

1. Introduction and Scope

IV Line associated bacteraemia is defined as a bloodstream infection due to colonisation of a vascular catheter. Approximately 5% to 7% of patients with indwelling central lines develop a bloodstream infection. The incidence of line associated bacteraemia increases with the length of time the line is in situ, the number of ports, and the number of manipulations.

All patients with an intravenous line should be monitored using a fully completed Visual Infusion Phlebitis (VIP) score.

Coagulase negative staphylococci and *S. aureus* are the most common colonising and infecting organisms, followed by *Enterococci*, Gram-negative bacteria and *Candida species*.

Central lines should be removed if there is evidence of the development of purulent discharge, cellulitis, or erythema at the puncture site, malfunction of the device, positive blood cultures with time to positivity of 2 hours or more between the paired cultures, or septic clinical pattern with no other obvious source of infection.

In patients with *Coagulase Negative Staphylococci* line infections, antibiotic line lock therapy (ALLT) may be considered for catheter-related infections where line replacement is difficult.

This guideline does not supersede the neutropenic sepsis guideline and should be used in addition to it in patients presenting with neutropenic sepsis. Management of haemodialysis lines is not included in these guidelines. Please refer to separate renal guidelines.

2. Guideline Standards and Procedures

2.1. Signs of IV line associated infections

- Pain around exit site
- Purulent discharge
- Erythema
- Induration around exit site
- There may be signs of systemic infection and sepsis if line infections have resulted in bacteraemia.
- Rigors or pyrexia associated with line use or line flushes

2.2. Peripheral Line Infections (e.g. cannulas and mid-lines)

2.2.1. Microbiological Samples for Peripheral Line Infections

- Swab cannula exit-site
- Peripheral blood cultures

2.2.2. Management for Peripheral Line Infections

Peripheral vascular catheters should always be removed if infected

No signs of Sepsis, localised infection only	Sign of Sepsis
<p>Initial management</p> <p>First line</p> <ul style="list-style-type: none"> • Oral flucloxacillin 1g QDS • If NBM give IV flucloxacillin 2 g QDS. <p>Penicillin allergy</p> <ul style="list-style-type: none"> • Oral doxycycline 200 mg OD <p>History of MRSA colonisation or Nil by mouth with penicillin allergy</p> <ul style="list-style-type: none"> • IV vancomycin, prescribed as per UHL adult vancomycin protocol 	<p>Initial management</p> <p>First line</p> <ul style="list-style-type: none"> • IV flucloxacillin 2 g QDS <p>Penicillin allergy or history of MRSA colonisation</p> <ul style="list-style-type: none"> • IV vancomycin, prescribed as per UHL adult vancomycin protocol
<p>Ongoing management</p> <ul style="list-style-type: none"> • Review culture results at least daily and ensure organism is susceptible to prescribed antimicrobials. <ul style="list-style-type: none"> ○ If <i>Staphylococcus aureus</i> is isolated from blood cultures: Seek microbiology advice for ongoing management. Patient will need at least 14 days of antimicrobial therapy. ○ If coagulase negative Staphylococcus isolated: Treat until signs of cellulitis resolve. If infective endocarditis or deep source of infection is suspected, seek microbiology advice. ○ If other Gram positive organism isolated: Complete 5 days treatment or until signs of cellulitis resolve. Seek microbiology advice for ongoing management. ○ If Gram negative or fungal organism isolated: Discuss with microbiology for advice on choice and duration of antimicrobial therapy 	

2.3 Central Vascular Catheter Infections

2.3.1 Microbiological Samples for CVC infections:

- Swab line exit site if purulent discharge present
- Paired line and CVC culture

2.3.2 Management of Central Vascular Catheter Infections

Central vascular catheters should be removed as soon as possible

No signs of Sepsis, localised infection only	Sign of Sepsis
<p>Initial management</p> <p>First line</p> <ul style="list-style-type: none"> • Oral flucloxacillin 1g QDS • If NBM give IV flucloxacillin 2g QDS. <p>Penicillin allergy</p> <ul style="list-style-type: none"> • Oral doxycycline 200 mg OD <p>History of MRSA colonisation or Nil by mouth with penicillin allergy</p> <ul style="list-style-type: none"> • IV vancomycin, prescribed as per UHL adult vancomycin protocol 	<p>Initial management</p> <ul style="list-style-type: none"> • IV vancomycin, prescribed as per UHL adult vancomycin protocol
<p>Ongoing management</p> <ul style="list-style-type: none"> • Review culture results at least daily and ensure organism is susceptible to prescribed antimicrobials. <ul style="list-style-type: none"> ○ If <i>Staphylococcus aureus</i> is isolated: Seek microbiology advice for ongoing management. Patient will need at least 14 days of antimicrobial therapy. ○ If coagulase negative Staphylococcus isolated: Complete 5 days treatment. Switch to oral therapy once clinically improving and taking medicines orally. Treat localised infection until cellulitis resolved. ○ If other Gram positive organism isolated: Continue current therapy. Seek microbiology advice for ongoing management ○ If Gram negative or fungal organism isolated: Discuss with microbiology for advice on choice and duration of antimicrobial therapy 	
<p>If central vascular catheter(s) cannot be removed consider antibiotic line lock therapy (ALLT) (section 2.4) if Coagulase Negative Staphylococci is identified on culture.</p>	

2.4 Antibiotic Line Lock Therapy (ALLT)

This section applies to patients with acute CVC related infections with *Coagulase Negative Staphylococci* (CoNS) where the CVC cannot be removed due to limited vascular access sites. ALLT involves instilling an antibiotic solution into a catheter hub and allowing the solution to dwell for a set period of time. The goal of the therapy is to eradicate intraluminal organisms.

Recurrent CVC-associated infections are most common in patients on long term parenteral nutrition (PN), and long-term or even life-long therapy may be needed. However, evidence is limited and ALLT is not routinely recommended. This guideline does not include the management and prevention of recurrent CVC infections, and such cases must be discussed with microbiology.

ALLT must not be used for monotherapy for systemic infection. Appropriate systemic antimicrobial therapy must be given in patients with signs of systemic infection.

ALLT should be discussed with microbiology before prescribing, and a verification code for the antibiotic must be documented on the prescription.

2.4.1 Patients must meet ***all*** of the following criteria:

- Documented CVC related infection with CoNS
- Replacement of CVC is not feasible
- No evidence of exit site or tunnel infection (ALLT is ineffective in extra-luminal infection)
- No documented allergy to vancomycin or teicoplanin

2.4.2 ALLT is generally ***not*** suitable for the following organisms:

- *Staphylococcus aureus*
- *Beta haemolytic Group A streptococcus*
- *Candida* spp and other fungal infections
- *Pseudomonas aeruginosa*
- Gram-negative *Enterobacteriales*
- Mycobacterial infections
- Polymicrobial infections

For other organisms not on the above list, ALLT may be a potential consideration depending on patient circumstances. Assessment of each individual case should be made via discussion with Microbiology to review culture results and assess suitability for ALLT.

2.4.3 Prescribing antimicrobials for ALLT

Choice and concentration of antimicrobial to prescribe

	Antibiotic to prescribe	Concentration to prescribe	Dwell Time
First line	Vancomycin	10 mg/mL	24 hours (e.g. OD prescription)
Second Line	Teicoplanin	10 mg/mL	24 hours (e.g. OD prescription)
Duration of ALLT is guided by microbiology, or until the line can be removed, but should be no longer than 14 days.			
Gentamicin locks may be considered for CVC related infections with selected gram negative organisms following discussion with microbiology.			

Volume of antimicrobial solution to prescribe

- Depending on the type of CVC the volume may be found written on the catheter or clamp. Do not exceed a maximum volume of 5mL

If CVC volume cannot be accurately determined as above, the volume should be estimated using the table below. If the volume of the line is estimated in this way it is accepted that some of the volume may be systemically injected into the patient but the effect this will have is nominal.

Type of CVC	Adult Patient >30kg
Non-tunnelled CVC (PICC)	3 mL
Tunnelled CVC (Hickman, Broviac)	5 mL
Tunnelled Haemodialysis CVC (PermCath)	5 mL
Porta-A-Cath (ALLT may be less effective in treating infections in implantable ports than other types of CVC)	2 mL

Other considerations

- ALLT should ideally dwell in the lumen for 24 hours without disruption. ALLT is not suitable if CVC is being accessed for multiple daily doses of other intravenous medicines. This information should form part of the discussion with microbiology
- If patient has a single lumen CVC or port, another line (peripheral or PICC) may need to be placed for other intravenous medication
- If patient has a double lumen CVC:
 - The antibiotic solution can be placed in the infected lumen for 24 hours while the other lumen is used for other medicines.
 - During the next 24-hour period, the other lumen can be locked with the antibiotic solution and allowed to dwell while the first lumen is used for medicines.
- Use of heparin with ALLT is not routinely recommended due to risk of reduced stability and systemic heparin exposure.

2.4.4 Procedure for ALLT

Procedure for the instillation of ALLT

1. Ensure aseptic non-touch technique followed as per Trust policy ([B20/2013](#)).
2. Prepare antibiotic line lock solution.
 - a. Calculate what overall dose of antibiotic is needed
(e.g. if vancomycin is prescribed at 10 mg/mL, and the volume required is 5 mL, the overall dose will be 50 mg).
 - b. Ensure calculations and reconstitution is double checked as per medicines administration policy (See [UHL IV Policy](#) and [LLR Medicines code](#)).
 - c. Reconstitute antibiotic vial as per product instructions
 - d. Draw up the required volume of antibiotic into a 10 mL syringe
(e.g. vancomycin vial concentration is 50 mg/mL once reconstituted, so 1 mL is required for a dose of 50 mg).
 - e. Draw up 0.9% sodium chloride into the 10 mL syringe which already contains the required dose of antibiotic until the required volume is obtained.
(e.g. draw up approximately 4 mL 0.9% sodium chloride in addition to the 1ml of vancomycin solution made in the previous step to make the final volume up to 5 mL)
3. Assemble all the required equipment and take to the patient's bed side. Required equipment:
 - a. The antibiotic line lock solution as described in point 2
 - b. One 5 mL or 10 mL sodium chloride 0.9% flush
 - c. 2% chlorhexidine in 70% alcohol wipes
 - d. Sharps bin
4. Confirm patient's identify and allergies.
5. Explain procedure to the patient.
6. Perform hand hygiene then don sterile gloves.
7. Thoroughly clean needle-free connector (for 30 seconds) using a 2% chlorhexidine in 70% alcohol wipe. Allow to dry.
8. If antibiotic line lock is already in situ, follow procedure as set out in '[Procedure for aspiration or removal of ALLT](#)' below.
9. Unclamp CVC and gently flush with one sodium chloride 0.9% flush using the push pause technique to maintain line and confirm patency.
10. Clamp CVC and remove syringe.
11. Unclamp CVC and gently instil appropriate volume of line lock solution.
12. Clamp CVC and remove syringe.
13. Discard of syringes into a sharps bin.
14. Clearly label the CVC to indicate the lumen contains an antibiotic line lock solution.
15. Remove gloves and wash hands.
16. Sign the prescription to demonstrate administration has occurred.

Procedure for aspiration or removal of ALLT

This procedure should be followed each time the antibiotic line lock needs to be given/changed. This procedure should also be followed if the CVC needs to be used to administer medicines or parenteral nutrition, ensuring the line is flushed with sodium chloride 0.9% before these are administered.

1. Ensure aseptic non-touch technique followed as per Trust policy ([B20/2013](#)).

2. Assemble all the required equipment and take to the patient's bed side. Required equipment:
 - a. One 10 mL IV medicines syringe, which will attach onto CVC
 - b. One 5 mL or 10 mL sodium chloride 0.9% flush
 - c. 2% chlorhexidine in 70% alcohol wipes
 - d. Sharps bin
3. Explain procedure to the patient.
4. Perform hand hygiene then don sterile gloves.
5. Check the CVC. Notify medical team and do not proceed if:
 - a. CVC is leaking
 - b. If concerned that a precipitate has formed in indwelling line lock solution
6. Thoroughly clean needle-free connector (for 30 seconds) using a 2% chlorhexidine in 70% alcohol wipe. Allow to dry.
7. Connect empty syringe onto CVC.
8. Unclamp CVC and withdraw the antibiotic line lock solution slowly, then clamp the CVC.
9. If the line lock cannot be withdrawn from the line (e.g. the line will not draw back):
 - a. Clamp the CVC
 - b. Remove the empty syringe and replace with the sodium chloride 0.9% flush.
 - c. Unclamp the CVC
 - d. Slowly flush the line using the push pause technique. This should be done over three minutes to avoid causing *red person syndrome*.
 - e. Clamp the CVC.
 - f. Inform the medical team that the line lock is being flushed rather than withdrawn and record this in the nursing or medical notes.
10. Remove gloves and wash hands.
11. Discard syringes in a sharps bin.

3. Education and Training

Nil additional

4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
Adherence to guideline prescribing recommendations	Trust wide annual antimicrobial prescribing audit	Antimicrobial Pharmacists	Annually	CMGs and TIPAC

5. Supporting References

1. Mermel LA, et al. (2009). Clinical Practice Guidelines for the Diagnosis and Management of Intravascular Catheter-Related Infection: 2009 Update by the Infectious Diseases Society of America, *Clinical Infectious Diseases*, **49**(1):1–45 [<https://doi.org/10.1086/599376>]
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6. Lal, S. Chadwick. P, Nightingale, J (2019) Management of catheter related blood stream infections (CRBSI) BAPEN
7. Cesar Bustos, Aitziber Aguinaga, Francisco Carmona-Torre, and Jose Luis Del Pozo. (2014) Long-term catheterisation: Current approaches in the diagnosis and treatment of port-related infections. *Infect Drug Resist.* **7**: 25-35

6. Key Words

- Central Venous Catheter
- CVC
- Line infections
- Line sepsis
- Antibiotic Line Lock therapy

CONTACT AND REVIEW DETAILS	
Guideline Lead (Name and Title) Dr Felicia Lim Consultant Medical Microbiologist	Executive Lead Medical Director
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