

# PHTLS

## Prehospital Trauma Life Support

NINTH EDITION

### LESSON 5

## Circulation

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## Lesson Objectives

- Describe shock pathophysiology.
- Recognize the clinical signs of shock.
- Explain basic shock treatment.
- Identify the modalities of fluid replacement.
- Explain the role of blood component replacement in the management of hemorrhagic shock.
- Describe special considerations in shock management (age, athletes, hypothermia, medications, pacemakers, and pregnancy).

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## Presentation/Dispatch

- Dispatch information
  - 40-year-old male
  - Motorcycle went out of control while passing a car
  - Patient lying on the ground with blood noted around him



Photograph provided courtesy of Air Glaciers, Switzerland.

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## Scene Size-Up and General Impression

- Scene size-up
  - Motorbike lying on the side of the street
  - Traffic stopped by law enforcement
- General impression
  - Patient lying in a pool of blood beside bike
  - Bike not deformed

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## Primary Survey

### Primary survey

- X—Profuse bleeding from anterior neck wound
- A—Tenuous with sonorous respirations
- B—Fast, shallow chest rise
- C—Rapid, thready radial pulse
- D—Unconscious, moves all extremities to painful stimulus
- E—Lying on ground next to his bike

## Discussion

- Is the patient in shock?
- What is the definition of shock?
- Why is it so time sensitive?
- What is special about oxygen transport in the blood?
- Is loss of red blood cells the only thing that can cause shock?



Photograph provided courtesy of Air Glaciers, Switzerland.

## Case Progression

### Primary survey—reassessed

- X—Bleeding is controlled with manual pressure.
- A—Helmet is removed, trauma chin lift to open airway.
- B—Fast with equal chest rise and clear breath sounds
- C—Rapid, thready radial pulse
- D—Regaining consciousness, moving all extremities
- E—Covered to maintain normothermia

## Discussion

- Why do we check for major bleeding first?
- What is your priority in the face of external hemorrhage?
- How does direct pressure ideally work?
- What if the dressing becomes soaked with blood?
- Can pressure be released once the bleeding has stopped?

## Discussion

- When would you use a tourniquet in the civilian setting?
- How does a tourniquet work?
- Why is a tourniquet applied so tightly?
- Where do I apply the tourniquet and why?
- Would a tourniquet be an option in this patient?
- What are the special considerations?



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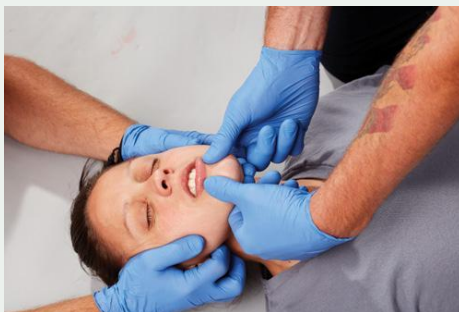
## Case Progression

- Primary survey—reassessed
  - X—External bleeding still controlled by direct pressure
  - A—Patent
  - B—24 breaths/min, good chest rise, clear equal breath sounds, SpO<sub>2</sub> 97%/O<sub>2</sub>
  - C—110 beats/min at carotid and radial; skin cool
  - D—Conscious, GCS 15 (E4, V5, M6), moves all extremities
  - E—Abrasion and bruising noted to LUQ

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## Discussion

- Why is it important to check the airway and breathing in this patient?
- What signs of shock are present this patient?
- Is there a possibility of internal bleeding?
- What is damage control resuscitation in trauma?



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## Discussion

- What happens in the body if it loses blood?
- Can the organs work without oxygen?
- Which organs will sustain damage first? When will they fail?
- How does the body react to blood loss?

**Table 3-1 Organ Tolerance to Ischemia**

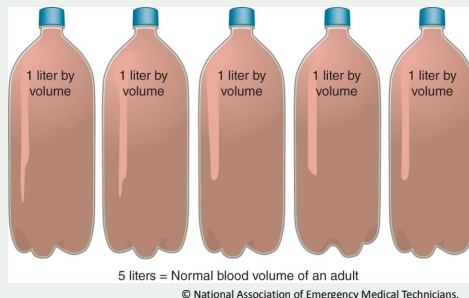
Organ	Warm Ischemia Time
Heart, brain, lungs	4–6 minutes
Kidneys, liver, gastrointestinal tract	45–90 minutes
Muscle, bone, skin	4–6 hours

Modified from American College of Surgeons (ACS) Committee on Trauma. Advanced Trauma Life Support for Doctors: Student Course Manual, 7th ed. Chicago, IL: ACS; 2004.

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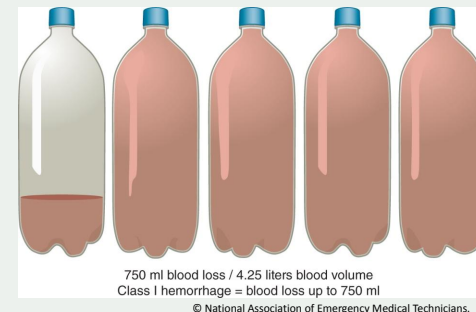
## Classes of Hemorrhage

- Estimating blood loss can be difficult.
- External versus internal loss
- Average blood volume is 5 liters in adults (65 ml/kg).
- Classes of hemorrhage are based on lost blood volume.
- Clinical signs reflect progression of shock.



## Class I Hemorrhage

- Mentation: Slightly anxious
- Ventilatory rate: 14–20 breaths/min
- Pulse: < 100 beats/min
- BP: Normal systolic/diastolic
- Pulse pressure: Normal
- Skin: Warm, dry
- Urine output: > 20 ml/hr

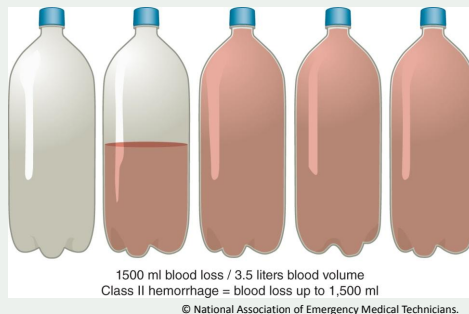


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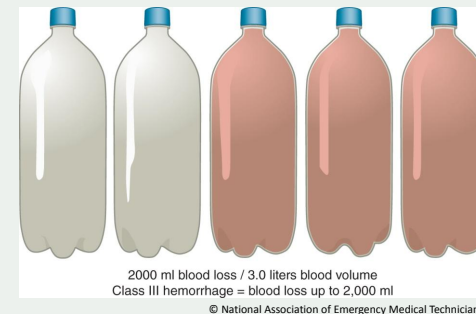
## Class II Hemorrhage

- Mentation: Mildly anxious
- Ventilatory rate: 20–30 breaths/min
- Pulse: 100–120 beats/min
- BP: Normal systolic
- Pulse pressure: Decreased
- Skin: Cool
- Urine output: 20–30 ml/hr



## Class III Hemorrhage

- Mentation: Anxious, confused
- Ventilatory rate: 30–40 breaths/min
- Pulse: 120–140 beats/min
- BP: Decreased
- Pulse pressure: Decreased
- Skin: Cool, diaphoretic, pale
- Urine output: 5–15 ml/hr



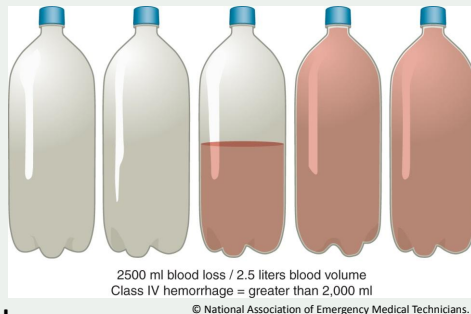
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## Class IV Hemorrhage

- Mentation: Difficult to arouse
- Ventilatory rate: >35 breaths/min
- Pulse: >140 beats/min
- BP: Decreased
- Pulse pressure: Decreased
- Skin: Cool, diaphoretic, pale
- Urine output: <5 ml/hr



## Special Considerations

- Athletes
- Geriatric patients
- Medications
- Pacemaker implants
- Pediatric patients
- Pregnancy



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## Discussion

- What is the purpose of giving IV fluids?
- What are the limitations of crystalloids?
- How do you monitor their effectiveness?
- How should trauma fluid resuscitation be titrated in the prehospital setting?

## Blood and Blood Products

- What are the advantages and limitations of blood products?
- What are the objectives of blood resuscitation?
- Are the objectives of resuscitation the same in each and every situation?



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## Tranexamic acid (TXA)

- What is TXA?
- What are the advantages of TXA?
- What are the objectives of TXA?
- How should TXA be administered?

## Discussion

- How can you stop internal bleeding?
- What does rapid transport mean?
- Should you delay transport to obtain IV access?
- What are the components of basic shock treatment?

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## Types of Traumatic Shock

- Cardiogenic
- Distributive
- Hypovolemic
- Neurogenic
- Obstructive

## Prevention of Hypothermia

- What is special about temperature in the human body?
- What happens if a patient becomes hypothermic?
- Does hypothermia affect mortality in the trauma patient?
- What can you do to prevent hypothermia in the field?

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## Case Progression

- Primary survey—reassessed
  - X—Bleeding is controlled by pressure dressing.
  - A—Patent
  - B—20 breaths/min, lungs clear bilaterally, SpO<sub>2</sub> 97%/O<sub>2</sub>
  - C—105 beats/min, radial pulse present, 18-gauge IV in place with LR running TKO
  - D—GCS 15 (E4, V5, M6), no neurologic deficit
  - E—Body heat maintained with blanket and warm environment

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## Case Summary

- Secondary survey was completed during transport.
- Patient was transported to a level I trauma center.
- Once in the trauma center, the patient is found to have a ruptured spleen with internal bleeding.
- He undergoes a surgical splenectomy and makes a good recovery after 5 days in the hospital.

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## Critical Actions

- Circulation assessment to identify potential life threats
- Determining the best method to manage perfusion in this patient
- Reassessment of perfusion status after initial management completed

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## Wrap-Up

- Stop the bleeding! No IV fluid is better than the patient's blood.
- Use the primary survey to identify life threats.
- Optimize oxygenation.
- Evaluate the need for volume replacement.
- Maintain normothermia.
- You cannot stop internal bleeding in the field—rapid transport is paramount.

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