Wound Care
The Role of Physical Therapy in Wound Management

- Education
- Prevention
- Assessment
- Intervention
Functions of the Skin

► Protection against the environment
► Controls body temperature
► Functions as an excretory organ
► Functions as a sensory organ
► Provides identity
Functional Components of Skin

Epidermis

- The tough, leathery outer surface of the skin
- **Cell types:** keratinocytes, melanocytes, Merkel cells, Langerhans’ cells
- **Functions:** protection, regulates body’s fluid content, production of vit D, cosmesis
Functional Components of Skin

- **Dermis**
  - Highly vascular, superficial lymphatics
  - **Cell types:** fibroblasts, macrophages, WBC, mast cells
  - **Functions:** nutrition, thermoregulation, sensation
Functional Components of Skin

- **Subcutaneous Tissue**
  - Supports the skin
  - Consists of adipose tissue & fascia
  - **Adipose:**
  - **Fascia:**
Partial Thickness vs. Full Thickness Wounds

- **Partial Thickness Wounds** = loss of the epidermis and/or a portion of the dermis

- **Full Thickness Wounds** = total destruction of the epidermis and dermis
Sequence for Tissue Healing

- Inflammatory Phase
- Proliferation Phase
- Maturation/Remodeling Phase
1. Inflammatory Phase

- Begins at the time of injury and lasts a few days
- Control of blood loss occurs first
  - Edema
  - Vasoconstriction of blood vessels
  - Platelets form a plug
- Within 30 minutes of vasoconstriction, vasodilation occurs resulting in localized redness, warmth, swelling, and pain
1. Inflammatory Phase continued

<table>
<thead>
<tr>
<th>Cell</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMN</td>
<td>Kills bacteria and cleans the wound</td>
</tr>
<tr>
<td>Macrophage</td>
<td>Kills bacteria and cleans the wound</td>
</tr>
<tr>
<td></td>
<td>Directs repair process</td>
</tr>
<tr>
<td>Mast cell</td>
<td>Secretes enzymes</td>
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<td>Accelerates demise of damaged cells</td>
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Signs & Symptoms of Inflammation

- Redness
- Swelling
- Heat
- Pain
Signs & Symptoms of Infection

► Elevated body temp / fever
► Flu-like symptoms
► Tachycardia
► Lab values consistent with infection
  ▪ WBC
► Purulent drainage / pus
► Persistence of malodorous wound drainage
► Induration
2. Proliferative Phase

As the inflammatory phase progresses & the cells needed for repair & regeneration reach the injury site, the proliferative phase begins.

4 crucial events during proliferative phase:

- Angiogenesis
- Granulation tissue formation
- Wound contraction
- Epithelialization
2. Proliferative Phase continued

The proliferative phase is complete when the wound is completely resurfaced with epithelial tissue & the functional barrier of the skin has been restored.

<table>
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<th>CELL</th>
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<tr>
<td>Angioblast</td>
<td>Forms new blood vessels</td>
</tr>
<tr>
<td>Fibroblast</td>
<td>Builds granulation tissue</td>
</tr>
<tr>
<td>Myofibroblast</td>
<td>Causes wound contraction</td>
</tr>
<tr>
<td>Keratinocyte</td>
<td>Reepithelializes wound surface</td>
</tr>
</tbody>
</table>
3. Maturation/Remodeling

- The granulation tissue laid down during the proliferation phase must be strengthened and reorganized to fit the surrounding tissue.

- Collagen synthesis continues and the fibers reorient along the lines of stress.
  - Internal influence:
  - External influence:

- Remodeling continues up to 2 years following wound closure.

- Even once fully remodeled, scar tissue is AT MOST only 80% of the original tissue’s strength.
Factors Influencing Wound Healing

► The wound itself
► Local Factors
► Systemic Factors
Factors Influencing Wound Healing

THE WOUND ITSELF

- Mechanism of onset
- Size and Location of wound
- Wound Hydration
- Necrotic Tissue
- Infection
Factors Influencing Wound Healing

► LOCAL FACTORS:
  - Circulation
  - Sensation
  - Mechanical Stress
Factors Influencing Wound Healing
Systemic Factors

► Age of patient

► Drugs
  ▪ steroids, immunosuppressive therapy

► Lifestyle
  ▪ Nutrition, obesity, smoker, exercise, stress

► Diseases (diabetes, anemia, PVD, COPD)
Types of Wound Closure

- Primary Intention
- Secondary Intention
- Tertiary Intention (aka delayed primary closure)
Wound Closure

**Primary Intention:**
When a wound is cleanly incised and has minimal tissue loss, the wound margins can be closely approximated and the defect sutured or otherwise promptly closed.
Wound Closure continued

► **Secondary Intention:**
An open wound missing tissue is allowed to close naturally as granulation tissue fills the defect.

*Figure 1. May 20, 2009: wound area = 307.50 cm²; volume = 1076.25 cm³. Tissue: 75% viable, 25% nonviable. Exudate was copious. After sharp debridement, ALH paste and NPWT were initiated.*
Wound Closure continued

- **Tertiary Intention**: Highly contaminated wounds are kept open for several days to observe for infection. Thereafter, they are closed as in primary intention closure

- *(Aka delayed primary closure)*
Abnormal Wound Healing

► Abnormal results
  - Hypertrophic scar formation
  - Keloid scar formation
PAUSE

► Pause to compare notes with your desk partner
► Ask your desk partner any questions you have
► Share a “light bulb” moment or help to clarify something for your desk partner
Ulcers

Types of Ulcers

- Arterial Insufficiency Ulcers
- Venous Insufficiency Ulcers
- Pressure Ulcers
Arterial Ulcers

► Wounds resulting from arterial insufficiency occur secondary to ischemia from inadequate circulation of oxygenated blood often due to complicating factors such as atherosclerosis.
Venous Ulcers

- Wounds resulting from **venous insufficiency** occur secondary to inadequate functioning of the venous system, resulting in inadequate circulation and eventual tissue damage and ulceration.
Characteristics of Arterial & Venous Insufficiency Ulcers

► See handout
Pressure Ulcers

► Wound caused by unrelieved external pressure against the skin over a bony prominence, resulting in localized ischemia and/or necrosis of the tissue beneath the area.
Pressure Ulcers

**Contributory Factors**

- **Shear** – force applied parallel to the skin
- **Moisture** – maceration & erosion
- **Friction** – may cause blister or abrasion
- **Extrinsic factors** – proper bed, W/C cushion
- **Intrinsic factors** – muscle atrophy, medications, malnutrition
Pressure Ulcer Classification

- Stage I
- Stage II
- Stage III
- Stage IV
Stage I

- Non-blanchable erythema of intact skin. An observable pressure related alteration of intact skin who compared to the opposite area may include the following changes:
  - Tissue consistency or sensation
  - Skin Temp
  - Redness/purple hues
  - Induration
Stage II

- Partial thickness loss of skin involving epidermis and/or dermis. The ulcer is superficial and presents clinically as an abrasion, blister or shallow crater.
Stage III

▶ Full thickness tissue loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through, underlying fascia. The ulcer presents clinically as a deep crater with or without undermining of the adjacent tissue.
Stage IV

- Full thickness tissue loss with extensive destruction, tissue necrosis, or damage to muscle, bone, tendon, or joint capsule.
Preferred Staging Descriptors

► Stage I
  ▪ Impaired integumentary integrity associated with superficial skin involvement

► Stage II
  ▪ Impaired integumentary integrity associated with partial thickness skin involvement and scar formation

► Stage III
  ▪ Impaired integumentary integrity associated with full thickness skin involvement and scar formation

► Stage IV
  ▪ Impaired integumentary integrity associated with skin involvement extending into fascia, muscle, bone, tendon, joint capsule and scar formation
Assessing, Measuring & DOCUMENTING Wounds

- Location & Shape
- Size
- Wound Bed (Tissue type)
- Exudate (drainage)
- Tunneling and/or Undermining
- Stage
- Pain or sensation
- Periwound Skin integrity
- Edema
- Peripheral pulses (with an extremity wound)
- Treatment
Location & Shape

- Be specific, using anatomically correct terminology
- Draw pictures to clarify, if necessary.
- Photography
Size

► Be sure to include length, width, and depth measurements in centimeters.

► Use a measuring device!! (small clear goni)
Wound Bed
Types of Tissue in Healing Wounds

- **Granulation tissue** – the pink to Red, moist fragile connective tissue – containing new collagen, blood vessels, fibroblasts, and inflammatory cells – that fills in an open wound bed during the proliferative phase of healing.

- **Eschar** – dry, leathery necrotic tissue adhering to a wound bed. **Black**, necrotic tissue.

- **Slough** – Loose, stringy necrotic tissue. **Yellow** = infected, fibrinous slough.
Wound Exudate (Drainage)

► Types of Exudate
- Serous (clear)
- Sanguinious (bloody)
- Purulent discharge (pus)

► When documenting, describe:
- **AMOUNT** – none, minimal, moderate, copious
- **COLOR** – see types above
- **ODOR** – present, absent
Tunneling

- Tunneling is a narrow passageway created by the separation of fascial planes.
- Measured (in cm) by inserting a probe into the passageway until resistance is felt (depth is the distance from the probe tip to the point at which the probe is level with the wound bed).
- Use clock terms to identify the tunnel’s position within the wound bed.
- Common in surgical wounds.
- May not be readily visible, so you need to thoroughly probe to identify the full extent of tissue destruction.
Undermining

- When the tissue under the wound edges erodes, resulting in a large wound with a small opening
- Measured (in cm) by inserting probe under the wound edge directed almost parallel to the wound surface until resistance is felt (depth is the distance from the probe tip to the point at which the probe is level with the wound bed)
- Use clock terms to identify the undermining
- Common in pressure ulcers
- May not be readily visible, so you need to thoroughly probe to identify the full extent of tissue destruction
Stage

► See previous slides.

► When eschar is present, accurate staging of the pressure ulcer is not possible until the eschar has sloughed or the wound has been debrided.
Pain or Sensation

► Can document patient’s report of pain during the procedure.

► Inability to perceive pain in a wound may lead to noncompliance with prevention & management.

► Assess sensation in patients with DM, peripheral neuropathy, or burns.

► Semmes-Weinstein monofilaments
Periwound Skin Integrity

► Is it macerated?
► Thin, frail, transparent?
► Scaley, cracked, callused?
Edema

- Assess for edema and induration (firm edema) because they impact function and are associated with wound infection
- Edema is either pitting or nonpitting
- Take circumferential measurements of both sides (right and left)
- Would you take volumetric measurements (volumeter)? Why or why not?
Peripheral Pulses

- Peripheral pulses should be assessed for all extremity wounds
Treatment

► Debridement
► Dressings
► Modalities
Treatment - Debridement

- **Purposes for Debridement**
  - Decrease bacteria in wound
  - Increase effectiveness of topical antimicrobials
  - Shorten inflammatory phase of healing
  - Decrease energy needed by body
  - Eliminate physical barrier to wound healing
  - Decrease wound odor

- **Debridement is indicated** when there is necrotic tissue, foreign material, or debris within a wound bed
Treatment - Debridement

- Types
  - Sharp Debridement
  - Autolytic Debridement
  - Enzymatic Debridement
  - Mechanical Debridement
    - Wet-to-Dry Dressings
      - Whirlpool
  - Surgical Debridement
Treatment - Dressings

- **Reasons for a dressing:**
  - Protection
  - Absorption
  - Compression
  - Immobilization

- **Common Dressings**
  - Gauze:
    - Widely used
    - May become enmeshed in wound and slow healing
  - Impregnated Gauze
Treatment - Modalities

- Whirlpool
- Pulsed lavage
- Electrical stimulation
- Hyperbaric oxygen therapy
Review of Today’s Lecture

► What is our role in wound management?
► Function of the skin?
► 3 phases of tissue healing?
► Factors influencing wound healing?
► 3 types of wound closure with short description
► Stages of pressure ulcers
► DOCUMENTING wounds
Looking Ahead

► Wednesday’s Lecture
  - Wound Care Continued
  - Body Mechanics
Questions???
