Wound Care in Practice:
A Guide for Frontline Clinicians

Laurin Mejia, Ph.D., PA-C, CWS
Miami VA Medical Center
Laurin.Mejia@va.gov
lampmejia@gmail.com

About Me!

- PhD Molecular Biology and Cell Science, University of Miami, 2015
  - Stem Cells, Aging, Hutchinson-Gilford Progeria Syndrome
- PA school 2015-2017, Nova Ft. Lauderdale
- Miami VA, Wound Care PA-C, 2017-Current
- Certified Wound Specialist (CWS) 2020
  - American Board of Wound Management (ABWM)
  - Flashcards and Prep Course – recommend for preparation, find on ABWM website
  - Successful step increase
    - Submitted request with requirements within 2 weeks of certification to Chief who fwd to HR

Who experiences wounds?

- ER
- Primary Care
- Vascular
- Surgery
- Geriatrics
- Hematology Oncology
- Nephrology
- Dermatology

Wound Care Basics

- Wounds significantly affect quality of life
  - Painful
  - Embarrassing
  - Anxiety producing
  - Compression wraps – showering issues
- Mismanagement of wounds:
  - Delays healing
  - Enables wound progression
  - Leads to chronicity
  - Increases risk for infection

- Moist wound healing is optimal
  - If it's dry, keep it wet. If it's wet, keep it less wet.
    - Promotes speedy wound healing, autolytic debridement
    - Decreases infection
    - Some exceptions to rule
      - E.g., dry stable eschars
- Wounds heal from the edges inward
  - Epithelial tissue slides across wound
- AVOID
  - 'Open to air'
    - Slower healing rate
    - Increases risk of infection
  - 'Wet to dry'
    - Removes healthy tissue
    - Causes trauma increases inflammation, pain

STAGES OF WOUND HEALING

Hemostasis

IMMEDIATE

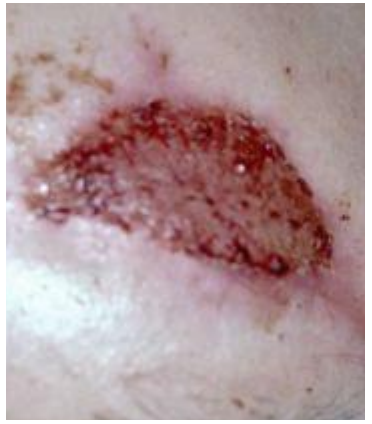
- **Stops bleeding**
- Clotting factors, platelets, fibrin, etc.
- Scab

Inflammation

0-4 DAYS

- **Decontaminate wound**
- Neutrophils, phagocytes
- Vasodilation allows influx WBCs and thrombocytes
- Local erythema, edema, warmth

Proliferation



4-21 DAYS

- **Close the wound**
- Fibroblasts, collagen 3 formation, angiogenesis, epithelialization
- Wound filling in and contracting

Maturation

21 DAYS – 2 YEARS

- **Strengthen Wound**
- Collagen 3 □ Collagen 1
- Fibroblasts & myofibroblasts
- Scar formation

Photos: Copyright Medetec

INFLAMMATION IS **NOT** INFECTION!

Inflammation

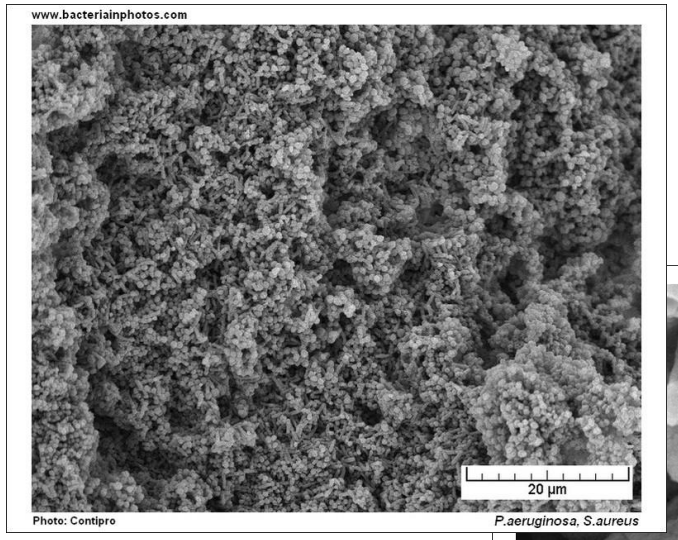
Typically days 0-4, but can prevail months – years in chronic wounds

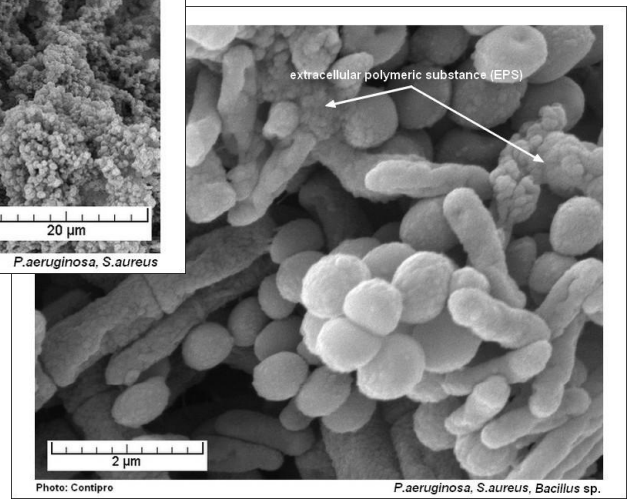
- Wound infection: **uncommon**
  - Wound colonization or hypercolonization: common
    - Hypercolonization and chronic inflammation can by treated with tetracyclines for *anti-inflammatory* properties
- Overprescribing antibiotics - dangerous environment of multi-drug resistant organisms (MDROs)
- Oral and topical antibiotics are not recommended without true infection
- Inflammation and infection overlap

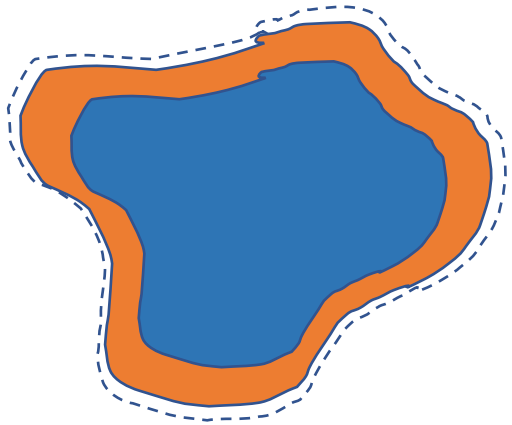
	INFLAMMATORY PHASE	**INFECTION**
Local erythema	+	+
Local edema	+	+
Local warmth	+	+
Tenderness	+	+
Purulence	-	+
Malodor	-	+
Leukocytosis	-	+
Lethargy, chills, n/v/d, etc.	-	+

Biofilm: True Enemy in Wound Healing

- Bacteria cooperate (quorum sensing) to form a strong protective barrier over wounds
  - Extracellular Polymeric Substances, EPS
    - Sugars, proteins, DNA
    - Enables microorganisms to link together with minimal disruption
    - Protects against toxic wound care products, immune system
- Properties
  - Biofilm bacteria are mostly senescent-Mitochondrially inactive
    - Minimal response to oral or topical antibiotics
  - Thrive in and promote moisture
  - Invisible to naked eye
  - Can re-constitute in 24-72 h
  - Covers wounds, med devices (heart valves, joints, catheters, pacemakers)
  - Pro-inflammatory
  - Delays wound healing
  - Obstructs access to wound bed
- Many wound products **DO NOT** penetrate or manage biofilm
- Recommend sharp debridement and specialty wound products
- Many wounds have biofilm. Increased suspicion when:
  - Persistent heavy drainage
  - Delayed wound healing (especially over implanted devices)







Senescent bacteria

Metabolically active bacteria

Biofilm

wwww.bacteriainphotos.com

Granulation Tissue

- Beefy red
- Does not protrude above surrounding skin/tissue
- Healthy wound bed
- Needed for epithelial cells to cover wound
- Healthy bleeding when debrided

Malhi, Harsimran Kaur & Didan, Ali & Ponosh, Stefan & Kumarasinghe, Sujith. (2017). Painful Leg Ulceration in a Poorly Controlled Hypertensive Patient: A Case Report of Martorell Ulcer. Case Reports in Dermatology. 9. 95-102. 10.1159/000468977.

Hypergranulation Tissue

- Beefy red
- Protrudes ABOVE surrounding skin
- Delays wound healing
  - Physical barrier that prevents epithelialization across wound surface
- Increases risk of infection and scar formation
- Can indicate biofilm presence
- Treatments
  - **Silver Nitrate**
  - Physical Pressure
  - Manage biofilm

Necrotic Tissue

- Dead cells/tissue
- Caused by
  - Infection
  - Circulatory compromise
  - Burns
  - End of life
- For wound healing, requires **debridement,** removal of devitalized tissue
  - Sharp
    - Bedside or surgical depending on size of necrosis & patient health (e.g., large firmly adhered necrotic tissue- surgical)
    - Curette, scissors, or scalpel to physically remove, controlled bleeding is good
  - Enzymatic
    - Ointments and dressings that contain specialty products that can target and breakdown necrotic tissue
  - Autolytic
    - Endogenous process, wound exudate contains various proteins, enzymes, immune cells, etc. that digest and dismantle necrotic tissue

Slough vs Eschar vs Scab

SLOUGH

- Collection of proteins, fibers, dead cells at wound bed
- Common finding in wounds, often **mistaken** for pus or infection
- Color varies: Yellow, white, gray, tan, green, brown
- Moist
- Can appear
  - Stringy
  - Firmly attached or loose/mushy
- Treatment
  - Must remove to allow healthy granulation tissue to form
  - Sharp and/or enzymatic debridement recommended - fastest

Slough vs **Eschar** vs Scab

ESCHAR

- Dead tissue over full thickness wound
- Often dark, dry, firm
- Stable and intact heel eschar should **NOT** be debrided
  - Heel has poor circulation
  - Eschar provides natural infection barrier
  - If eschar becomes unstable – wet, erythematous, edematous, boggy – needs debridement
- Recommendation depends on location and status
  - Sharp debridement if good circulation and goal is wound healing
  - Dry dressing (betadine) to prevent wet gangrene in poor circulation, e.g., diabetic foot wounds – e.g., heels and toes, goal is infection prevention

Slough vs Eschar vs **Scab**

SCAB

- Dry plug of blood and clotting factors covering wound bed
  - RBCs, platelets, fibrin, etc.
- Dark red/brown, dry crust
- Recommendation
  - Remove for access to wound bed
    - Increases speed of healing, decreases risk of infection
  - If firmly attached, apply moist dressing (e.g., hydrogel) to wound x days and then re-attempt removal
  - In young and healthy patients, a scab is often sufficient to promote wound healing beneath, will lift independently

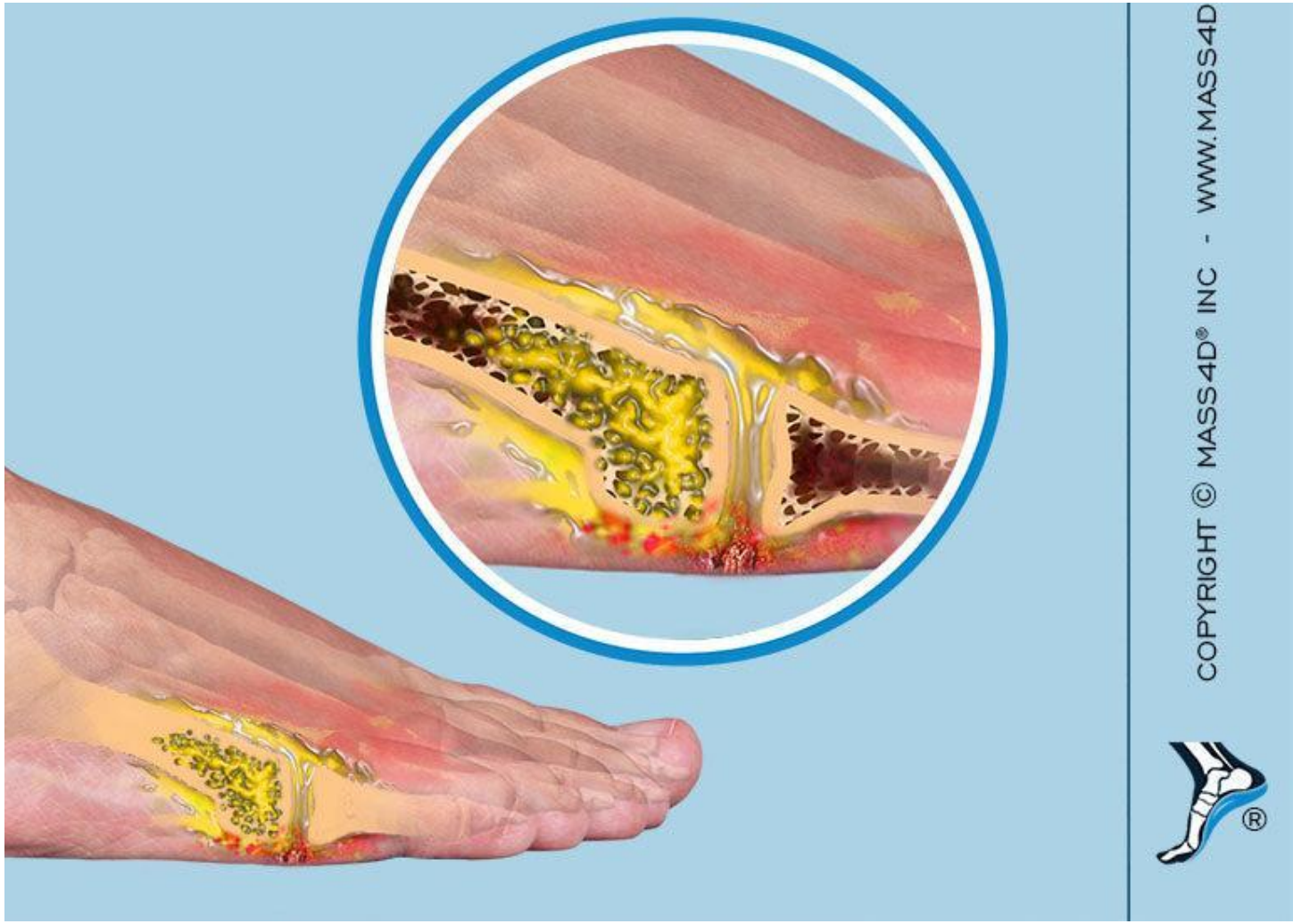
Wound and Surrounding Skin

Tunneling

- Thin narrow tract into wound
- Can be straight down, at an angle, center of wound, along margins
- Probe to determine depth
  - Near a joint with firm depth, suspect bone exposure
    - Bone exposure=osteomyelitis
- Chronic tunneling with heavy drainage over prosthetic joint suspect prosthetic joint infection
- Must be packed
  - E.g., antimicrobial, negative pressure, collagen, foam, absorptive dressing

Osteomyelitis (OM)

- Local bone infection
  - Wound may or may not close prior to infection management
- Bone exposed Presumed OM
  - Trauma – car/motorcycle accident, fall
  - Chronic deep wound - DFU
- Also hematogenous spread (greatest in spine)
- Acute vs chronic
- Consult ID for antibiotic recommendations
- Consult corresponding specialty services, e.g., podiatry, orthopedics, wound care, etc.
- Xray – first line imaging
  - Doesn't always identify OM, especially early cases
- MRI – best imaging
- Bone biopsy – gold standard diagnostics



Wound and Surrounding Skin

Undermining

- Area along edge of wound that extend under the surrounding skin
  - Common in pressure injuries due to **shearing and friction**
- Often cannot see it visually
- Probe for location, depth, ?bone exposure
  - Oriented along axis of clock for documentation – Head is 12 oclock, feet are 6 oclock
    - Documentation example: Undermining 9-5 oclock, max of 4cm at 12 oclock
- Undermining must be gently packed
  - Collagen, foam, absorptive dressing
  - Gentle packing = like tissue paper in a gift back
    - Occupy the open space but not tightly packed
- Remove all packing during dressing changes
  - Retained dressings can cause infection, obstruct wound healing

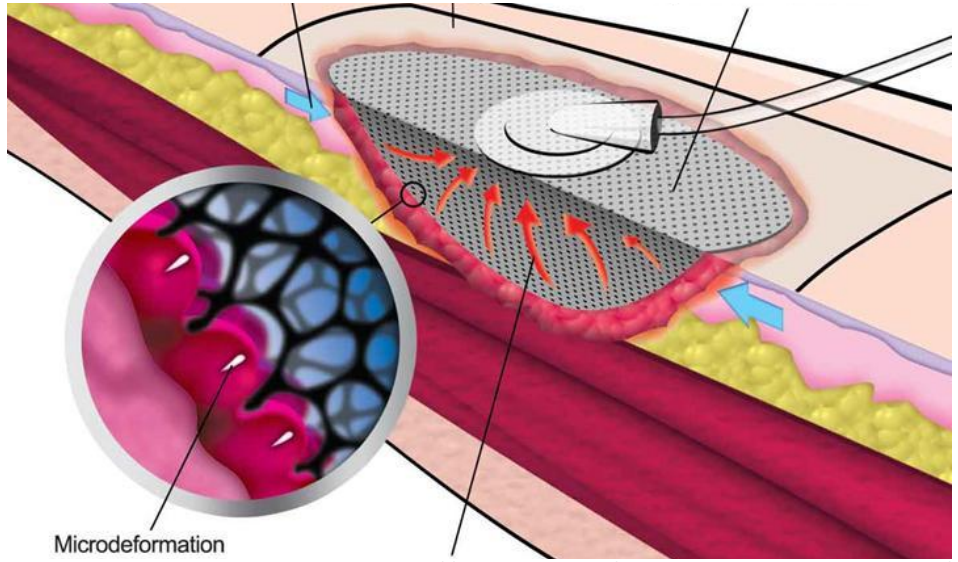
Wound and Surrounding Skin

Epibole

- Skin along wound border is rolled into wound bed
- Senescent cells at leading edge
- Once wound has granulated to the surface, epithelial tissue will not cover wound
- Must be debrided
  - Iris scissors, scalpel

Negative Pressure Wound Therapy (NPWT) Wound VACs

- A foam dressing is cut to fit, applied at the wound (packed or topical), sealed with an occlusive drape, and connected by tubing to a machine that applies negative pressure (suction) to the wound
- **Microdeformation in wound bed** is the primary mechanism of action
  - Stimulates granulation, angiogenesis
- Drainage collection is secondary
  - If there is no drainage in canister, ITS OKAY. VAC is still working
- VAC must maintain the seal to function properly. If the VAC malfunctions, the dressing must be sealed or VAC removed within 2 hours to prevent complications, e.g., infection
  - Most common cause of malfunction are leaks in the dressing. Use tegaderm to cover any bubbles or wrinkles that may be allowing air in. Adjust patient positioning as needed to reduce risk of dressing leaks (e.g., if wound is over the anterior knee, put knee in flexion prior to application).
- Different foam densities, silver impregnated foams (antimicrobial), irrigation settings, debridement settings, etc.
- Surgical incisions, dehisced wounds, deep wounds, shallow wounds, heavy or light drainage, pressure injuries, etc.



https://sunmedic.eu/mechanism-of-npwt-action/

(Credit: 3M, KCI, an Acelity Company)

Trauma

- Dressing removal (bandages, securement devices)
  - Use adhesive remover, minimal tape on fragile skin
  - Recommend silicone tape/dressing
  - Secure limb dressings with kerlix or tubular dressings, no tape to skin
  - Consider barrier ointments
- Burns
- Often linear or pattern-like
- Can be over bony prominence, evaluate closely to distinguish from pressure
  - Will decrease threshold for pressure injuries

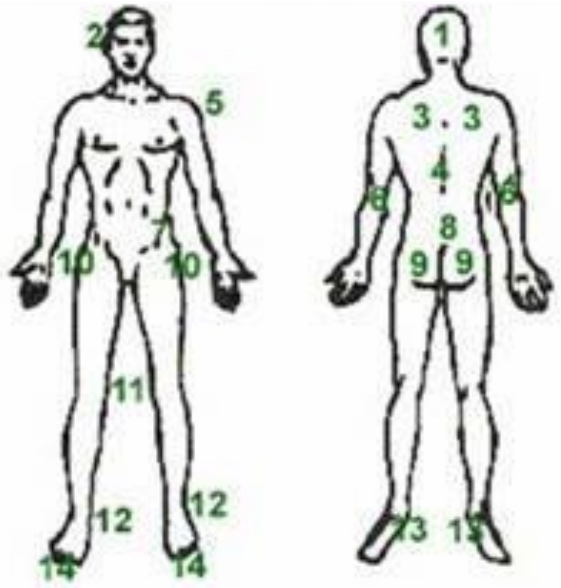
Pressure Injuries

- Localized damage to skin and underlying soft tissue
- Resulting from pressure
  - Just because there is a wound in a high pressure area, doesn't mean it's a pressure injury
    - If the patient walks, unlikely pressure
- Over bony prominence or medical device
- Can be avoidable or unavoidable
  - Avoidable - medical device placement, not turning in bed, inappropriate surface
  - Unavoidable - end of life, circulatory compromise
- Stage 1-4, unstageable, deep tissue injury

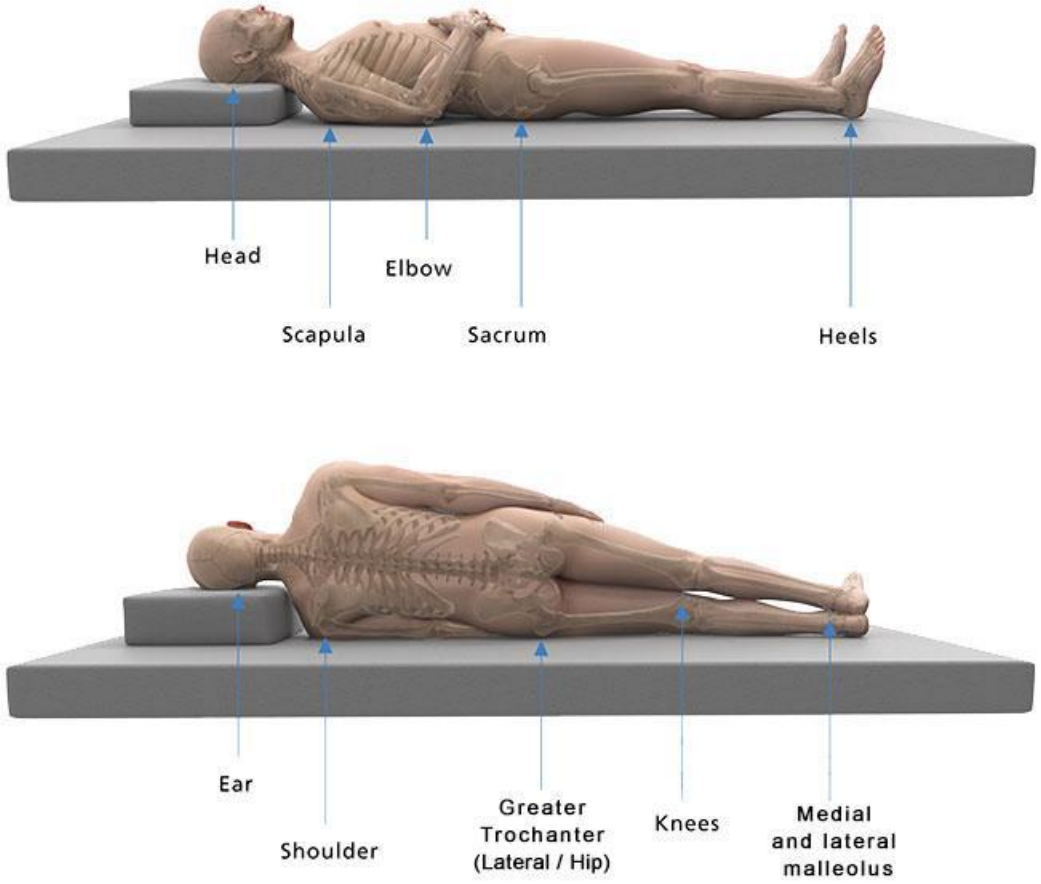
Sitting

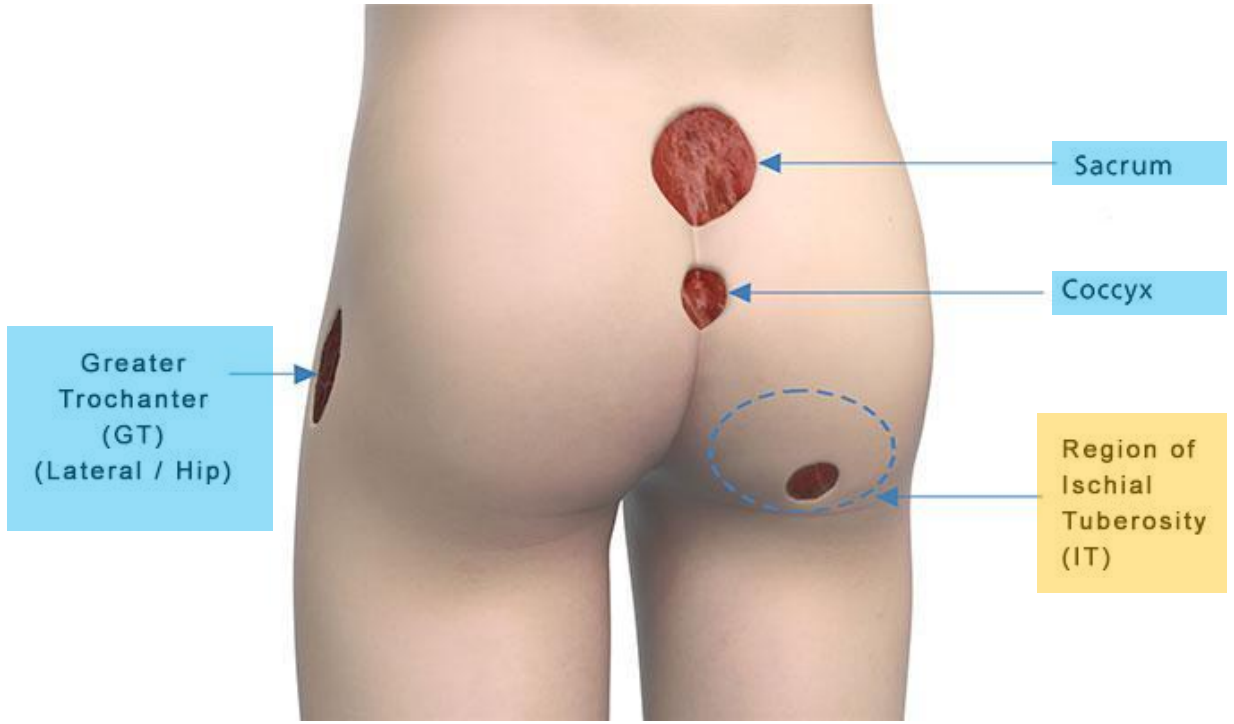
Laying

- Over Bony Prominences
  1. Occiput
  2. Ears
  3. Scapula
  4. Spinous Processes
  5. Shoulder
  6. Elbow
  7. Iliac Crest
  8. Sacrum/Coccyx
  9. Ischial Tuberosity
  10. Trochanter
  11. Knee
  12. Malleolus
  13. Heel
  14. Toes



Common Pressure Injury Locations





Sitting

Laying

https://www.aci.health.nsw.gov.au/networks/spinal-cord-injury/pi-toolkit/assessment/wound-assessment/location

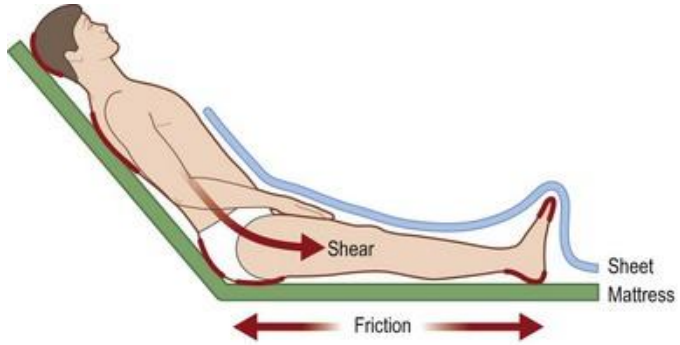
Pressure Injury Locations

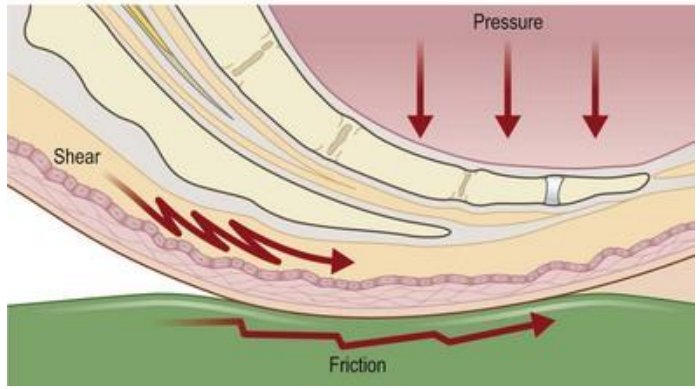
- Do not always occur in common areas
- Achilles
  - Muscle atrophy, spinal cord patients
- Medical device related pressure injuries
  - ET tube holders, NG tubes, foley tubes, etc.

Pressure Injury Contributors and Risk Factors

Braden Scale

- Sensory perception
  - Ability to respond meaningfully to pressure-related discomfort
- Moisture
  - Degree to which skin is exposed to moisture
- Activity
  - Degree of physical activity
- Mobility
  - Ability to change and control body position
- Nutrition
  - Usual food intake pattern
- **Friction and Shear**
  - Friction – gravity not involved
    - Interaction between skin and other surface
      - E.g., skin against sheet of bed
  - Shear – involves gravity
    - Opposing motion of tissue and bone
      - E.g., Patient sitting in chair, skin interacts with sheets creating friction, bone being pulled down by gravity





Pressure Injuries - Friction and Shear

- Most predictive factor for pressure injuries
- Important to eliminate
- When transferring and repositioning, lift then move
  - 2-person, use repositioning sheet
  - Do NOT slide skin across surface
- Float heels (offloading boots, pillows under calf)
- Turn frequently - wedges
  - Q 2 hours is a good place to start, modify based on patient
  - 30 degrees left, supine, 30 deg right
  - If pressure injury present, modify to eliminate that position

It Is NOT Always Pressure

- Do not assume that ALL buttock, sacral, coccyx wounds are pressure
  - **The etiology will dictate education, treatment, and prevention!**
- If a wound has an environmental or behavioral cause, it will not heal, or will continue to recur, until we eliminate the cause
- If you are treating a wound as pressure (e.g., offloading, turning and repositioning), but the wound is actually the result of moisture, it will not improve until we manage the moisture!

Moisture-Associated Skin Damage (MASD)

- Can be caused by incontinence, body heat/sweating, poor hygiene
- Erythema, moisture, sometimes skin erosion
- Common in groin, perineum, gluteal cleft
- **Manage moisture** –condom catheters, zinc ointments, scheduled toileting
  - Diapers in bed discouraged – they hold moisture to the skin! Instead – use an underpad

"Kissing Ulcers" in gluteal cleft

Moisture-Associated Skin Damage (MASD)

Fungal Infection

https://www.dermnetnz.org/topics/candida/

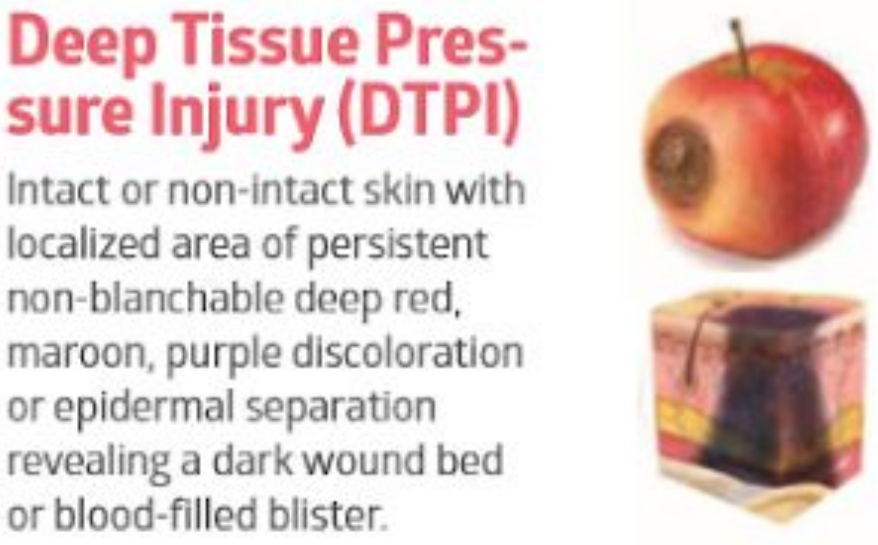
Treat with antifungal and barrier (e.g., zinc)

Mind The Gap

- Be aware that skin changes can look different on different shades and colors of skin
- Mind The Gap is a database that is routinely updated with photos of different dermatological conditions on black and brown skin

Pressure Injuries
Deep Tissue Injury (DTI)

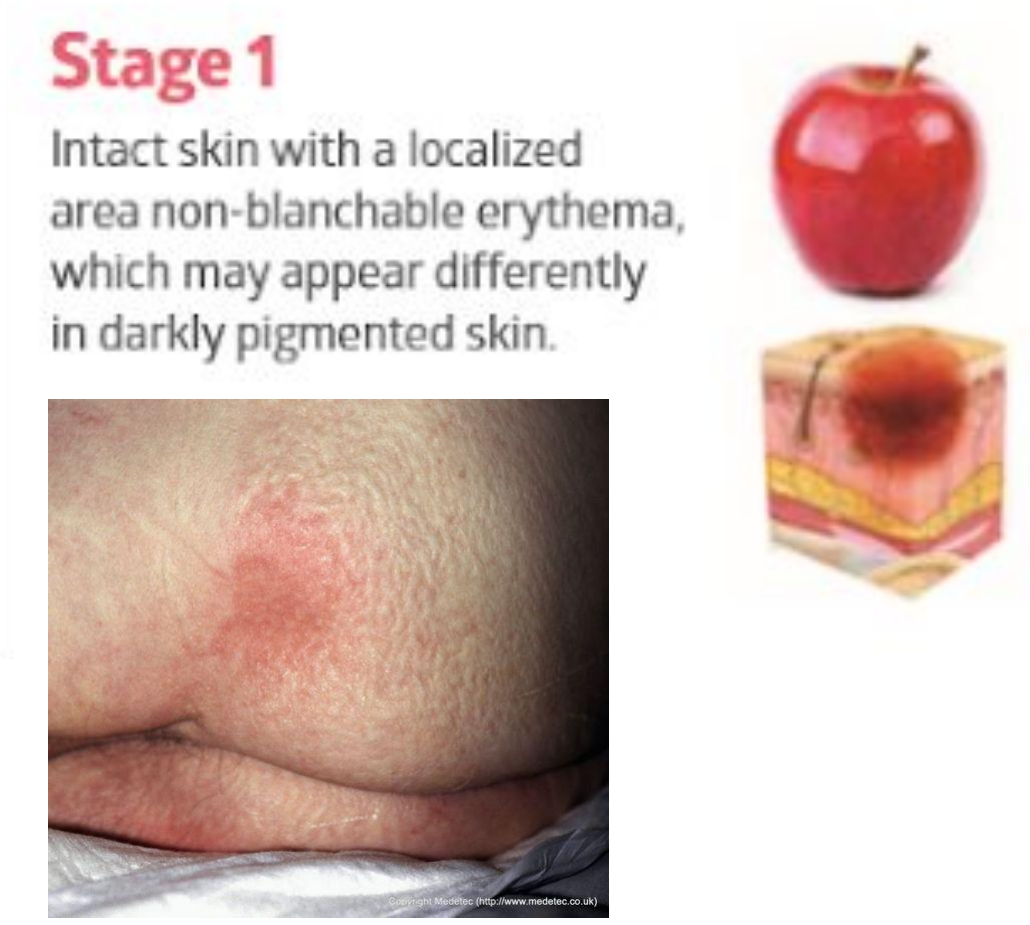
- Localized persistent discoloration
  - Purple, maroon, dark red, blood blister – looks like bruising
- Skin intact or non-intact
- Tissue damage beneath intact skin
- Can evolve to full wound, or may resolve without tissue loss
- With appropriate wound care, often can resolve without open wound
- **Offload pressure**, MIST ultrasound therapy



https://www.medline.com/skin-health

Pressure Injuries
Stage 1

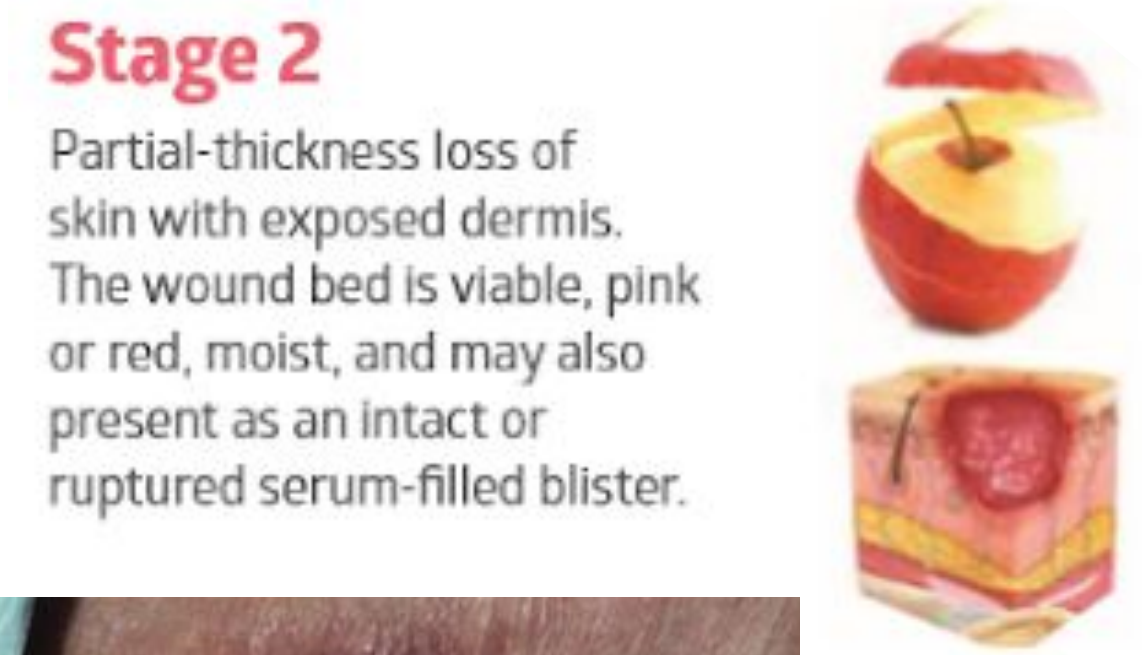
- Intact skin
- **Non-blanchable** erythema
  - Blanchable erythema can precede
    - Can serve as a warning sign
  - Color changes do NOT include purple or maroon discoloration
- Firm to palpation
- Sometimes tender/pain
- Recommendation
  - **Offload pressure** (turning/repositioning devices, dressings), moisturize



https://www.medline.com/skin-health

Pressure Injuries
Stage 2

- Open wound
- Partial-thickness loss of skin, exposed dermis
- Common causes:
  - Microclimate
  - Shear
- NOT present in a stage 2 (indicates stage 3-4):
  - Granulation
  - Slough
  - Eschar
  - Adipose (fat)
  - Deeper structures
- **Offload pressure**, moist dressing



https://www.medline.com/skin-health

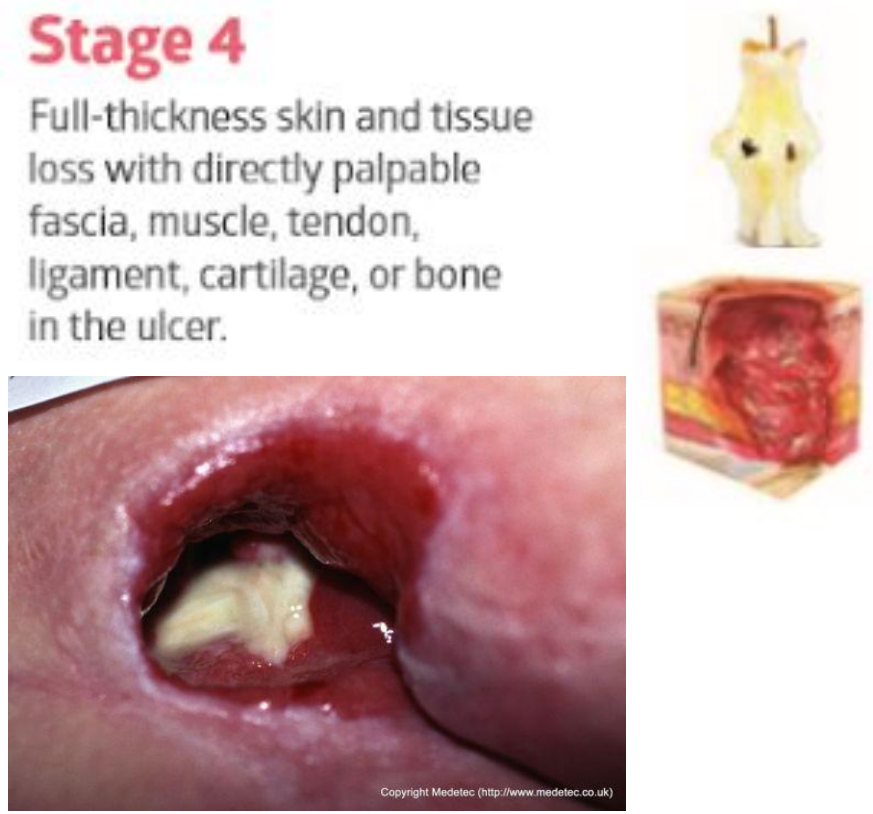
Pressure Injuries
Stage 3

- Open wound
- Full thickness
- Adipose (fat), granulation, slough, eschar, epibole, undermining, tunneling may be present
- NO connective tissue (fascia, muscle, tendon, bone, cartilage, ligament) –this would be a stage 4
- Drainage must be managed
- **Offload pressure**, sometimes packing if deep enough

https://www.medline.com/skin-health

Pressure Injuries
Stage 4

- Full thickness skin and tissue loss
- Exposed or directly palpable connective tissue
  - Tendon, bone, muscle, fascia, ligament, or cartilage
- Epibole, undermining, tunneling are common
- Drainage must be managed
- **Offload pressure**, packing



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Pressure Injuries
Unstageable

- Full thickness skin and tissue loss, but cannot evaluate depth because slough or eschar is covering
  - E.g., is there bone/muscle/tendon exposed?
- If slough or eschar removed, stage 3 or 4 (because stage 2 doesn't have slough)
- Debridement
  - Sharp or enzymatic
  - UNLESS dry stable eschar on the heel or ischemic limb – should not be softened or removed
- Manage moisture, packing, **offload pressure**

https://www.medline.com/skin-health

What Stage Is It? What Treatment?

- Necrotic eschar
- **Unstageable**
- Check vascular status
- Macerated edges – absorbent dressing
- Investigate cause
  - Shoes
  - Anything in bed with patient? TV remotes, phones, bed rails, etc.

What Stage Is It? What Treatment?

- Slough
- **Unstageable**
- Debride, moist dressing or wound VAC
- Offloading dressing, offloading boots

What Stage Is It? What Treatment?

- Erythema to left ischium
- Non-blanchable? **Stage 1**
  - Offload 5+ minutes to truly assess blanchability
- Blanchable? Pre-pressure injury
- What typically causes this wound?
  - Sitting
- Educate – offloading (shift weight, cushion)
- Pressure relieving foam dressing if available
- Consider for long term prevention:
  - Offloading cushion
  - Tilt in space wheelchair

What Stage Is It? What Treatment?

- Tendon exposure
- Stage 4
- If desiccated – needs debridement
- Moist absorptive dressing and offloading

What Stage Is It? What Treatment?

- Moist beefy red granulation
- Stage 3
- Probe tunneling – if firmness palpated, expect bone exposure, then stage 4
- Packing, absorptive dressing, offloading foam, consider wound VAC if deep

Pressure Injury Treatments

- Priority: OFFLOAD PRESSURE
- Devices
  - Heels/malleoli: Offloading boots
  - Sacrum/coccyx: Bed or overlay
  - Ischium: Cushion, tilt in space wheelchair
  - Wedges, repositioning sheets, lifts
- Address contributing factors
  - Moisture, nutrition, friction, shear
- Primary and secondary wound dressings optimize drainage mgmt and offloading

- Education
  - Turn and reposition frequently
    - 30deg right and left, supine
      - Can omit position over wounds
      - NOT completely on side □ trochanter pressure injuries
    - Also turn and reposition when sitting
      - Tilt-in-space wheelchair if wheelchair bound
  - Eliminate high pressure behaviors
    - E.g., sitting or laying in same position

Sage Offloading Boot

Joerns Dolphin

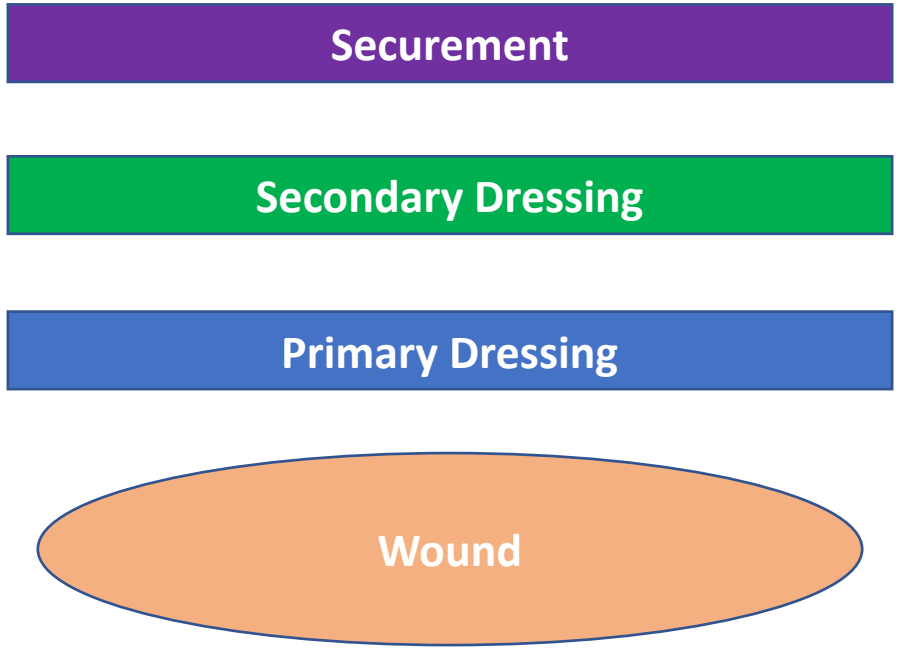
ROHO® Hybrid Select Cushion

Wound History

- Very important info - will dictate treatment plan, specialty equipment, and education
- HPI:
  - How did it happen?
    - Wheelchair/bed bound?
    - Surfaces? Mattress? Wheelchair cushion?
    - Medical devices?
  - When?
  - Wound care until now?
  - Has it gotten better, worse, or stayed the same?
  - Hospital Acquired?
- Physical Exam
  - Location, size
  - Characteristics
    - Wound color
    - Tissue type – granulation, yellow slough?
    - Drainage – scant, small, moderate, heavy?
    - Drainage color – serous, serosanguineous, cloudy yellow
    - Pain or odor?
    - Surrounding skin – dry, intact? Maceration? Localized erythema, edema, warmth, induration?
- Assessment
  - Stage (Pressure Injury)
  - Treatment plan

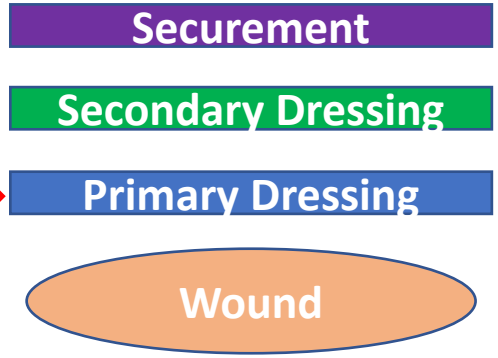
Wound Dressings

- Primary Dressings
  - Go directly against the wound
- Secondary Dressings
  - Go behind primary dressings, typically to absorb and/or secure

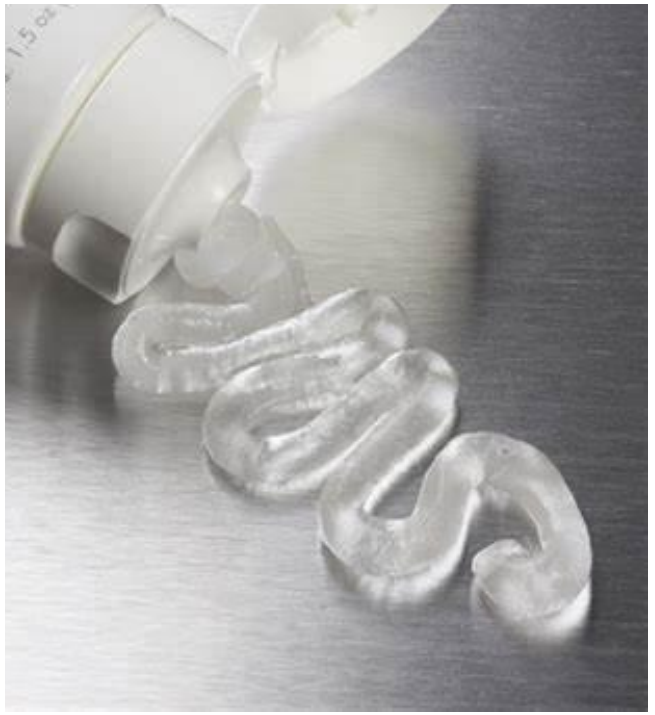


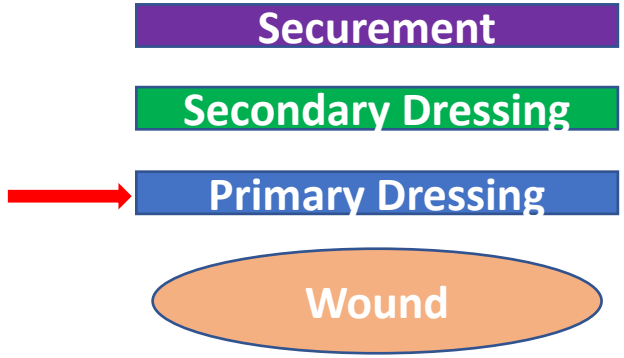
Wound Dressings

Hydrogel, Collagenase, Antimicrobial Ointments



- Primary dressings
- Moist wound environment – promote wound healing, decrease infection risk
- Breakdown nonviable tissue
  - Autolytic debridement
  - Enzymatic debridement
- Hydrogel
  - Autolytic debridement
  - Good for dry wounds (arterial), well adhered scabs
- Collagenase
  - Enzymatic debridement
  - Good for lightly draining wounds with slough
- Antimicrobial Ointments
  - Decrease bioburden
  - SOME manage biofilm

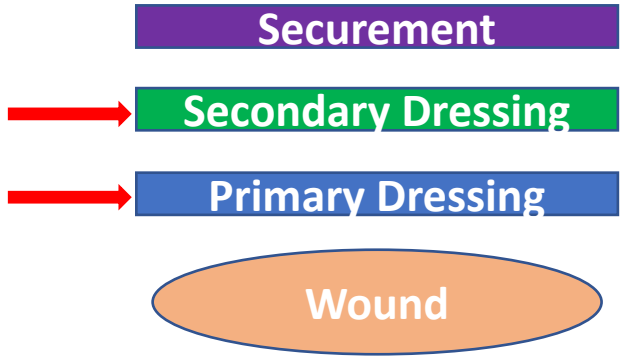




Wound Dressings
Collagen Dressings

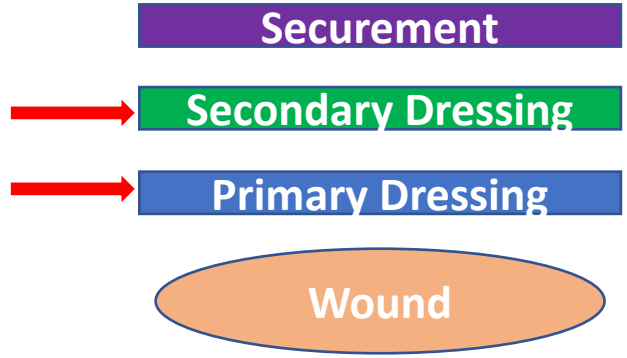
- Primary dressing
- Decoy collagen allows body's collagen to lay down scaffolding
- Absorb light to moderate drainage
  - Moderate to heavy drainage, use with a secondary for greater absorption
- Can be impregnated with antimicrobial component
  - PHMB (prevents biofilm formation)
  - Silver (broad spectrum antimicrobial)

Wound Dressings
Calcium Alginate



- Primary or secondary dressing
- Derived from seaweed
- Absorbs drainage
- Light to moderate draining wounds
- Promotes autolytic debridement
- Can be used as packing or over top of wound

https://www.vitalitymedical.com/melgisorb-plus-calcium-alginate-dressing.html

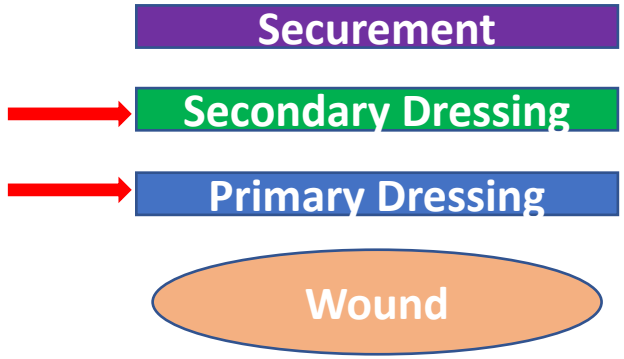


Wound Dressings
Foam

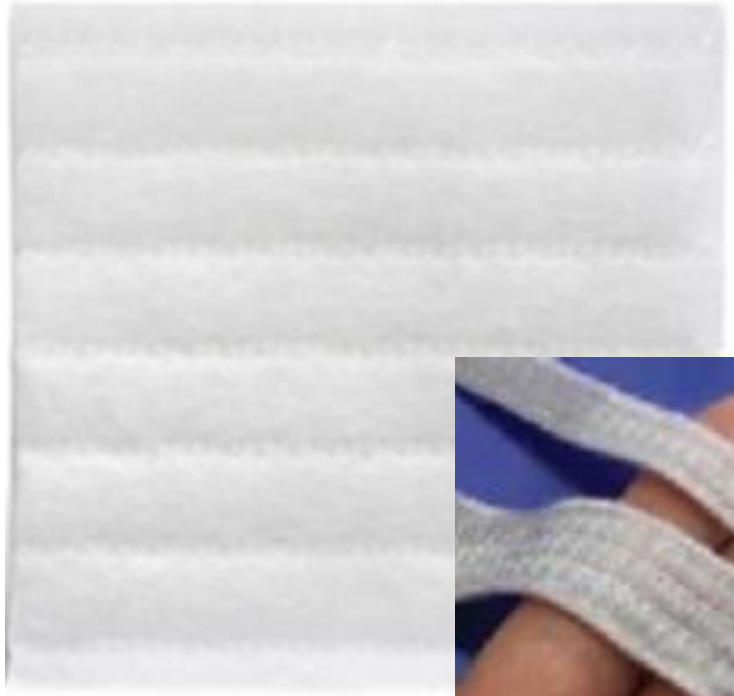
- Secondary, or securement
- Absorb moderate to heavy drainage
- Sometimes treated with detergents to promote cleansing and debridement
- Foam can have anti-shearing and offloading properties for pressure injuries
- Some with adhesive attached, some are occlusive

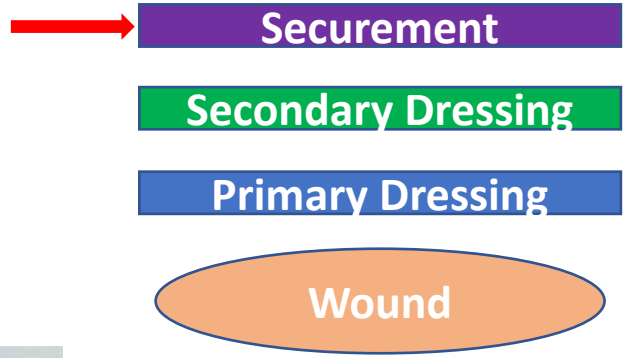
Wound Dressings

Absorbent and Superabsorbent Dressings



- Primary or secondary dressing
- Moderate to heavy drainage
- Various compositions
- Can be impregnated with treatments
  - Iodine
  - Silver





Wound Dressings
Adhesives and Securement

- Tape
  - Silicone tape
    - good for sensitive skin
  - Clear film (e.g., tegaderm)
    - strong adhesive
    - can cause skin tears if skin is thin (elderly)
  - Waterproof tape
    - Ostomy reinforcement
- Kerlix
  - Gauze wrap to secure dressings on limbs
    - Enables ‘no tape to skin’
  - Wrap loosely to avoid tourniquet, especially with edema
- Tubular Dressings
  - High elastic – tubigrip
    - Provides mild compression for edema, supportive
  - Low elastic – bandnet
    - Provides no compression
    - poor pulses, pain

Wound Treatments

- Clean with a MILD SOAP or NORMAL SALINE
  - NO betadine, hydrogen peroxide, alcohols. This kills healthy cells
- Keep wounds **MOIST** and **PROTECTED**
- Dry wounds
  - Hydrogels, collagenase, antimicrobial ointments (**NOT** mupirocin, bacitracin, Neosporin, triple antibiotic, etc.)
- Wet wounds
  - Absorbent dressings, alginates, foams

- Why not antibiotic ointments?
  - Common allergen – contact dermatitis
    - Causes erythema, edema, pain, looks like infection, patient applies more
  - Can promote resistance
  - Evidence does not indicate advantage to using topical or oral antibiotics in the absence of true infection

Leg Wounds

- Causes
  - Swelling
    - VENOUS INSUFFICIENCY!
      - Venous reflux
    - CHF exacerbation
  - Peripheral Arterial Disease (PAD, PVD)
  - Lymphedema
  - Cellulitis
    - Trauma
    - Bug bite
    - Scratching
    - Wound complication
  - Medical conditions
    - Bullous pemphigoid

- Evaluate/treat cause
- If good pulses, compression
- Smoking cessation
- Consult specialty services as needed

Peripheral Vascular Disease (PVD)
Peripheral Arterial Disease (PAD)

- Atherosclerotic disease leading to peripheral artery obstruction
  - PMHx e.g., smoking, DM
- Blood flow is insufficient to meet increased demand for wound healing
- Wounds
  - Dry or scant drainage
  - Often start as trauma that fails to heal
- Accompanied by lower extremity pain, decreased pulses

- Rest pain
  - Severe decrease in limb perfusion
  - Ischemic pain worsened by leg elevation
  - Patients may report they dangle their feet over side of bed when sleeping to relieve (gravity pulling blood into legs)
- Important to distinguish between arterial disease and other wound causes
  - Physical exam
    - Poor pulses
    - Leg appearance □no hair, dry wound, cool leg, dusky coloration
  - Ankle Brachial Index 0.91 – 1.3
    - Less than 0.9 □ suspicious for PAD, increasing severity as ABI decreases
    - Greater than 1.3 □ suspicious for PAD, calcified vessels artificially elevate ABI

PAD Wound Treatment Options

- Moist absorptive dressing
  - Hydrogel
- Dry stable eschar? Keep it dry!
- Vascular intervention
- Hyperbaric oxygen
- Local oxygen therapies becoming more prominent (sleeves, dressings)
- Arterial leg pumps
- Compression therapy is debatable
- Smoking cessation

Hyperbaric Oxygen Therapy

AOTI Topical Wound Oxygen

- Small machine that concentrates oxygen from the air (no oxygen tank) connect by tubing to a boot or patch that the patient applies at home 90m daily
- Delivers concentrated oxygen under pressure directly to wound bed
  - Different mechanism than HBO chambers breathing in

https://aotinc.net/

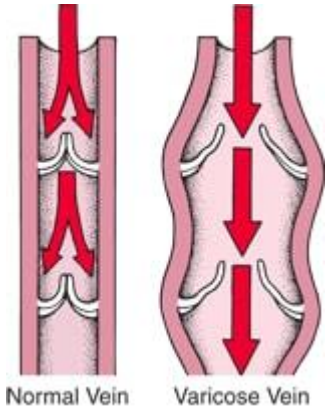
Calciphylaxis and Topical Oxygen

- Painful, necrotic ischemic wounds
- Typically ESRD + HD, but also non-ESRD patients
- Rare, difficult to study
- High morbidity and mortality
- Poorly understood

- 64 y/o patient on HD 3/weekly
- Worsening wounds x 5 months
- Diagnosed calciphylaxis by punch biopsy

TIMELINE	RIGHT LEG	LEFT LEG
Day 0 Initial Presentation at referral		
ITOT Oxygen Sleeve started within 14 days of initial presentation. REGIMEN: Oxygen therapy daily for 90 minutes to one leg, alternating legs each day. Each leg received 3-4 days of 90 minutes therapy each week. Sharp debridement every 1-2 weeks with local wound care.		
+14 days		
+57 days		
+86 days		
+118 days		

Venous Stasis



- NOT INFECTION
- Veins do not have muscles, depend on muscles around them to pump fluid
- Vein valves become leaky, dilated over time
- Leads to backflow to dependent areas
  - Lower legs – sitting or standing
- Often start as weeping/swelling without inciting factors
- Common in elderly, wheelchair bound, sedentary
- When supine, fluid redistributes throughout the body
  - Legs less swollen in AM just after getting out of bed, more swollen in PM when dependent throughout day

Image courtesy of Merck

Venous Stasis – Physical Exam

- Swelling
  - Bilateral – Systemic
  - Unilateral – Local
    - Trauma, surgery, DVT
    - Rule out infection - cellulitis
- Pain
  - Aching
  - Greater in dependent positions
    - Sitting, standing
  - Relieved on elevation
- Weeping serous fluid
  - ±Wounds, skin breakdown
  - Drainage volume can vary
- Skin is warm to touch, pink color
- Hemosiderin staining – skin darkening
  - Red blood cell lifespan – 3mo
    - apoptosis throughout normal life cycle, deposit heme under skin darkening of skin, can look like erythema
  - Sometimes improves with treatment
- Stasis dermatitis
  - Thick skin
  - Hyperpigmented
  - Scaling or flaking
- Typically no testing required
  - Venous ultrasound if suspicious for DVT (unilateral, hot, tender, risk factors)
  - If refractory to treatment, order venous duplex ultrasound to evaluate nature and extent of venous reflux

Venous Stasis - Treatment

- Manage edema
- **<u>COMPRESSION FOREVER</u>**
  - Check pulses first
  - Confirm CHF/pulmonary status
    - CHF does not mean you can't use compression, but you should slowly increase pressure over time
      - E.g., light compression to 1 leg, then add 2nd leg, then increase to firm compression 1 leg, then add 2nd leg
  - If wounds – compression wraps until resolved
    - **Friction across wound from stockings worsen wound**
  - Compression stockings/garments long term
  - Compression pumps as needed
    - Contraindicated in acute DVT, not contraindicated in chronic DVT
  - 20-30mmHg or 30-40mmHg recommended depending on severity
  - Consider the physical health of your patient
    - Can they apply stockings themselves? Do they have a caregiver at home to help?
      - Donning/doffing devices
    - Some compression is better than nothing
      - less than 20mmHg is not considered treatment grade but can still be helpful
- Exercise
  - Walking
  - Flex/extend at ankle- calf pumping
- Lay supine to redistribute fluids (elevate legs)
- Skin care
  - Moisturizers, daily cleansing
- Surgery in refractory cases
  - Venous ablation – superficial veins
  - Endovenous treatment of venous obstruction (e.g., angioplasty/stenting) – deep veins
  - Sometimes compression is sufficient to avoid need for surgery

Cellulitis

- Acute bacterial infection of skin and subcutaneous tissue
- Typically diagnosed clinically
- Physical Exam Findings
  - Pain
  - Localized erythema
    - Bright
    - Well demarcated, mark margins to track
    - Sometimes rapidly spreading
  - Warmth
  - Edema
  - Typically unilateral
    - Bilateral – think venous stasis, venous reflux
  - Possible wounds – not always
  - More severe symptoms
    - Malaise, fever, chills, lymphangitis, circumferential cellulitis, pain out of proportion to PE
  - Emergent findings
    - Violaceous bullae, cutaneous hemorrhage, skin slough, skin anesthesia, gas in tissue, hypotension

- Most commonly caused by staph or strep
  - Can be fungal – tinea pedis
  - Venous stasis is a risk factor
- Early treatment with antibiotics
  - Empirically: Dicloxacillin, amoxicillin
    - Penicillin allergy: Clindamycin
  - MRSA coverage
    - Bactrim, **Doxycycline, Minocycline**
- Lower legs: Compression as tolerated (see venous stasis)
- Order
  - Blood cultures
  - CBC + diff

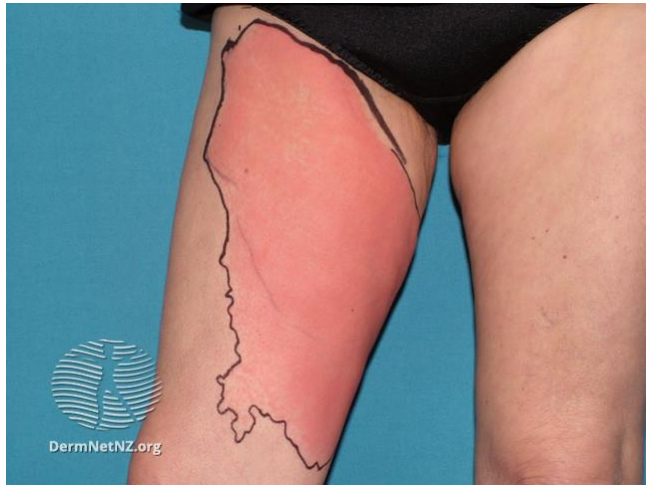


Photo Credit: Dermnetnz.org No changes made to image

What is that? Cellulitis vs Venous Stasis

	Cellulitis	Venous Stasis
Unilateral vs Bilateral	Unilateral (typically)	Bilateral (typically)
Color Changes	Well demarcated erythema-acute, possibly expanding rapidly	Diffuse hemosiderin staining-chronic
Swelling	Yes	Yes
Pain	Yes	Yes
Testing	Blood cultures, CBC	Initially – no testing, Venous duplex ultrasound if refractory to treatment
Treatment	**Antibiotics, compression**	**Compression,** skin care, exercise, elevation

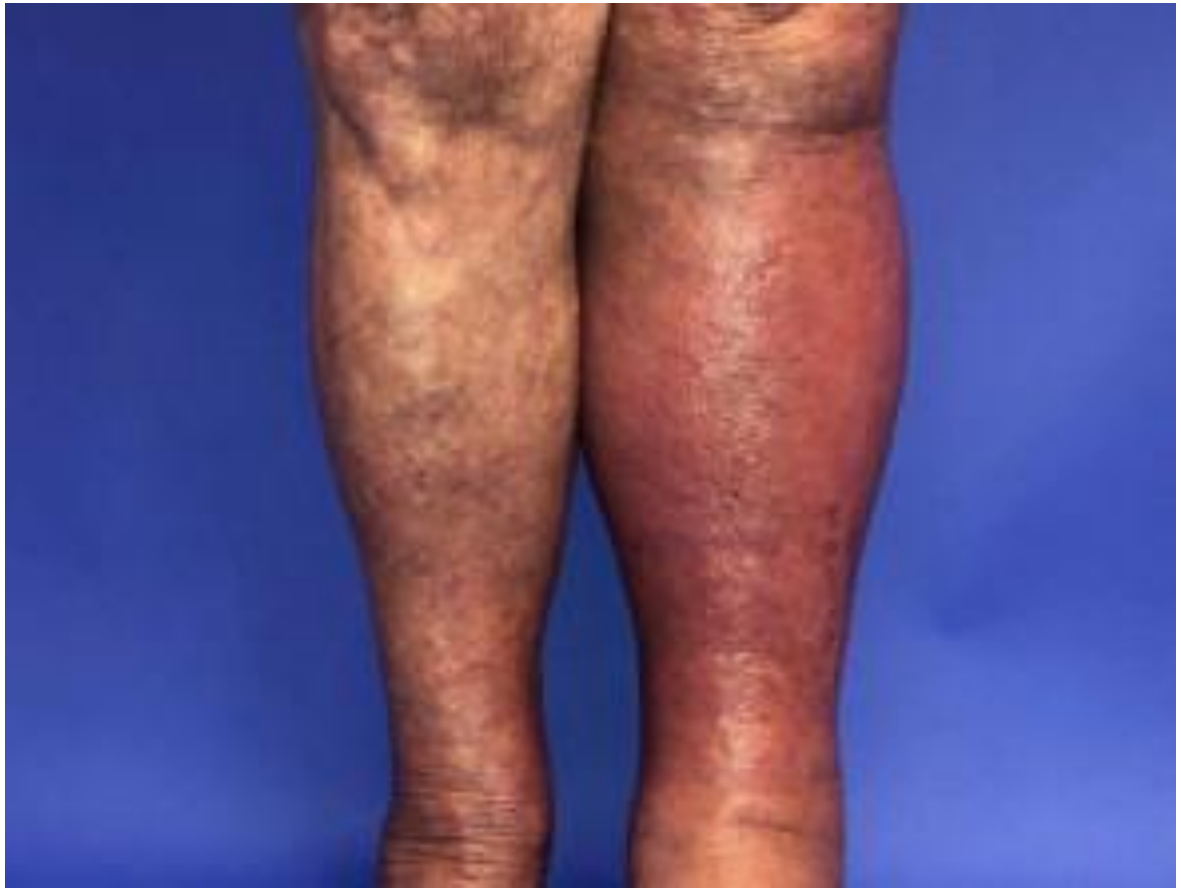
Is it Cellulitis? Or Venous Insufficiency?

- Unilateral
- Swelling
- Bright angry well demarcated erythema

Cellulitis

Photo Credit: Dermnetnz.org No changes made to image

Is it Cellulitis? Or Venous Insufficiency?



- Unilateral
- Swelling
- Erythema
- Check for DVT

Cellulitis

Photo Credit: Dermnetnz.org No changes made to image

Is it Cellulitis? Or Venous Insufficiency?

- Bilateral
- Swelling
- Hyperpigmention fades Hemosiderin Staining

Venous Insufficiency

Photo Credit: Dermnetnz.org No changes made to image

Is it Cellulitis? Or Venous Insufficiency?

- Open wounds
- Yellow slough
- Wet skin around wounds (maceration)
- Heavy draining
- Crusting skin

Textbook Venous Stasis Ulcer

Photo Credit: Dermnetnz.org No changes made to image

Is it Cellulitis? Or Venous Insufficiency?

- Bilateral
- Swelling, hyperigmented
- Lipodermatosclerosis
  - Chronic inflammatory subcutaneous fibrosis/hardening of the skin on lower legs

Sequelae of chronic venous insufficiency

Photo Credit: Dermnetnz.org No changes made to image

Take Aways

- Antibiotics are not always the answer.
- Moist wound healing is best!
  - Except dry stable eschar
- Cause of wound will dictate treatment, education, prevention.
- Offloading pressure is patient specific.
  - **Wheelchair bound**
    - Sitting wounds
      - Ischium
    - Recommend: Specialty cushion, tilt in space wheelchair, education
  - **Bed bound**
    - Laying wounds
      - Sacrum, trochanters
    - Recommend: Specialty mattress or overlay, wedges, turning and repositioning frequently, education
  - **Medical Devices**
    - Nares, mouth
    - Recommend: Offload and reposition med devices
- Leg wounds
  - Investigate arterial and venous etiologies
  - Compression for venous insufficiency
    - Treatment AND prevention

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Thank you!

Laurin Mejia, Ph.D., PA-C, CWS

Laurin.Mejia@va.gov