ProCare Training Manual
Chapter 5
Types of Wounds

Wounds are classified into two types acute and chronic and sub-classified into groups such as pressure, vascular, arterial, diabetic, burns, etc.

ProCare treats primarily chronic wounds but it is important that you know about acute wounds and their treatment, as many acute wounds will eventually become chronic wounds.

The question of when does an acute wound become chronic is one that is often asked. Time alone does not distinguish an acute wound from a chronic wound. Progress toward complete healing is also a component. An acute wound is better characterized by the following:

- It is a new or relatively new wound
- It occurred suddenly (as opposed to over time)
- Healing is progressing in a timely and predictable manner.

Acute wounds can occur by intention or trauma. A surgical incision is an example of an acute wound that is caused by intention. Traumatic wounds can range from simple to severe. Burns are a category of traumatic wounds that are unique to wound care.

Regardless of the cause, caring for a patient with an acute wound focuses on restoring normal anatomic structure, physiologic function, and appearance of the wound.

Surgical Wounds

The wound care clinic will see a number of surgical wounds. An acute surgical wound is a healthy and uncomplicated break in the skin resulting from surgery. In an otherwise healthy individual this type of wound responds well to postoperative care and heals without incident.

However, there are several factors that can greatly affect the healing of a surgical wound they include the patient's age, nutritional status, general health before surgery, and oxygenation status.

Age is an important factor as a person gets older. They commonly have a harder time healing after surgery due to skin changes. Skin in the older person is thinner and less elastic. Growth factors that repair tissues and fight infection decline, and the skin's vascular system is less robust. As a result, surgical wounds heal slower and the risk of infection is higher.

Nutrition after surgery is crucial to normal healing. After surgery, the body quickly depletes its stores of nutrients and even an otherwise healthy patient can become malnourished. The plan of care must include a diet with adequate nutrients to maintain homeostasis and create an optimal healing environment.

The wound clinic will see a number of obese patients, which add to problems with healing after surgery. Adipose tissue lacks the extensive vascular supply present in skin, and as the amount of adipose increases, blood flow to the skin decreases. This reduces the amount of oxygen and nutrients reaching the wound area.

Preexisting illness and infection delays or complicates healing after surgery. Unfortunately, surgery cannot always be delayed and the healing process can be impacted by the underlying conditions. The conditions can include:

- Disorders that impede blood flow, such as coronary artery disease, peripheral vascular disease, and hypertension, can cause problems by reducing the flow of blood reaching the incision site.
- Cancer may necessitate more aggressive pain management
- Diabetes mellitus impedes healing in many and increases the risk of infection. If the patient has neuropathy it may interfere with vasodilation and circulation to the incision.
- Immunosupression resulting from a disease or drug therapy (corticosteroids or chemotherapy) may impair the inflammatory response, delaying wound healing and increasing the patient's risk of infection

A preexisting infection can also delay or impair healing. Signs of wound infection include:

- Increased exudates
- Purulent exudates
- Erythema
- Warmer skin temperature around the wound
- New or increased pain
- General malaise
- Fever
- High white blood cell count

All open wounds are colonized with surface bacteria, but infected wounds are slow to heal and may become dehisced or eviscerated.

Oxygen status during healing is an important factor. Neutrophils require oxygen to produce the hydrogen peroxide they use to kill pathogens. Fibroblasts require oxygen for collagen proliferation. Therefore, adequate oxygenation is critical to the healing process. Any condition that impedes overall oxygenation slows the healing

process and the patient should be assessed for hyperbaric oxygen therapy. Proper care of surgical incision depends partly upon the type of closure used by the surgeon in closing the wound.

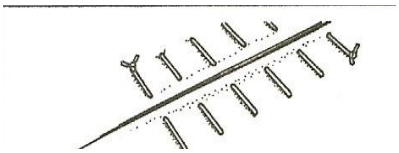
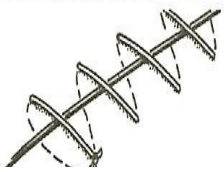
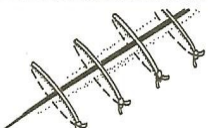
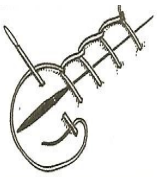
The two types of common closures are suturing and staples. Sutures typically remain in place for 7 to 10 days, provided that healing is progressing as expected. Any complications can lengthen the healing process.

Staples or clips can be an alternative to sutures if cosmetic results aren't the issue. The closures secure a wound faster than sutures and, because they're made of surgical stainless steel, tissue reaction is minimal. Properly placed staples and clips distribute tension evenly along the suture line, reducing tissue trauma and compression. This promotes healing and minimizes scarring. The surgeon won't use staples or clips if less than 5 mm of tissue exists between the staple and any underlying bone, vessel, or organ.

Suturing

There are various methods of suturing that a physician may use. It is important to become familiar with some of the suturing techniques in order to remove all of the sutures that were placed. Always cut the suture nearest to the skin and pull the long portion out. This prevents contaminated exposed suture from being pulled underneath the skin during removal. A few of the common suturing techniques and descriptions are listed in table 5-A.

Table 5-A Suturing techniques

Method	Explanation	Description
Mattress continuous	continuous suture with a knot at the beginning and the end	
Plain continuous	continuous running suture, the thread is knotted at the beginning and the end	
Mattress interrupted	series of independent stitches, similar to plain interrupted sutures, however, in this suture, both threads cross beneath the suture line, leaving only a small portion of suture exposed on each side of the wound	
Plain interrupted	individual sutures, each with a separate piece of thread. Half of the thread length crosses under the suture line and the other half crosses over the skin surface	
Blanket continuous	series of looped stitches with a knot at the beginning and end of the series	

Adhesive closures – these include steri-strips and butterfly closures- Both of these are used to hold a wound closed after sutures are removed. The steri-strips are thin and have adhesive across their entire under surface. Butterfly closures have adhesive on tabs between non-adhesive bridges that go over the wound.

The Healing Ridge – this is a buildup of collagen fibers that begin to form during the inflammatory phase of wound healing and peaks during the proliferation phase. You can feel this ridge as you palpate the skin on each side of the wound. This tells you that the healing is progressing. If you cannot feel this ridge 5 to 9 days after the incision, your wound is failing to progress as expected. In many cases there may be a mechanical strain on the wound that is

keeping it from progressing.

Dressing a surgical wound – The dressing is the primary aspect of wound management for surgical wounds, therefore, choosing the right type is important.

When dressing a surgical wound use **sterile technique.** This differs from other types of wounds that are chronic in nature. If there is little drainage only packing and a gauze drainage will be required. If the wound has heavy drainage an absorbent dressing, such as an alginate, or even pouching may be required to protect the surface skin.

Change the dressing as often as needed to absorb drainage and keep the surrounding skin dry. However, remember that a wound heals best at body temperature. Changing the dressing lowers the temperature at the wound site and healing slows until the site returns to normal body temperature.

Some complications in surgical incisions are infection, ,hemorrhage, wound dehiscence and evisceration.

Wound Infection – this is the most common wound complication as well as the second most common nosocomial infection. Preventing wound infection requires meticulous attention to sterile technique when caring for the surgical wound. Typical interventions when a wound infection is suspected or occurs are:

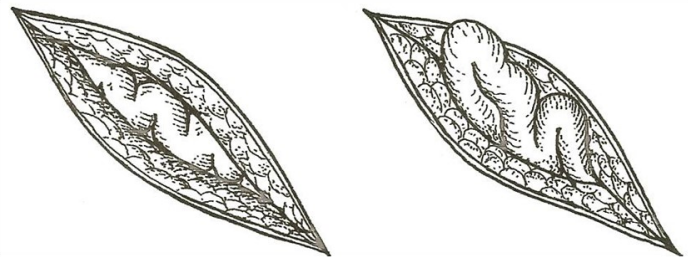
- Obtaining a wound culture and sensitivity test
- Administering antibiotics
- Irrigating/cleaning the wound
- Dressing the wound and packing it, if needed
- Monitoring wound drainage

Hemorrhage – In a post-operative patient, hemorrhage can be either internal or external. Hemorrhage will significantly reduce the volume of circulating blood and precipitates hypovolemia. Nursing interventions include administering I.V. fluids to increase blood pressure and urine output and helping to determine the source of the bleeding. If the hemorrhage is external from the wound itself or from damage to the fragile, newly developed blood vessels, place pressure or a pressure dressing on the site of the bleeding and notify the physician for orders.

Wound dehiscence and evisceration – Dehiscence is mostly likely to occur when collagen fibers aren't strong enough to hold the incision closed without sutures. The first sign of dehiscence may be an abscess or gush of serosanguinous fluid, often followed by purulent fluid, from the wound site. Complete dehiscence leads to evisceration, in which underlying tissues protrude through the wound opening. Abdominal wounds are more likely to dehisce and eviscerate than thoracic wounds.

If dehiscence occurs, stay with the patient and have someone notify the physician. If evisceration is evident, cover extruding tissues with warm sterile normal saline soaks.
If the patient has an abdominal wound, help him into low Fowler's position, with knees bent to reduce abdominal tension.

Figure 5-B Dehiscence and Evisceration



Dehiscence **Evisceration**

Traumatic Wounds
A traumatic wound is a sudden, unplanned injury to the skin, it can be anything from a minor scrape to a severe wound. This category of wounds includes abrasions, lacerations, skin tears, bites and penetrating trauma wounds.

Abrasions – occur when a mechanical force, such as friction or shearing, scrapes away a partial thickness of the skin. It is usually a minor event.

Lacerations – occurs when there is a tear in the skin that's caused by a sharp object, such as metal, glass, or wood. It can also be caused by trauma that produces high shearing force. A laceration has jagged, irregular edges and its

severity depends on its cause, size, depth, and location.

Skin tears – most often affects older adults, in a skin tear, friction or shearing force separate layers of the skin. A partial-thickness wound occurs if the epidermis separates from the dermis, a full-thickness wound occurs if the epidermis and dermis separate from underlying tissue. This type of wound may be preventable through careful handling by members of the health care team.

Bites – When assessing a bite wound, it is important to quickly discover the bite's source – cat, dog, bat, snake, spider, human? This helps the wound care staff determine which bacteria or toxins may be present.

A human bite can cause a puncture wound that can introduce numerous organisms present in the mouth into the wound. Staphylococcus aureus and streptococci are two such organisms that can be transmitted to the wound or into the victim's bloodstream. Other serious diseases that can be transmitted in this manner are AIDS, hepatitis B and C, syphilis, and tuberculosis. Some evidence suggests that a human bite can also cause necrotizing fasciitis.

A bite from a animal may introduce rabies into the wound. A dog can generate up to 200psi of pressure when biting and if he shakes his head at the same time, which he usually does, strong torsional force is also a factor. Together these forces can cause massive tissue damage.

Penetrating Traumatic Wound – a penetrating trauma wound is a puncture wound. This type of wound may be the result of an accident or a personal attack as in the case of a stabbing or gunshot wound.

A wound from a stabbing is usually a low-velocity wound that presents as a puncture wound or laceration. In some cases it can involve organ damage beneath the site of the wound. X-rays, CT scans and MRI's are used to evaluate the patient for possible organ damage. If the weapon used is contaminated, the patient is at risk for local infection, sepsis and tetanus.

A gunshot wound is a high-velocity wound. Factors that affect the severity of the tissue damage include the caliber of the weapon, the velocity of the projectile, and the patient's position at the time of the injury.

In some cases, the patient requires surgical intervention. After surgery, treat as you would a surgical wound.

Assessment of the Acute Wound

Time is critical when caring for a patient with a traumatic wound. First, assess airway, breathing, and circulation (ABC's). These are the first and most critical priorities, next comes the wound itself. Control bleeding by applying firm, direct pressure and elevate the patient's extremities. If bleeding continues, you may need to compress a pressure point above the wound. Specific wound management and cleaning depends on the type of wound and degree of contamination.

The Dos and Don'ts in Traumatic Wounds

Dos

- Do avoid using greater than 8 psi of pressure when irrigating the wound
- Do use sterile normal saline solution to remove the debris
- Do monitor closely for signs of infection, such as warm skin or purulent discharge from the wound.
- Do inspect the dressing regularly. If edema develops, adjust to ensure adequate circulation.

Don'ts

- Don't use hydrogen peroxide on a deep wound, the evolving gases can cause an embolism.
- Don't' use alcohol to clean a traumatic wound it dehydrates the tissue. Also avoid cleaning with any antiseptic because they can impede healing.
-
- Never use a cotton ball or a cotton-filled gauze pad to clean a wound the fibers left behind can cause contamination or a foreign body reaction.

When cleaning acute trauma wounds you should follow the basic cleaning guidelines listed below in Table 5-C.

Table 5-C Basic Cleaning Instructions

Abrasion • Flush the area of the abrasion with normal saline or wound cleaning solution • Use a sterile 4"X4" gauze pad moistened with normal saline solution to remove dirt or gravel, and gently rub toward the entry point to work contaminants back out of the way they entered • If the wound is very dirty, you may need to scrub with a surgical brush. Be as gentle as possible • Allow a small wound to dry and a scab to form. Cover larger wounds with a non-adherent pad or petroleum gauze and a light dressing. • Apply antibacterial ointment as ordered	**Bite** • Immediately irrigate the wound with copious amount of normal saline. Don't immerse the wound as contaminants can flow back into the wound. • Clean the wound with sterile 4"X4" gauze pads and an aseptic solution such as povidone-iodine • Assist with debridement if ordered • Apply a loose dressing. If the bite is on an extremity, elevate it to reduce swelling. • Ask the patient about the animal that bit him to determine whether there is a risk of rabies. Administer rabies or tetanus shots as needed.
Laceration • Moisten a sterile 4"X4" gauze pad with normal saline solution or wound cleaning solution. Gently clean the wound beginning at the center and working out to approximately 2" beyond the edge of the wound. Whenever the pad becomes soiled, discard it and use a new one. Continue until the wound appears clean. • If necessary, irrigate the wound with a 50 ml catheter-tip syringe and normal saline solution • Assist the doctor in suturing the wound if necessary, apply steri- strips or porous tape if suturing isn't needed • Apply antibacterial ointment as ordered • Apply a dry sterile dressing over the wound to absorb drainage and help prevent bacterial contamination.	**Penetrating Wound** • If the wound is minor, allow it to bleed for a few minutes before cleaning it. A larger puncture wound may require irrigation • Cover with a dry dressing • If wound contains an embedded foreign object, such as a shard of glass or metal, stabilize the object until the physician can remove it. When the object is removed and bleeding is under control, clean the wound as you would a laceration.

Burns

Burns are wounds that are caused by exposure to thermal extremes, caustic chemicals, electricity or radiation. The degree of damage is related to the strength of the source and the duration of the exposure.

Thermal burns – This is the most common type of burn, it can result from any misuse or mishandling of fire or a combustible product. Thermal burns can result from anything from house fires to playing with fireworks. It can also result from extreme cold, however, this is much less common. Many thermal burns occur from patients soaking their neuropathic feet in water that is too warm.

Figure 5-E Thermal injury in neuropathic foot

Chemical Burns – A result of a caustic agent coming into contact with the skin.

Electrical Burns – Result from contact with flowing electrical current. Household current, high-voltage transmission lines and lightening are a few examples.

Radiation Burns – Most commonly this is a sunburn, which follows excessive sun exposure. Most other causes of radiation are from radiation treatment or from accidents with radioactive materials. Tissue injury from radiation treatments may take anywhere from 2 months up to 20 years to develop. The later is called delayed radiation injury and is discussed more extensively in Chapter 10, Commonly Misdiagnosed and Recalcitrant Wounds.

The assessment of a burn should be done as soon as possible after the burn occurs. First, assess the ABC's then the size, depth, and severity of the burn.

When determining the size of a burn we use the Rule of Nines. Below is an explanation of calculating the percentage of a burn. Note that infants and children must be determined using the Lund and Browder chart. Please see table 5-F for further explanation.

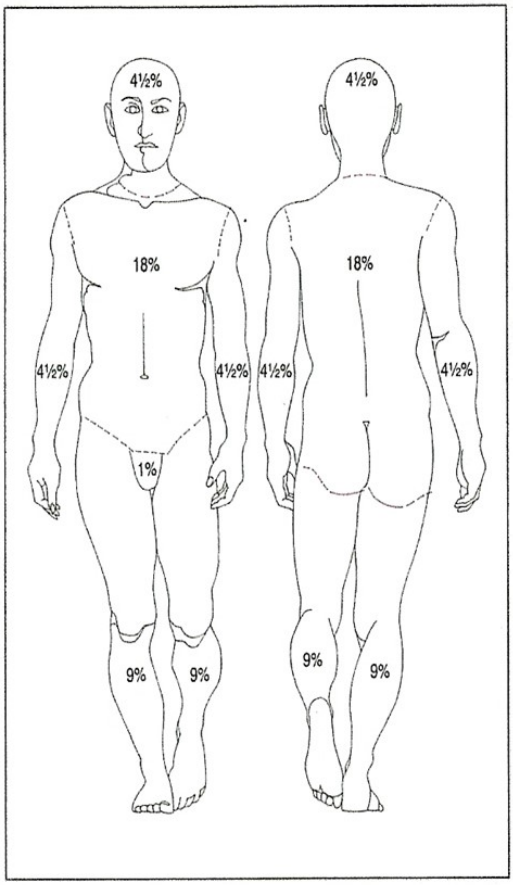
Table 5-F Estimating burns

Estimating burn surfaces in adults and children

You need to use different formulas to compute burned body surface areas in adults and children because the proportion of body surface areas varies with growth.

Rule of nines

You can quickly estimate the extent of an adult patient's burn by using the "rule of nines." This method quantifies body surface area in percentages either in fractions of nine or in multiples of nine. To use this method, mentally assess your patient's burns by the body chart shown below. Add the corresponding percentages for each body section burned. Use the total—a rough estimate of burn extent—to calculate initial fluid replacement needs.

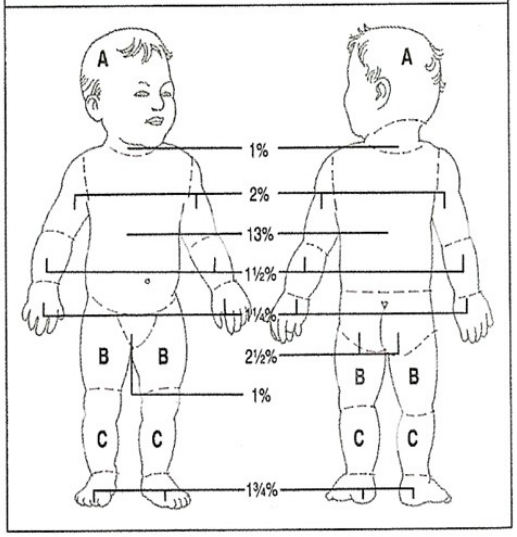


Lund and Browder

The rule of nines isn't accurate for infants and children because their body shapes differ from those of adults. An infant's head, for example, accounts for about 17% of his total body surface area, compared with 7% for an adult. Instead, use the Lund and Browder chart shown here.

Percentage of burned body surface by age

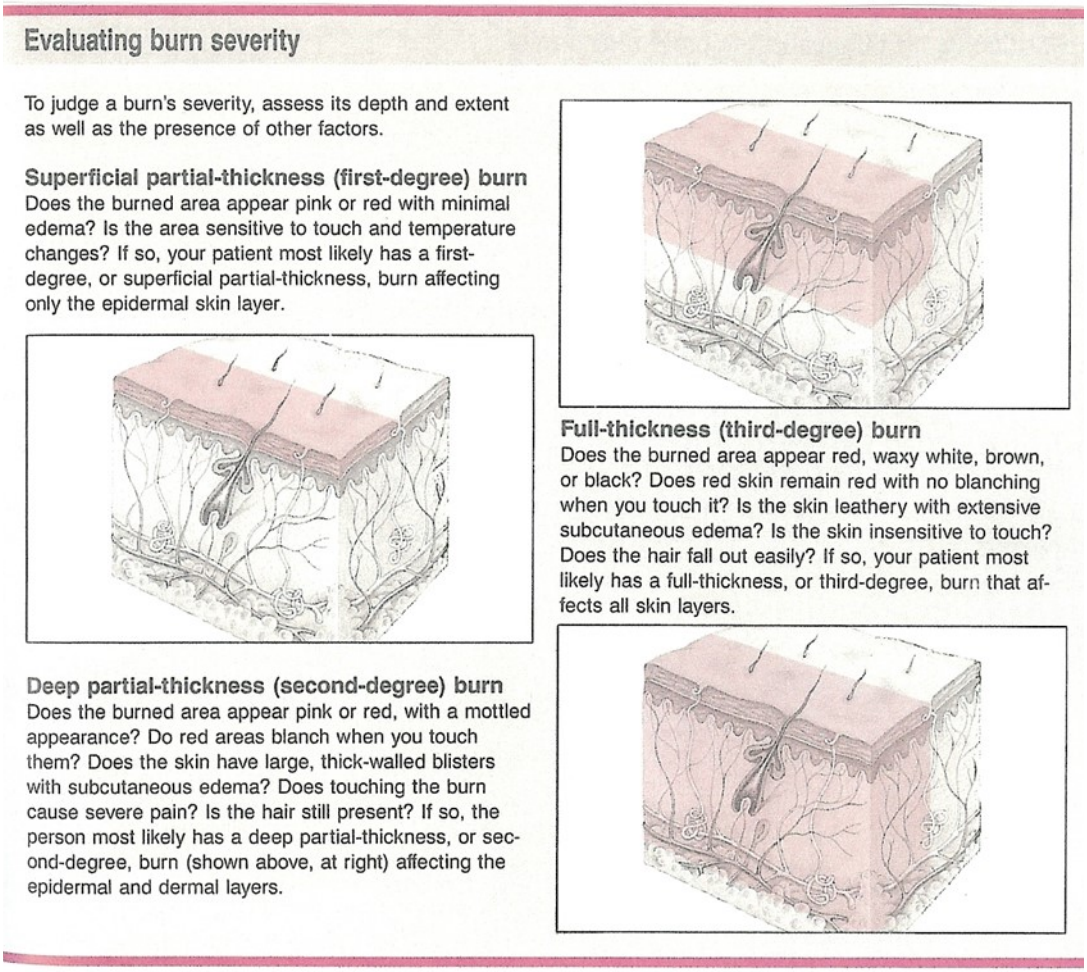
AT BIRTH	0 TO 1 YR	1 TO 4 YR	5 TO 9 YR	10 TO 15 YR	ADULT
A: Half of head					
9½%	8½%	6½%	5½%	4½%	3½%
B: Half of thigh					
2¾%	3¼%	4%	4¼%	4½%	4¾%
C: Half of leg					
2½%	2½%	2¾%	3%	3¼%	3½%



Determining Depth – There are four degrees of wound depth in burns, they are:
1) First-degree – damage is limited to the epidermis, causing redness and pain
2) Second-degree – the epidermis and part of the dermis are damaged, producing blisters, mild to moderate edema, and pain
3) Third-degree – the epidermis and dermis are damaged; no blisters appear, but white, brown, or black leathery tissue and thrombosed vessels are visible
4) Fourth-degree – damage extends through deeply charred subcutaneous tissue to muscle and bone.

In most instance damage involves several depths and degrees. See Figure 5-G.

Figure 5-G Determining burn depth



Determining severity

Major burns meet one or more of these criteria:
- Third-degree burns on more than 10% of body BSA (body surface area)
- Second-degree burns on more than 25% of BSA in adults; more than 2% in children
- Burns on the hands, face, feet, or genitalia
- Burns complicated by fractures or respiratory damage
- Electrical burns
- Any burn in a poor risk patient

Moderate Burns
- Third-degree burns on 2% to 10% of BSA
- Second-degree burns on 15% to 25% of BSA in adults, 10% to 20% BSA in children

Minor

Third-degree burns on less than 2% of BSA
Second-degree burns on less than 15% of BSA in adults, less than 10% of BSA in children.

The type and severity of the burn will determine the care of the burn. In major to moderate burns the first step is to assess the ABC's. Be especially alert to signs of smoke inhalation and pulmonary damage. Singed nasal hairs, mucosal burns, changes in the patient's voice, coughing, wheezing, soot in the mouth or nose, or darkened sputum can be signs of smoke inhalation. If necessary, assist with endotracheal intubation and administer 100% oxygen. When the patient's ABC's are stable, take a brief history of the burn and draw blood samples, as ordered, for diagnostic tests.

After assessing the ABC it is important to stop the burning process and relieve pain. Remove smoldering clothing and provide pain medication, as ordered. When cleaning the burns, never use hydrogen peroxide or povidone-iodine, or products containing these agents, because they can cause further damage to tissue. Cover large surface area burns with dry sterile bed sheets or towels. Covering large surface area burns with normal saline soaked dressings can drastically lower the patient's temperature.

The burn patient will need to be started on I.V. therapy by the physician to prevent hypovolemic shock and to help maintain cardiac output. A patient with serious burns needs massive fluid replacement, especially during the first 24 hours. It will be necessary to closely monitor the intake and output and check vital signs often.

Skin Grafting

Skin grafting is used to repair defects caused by burns, trauma, or surgery. Depending on the difficulty of the procedure it can be performed under local or general anesthesia and in many cases in the outpatient wound care clinic. A few examples of grafts in the wound care clinics are dermagrafts, apligrafts, gammagrafts, and traycyte.

There are three types of skin grafts (not including the biologically engineered dressings and grafts) they are:

1)Split-thickness grafts, which consist of the epidermis and a small portion of the dermis
2) Full-thickness grafts, which include the epidermis and all of the dermis
3) Composite grafts, which include the epidermis, dermis, and underlying tissues, such as muscle, cartilage, and bone.

The secret to success in all grafts lies in the revascularization. Grafts die unless new blood vessels are able to develop. For split-thickness grafts, revascularization, usually takes 3 to 5 days for full-thickness grafts, up to 2 weeks.

The aftercare of the skin graft focuses on promoting graft survival. It is important to keep the patient from lying on the area of the graft. If possible keep the graft elevated and immobilized. Never use a blood pressure cuff over a graft site. Always use sterile technique when changing dressings and work gently to avoid dislodging the graft. Clean the graft site with a warm saline solution and cotton-tipped applicator, leaving the fine-mesh gauze over the graft intact. Aspirate any serous pockets. Change the gauze and apply the prescribed topical agent as needed. Cover the area with a gauze bandage.