

WOUNDS

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INTRODUCTION

- **Wound** Is a physical injury compromising the normal integrity of skin. It may involve the underlying structures i.e. tendons, muscle, bone etc.
- **Acute Wound:** Disruptions to the integrity of the skin +/- the underlying tissues that progresses to heal continuously/timely through the normal phases of healing. (Hemostasis, Defensive/Inflammatory. Proliferative, Maturation.)
- **Chronic wound:** Disruptions in the skin which does not progress to heal normally. The process of healing mostly stagnates at inflammatory phase

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- The term **soft tissues** refers to those parts which are not bone or cartilage.
- From the point of view of injuries, it is necessary to consider the *skin, muscles, tendons, ligaments, blood vessels* and *nerves*.
- It is vital to consider not only what structures have been damaged, but also how the damage has come about, known as the **mechanism of injury** .

Mechanism of injury

- Injuries may be either **blunt** or **penetrating**.
- They may occur by external insult, such as a cut by a knife, or indirectly, such as a nerve damaged by the sharp end of a bone.
- The amount of energy imparted to the soft tissues is proportional to the degree of violence applied

Wound closure

- **Primary**-Edges of the wound can be approximated and bound together i.e. through stapling, suturing, gluing or taping. Healing occurs by primary intention.
- **Secondary** -Wound is allowed to granulate & re-epithelialize. Healing occurs by *secondary intention*.
- **Delayed primary closure**- Mostly done when an already existing open wound is closed similarly to primary wound closure. Debridement has to be done prior.

Phases of wound healing

- Primarily, the body has the capability of healing the wound on its own. At times, internal and external factors can cause stagnation or retrogress. It is the responsibility of the practitioner to make the healing environment conducive to facilitate quick healing and establish good skin integrity.
- The stages of wound healing are a complex and fragile process. Failure to progress in the stages of wound healing can lead to chronic wounds.
- Factors that lead up to chronic wounds are venous disease, infection, diabetes and metabolic deficiencies of the elderly. Advanced wound care can speed up the stages whereby a moist option for dressing are considered, protection from re-injury and infection

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There are 4 phases of wound healing:

- i. Hemostasis
- ii. Defensive/Inflammatory.
- iii. Proliferative,
- iv. Maturation.

Hemostatic phase

- This is the process of the wound being closed by clotting. Hemostasis starts when blood leaks out of the body. The first step of hemostasis is when blood vessels constrict to restrict the blood flow. Next, platelets stick together in order to seal the break in the wall of the blood vessel. Finally, coagulation occurs and reinforces the platelet plug with threads of fibrin which are like a molecular binding agent.
- The hemostasis stage of wound healing happens very quickly. The platelets adhere to the sub-endothelium surface within seconds of the rupture of a blood vessel's epithelial wall. After that, the first fibrin strands begin to adhere in about sixty seconds. As the fibrin mesh begins, the blood is transformed from liquid to gel through pro-coagulants and the release of prothrombin.
- The formation of a thrombus or clot keeps the platelets and blood cells trapped in the wound area. The thrombus is generally important in the stages of wound healing but becomes a problem if it detaches from the vessel wall and goes through the circulatory system, possibly causing a CVA, pulmonary embolism or Cardiac arrest.

Inflammatory phase

- Inflammation is the second stage of wound healing and begins right after the injury when the injured blood vessels leak **transudate** (made of water, salt, and protein) causing localized swelling.
- Inflammation both controls bleeding and prevents infection. The fluid engorgement allows healing and repair cells to move to the site of the wound.
- *During the inflammatory phase, damaged cells, pathogens, and bacteria are removed from the wound area.* These white blood cells, growth factors, nutrients and enzymes create the swelling, heat, pain and redness commonly seen during this stage of wound healing.
- Inflammation is a natural part of the wound healing process and only problematic if prolonged or excessive.

Proliferative phase

- The proliferative phase of wound healing is when the wound is rebuilt with new tissue made up of collagen and extracellular matrix.
- In the proliferative phase, the wound contracts as new tissues are built. In addition, a new network of blood vessels must be constructed so that the granulation tissue can be healthy and receive sufficient oxygen and nutrients.
- Myofibroblasts cause the wound to contract by gripping the wound edges and pulling them together using a mechanism similar to that of smooth muscle cells. In healthy stages of wound healing, granulation tissue is **pink** or **red** and **uneven in texture**.
- Moreover, healthy granulation tissue does not bleed easily. Dark granulation tissue can be a sign of **infection**, **ischemia**, or **poor perfusion**. In the final phase of the proliferative stage of wound healing, epithelial cells resurface the injury. It is important to remember that epithelialization happens faster when wounds are kept moist and hydrated.
- Generally, when occlusive or semi occlusive dressings are applied within 48 hours after injury, they will maintain correct tissue humidity to optimize epithelialization.

Maturation phase

- Also called the **remodeling stage** of wound healing, the maturation phase is when collagen is remodeled from **type III** to **type I** and the wound fully closes. The cells that had been used to repair the wound but which are no longer needed are removed by **apoptosis**, or **programmed cell death**.
- When collagen is laid down during the proliferative phase, it is disorganized and the wound is thick. During the maturation phase, collagen is aligned along tension lines and water is reabsorbed so the collagen fibers can lie closer together and cross-link. Cross-linking of collagen reduces scar thickness and also makes the skin area of the wound stronger.
- Generally, remodeling begins about 21 days after an injury and can continue for a year or more. Even with cross-linking, healed wound areas continue to be weaker than uninjured skin, generally only having 80% of the tensile strength of unwounded skin.

Factors affecting wound healing

1. Age

- Aging affects everything in the body, including the structure and function of the skin. Everything slows down during the aging process, including the phases of wound healing. Functional changes in the skin include **thinning of the skin and a decreased inflammatory response**. Thinning of the skin predisposes the elderly to **injuries and fragility**. There are a few physical findings in the elderly that affect their ability to heal normally within the layers of the skin:
 - **Epidermis**
 - ✓ Decreased thickness in the epidermal layer that causes increased transparency and fragility
 - ✓ A decrease in cell replacements means a delay in wound healing
 - ✓ Reduced number of Langerhans cells
 - ✓ Change in the shapes and sizes of the keratinocytes
 - **Dermis**
 - ✓ Dry skin brought on by a decrease in dermal blood flow
 - ✓ Decreased dermal thickness, which causes a paper-thin, transparent appearance, increasing the risk of pressure ulcers

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2. Nutrition

- It is vital that the patient has proper nutrition to promote healing. The wound is unable to heal properly if the patient lacks the necessary nutrients to maintain adequate energy for collagen synthesis.

3. Obesity

- A patient who weighs 20 percent more than his or her ideal body weight has a higher risk of infection leading to an interruption of the healing process.

4. Presence of debris, necrotic tissue, and infection

Foreign bodies prevents tissue cohesion and prolong the inflammation process leading to increased exudate and susceptibility to infection. Collagen lysis can occur when an infection is present. This further delays healing and can lead to Tissue death..

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5. Repeated trauma

- Injuries subjected to existing wounds retrogresses the healing wound either by increasing the wounds surface area or destroying the granulating/epithelializing cells. Injuries and/or open wounds on previous scars heal slowly and poorly due to reduced cellular activities due to rigidity and compromise of the skin structure caused by the scar tissue.

6. Skin and moisture

Skin must have an adequate amount of fluid to ensure proper functioning and viability of the tissue. Alteration in moisture predisposes the patient to further skin breakdown, infection and maceration. The formation of eschar commonly associated with pressure ulcers is brought on in severe cases when dehydration induced by the death of the underlying dermal structures occurs.

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7. Systemic causes

- Common systemic disorders include **diabetes mellitus, malnourishment, and immunodeficiency**. **Diabetes mellitus** plays an enormous role in the healing process of wounds. It predisposes patients to wounds due to **diminished sensation** and **poor arterial flow, compromised immunity** and **susceptibility to tissue breakdown**. There are countless medications and other diseases that compromise the healing of wounds, and many of the medications such as prolonged steroid use leads to thinning skin.

8. Tissue hypoxia

- The most common causes of tissue hypoxia are related to **arterial occlusions** or **vasoconstrictors**, **hypotension, hypothermia** and **peripheral venous congestion**. Limited oxygen supply to the wound prevents collagen production. When the patient lacks the proper amount of oxygen in the bloodstream, the patient will endure vasoconstriction. **Smoking** also leads to tissue hypoxia.

9. Dry skin

- Patients who are prone to dry skin, especially the elderly are at risk for **skin lesions, excoriations, infection, and thickening due to scratching and rubbing the skin**. This leads to reduced cellular regeneration.

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10. Wound Infection

- Due to the injury process, all wounds are contaminated with bacteria. However, the patient's immune competence and the size of the bacterial inoculum determine whether the wound will become infected. If the patient has normal host defenses, the wound will heal effectively. Bacteria/viral load increase the inflammatory period, prolonging the phase.