GENERAL NEPHROLOGY CONFERENCE:
CRBSI

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ADULT NEPHROLOGY FELLOW
OBJECTIVES

- To discuss the burden of catheter-related blood stream infection (CRBSI) among patients on hemodialysis
- To present guidelines on diagnosis and treatment of CRBSI
- To enumerate measures on how to prevent CRBSI
PATIENT PROFILE

- E.V.
- 61 y/o
- Female
- Filipino
- Roman Catholic

- Single
- Unemployed
- Highschool graduate
- From Aklan, lives in Quezon City
- 2nd admission last March 5, 2016
CHIEF COMPLAINT:
Fever of 2 weeks duration
BACKGROUND

- ESRD sec. to HPNNS
- Maintenance hemodialysis 3x/wk since November 2015
- CRBSI last January 2016 - Co-amoxiclav and IJ catheter replacement
- S/P AVF creation, left brachiocephalic (January 2016) not yet cleared for use
HISTORY OF PRESENT ILLNESS

2 weeks

Consult

HD

HD

HD

HD

+ Fever & Chills

Doctrine Non-productive cough
PAST MEDICAL HISTORY

- Hypertension (~15 years)
  - Losartan 100 mg OD and Amlodipine 10 mg OD
  - Usual BP 140/80 mmHg
  - Highest BP 200/110 mmHg

- ESRD sec. to HPNNS (Nov. 2015)
  - Maintenance hemodialysis 3x/wk (T-Th-S)
  - S/P AVF creation, left brachiocephalic (Jan. 18, 2016)
FAMILY HISTORY

- Hypertension (both parents)
SOCIAL HISTORY

- Non-smoker
- Non-alcoholic beverage drinker
- Denies illicit drug use
<table>
<thead>
<tr>
<th>System</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>(-) Sweating, (-) weight gain, (-) weakness</td>
</tr>
<tr>
<td>Skin</td>
<td>(-) Itching, (-) rashes, (-) changes in hair/nails</td>
</tr>
<tr>
<td>Eyes</td>
<td>(-) Visual impairment, (-) redness, (-) tearing, (-) pain, (-) double vision, (-) discharge, (-) trauma</td>
</tr>
<tr>
<td>Ears</td>
<td>(-) Hearing, (-) pain, (-) discharge, (-) tinnitus</td>
</tr>
<tr>
<td>Nose, Throat, Mouth</td>
<td>(-) Hoarseness, (-) sore throat, (-) trauma, (-) frequent colds, (-) nose bleeding, (-) neck mass, (-) dental carries, (-) facial pain, (-) sinus disorder, (-) gum bleeding, (-) toothache</td>
</tr>
<tr>
<td>Respiratory</td>
<td>(-) Dyspnea, (-) hemoptysis</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>(-) Chest pain, (-) palpitation, (-) syncope, (-) orthopnea, (-) paroxysmal nocturnal dyspnea, (-) edema</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>(-) Dysphagia, (-) nausea, (-) vomiting, (-) change in appetite, (-) abdominal pain, (-) melena, (-) jaundice, (-) bleeding, (-) indigestion, (-) heartburn, (-) hematemesis, (-) fatty food intolerance, (-) stool frequency/character, (-) hemorrhoids, (-) hernia</td>
</tr>
</tbody>
</table>
## Review of Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary</td>
<td>(-) Dysuria, (+) <strong>oliguria ~100 cc/day</strong>, (-) retention, (-) bleeding, (-) stream, (-) nocturia, (-) stones, (-) hesitancy, (-) urgency, (-) change in color, (-) frequency, (-) dribbling</td>
</tr>
<tr>
<td>Genito-Reproductive</td>
<td>(-) Discharge, (-) pain, (-) libido, (-) sexual difficulties</td>
</tr>
<tr>
<td>Breast</td>
<td>(-) Nipples, (-) lump, (-) pain, (-) discharge</td>
</tr>
<tr>
<td>Extremities</td>
<td>(-) Cyanosis, (-) clubbing, (-) varicosity, (-) ulcers, (-) claudication</td>
</tr>
<tr>
<td>Hematopoietic System</td>
<td>(-) Excessive bleeding/bruising, (-) pica</td>
</tr>
<tr>
<td>Nervous System</td>
<td>(-) Headache, (-) tremor, (-) fainting spells, (-) seizures, (-) neurological deficit, (-) gait disturbance, (-) dizziness/vertigo, (-) head trauma, (-) sensory perversions</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>(-) Joint pain or stiffness, (-) muscle weakness</td>
</tr>
<tr>
<td>Endocrine System</td>
<td>(-) Heat/cold intolerance, (-) thyroid problems, (-) neck surgery/irradiation, (-) proximal muscle weakness, (-) easy bruisability</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>(-) Mood swings, (-) behavioural changes, (-) anxiety, (-) depression</td>
</tr>
</tbody>
</table>
# PHYSICAL EXAMINATION

<table>
<thead>
<tr>
<th>Gen. Survey</th>
<th>Awake, coherent, ambulatory, not in respiratory distress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital Signs</td>
<td>BP: 130/80 mmHg, HR: 88 bpm, RR: 19 cpm, <strong>Temp.: 37.8 °C</strong></td>
</tr>
<tr>
<td>Skin</td>
<td>Warm and soft, no ecchymosis, no hematoma, no jaundice</td>
</tr>
<tr>
<td>HEENT</td>
<td>Anicteric sclera, <strong>pale palpebral conjunctiva</strong>, no tonsillopharyngeal congestion, moist oral mucosa, no cervical lymphadenopathies, IJ catheter site with no discharge</td>
</tr>
<tr>
<td>Chest/Lungs</td>
<td>Equal chest expansion, <strong>bibasal crackles</strong></td>
</tr>
<tr>
<td>Heart</td>
<td>Adynamic precordium, normal rate, regular rhythm, distinct S1 and S2, PMI at 5th ICS LMCL, <strong>grade 3 systolic murmur</strong></td>
</tr>
<tr>
<td>Abdomen</td>
<td>Flabby, normoactive bowel sounds, soft, no tenderness, no masses, no hepatosplenomegaly</td>
</tr>
<tr>
<td>Extremities</td>
<td>Full and equal pulses, no edema, no cyanosis, good capillary refill time, left brachicephalic AVF with good bruit</td>
</tr>
</tbody>
</table>
COURSE IN THE ER – 1st HD

- Admitting impression:
  - Catheter-related blood stream infection
  - T/C infective endocarditis
  - Health-care associated pneumonia
  - End stage renal disease sec. to hypertensive nephrosclerosis
  - Hypertension

- Dx: CBC, electrolytes, blood CS x 2 sites, IJ catheter tip GS/CS, sputum GS/CS, chest x-ray and 2D echo with doppler study

- Tx: IDS referral, empiric antibiotics (TZP, VAN & AZM), IJ catheter removal and supportive treatment

<table>
<thead>
<tr>
<th>Blood Chemistries</th>
<th>3/6/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium</td>
<td>4.7 mmol/L</td>
</tr>
<tr>
<td>Sodium</td>
<td>136 mmol/L</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>1%</td>
</tr>
<tr>
<td>Basophils</td>
<td>0.4%</td>
</tr>
<tr>
<td>Platelet</td>
<td>140 x 10^3/L</td>
</tr>
</tbody>
</table>

- CBC 3/5/16
  - Hgb 7.4 g/L
  - Hct 23.6%
  - WBC 23.15 x 10^9/L
Afebrile with stable vital signs

Dx:
- Repeat CBC
- Blood CS: Staphylococcus lugdunensis
- 2D Echo with Doppler study: possible vegetation in the aortic valve

Tx:
- Antibiotics continued, IJ catheter reinsertion and hemodialysis

2D Echo with Doppler Study (3/8/16)
- EF 66%
- Fluttering echogenic density attached to the aortic valve cusp probably a vegetation
- Aortic valve sclerosis with aortic regurgitation
- Mitral valve sclerosis with mild mitral regurgitation
- Mild tricuspid regurgitation
- Concentric LVH with normal wall motion, contractility and systolic function
- Dilated left atrium with increased volume index
- Normal pulmonary artery pressure

Microcytic, hypochromic
Sudden onset of chest pain characterized as heaviness associated with difficulty of breathing

- BP 200/90, HR 130s, O2 sat. 89% at room air
- Bibasal crackles and rhonchi

Impression: ACS

Dx: ECG, troponin I (1.731 ug/L → 3.198 ug/L) and chest x-ray
Sudden onset of chest pain characterized as heaviness associated with difficulty of breathing

BP 200/90, HR 130s, O2 sat. 89% at room air

Bibasal crackles and rhonchi

Impression: ACS → NSTEMI

Dx: ECG, troponin I (1.731 ug/L → 3.198 ug/L) and chest x-ray

Tx: CV referral, aspirin, clopidogrel, enoxaparin, atorvastatin, nitrates, carvedilol, enalapril, O2 support, blood transfusion and SLED
6th to 10th HD

- Afebrile, stable vital signs, no recurrence of chest pain or difficulty of breathing
- Decrease in sensorium, eye opening to vigorous stimulation, does not follow command and with no verbal output
- Impression: CVA, R/O bleed
- Dx: plain cranial CT scan
6th to 10th HD

- Afebrile, stable vital signs, no recurrence of chest pain or difficulty of breathing
- Decrease in sensorium, eye opening to vigorous stimulation, does not follow command and with no verbal output

**Impression:** acute intraparenchymal bleed, left frontal area

**Dx:** plain cranial CT scan

**Tx:** Neurology referral, antiplatelets and LMWH put on hold, mannitol and NGT feeding started, Palliative Care referral
BURDEN OF CRBSI

- April 2016
  - 635 ER Nephrology consult
  - 31 cases of CRBSI

- Estimated cost
  - Average length of stay - ~5 days
  - Laboratories - ~Php 7,000 - 10,000
  - Medications - ~Php 5,000 - 7,000
  - Hemodialysis - ~Php 5,000
  - IJ catheter replacement - ~Php 7,000
  - ER fee - Php 3,350 + 3,240/24 hrs.

4.88%

~Php 45,310
EPIDEMIOLOGY

- Decreasing incidence in the US and Canada
  - Widespread prevention efforts
- Increased incidence in Latin America, Asia, Africa and Europe
  - Resource-limited areas
  - Lack of official regulations regarding catheter care
- The relative risk of tunneled dialysis catheters causing bacteremia in dialysis patients is approximately \textbf{10 times} higher than the risk of bacteremia in patients with arteriovenous (AV) fistulas
- Catheter-dependent hemodialysis patients have a \textbf{two- to threefold} higher risk of infection-related hospitalization and death as compared with patients undergoing dialysis via a fistula or graft
- Cumulative likelihood of catheter-related bacteremia was \textbf{35 percent within three months} and \textbf{54 percent within six months} of catheter insertion

\textit{UpToDate}
Surveillance and Control of Pathogens of Epidemiologic Importance (SCOPE) Database

- The mean time from admission to BSI onset ranged from 12 to 26 days and depended on the isolated pathogen
- The crude mortality rate was 27 percent
RISK FACTORS

HOST FACTORS

- Chronic illness
- Bone marrow transplantation
- Immune deficiency, especially neutropenia
- Malnutrition
- TPN
- Previous BSI
- Extremes of age
- Loss of skin integrity as with burns

CATHETER FACTORS

- Duration of catheterization (although there is no indication for routine line changing based on number of catheter days)
- Type of catheter material
- Conditions of insertion
- Catheter-site care
- Skill of the catheter inserter
HIGH RISK FACTORS

- Femoral or internal jugular placement compared with subclavian
- Use for hyperalimentation or hemodialysis compared with other indications
- Submaximal compared with maximal (mask, cap, sterile gloves, gown, large drape) barrier precautions during insertion
- Nontunneled compared with tunneled insertion
- Tunneled insertion compared with a totally implantable device
- Bare compared with antibiotic impregnated catheter
- Thrombosis of the catheter, repeated catheterization, increased manipulation of the catheter (including catheter repair) and presence of septic foci elsewhere
Sources of Infection

Skin organisms
- Endogenous
- Skin flora
- Extrinsic
- HCW hands
- Contaminated disinfectant

Contaminated catheter hub
- Endogenous
- Skin flora
- Extrinsic
- HCW hands

Contaminated infusate
- Extrinsic
- Fluid
- Medication
- Intrinsic
- Manufacturer

Fibrin sheath, thrombus

Hematogenous from distant infection

UpToDate
Coagulase-negative staphylococci - 31 percent
Staphylococcus aureus - 20 percent
Enterococci - 9 percent
Candida species - 9 percent
Escherichia coli - 6 percent
Klebsiella species - 5 percent
Pseudomonas species - 4 percent
Enterobacter species - 4 percent
Serratia species - 2 percent
Acinetobacter baumannii - 1 percent
COMPLICATIONS

- Metastatic infections
  - 5 to 10 percent of CRBSI
  - *Staphylococcus aureus* (10 to 40 percent)
  - Onset can occur weeks or even months
  - Osteomyelitis, endocarditis, septic arthritis, epidural abscess, etc.

- Suppurative thrombophlebitis
- Abscess
Fever & chills
Purulence at the insertion site or an exit-site infection
Hemodynamic instability
Altered mental status
Catheter dysfunction
Sepsis
EVALUATION

CRBSI?  Blood CS x 2 sites  Exclude other possible causes

UpToDate
DIAGNOSTIC DIFFICULTIES AMONG DIALYSIS PATIENTS

Obtaining peripheral blood cultures

Systemic blood is circulating through the dialysis system

Transport of specimen
DIAGNOSIS

- Concurrent positive blood cultures of the same organism from the catheter and a peripheral vein
- Culture of the same organism from both the catheter tip and at least one percutaneous blood culture
- Cultures of the same organism from two peripherally drawn blood cultures and an absence of an alternate focus of infection
- Two cultures drawn at separate times (10 to 15 minutes) from blood tubing
TREATMENT

Antibiotic therapy

Catheter management
ANTIBIOTIC THERAPY

- **Empiric treatment** - broad-spectrum (gram +, gram - and MRSA) and pharmacokinetics
  
  *Vancomycin / Daptomycin + Gentamicin / Ceftazidime*

- **Stopping empiric therapy** - negative blood cultures, no other identified source of infection and signs and symptoms resolved

- **Tailored treatment** - based on the organism and sensitivity
<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Preferred antimicrobial agent</th>
<th>Example, dosage</th>
<th>Alternative antimicrobial agent</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gram-positive cocci</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>Penicillinase-resistant Pen$^b$</td>
<td>Naf or Oxa, 2 g q4h</td>
<td>Claz, 2 g q8h; or Vm, 15 mg/kg q12h</td>
<td>Penicillinase-resistant Pen or Caps are preferred to Vm.$^b$ For patients receiving hemodialysis, administer Claz 20 mg/kg (actual weight), round to nearest 500-mg increment, after dialysis</td>
</tr>
<tr>
<td>Meth susceptible</td>
<td>Penicillinase-resistant Pen$^b$</td>
<td>Naf or Oxa, 2 g q4h</td>
<td>Claz, 2 g q8h; or Vm, 15 mg/kg q12h</td>
<td>Penicillinase-resistant Pen or Caps are preferred to Vm.$^b$ For patients receiving hemodialysis, administer Claz 20 mg/kg (actual weight), round to nearest 500-mg increment, after dialysis</td>
</tr>
<tr>
<td>Meth resistant$^a$</td>
<td>Vm</td>
<td>Vm, 15 mg/kg q12h</td>
<td>Dapto, 6–8 mg/kg per day, or linezolid; or Vm plus (Rif or Gm); or TMP-SMZ alone (if susceptible)</td>
<td>Strains of S. aureus with reduced susceptibility or resistance to Vm have been reported; strains resistant to linezolid and strains resistant to Dapto have been reported</td>
</tr>
<tr>
<td><strong>Coagulase-negative staphylococci</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meth susceptible</td>
<td>Penicillinase-resistant Pen</td>
<td>Naf or Oxa, 2 g q4h</td>
<td>First-generation Csp or Vm or TMP-SMZ (if susceptible)</td>
<td>Vm has dosing advantages over Naf and Oxa, but the latter are preferred because of concerns about increasing Vm resistance</td>
</tr>
<tr>
<td>Meth resistant</td>
<td>Vm</td>
<td>Vm, 15 mg/kg iv q12h</td>
<td>Dapto 6 mg/kg per day, linezolid, or Quin/DAlf</td>
<td>For adults &lt;40 kg, linezolid dose should be 10 mg/kg; strains resistant to linezolid have been reported</td>
</tr>
<tr>
<td><strong>Enterococcus faecalis/Enterococcus faecium</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amp susceptible</td>
<td>Amp or (Amp or Pen) ± aminoglycoside</td>
<td>Amp, 2 g q4h or q8h; or Amp ± Gm, 1 mg/kg q8h</td>
<td>Vm</td>
<td>Vm may have dosing advantages over Amp, but there are concerns about Vm resistance</td>
</tr>
<tr>
<td>Amp resistant, Vm susceptible</td>
<td>Vm ± aminoglycoside</td>
<td>Vm, 15 mg/kg iv q12h ± Gm, 1 mg/kg q8h</td>
<td>Linezolid or Dapto 6 mg/kg per day</td>
<td>Quin/DAlf is not effective against E. faecalis</td>
</tr>
<tr>
<td>Amp resistant, Vm resistant</td>
<td>Linezolid or Dapto</td>
<td>Linezolid, 600 mg q12h; or Dapto 6 mg/kg per day</td>
<td>Quin/DAlf 7.5 mg/kg q8h</td>
<td>Susceptibility of Vm-resistant enterococci isolates varies; Quin/DAlf is not effective against E. faecalis</td>
</tr>
<tr>
<td><strong>Gram-negative bacilli$^d$</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Escherichia coli</em> and <em>Klebsiella</em> species</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESBL negative</td>
<td>Third-generation Cap</td>
<td>Ctri, 1–2 g per day</td>
<td>Cipro or Atm</td>
<td>Susceptibility of strains varies</td>
</tr>
<tr>
<td>ESBL positive</td>
<td>Carbapenem</td>
<td>Erta, 1 g per day; Imi, 500 mg q6h; Mero, 1 g q8h; or doripenem, 500 mg q8h</td>
<td>Cipro or Atm</td>
<td>Susceptibility of strains varies</td>
</tr>
<tr>
<td><em>Enterobacter</em> species and <em>Serratia marcescens</em></td>
<td>Carbapenem</td>
<td>Erta, 1 g per day; Imi, 500 mg q6h; Mero, 1 g q8h</td>
<td>Cefepime or Cipro</td>
<td>Susceptibility of strains varies</td>
</tr>
<tr>
<td><em>Acinetobacter</em> species</td>
<td>Amp/Sub or carbapenem</td>
<td>Amp/Sub, 3 g q6h; or Imi, 500 mg q6h; Mero, 1 g q8h</td>
<td></td>
<td>Susceptibility of strains varies</td>
</tr>
<tr>
<td>Stenotrophomonas maltophilia</td>
<td>TMP-SMZ, 3–5 mg/kg q8h</td>
<td>Tic and Clv</td>
<td>...</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
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<td></td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>Cefepime, 2 g q8h; or Imi, 500 mg q8h; or Mero, 1 g q8h; or Pip and Tazo, 4.5 g q8h, Amik, 15 mg/kg q24h or Tobra 5–7 mg/kg q24h</td>
<td>...</td>
<td>Susceptibility of strains varies</td>
<td></td>
</tr>
<tr>
<td>Burkholderia cepacia</td>
<td>TMP-SMZ or carbapenem</td>
<td>...</td>
<td>Other species, such as B. acidovorans and B. pickettii, may be susceptible to same antimicrobial agents</td>
<td></td>
</tr>
<tr>
<td>Fungi</td>
<td>Echinocandin or fluconazole (if organism is susceptible)</td>
<td>Caspo, 70-mg loading dose, then 50 mg per day; micafungin, 100 mg per day; anidulafungin, 200 mg loading dose followed by 100 mg per day; or fluconazole, 400–600 mg per day</td>
<td>Lipid AmB preparations</td>
<td>Echinocandin should be used to treat critically ill patients until fungal isolate is identified</td>
</tr>
<tr>
<td>Candida albicans or other Candida species</td>
<td>Vm, 15 mg/kg q12h</td>
<td>Linezolid (based on in vitro activity)</td>
<td>Check susceptibilities for other corynebacteria</td>
<td></td>
</tr>
<tr>
<td>Uncommon pathogens</td>
<td>Fluoroquinolone, such as Lfx</td>
<td>Lfx 750 mg q24h</td>
<td>TMP-SMZ or Imi or Mero</td>
<td>Based on in vitro activity.</td>
</tr>
<tr>
<td>Corynebacterium jeikeium (group JK)</td>
<td>Vm</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Chryseobacterium (Flavobacterium) species</td>
<td>Lfx</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Mycobacterium species</td>
<td>Susceptibility varies by species</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

**NOTE.** See *S. aureus* section of the text regarding important antibiotic management issues concerning linezolid. AmB, amphothericin B; Amp, ampicillin; Atm, atramycin; Cfx, cefazolin; Cfl, cefuroxime; Clv, clavulanate; Cpx, ciprofloxacin; Csp, cephalosporins; CtrI, ceftriaxone; Czd, ceftazidine; Ert, ertapenem; Gm, gentamicin; Imi, imipenem; IV, intravenous; Ket, ketoconazole; Lfx, levofloxacin; Mero, meropenem; Meth, methicillin; Mex, mezlocillin; Naf, nafcillin; Oxa, oxacillin; Pen, penicillin; PenG, penicillin G; po, by mouth; Pip, piperacillin; Quin/Daf, quinupristin/dalfopristin; Rif, rifampin; Sub, subactam; Tic, ticarcillin; Tm, tobramycin; TMP-SMZ, trimethoprim-sulfamethoxazole; Vm, vancomycin.

* Initial antibiotic dosages for adult patients with normal renal and hepatic function and no known drug interactions. Fluoroquinolones should not be used for patients <18 years of age (see the section of the text devoted to treating pediatric infection [256, 257]).
* Pen, if the strain is susceptible.
* Some clinicians will add an aminoglycoside for the first 5 days of therapy.
* Pending susceptibility results for the isolate.
MONITORING ISSUES

- Repeat blood cultures 48 to 96 hours after the institution of treatment
- Echocardiogram and evaluation for a metastatic infection in all patients with prolonged S. aureus bacteremia (positive S. aureus blood cultures that occur after 72 hours of therapy)
- Serum antibiotic levels
DURATION

- Infected catheter removed and replaced, all signs of infection rapidly resolved and follow-up blood cultures were negative - two to three weeks
- Infected catheter treated with an antibiotic lock solution - two to three weeks
- Uncomplicated catheter-related bacteremia due to S. aureus - four weeks
- Metastatic infection or blood cultures remain positive after three or more days of appropriate therapy - at least six weeks of therapy
- Osteomyelitis - six to eight weeks
CATHETER MANAGEMENT

- **Immediate removal** - best option
  - Severe sepsis
  - Hemodynamic instability
  - Evidence of metastatic infection
  - Signs of accompanying exit-site or tunnel infection, such as pus at the exit-site
  - If fever and/or bacteremia persist 48 to 72 hours after initiation of antibiotics to which the organism is susceptible
  - When infection is due to difficult-to-cure pathogens, such as *S. aureus, Pseudomonas, Candida*, other fungi, or multiple-resistant bacterial pathogens
CATHETER MANAGEMENT

- Guidewire catheter exchange
  - Delayed exchange of the infected cuffed catheter over a guidewire with a new catheter two to three days after institution of effective antimicrobial therapy and resolution of fever
  - Follow-up blood cultures even if the patient is asymptomatic
**CATHETER MANAGEMENT**

- **Antibiotic lock**
  - Alternative approach to immediate catheter removal with delayed replacement or to guidewire catheter exchange
  - Kill the bacteria present in biofilms
  - Mixture of an anticoagulant (heparin or citrate) and high concentrations of an antibiotic in a small volume

- **Leaving the catheter in place without intervention**
  - Biofilms form rapidly on the inner surface of infected central vein catheters
Short-term central venous catheter (CVC) or arterial catheter (AC) infection – related bloodstream infection

Complicated

Uncomplicated (bloodstream infection and fever resolves within 72 hours in a patient who has no intravascular hardware and no evidence of endocarditis or suppurative thrombophlebitis and for S. aureus is also without active malignancy or immunosuppression)

- Suppurative thrombophlebitis, endocarditis or osteomyelitis, etc
  - Remove catheter & treat with systemic antibiotic for 4-6 weeks; 6-8 weeks for ostomyelitis in adults
  - If catheter is retained, treat with systemic antibiotic + antibiotic lock therapy for 10-14 days

- Coagulase-negative staphylococci
  - Remove catheter & treat with systemic antibiotic for 5-7 days

- Staphylococcus aureus
  - Remove catheter & treat with systemic antibiotic for ≥14 days

- Enterococcus
  - Remove catheter & treat with systemic antibiotic for 7-14 days

- Gram-negative bacilli
  - Remove catheter & treat with systemic antibiotic for 7-14 days

- Candida spp.
  - Remove catheter & treat with antifungal therapy for 14 days after the first negative blood culture

IDSA 2009
Long-term central venous catheter (CVC) – or port (P) – related bacteremia or fungemia

Complicated

- Tunnel infection, port abscess
  - Remove CVC/P & treat with antibiotics for 7-10 days

- Septic thrombosis, endocarditis, osteomyelitis
  - Remove CVC/P & treat with antibiotics for 4-6 weeks; 6-8 weeks for osteomyelitis in adults

- Coagulase-negative staphylococcus
  - May retain CVC/P & use systemic antibiotic for 10-14 days + antibiotic lock therapy for 10-14 days
  - Remove CVC/P if there is clinical deterioration persisting or relapsing bacteremia, work-up for complicated infection and treat accordingly

- Staphylococcus aureus
  - Remove the infected catheter and then treat with 4-6 weeks of antimicrobial therapy unless the patient has exceptions listed in Recommendation 80

- Enterococcus
  - May retain CVC/P & use systemic antibiotic for 7-14 days + antibiotic lock therapy for 7-14 days
  - Remove CVC/P if there is clinical deterioration persisting or relapsing bacteremia, work-up for complicated infection and treat accordingly

- Gram-negative bacilli
  - Remove CVC/P & treat for 7-14 days
  - For CVC/P salvage, use systemic antibiotic & antibiotic lock therapy for 10-14 days; if no response, remove CVC/P, rule out endocarditis or suppurrative thrombophlebitis, and if not present treat with antibiotic for 10-14 days

- Candida spp.
  - Remove CVC/P & treat with antifungal therapy for 14 days after the first negative blood culture

Uncomplicated (Fig. 2)

IDSA 2009
PREVENTIVE DIFFICULTIES

Chronic need for vascular access

Anatomic and blood vessel preservation issues
PREVENTION

Aseptic technique

Hand hygiene

Nonsterile gloves and mask

Chlorhexidine gluconate-impregnated sponge
PREVENTION

- Site care
- Elimination of *S. aureus* nasal carriage
- Different type of dialysis catheters
- Topical application of different substances
- Antibiotic-lock technique
- Catheters impregnated with antimicrobial agents
- Topical antibiotics
TOPICAL ANTIMICROBIAL EXIT-SITE APPLICATION


Meta-analysis: antibiotics for prophylaxis against hemodialysis catheter-related infections.

James MT¹, Conley J, Tonelli M, Manns BJ, MacRae J, Hemmelgarn BR; Alberta Kidney Disease Network.
PROBLEMS WITH USE OF TOPICAL ANTIBIOTICS

CA-MRSA

Antimicrobial resistance
CATHETERS WITH A LOWER INFECTION RATE

- Tunneled and cuffed catheters decrease infection and permit longer usage
- No significant decrease in catheter-related bacteremia and exit-site infections with antimicrobial coating of hemodialysis catheters
LOCK SOLUTIONS

Systematic review of antimicrobials for the prevention of haemodialysis catheter-related infections.
Rabindranath KS¹, Bansal T, Adams J, Das R, Shail R, MacLeod AM, Moore C, Besarab A.


Comparative effectiveness of two catheter locking solutions to reduce catheter-related bloodstream infection in hemodialysis patients.
Moore CL¹, Besarab A², Ailuni M³, Soi V⁴, Peterson EL⁵, Johnson LE⁶, Zervos MJ⁷, Adams E⁴, Yee J⁴.
Issues

- Antimicrobial resistance
- Systemic toxicity
- Financial burden

UpToDate
ELIMINATION OF S. aureus NASAL CARRIAGE

- Antibiotic therapy (Mupirocin) to decrease nasal carriage of S. aureus has led to fewer access-related infections
- The emergence of resistance with chronic antibiotic use has limited the widespread adoption of this technique
Thank you for listening!