

Management of Catheter Related Bloodstream Infection (CRBSI), including Antibiotic Lock Therapy.

Written by: Dr K Gajee, Consultant Microbiologist

Date: June 2017

Approved by: Drugs & Therapeutics Committee

Date: October 2017

Implementation Date: December 2017

For Review: October 2019

BACKGROUND

Micro-organisms can gain access to the catheter lumen via a contaminated hub or infusate

Colonisation of catheter external surface may result from contamination during insertion, via exit site colonisation or due to a bacteraemia

The longer a catheter is in place, the more likely it is to become colonized

Infection:

- is the major complication associated with long term intravascular catheters
- can have serious consequences such as metastatic infection and death
- is divided clinically into local (exit site or tunnel infection) and bloodstream infections, but these may coexist
- begins with colonisation of either the external surface or catheter lumen, the latter being more common in long-term device infection

Please refer to the Central Venous Access Devices (CVADS) Care and Management Policy PAT/T23

Causative organisms

- Coagulase-negative staphylococci are the most common cause of CRI
- *Staphylococcus aureus*
- *Candida species*
- *Enterococcus species*
- Gram-negative organisms such as *Pseudomonas aeruginosa* and *Stenotrophomonas maltophilia*
- Enterobacteriaceae (eg *E.coli*, *Citrobacter*, *Enterobacter* and *Serratia species*) –common with femoral lines
- Alpha-haemolytic streptococci (particularly in patients with haematological malignancy)
- *Mycobacterium species*

Catheter related blood-stream infection (CRBSI)

Clinical Presentation

- history of rigors, chills or fever after use of the line is highly suggestive
- symptoms of CRBSI: fever, rigors, chills, general malaise, anorexia, vomiting
- patients with tunnel infection usually complain of pain along the tract
- exit site infection may complain of pain and/or discharge from the exit site

Investigation

- paired blood cultures : taken via the catheter and the same volume of blood taken from a peripheral vein **within 15 min of each other**
 - if the catheter has more than one lumen, then take blood through each lumen in addition to the peripheral set
 - blood culture from dialysis circuit if patient is on haemodialysis

 - if the line is being removed : send the distal 5cm of the line tip plus a peripheral blood culture

 - if exit site is red, painful or discharging pus then take swabs for culture
- * Only staff who have completed a competency based package from clinical skills should access any CVAD device

Diagnostic Criteria

A diagnosis of CRBSI is achieved by any of the following 2 criteria :

- same organism recovered from peripheral blood culture and from quantitative (>15 colony-forming units) culture of the catheter tip
- same organism recovered from a peripheral and a catheter lumen blood culture, with growth detected 2 hours sooner (ie, 2 hours less incubation) in the latter

Empiric antimicrobial treatment (before the pathogen is known)

Clinical Condition	Agents	Alternative
Low –Moderate risk of sepsis (as per Trust Sepsis IPOC)	Teicoplanin 400mg BD for first 3 doses then 400mg OD Except for patients on dialysis then IV Vancomycin (refer to the dialysis protocol)	If allergy to Teicoplanin or Vancomycin then discuss with the Microbiologist
High risk sepsis (as per Trust Sepsis IPOC)	Teicoplanin 400mg BD X 3 doses, then 400mg OD PLUS Temocillin 2g BD	<i>If non-life threatening allergy to penicillin</i> IV Aztreonam 1g TDS PLUS Teicoplanin 400mg BD X 3 doses then 400mg OD <i>If life threatening allergy to penicillin</i> IV Ciprofloxacin 400mg BD Plus Teicoplanin 400mg bd X 3 doses then 400mg OD
Neutropenic sepsis	Teicoplanin 400mg BD X 3 doses then 400mg OD PLUS Piperacillin –Tazobactam 4.5g QDS	<i>If non-life threatening allergy to penicillin</i> Teicoplanin 400mg BD X3 dose, then 400mg OD PLUS IV Meropenem 1g TDS
Exit site infection	Oral Flucloxacillin 500mg – 1g QDS	If Penicillin allergy then Oral Clarithromycin 500mg BD or Oral Clindamycin 450mg QDS

Other measures

- Removal of the intravascular catheter is the most reliable means of eliminating infection, usually in combination with antimicrobial therapy
- Catheters should ideally be removed in the following situations:
 - * Bacteraemia, sepsis or local complications [e.g. signs of tunnel or exit site infections] persisting >72h after commencing therapy
 - * Micro-organisms known to be difficult to eradicate e.g. *Staphylococcus aureus*, *Bacillus sp.*, *Corynebacterium sp.* Mycobacteria, *Stenotrophomonas maltophilia* and fungi
 - * Presence of metastatic complications e.g. infective endocarditis, infected pulmonary embolism
 - * Relapse of infection after antibiotics have been discontinued.
- **Catheter removal alone may be sufficient for intravascular catheters colonised by low-grade pathogens, such as coagulase-negative staphylococci**
 - * Decision to remove the catheter should involve the managing consultant or registrar
 - * For patients receiving parenteral nutrition via the catheter, please contact nutrition support team (**bleep 1812**) before arranging removal of the catheter
 - * For patients on Home parenteral nutrition, the patient must be discussed with the relevant Intestinal Failure centre if the DBH NST are not available
- **Intravascular catheter salvage**
 - * May be appropriate because infection and catheter colonisation can sometimes be eradicated with antimicrobial therapy alone
 - * Should be discussed with a Microbiologist and considered when:
 - the risk of replacing catheter is high [e.g. coagulopathy]
 - alternative vascular access sites are limited/not available

Confirmed CRBSI

- Complicated**
- Suppurative thrombophlebitis
 - Endocarditis
 - Osteomyelitis
 - Etc.

- Uncomplicated**
- Bloodstream infection and fever resolves within 72 hours in a patient who has no intravascular hardware
 - No evidence of endocarditis
 - Suppurative thrombophlebitis and for *S. aureus* is also without active malignancy
 - Immunosuppression

Remove catheter and treat with systemic antibiotic for 4-6 weeks: 6-8 weeks for osteomyelitis in adults

Coagulase-negative staphylococci

- Remove catheter & treat with systemic antibiotic for 24-48hrs
- If catheter is retained, treat with systemic antibiotic + antibiotic lock therapy for 10-14 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.

Antibiotic options should be discussed with Microbiology and directed based on sensitivity results

ANTIBIOTIC LOCK THERAPY

Indicated for patients with CRBSI involving long-term catheters with no signs of exit site or tunnel infection for whom catheter salvage is the goal.

Antibiotic lock therapy should be used in conjunction with systemic antimicrobial therapy

Discuss with the Microbiologist before lock therapy is commenced.

* If the catheter is being used for parenteral nutrition please contact the nutrition support team within working hours (or Intestinal Failure Centre for patients on Home parenteral Nutrition outside of working hours)

AGENTS AND CONCENTRATION

<i>AGENT</i>	<i>CONCENTRATION</i>	<i>DILUENT</i>
Vancomycin	10mg/ml	Na chloride 0.9%
Teicoplanin	10mg/ml	Na chloride 0.9%
Gentamicin	5mg/ml	Na chloride 0.9%
Taurolock™	4%	N/A

Addition of heparin is not usually recommended. There is poor evidence of the role of heparin in reducing central venous catheter thrombosis

ANTIBIOTIC VOLUMES

<i>TYPE OF CVC CATHETER</i>	<i>VOLUME</i>
Picc	1 ml per lumen
Hickman	2 ml per lumen
Vascath	2 ml per lumen
Temporary CVC	0.5 ml per lumen

WHEN TO REPLACE THE LINE LOCK FLUID

- Ideally the lock should be left in place for 24hours
- Dwell time for the lock solution should not exceed 48hours before reinstallation of lock solution
- The line should not be used between locks but if necessary the lock must be removed before infusion of the next dose of antibiotic, other intravenous medication or solution

DURATION OF ANTIBIOTIC LOCK THERAPY

- The duration of therapy has varied substantially between different studies, most studies have used 2-week duration
- If antibiotic lock therapy is used in conjunction with systemic antimicrobial therapy for catheter related blood stream infection – treat for 7-14 days
- For patients with multiple positive catheter-drawn blood cultures that grow coagulase negative staphylococci or gram negative bacilli and concurrent negative peripheral blood cultures, antibiotic lock therapy can be given without systemic therapy for 7-14 days
- Take surveillance blood culture 48-72h after completing the course of antibiotic line locks to check for clearance

EXCEPTIONS

- Catheter removal is recommended for catheter related bloodstream infection due to *Staphylococcus aureus*, *Candida species*, resistant gram Negatives and *Mycobacteria species* instead of treatment with antibiotic lock and catheter retention