Objectives
- Understand the basic assessment of wound and normal healing
- Understand contributing factors to poor healing/problem wounds
- Understand the initial treatment regarding pressure ulcers, venous ulcers, diabetic ulcers, surgical wounds

Why evaluate wounds?
- A diabetic foot ulcer is more deadly than cancer
  - In a study of 20373 diabetic foot ulcers – 5% of people with new ulcers died within 12 months of 1st ulcer visit, 42.2% of people with foot ulcers died within 5 years (versus cancer – 32% 5 year mortality)
- The population is aging and becoming sicker
  - More diabetic
  - More obese
  - Yet living longer (maybe...)
- Wounds are a source of infection (cellulitis, osteomyelitis, other infections) => hospitalization
- Chronic wounds affect 6.5 million Americans per year – cost is $25 billion per year

It's not (totally) about the dressing
- When to intervene – depends on the wound and etiology
  - If a wound is due to diabetes, pressure, venous or arterial insufficiency etc, we need to create an environment that permits the patient to heal...
- Wound care is an emerging specialty with improved outcomes over "standard of care" and lower cost
- Coordinating care and working together improves outcomes
- There are many factors to consider that may be delaying ability to heal
  - Malperfusion/hypoxia
  - Necrotic tissue, bioburden
  - Infection/inflammation
  - Edema
  - Wound/wound issues
  - Deficient tissue growth
  - Unrelieved pressure/trauma
  - Pain
  - Systemic issues

Disclosures
- None
How to assess the wound

- Thorough history of the wound
  - Chronicity of wound
  - What has made it better or worse?
  - Prior treatments done
  - Tests previously completed

- Helps with diagnosis and selecting an appropriate treatment algorithm

Location of the wound

- Wound on the leg? Consider diabetic foot ulcer, arterial insufficiency ulcer, venous leg ulcer (often mixed), pressure ulcer, atypical ulcer, acute surgical wound or surgical dehiscence...
- Wound over a bony prominence? Utilize pressure ulcer treatment guidelines

Complete a review of systems

- Possible contributing factors for the wound
  - Uncontrolled diabetes – the likelihood of healing is significantly decreased with hyperglycemia due to microvascular disease
  - Autoimmune inflammatory diseases – disease itself and some medications can delay wound healing
  - Patients with RA and lower extremity ulcers are at 2 fold risk of early death
  - Smoking – has similar outcomes regarding wound healing as diabetes
  - Is underlying malignancy present?
    - Palliative or surgical management anticipated?
  - Is the patient malnourished?
    - Patients with pressure ulcers supplemented with oral nutrition containing arginine, zinc, and antioxidants improved healing (40% reduction in area versus control at 8 weeks)
  - Nutrition quality is different from quantity

Vascular and Neuromuscular assessment

- Required if wound is below inguinal ligament
- Vascular assessment by presumed etiology:
  - Venous testing for insufficiency can be done early, as treating reflux or incompetence can reduce recurrence (literature varies more for healing)
  - Arterial testing depends on the ulcer
    - Is there gangrene? Consider more definitive testing for possible intervention
    - Is the ulcer not healing after 4-6 weeks? Consider rest and stress arterial US.
    - Is the patient low risk and needs compression? Consider ABI only

Assess the wound

- Before assessment, wound must be cleaned (recommend pH balanced, hypoallergenic gentle soap – J&J)
- Dimensions – length, width, depth
  - Imagine grid over wound, measure vertically and horizontally
  - Exudate present? Odor?
  - Wound appearance – wound bed granulation, slough, necrosis?
    - Edges – are they attached? Is there undermining present (epibole)? Are they calloused?
    - Peri-wound skin macerated, dried, inflamed, infected?
  - Pictures are helpful to document, especially in venous insufficiency as skin can already be discolored.
    - Especially helpful when patient has cellulitis (imaging wound and body part to better describe overall condition)

Which is better?
Epibole

Failure to heal due to...

- Infection — usually see increase in erythema or exudate
- Difference in contamination, colonization, infection
- Low O2 in tissue (hypoxia)
- Cellular failure — wound bed has senescent cells that send improper signals for tissue growth
- Weekly debridement has been shown to be optimal interval for healing
- Unrelieved pressure or trauma — not off-loading ulcerated area or continued injury
- Pathologic inflammation — vasculitis, cancer — biopsy may be helpful

Where to start?

- Unfortunately there is no universal guideline for all wounds
- Multiple societies & organizations exist that have evidence-based guidelines
- Remembering the basic assessment and first steps will get you far, and working together with wound clinic gives the best possible outcomes (evidence-based)
- Wound care center in diabetic foot ulcers — increased probability of healing after 20 weeks compared with standard care, less costly for healed outcome
- Managing contributing conditions is most helpful (treating cellulitis, prescribing compression, controlling diabetes, etc)

Stages, grades, etc

- For supplies/prescriptions:
  - Pressure ulcers are staged 1–4, unstageable, deep tissue injury
  - Diabetic ulcers are graded 0–5 (Wagner)
  - Other ulcers are partial or full-thickness
- For ICD-10 documentation/billing:
  - Diabetic and other ulcers: describe anatomic location, add limited to breakdown of skin, with fat layer exposed, with necrosis of muscle, with necrosis of bone
  - Pressure ulcers: document stage 1–4, unstageable, suspect DTI, device related
  - New nomenclature from NPUAP recommends injury instead of ulcer, eliminated roman numerals, eliminated “suspect DTI”

80 year old female

- Recent hip surgery
- BMI 19
- Developed pressure ulcer post-operatively
- Difficulty eating

80 year old female

Stage 3 pressure ulcer over R ischium (bony prominence)
### Pressure injury stages (NPUAP)

- **1**: non-blanchable erythema, skin intact
- **2**: partial thickness — shallow ulcer with red pink wound bed, no slough, exposed dermis
  - Intact or open/ruptured serum or serosanguineous-filled blister
  - No granulation tissue, slough, eschar are present
  - No bruising — bruising indicates deep tissue injury
- **3**: full thickness — subcutaneous fat may be visible, no bone, tendon or muscle exposed
  - Slough may be present but does not obscure depth of tissue loss
  - Depth varies by anatomical location
- **4**: full thickness with exposed bone, tendon or muscle
  - Slough may be present but does not obscure depth of tissue loss
  - Depth varies by anatomical location
- **Unstageable**: full thickness skin or tissue loss, depth unknown
  - True depth unknown, but either stage III or IV
  - Stable eschar on heels should not be removed
- **Deep tissue injury** — purple or maroon discolored intact skin
- Additional definitions exist for medical device related and mucosal membrane pressure injuries

### 80 year old female

- Clean the wound (soap & water) and advise the patient or caregiver to do so — gently removes debris and bioburden
- Most important for healing — nutrition and off-loading
- Off-loading — depending on the stage of pressure ulcer, may qualify for a group 1-3 surface, but need **equal pressure distribution = redistribution**
  - For CMS, need 30 days of comprehensive program & meet other criteria for group 2 (low air loss, alternating mattresses)
  - Air cushions are available for purchase at DME (insurance does not cover)
- Protect skin from moisture and shear forces to reduce further damage (zinc-based formulation if not allergic)

### Air cushion

This is a basic pressure redistribution cushion. Patients who are paraplegic may have a ROHO cushion. Patients can have their more expensive cushions mapped (in CR – done at St Lukes physical medicine & rehab).

### 48 year old male

- Lower leg ulcer for 5 months, weeping
- BMI 48
- Diabetic, A1c 9
- Standard American diet

### 48 year old male

- Venous leg ulcer

### CAEP classification of chronic venous disease

(Clinical, Etiological, Anatomic, Pathophysiologic)

- **C0**: no visible or palpable signs of venous disease
- **C1**: telangiectasies or reticular veins
- **C2**: varicose veins
- **C3**: edema
- **C4a**: pigmentation or eczema
- **C4b**: lipodermatosclerosis or atrophie blanche
- **C5**: healed venous ulcer
- **C6**: active venous ulcer
- This classification is not clinically useful in wound care (all are C5 or C6), nor ICD-10 documentation
- Classification of lymphedema also exists
Based on history and appearance — most likely venous ulcers (but 30-40% of chronic ulcers have more than 1 cause... ) — test both arteries & veins

Primary treatment — compression, minimum 25-30 at ankle if normal ABI
- Need to ensure good flow prior to high-grade compression as adding compression can further stress compromised system
- Patient must be compliant — use level of compression that patient can tolerate!
- Treating venous disease can reduce recurrence, may help ulcer heal depending on findings
- More important — weight loss, diabetes control

Types of compression
- Stockings — reduced compliance due to difficulty donning & doffing (consider prescribing device to improve compliance); multiple classes
  - Class 1: 18-21 mmHg
  - Class 2: 23-32 mmHg
  - Class 3: 34-46 mmHg
  - Class 4: 49+ mmHg
- Circular knit — off the shelf
- Flat knit — custom made — esp for extreme body shapes
- Wraps — good investment for patient, not always covered
  - SOMETIMES covered if active ulcer present
  - 3 layer wraps — done by OT or other trained personnel
  - Pneumatic compression
- CMS requires 4 week trial of conservative therapy — appropriate compression garment, exercise, elevation
  - Calf muscle pump failure is one of largest negative prognostic indicators — calf muscle atrophy, fixed ankle, limited ROM

Compression wraps
- Fitted garments with (usually) velcro closure

63 year old female
- Diabetic foot ulcer for 1 year
- Neuropathy present bilaterally
- Foot deformity present
- A1c 10.3
- BMI 35

Diabetic foot ulcer
Wagner more commonly used, UT system is complex
- UT system more predictive of healing time
- UT system distinguishes ischemia and infection
- Wagner 0: foot at risk
- Wagner 1: superficial ulcer — no deep exposed structure or infection
- Wagner 2: full thickness of skin with deeper structure exposed
- Wagner 3: grade 2 with infection of deeper structure
- Wagner 4: partial gangrene
- Wagner 5: gangrene of entire foot
- GRADES 4 & 5 indicative of ISCHEMIA
63 year old female

- Stress importance of off-loading – gold standard is total contact cast – 88% heal at mean time of 44 days
- Not well received until the healing is evident
- Not always feasible, some refuse
- Ensure no infection is present (esp osteomyelitis)
- Perfusion is important for healing
- Hyperbaric oxygen is an option in select cases

Surgical wound dehiscence

- Major recommendations postoperatively:
  - Wounds healing by secondary intention: do not use Eusol (chlorinated lime and boric acid solution), moist cotton gauze, mercuric antiseptic solutions
  - Use appropriate interactive dressing to manage – refer to tissue viability nurse for advice on appropriate dressings
- Surgical site infection noted – use antibiotic that covers likely causative agent considering local resistance, or based on results of microbiology

Surgical wound dehiscence

-started in 1930s – used wound coverings and fillings consisting of gauze, cotton wool pads, impregnated gauze, absorbent cotton, adhesive pads
- Despite evidence, practice has not changed since
- Problems:
  - Does not provide physical barrier to entry of bacteria
  - Frequent (3-4 times daily) dressing changes can reduce wound temperature → vasoconstriction → decreased perfusion
  - Impairs leukocyte mobility, phagocytic efficiency
  - No significant impedance of evaporation → do not keep moist unless continuously wet
  - Prolong inflammatory phase of wound healing
  - Causes substantial discomfort and wound bed disturbance
  - Nonselective mechanical debridement (causes tissue destruction)

What about debridement?

- Studies indicate that weekly debridement improves healing versus less frequent debridement
- Most of literature is in DFU, some in VLU
- Typically also evaluating advanced wound care product as primary endpoint
- SO… much of the data about benefits of debridement for all wounds is based on weaker evidence that shows a small effect, and is extrapolated from DFU and VLU
- Debridement should not be done in a stable eschar on heel or ischemic limb

The icing on the cake – dressings

- Almost never the primary treatment in wound care - control contributing factors first
- Help control exudate, reduce bioburden, promote healing
- Evaluate the etiology of the wound, rule out infection, if high bioburden is present, choose an appropriate dressing

Colwell et al, 1993
- Semiocclusive dressing had higher hard dollar costs, less frequent changes, provided faster healing outcomes, less expensive than wet-to-dry

Moffat et al, 2002
- European Wound Management Association no longer recommended gauze as best practice – newer products (hydrogels, hydrofibers, alginates, soft silicones) less likely to cause pain

Vermeulen et al, 2004
- Cochrane review – dressings and topical agents for surgical wounds healing by secondary intention
- Most evidence low quality
- Gauze used more nursing time, associated with more pain, patients less satisfied
- Typically, products are compared to moist gauze prior to FDA approval. While these studies are biased, they typically require efficacy to be approved. In contrast, wet-to-dry dressings are not evidence based – they are done because of history...
**Very Simplified Algorithm**

**Clean Wound!
Wound exudate**

- **Moderate**
  - Foam
    - Mepilex
    - Mepilex AG
  - Alginate
    - Melgisorb
    - Melgisorb AG
    - Aquacel

**High**

Disclaimer: This is NOT good care – this leaves out all the important evaluation and gold standards to help heal wounds. This list is not inclusive.

**More Help**

- There are many guidelines from different societies. The Wound Healing Society publishes their guidelines for free on-line, and National Pressure Ulcer Advisory Panel has their 75 page “quick reference guide” online.

- If a patient is admitted to the hospital for another reason, the wound should be undressed, cleaned and evaluated. It may be a contributing factor. The WOC team is available for consults during “business hours.”

- Our clinic is heavily evidence-based. We review new recommendations and literature frequently. We started a nursing CME program to ensure our practice is most effective and up-to-date in helping heal wounds.

**Referrals to Wound Care**

- Please consider early on in wound presence, especially for diabetic foot ulcers and venous/mixed ulcers. Our clinic goal is to schedule initial visit within 3-5 business days of referral.

- Many traumatic wounds (skin tears) and acute wounds can be handled by PCP if comfortable. We typically have a full schedule, so add-ons are not usually possible. If significant pain or infection, ER may be more appropriate.

- Burns, especially extensive or 3rd degree, are better served at a burn clinic (UIHC).

- We do a thorough intake, so new appointments can take 60+ minutes.

- Goal is to work together to heal the patient – weight loss, diabetes control, compression, smoking cessation should be encouraged by everyone involved in patient’s care. Education is important!

**Questions??**

**References**


