OBJECTIVES

* Identify chronic wounds
* Evaluation/patient work up
* Barriers to wound healing
* When to refer
Chronic Wounds

- Wounds that have failed to heal in an orderly/timely fashion, usually 3 months
- Approximately 1% of the population will develop leg ulcerations in their lifetime

- In the U.S. alone, chronic wounds affect 3-6 million patients each year
  - **Cost approximates up to 20 billion..... each year**

- Increase in the number of insufficiently treated wounds over protracted courses
- Establish treatment standards for chronic wounds

- Current concepts concerning the management of chronic wounds
- The most common chronic wound is the lower extremity ulcer (vascular or diabetic)
- 98% of all leg wounds are these types
Non-healing chronic wounds

- Wounds that fail to follow the normal healing process
- Usual methods fail to heal wounds
Wound Healing

- **Hemostasis/inflammatory phase**: 2 - 5 days
- **Proliferative phase**: 5 days - 3 weeks
- **Remodeling phase**: 3 weeks - 2 years

- **Constant battle**: Skin provides the primary barrier between the human and entropy of the external environment
It is not all about the wound, ASSESS THE PATIENT

- Why is the wound there?
- How Long?
- What has been done so far?
- Complete history and physical exam
- Nutrition (albumin/pre albumin)
- Hydration
- Oxygenation/vascular supply
- Pain
- Infection
- Smoking
- Blood Sugar/A1C
- Immune
Local Wound Management

“TIME”

T.... tissue (remove/debride)

I.... infection (culture/antibiotic)

M.... moisture (wound cleaning/dressing)

E.... edge of wound (monitor regularly, by same caregiver if possible, wound should improve in size)
Factors that Adversely Affect Wound Healing

- **D** - diabetes
- **I** - infection
- **D** - drugs
- **N** - nutrition
- **T** - tissue necrosis
- **H** - hypoxia
- **E** - excessive torsion of wound edges
- **A** - another wound (competition)
- **L** - low temperature
Systemic Disease

**Diabetes:**

- **20 million** people or **7%** population
- **15%** of these have foot ulcers
- **15%** with foot ulcers need amputation

- neuropathy/ vascular/ insulin stimulates protein synthesis

- glycosylation impairs neutrophils and macrophage phagocytosis

- erythrocytes less pliable, deliver less oxygen
Diabetic Foot Ulcer

- Poor circulation (PAD)
- Neuropathy (motor and autonomic)
- Proper foot care
- Osteomyelitis
- Off loading
Local Infection

Cellulitis

• prolongs inflammatory phase

• maintains high levels of pro-inflammatory cytokines and proteases

• degrades granulation tissue and tissue growth factors, delays collagen deposition

• **Solution:** debridement and antibiotics, look for foreign bodies
**DRUGS**

* **Steroids** (disrupts inflammatory healing phase)

* **Chemotherapy/Radiation** (disrupts actively dividing tissues or cell turnover, microvascular damage)

* **Sedatives** (decreased movement)

* **NSAID** (inhibit platelet fxn)
Nutrition

* diminished fibroblast proliferation

* impaired neovascularization

* decreased cellular/humoral immunity

*Amino Acids are essential for normal function and repair of cutaneous wounds

*Essential fatty acids must be supplied in the diet, we cannot de novo synthesize these

*Vit A-C-E (collagen metabolism)

*Copper-Zinc (stabilize collagen)
<table>
<thead>
<tr>
<th>Protein</th>
<th>Normal Value</th>
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</thead>
<tbody>
<tr>
<td>• Albumin</td>
<td>• 3.5-5.5 gm/dl</td>
</tr>
<tr>
<td>• Prealbumin</td>
<td>• 10-40 mg/dl</td>
</tr>
<tr>
<td>• Transferrin</td>
<td>• 200-400 mg/dl</td>
</tr>
</tbody>
</table>

Protein (1.25-1.5 gm/kg)

Calories (30-35 kcal/kg body wt)

Fluid (approx 1500 ml/day depending on disease state)
Cellular Hypoxia

• Collagen fibril crosslinking requires oxygen to hydroxylate proline and lysine (does not happen with $T_{\text{com}} < 40$)

• Leukocyte oxidative phosphorylation (bacteriocidal)suffers with hypoxia

• Tobacco-CO-Vasoconstriction

• Pain-Epinephrine-Vasoconstriction
Arterial Insufficiency Ulcer

• Rest pain, claudication
• Temperature difference
• Pulses, doppler
• ABI, angiography
• Tcom
Ankle Brachial Index

• Screen all patients with leg lesions, especially important to do if you are planning compression therapy.

• Doppler US and BP cuff
• Ankle systolic pressure divided by brachial systolic pressure

• $>0.9$ Normal
• 0.5-0.9 Claudication
• 0.2-0.5 Resting Ischemic pain
• $<0.2$ Gangrene
Doppler ultrasound amplifies the sound of arterial blood flow. Pressure recorded in the brachial artery of the arm. Sound of arterial blood flow located in the ankle. Pressure recorded in arteries of the ankle after each arterial flow is located.

Ankle systolic pressure \(\frac{\text{brachial systolic pressure}}{\text{ABI}}\)
Consider Other Testing

- Segmental pressures (arms=legs)
- Transcutaneous oxygen measurement

- **Tcom > 40 mm Hg** necessary for healing
- Arteriography/Aortogram with runoff
- Duplex US/venous screening

- Culture
- Biopsy (debride first)
- Screening Labs
Venous Insufficiency Ulcer

- Incompetent valves
- Venous hypertension
- Elevation and Compression (check ABI first)
Lymphedema

- Rule out vascular cause
- Prone to tissue infections/cellulitis
- Elevation, compression,
Pressure Ulcers

- Shear, friction....off loading
- Moisture/incontinence
- Infection
- Nutrition, Age, Nursing Home, spinal cord injuries and ICU patients
Neoplasm

- Remember to biopsy any lesion that behaves differently than expected
- Bleeding, highly vascular
- Exudates, infected (odor)
- Radiation
- Chemotherapy
Pyoderma Granulosum

- Painful papule/nodule
- “insect bite”
- enlarges, ulcerates, painful
- Violaceous borders

- Search for underlying diseases:
  - IBD (UC, Chron’s)
  - Arthritis (RA, psoriatic)
  - Immunologic (SLE, AIDS)
  - Hematologic (leukemia, myeloma, PCV)
Vasculitis

- Biopsy perilesional skin as well as lesion
- Immune mediated
- Underlying connective tissue disease, malignancy, infection
- Medications/OCP’s
Education:
often neglected/ very important

Proper education of patient and family members/care givers:

• Increases quality, frequency, efficacy of dressing changes

• Increases compliance

• Decreases recurrence
References


