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Wound Healing

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Wound Healing

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Introduction

Wound healing is a complex process that occurs after injury and inflammation. It consists of three phases including inflammation, reconstruction, and maturation. If wound healing is uncomplicated and complete it results in resolution. However, if resolution does not occur it can lead to infection, chronic wounds, and the development of scar tissue. Scar tissue is unable to perform that physiologic functions that the original tissue was able to complete.

Types of wounds being discussed include:

- Cuts and scrapes
- Incisions
- Diabetic foot ulcers
- Burns
- Pressure ulcers
- Traumatic wounds (i.e., gun shot wounds, stab wounds, etc.)
- Ischemic injury to tissues

Wounds may heal under primary or secondary intention. (McCance & Huether, 2019)

- Primary intention: wounds that heal under conditions of minimal tissue loss
- Secondary intention: wounds that require a greater degree of tissue replacement and extended periods of epithelialization, scar formation, and contraction



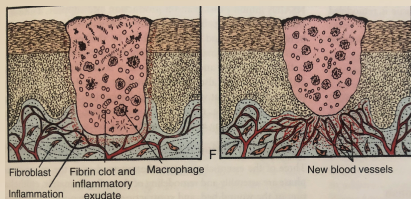
(DerSarkissian, 2019)

Wound healing was chosen to be presented because education, assessment, and treatment of wounds are important roles of the Advanced Practiced Nurse. It is important for health care institutions to participate in the management of chronic wounds because there is an economic burden associated with chronic wounds.

Phases of Wound Healing

Phase I: Inflammation (McCance & Huether, 2019)

- Occurs immediately after tissue injury
- Neutrophils, platelets, and macrophages infiltrate the injured tissue
- Platelets promote fibrin clot formation and their degranulation causes of release of factors that initiate cell proliferation
- Neutrophils and macrophages remove fibrin, microorganism, erythrocytes, and dead tissue cells from the wound
- Residual debris is drained through the blood vessels and lymphatic system



(McCance & Huether, 2019)

Phase II: Proliferation and New Tissue Formation (Reconstruction)

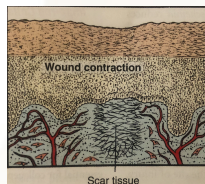
- Begins 3-4 days after injury
- The fibrin clot is dissolved by macrophages
- Macrophages secrete transforming growth-beta factor, angiogenesis factors, and matrix metalloproteinases which all promote wound healing
- Granulation tissue forms inward from nearby healthy connective tissue
- Invasive cells, new lymphatic vessels, and new capillaries occupy the granulation tissue
- Fibroblasts secrete immature collagen, which cross-link to form collagen fibers after several months
- Wound contraction occurs when the wound edge begins to move inward
- Myofibroblasts connect with neighboring cells, contract their fibers, and exert tension while anchoring themselves to the wound bed to close the wound



(McCance & Huether, 2019)

Phase III: Remodeling and Maturation

- Begins weeks after injury and typically completes within 2 years
- Cellular differentiation, scar formation, and scar remodeling take place
- Fibroblasts continue to deposit collagen into an organized matrix
- Wounds may form scar tissue, which does not contain capillaries and the scar is avascular



(McCance & Huether, 2019)

Significance of Pathophysiology

Wound healing can be an uncomplicated process that can occur without any intervention. However, several factors can lead to chronic wounds. Chronic wounds are those that fail to progress through the phases of wound healing.

Underlying health issues such as diabetes mellitus, arthritis, and renal disease may contribute to chronic wounds. Smoking, alcohol consumption, mechanical stress, and medications may also inhibit wound healing.

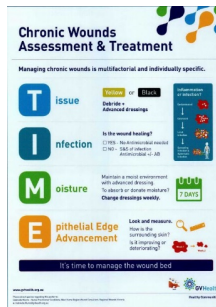
Preventing ischemia and controlling hemorrhage during the inflammatory response helps wounds progress through the inflammatory phase. Optimizing nutritional status is beneficial during the reconstructive phase.

The most common categories of chronic wounds are pressure injuries; lower limb ulcers; venous, arterial, mixed or lymphoedema, diabetic foot or neuropathic wounds; palliative or malignant wounds; and chronic or dehisced surgical wounds (Munro, 2017).

Chronic Wound Assessment and Management Framework

T.I.M.E. Framework (Munro, 2017)

- **T:** tissue assessment and management identifying the presence of non-viable tissue and treating using debridement
 - Non-viable tissue presents as yellow slough and blackened areas
 - Debridement forces the chronic wound to become an acute wound and restart the phases of healing
- **I:** inflammation/infection assessment and management that can occur as local contamination or systemic infection
 - Bacteria may colonize on the wound and spread to surrounding tissue, leading to systemic infection
 - Biofilms occur when bacteria start becoming attached, grow, and multiply, and cannot be destroyed by the body's normal host defenses
- **M:** moisture imbalance is assessed and managed using dressings
 - Dressings that maintain optimal moisture balance and promote autolytic debridement should be used
- **E:** edge advancement through assessing the wound size and the surrounding tissue allowing the treatment plan to be reviewed and changed if necessary
 - There are several treatment options to enhance edge advancement such as skin grafting, electrical stimulation, hyperbaric oxygen therapy, autologous platelet rich plasma, and more



(Munro, 2017)

Implications for Nursing Care

Primary Prevention

- Educate diabetic patients on how to avoid the development of foot ulcers
- Teach pediatric patients on the importance of helmets and protective gear while playing sports
- Educate patients with a history of wounds on the effects of smoking and alcohol

Secondary Prevention

- Assess bed ridden patients for pressure ulcers and skin breakdown
- Monitor a diabetic patient's A1c levels to determine if they have been managing their glucose levels effectively

Tertiary Prevention

- Manage pain related to chronic wounds
- Apply appropriate dressings to chronic wounds
- Perform debridement
- Perform skin grafts

Wound Treatment and Supportive Care

Honey Dressings (Vyhldalová, Kozáková & Zeleníková, 2018)

- Viscosity of honey prevents bacteria from colonizing in the wound
- The high sugar content creates osmotic pressure, which removes water from the wound and dehydrates bacteria
- Promotes autolytic debridement by assisting in the mobilization of lymph to the wound and the removal of necrotic tissue

Moist Wound Bed (Lumbers, 2019)

- Supports cell migration
- Minimizes pain
- Reduces the risk of infection

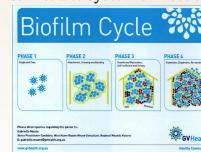
Optimal Nutrition (McGuire & Sheltzer, 2019)

Nutrient	Effect on Wound Healing
Vitamin C	Co-factor for collagen synthesis, anti-inflammatory effects, and promotes fibroblast proliferation
Zinc	Required for cell growth, membrane repair, and immune cell migration
Protein	Required for collagen synthesis, inflammatory cell formation, and wound contraction
Vitamin D	Improves glucose hemostasis, inflammatory cell migration, and angiogenesis
Copper	Promotes red and white cell maturation and wound closure

Barriers to Wound Healing

Biofilms (Azevedo et al., 2020)

- A polymeric matrix forms over clusters of bacteria and adheres to surfaces
- Unable to be destroyed unless disruption by debridement
- Can lead to systemic infection



Hemorrhage

- Hypovolemia causes vasoconstriction which prevents inflammatory cells from reaching the site of injury

Medications (McCance & Huether, 2019)

- NSAIDs: prevent prostaglandin production and suppress inflammation
- Steroids: prevent fibroblast migration and delay epithelialization

Conclusions

Wound healing is a complex pathologic process that occurs in instances of inflammation and injury. Advanced Practice Nurses play a critical role in the prevention, assessment, and treatment of wounds. Advanced Practice Nurses must be able to understand and apply the T.I.M.E. framework to assess the wound, prevent infection, and promote edge advancement.

Wound healing is a process that can take years to completely resolve. The three phases of wound healing are inflammation, reconstruction, and maturation. If a wound fails to progress from inflammation to reconstruction to maturation in a timely manner it is considered a chronic or hard to heal wound.

Factors that can affect wound healing are underlying health conditions, medications, nutrition, infection, debridement, moisture imbalance, ischemia, hemorrhage, smoking status, and more.

References

