

Hemodialysis catheter infection

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Case # 1

- 65 y/o elderly male
- DM, HTN, CAD
- ESRD for 3 months
- Access right internal jugular tunneled catheter,
placed in the 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 th 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)**

Sources of intravascular catheter infection

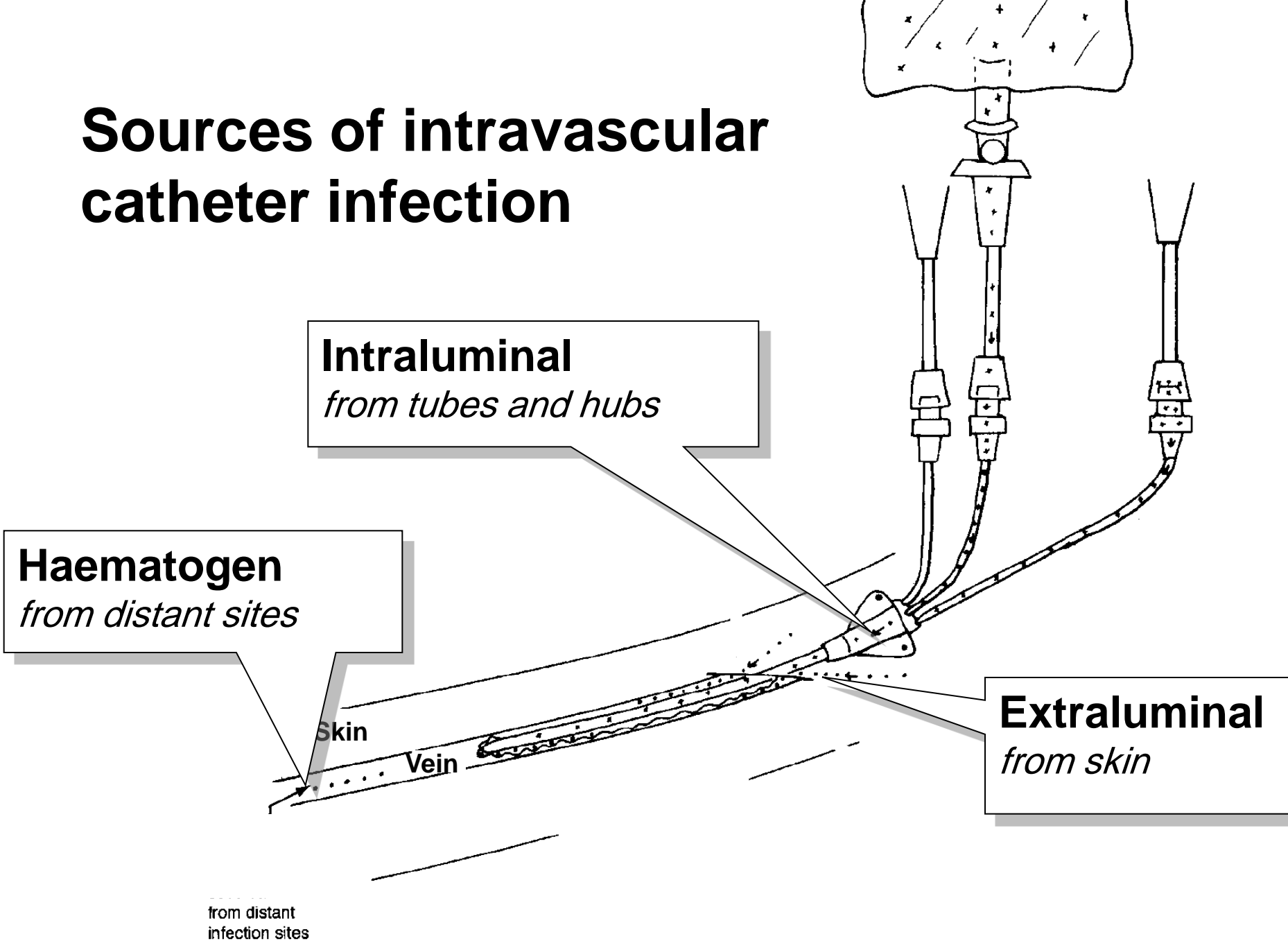


Figure. Source of intravascular catheter-related infections.

Focus of prevention of infections

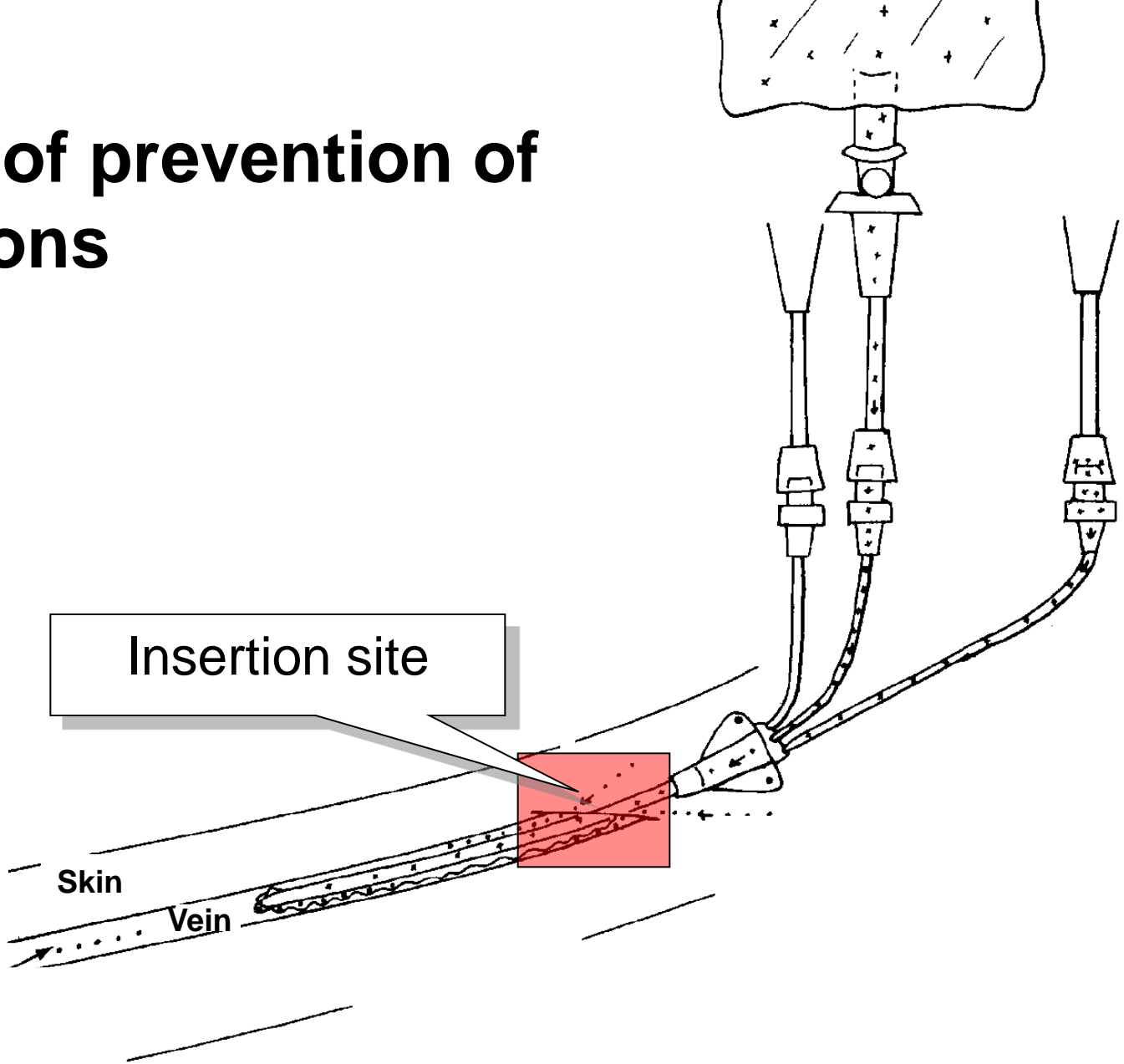


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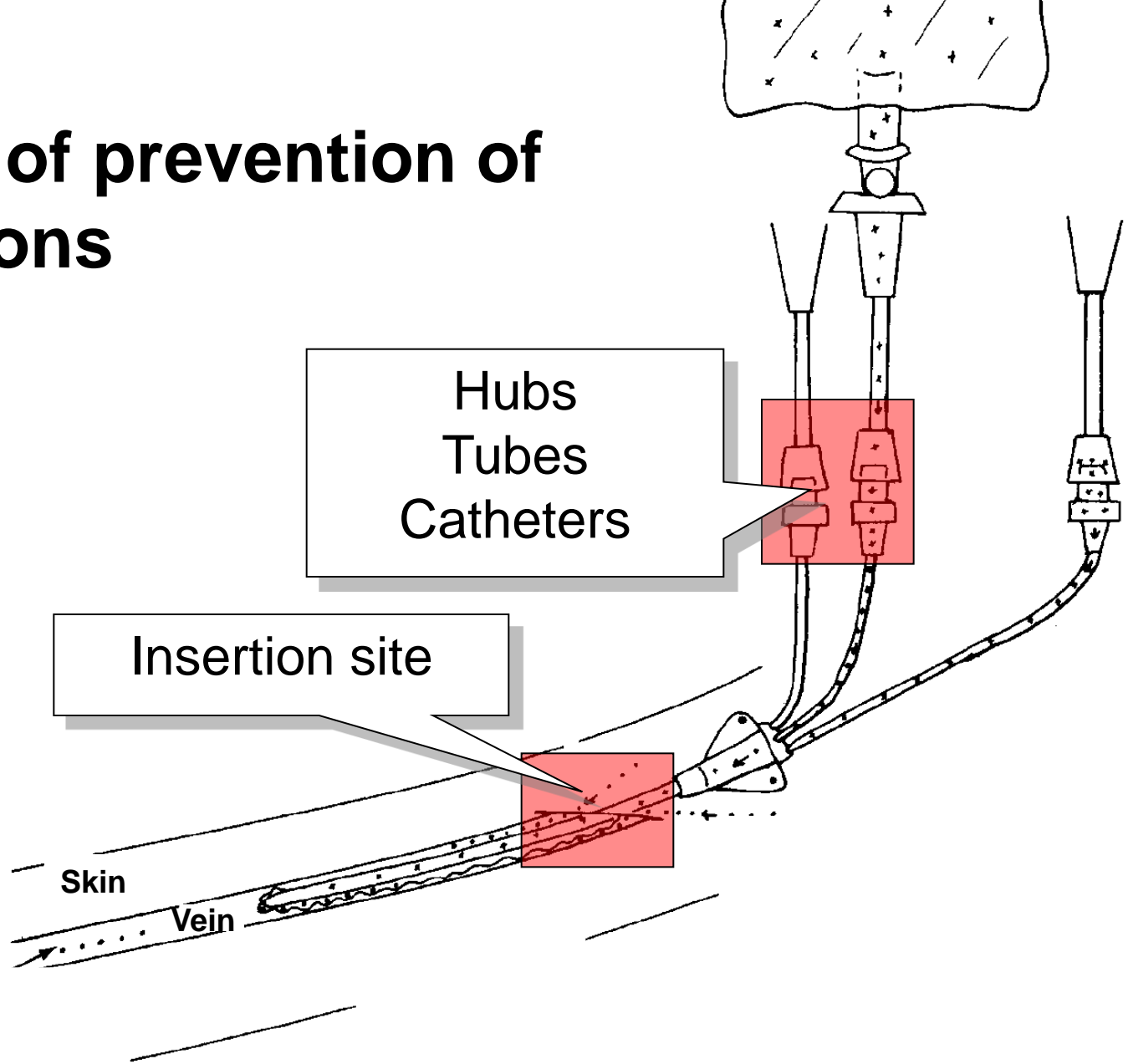


Figure. Source of intravascular catheter-related infections.

Incidence density

Events per 1000 device-days

Central venous catheter (CVC)

2.7/1000 catheter-days

PICCs

2.1/1000 catheter-days

Tunneled CVCs

1.6/1000 catheter-days

Peripheral venous catheters

0.5/1000 catheter-days

Implantable port systems

0.1/1000 catheter-days



**Risk for
CLABSI**

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*

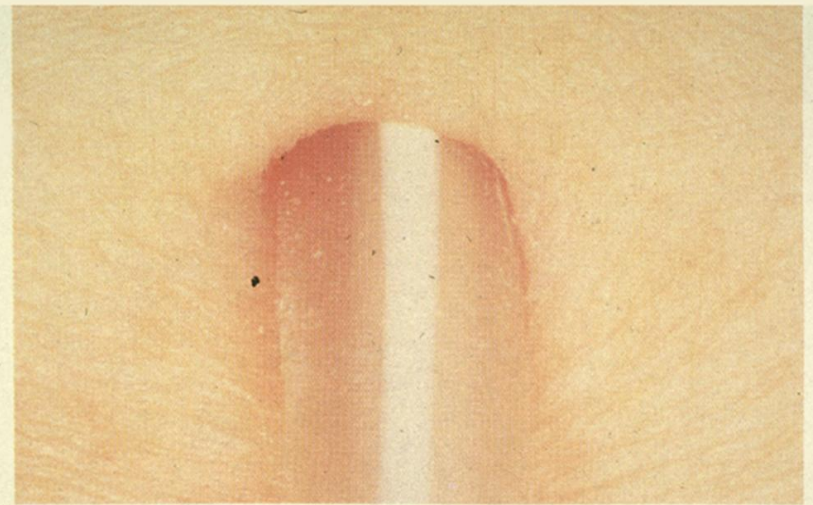


Figure BU—External appearance of a good exit. Skin color natural with pale pink rim; no drainage (magnification 4.5 X).

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 the 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

Sources of intravascular catheter infection

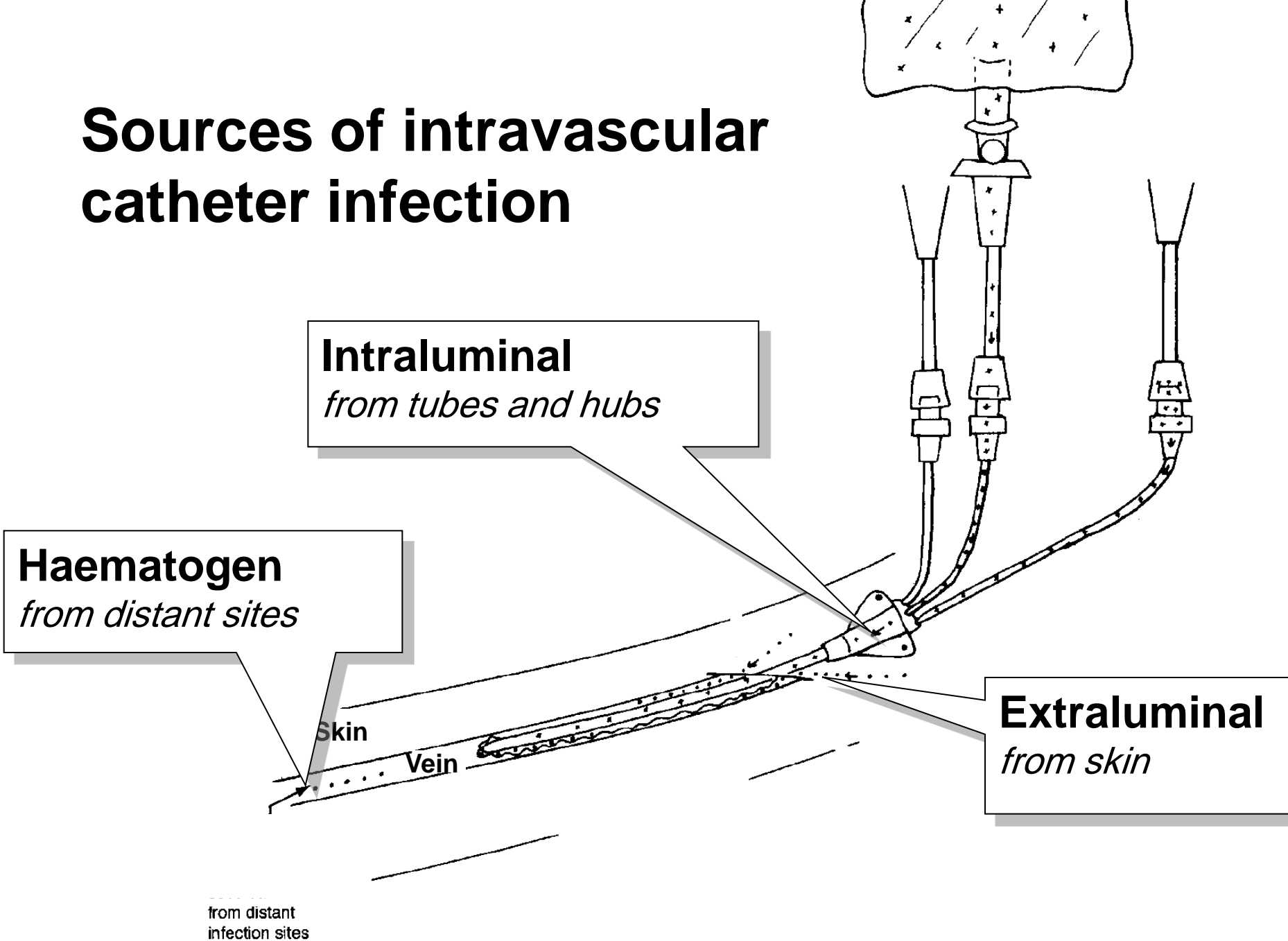


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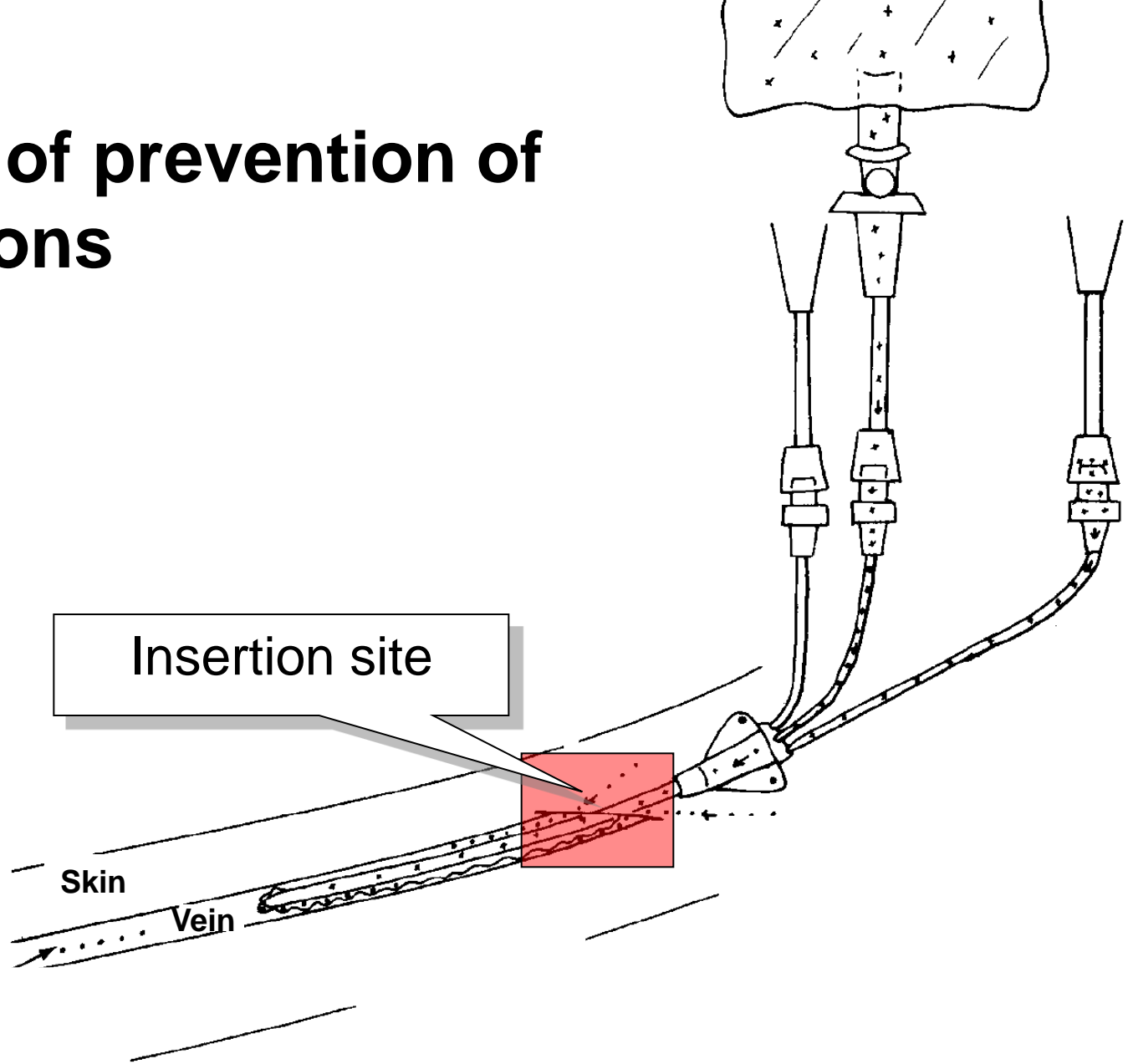


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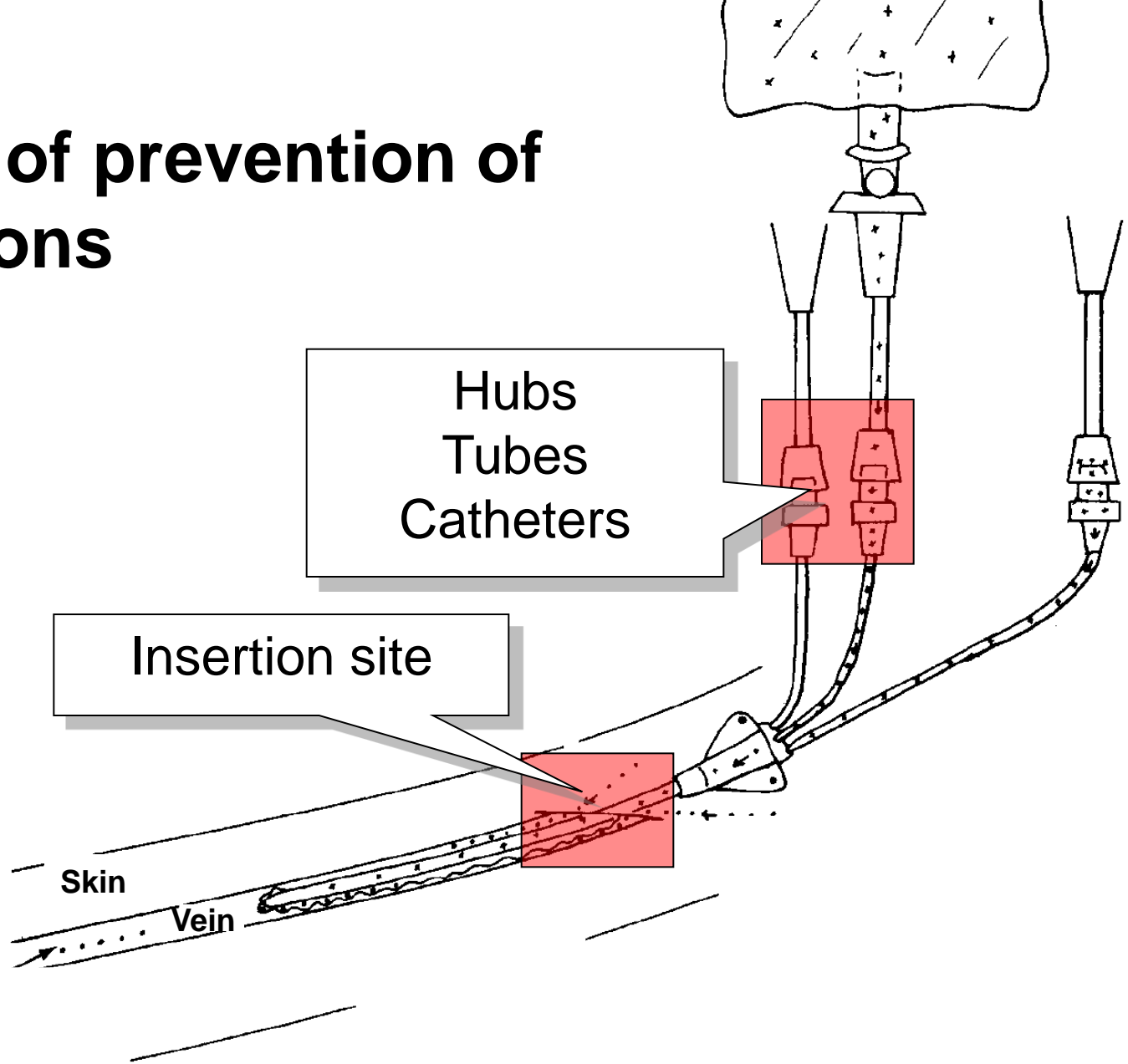


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Catheter-related Bacteremia: Treatment Options

□ 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

Systemic Antibiotics				
Antibiotic	Dosing Regimen			
Vancomycin	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			
Gentamicin (or tobramycin)	1 mg/kg, not to exceed 100 mg, after each dialysis session			
Ceftazidime	1 g IV after each dialysis session			
Cefazolin	20 mg/kg IV after each dialysis session			
Daptomycin	6 mg/kg after each dialysis session			
Antibiotic Lock				
Type of Lock Solution	Volume of Solution (mL)			
	Vancomycin*	Ceftazidime†	Cefazolin‡	Heparin‡
Vancomycin/ceftazidime	1.0	0.5	—	0.5
Vancomycin	1.0	—	—	1.0
Ceftazidime	—	1.0	—	1.0
Cefazolin	—	—	1.0	1.0

(a) Vancomycin(5mg/cc) 1.5 cc

(b) Ceftazidime(10mg/cc) 1.0 cc

(c) Heparin (5000u/cc) 1.0 cc

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

Tunneled HD catheter, with probable CRBSI

Draw blood cultures

Start empiric antibiotics +/- antibiotic locks

Blood cultures positive & Symptom resolution

Coagulase negative Staph

Antibiotics for 10-14 days
Exchange CVC over guidewire

Gram negative

Staph aureus

Antibiotics for 3-4 weeks,
if TEE negative
Remove CVC

Blood cultures positive
Symptoms worsening

Look for metastatic infections

Antibiotics for 6 weeks
Remove CVC

Core Interventions for Dialysis BSI Prevention.

Surveillance and feedback

- Conduct monthly surveillance for BSIs and other dialysis events using CDC's NHSN.
- Calculate facility rates and compare with rates in other NHSN facilities.
- Actively share results with front-line clinical staff.

Hand hygiene observations

- Perform observations of hand hygiene opportunities monthly
- Share results with clinical staff.

Catheter/vascular access care observations

- Perform observations of vascular access care and catheter accessing quarterly.
- Assess staff adherence to aseptic technique when connecting and disconnecting catheters and during dressing changes.
- Share results with clinical staff.

Staff education and competency

- Train staff on infection control topics, including access care and aseptic technique.
- Perform competency evaluation for skills such as catheter care and accessing every 6 to 12 mo and upon hire.

Core Interventions for Dialysis BSI Prevention

Patient education/engagement

- Provide standardized education to all patients on infection prevention topics including vascular access care, hand hygiene, risks related to catheter use, recognizing signs of infection, and instructions for access management when away from the dialysis unit.

Catheter reduction

- Incorporate efforts (eg, through patient education, vascular access coordinator) to reduce catheters by identifying and addressing barriers to permanent vascular access placement and catheter removal.

Chlorhexidine for skin antisepsis

- Use an alcohol-based chlorhexidine (>0.5%) solution as the first-line skin antiseptic agent for central line insertion and during dressing changes.

Catheter hub disinfection

- Scrub catheter hubs with an appropriate antiseptic after cap is removed and before accessing. Perform every time catheter is accessed or disconnected.

Antimicrobial ointment

- Apply antibiotic ointment or povidone-iodine ointment to catheter exit sites during dressing change.

Summary

- CRBSIs are a major cause of hospitalization and mortality in hemodialysis patients.
- Prevention is key! The CDC outlines 9 core preventive measures to reduce CRBSIs, including maximal barrier precautions with catheter insertion and catheter care, topical antibiotics, education, and surveillance.
- Gram-positive organisms are responsible for most CRBSIs, with *S aureus* and coagulase-negative staphylococci comprising 40% to 80%.
- *S aureus* bacteremia is associated with 30% to 50% mortality in hemodialysis patients, and most likely to cause metastatic complications.
- Treatment strategies for CRBSIs can be categorized into systemic antibiotics, antibiotics locks, and catheter management.
- CRBSI management decisions depend on clinical presentation of the patient, microorganism isolated, and vascular access options of the patient.

- All CRBSIs require a minimum 2 to 3 weeks' systemic antibiotic therapy.
- *S aureus* CRBSIs and complicated infections should be treated with systemic antibiotic therapy for minimum 4 to 6 weeks.
- Antibiotics locks have been shown to be effective adjunctive therapy to systemic antibiotics in the treatment of CRBSIs.
- CRBSI catheter management options include immediate catheter removal with insertion of a temporary catheter at another site, guidewire exchange, or catheter salvage with an antibiotic lock.
- Catheters should be removed in patients who are hemodynamically unstable, have metastatic complications, or have the following organisms on blood culture—*S aureus*, *Pseudomonas*, fungus.
- If catheter salvage is attempted, an adjunctive lock should be used in conjunction with the systemic antibiotics.
- Every dialysis program should have an infection surveillance program with dedicated personnel and resources, to facilitate identification of catheter-related infections and timely interventions to reduce infection rates and improve patient clinical outcomes.

Thank you