Osteomyelitis, a Nonsurgical Approach.

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Disclosures:
None
Hyperbaric Oxygen Therapy

- Osteomyelitic bones have been shown to be hypoxic with a partial pressure of 20-25 mm Hg in animal models, and this oxygen content can be dramatically raised in hyperbaric conditions. 17.18
- In the presence of infection, the phagocytic and bactericidal ability of leukocytes parallels the oxygen tension in the tissue. Although the hypoxic conditions in the diseased bone reduce the ability of neutrophils to generate the reactive oxygen species necessary to kill bacteria, hyperbaric oxygen (HIBO) can enhance this bactericidal activity. 17.18.19.20.
Growth Factor Therapy/Gene Therapy

- Only a few animal studies have been reported in recent years evaluating the effects of either growth factor therapy or gene therapy in the setting of osteomyelitis. Chen et al first reported in 2002 that recombinant human osteogenic protein-1 (rhOP-1, or BMP-7) could induce bone formation in an acutely infected femur.

- Growth factors such as the BMPs are known to play important roles in skeletal development and bone formation.
Biofilm Microbiology

- Biofilms have been linked to the pathogenesis of various human chronic infections, including dental caries, endocarditis, cystic fibrosis pneumonia, and osteomyelitis.

- The formation of biofilms has been proposed as a major pathogenic factor in the development of chronic osteomyelitis, whether or not the infection is associated with prosthetic devices.

- Recent progress in the understanding of biofilm microbiology has opened the doors to exciting new approaches that may soon become realistic and valuable components to the current treatment paradigm of osteomyelitis.
How do I choose antibiotics for treatment of osteomyelitis?

- The choice of antibiotic therapy is best guided by a bone biopsy or debridement culture results.

- *Staphylococcus aureus* was the most common pathogen to be isolated from our specimens, which was in agreement with most international reports (1, 15, 22, 25), but a higher than usual incidence of *Pseudomonas aeruginosa* osteomyelitis was noticed.

- The dominant pathogen, *Staphylococcus aureus*, expresses receptors (adhesins) for bone matrix proteins [7] and becomes incorporated into a relatively impermeable glycocalix biofilm.
Patients received antibiotics according to the results of culture and sensitivity for at least 6 weeks. Initially, broad-spectrum intravenous antibiotics were used in the presence of a severe diabetic foot infection until the final microbiological results were received.

**Polymicrobial infection.** Studies of the bacteria isolated from diabetic foot infections [13–22] have reported an average of 2–5 organisms per case.

- Aerobic gram-positive cocci and gram-negative bacilli. Anaerobic organisms have been isolated in up to 40% of cases in some series.

- Oral antibiotics with good bioavailability (e.g., fluoroquinolones and clindamycin) may be adequate for most, or perhaps all, of the therapy.
Studies of 6 weeks of oral antibiotics vs 12 week regiments

The present multicenter prospective randomized study provides data suggesting that 6-week duration of antibiotic therapy may be sufficient in patients with DFO for whom nonsurgical treatment is considered.
Diagnostic modalities for osteomyelitis

- Gold standard bone biopsy
- x-rays
- Bone infection can precede radiological changes by up to 4 weeks.
- Bone scan
- Technetium bone scan is certainly greater than for that of radiography in early osteomyelitis.
- MRI
  - The characteristic changes seen in MRI of osteomyelitis are caused by marrow edema associated with inflammation; they include fat signal-intensity loss on T1-weighted images and high signal intensity on T2-weighted images, along with contrast (gadolinium) enhancement.
What does acute osteomyelitis look like?
What does chronic osteomyelitis look like?
Visualization of Osteomyelitis with MRI
# Antibiotics for Osteomyelitis

## Mild disease:

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin</td>
<td>750mg PO q12h (+/- rifampin 600mg PO qd)</td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>750 mg PO qd (+/- rifampin 600mg PO qd for S. aureus if present)</td>
<td>OR</td>
<td></td>
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<tr>
<td>Augmentin</td>
<td>500mg three times daily.</td>
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<td></td>
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</tbody>
</table>

## Severe disease:

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperacillin-tazobactam</td>
<td>3.375 grams IVPB q4-6h</td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Ticarcillin-clavulanic acid</td>
<td>3.1 grams IVPB q4-6h</td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td>Ampicillin-sulbactam</td>
<td>1.5 to 3 grams IVPB q6h</td>
<td>OR</td>
<td></td>
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<tr>
<td>(Ciprofloxacin)</td>
<td>400mg IVPB q12h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>1 gram ivpb q12h</td>
<td></td>
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</tbody>
</table>

Diabetic foot infections with osteomyelitis: efficacy of combined surgical and medical treatment - [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3464066/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3464066/)


Controversies in Diagnosing and Managing Osteomyelitis of the Foot in Diabetes - [http://cid.oxfordjournals.org/content/39/Supplement_2/S115.long](http://cid.oxfordjournals.org/content/39/Supplement_2/S115.long)

Osteomyelitis of the Foot in Diabetic Patients - [http://cid.oxfordjournals.org/content/25/6/1318.abstract?ijkey=871f815ea81f4f69ac177166a424fb7439e262f7&keytype2=tf_ipsecsha](http://cid.oxfordjournals.org/content/25/6/1318.abstract?ijkey=871f815ea81f4f69ac177166a424fb7439e262f7&keytype2=tf_ipsecsha)


Outcome of Diabetic Foot Osteomyelitis Treated Nonsurgically - [http://care.diabetesjournals.org/content/31/4/637.full](http://care.diabetesjournals.org/content/31/4/637.full)

Six-Week Versus Twelve-Week Antibiotic Therapy for Nonsurgically Treated Diabetic Foot Osteomyelitis: A Multicenter Open-Label Controlled Randomized Study - [http://care.diabetesjournals.org/content/38/2/302.abstract?sid=724e3ecc-baba-4931-8c28-0240fcc2e53](http://care.diabetesjournals.org/content/38/2/302.abstract?sid=724e3ecc-baba-4931-8c28-0240fcc2e53)

Antibiotics Versus Conservative Surgery for Treating Diabetic Foot Osteomyelitis: A Randomized Comparative Trial - [http://care.diabetesjournals.org/content/38/2/302.abstract?sid=724e3ecc-baba-4931-8c28-0240fcc2e53](http://care.diabetesjournals.org/content/38/2/302.abstract?sid=724e3ecc-baba-4931-8c28-0240fcc2e53)

Treating Diabetic Foot Osteomyelitis Primarily With Surgery or Antibiotics: Have We Answered the Question? - [http://care.diabetesjournals.org/content/37/3/593.full?sid=38e41290-368a-474a-840d-5acd880918ee](http://care.diabetesjournals.org/content/37/3/593.full?sid=38e41290-368a-474a-840d-5acd880918ee)