Chief Complaint: Leg wound

No disclosures to report.

Today’s Objectives:
• Form plausible differential diagnoses for lower extremity (LE) wounds based on history and exam.
• Use pertinent diagnostics and imaging to determine wound etiology.
• Know when and to whom a referral is necessary for LE wound diagnostics and treatment.
How to evaluate a wound...

- Clean the wound **BEFORE** assessing.
- Do **NOT** evaluate a wound by its dressing.

Be Familiar with Exudate Descriptions

- Serous - clear
- Serosanguinous - clear/bloody
- Dish-Water
- Bloody
- Purulent: 2 sources
  - Liquification of devitalized tissue
  - Infection
- Amount: scant to copious
  - Too dry - cells stick
  - Too wet - cells drown

Wound Beds – Granulation Tissue and Epithelialization
Devitalized Tissue: Fibrin Necrosis

Devitalized Tissue: Eschar


How to Know if the wound is “getting better”

- **Measure:**
  - Length - longest
  - Width - widest
  - Depth - deepest

- **Unsure of improvement:**
  - Calculate
    - Surface: \( l \times w \)
    - Volume: \( l \times w \times d \)

- **Objective Improvement:**
  - Decrease in volume by 50% in 4 weeks

Clinical Vascular Exam

- **Inspection**
  - **Use acronym: SEADS:**
    - Swelling - including any edema
    - Erythema
    - Atrophy/Hypertrophy
    - Deformities - includes bony abnormalities (especially feet), masses, or protrusions
    - Skin Changes - discolorations, thinning, hair loss, shiny skin
  - Look for ulcers
  - Varicose veins (enlarged superficial)
  - Peripheral cyanosis

Photo source: https://commons.wikimedia.org/wiki/File:Lymphedema.jpg
Clinical Vascular Exam

- **Temperature**: not clinically reliable by touch; **temp probe: YES**
  - Cool Extremities - Possible arterial insufficiency
  - Warm Extremities - Possible venous insufficiency
- **Edema**
  - Pitting - Venous cause
  - Non-pitting - Lymphatic cause
- **Capillary Refill** – has little clinical relevance in wound care
- **Pulses** – Amplitude has little clinical relevance in wound care
  - Macro-circulation only
    - Present, Absent, Dopplered
    - Femoral
    - Popliteal – difficult, generally need two hands
    - Posterior Tibialis
    - Dorsalis Pedis

Exam Drives Diagnostics

- **Ankle-Brachial Indices (Screening)**
  - > 0.8 – 1.0 Normal
  - >1.0 may indicate non-compressible vessels
  - 0.5-0.8 moderate limb ischemia
  - ≤ 0.4 critical limb ischemia
- **Toe Brachial Index (Diabetics)**
  - > 30mmHg
  - In Hospital setting: skip
    - Go to arterial doppler

Duplex & Doppler Ultrasound for Venous Reflux

- **Regular US**
  - HF sound waves
  - Creates images of organs
- **Doppler US**
  - Sound waves
  - Evaluate blood flow through vessels looking for blockages
    - DVT
- **Duplex US**
  - Combines US with Doppler US
  - Uses HF sound waves
  - Looks at how blood flows through the vessels.
Arterial Doppler

\[ \text{ABI: 0.6} \quad \begin{array}{c}
133 - \\
115 - \\
99 - \\
86 - \\
80 PT \\
79 DP \\
72 - \\
\end{array} \quad \text{ABI: 0.5} \]

CT Angiogram

- Looking for popliteal trifurcation below knee
- Trifurcation includes:
  - Anterior tibial
  - Posterior tibial
  - Peroneal
- Stents may be inserted during procedure.
- If unsuccessful:
  - Bypass
  - HBOT

A Word on Swab Cultures:

DON’T

- All wounds are contaminated.
- Cultures direct antibiotic therapy.
  - 4+ or large/heavy
- Exception: Beta hemolytic strep - treat always
- Tissue culture is gold standard.
- No routine cultures. No swab cultures. Decision to culture is based on clinical findings and treatment failure
- Treat empirically for Staph and/or Strep if s/s acute infection.
- New DNA cultures
Next Generation DNA Sequencing

• Targets the species causing infection
  - > 25,000
• DNA microbe sequencing paired with customized topical antibiotics has improved heal rates from 48.5% to 90.4% (Martin, 2010)

Eyes can not see what the mind does not know
Expand your differential.

Clinical Exam & Diagnostics Help Differentiate TX

• Most Common:
  - Venous Reflux Disease
  - Arterial Insufficiency
• Most Painful:
  - Pyoderma Gangrenosum
  - Calciphylaxis
• Most Emergent:
  - Necrotizing Soft Tissue Infections
How to Clinically Determine a Wound Infection

- **ACUTE**
  - Pain*
  - Erythema*
  - Swelling*
  - Heat*
  - Purulent drainage
  - **NO ODOR**

- **CHRONIC**
  - Increased drainage
  - Delayed healing
  - Granulation Tissue
  - Discolored or friable
  - Wound breakdown/deterioration
  - Pocketing (tunnels/undermining)
  - New onset of devitalized tissue
  - Odor
  - Foul - Anaerobes

Venous Ulcers

- Account for 70% of all LE ulcers
- USA: approximately 2.5 million people w/ VRD
  - 20% develop venous ulcers.
- Economic burden:
  - $2500/month/patient
  - $14.9 billion annually
- Definition:
  - An open skin lesion of leg that occurs in an area affected by venous hypertension.

Venous Reflux Disease

- Risk Factors:
  - DVT, CHF
  - Obesity, pregnancy
  - Varicose veins
  - Incompetent veins

- Clinical findings:
  - Affects distal aspect of LE
  - Gaiter area
  - Shallow with irregular borders
  - Superficial
  - Moderate discomfort
  - Hemosiderin Staining
  - Lymphorrhea (weeping)
  - Stasis dermatitis (allergic)
Gaiter

- Covering of cloth or leather for the ankle and instep

Most common area for ulceration

Gaiter Area

Venous Hypertension Cause of VRD

- Walking: Venous pressure zero
- Initially standing w/o VRD: virtually zero
- With VRD & standing and/or sitting
  - Incompetent perforator valves: > 90mmHg

Source: Wikipedia: https://sr.wikipedia.org/wiki/%D0%92%D0%B5%D0%BD%D1%81%D0%BA%D0%B8_%D1%87%D0%B8%D1%80
Venous Ulceration

Management

- **Diagnose: Clinical Exam**
  - ABI
  - Duplex doppler

- **Open Ulcers**
  - Primary treatment to wound
    - Clean: Alginate
    - Slough: ionic silver or honey
    - Should debride first
  - Secondary treatment to wound
    - Non-adherent foam
    - ABD pad
  - Compression wraps is the **gold standard**.
  - Multi-layered - not single layer
  - Say NO to ace wraps, TEDs & Tubigrips
  - May compress: ABI > 0.5

- **Closed Ulcers**
  - Graduated compression hose with
    - Ankle pressure 20-30mmHg

Management

- **Medication**
  - Pentoxifylline
    - Micronized purified flavonoid fraction (Cochrane, 2013)
      - Domilflex (FDA approved)
  - Pneumatic Compression
  - Surgical
    - Endovascular
      - Superficial
      - Deep
Diomiflex
- Plant chemical found in citrus fruits
- Sold in US as a food supplement
- Improves all stages of venous disease including venous ulcers and improves quality of life (Cochrane, 2013)
- May take up to eight weeks for symptoms to improve
- Contraindicated in pregnancy and breastfeeding and allergies to povidone, cellulose, or corn products.

Arterial Ulcers
- Prevalence
  - High among people with Diabetes
  - D/T decreased blood flow caused by arterial thinning
  - Sensory loss d/t diabetic neuropathy
- High risk of amputation compared to other LE ulcers
- Require more advanced diagnostics and therapy
  - CT angiogram
  - HBOT
- Individuals with history of previous ulcerations
  - 36 times more likely to develop another ulcer
- 50% of USA LE amputations occur without any vascular testing

Arterial Insufficiency

Source: M.J. Maloney, 2015
**Arterial Ulcer Risk Factors**

- HbA1c > 6.5
- Uncontrolled HTN
- Hypercholesterolemia
- BMI > 25%
- No exercise
- Smoking: stops wound in its tracks

**Arterial Ulcer Clinical Findings**

- Claudication
- Pain at rest
  - ESAI >>> Re-vascularization
- Pain increases at night
- Pain is relieved in a dependent position
- LE hair loss
- Shiny skin
- Gangrene
- Dependent Rubor

- Punched out appearance
- Appears oval or circular
- Decreased exudate unless edema
- Toes, feet, distal LE and lateral malleoli

**Management**

- Keep ulcer dry.
- No debridement below the knee
- Oxygen, Oxygen, Oxygen, Oxygen
- Vascular Medicine or Surgical referral
  - Need to get LE re-perfused before infection sets in
- Bypass/Stent
- HBOT – Not surgical candidate
- Amputation
Calciphylaxis

- A syndrome of calcification of the blood vessels, blood clots, and skin necrosis.
- Pathogenesis still unclear
  - If Continuous disruption of calcium homogenesis
- Prevalence
  - Uncommon; affects 1-4% of the population with ESRD.
- Incidence
  - Has increased since 2000
    - Widespread use of parenteral vitamin-D and iron dextran.
    - Whites > Blacks
    - Females > males
    - Age variable: six months to 83 years

Calciphylaxis Risk Factors

- Chronic Kidney Failure
  - ESRD
  - Recent kidney transplant
- Obesity
- T2DM & T2DM
- Hypercalcemia
- Secondary hyperparathyroidism
- Hyperphosphatemia
- Elevated calcium-phosphate product
- Hypercoaguable states
  - Protein C or S deficiency
  - Antiphospholipid Syndrome

Calciphylaxis Prognosis: poor

- Mortality: 40-80% non-ulcers
  - > 80% with ulcers
  - Higher in central vs. acral
- COD: Sepsis.
Calciphylaxis Diagnosis

- Skin biopsy
  - Punch at edges
  - Has risks of Pathergy
- Pathergy: an exaggerated skin injury resulting in persistent ulceration
- Unless co-morbidity of PAD, has peripheral pulses

Testing for Pathergy

- How to test:
  - Using a sterile needle, make multiple skin pricks on forearm
  - Circle area with non-toxic marker
  - Check in 24 hours
  - Take a picture
  - Positive: red bump (papule), pustule, ulceration

Calciphylaxis Management

- Complex
- If not derm, nephrology or wound care trained, refer.
- Management includes
  - Pain control with opioids – Pain Management
  - Control of calcium and phosphate product within the sphere of hemodialysis – Nephrology
  - Management of IV sodium thiosulfate – Nephrology
  - Local sodium thiosulfate to ulcer – You or Derm/Nephrology
  - Wound care is supportive with minimalization of infection.
  - Surgical debridement rarely done unless ulcer eschar starts to liquify.
Pyoderma Gangrenosum (Neutrophilic Dermatosis)

- Auto-immune etiology, not infectious
- Most common in T1DM, Crohn’s, Inflammatory Bowel Disease.

Prevalence
- Young & middle-aged most common
- Women more often

Most common presentation:
- Rapid progression of painful, necrotic ulcer w/ irregular, violaceous, & undermined border
  - Increases by 1 to 2 cm/day or 50% increase in size w/i one month
- Initial lesion c/w papule, pustule, or vesicle
- Pain out of proportion to lesion
- H/o preceding trauma (pathergy)
- H/o disorders associated with PG

Diagnosis of Exclusion

Skin biopsy
- High Pathergy Risk
- Elliptical incision

Four types:
- Ulcerative – Most common
- Bullous
- Extracellular
- Vegetative

Pyoderma Gangrenosum

Management

Early PG Lesion

Note cribiform pattern

Pyoderma Gangrenosum

Mangement

• Wound Care
  o Moist wound healing
  o Does not stick to wound
  o No wet-to-dry
  o No use of silver nitrate

• Surgical Debridement
  o Avoid unless grossly infected

• Intraleisonal Steroids
  o Triamcinolone
  o Caution: May initiate pathergy

Management (cont…)

• Topical Steroids
  o Super-Potent
    • Clobetasol
  o Healing – 6-8 weeks

• Topical Calcineurin Inhibitor
  o Tacrolimus

• Systemic Glucocorticoids
  o Weight-based – High doses
  o Multiple lesions or refractory to topicals
  o Max 60 mg/day

• Systemic Cyclosporine
  o Unable to tolerate glucocorticoids
  o Not comfortable managing?
    o Refer to Derm
Necrotizing Soft Tissue Infections = **EMERGENCY**


**NF Risk Factors**

- Major penetrating trauma
- Minor laceration or blunt trauma (muscle strain, sprain, or contusion)
- Skin breach (varicella lesion, insect bite, injection drug use)
- Immunosuppression (diabetes, cirrhosis, neutropenia, HIV infection)
- Malignancy
- Obesity
- Alcoholism
- NSAIDS
- Association with progression
- May mask signs / symptoms of inflammation in which may be associated with a delay in diagnosis

**Necrotizing Fasciitis (Hemolytic Strep Gangrene)**

- Deep soft tissues infection
  - Progressive destruction of muscle fascia & overlying subcutaneous fat.
  - High mortality
- Clue: Development of anesthesia may precede skin necrosis
- Overlying tissue can appear unaffected
- Maintain a VERY HIGH Suspicion
- Refer for emergent surgical evaluation
Dermatotillimania & Skin Tears
Impulse Control Disorder
40% of PAD is silent

Source:
https://www.pinterest.com/pin/407927678719751066/
https://www.youtube.com/watch?v=8UbDbd0fv9Q
Diabetic Dermopathy

Most common diabetic skin condition with >50% of people with diabetes exhibiting this symptom.

Source: www.dermaamin.com

Recap…

- Know common etiologies to expand differential
- Think oxygen, oxygen, oxygen
  - Arterial Doppler, ABI, Segmental Pressures
- Check vein competency: Venous Duplex ultrasound for venous reflux - NOT DVT.
- Biopsies are helpful – Pathergy!
- Swear off swab cultures... tissue cultures forevermore
- If etiology in doubt, refer the patient out.
- LE wounds stem from disease chronicity. Find disease... heal the wound.

Any questions?