VASCULAR ACCESS

Diagnosis and Management of Catheter Related Bloodstream Infections
Key Concepts for CRSBI

Diagnosis of CRSBI

- Rule out non-catheter causes of CRBSI
- Send 2 sets of cultures (aerobic and anaerobic) from the catheter hub and dialysis circuit BEFORE starting empiric antibiotics

Management: The Patient

- Start empiric broad spectrum antibiotics
- FOLLOW UP culture and sensitivity results and change antibiotics accordingly
- As much as possible, provide IV antibiotics on dialysis and avoid PICCs (or use po antibiotics if appropriate)
- Treatment duration should be guided by type of infecting organism, type and degree of complications

Management: The Catheter

- Need for catheter removal is dependent on diagnostic findings and clinical scenario
- Catheter removal or exchange and location of new catheter depends on presence of exit site or tunnel infection, the patients ESKD Life-Plan, current and future access options
  - 3 possibilities:
    1) Catheter removal and insertion at new site (+/- Catheter free duration, which would require temporary catheter insertion)
    2) Catheter removal and new catheter via exchange over guidewire
    3) Catheter salvage with antibiotic locking for the same duration as systemic antibiotic coverage
Flow Diagram 25.a.
Immediate Approach to Suspected Hemodialysis Central Venous Catheter related Bloodstream infection (CRBSI)

Hemodialysis patient with CVC and findings suggestive of CRBSI (fever, chills, mental status change, hypotension and/or tachycardia)

- Examine patient for evidence of infection and try to identify its source (i.e. rule out non-CVC related infection)
  - (CVC exit-site and tunnel, other skin and soft tissue sites, lung, urine, abdomen, joint/extremities (e.g. diabetic foot), etc.)

Does patient have purulence at exit site or tunnel?

Yes
- Insert new CVC at different site ASAP (Check for fibrin sheath — see Care Path #3)

No
- Provide supportive care (e.g. fluids; send to ER/ICU or other supportive setting for pressors if needed)
- Dialyze once through existing catheter (then remove and replace as below)

Does patient need immediate hemodialysis? (severe hyperkalemia and/or pulmonary edema)

Yes
- Provide supportive care (e.g. fluids; send to ER/ICU or other supportive setting for pressors if needed)
- Dialyze once through existing catheter (then remove and replace as below)

No
- Leave catheter in place
- Monitor patient for 48-72 hours to confirm diagnosis of CRBSI - See Care Path #2 and 3

Is patient hemodynamically unstable despite fluid administration (+/- allow up to 16-24 hours on appropriate empiric broad spectrum antibiotics)*

Yes
- Leave catheter in place
- Monitor patient for 48-72 hours to confirm diagnosis of CRBSI - See Care Path #2 and 3

No
- Provide supportive care (e.g. fluids; send to ER/ICU or other supportive setting for pressors if needed)
- Insert new catheter (See Care Path #3) according to:
  - Patient’s need for dialysis and evolving clinical condition
  - Patient’s options for vascular access

Prior to next needed dialysis, Change CVC over guidewire to preserve sites OR Use AV access if one present and ready to use

* According to local practice.
Flow Diagram 25.b.
Manage the Patient: Empiric Initial and Subsequent Antibiotic Therapy for Hemodialysis Patient with Suspected CRSBI

Administer antibiotics to cover both gram positive and gram negative bacteria until results from blood cultures and sensitivities are available

Does patient have:
1. Serious beta-lactam allergy? And/or
2. Known or suspected MRSA infection?

Yes to 1 or both
- Use Vancomycin at first
  - Loading dose 20-25 mg/kg IV
  - Maintenance dose 10-15 mg/kg IV at end of each dialysis

No to both
- Use Cefazolin at first
  - 2 g IV at end of each dialysis

Does patient have:
1. Significant residual kidney function? And/or
2. Concerns of aminoglycoside ototoxicity?

Yes to 1 or both
- Use Ceftazidime at first
  - 1 g IV at end of each dialysis

No to both
- Use Tobramycin at first
  - Loading dose 2 mg/kg IV (up to 100 mg total)
  - Maintenance dose 1 mg/kg IV at end of each dialysis

Reassess antibiotics according to blood culture & sensitivity results

No growth
- Individualized approach
  - Possible false-negative due to prior antibiotic use
  - Stop antibiotic if false negative unlikely
  - Possible viral, or non-infectious cause of illness

Gram positive bacteria
- Sensitive to Cefazolin?
  - Yes
    - Use Vancomycin*
    - Use Cefazolin
  - No

Gram negative bacteria
- Use Ceftazidime or Tobramycin according to
  - Same considerations as above, and
  - Sensitivities

Fungus
- Options
  - Fluconazole
  - Micofungin

* Or according to sensitivity report and local antibiotic availability.

# See below.
Table 25.a. for Flow Diagram 25.b. Manage the Patient: Subsequent Antibiotic Therapy for Hemodialysis Patient with CRBSI

<table>
<thead>
<tr>
<th>Infecting Organism</th>
<th>Duration of Treatment</th>
<th>Special Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulase negative</td>
<td>14 days</td>
<td>• Consider infectious diseases consult</td>
</tr>
<tr>
<td>Staphylococcus</td>
<td></td>
<td>• Transthoracic 2D echo to evaluate for vegetations</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>4-6 weeks</td>
<td>• Carefully monitor for metastatic infection</td>
</tr>
<tr>
<td>Gram negative organisms</td>
<td>14 days minimum</td>
<td>• Consider infectious diseases consult</td>
</tr>
<tr>
<td>Candida species</td>
<td>14 days minimum</td>
<td>• CVC should be removed (see Care Path # 3)</td>
</tr>
</tbody>
</table>

All: Re-evaluate CVC care e.g. connect/disconnect and dressing practices, and risk factors for CRBSI
Flow Diagram 25.c.
Manage the Catheter – Catheter Removal and Replacement in Hemodialysis Patient with Suspected CRBSI

1. Does the catheter need to be removed now? (See Flow Diagram 25a)
   - Yes
   - No

2. Does the patient have purulence at exit site or obvious tunnel infection? Or suspected exit site infection (discharge, new erythema, new tenderness)?
   - Yes
   - No

   Remove CVC and Insert new CVC at different site
   #

3. Can the patient have CVC removed with new CVC insertion under fluoroscopy?
   - Yes
   - No

   Is it possible to evaluate for and disrupt fibrin sheath, if present
   - Yes
   - No

   As old CVC is being removed, evaluate for fibrin sheath using dye, if found, disrupt or snare

   SS of sepsis or metastatic infection?
   - No
   - Yes

4. Exchange old CVC for new CVC via guidewire (or new site on same side if CVC free time deemed necessary)

5. Remove old CVC* Insert new non-tunneled temporary CVC* under US guidance

6. Repeat blood cultures – if negative at 48 hours, insert new tunneled CVC# under imaging (fluoro or ultrasound) guidance

7. Assess patient at 48-72 hours: Is the patient’s condition “stable”: VSS, afebrile, no evidence of metastatic infection and otherwise well?
   - Yes
   - No

8. Remove CVC and Insert new CVC at same site to preserve sites or use AV-access if available/ready to use

9. Can the patient have CVC removed with new CVC insertion under fluoroscopy?
   - Yes
   - No

10. Is it possible to evaluate for and disrupt fibrin sheath, if present
    - Yes
    - No

    Remove old CVC*

11. Insert new non-tunneled temporary CVC* under US guidance

12. Repeat blood cultures – if negative at 48 hours, insert new tunneled CVC# under imaging guidance

13. Are initial blood cultures positive?
    - Yes
    - No

    Antibiotic lock with concurrent systemic antibiotics (same duration)
    Ensure organism is sensitive to antibiotic in the locking solution (See Table)

14. Should the CVC be salvaged? E.g. no other CVC site options, difficult access, patient refusal for procedure, resource constraints
    - Yes
    - No

    Do Not Remove CVC
    Monitor for S&S of CRBSI

15. Remove CVC

16. Exchange old CVC for new CVC via guidewire (or new site on same side if CVC free time deemed necessary)

17. Insert new non-tunneled temporary CVC*

18. Repeat blood cultures – if negative at 48 hours, insert new tunneled CVC# under imaging guidance

# Ability for “CVC free time” depends on local resources and feasibility, as well as clinical considerations, such as ease of re-insertion after current CVC removed without guidewire exchange.

* Send old CVC tip for C&S if feasible, to confirm diagnosis of CRBSI.
## Antibiotic Lock Solutions for Treatment of CRBSI

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Anticoagulant</th>
<th>Comments</th>
</tr>
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</table>
| **Vancomycin 50 mg/mL**  
Reconstitute 50 mg vial of Vancomycin with 10 mL water for injection (to give concentration of 50 mg/mL)  
Draw up 1 mL (50 mg) | **Citrate 4.67% (1 ml)**  
Draw up 1 mL of Trisodium Citrate 46.7 % and add to 1 mL of Vancomycin 50 mg/mL and 8 mL of Sodium Chloride 0.9% to give a total volume of 10 mL.  
Final concentration = 5 mg/ml Vanco and 4.67% Citrate in total vol 10 mL |  |
| **Gentamicin (1 mg/mL)**  
Draw up 0.25 mL (10 mg) of Gentamicin 40 mg/mL | **Citrate 4.67% (1 ml)**  
Draw up 1 mL of Citrate 46.7 % and add to 0.25 mL Gentamicin 40 mg/mL and 8.75 mL of Sodium Chloride 0.9% to give a total volume of 10 mL | Final concentration of Gentamicin 1 mg/mL and Citrate 4.67% in a total volume of 10 mL |
| **Vancomycin 5 mg/mL + Ceftazidime 10 mg/mL** | Heparin 1000 U/mL | Final concentrations: 2.5 mg/mL vancomycin  
2.5 mg/mL ceftazidime  
250 U/mL heparin |
| **Vancomycin 5 mg/mL** | Heparin 1000 U/mL | Final concentrations: 2.5 mg/mL vancomycin  
500U/mL heparin |
| **Ceftazidime 10 mg/mL** | Heparin 1000 U/mL | Final concentrations: 2.5 mg/mL ceftazidime  
500U/mL heparin |
| **Cefazolin 10 mg/mL** | Heparin 1000 U/mL | Final concentrations: 2.5 mg/mL cefazolin  
500U/mL heparin |