often, visible bleeding.

**Extremity:** A limb of the body; upper extremity is the arm; lower extremity is the leg.

**Extremity lift:** A two-responder, nonemergency lift in which one responder supports the patient's arms and the other the patient's legs.

**Extrication:** The safe and appropriate removal of a patient trapped in a motor vehicle or a dangerous situation.

**Fainting:** Temporary loss of consciousness; usually related to temporary insufficient blood flow to the brain; also known as syncope, "blacking out" or "passing out."

**FAST:** An acronym to help remember the symptoms of stroke; stands for **F**ace, **A**rm, **S**peech and **T**ime.

**Febrile seizures:** Seizure activity brought on by an excessively high fever in a young child or an infant.

**Fetal monitoring:** A variety of tests used to measure fetal stress, either internally or externally.

**Fetus:** The term used to describe the stage of development in the uterus after the embryo stage, beginning at the start of the third month.

**Fever:** An elevated body temperature, beyond normal variation.

**Finger sweep:** A method of clearing the mouth of foreign material that presents a risk of blocking the airway or being aspirated into the lungs.

**Firefighter's carry:** A type of carry during which the patient is supported over the responder's shoulders.

**Firefighter's drag:** A method of moving a patient in which the patient is bound to the responder's neck and held underneath the responder; the responder moves the patient by crawling.

**Flail chest:** A serious injury in which multiple rib fractures result in a loose section of ribs that does not move normally with the rest of the chest during breathing and often moves in the *opposite* direction.

**Flammability:** The degree to which a substance may ignite.

**Flowmeter:** A device used to regulate, in liters per minute (LPM), the amount of oxygen administered to a patient.

**Focused trauma assessment:** A physical exam on a trauma patient, focused only on an isolated area with a known injury such as a hand with an obvious laceration.

**Foreign body airway obstruction (FBAO):** The presence of foreign matter, such as food, that obstructs the airway.

**Fracture:** A break or disruption in bone tissue.

**Free diving:** An extreme sport in which divers compete underwater without any underwater breathing apparatus.

**Frostbite:** A condition in which body tissues freeze; most commonly occurs in the fingers, toes, ears and nose.

**Full-thickness burn:** A burn injury involving all layers of skin and underlying tissues; skin may be brown or charred, and underlying tissues may appear white; also referred to as a third-degree burn.

**Generalized tonic-clonic seizures:** Seizures that affect most or all of the brain; types include absence (petit mal) seizures and grand mal seizures.

**Genitourinary system:** A group of organs and other structures that eliminates waste and enables reproduction.

**Gestational diabetes:** A type of diabetes that occurs only during pregnancy.

**Glasgow Coma Scale (GCS):** A measure of level of consciousness (LOC) based on eye opening, verbal response and motor response.

**Glucometer:** A medical device that measures the concentration of glucose in the blood.

**Glucose:** A simple sugar that is the primary source of energy for the body's tissues.

**Golden Hour:** A term that refers to the critical first hour after a patient sustains a life-threatening traumatic injury; the highest risk of dying from shock or bleeding occurs during this time; providing early interventions and advanced medical care to the patient as soon as possible within the hour can result in the best chance of patient survival.

**Good Samaritan laws:** Laws that protect people against claims of negligence when they give emergency care in good faith without accepting anything in return.

**Grand mal seizure:** A type of generalized seizure; involves whole-body contractions with loss of consciousness.

**Hallucination:** Perception of an object with no reality; occurs when a person is awake and conscious; may be visual, auditory or tactile.

**Hallucinogen:** A substance that affects mood, sensation, thinking, emotion and self-awareness; alters perceptions of time and space; and produces hallucinations or delusions.

**Hard of hearing:** A degree of hearing loss that is mild enough to allow the person to continue to rely on hearing for communication.

**Hazardous materials (HAZMATs):** Chemical substances or materials that can pose a threat or risk to health, safety and property if not properly handled or contained.

**Hazardous material (HAZMAT) incident:** Any situation that deals with the unplanned release of hazardous materials.

**Head-on collision:** A collision in which a vehicle hits an object, such as a tree or other vehicle, straight on.

**Head-tilt/chin-lift maneuver:** A common method for opening the airway unless the patient is suspected of having an injury to the head, neck or spine.

**Healthcare proxy:** A person named in a healthcare directive, or durable power of attorney for healthcare, who can make medical decisions on someone else's behalf.

**Heart:** A fist-sized muscular organ that pumps blood throughout the body.

**Heat index:** An index that combines the air temperature and relative humidity to determine the perceived, human-felt temperature; a measure of how hot it feels.

**Heat stroke:** The most serious form of heat-related illness; life threatening and develops when the body's cooling mechanisms are overwhelmed and body systems begin to fail; can be classified as classic heat stroke or exertional heat stroke.

**Hematoma:** A mass of usually clotted or partially clotted blood that forms internally in soft tissue space or an organ as a result of ruptured blood vessels.

**Hemodialysis:** A common method of treating advanced kidney failure in which blood is filtered outside the body to remove wastes and extra fluids.

**Hemopneumothorax:** An accumulation of blood and air between the lungs and chest wall.

**Hemorrhage:** The loss of a large amount of blood in a short time or when there is continuous bleeding.

**Hemorrhagic shock:** Shock due to excessive blood loss.

**Hemostatic dressing:** A dressing treated with an agent or chemical that assists with the formation of blood clots; used with direct pressure to help control severe, life-threatening bleeding.

**Hemothorax:** An accumulation of blood between the lungs and chest wall; caused by bleeding that may be from the chest wall, lung tissue or major blood vessels in the thorax.

**Hepatitis:** An inflammation of the liver most commonly caused by viral infection; there are several types including hepatitis A, B, C, D and E.

**High-order explosives (HE):** Explosives such as TNT, nitroglycerin, etc., that produce a defining supersonic over-pressurization shockwave.

**High-performance CPR:** Providing high-quality chest compressions as part of a well-organized team response to a cardiac arrest.

**HIV:** A virus that weakens the body's immune system, leading to life-threatening infections; causes AIDS.

**Homeostasis:** A constant state of balance or well-being of the body's internal systems that is continually and automatically adjusted.

**Hospice care:** Care provided in the final months of life to a terminally ill patient.

**Hot zone:** Also called the exclusion zone, this is the area in which the most danger exists from a HAZMAT incident.

**Hyperglycemia:** A condition in which too much sugar is in the bloodstream, resulting in higher than normal BGLs; also known as high blood glucose.

**Hyperkalemia:** Abnormally high levels of potassium in the blood; if extremely high, can cause cardiac arrest and death.

**Hyperresonance:** Abnormal sounds during percussion on the affected side of the chest.

**Hypertension:** Another term for high blood pressure.

**Hyperthermia:** Overheating of the body; includes exercise-associated muscle cramps, exertional heat exhaustion and heat stroke (exertional and classic).

**Hyperventilation:** Rapid, deep or shallow breathing; usually caused by panic or anxiety.

**Hypervolemia:** A condition in which there is an abnormal increase of fluid in the blood.

**Hypodermis:** A deeper layer of skin located below the epidermis and dermis; contains fat, blood vessels and connective tissues.

**Hypoglycemia:** A condition in which too little sugar is in the bloodstream, resulting in lower than normal BGLs; also known as low blood glucose.

**Hypoglycemic shock:** A type of shock that is a reaction to extremely low blood glucose levels.

**Hypoperfusion:** A life-threatening condition in which the circulatory system fails to adequately circulate oxygenated blood to all parts of the body, resulting in inadequate tissue perfusion; also referred to as shock.

**Hypotension:** Abnormally low blood pressure.

**Hypothalamus:** Control center of the body's temperature; located in the brain.

**Hypothermia:** The state of the body being colder than the usual core temperature, caused by either excessive loss of body heat and/or the body's inability to produce heat.

**Hypovolemia:** A condition in which there is an abnormal decrease of fluid in the blood.



**Hypovolemic shock:** A type of shock caused by an abnormal decrease in blood volume.

**Hypoxemia:** A condition in which there are decreased levels of oxygen in the blood; can disrupt the body's functioning and harm tissues; may be life threatening.

**Hypoxia:** A condition in which insufficient oxygen is delivered to the body's cells.

**Hypoxic:** Having below-normal concentrations of oxygen in the organs and tissues of the body.

**Immediate care (Red):** A triage category of those involved in an MCI whose needs require urgent lifesaving care.

**Immobilize:** To use a splint or other method to keep an injured body part from moving.

**Immune system:** The body's complex group of body systems that is responsible for fighting disease.

**Impaled object:** An object that remains embedded in an open wound; also referred to as an embedded object.

**Implantable cardioverter-defibrillator (ICD):** A miniature version of an AED, implanted under the skin, that acts to automatically recognize and help correct abnormal heart rhythms.

**Implantation:** The attachment of the fertilized egg to the lining of the uterus, 6 or 7 days after conception.

**Implied consent:** Legal concept that assumes a patient would consent to receive emergency care if they were physically able or old enough to do so.

**Incendiary weapons:** Devices designed to burn at extremely high temperatures, such as napalm and white phosphorus; mostly designed to be used against equipment, though some (e.g., napalm) are designed to be used against people.

**Incident command system (ICS):** A standardized, on-scene, all-hazards incident management approach that allows for the integration of facilities, equipment, personnel, procedures and communications operating within a common organizational structure; enables a coordinated response among various jurisdictions and functional agencies, both public and private; and establishes common processes for planning and managing resources.

**Incident commander:** Through delegated authority of a local government, the incident

commander (IC) is responsible for establishing the incident objectives and managing resources, including assessing the situation, deciding what calls to make and what tasks need to be done, and assigning those tasks to appropriate personnel.

**Indirect contact:** Mode of transmission of a disease caused by touching a contaminated object.

**Indirect force:** A force that transmits energy through the body, causing injury at a distance from the point of impact.

**Indirect medical control:** A type of medical direction, also called "off-line," "retrospective" or "prospective" medical control; this type of medical direction includes education, protocol review and quality improvement for emergency care providers.

**Infant:** For the purpose of providing emergency medical care, anyone who appears to be younger than about 1 year of age.

**Infection:** A condition caused by disease-producing microorganisms, called pathogens or germs, in the body.

**Infectious disease:** Disease caused by the invasion of the body by a pathogen, such as a bacterium, virus, fungus or parasite.

**Ingested poison:** A poison that is swallowed.

**In good faith:** Acting in such a way that the goal is only to help the patient and that all actions are for that purpose.

**Inhalant:** A substance, such as a medication, that a person inhales to counteract or prevent a specific condition; also a substance inhaled to produce mood-altering effects.

**Inhaled poison:** A poison breathed into the lungs.

**Injected poison:** A poison that enters the body through a bite, sting or syringe.

**Innate immunity:** The type of protection from disease with which humans are born.

**Insulin:** A hormone produced by the pancreas to help glucose move into the cells; in patients with diabetes, it may not be produced at all or may not be produced in sufficient amounts.

**Integumentary system:** A group of organs and other structures that protects the body, retains fluids and helps to prevent infection.

**Intercostal:** Located between the ribs.

**Internal bleeding:** Bleeding inside the body.

**Jaw-thrust (without head extension)**

**maneuver:** A maneuver for opening the airway in a patient suspected of having an injury to the head, neck or spine.

**Joint:** A structure where two or more bones are joined.

**Jugular venous distension (JVD):** Neck veins that are swollen due to pressure from inside the vein.

**Jump kit:** A bag or box containing equipment used by the emergency medical responder (EMR) when responding to a medical emergency; includes items such as resuscitation masks and airway adjuncts, disposable latex-free gloves, blood pressure cuffs and bandages.

**Kinematics of trauma:** The science of the forces involved in traumatic events and how they damage the body.

**Labor:** The birth process, beginning with the contraction of the uterus and dilation of the cervix, and ending with the stabilization and recovery of the mother.

**Laceration:** A cut, usually from a sharp object, that can have either jagged or smooth edges.

**Landing zone (LZ):** A term from military jargon used to describe any area where an aircraft, such as an air medical helicopter, can land safely.

**Legal obligation:** Obligation to act in a particular way in accordance with the law.

**Level of consciousness (LOC):** A person's state of awareness, ranging from being fully alert to unconscious; also referred to as mental status.

**Licensure:** Required acknowledgment that the bearer has permission to practice in the licensing state; offers the highest level of public protection; may be revoked at the state level should the bearer no longer meet the required standards.

**Ligament:** A fibrous band that holds bones together at a joint.

**Litter:** A portable stretcher used to carry a patient over rough terrain.

**Lividity:** Purplish color in the lowest-lying parts of a recently dead body, caused by pooling of blood.

**Living will:** A type of advance directive that outlines the patient's wishes about certain kinds of medical treatments and procedures that prolong life.

**Local credentialing:** Local requirements EMRs must meet in order to maintain employment or obtain certain protocols so that they may practice.

**Log roll:** A method of moving a patient while keeping the patient's body aligned because of a suspected head, neck or spinal injury.

**Low-order explosives (LE):** Explosives such as pipe bombs, gunpowder, etc., that create a subsonic explosion.

**Malpractice:** A situation in which a professional fails to provide a reasonable quality of care, resulting in harm to a patient.

**Mania:** An aspect of bipolar disorder characterized by elation, hyperexcitability and accelerated thoughts, speech and actions.

**Manual stabilization:** A technique used to achieve spinal motion restriction by manually supporting the patient's head and neck in the position found *without* the use of any equipment.

**Mechanism of injury (MOI):** The force or energy that causes a traumatic injury (e.g., a fall, explosion, crash or attack).

**Meconium aspiration:** Aspiration of the first bowel movement of the newborn; can be a sign of fetal stress and can lead to meconium aspiration syndrome.

**Medical control:** Direction given to emergency medical responders (EMRs) by a physician when EMRs are providing care at the scene of an emergency or are en route to the receiving facility; may be provided either directly via radio or indirectly by pre-established local medical treatment protocols; also called standing orders.

**Medical direction:** The monitoring of care provided by out-of-hospital providers to injured or ill persons, usually by a medical director.

**Medical director:** A physician who provides oversight and assumes responsibility for the care of injured or ill persons provided in out-of-hospital settings.

**Medical futility:** A situation in which a patient has a medical or traumatic condition that is scientifically accepted to be futile should resuscitation be attempted and, therefore, the patient should be considered dead on arrival.

**Meningitis:** An inflammation of the meninges, the thin, protective coverings over the brain and spinal cord; caused by virus or bacteria.

**Mental illness:** A range of medical conditions that affect a person's mood or ability to think, feel, relate to others and function in everyday activities.

**Metabolic shock:** A type of shock that is the result of a loss of body fluid, which can be due to severe diarrhea, vomiting or a heat-related illness.

**Metabolism:** The physical and chemical processes of converting oxygen and food into energy within the body.

**Methicillin-resistant *Staphylococcus aureus* (MRSA):** A staph bacterium that can cause infection; difficult to treat because of its resistance to many antibiotics.

**Midaxillary line:** An imaginary line that passes vertically down the body starting at the axilla (armpit); used to locate one of the areas for listening to breath sounds.

**Midclavicular line:** An imaginary line that passes through the midpoint of the clavicle (collarbone) on the ventral surface of the body; used to locate one of the areas for listening to breath sounds.

**Midscapular line:** An imaginary line that passes through the midpoint of the scapula (shoulder blade) on the dorsal surface of the body; used to locate one of the areas for listening to breath sounds.

**Minimum data set:** A standardized set of data points about the response and care for patients; this information is included in the prehospital care report (PCR).

**Minute volume:** The amount of air breathed in a minute; calculated by multiplying the volume of air inhaled at each breath (in mL) by the number of breaths per minute.

**Miscarriage:** A spontaneous end to pregnancy before the 20th week; usually because of birth defects in the fetus or placenta; also called a spontaneous abortion.

**Moral obligation:** Obligation to act in a particular way in accordance with what is considered morally right.

**Morals:** Principles relating to issues of right and wrong and how individual people should behave.

**Morbidity:** Illness; effects of a condition or disease.

**Mortality:** Death due to a certain condition or disease.

**Mucous plug:** A collection of mucus that blocks the opening into the cervix and is expelled, usually toward the end of the pregnancy, when the cervix begins to dilate.

**Multidrug-resistant tuberculosis (MDR TB):** A type of tuberculosis (TB) that is resistant to some of the most effective anti-TB drugs.

**Multiple birth:** Two or more births in the same pregnancy.

**Multiple- (or mass-) casualty incident (MCI):** An incident that generates more patients than available resources can manage using routine procedures.

**Muscle:** A tissue that contracts and relaxes to create movement.

**Musculoskeletal system:** A group of tissues and other structures that supports the body, protects internal organs, allows movement, stores minerals, manufactures blood cells and creates heat.

**Myocardial infarction (MI):** The death of cardiac muscle tissue due to a sudden deprivation of circulating blood; also called a heart attack.

**Naloxone:** A medication used to reverse the effects of an opioid overdose.

**Nasal cannula:** A device used to administer oxygen through the nostrils to a breathing person.

**Nasal (nasopharyngeal) airway (NPA):** An airway adjunct inserted through the nostril and into the throat to help keep the tongue from obstructing the airway; may be used on a conscious or an unconscious patient.

**National Response Framework (NRF):** The guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies—from the smallest incident to the largest catastrophe. The Framework establishes a comprehensive, national, all-hazards approach to domestic incident response.

**Nature of illness:** The medical condition or complaint for which the person needs care (e.g., shock, difficulty breathing), based on what the patient or others report as well as clues in the environment.

**Needlestick:** A penetrating wound from a needle or other sharp object; may result in exposure to pathogens through contact with blood or OPIM.

**Negligence:** The failure to provide the level of care a person of similar training would provide, thereby causing injury or damage to another.

**Nerve agents:** Toxic chemical warfare agents that interrupt the chemical function of nerves.

**Nervous system:** A group of organs and other structures that regulates all body functions.

**Neurogenic shock:** A type of distributive shock caused by trauma to the spinal cord or brain, where the blood vessel walls abnormally constrict and dilate, preventing relay of messages and causing blood to pool at the lowest point of the body.

**Next of kin:** The closest relatives, as defined by state law, of a deceased person; usually the spouse and nearest blood relatives.

**Non-rebreather mask:** A type of oxygen mask used to administer high concentrations of oxygen to a breathing person.

**Non-swimming rescues and assists:** Rescues and assists that can be performed from a pool deck, pier or shoreline by reaching, by using an extremity or object, by throwing a floating object or by standing in the water to provide either of these assists; performed instead of swimming out to the person in distress.

**Normal sinus rhythm (NSR):** The normal, regular rhythm of the heart, set by the SA node in the right atrium of the heart.

**Obstetric pack:** A first aid kit containing items especially helpful in emergency delivery and initial care after birth; items can include personal protective equipment, towels, clamps, ties, sterile scissors and bulb syring.

**Obstructive shock:** A type of shock caused by any obstruction to blood flow, usually within the blood vessels, such as a pulmonary embolism.

**Occlusive dressing:** A special type of dressing that does not allow air or fluid to pass through.

**Occupational Safety and Health Administration (OSHA):** Federal agency whose role is to promote the safety and health of American workers by setting and enforcing standards; providing training, outreach and education; establishing partnerships; and encouraging continual process improvement in workplace safety and health.

**Ongoing assessment:** The process of repeating the primary assessment and physical exam while

continually monitoring the patient; performed while awaiting the arrival of more highly trained personnel or while transporting the patient.

**Open fracture:** A type of fracture in which there is an open wound in the skin over the fracture.

**Open wound:** A wound resulting in a break in the skin's surface.

**Opioid narcotics:** Drugs often derived from opium or opium-like compounds; used to reduce pain and can alter mood and behavior; also known as opioids.

**Opportunistic infections:** Infections that strike people whose immune systems are weakened.

**OPQRST:** Mnemonic to help remember the questions used to gain information about pain; the initials stand for onset, provoke, quality, region/radiate, severity and time.

**Oral (oropharyngeal) airway (OPA):** An airway adjunct inserted through the mouth and into the throat to help keep the tongue from obstructing the airway; used *only* with unconscious patients.

**Organ:** A structure of similar tissues acting together to perform specific body functions.

**“O-ring” gasket:** Plastic, O-shaped ring that makes the seal of the pressure regulator on an oxygen cylinder tight; can be a built-in or an attachable piece.

**Other potentially infectious materials (OPIM):** Materials, other than blood, that can cause illness; these materials include body fluids such as semen and vaginal secretions.

**Overdose:** The use of an excessive amount of a substance, resulting in adverse reactions ranging from mania (mental and physical hyperactivity) and hysteria, to coma and death.

**Overventilation:** Blowing too much air into the patient, which can enter the stomach, causing gastric distention and likely vomiting. Overventilation can also increase the amount of pressure in the chest, which compresses the blood vessels returning to the heart, thus limiting effective circulation.

**Oxygenation:** The addition of oxygen to the body; also, the treatment of a patient with oxygen.

**Oxygen cylinder:** A steel or alloy cylinder that contains 100 percent oxygen under high pressure.



**Pacemaker:** A device implanted under the skin, sometimes below the right collarbone, to help regulate the heartbeat in someone whose natural pacemaker (the sinoatrial node) is not functioning properly, causing the heart to skip beats or beat too fast or too slow.

**Packaging:** The process of getting a patient ready to be transferred safely from the scene to an ambulance or a helicopter.

**Pack-strap carry:** A type of carry in which the patient is supported upright, across the responder's back.

**Palpation:** Examination performed by feeling part of the body, especially feeling for a pulse.

**Pandemic influenza:** A respiratory illness caused by virulent human influenza A virus; spreads easily and sustainably, and can cause global outbreaks of serious illness in humans.

**Panic:** A symptom of an anxiety disorder, characterized by episodes of intense fear and physical symptoms such as chest pain, heart palpitations, shortness of breath and dizziness.

**Paradoxical breathing:** An abnormal type of breathing that can occur with a chest injury (e.g., flail chest); one area of the chest moves in the opposite direction to the rest of the chest.

**Paramedic:** An allied health professional whose primary focus is to give advanced emergency medical care for critical and emergent patients who access the EMS system. Paramedics may also give nonemergency, community-based care based on state and local community paramedicine or mobile integrated healthcare programs.

**Paranoia:** A condition characterized by feelings of persecution and exaggerated notions of perceived threat; may be part of many mental health disorders and is rarely seen in isolation.

**Parenchyma:** Tissue that is involved in the functioning of a structure or organ as opposed to its supporting structures.

**Partial seizures:** Seizures that affect only part of the brain; may be simple or complex.

**Partial-thickness burn:** A burn injury involving the epidermis and dermis, characterized by red, wet skin and blisters; also referred to as a second-degree burn.

**Passive immunity:** The type of immunity gained from external sources such as from a mother's breast milk to an infant.

**Pathogen:** A term used to describe a germ; a disease-causing agent (e.g., bacterium or virus).

**Pathophysiology:** The study of the abnormal changes in mechanical, physical and biochemical functions caused by an injury or illness.

**Patient narrative:** A section on the prehospital care report where the assessment and care provided to the patient are described.

**Patient's best interest:** A fundamental ethical principle that refers to the provision of competent care, with compassion and respect for human dignity.

**Pediatric Assessment Triangle:** A quick initial assessment of a child that involves observation of the child's appearance, breathing and skin.

**Penetrating injury:** An injury in which a person is struck by or falls onto an object that penetrates or cuts through the skin, resulting in an open wound or wounds, the severity of which is determined by the path of the object (e.g., a bullet wound).

**Percussion:** A technique of tapping on the surface of the body and listening to the resulting sounds, to learn about the condition of the area beneath.

**Perfusion:** The circulation of blood through the body or through a particular body part for the purpose of exchanging oxygen and nutrients with carbon dioxide and other wastes.

**Peritoneal dialysis:** A method of treatment for kidney failure in which waste products and extra fluid are drawn into a solution which has been injected into the abdominal cavity and are withdrawn through a catheter.

**Peritoneum:** The membrane that lines the abdominal cavity and covers most of the abdominal organs.

**Personal protective equipment (PPE):** All specialized clothing, equipment and supplies that keep the user from directly contacting infected materials; includes gloves, gowns, masks, shields and protective eyewear.

**Phobia:** A type of anxiety disorder characterized by strong, irrational fears of objects or situations that are usually harmless; may trigger an anxiety or panic attack.

**Physical counter-pressure maneuver (PCM):** Physical maneuver used to hinder the progression from presyncope to syncope.

**Physical exam:** Exam performed after the primary assessment; used to gather additional information and identify signs and symptoms of injury and illness.

**Physician Orders for Life-Sustaining Treatment (POLST) form:** Medical orders concerning end-of-life care to be honored by healthcare workers during a medical crisis.

**Physiology:** How living organisms function (e.g., movement and reproduction).

**Placenta:** An organ attached to the uterus and unborn baby through which nutrients are delivered; expelled after the baby is delivered.

**Placenta previa:** Placental implantation that occurs lower on the uterine wall, touching or covering the cervix; can be dangerous if it is still covering part of the cervix at the time of delivery.

**Pleural space:** The space between the lungs and chest wall.

**Pneumonia:** A lung infection caused by a virus or bacterium that results in a cough, fever and difficulty breathing.

**Pneumothorax:** Collapse of a lung due to pressure on it caused by air in the chest cavity.

**Poison:** Any substance that can cause injury, illness or death when introduced into the body, especially by chemical means.

**Poison Control Center (PCC):** A specialized health center that provides information on poisons and suspected poisoning emergencies.

**Position of comfort:** The position a patient naturally assumes when feeling ill or in pain; the position depends on the mechanism of injury or nature of illness.

**Positive pressure ventilation:** An artificial means of forcing air or oxygen into the lungs of a person who has stopped breathing or has inadequate breathing.

**Post-ictal phase:** The final phase of a generalized seizure, during which the patient becomes extremely fatigued.

**Power grip:** A hand position for lifting that requires the full surface of the palms and fingers to come in contact with the object being lifted.

**Power lift:** A lift technique that provides a stable move for the patient and protects the person lifting from serious injury.

**Pralidoxime chloride (Protopam Chloride; 2-PAM Cl):** A drug contained in antidote kits used to counteract the effects of nerve agents; commonly called 2-PAM chloride.

**Preeclampsia:** A type of toxemia that occurs during pregnancy; a condition characterized by high blood pressure and excess protein in the urine after the 20th week of pregnancy.

**Prehospital care:** Emergency medical care provided before a patient arrives at a hospital or medical facility.

**Prehospital care report (PCR):** A document filled out for all emergency calls; used to keep medical personnel informed so they can provide appropriate continuity of care; also serves as a record for legal and billing purposes; may be written or electronic; if electronic, it is then an E-PCR.

**Premature birth:** Birth that occurs before the end of the 37th week of pregnancy.

**Pressure bandage:** A bandage applied snugly to create pressure on a wound, to aid in controlling bleeding.

**Pressure regulator:** A device on an oxygen cylinder that reduces the delivery pressure of the oxygen to a safe level.

**Presyncope:** The medical term for “faintness” or “feeling faint”; symptoms include light-headedness or dizziness, blurry vision and nausea, while signs include sweating and pallor.

**Primary effects:** In referring to explosive and incendiary devices, the effects of the impact of the over-pressurization wave from HE on body surfaces.

**Primary (initial) assessment:** A check for conditions that are an immediate threat to a patient’s life.

**Prolapsed cord:** A complication of childbirth in which a loop of the umbilical cord protrudes through the vagina before delivery of the baby.

**Protocols:** Standardized procedures to be followed when providing care to injured or ill persons.

**Psychogenic shock:** A type of shock that is due to factors such as emotional stress that cause blood to pool in the body in areas away from the brain, which can result in fainting (syncope).

**Pulmonary embolism:** Sudden blockage of an artery in the lung; can be fatal.

**Pulse:** The beat felt from each rhythmic contraction of the heart.

**Pulse oximetry:** A test to measure the percentage of oxygen saturation in the blood using a pulse oximeter.

**Puncture/penetration:** A type of wound that results when the skin is pierced with a pointed object.

**Rabies:** An infectious viral disease that affects the nervous system of humans and other mammals; has a high fatality rate if left untreated.

**Radiation:** One of the ways the body loses heat; heat radiates out of the body, especially from the head and neck.

**Radiation burn:** A burn caused by exposure to radiation, either nuclear (e.g., radiation therapy) or solar (e.g., radiation from the sun).

**Rales:** An abnormal breath sound; a popping, clicking, bubbling or rattling sound, also known as crackles.

**Rape:** Non-consensual sexual intercourse often performed using force, threat or violence.

**Rape-trauma syndrome:** The three stages a person typically goes through following a rape: acute, outward adjustment and resolution; a common response to rape.

**Rapid medical assessment:** A term describing a rapid head-to-toe exam of a medical patient.

**Rapid trauma assessment:** A term describing a rapid head-to-toe exam of a trauma patient.

**Rappelling:** The act of descending (as from a cliff) by sliding down a rope passed under one thigh, across the body and over the opposite shoulder or through a special friction device.

**Reaching assist:** A method of rescuing someone in the water by using an object to extend the responder's reach or by reaching with an arm or leg.

**Reactivity:** The degree to which a substance may react when exposed to other substances.

**Reasonable force:** The minimal force necessary to keep a patient from harming themselves or others.

**Recovery position:** A side-lying posture used to help maintain a clear airway in an unresponsive patient who is uninjured and breathing normally.

**Refusal of care:** The declining of care by a competent patient; a patient has the right to refuse the care of anyone who responds to an emergency scene, either before or after care is initiated.

**Respiratory arrest:** A condition in which there is an absence of normal breathing.

**Respiratory distress:** A condition in which a person is having difficulty breathing or requires extra effort to breathe.

**Respiratory failure:** Condition in which the respiratory system fails in oxygenation and/or carbon dioxide elimination; the respiratory system is beginning to shut down; the person may alternate between being agitated and sleepy.

**Respiratory rate:** The number of breaths per minute; normal rates vary by age and other factors.

**Respiratory shock:** A type of shock caused by the failure of the lungs to transfer sufficient oxygen into the bloodstream; occurs with respiratory distress or arrest.

**Respiratory system:** A group of organs and other structures that brings air into the body and removes wastes through a process called breathing, or respiration.

**Restraint:** A method of limiting a patient's movements, usually by physical means such as a padded cloth strap; may also be achieved by chemical means, such as medication.

**Resuscitation mask:** A pliable, dome-shaped breathing device that fits over the mouth and nose; used to provide artificial ventilations and administer supplemental oxygen.

**Retraction:** A visible sinking in of soft tissue between the ribs of a child or an infant.

**Return of spontaneous circulation (ROSC):** A term to describe the successful resuscitation of a patient in cardiac arrest; a return of a pulse during resuscitative efforts.

**Reye's syndrome:** An illness brought on by high fever that affects the brain and other internal organs; can be caused by the use of aspirin in children and infants.

**Rhonchi:** An abnormal breath sound when breathing that can often be heard without a stethoscope; a snoring or coarse, dry rale sound.

**Rigid splint:** A splint made of rigid material such as wood, aluminum or plastic.

**Risk factors:** Conditions or behaviors that increase the chance that a person will develop a disease.

**Roller bandage:** A bandage made of gauze or gauze-like material that is wrapped around a body part, over a dressing, using overlapping turns until the dressing is covered.

**Rollover:** A collision in which the vehicle rolls over.

**Rotational impact:** A collision in which the impact occurs off center and causes the vehicle to rotate until it either loses speed or strikes another object.

**Rule of Nines:** A method for estimating the extent of a burn; divides the body into 11 surface areas, each of which comprises approximately 9 percent of the body, plus the genitals, which are approximately 1 percent.

**“Rule of thumb”:** A guideline for positioning oneself far enough away from a scene involving hazardous material (HAZMAT): one’s thumb, pointing up at arm’s length, should cover the hazardous area from one’s view.

**Run data:** A section on the PCR where information about the incident is documented.

**Safety Data Sheet (SDS):** A sheet (provided by the manufacturer) that identifies the substance, physical properties and any associated hazards (e.g., fire, explosion and health hazards) for a given material, as well as emergency first aid; formerly called a Material Safety Data Sheet (MSDS).

**SAMPLE history:** A way to gather important information about the patient, using the mnemonic SAMPLE; the initials stand for signs and symptoms, allergies, medications, pertinent medical history, last oral intake and events leading up to the incident.

**Schizophrenia:** A chronic mental illness in which the person hears voices or feels that their thoughts are being controlled by others; can cause hallucinations, delusions, disordered thinking, movement disorders and social withdrawal.

**Scope of practice:** The range of duties and skills that are allowed and expected to be performed when necessary, according to the professional’s level of training, while using reasonable care and skill.

**Secondary assessment:** A head-to-toe physical exam as well as the focused history; completed following the primary assessment and management of any life-threatening conditions.

**Secondary effects:** In referring to explosive and incendiary devices, the impact of flying debris and bomb fragments against any body part.

**Seizure:** A disorder in the brain’s electrical activity, sometimes marked by loss of consciousness and often by uncontrollable muscle movement; also called a convulsion.

**Self-mutilation:** Self-injury; deliberate harm to one’s own body used as an unhealthy coping mechanism to deal with overwhelming negative emotions.

**Self-splint:** A splint formed by supporting one part of the body with another; also called an anatomic splint.

**Sepsis:** A life-threatening illness in which the body is overwhelmed by its response to infection; commonly referred to as blood poisoning.

**Septic shock:** A type of distributive shock that occurs when an infection has spread to the point that bacteria are releasing toxins into the bloodstream, causing blood pressure to drop when the tissues become damaged from the circulating toxins.

**Service animal:** A guide dog, signal dog or other animal individually trained to provide assistance to a person with a disability.

**Sexual assault:** Any form of sexualized contact with another person without consent and performed using force, coercion or threat.

**Shaken baby syndrome:** A type of abuse in which a young child has been shaken harshly, causing swelling of the brain and brain damage.

**Shipping papers:** Documents drivers must carry by law when transporting hazardous materials; list the names, possible associated dangers and four-digit identification numbers of the substances.

**Shock:** A life-threatening condition that occurs when the circulatory system fails to provide adequate oxygenated blood to all parts of the body, resulting in inadequate tissue perfusion; also referred to as hypoperfusion.

**Shoulder drag:** A type of emergency move that is a variation of the clothes drag.



**Shunt:** A surgically created passage between two natural body channels, such as an artery and a vein, to allow the flow of fluid.

**Side-impact collision:** A collision in which the impact is at the side of the vehicle; also known as a broadside, t-bone or lateral collision.

**Signs:** Term used to describe any observable evidence of injury or illness, such as bleeding or unusual skin color.

**Signs of life:** A term sometimes used to describe normal breathing and a pulse in an unresponsive patient.

**Silent heart attack:** A heart attack during which the patient has either no symptoms or very mild symptoms that the person does not associate with heart attacks; mild symptoms include indigestion or sweating.

**Simple access:** In an extrication, the process of getting to the patient without the use of equipment.

**Simple partial seizures:** Seizures in which a specific body part experiences muscle contractions; does not affect memory or awareness.

**Simple Triage and Rapid Transport (START):** A method of triage that allows quick assessment and prioritization of injured people.

**Sinoatrial (SA) node:** A cluster of cells in the right atrium that generates the electrical impulses that set the pace of the heart's natural rhythm.

**Smooth muscles:** Muscles responsible for contraction of hollow organs such as blood vessels or the gastrointestinal tract.

**Soft splint:** A splint made of soft material such as towels, pillows, slings, swathes and cravats.

**Soft tissues:** Body structures that include the layers of skin, fat and muscles.

**Sphygmomanometer:** A device for measuring BP; also called a BP cuff.

**Spinal column:** The series of vertebrae extending from the base of the skull to the tip of the tailbone (coccyx); also referred to as the spine.

**Spinal cord:** A cylindrical structure extending from the base of the skull to the lower back, consisting mainly of nerve cells and protected by the spinal column.

**Spinal motion restriction (SMR):** A collective term that includes all methods and techniques used to limit the movement of the spinal column of a patient with a suspected spinal injury.

**Splint:** A device used to immobilize body parts.

**Sprain:** The partial or complete tearing or stretching of ligaments and other soft tissue structures at a joint.

**Squat lift:** A lift technique that is useful when one of the lifter's legs or ankles is weaker than the other.

**Stabilization:** The final stage of labor in which the mother begins to recover and stabilize after giving birth.

**Staging area:** Location established where resources can be placed while awaiting tactical assignment.

**Stair chair:** Equipment used for patient transport in a sitting position.

**Standard of care:** The criteria established for the extent and quality of an EMR's care.

**Standard precautions:** Safety measures, including BSI and universal precautions, taken to prevent occupational-risk exposure to blood and OPIM; these precautions assume that all body fluids, secretions and excretions (except sweat) are potentially infective.

**Standing orders:** Protocols issued by the medical director allowing specific skills to be performed or specific medications to be administered in certain situations.

**Status asthmaticus:** A potentially fatal episode of asthma in which the patient does not respond to usual inhaled medications.

**Status epilepticus:** An epileptic seizure (or repeated seizures) that lasts longer than 5 minutes without any sign of slowing down; should be considered life threatening and requires prompt advanced medical care.

**Stethoscope:** A device for listening, especially to the lungs, heart and abdomen; may be used together with a BP cuff to measure BP.

**Stillbirth:** Fetal death; death of a fetus at 20 or more weeks of gestation.

**Stimulant:** A substance that affects the central nervous system and speeds up physical and mental activity.

**Stoma:** A surgical opening in the body; a stoma may be created in the neck following surgery on the trachea to allow the patient to breathe.

**Strain:** The excessive stretching and tearing of muscles or tendons; a pulled or torn muscle.

**Stress:** The body's normal response to any situation that changes a person's existing mental, physical or emotional balance.

**Stretcher:** Equipment used for patient transport in a supine position.

**Stridor:** An abnormal, high-pitched breath sound caused by a blockage in the throat or larynx; usually heard on inhalation.

**Stroke:** A disruption of blood flow to a part of the brain which may cause permanent damage to brain tissue.

**Subconjunctival hemorrhage:** Broken blood vessels in the eyes.

**Subcutaneous emphysema:** A rare condition in which air gets into tissues under the skin that covers the chest wall or neck; may occur as a result of wounds to those areas.

**Substance abuse:** The deliberate, persistent, excessive use of a substance without regard to health concerns or accepted medical practices.

**Substance misuse:** The use of a substance for unintended purposes or for intended purposes but in improper amounts or doses.

**Sucking (open) chest wound:** A chest wound in which an object, such as a knife or bullet, penetrates the chest wall and lung, allowing air to pass freely in and out of the chest cavity; breathing causes a sucking sound, hence the term.

**Suctioning:** The process of removing foreign matter, such as blood, other liquids or food particles, by means of a mechanical or manual suctioning device.

**Sudden cardiac arrest:** A condition where the heart's pumping action stops abruptly, usually due to abnormal heart rhythms called arrhythmias, most commonly ventricular fibrillation (V-fib) or ventricular tachycardia (V-tach); unless an effective heart rhythm is restored, death follows within a matter of minutes.

**Sudden death:** An unexpected, natural death; usually used to describe a death from a sudden cardiac event.

**Sudden infant death syndrome (SIDS):** The sudden death of an infant younger than 1 year that remains unexplained after the performance of a complete postmortem investigation, including an autopsy, an examination of the scene of death and a review of the care history.

**Suicide:** An intentional act to end one's own life, usually as a result of feeling there are no other options available to resolve one's problems.

**Sundowning:** A symptom of Alzheimer's disease in which the person becomes increasingly restless or confused as late afternoon or evening approaches.

**Superficial burn:** A burn injury involving only the top layer of skin, characterized by red, dry skin; also referred to as a first-degree burn.

**Supine:** The body position of lying flat on the back.

**Supplemental oxygen:** Oxygen delivered to a patient from an oxygen cylinder through a delivery device; can be given to a nonbreathing or breathing patient who is not receiving adequate oxygen from the environment.

**Surrogate decision maker:** A third party with the legal right to make decisions for another person regarding medical and health issues through a durable power of attorney for healthcare.

**Swathe:** A cloth wrapped around a patient to securely hold the arm against the patient's chest, to add stability; also called a binder.

**Symptoms:** What the patient reports experiencing, such as pain, nausea, headache or shortness of breath.

**Syncope:** A term used to describe the loss of consciousness; also known as fainting.

**Synergistic effect:** The outcome created when two or more drugs are combined; the effects of each may enhance those of the other.

**Systolic blood pressure:** The force exerted against the arteries when the heart is contracting.

**Tendon:** A fibrous band that attaches muscle to bone.

**Tension pneumothorax:** A life-threatening injury in which the lung is completely collapsed and air is trapped in the pleural space.

**Tertiary effects:** The results of individuals being thrown by the blast wind caused by explosive and incendiary devices; can involve any body part.

**Tetanus:** An acute infectious disease caused by a bacterium that produces a powerful poison; can occur in puncture wounds, such as human and animal bites; also called lockjaw.

**Thoracic:** Relating to the thorax, or chest cavity.

**Thready:** Used to describe a pulse that is barely perceptible, often rapid and feels like a fine thread.

**Thrombus:** A blood clot that forms in a blood vessel and remains there, slowing the flow of blood and depriving tissues of normal blood flow and oxygen.

**Throwing assist:** A method of rescuing someone in the water by throwing the person a floating object, with or without a line attached.

**Tidal volume:** The normal amount of air breathed at rest.

**Tissue:** A collection of similar cells acting together to perform specific body functions.

**Tolerance:** A condition in which the effects of a substance on the body decrease as a result of continued use.

**Tonic phase:** The second phase of a generalized seizure, during which the patient becomes unconscious and muscles become rigid.

**Tourniquet:** A tight, wide band placed around an arm or a leg to constrict blood vessels in order to stop blood flow to a wound.

**Toxemia:** An abnormal condition associated with the presence of toxic substances in the blood.

**Toxicity:** The degree to which a substance is poisonous or toxic.

**Toxicology:** The study of the adverse effects of chemical, physical or biological agents on the body.

**Toxin:** A poisonous substance produced by microorganisms that can cause certain diseases but is also capable of inducing neutralizing antibodies or antitoxins.

**Traction splint:** A splint with a mechanical device that applies traction to realign the bones.

**Transdermal medication patch:** A patch on the skin that delivers medication; commonly contains nitroglycerin, nicotine or other medications; should be removed prior to placing defibrillation pads on the chest.

**Transferring:** The responsibility of transporting a patient to an ambulance, as well as transferring information about the patient and incident to advanced medical personnel who take over care.

**Transient ischemic attack (TIA):** A condition that produces stroke-like symptoms but causes no permanent damage; may be a precursor to a stroke.

**Trauma alert criteria:** An assessment system used by emergency medical services (EMS) providers to rapidly identify those patients determined to have sustained severe injuries that warrant immediate evacuation for specialized medical treatment; based on several factors including status of airway, breathing and circulation, as well as Glasgow Coma Scale score, certain types of injuries present and the patient's age; separate criteria for pediatric and adult patients.

**Trauma dressing:** A dressing used to cover very large wounds and multiple wounds in one body area; also called a universal dressing.

**Trauma system:** A regional or community-based system that provides definitive care for injured (trauma) patients; provides patients with a seamless transition from prehospital care to acute and post-hospital care, leading to improved patient outcomes. A comprehensive trauma system also participates in community outreach activities, including injury prevention programs.

**Traumatic asphyxia:** Severe lack of oxygen due to trauma, usually caused by a thoracic injury.

**Traumatic brain injury (TBI):** An injury to the brain resulting from an external force such as a blow to the head or a penetrating injury to the brain; TBIs are associated with temporary and/or permanent impairment to brain function, including physical, emotional and cognitive functioning; a concussion is a common type of TBI.

**Triage:** A method of sorting patients into categories based on the urgency of their need for care.

**Triage tags:** A system of identifying patients during an MCI; different colored tags signify different levels of urgency for care.

**Triangular bandage:** A triangle-shaped bandage that can be rolled or folded to hold a dressing or splint in place; can also be used as a sling to support an injured shoulder, arm or hand.

**Trimester:** A three-month period; there are three trimesters in a normal pregnancy.

**Tripod position:** A position of comfort that a person may assume automatically when breathing becomes difficult; in a sitting position, the person leans slightly forward with outstretched arms, and hands resting on knees or an adjacent surface for support to aid breathing.

**Tuberculosis (TB):** A bacterial infection that usually attacks the lungs.

**Twisting force:** A force that causes injury when one part of the body remains still while the rest of the body is twisted or turns away from it.

**Two-person seat carry:** A nonemergency method of carrying a patient by creating a “seat” with the arms of two responders.

**Type 1 diabetes:** A type of diabetes in which the pancreas does not produce insulin; formerly known as insulin-dependent diabetes or juvenile diabetes.

**Type 2 diabetes:** A type of diabetes in which insufficient insulin is produced or the insulin is not used efficiently; formerly known as non-insulin-dependent diabetes or adult-onset diabetes.

**Umbilical cord:** A flexible structure that attaches the placenta to the fetus, allowing for the passage of blood, nutrients and waste.

**Universal precautions:** A set of precautions designed to prevent transmission of HIV, hepatitis B virus (HBV) and other bloodborne pathogens when providing care; these precautions consider blood and OPIM of all patients potentially infectious.

**Uterus:** A pear-shaped organ in a woman's pelvis in which an embryo forms and develops into a baby; also called the womb.

**Vacuum splint:** A splint that can be molded to the shape of the injured area by extracting air from the splint.

**Vagina:** Tract leading from the uterus to the outside of the body; often referred to during labor as the birth canal.

**Vector-borne transmission:** Transmission of a pathogen that occurs when an infectious source, such as an animal or insect bite or sting, penetrates the body's skin.

**Vehicle stabilization:** Steps taken to stabilize a motor vehicle in place so that it cannot move and cause further harm to patients or responders.

**Veins:** Blood vessels that carry oxygen-poor blood from all parts of the body to the heart, except for the pulmonary veins, which carry oxygen-rich blood to the heart from the lungs.

**Ventilation:** The exchange of air between the lungs and the atmosphere; allows for an exchange of oxygen and carbon dioxide in the lungs.

**Ventricular fibrillation (V-fib):** A life-threatening heart rhythm in which the heart is in a state of totally disorganized electrical activity.

**Ventricular tachycardia (V-tach):** A life-threatening heart rhythm in which there is very rapid contraction of the ventricles.

**Vial of Life:** A community service program that provides emergency medical services (EMS) personnel and other responders with vital health and medical information (including any advance directives) when a person who suffers a medical emergency at home is unable to speak; consists of a label affixed to the outside of the refrigerator to alert responders and a labeled vial or container that has pertinent medical information, a list of medications, health conditions and other pertinent medical information regarding the occupant(s).

**Virus:** A common type of pathogen that depends on other organisms to live and reproduce; can be difficult to kill.

**Visual warning devices:** Warning lights in an emergency vehicle that, used together with audible warning devices, alert other drivers of the vehicle's approach.

**Vital organs:** Those organs whose functions are essential to life, including the brain, heart and lungs.

**Vital signs:** Important information about the patient's condition obtained by checking respiratory rate, pulse and blood pressure.

**Voluntary muscles:** Muscles that attach to bones; also called skeletal muscles.

**Wading assist:** A method of rescuing someone in the water by wading out to the person in distress.



**Walking assist:** A method of assisting a patient to walk by supporting one of the patient's arms over the responder's shoulder (or each of the patient's arms over the shoulder of one responder on each side).

**Walking wounded (Green):** A triage category of those involved in an MCI who are able to walk by themselves to a designated area to await care.

**Warm zone:** Also called the contamination reduction zone; the area immediately outside the hot zone.

**Wheezing:** A high-pitched whistling sound heard during inhalation but heard most loudly on exhalation; an abnormal breath sound that can often be heard without a stethoscope.

**Withdrawal:** The condition of mental and physical discomfort produced when a person stops using or abusing a substance to which the person is addicted.

**WMD:** Weapons of mass destruction.

**Work practice controls:** Control measures that reduce the likelihood of exposure by changing the way a task is carried out.

**Wound:** An injury to the soft tissues.

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Care steps outlined within this manual are consistent with:

- 2015 International Consensus on CPR and Emergency Cardiovascular Care (ECC) Science with Treatment Recommendations
- 2015 American Heart Association Guidelines Update for CPR and ECC
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