

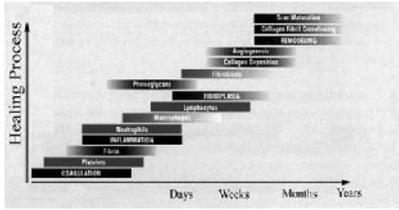
Wound Care in



60
MINUTES

Mary D. Jones, RN,MSN,ANP-BC,CWON

Normal Healing Process



Smith and Nephew, 1999

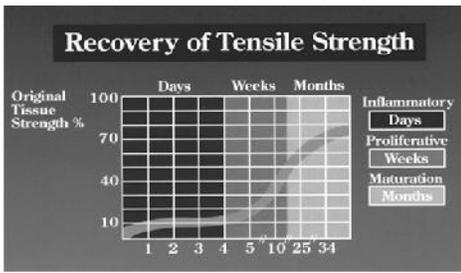
Objectives

- Define pressure ulcers, **venous** stasis ulcers, and arterial ulcer with treatment options
- Identify non-healing wounds and treatment
- Utilize M-E-A-S-U-R-E acronym for wound assessment
- Explain the principles of wound management and topical treatment
- Discuss advanced wound care modalities

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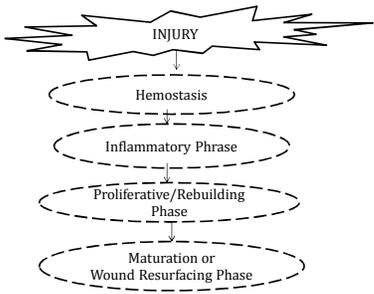
Tissue Recovery

Recovery of Tensile Strength



Smith & Nephew, 1999

Cascade of Wound Healing



Factors Effecting Wound Healing

- Co-morbidies
- Medications
- Age
- Infection
- **Circulation! Circulation! Circulation!**
- Nutrition

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Principles of Wound Management

- Identify and correct etiology factors (pressure, arterial or venous insufficiency, etc)
- Provide systemic support (blood glucose control, nutritional support, edema management, etc)
- Assess for infection
- Ongoing evaluation
- What is the **GOAL?**

Maintenance vs Healing

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Pressure Ulcer Contributed to The Death of Superman



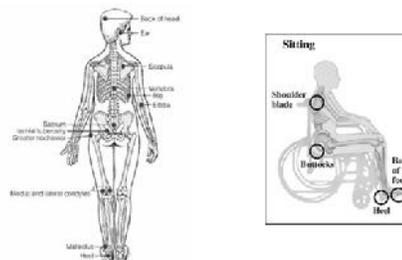
Cost of Pressure Ulcers

- Cost to treat a PU in the US grew from \$1.3 billion in 1992 to \$17.2 billion in 2003 with an average cost of \$21,675 per PU treated
- In 2008, PUs are described as the most frequent and expensive medical error costing more than \$3.8 million
- Cost reporting methods vary across different healthcare systems

Black J, Girolami S, Woodbury MG, Hill M, Contreras-Ruiz J, Whitney JA, and Bolton L. Understanding pressure ulcer research and education needs: A comparison of the association for the advancement of wound care pressure ulcer guideline evidence levels and content validity scores. *Ostomy Wound Management*. 2011;57(11):22-33.

npuap@http://www.npuap.org/pr2.htm.2007

Typical Pressure Site



npuap@http://www.npuap.org/pr2.htm.2007

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Pressure Ulcers

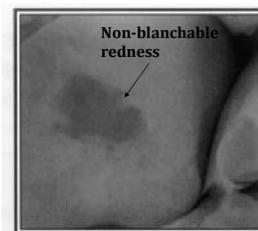
- Localized tissue injury to the skin and underlying tissue
- As a result of **pressure**
- Ulcers are most commonly located over **bony prominences**
- Staged to classify degree of tissue damage.
- The pressure ulcer staging system developed by the National Pressure Ulcer Advisory Panel.
- **Do not** back stage (stage 4 **cannot** become a stage 3)

npuap@http://www.npuap.org/pr2.htm.2007

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Stage I Pressure Ulcer

- **Intact skin with non-blanchable redness of a localized area usually over a bony prominence**
- Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area
- Skin may be painful, firm, soft, warmer or cooler as compared to adjacent tissue



Stage I

Remove the CAUSE

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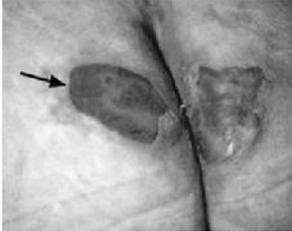
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Stage 2 Pressure Ulcer

partial thickness skin loss

- Loss of the epidermis presenting as a shallow open ulcer with a red pink wound bed, **without slough**.
- May also present as an intact or open/ruptured serum-filled blister

May use a barrier cream as zinc oxide



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Unstageable Pressure Ulcer

- Full thickness tissue loss in which the base of the ulcer is covered by **slough** (yellow, tan, gray, green or brown) and/or **eschar** (tan, brown or black) in the wound bed.
- Until enough **slough** and/or **eschar** is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined.

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Stage 3 Pressure Ulcers

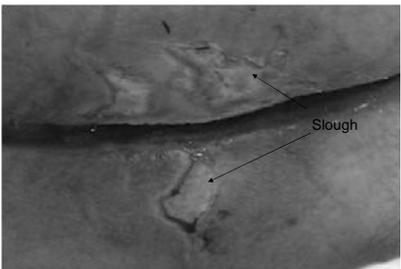
Full thickness tissue loss

- Subcutaneous fat may be visible but bone, tendon or muscle are not exposed
- Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling
- Depth will vary based on anatomical location of the body
 - Nose, ears, thin/malnourished person

Wound or Surgical Consult

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Unstageable Pressure Ulcer



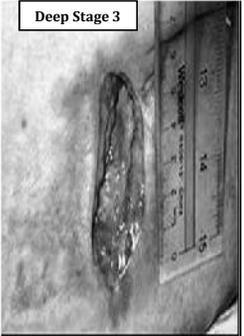
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Stage 3 Pressure Ulcer

Shallow stage 3

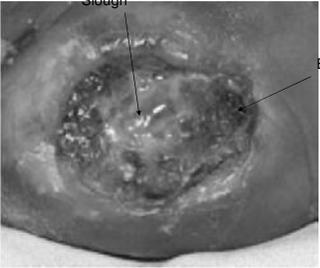


Deep Stage 3



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Unstageable Pressure Ulcer



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Which is Pressure and Which is Not?

Documentation of Wounds

Anatomical Position as Standard Body Position

Use of the Clock Face Providing Direction

Assessing Wounds/Ulcers

- History of the wound
- Etiology factors
- Systemic Factors
- **Infection?**
- Diagnostic tests
- Topical treatment
- Pain
- Follow-up care

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Clinical Wound Assessment

M-E-A-S-U-R-E

M – Measure (Length x Width x Depth)

E – Exudate (Quality and Quantity)

A – Appearance (Wound bed tissue type and amount)

S – Suffering (pain type and level)

U – Undermining (Presence or absence)

R – Reevaluate (Monitoring of all parameters routinely)

E – Condition of edges and surrounding tissue

Keast DL, Bowering CK, Evans AW, Mackean, GL, Burrows C, D'Souza L. MEASURE: A proposed assessment framework for developing best practice recommendations for wound assessment. *Wound Repair and Regeneration*. 2004;12:51-517.

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Exudate/Drainage

- Wound fluid**
 - ✓ Serum
 - ✓ Cellular debris
 - ✓ Bacteria and leukocytes
- Amount**
 - ✓ Minimal
 - ✓ Moderate
 - ✓ Large
- Presence of odor**
- Color**
 - ✓ Sero-sanguinous
 - ✓ Serous
 - ✓ Tan
 - ✓ Green

Red is Good

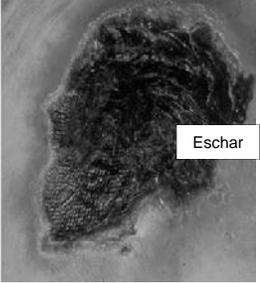
- **Red** refers to granulation tissue
the goal for the wound bed to achieve healing
- **Yellow/tan** refers to loose stringy necrotic tissue
- **Black** is eschar. Thick, leathery, **DEAD** tissue



Appearance

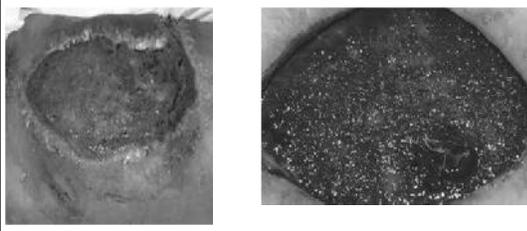
- Eschar is brown or black avascular tissue.
- The eschar is **DEAD** tissue
- It may be tightly adhering or loosely adhering to the wound

Surgical and Wound Care Referral



Appearance

Granulation tissue is the raspberry of wound healing



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Caution, Caution.....

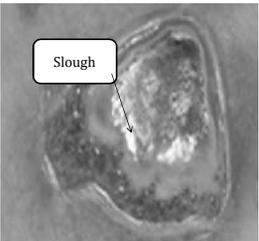
- If scab or dry eschar on lower extremities leave it dry and open to air unless further instructed by MD or wound care nurse
 - There may not be adequate blood flow to support wound healing
- Do NOT recommend a Hydrocolloid dressing over intact eschar!



Appearance

- Slough is a yellow or tan colored tissue
- Slough is avascular tissue
- Treatment varies:
 1. May be mechanically removed with wet-to-dry gauze dressings,
 2. surgically removed or
 3. Enzymatically

Referral for Wound Care or Surgeon



Suffering



Re-evaluate Wounds with Follow-up Plan

Feet, Diabetic ulcers, toenail problems = **Podiatry**

Complex wounds, Stage 3 or 4 Pressure Ulcers = **Surgeon**

Chronic wounds or ulcerations/ostomy = **Out-Patient Wound / Ostomy Clinic**

Must have a **PCP**

Vascular ischemic arterial wounds = **Vascular Surgeon**

Non-Healing Wounds

If the wound does not respond to therapy in a timely manner

BIOPSY
and it looks funky

BIOPSY
and located in a strange place.....

BIOPSY

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Edges and Peri-wound Skin

Non-Healing Wounds

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Model for Healing Rate

```

    graph TD
      A[Good Wound Care] --> B[Period of Monitoring]
      B --> C{Healing at 4 weeks ≥ 50%}
      C -- Yes --> D[Educate patients about  
• S/Sx of infection  
• Edema control  
• Goal of healing  
• Provide regular follow-up]
      C -- No --> E[Reassess for infection  
• Check for circulation and compliance  
• Consider adjuvant care]
      E --> F[Advanced Therapies]
    
```

Sheehan PJ, Jones D, Caselli A, et al. Percent change in wound area of diabetic foot ulcers over a 4-week period is a robust predictor of complete healing in a 12 week prospective trial. Diabetes Care. 2003;26:1879-1882.

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Marjolin Ulcer

- Malignant transformation of chronic ulcer, scar or area of chronic inflammation with average time from injury to diagnosis was 21.4 years
- Secondary to trauma, burns or chronic non-healing ulcers
- Well-differentiated squamous cell carcinoma
- Usually on extremity
- Males > Females
- Ages ranged from 32 to 70 years (mean 46.6)

Asuquo ME, Ikpeme IA, Godwin E, Bassey EE. Marjolin's ulcer: sequelae of mismanaged chronic cutaneous ulcers. Advances in Wound Care 2010;23:414-16.

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Marjolin Ulcer



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Venous Stasis Treatment

GOLD Standard
IS

COMPRESSION



Art Galley of Wounds



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Arterial Ulcers

- Distally located on toes and areas of trauma
- Painful
- Minimal exudate
- Punctuated ulcer with pale ulcer bed
- Decreased edema
- Pallor with elevation of the limb and rubor in the dependent position



Venous Stasis Ulcer

- Edema
- Hemosiderin staining
- Location
 - Medial malleolus
- Highly exudating
- Shallow
- Dark red, often with thin layer of slough
- Irregular edges
- Painful



Arterial Ulcer Treatment

Circulation!Circulation!Circulation!

- **Minimize risk of infection**
- Continual assessment/management for tissue deterioration of tissue status
- Pain Management
- Patient Education

Debride or NOT Debride

<u>Debride</u>	<u>Not Debride</u>
<ul style="list-style-type: none"> ▪ Removal of Senescent/Non-healing cells ▪ Necrosis associated with infection ▪ Remove necrotic tissue ▪ Converts chronic to acute wound ▪ Preparation for Advanced wound modalities 	<ul style="list-style-type: none"> ▪ Ischemic wound ▪ Intact dried eschar in non-infected wound, on distal extremity ▪ Clotting disorder ▪ Systemic infection, i.e., cellulitis with risk of sepsis

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Non-Surgical Debridement Options

- **Enzymatic Debridement (Santyl)**
Somewhat costly
Prescription required
- **Autolytic Debridement**
Healthy person
- **Chemical Debridement**
Dakin's Solution soaked gauze changed every 12 hrs
Good for malodorous wounds
- **Ultrasound Debridement**
Mist therapy
- **Mechanical Debridement:**
Non-selective wet-to-dry gauze
- **Maggot Therapy:**
Used with containment dressing

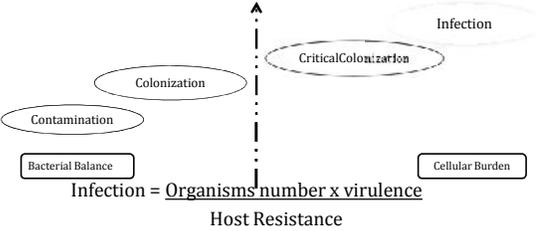
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Debride or Not?



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Chronic Wounds and Bacteria



$$\text{Infection} = \frac{\text{Organisms' number} \times \text{virulence}}{\text{Host Resistance}}$$

Ramundo JM: Wound debridement. In Bryant, RA & Nix, DP: Acute & Chronic Wounds Current Management Concepts.ed 3, St. Louis, MO, 2007, Mosby Elsevier.

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- Debridement is not a single event:
 - *Initial debridement
 - *Maintenance phases
- There is evidence for a "cellular burden" of senescent cells need to be removed

Huntley, JS. Debridement : development of the concept. J Perioper Practice 2011;21 (3):104-5.

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Guidelines for the Management of Skin and Soft Tissue Infections (SSTI)

- Cutaneous abscess: I & D is primary tx
- Abscesses associated with severe, extensive or rapid progression of the infection start antibiotic therapy
- For empirical coverage for CA-MRSA in out-patient with SSTI oral antibiotics: Clindamycin, Septra, a tetracycline and Linezolid
- Out-patient **purulent** cellulitis empirical antibiotic therapy for CA-MRSA until culture results
- Out-patient with **non-purulent** cellulitis empirical therapy for B-hemolytic streptococci is recommended
If no improvement recommended empirical coverage for CA-MRSA
- Hospitalized patient with complicated SSTI required surgical debridement with broad spectrum antibiotic and empirical therapy for MRSA pending cultures
- Children with minor infections as impetigo and secondarily infected skin lesions use Mupirocin 2% topical treatment

Liu C, Bayer A, Cosgrove SE, et al. Clinical practice guidelines by the infectious disease society of America for the treatment of MRSA infections in adults and children, Clinical Infectious Diseases 2011;52:1-38

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Preventive Education

- Maintain good personal hygiene with bathing and hand washing with soap and water or alcohol-based hand gel
- Not sharing personal items (i.e., razors or towels)
- Cleaning high-touch surfaces cleaned routinely
- Decolonization to be considered infection recurrence despite the hygiene efforts using:
 - Nasal decolonization with mupirocin 2% ointment 2x/day for 5-10 days
 - Body decolonization with antiseptic solution (i.e., chlorhexidine) for 5-14 days.
 - Taking dilute bleach baths for 15 minutes 2x/week for 3 months.
 - Dilute bath receipt is 1 teaspoon per gallon of water or ¼ cup per ¼ tub or 13 gallons of water

Liu C, Bayor A, Cosgrove, SE, et al. Clinical practice guidelines by the infectious diseases society of America for the treatment of MRSA infections in adults and children. Clinical Infectious Disease 2011;52:1-38

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What should I put on this wound?

Laboratory Essentials

- Cultures of the wound using the Levine technique
- Non-invasive arterial study with ABI and Toe pressures
- Arterial Doppler
- Venous Doppler study
- HgbA1C
- CBC with a complete Nutritional Panel including the prealbumin
- Plain x-ray with 3 views

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Principles for Topical Wound Therapies:

- Address the etiology of the wound
- Identify and treat infection
- Debride necrotic tissue
- Manage the dead space, tunnels and undermining
- Absorb excess exudate
- Maintain a moist wound surface
- Open all wound edges
- Protect the healing wound from trauma
- Insulate the wound bed
- Pack wounds lightly but not **too** tightly

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Purpose of Wound Therapies

To Augment the Body's Ability to Heal

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Keep in Mind...

What is the Goal of Treatment?

Risk vs Benefit

Multiple Wound Therapies

- Gels, Sterile Medical-Grade Honey, Silver
- Dressings, i.e., foam, composite, absorbent
- Larva Therapy
- Negative Pressure Wound Therapies
- Hyperbaric
- Ultrasound
- Biological

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Negative Pressure Wound Therapy

- Microstrain and macrostrain of cell stimulating cell proliferation and increase wound healing
- Promotes granulation tissue
- Reduces edema
- Removes exudate and infectious fluid
- Increases cellular perfusion
- Draws the wound edges together
- Decreases frequency of dressing changes

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Topical Therapies

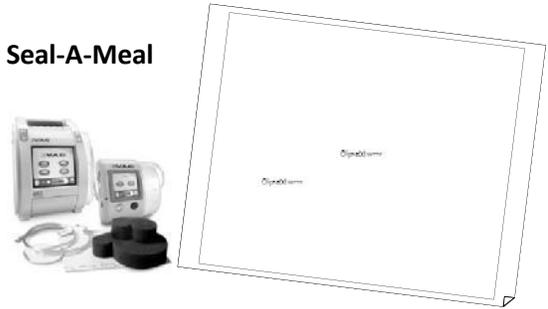
Antimicrobial Topical Therapies

1. **Sterile Medical Grade Honey**
 - *Honey is broad-spectrum antimicrobial with a high sugar content, low water content and acidity inhibiting a wide range of bacteria, fungi, protozoa and viruses
 - *Possible presence of clostridial spores in OTC honey should not be ignored
 - *Sterile medical grade honey recommended
2. **Cadexomer iodine**
 - *Improved venous stasis ulcers (Cochrane review, 2008)
 - *Can cause a stinging sensation in wound beds
 - *Iodine allergy is contraindicated
3. **Silver-containing dressings**
 - *May stain the skin
 - *Questions of developing silver resistance over time
4. **Hydrofera Blue**
 - *Bacteriostatic combining Methylene blue and Gentian Violet

All antimicrobial topical treatments have limited evidence on the effectiveness and require more research to make any definitive conclusion

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Seal-A-Meal



The image shows the Seal-A-Meal negative pressure wound therapy system. It includes a portable pump unit with a control panel, a small reservoir, and a large, rectangular adhesive dressing with a central opening for the wound. The pump is connected to the dressing via a tube.

Dressings Options

- Mepilex
 
 - Used on skin tears, wounds with moderate amount of drainage.
 - Good for 2-3 days
 - \$4.80/each
- Feminine Pads
 
 - Used on all types of wounds and drainage
 - Easily purchased
 - Change prn
 - Cost \$.40/each

Hyperbaric Therapy

- Hyperoxgenation increase the amount of oxygen in the blood reducing nitrogen and carbon monoxide levels thus supplying more oxygen to the skin and underlying tissues
- Reduction in edema occurs because of an adrenergic-like vasoconstriction like in burns and crushing injuries
- Antimicrobial effect includes inhibition and inactivation of toxins; bacteriostasis; enhances white blood function and improves antibiotic transport
- Enhanced angiogenesis and increases capillary formation
- Tissue viability maintained in the ischemic regions

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HBO Chambers



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Treat for Success

- NPWT Outpatient costs for one month = \$3,870
 *Data provided by "The Clinical Advantage" KCI
 Total Cost to heal a wound 22.2cm with NPWT for 97 days =\$14,546
 *Data from Kirby in Brit J Diabetes and Vascular Disease 2007
- HBO
 *Medicare reimbursement is approx \$14,700 for 120 minutes/session for 30 treatment (This is estimated cost)
- Apligraf
 * Approximately \$1373.00 per sheet
- Medihoney: \$60.00/per box of 10 of 2"x2"
- Aquacell Ag: \$100.00/box of 10 of 2"x2"
- Foam: \$70.00/box 10 of 2"x2"

(All the pricing is a ball park figure not actual and depends on insurance)

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Biological Therapies

- Apligraf
 *Bi-layered skin substitute: Epidermal layer with human keratinocytes and a dermal layer with fibroblasts
 *From the neonate male foreskin

Indications: Ulcers NOT responding to conventional therapy

- Non-infected partial and full thickness venous stasis ulcer greater than 1 month duration
- Diabetic foot ulcer greater than 3 weeks duration not involving tendon, muscle, capsule or bone exposure

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TEAM Approach

- PCP actively participates in the plan
- Patient actively participates in the wound care
- Wound care providers communicate with the provider and patient about the wound and expectations to achieve maximum healing
- Multi-disciplinary approach to wound healing



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Biological Therapies

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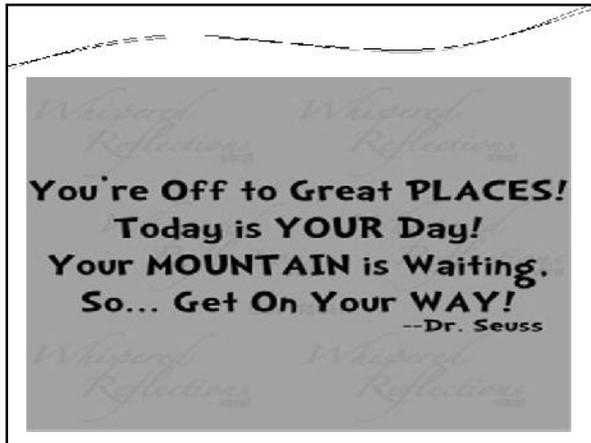
- Non-infected partial and full thickness venous stasis ulcer greater than 1 month duration
- Diabetic foot ulcer greater than 3 weeks duration not involving tendon, muscle, capsule or bone exposure

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Multidisciplinary Team



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Vasculitis

An immune-mediated disorder leading to inflammation and necrosis of blood vessels, which may result in tissue necrosis. Any size vessel may be affected

Clinical Presentation

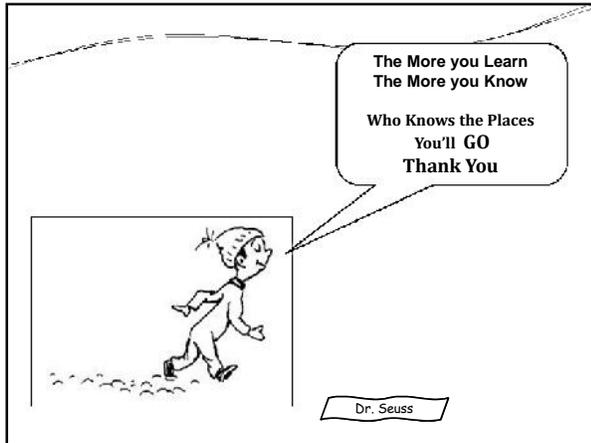
Depends on the underlying etiology but fever, malaise and joint pain is common

Local cutaneous presentation:

- *Palpable purpura: small papules, nodules, large ecchymotic areas
- *Bulla
- *Tissue necrosis/eschar
- *Pruritis
- *Very painful
- *Livedo reticularis

Treatment

- *Consult Rheumatologist
- *Manage underlying disease
- *Steroid therapy



Vasculopathy

Inherited and acquired defects in coagulation with an increase of thrombotic event

CLINICAL PRESENTATION

- *Necrotizing purpura
- *Very painful necrotic ulcers
- *Livedo reticularis
- *Digital cyanosis and gangrene
- *Possible Raynaud's phenomenon
- *Possible co-existing CVI (previous DVT)
- *Warfarin necrosis

Treatment

- *Consult Hematologist
- *Anticoagulation with Warfarin or LMWH