DIABETIC FOOT INFECTION

ISABELLE TREPICCIONE, MD
OUTLINE

- Scope of problem
- Predisposition
- Prevention
- Diagnosis
- Treatment
SCOPE OF THE PROBLEM

- Lifetime incidence of foot ulcer is 25%
- 50% are infected
- 50% of non-traumatic lower extremity amputations are due to DFI
- 131 million diabetics worldwide in 2000
- 366 million diabetics by 2030
COST OF THE PROBLEM

Mean annual cost of treatment in 2001:

- $9,000 for an uninfected foot ulcer
- $25,000 for an infected foot ulcer
- $45,000 for a foot ulcer with osteomyelitis
PREDISPOSING FACTORS

NEUROPATHY

VASCULAR DISEASE

IMMUNE DYSFUNCTION
NEUROPATHY

- Sensory neuropathy: Wounds go undetected and worsen with exposure to repetitive trauma
- Autonomic neuropathy: Gland dysfunction makes skin dry and susceptible to tearing
- Motor neuropathy: Atrophy of intrinsic foot muscles leads to anatomic deformities
VASCULAR DISEASE

- Hyperglycemia causes endothelial cell dysfunction and smooth muscle cell abnormalities
- Hyperglycemia is associated with an increase in thromboxane A2 contributing to hypercoagulability
- Co-existing hypertension and hyperlipidemia
IMMUNE DYSFUNCTION

- Fewer inflammatory cytokines
- Impaired neutrophil chemotaxis
- Impaired neutrophil phagocytosis
IDENTIFYING THOSE AT RISK

- Hemoglobin a1c >9% (OR 3.2)
- >10 years with diabetes (OR 3.0)
- Prior lower extremity amputation (RR 2.8)
- Visual acuity less than 20/40 (RR 1.9)
- Prior foot ulceration (RR 1.6)
PREVENTION

- **Patient education**: Improvement in patient knowledge and behavior. No ulcer or amputation prevention.
- **Yearly screening foot exam**: Decreased ulcer recurrence at 1 year if referred to podiatry. No reduction in amputation.
- **Diabetic footwear**: Custom footwear prevents ulcer recurrence.
- **Optimize glycemic control**: Improves neuropathy. Nonsignificant reduction in amputation.
- **Smoking cessation**: Nonsmoking diabetics have lower rates of foot ulceration and amputation.
- **Not studied**: Callus debridement, treatment of tinea pedis or onychomycosis, and lower extremity revascularization.
Infection indicated by presence of 2 or more of:
- Swelling or induration
- Erythema
- Tenderness
- Warmth
- Purulent discharge

Figure 1. Hospitalization and amputation based on the Infectious Diseases Society of America and the International Working Group on the Diabetic Foot foot infection severity classification.
<table>
<thead>
<tr>
<th>UNINFECTED</th>
<th>MILD INFECTION</th>
<th>MODERATE INFECTION</th>
<th>SEVERE INFECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local infection confined to skin and subcutaneous tissue</td>
<td>Local infection with involvement of deeper structures</td>
<td>Local infection plus systemic inflammatory response syndrome</td>
</tr>
<tr>
<td></td>
<td>Circumference of erythema &gt;0.5cm and &lt;2cm</td>
<td>Circumference of erythema &gt;2cm</td>
<td></td>
</tr>
</tbody>
</table>

http://www.aafp.org/afp/2008/0701/p71.html
https://www.drugs.com/health-guide/images/205064.jpg
https://d2v9y0dtkr6m2.cloudfront.net/video/thumbnail/5ImAn91gm31gtkx/icu-screen-monitoring-dying-patient-vital-signs-dropping-clinical-death_h7xw2pd0_thumbnail-small01.jpg
IDENTIFYING INFECTED ULCERS

- Probe to bone, RR 6.7
- Ulceration present >30 days, RR 4.7
- History of recurrent ulcers, RR 2.4
- Traumatic foot wound, RR 2.4
- Presence of vascular disease in same limb, RR 1.9

http://www.antimicrobe.org/printout/e26printout/e26assessment.htm
WOUND CULTURE

INDICATIONS

- Culture and gram stain moderate to severely infected wounds
- Consider culture of mild infection if there are MRSA or pseudomonas risk factors
- Don’t culture uninfected wounds

TECHNIQUE

- Clean and debride wound
- Obtain culture specimen from base
- Aspirate purulence if present
- Do not send superficial swabs or swabs of wound drainage
IMAGING

- Xrays of all new diabetic foot infections
- MRI if there is concern for other deep space infection
- MRI when a chronic ulceration becomes infected
TREATMENT OF THE INFECTED ULCER

- Antibiotics
- Wound care
- Sometimes surgery
- Does anything else make a difference?
ANTIBIOTICS

- MILD infection: target gram positive cocci, maybe MRSA (ORAL)
- MODERATE infection: target gram positive cocci, maybe MRSA (ORAL)
- SEVERE infection: target gram positive cocci, gram negative and obligate anaerobes, MRSA and pseudomonas (PARENTERAL)
WHEN DO I NEED TO COVER FOR MRSA?

- When the patient has a history of MRSA or MRSA colonization within the past year
- When the infection is severe
- When local MRSA prevalence is 50% (for mild) or 30% (for moderate)
WHEN DO I NEED TO COVER FOR MRSA?

<table>
<thead>
<tr>
<th>Outpatients</th>
<th>(n)</th>
<th>Oxacillin</th>
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<tbody>
<tr>
<td>Staphylococcus aureus</td>
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<td>74</td>
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<tr>
<td>MSSA (only)</td>
<td>1616</td>
<td>S</td>
</tr>
<tr>
<td>MRSA (only)</td>
<td>559</td>
<td>R</td>
</tr>
<tr>
<td>Staphylococcus (coag neg)</td>
<td>263</td>
<td>62</td>
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</table>

<table>
<thead>
<tr>
<th>Inpatients</th>
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</thead>
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<tr>
<td>Staphylococcus aureus</td>
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<td>58</td>
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<tr>
<td>MSSA (only)</td>
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<td>S</td>
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<tr>
<td>MRSA (only)</td>
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<td>R</td>
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<tr>
<td>Staphylococcus (coag neg)</td>
<td>710</td>
<td>47</td>
</tr>
</tbody>
</table>

25% MRSA

DO NOT ROUTINELY NEED TO COVER (UNLESS SEVERE)

40% MRSA

COVER IN MODERATE AND SEVERE INFECTION
WHEN DO I NEED TO COVER FOR PSEUDOMONAS?

- Not as common a pathogen in DFI as previously thought
- Increasing evidence that it may be a wound colonizer
- The IDSA recommends coverage in:
  - Severe infections
  - Tropical climates
  - Frequent exposure of the foot to water
WOUND CARE

- Debridement
- Off-loading
- Moist wound environment
- No topical antimicrobials
WHEN SHOULD I CONSULT A SURGEON?

- Evidence of life or limb threatening infection
- Evidence of critical ischemia
- Evidence of deep-space infection or abscess
- Failure to improve with otherwise appropriate treatment
OTHER TREATMENTS

- Negative-pressure wound therapy AKA wound vac
- Hyperbaric oxygen
- Granulocyte colony stimulating factors (G-CSF)
- Stem cell

Not studied:
- intensive glycemic control
- limb revascularization
LEARNING POINTS

❖ When it comes to prevention; focus on appropriate footwear, a1c control, and smoking cessation
❖ Send a tissue culture in all but mild diabetic foot infections
❖ Most mild and moderate infections do not require MRSA or pseudomonas coverage
❖ Wound care is critical to complete healing
❖ Call a podiatrist or orthopedic surgeon when the infection is deep or severe
QUESTIONS?

“This is what you call diabetic foot care?”

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REFERENCES


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