Wounds and Infections: Wound Management From the ID Physician Standpoint

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Objectives

- Distinguish between colonization, critical colonization, and infection
- Identify the most valid method of determining wound infection
- Identify conditions in which antimicrobial therapy is indicated
- State significance of foot ulcers in patient who have diabetes mellitus
- Discuss importance of suspecting, diagnosing and managing osteomyelitis as a sequela of particularly diabetic foot ulcers
- Recognize the importance of recognizing and identifying atypical wounds

Bioburden in wounds

- Human body is not sterile and in constant interaction with endogenous and exogenous flora
- Balance between host resistance and microbial growth
- Infection occurs when pendulum swings
  - because of lowered host defenses
  - increased micro-organism quantity or virulence

Identifying infection

- Contamination and colonization of the wound does not constitute infection
- The first sign of critical colonization may be delayed wound healing
  - as evidenced by no change in wound size and/or increasing exudate

Key elements of wound infection

- It prolongs the inflammatory phase and disrupts the proliferative phase of wound healing
- It occurs in wound **tissue**, but not in the surface of wound bed
- It occurs in **viable** wound tissue (not in eschar, necrotic tissue or surface debris)
- It is caused by invasion and multiplication of micro-organisms
- It is manifested by a host reaction or tissue injury

Wound infection

- Can be present in the absence of systemic signs
- Local signs of wound infection
  - warmth, erythema, local tenderness, purulent discharge, foul odor
- Delayed wound healing being the **only** sign of infection

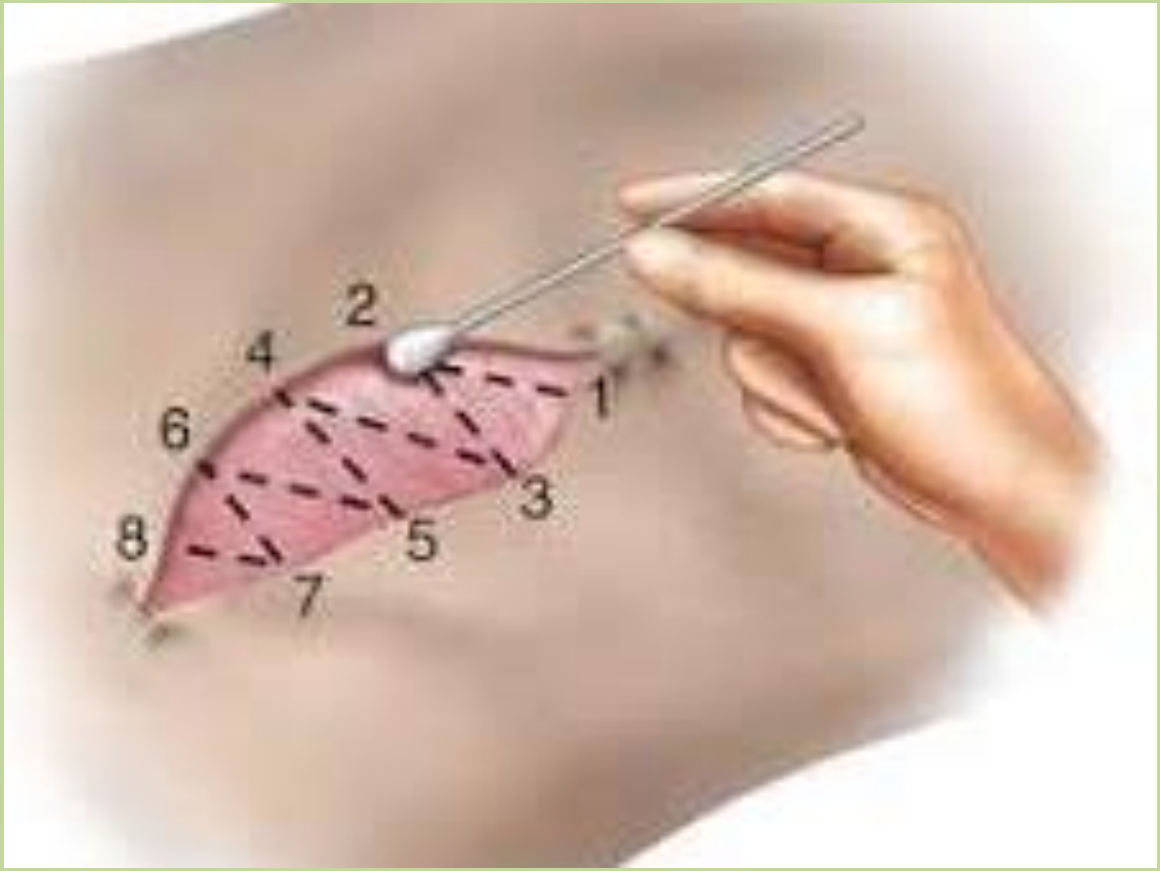
Cultures

- The most reliable samples
  - Deep tissue cultures obtained through local debridement

- If deep tissue cultures not possible
  - Culture and gram stain obtained from curettage of the base or purulent drainage

Obtaining wound culture

- **DO**
  - perform culture after thorough cleaning and debridement of the wound
  - obtain culture early in the course of evaluation preferably off antibiotic therapy
- **DON'T**
  - take specimen from exudate or eschar
  - use cotton swabs

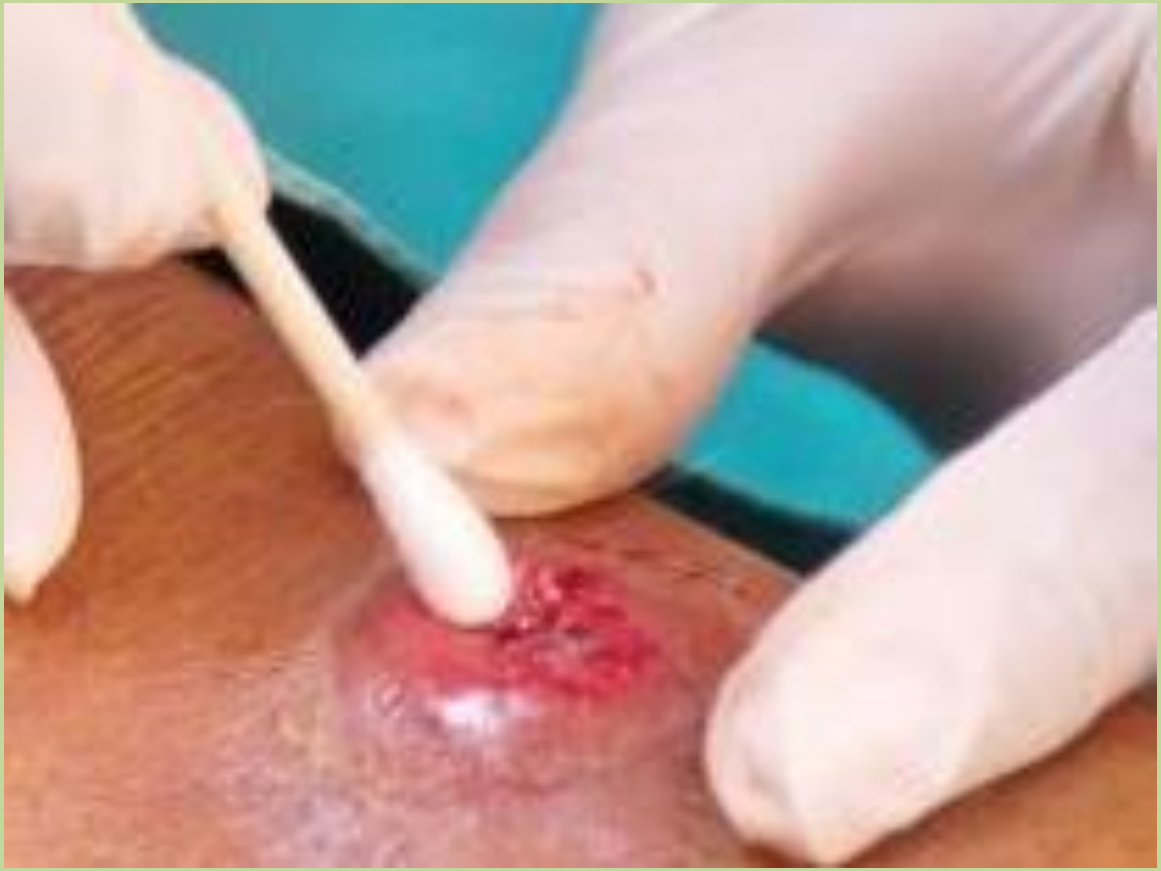


Z- stroke

Swab from margin to margin in 8-10 point zigzag fashion

Swab wound by gently rotating a sterile e - swab between your fingers

Use enough pressure to express fluid from tissue



The Levine technique

It consists of rotating a swab over 1 cm2 area with sufficient pressure to express fluid from wound tissue.

It is believe to be more reflective of tissue bioburden than swabs taken with Z- stroke

Quantitative vs qualitative cultures

- **Qualitative** cultures provide useful information in clinically infected wounds, but can be misleading unless certain pathogens are isolated such as group B strep
- **Quantitative** cultures are gold standard for diagnosing localized wound infections in the absence of clinical signs and symptoms
- Wounds with greater than 1,000,000 organisms per gram of tissue are considered to be infected

Question 1

The single leading cause of lower extremities amputation is

A. Diabetes mellitus
B. Lymphedema
C. Arterial occlusion
D. Venous disease

Diabetic Foot Ulcers

- Lifetime risk of a foot ulcer - up to 25 %
- **Early** recognition and management of risk factors

  -previous foot ulceration

  -neuropathy (loss of protective sensation)

  -foot deformity

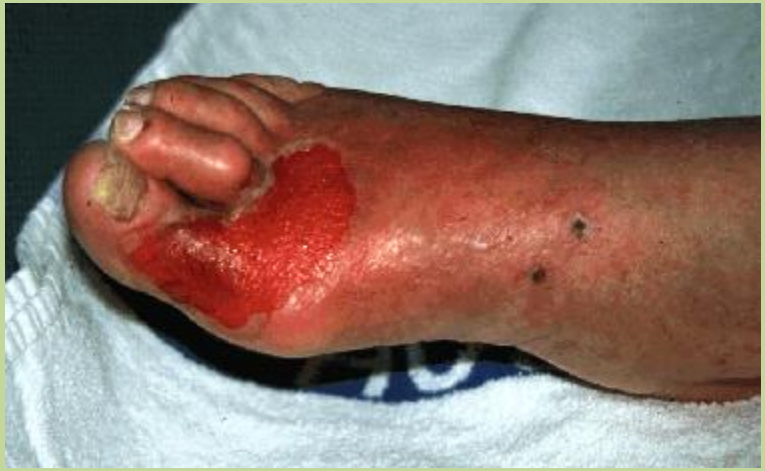
  -vascular disease

Diabetic foot ulcers

- In community-based study of 1300 type 2 diabetic patients
- The incidence of lower extremity amputation was 3.8 per 1000 patient-years
- Predictors of amputation were:
  - foot ulceration (HR 5.6)
  - ABI <0.9 (HR 2.21)
  - elevated A1C with increase 1% (HR 1. 3)
  - neuropathy (HR 2.65)

Davis T et al Diabetologia. 2006

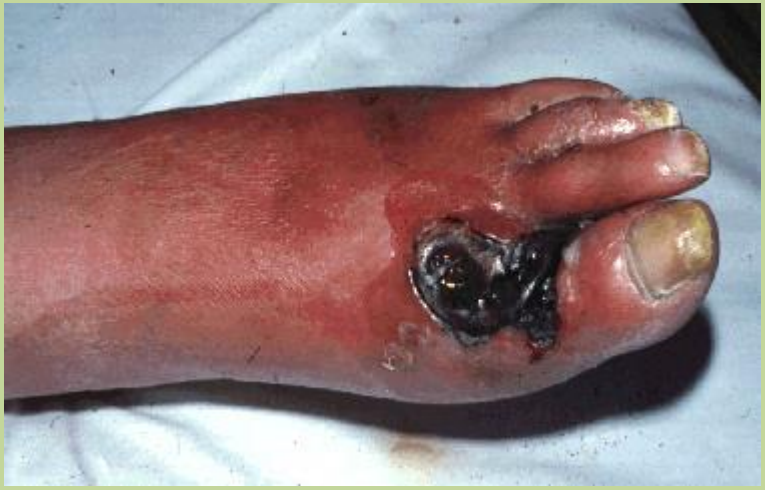
Superficial diabetic foot ulcer



Diabetic foot infections

- Usually complicate initially uninfected ulcerations that follow minor trauma
- Extent of infection:
  - Mild: spread < 2 cm beyond the ulcer margins
  - Moderate: more extensive or invasive infection associated with necrosis/gangrene
    - Abscess or deep soft tissue, skeletal involvement
  - Severe: with systemic complications (fever, hypotension, acidosis)

Infected and Ischemic diabetic foot ulcer



Microbiology of infected diabetic ulcers

- Cellulitis or mild infections
  - *Staphylococcus aureus* and *B- hemolytic streptococci* are usually responsible
  - More chronic or previously treated with antibiotic ulcers
  - *Enterobacteriaciae* or in macerated wounds - non enteric *Gram negative bacilli* i.e. *Pseudomonas spp.*
- Chronic refractory ulcers, or associated with gangrene
  - Multimicrobial: *enterococci, diphteroids ,anaerobes fungi*

Microbiological clues

- Gas present on radiographs or in surrounding tissue may represent
  - the air introduced through tissue or
  - by gas producing anaerobic bacteria
- Malodor
- Gram positive microorganisms are the first to invade wounds with decreased host resistance, followed by gram negative and then anaerobic m/o

Initial antibiotic choice

- In case of mil non- threatening infection in previously untreated patient
  - Staphylococcal /streptococcal coverage
  - At home: oral clindamycin, dicloxacillin, cephalexin X 2 week
  - Parenteral ampicillin – subactam (unasyn) or ceftriaxone
  - Restrict use of quinolones/ie. Ciprofloxacin a monotherapy to avoid multiple sequalae associated with class, selecting for resistance and limited coverage

Antimicrobial therapy in life/limb threatening infections

- Broad spectrum antibiotic coverage aimed at polymicrobial nature of infection
- MRSA, enteric gram negative rods(GNRs),and anaerobic coverage is imperative
- Further therapy to be narrowed, as guided by culture data

MRSA

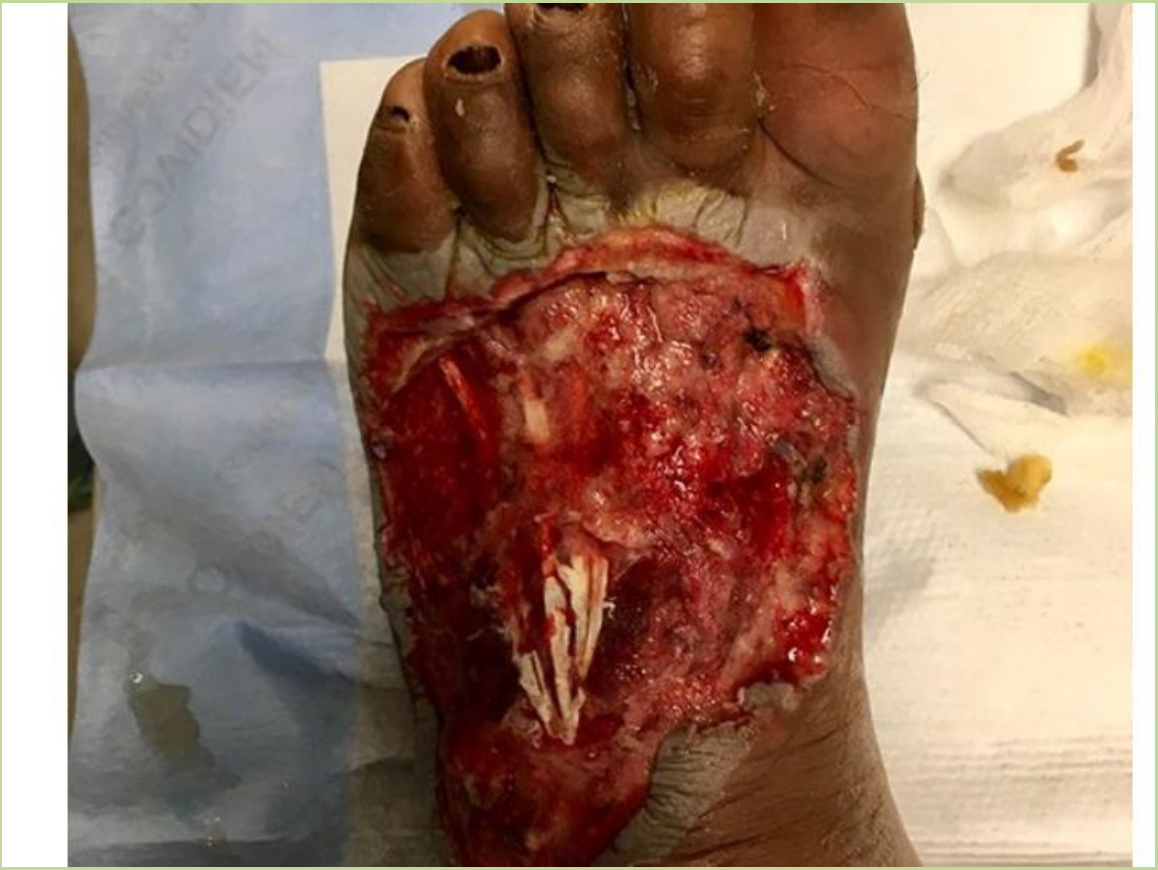
- Rising incidence
- As high as 30 % in diabetic foot ulcers
- Anti- MRSA antibiotics:
  - PO: doxycycline, TMP-SMZ ,clindamycin
  - IV: vancomycin, daptomycin, ceftaroline

Antimicrobial therapy of the wounds

- Topical
  - Metrogel, Mupirocin, Nitrofurazone, Polysporin
- Silver-based creams should be limited to 2 weeks
- Topical antibiotics while effective to reduce bioburden, have limited ability to control more extensive tissue involvement and cellulitis
- The effectiveness of systemic antibiotics is dependent on adequate blood supply of the wound

Surgical debridement

- Should be carried out promptly in patients with
  - deep ulcers extending to SQ tissues
  - deep tissue necrosis
  - suppuration
  - concerns of abscess



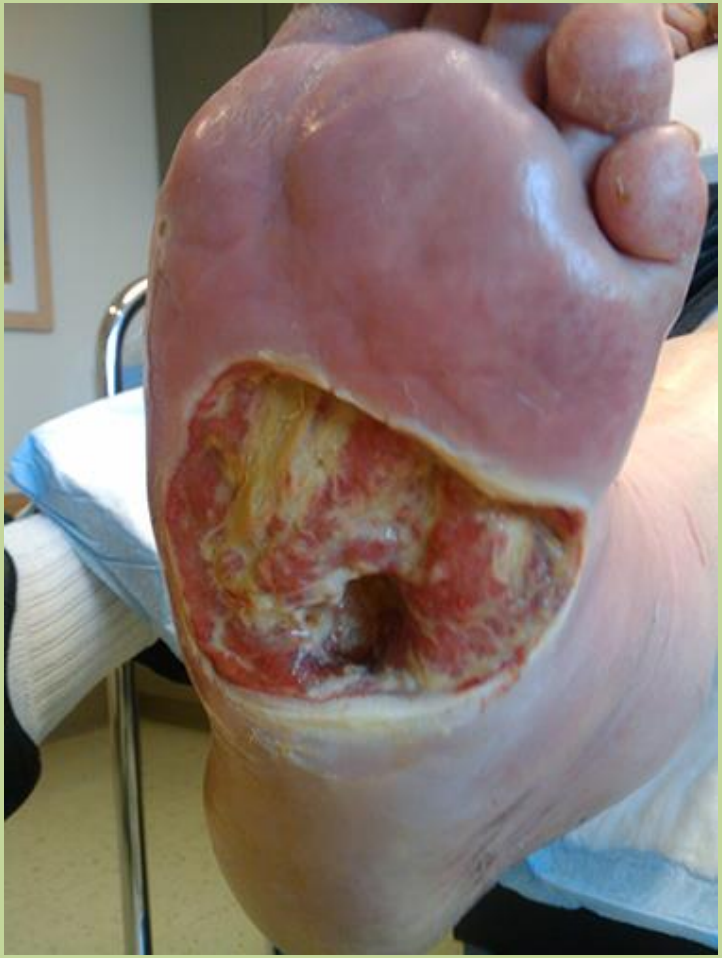
Dorsal diabetic foot wound

Dorsal diabetic foot wound following debridement of necrotizing streptococcal infection with exposed tendon and joint capsule.

Essentials of Osteomyelitis: Making a Diagnosis

- For infected open wound, perform a probe-to bone test:
  - in low risk patients negative test rules out OM
  - in high risk patients – a positive test is diagnostic
- Bone biopsy/ curettage sent for histopathology and cultures
- Markedly elevated serum inflammatory markers – ESR / CRP
- Imaging: X-ray, MRI, CT or dual isotope bone scan

Deep diabetic foot ulcer involving bone



Essentials of Osteomyelitis: Treatment

- Obtain tissue / bone biopsy
  - Superficial or sinus tract cultures do not accurately reflect bone culture results
- Consider surgical intervention in cases of OM
  - accompanied by destroyed soft tissue
  - progressive bone destruction on x-ray
  - bone protruding through ulcer
- Culture guided preferably IV antibiotic therapy for 6 weeks, or short duration (1-2 weeks) after complete resection of infected bone
- Assess and document arterial vascular supply

Care of diabetic foot ulcers in a nutshell

- **COMPREHENSIVE** assessment of ulcer AND overall health condition of the patient
- **LOOK** for underlying neuropathy, bony deformity, and peripheral artery disease
- **CLASSIFY** wound initially and document in standardized fashion progress and plan of care
- Debridement, local care, relief of pressure , control of infection
- All necrotic tissue or infected bone **MUST BE REMOVED** from the wound prior to using wound vac
- **Revascularization** in presence of limb ischemia and a non-healing ulcer
- Necrotic ulcers require immediate **surgical consultation**

Atypical wounds

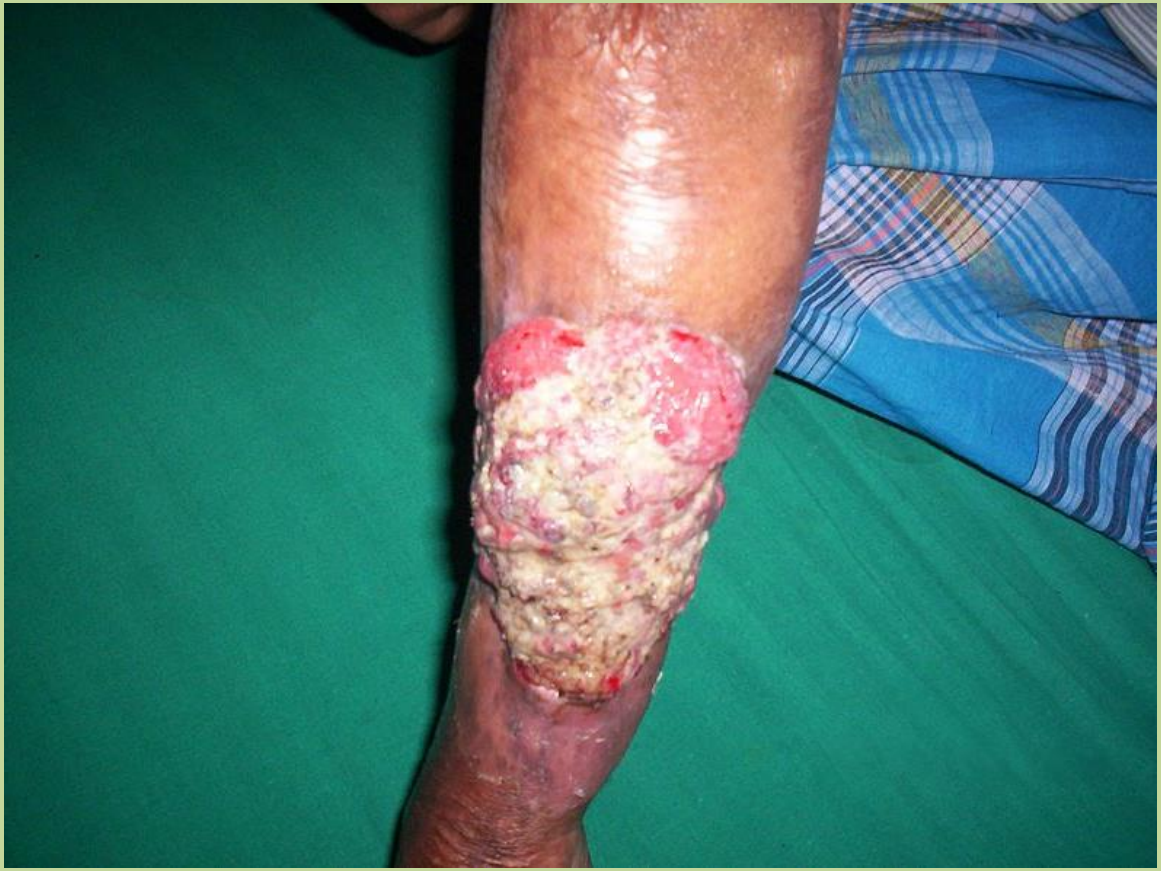
- At least 10 % of more than 500,000 leg ulcers in US may be due to unusual causes
- A wound should be evaluated for atypical etiology if:
  - it is present in unusual location
  - its appearance varies from common chronic wound
  - it does not respond to conventional therapy

Atypical Wounds continued

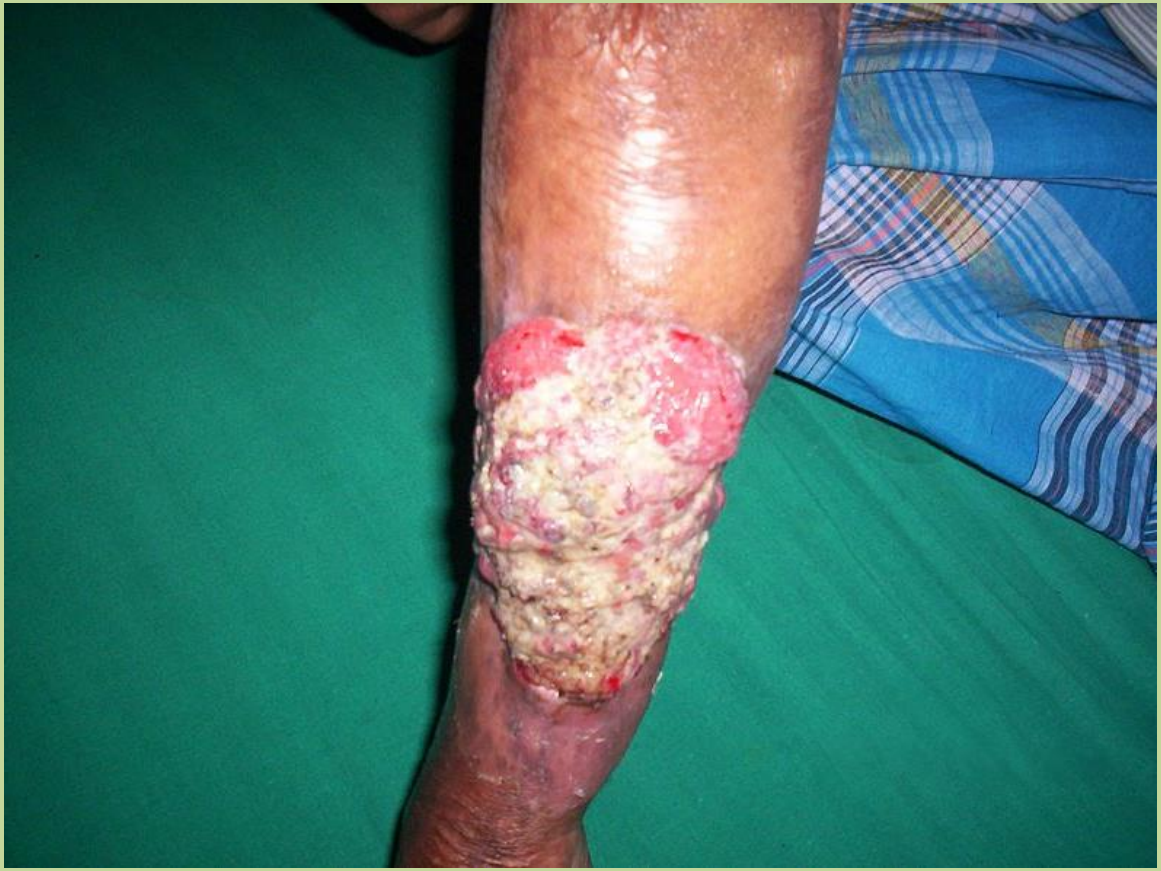
- **Inflammatory causes**: Vasculitis and Pyoderma Gangrenosum
- **Infections**: Atypical Mycobacteria and Deep Fungal Infections
- **Vasculopathies**: Cryoglobulinemia, Antiphospholipid Antibody Syndrome, Medications and CTD
- **Metobolic and genetic causes**: Calcyphylaxis and SCD
- **External causes**: Burns, Bites, Stings and Radiation

Visual diagnosis alone is difficult and risky

- “Things are not always what they appear to be“
- Tissue sample is critical for histologic evaluation, special stains, cultures and immunofluorescence testing



Question 2: Can you name the lesion ?



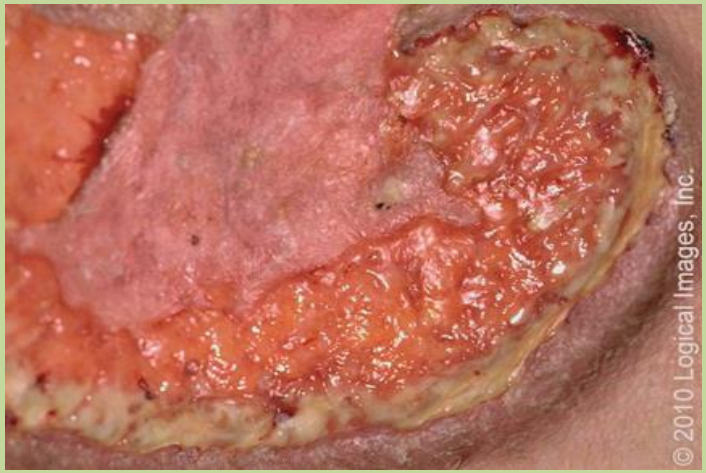
Question 2: Can you name the lesion ?

An aggressive ulcerating SCC presenting in an area of previously traumatized chronically inflamed, or scarred skin

Question 3

Which of the following should not be typically debrided

A. Diabetic foot ulcer
B. Ulcer due to infectious causes
C. Pyoderma gangrenosum
D. Ulcer due to vasculitis



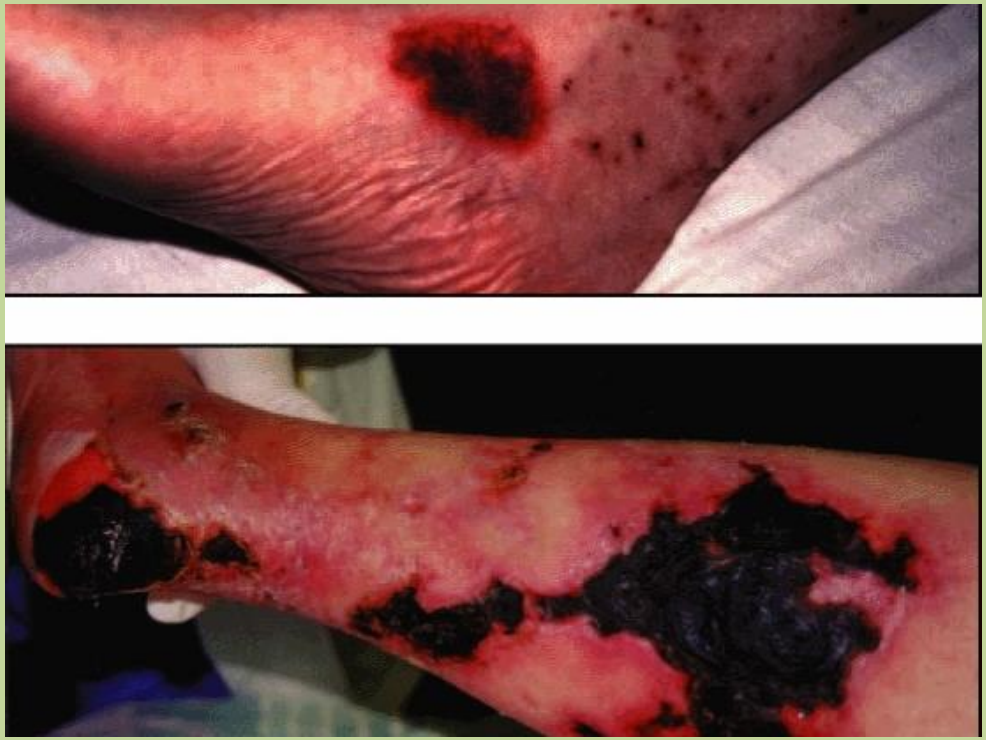
Answer C . Pyoderma gangrenosum

- Purulent ulcer with a ragged and violaceous border, painful
- Debridement may lead to severe worsening due to pathergy
- Correct diagnosis relies on clinical presentation and exclusion of other causes
- DD: fungal, mycobacterial infections, syphilis, ecthyma gangrenosum, leukemia cutis, etc.
- Associated with IBD, arthropathies, malignancies
- Can occur around stoma in IBD
- Systemic corticosteroids are first line therapy

Question 4

Which type of the wound is rare, often fatal condition characterized by cutaneous necrosis which occurs in patients with ESRD

A. Calciphylaxis
B. Vasculopathy
C. Radiation dermatitis
D. Chemical burn



Answer A. Calciphylaxis

Progressive cutaneous necrosis in patients with ESRD

Occurs in approximately 1 % of patients.

1 year survival -46 % .

Treatment: Sodium thiosulfate. Parathyroidectomy. Wound care.

Take Home Points

- Wound infection is a clinical diagnosis and culture is an adjunct
- Deep ulcers should be evaluated for osteomyelitis
- Multidisciplinary approach

And most importantly …

Treat you patient and then the wound !

References

- Lipsky et al. IWGDF guidance on the diagnosis and management of foot infections in persons with diabetes. Diabetes Metab Res Rev 2016; 32 (Suppl.1) 45-74
- Baranoski S, Ayello EA. Wound Care Essentials: Practice Principles, LWW; 4th edition
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