Pressure Injury Complications: Diagnostic Dilemmas

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Objectives

- Describe some common complications associated with pressure ulcers

- Identify issues that impede evaluation of complications
Complications

- Infection
- Osteomyelitis
- Fistulas
- Carcinoma
- Sepsis
## CLINICAL BEDSIDE MNEMONIC TO DIFFERENTIATE CRITICAL COLONIZATION AND INFECTION

<table>
<thead>
<tr>
<th>Mnemonic</th>
<th>Detail</th>
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</thead>
<tbody>
<tr>
<td><strong>NERDS</strong></td>
<td>Nonhealing of the wound, Presence of inflammatory Exudate, Friable or Red granulation tissue, Tissue Debris, and Smell</td>
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<tr>
<td>Critical colonization:</td>
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<tr>
<td>Use <em>topical</em> agents</td>
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<tr>
<td><strong>STONEES</strong></td>
<td>Increased wound Size, Increased local wound Temperature, Extension of the wound to bone (Os), New wound breakdown, Exudate/Edema/Erythema, Smell or odor</td>
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<tr>
<td>Progression to infection:</td>
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<tr>
<td>Use <em>systemic</em> agents</td>
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Bacterial Burden
Negative Impact on Wound Healing

- Prolongs the inflammatory stage
- Induces additional tissue destruction
- Delays collagen synthesis
- Prevents epithelialization

Levels of Bacterial Burden

- Contamination
  - Bacteria in a wound

- Colonization
  - Bacteria are replicating
  - Host remains in control
  - Usually polymicrobial
    - Surrounding skin
    - External environment
    - Endogenous sources

Levels of Bacterial Burden

• Critical Colonization
  – wounds with more than 100,000 organisms/gram will not heal
  – Suspect bacterial burden if a clean wound shows no improvement after 14 DAYS of topical therapy

• Infection
  – Invasion of the soft tissues
Probability of Host Infection

\[ P (\text{Infection}) = \text{Bacterial burden} \times \text{Virulence} \]
\[ \text{Host resistance} \]


Wound Cultures

- Traditional swab culture detects only surface bacterial colonization/contamination
  - may not reflect the invasive organism causing infection

- Quantitative Wound Culture recommended for determining infection
  - documents bacterial burden
  - identifies bacteria actually invading wound tissue
Quantitative Analysis

- Superficial Swab
  - Z swab
  - Levine technique

- Needle aspiration

- Punch Biopsy

- Tissue sample

Z swab

Swabs using the Z-stroke entail rotating the swab between the fingers as the wound is swabbed from margin to margin in a 10 point zig-zag fashion.
Levine technique

• The Levine Technique consists of rotating the swab over a 1 cm square area with enough pressure to express fluid from within the wound tissue

• The Levine Technique is best used when in the wound is first cleaned and there is no necrotic tissue or eschar

Tissue hypoxia

• Inhibition of oxidative burst activity in polymorphonuclear leukocytes
  – ↓ intracellular production of antimicrobial metabolites

• Reduced leukocyte killing capacity

• Fecal contamination contains high numbers of anaerobes

Infection

- Critical Colonization

- Topical therapy
  - Silver therapy
  - Cadexomer iodine
  - Acetic Acid-good for pseudomonas
  - Chlorpactin

- Systemic therapy
  - MRSA or MSSA
  - Pseudomonas
  - Anaerobes

Microbiology

- Complex microbiological environment
  - Changes over time

- Initial colonization
  - Coagulase-negative staphylococci
  - Streptococcus spp
  - Corynebacterium spp
  - S aureus
Microbiology

- **Gram-negative bacilli**
  - *E. Coli*
  - *Klebsiella*
  - *Proteus spp*

- **Anaerobes**
  - Statistically higher proportion in chronic wounds (especially in diabetic foot wounds)
  - Not routinely identified on routine microbial culture

Anaerobes

- **Mean 2.0 species**

- **Most frequent colonizers**
  - *Prevotella*
  - *Bacteroides*
  - *Peptostreptococcus*
  - *Porphyromonas*

Aerobic Gram Negative Bacilli

- **Acenitobacter spp** and **Pseudomonas spp**
- Exogenous sources
  - MRSA
  - Fecal contaminants
- **Pseudomonas spp**
  - Immunocompromised host
  - Microbial exotoxins and endotoxins exacerbate tissue damage
- Mean: 4.3 species

Landis SJ. Adv Skin Wound Care 2008;21:531-40

Bacterial synergy

- **Klebsiella** and **Prevotella sp.**
  - Klebsiella provides succinate
- **Staph Aureus**
  - Promotes proliferation of anaerobes through provision of growth factors
Osteomyelitis

- Can occur in 1/3rd of pressure ulcers

- Osteomyelitis most common in:
  - Pelvis
  - Femoral head
  - Ischial bones
  - Calcaneus

- If bone is visible or palpable, likelihood of osteomyelitis is >90%

Osteomyelitis

- Work up
  - Plain x-rays
  - Lab analysis
    - ESR, CRP
  - Bone scans
  - MRI
  - Biopsy
Undermining
Tunneling/Sinus Tracts

- Abnormal passage between two epithelialized surfaces that connect one viscer to another or to the body surface

Fistulas

- Abnormal passage between two epithelialized surfaces that connect one viscer to another or to the body surface

http://www.nhstaysideadte.scot.nhs.uk/wound%20Formulary/Section%2010/Section%2011%20fistula%20attachment.pdf
Fistulas

- **Management goals:**
  - Management and free drainage of exudate
  - Protection of surrounding skin
  - Prevention of infection
  - Removal of necrosis or slough
  - Promotion of granulation from the base of the wound

Sinus Tracts

- Discharging, blind-ended track that extends from the surface of the skin to an underlying abscess/cavity. May be caused by infection, liquefaction or a foreign body

[Diagram of Fistula and Sinus Tract]

http://www.nhstaysideadtc.scot.nhs.uk/wound%20Formulary/Section%2010/Section%2011%20fistula%20attachment.pdf
Sinus Tracts

• Management goals:
  – Allow cleansing and draining
  – Do not plug
  – Protection of surrounding skin
  – Prevention of infection
  – Removal of necrosis or slough
  – Promotion of granulation from the base of the wound

Carcinoma in Pressure Ulcers

• Marjolin’s ulcer
  – Most commonly found in burn wounds and osteomyelitis
  – Most common type: squamous cell carcinoma
  – Other types:
    • Basal cell
    • Melanoma
    • Fibrosarcoma
    • Angiosarcoma
    • Osteosarcoma
    • Others
Occurrence

- Most malignancies in pressure ulcers occur in the sacral or iliac areas

- Rich lymphatic drainage to the pelvic region
  - Higher rates of metastasis

- Little support for chemo; Radiation can be effective for palliation

Marjolin’s Ulcer

- Occurs in 1.7% of chronic wounds

- Incidence of SCCa in pressure ulcers is 0.5%

- Very aggressive

- Metastatic rate in pressure ulcers is 60%
  - Burns (38%)
  - Osteo (14%)

- Biopsy if wound present for >6 months
Prognosis

• Factors affecting prognosis
  – Tumor type
  – Location
  – Rate of metastasis

• Survival rates
  – 65-75% in 3 years
  – 35-50% if metastatic disease present

SIRS

• Defined as a systemic response to infection
• Criteria:
  – Fever of more than 38° C (100.4° F) or less than 36° C (96.8° F)
  – Heart rate of more than 90 beats per minute
  – Respiratory rate of more than 20 breaths per minute or arterial carbon dioxide tension (PaCO₂) of less than 32 mm Hg
  – Abnormal white blood cell count (>12,000/µL or < 4,000/µL or >10% immature [band] forms)
SIRS

- Non-specific
- Can be caused by multiple conditions:
  - Infection
  - Ischemia
  - Trauma
  - Inflammation
  - Combination of above

Sepsis

- Bacteremia
  - Not always related to SIRS or sepsis
- Sepsis
  - Systemic response to infection
  - SIRS + infection
- Associated with:
  - Hypoperfusion
  - Organ dysfunction
  - Hypotension
Diagnostic Dilemmas

- Dementia
- Contractures
- Presentation of infection in the elderly
- Co-morbidities
- Multiple infections

Dementia

- Patient cannot give a history
- Patient cannot understand work up
- End of life issues
Contractures

Infection in the Elderly

- Decrease in immune response
- Atypical presentation to infection
  - Mental status
  - Functional
- Less reserve
Co-morbidities

- Patients at risk for pressure ulcers often have multiple medical issues

- Other co-morbidities can affect ability to do diagnostic w/u

Multiple infections

- Most common infections
  - Pneumonia
  - Urinary Tract
  - Skin and Soft Tissue

- MDRO

- Which source is causing systemic symptoms?
Conclusions

• Pressure ulcers can lead to significant and severe complications

• Early interventions can prevent further complications

• Clinical issues can impede evaluations in pressure ulcers