Diagnosis & Management of Hemodialysis Catheter Infections

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Case # 1

- 65 y/o elderly male
- DM, HTN, CAD
- ESRD for 3 months
- Access RIJ tunneled catheter, placed in hospital when he started dialysis
- Now presents with pain and discharge at the exit site X 2 days
Case # 1 (contd)

- O/E: Exit site inflamed, tender
- Crusting around the exit site
- No discharge
- VS: T 97.6 F, P 76, BP 136/82 mm Hg
- How do you proceed?
Sites of Catheter-related Infections

- **Local infection:**
  - Exit site infection
  - Tunnel infection

- **Systemic infection:**
  - Catheter related bacteremia (CRB)
Catheter-related Bacteremia: Metastatic Infections

- Frequent - 20 to 30%
  - Septic arthritis
  - Endocarditis
  - Epidural abscess
  - Death - 6 to 18%
Exit Site Infection

- Erythema, swelling, tenderness, purulent drainage
- Inflammation confined to the area surrounding the catheter exit site, not extending superiorly beyond the cuff if the catheter is tunneled, with exudate culture confirmed to be positive
- **Rx: Local antibiotics**
**Tunnel Infection**

- **Tunnel infection:**
  - The catheter tunnel superior to the cuff is inflamed, painful, and may have drainage through the exit site that is culture positive
  - *Rx: Systemic antibiotics*
  - *CVC exchange with new tunnel and exit site*
Case # 2

- 65 y/o elderly male
- DM, HTN, CAD
- ESRD for 6 months
- Access RIJ tunneled catheter, placed in hospital when he started dialysis
- Now presents with fever and chills on dialysis
- No overt sign of infection at the exit site/tunnel
- No other source of infection
Case #2 (contd)

- **O/E:** T 102 F, P 120/min, BP 140/84 mm Hg
- **What do you do now?**

- **What if:**
  - T 102 F, P 120/min, but BP 90/60 mm Hg
  - How would your management differ?
Catheter-related Bacteremia: Pre-disposing factors

**HOST RELATED FACTORS**
- Older age
- Diabetes mellitus
- Impaired immunity
- Poor personal hygiene

**PATHOGEN RELATED FACTORS**
- Biofilm Formation
- Antibiotic resistance
- Bacterial virulence
- *Staph aureus* nasal carriage

**CATHETER RELATED FACTORS**
- Site of insertion
- Lack of aseptic precautions during insertion
- Duration of catheter use
- Colonization of S/C tract with skin flora
- Catheter lumen contamination
- Hematogenous seeding from another infectious source
Catheter-related Bacteremia: Treatment Options

Two issues:

- **Antibiotic treatment** - immediate and prolonged
  - Systemic
  - And / Or Anti-microbial lock solutions

- **Catheter management** - alternatives
  - Leave it in – “treat through the infection”
  - Guidewire exchange
  - Guidewire exchange with new tunnel and exit site
  - Remove - delay replacement
Catheter Management

- Leave it in – “treat through the infection”
  - Only systemic antibiotics
  - 75% recurrence rate once antibiotic course is completed

- Remove - delay replacement
  - Most labor-intensive, though optimal
  - Two procedures
  - Challenging in patients with limited access sites
Catheter Management

- Guidewire exchange
  - Cure rates similar to removal, while removing the number of access procedures required
  - “Nephro-centric” approach – preserves access sites while providing comparable success in eradicating infections
Antibiotic Dosing in HD patients – Clinical Pearls

- Empiric therapy should include Vancomycin (Gram positive) with either aminoglycosides or 3rd generation cephalosporins (Gram negative)
- Select antibiotics that can be dosed after dialysis
  - Vancomycin
  - Aminoglycosides
  - Ceftazidime
  - Cefazolin
Antibiotic Dosing in HD Patients

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosing Regimen</th>
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<tbody>
<tr>
<td>Vancomycin</td>
<td>20-mg/kg loading dose infused during the last hour of the dialysis session, then 500 mg during the last 30 min of each subsequent dialysis session</td>
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<tr>
<td>Gentamicin (or tobramycin)</td>
<td>1 mg/kg, not to exceed 100 mg, after each dialysis session</td>
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<tr>
<td>Ceftazidime</td>
<td>1 g IV after each dialysis session</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>20 mg/kg IV after each dialysis session</td>
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<tr>
<td>Daptomycin</td>
<td>6 mg/kg after each dialysis session</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Antibiotic Lock</th>
<th>Vancomycin*</th>
<th>Ceftazidime†</th>
<th>Cefazolin†</th>
<th>Heparin‡</th>
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</thead>
<tbody>
<tr>
<td>Vancomycin/ceftazidime</td>
<td>1.0</td>
<td>0.5</td>
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<tr>
<td>Vancomycin</td>
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<td>Ceftazidime</td>
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<td>Cefazolin</td>
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Antibiotic Dosing in HD patients – Clinical Pearls

- Lock therapy – May be used for eradication of CRB to attempt to preserve vascular access sites
- High local concentrations of antibiotics (100-fold > therapeutic plasma concentrations)
- Cure rate dependent on type of organism
  - 85-100% Gram negative
  - 75-84% *Staph epidermidis*
  - 61% *Enterococcus*
  - 40-55% *Staph aureus*
# Summary: Catheter-related Bacteremia Management Algorithm

<table>
<thead>
<tr>
<th>Blood cultures positive</th>
<th>Coagulase negative Staph</th>
<th>Gram negative</th>
<th>Staph aureus</th>
<th>Antibiotics for 3-4 weeks, if TEE negative</th>
<th>Remove CVC</th>
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<tbody>
<tr>
<td>Symptom resolution</td>
<td></td>
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<td>Antibiotics for 10-14 days</td>
<td>Exchange CVC over guidewire</td>
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<td>Blood cultures positive</td>
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<td>Blood cultures positive</td>
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<td>Symptoms worsening</td>
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<td>Look for metastatic infections</td>
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<td>Antibiotics for 6 weeks</td>
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Adapted from IDSA Guidelines 2009
“The greatest risk….to human health comes in the form of antibiotic-resistant bacteria. We live in a bacterial world where we will never be able to stay ahead of the mutation curve. A test of our resilience is just how far behind the curve we allow ourselves to fall.” – World Economic Forum

Spellberg et al. The Future of Antibiotics And Resistance. NEJM 2013; 368:299-302