Wounds and Burns

Injuries that Break the Skin
p. 249 in Rattray

An injury is the disruption of the continuity of the skin

Anatomy of the skin
-The body is covered by skin, which is the largest protective organ, forming a barrier between the body and the external environment. Comprised of 3 layers:

- Epidermis: the outer layer, sloughing of this layer occurs every 28-30 days. Therefore has continuous renewal
- Dermis: Lies just below the epidermis. It anchors and nutritionally supports the epidermis. Composed of elastin and collagen which gives the tissue flexibility and strength. Contains oil and sweat glands, hair follicles, nerve receptors, blood vessels and lymphatic vessels
- Subdermal/Subcutaneous: this layer contains adipose tissue, larger blood vessels and deep hair follicles. Below this layer are muscle and bone

Function of skin
-Skin prevents the invasion of infective organisms and protects the underlying tissue from injury. Nerve endings in the skin inform the body of various sensory stimuli such as temperature, pressure, touch and pain.
-the skin controls body temperature through sweating or shivering as well as through constriction and dilation of blood vessels. It allows gas exchange through the pores and keeps the body systems' fluids and electrolytes balanced.
-Absorption of sunlight by the skin aids in the synthesis of vitamin D.
-The subcutaneous layer stores water and fat which act as a layer of insulation and protection of underlying tissue.

Wounds:

Definition: wounds are a disruption in the continuity of the skin (Break the skin)

Causes

- *Thermal sources*, such as extreme temperatures, and chemical and electrical sources, all of which result in a burn.
- *Mechanical forces:* direct trauma or pressure, shear or friction forces, or conditions within the body.

Types

- *Abrasion*: a superficial wound with ragged edges. Usually the result of a scrape or tear causing loss of skin, (ie. Fall on gravel surface) It is often extremely painful. After careful cleaning, a dressing is applied to the wound to keep it moist. Pain is reduced if the nerve endings do not dry out
- *Laceration*: has increased tissue loss with ragged wound edges. Once cleaned to facilitate healing by first intention, sutures or tape may be used to bring the edges together.
- *Incision:* has clean approximated wound edges and results from a sharp-edged object such as a scalpel in surgery or a piece of glass. Sutures or tape are used to secure the edges together.

- *Puncture:* has clean edges with a small entry. It can penetrate deeply, such as a bullet wound or an injury from stepping on a nail. This type of wound can close over at the entry point before the rest of the damage heals and result in increased risk of infection
- *Animal Bite:* is often a combination of crush, laceration and puncture wounds
- *Burns:* discussed later in this chapter.

Healing of Wounds:
-Disruptions in the continuity of the skin heal through the inflammatory response (see Massage and the Inflammatory Process). Depending on the type of wound and the amount of tissue loss, healing can occur with simple regeneration or by first or second intention healing

First Intention Healing and Sutures
- Likely when there is minimal tissue lost, and the edges of the wound are approximated.
- Stitches can be used to further approximate the edges.
- Initially a thin layer of fibrin is laid down under the incision. This is the basis for the clot.
- Re-epithelialization is completed in 2-3 days. While the site is not strong, it is closed to external intruders.
- Sutures are often treated with application of antibiotic ointment and then covered by gauze and bandages for the first 48 hours. After this time sutures are often kept covered to prevent them from trauma.
- 10-14 days after injury, the site is often much stronger as a result of the collagen laid down by the fibroblasts. Sutures may be removed at this point.
- Signs of infection include: redness, pus, swelling, and possibly pain. Should these occur, see a physician immediately.
- The patient should be directed to begin AROM as soon as possible, with the physician's approval. ROM activities promote appropriate maturation of newly formed collagen fibres.

Second Intention Healing
- Occurs when the injury penetrates the dermis, increased tissue loss, or poor approximation of wound edges.
- Use of ice or cold application for pain and inflammation, antibiotic ointment for prevention of infection along with dressings and bandages.
- Re-epithelialization occurs best in a clean, moist environment.
- The dressing reduces friction on the wound site. It also has the ability to absorb exudate into the gel and keep the area moist. It is particularly good for abrasions or burns, providing a cooling effect and reducing itching.
- A moist, covered wound can re-epithelialize in 12-15 days versus 25-30 days for an air –exposed wound
- Air exposure causes the site to dry out and develop a scab; the epithelial cells must migrate from the wound edges under this crust. Re-epithelialization also takes longer with deeper and larger wounds.

BURNS:

Definition: A burn is a specific type of wound caused by an external thermal agent.
-The severity of a burn may range from mild redness to full-thickness tissue destruction of the dermis and deeper tissues.
-many factors are taken into consideration when assessing the severity of a burn:

- Depth of burn
- amount of body tissue burned
- The specific area burned
- The cause of the burn
- The age of the person
- Pre-existing illness
- Associated injuries such as smoke inhalation and fractures

-these will influence the type of therapy the person receives and the functional difficulties that may result.

Types of burns based on depth of damage:

- **Superficial Burn** (First Degree Burn): Affects the epidermis. Usually the result of prolonged exposure to low intensity heat or quick exposure to high intensity heat. It results in redness and pain. Some mild localized edema (unobservable) is present in the superficial tissue. Within a week, the epithelium sloughs off, as with a sunburn. Healing is rapid and without scar tissue, though in some cases there may be discolouration of the skin
- **Partial Thickness Burn** (Second Degree Burn): Extends to the dermis. Along with redness, pain and some localized edema, the most distinguishing feature is the presence of blistering. Partial thickness burns are classified as superficial or deep. Increased depth of the burn results in increased edema, increased risk of infection, and often decreased pain due to some nerve damage. With a superficial partial thickness burn, a new skin layer that can actively regulate temperature and act as a barrier to bacteria develops within 14-21 days, whereas a deeper burn will require 21-35 days to develop this layer. A more superficial second degree burn will re-epithelialize with good functional return and minimal scar tissue. Deeper second degree burns epithelialize with difficulty and result in fibrosis, contracture and joint mobility restrictions.
- **Full-Thickness Burn** (Third Degree Burns): Cause damage that affects all tissue layers including the epidermis, dermis and the subcutaneous tissue.
- **A fourth degree burn** (also considered a full thickness burn) is used to describe a burn that damages all the skin layers as well as fascia, muscles and even bone that is immediately under the skin. With full-thickness burns, substantial damage occurs to the structures in the tissue layers, such as hair follicles, sweat glands and nerves. These burns appear dry and inelastic, white and waxy or charred in colour; they are painless because of nerve damage. Re-epithelialization over the wound is not possible because of extensive tissue damage, though it may occur at the wound edges after many weeks. Skin grafts are required to cover the wound and facilitate healing of the affected area. See figure 21.2 on pg.254 to determine percentage of the body surface damage “Rule of nines”

Causes of Burns:

- **Thermal damage**: from heat, such as an open flame or scalding from a hot liquid, as well as from cold- a severe example is frostbite. Common causes of deep partial-thickness burns are grease burns, scalding from liquids over 71^{o} C and flame burns.
- **Chemical substances**: such as acids and alkalines. These must be deactivated through the removal of contaminated clothing and cleansing of the skin to prevent continuation of the injury. Injury can result from skin contact or inhalation. Secondary injuries can occur (ex. Phenol depresses the CNS and causes kidney damage) it appears that chemical burns heal slower than other types of burns.
- **Electrical sources**: Thin, wet or sweaty skin is most susceptible to electrical burns. The superficial damage caused by electrical burn can be misleading. The entry site appears black at its centre surrounded by a ring of white necrotic tissue and an outer ring that is hyperemic. Internally, along the path of current, substantial damage results to the muscle, bone and nerves. Cardiac arrhythmias often occur. The greatest numbers of amputations occur with this type of burn. CNS damage may result. Memory loss, headaches personality changes, deafness, visual disturbances, weakness, paralysis and convulsions may occur temporarily or become permanent.
- **Radiation**: including burns from ultraviolet sources such as sunburn

Burns requiring Hospitalization

- moderate partial thickness(second degree) burns on 15 – 20 percent or greater of the total surface area of the body in adults (10 to 20 percent in children)
- full thickness (third degree) burns on 10 percent or greater of the total surface area of the body in adults
- burns on specific areas such as the face, eyes, ears, perineum, hands or feet
- burns complicated by smoke inhalation
- high voltage electrical burns
- burns on people with compromised health, under 2 years of age and of advanced age.

Burns: Acute and Early Subacute Stage Concerns:

-With smaller burns, the wound should be cooled after a thermal injury to prevent further tissue necrosis. Immersion of the affected area for 10minutes in cold water has proven helpful in stabilizing the tissue and improving healing time. With burns over a very large surface, this application is not used due to risk of hypothermia.

-Destruction of the skin causes an inflammatory response locally. This results in **massive edema and loss of fluids**, including water and electrolytes, in the burned tissue and distal to it. If the burn is large enough – covering 25 – 30 percent of the bidy – systemic circulation is affected which causes generalized edema. Excessive edema can cause destructive pressure on local and distal nerves and blood vessels. A burned tissue itself, which is inelastic, can act as a tourniquet and exacerbate edema, as well as being a damaging force in itself. In such a case, an **escharotomy** – an incision made through the burned tissue – is performed to relieve pressure on susceptible structures.

-**Sepsis** is the most common cause of death with a burn. The increased risk of infection is due to the loss of the protective skin barrier, accompanied by the depressed immune function as a result of deeper burns. The wound is treated with a topical antibiotic and covered with a synthetic or biological dressing. The biological dressing is produced from pigs, cadavers or human amniotic membranes. To promote further healing and to prevent bacteria growth, **debridement** of the tissue

is performed. Debriding involves the removal of dead tissue layers until living, viable tissue is reached.
-Skin grafting is necessary with all but the smallest full-thickness burns and deep partial – thickness burns. It is also necessary if, after three weeks, a partial thickness burn has not shown significant healing. **Autografting** is the harvest of skin from one area of the body for transfer to another part. Thin layers of skin are shaved from an unburned area of the body.
-**Splints and positioning** are used to prevent contracture of healing tissue. It is natural for the burn patient to hold the burned limb in a shortened and relaxed position to relieve any stretch on the damaged tissue.
-**Pain control** allows more positive attitude to recovery. Analgesics are given during and after debridement procedures.

Burns: Late Subacute and Chronic Stage Concerns:
-The later stages of healing burns bring many physical and emotional changes for the person and their family. The full impact of the burn injury becomes apparent over the course of the hospital stay.
-Physically, wound care, exercise and splinting are continued to promote healing and improve the functional ability of the person
-Upon leaving the hospital, the person's wound and skin graft donor sites are not completely healed. Debridement and cleaning are still required. Newly formed skin is fragile and susceptible to damage from stretching, splints or trauma. Affected areas are moved with care and observed for any new injuries.
-Scar tissue forms (hypertrophic scar tissue), pressure garments are used to help keep the scarring flatter.
-ROM of joints must be maintained
-Emotionally, the person attempts to come to terms with alterations in appearance and function.
-May have some depression or post-traumatic stress from the incident.
-Supportive touch of massage is helpful in promoting a positive self image with a person who has experienced disfiguring burns.

Complications of Burns: (pg 259-260)

- Breathing
- Inhalation injuries – respiratory failure can result up to 2 days after the injury
- Gastrointestinal complications – 66 percent of people with severe burns have gastric and duodenal ulcerations.
- Renal complications
- Heterotopic calcification – may occur at joints in burned and unburned areas. Happens at the end of the healing process
- Burned skin – is very sensitive to ultraviolet light
- Thermoregulation – impaired ability to regulate heat due to diminished vascularity and sweat glands. Severe burns often lead to an increased sensitivity to cold even 10 years later.
- Peripheral nerve damage – is possible especially with electrical burns. Can be due to compression of nerves from edema or restricted fascia and scar tissue.
- Sensory impairment or loss – sensory fibres may be unable to penetrate thick scar tissue, there may be nerve damage or sensory perception may be altered.
- Subluxation and dislocation – of the joints of the hands and feet can occur especially with a burn on the dorsal surface. Splinting and exercise in the acute stages are key.

- Amputation – for severe infection and ischemia that can occur – most often with electrical burns.

Treatment Considerations for Wounds and Burns:

Assessment

- Observations and Palpation: see Strategies: Massage and the inflammatory process
- Testing AF, then PR ROM of affected area. Range is reduced due to pain, edema and fear, especially in the acute stage. AR ROM begins in the early-subacute stage and may reveal weakness in the affected muscles. As healing progresses, ranges and strength usually improve unless adhesions or contractures remain

Contraindications:

- High infection risk..Hand washing is necessary. Gloves may be worn
- Oil around site of wound
- Avoid direct contact with burns that produce blisters to prevent rupturing them. (once a blister ruptures, an avenue of bacterial infection is present and local massage continues to be CI'd
- Modifications of Hydro are required when applied to affected area. (Often hypersensitivity to temperature extremes. With burns, inability to dissipate heat
- Direction of pressure must be modified in early healing stages. Due to fragile granulation tissue, drag and torqueing of tissue are avoided. Pressure directed towards injury site
- With burns, AR ROM may be CI'd in acute stage if large area is affected and if other complications are present, such as respiratory or heart problems.

Massage

-Therapist must establish clear treatment goals with client. A supportive environment is created. A signal is established so the client can easily indicate to the therapist when they have had enough, especially when treating the wound or burn site. Therapist must respect the request to stop or modify immediately – not a few minutes later after several more strokes have been applied.

Acute and Early Subacute

- Essential component is to promote relaxation, reduce pain, reduce edema, prevent infection and encourage activity that the person can perform without reinjury the healing wound.
- Encourage diaphragmatic breathing
- Massage of uninjured areas of the body provides comfort and stress reduction, and reduce some pain. No enriched oils while re-epithelialization is occurring
- Affected limb is elevated, appropriate lymph drainage
- Distally, only techniques that do not increase circulation (light muscle squeeze or stroke)
- No onsite work
- Painfree movement within 48hrs
- With **sutures**, the incision usually closes within a few days. The skin is held together under normal stress and movement after a week
- After **skin grafting** Passive and active movement is performed to the affected area within 5-10 days. All remedial exercises are in client pain tolerance
- After **re-epithelialization** or after any suture removal of affected area, the risk of infection decreases. Can now use lavender, vitamin E and aloe vera oils and lotions to help healing process
- Before the scar has matured, in the early subacute stage, massage to reduce edema is still appropriate. As well as additional Swedish techniques

- Take caution when massaging near or over the wound site. Stabilize the tissue proximal to the wound to monitor the drag placed on the injury site, and senses if the proximally applied techniques should be modified.
- Initially pressure is directed towards injury site. Very light work on site (stroking or scooping)

Late Subacute and Chronic

- The goals at the late subacute and chronic stages is to reduce any remaining edema, decrease SNS firing, decrease pain, increase local circulation, reduce adhesions and improve ROM
- Promoting relaxation of the client decreases pain perception and improves client compliance. All within client pain tolerance. Slow diaphragmatic encouraged, especially if it becomes painful
- Edema is treated for as long as it is observed. General Swedish techniques proximal to injury
- Massage techniques are applied cautiously nearby and on site with increased vigor and torqueing. (can slowly introduce gentle bowing and picking up
- Massage at this stage is a preventative treatment for hypertrophic and hypersensitive scar tissue
- With burns, depending on the time it takes for the area to re-epithelialize, preventative techniques are performed as early as 1 month and for as long as 18 months post injury
- As scar matures, deeper specific C-bow, S-bow, skin roll, and cross fiber frictions are performed on the periphery of the scar tissue. These more aggressive techniques are mixed with alternating effleurage and stroking
- Slow sustained stretching is applied to the stress the treated scar tissue. Position the limb so that the stretch is applied to the entire line of the restriction. Hold until initial blanching becomes more pliable and colour returns to normal
- Joint play is performed on the affected joints. With burns, it is introduced only when the tissue has healed sufficiently to accommodate the forces that must be applied to perform the technique.

Hydrotherapy

- Hydro such as wax is useful before stretching because the oil in paraffin lubricates the tissue
- Local heat also increases local circulation and helps to relax the client.
- For Burns, the temperature of the wax is lowered to between 45-46^{o} C for hypersensitive skin

- Ice is useful for decreasing pain in hypertrophic scar tissue, after cross –fiber frictions are performed or if the treated area remains hyperemic and warm.

- The application time or type of cold modality may need to be modified if the client is hypersensitive to cold.

- With burns, painful scarring often occurs over the lateral chest wall, medial arm and flexor surface of the wrist

Self care

- Relaxation exercises and diaphragmatic breathing are used to decrease pain and stress.
- Self-massage to the scar tissue is encouraged to desensitize the scar and reduce restrictions during development. Due to longer healing times for burns, it is suggested that massage be taught to family members or friends
- Stretch and strengthen program promoted. Generally heat applied first; with a burn injury, an enriched lubricant is applied first

- From the beginning activities of daily life are encouraged. Stretching routine for all restricted areas once the granulation tissue is no longer fragile
- Cool to cold hydrotherapy are recommended in the early stages of wound healing and after activity. In late subacute and chronic stages, heat is used before self-massage with cool after