### Nottingham Renal and Transplant Unit

<table>
<thead>
<tr>
<th><strong>Full Title of Guideline:</strong></th>
<th>Guideline for the Diagnosis and Treatment of Central Venous Catheter Related Infections in Haemodialysis Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Author (include email and role):</strong></td>
<td>Dr S.D. Roe, Consultant Nephrologist. <a href="mailto:simon.roe@nuh.nhs.uk">simon.roe@nuh.nhs.uk</a></td>
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<tr>
<td><strong>Division &amp; Speciality:</strong></td>
<td>Cancer and Associated Specialities (CAS) / Renal and Transplant</td>
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<td><strong>Scope (Target audience, state if Trust wide):</strong></td>
<td>Speciality specific guideline</td>
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<tr>
<td><strong>Review date (when this version goes out of date):</strong></td>
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<td><strong>Explicit definition of patient group to which it applies (e.g. inclusion and exclusion criteria, diagnosis):</strong></td>
<td>Applies to: All patients under the care of the Nottingham Renal and Transplant Unit (including patients dialysing at Kings Mill Hospital and Ilkeston Community Hospital and Diaverum Clinic Lings Bar Hospital</td>
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<tr>
<td><strong>Changes from previous version (not applicable if this is a new guideline, enter below if extensive):</strong></td>
<td>No major changes from previous version, apart from reduction in duration of antibiotic line locks from 3 to 2 weeks.</td>
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<tr>
<td><strong>Summary of evidence base this guideline has been created from:</strong></td>
<td>See evidence base section below</td>
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</tbody>
</table>

*This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date or outside of the Trust.*
Evidence base of policy:

These guidelines have been derived using the following evidence base.


2. Management of infected cuffed central venous catheters used for hemodialysis. *UpToDate Accessed January 2017*

3. Local microbiological advice.


Audit Plans:

The following are the subject of prospective audit:

- Line insertions (tunneled and non-tunneled)
- Proportion of patients dialysing using tunneled catheters
- Bacteraemic episodes related to line infections
- Outcome of tunneled catheters in patients with catheter related bacteraemia (proportion removed, proportion salvaged with antibiotic lock protocol alone, proportion salvaged with antibiotic therapy and guidewire catheter exchange).
- Serious morbidity and mortality related to line exposure

A root cause analysis is undertaken of all MRSA and MSSA catheter related bacteraemias.

Training and implementation:

Management of Dialysis Lines is discussed in the Junior Doctors induction day and these guidelines will be included in the programme. Handling and management of lines is taught in the Renal course, and in the clinical areas by the clinical educators.

Changes from previous guidelines:

- There has been a sustained and significant reduction in the proportion of patients dialysing using a tunneled dialysis catheter from over 40% to around 14%.
- A catheter care bundle is used for both the insertion and on-going maintenance of central venous catheters.
- The Mr Victor (Multi Racial Visual Inspection Catheter Tool Observation Record) tool is used to formalise the documentation of exit sites for both tunneled and non-tunneled catheters.
• In order to preserve future access options, the practice of peripheral blood sampling from vessels that potentially could be used in the future for creation of vascular access should be limited or avoided.
• Duration of antibiotic line locks reduced to 2 weeks.

INTRODUCTION
Central venous catheters were originally introduced for short-term dialysis. They have now become an acceptable form of permanent access in patients with limited access options. Dual lumen non-cuffed catheters are used for temporary access. Dual lumen tunnelled catheters are the preferred form of access for intermediate use. They also form the permanent access option in a limited subset of dialysis patients. Catheter related infections remain a significant cause of morbidity and mortality. Metastatic complications frequently occur with systemic infections. The risk is higher with *Staphylococcus aureus* infections. Fatal outcome is reported in 6-18% of patients.

Local Bacteriology Data
Gram-positive organisms are responsible for about 80% of catheter-related infections. Staphylococcal infections account for around 60% of infections. The remainder are due to enterococci and gram-negative rods. Rates of pseudomonas, MRSA and fungal infections are very low. Over the last year all the Gram positive isolates were vancomycin sensitive, gentamicin resistance amongst Gram negative isolates remains low. Mupirocin resistance amongst Staphylococcal aureus infections remains low (7.7%).

KEY POINTS
• Empirical antibiotic therapy for catheter related infections should consist of vancomycin and gentamicin.
• Non-cuffed catheters should be removed as soon as infection is suspected.
• Cuffed Catheters
  o Exit site infections usually respond to antibiotic treatment alone.
  o Tunnel infections may respond to parenteral antibiotic therapy, but catheter removal will generally be necessary if the infection involves the Dacron cuff.
  o **Patients who are unwell with catheter related bacteraemia or positive blood cultures for pseudomonas or fungi should have their catheter removed promptly.**
  o Patients with positive blood cultures for *Staphylococcus aureus*, who are clinically stable and have been afebrile for 72 hours, should be treated with catheter exchange over a guidewire at around day 7, 4 weeks antibiotics (parenteral antibiotics for 2 weeks) and antibiotic line locks for 2 weeks.
  o Catheter salvage can be attempted in stable patients with catheter related bacteraemia. Parenteral antibiotics should be given in combination with a vancomycin/ gentamicin/ heparin line lock for 2 weeks.
  o Patients with recurrent or relapsed infections should be treated either with catheter exchange over a guidewire or catheter removal followed by replacement at a later date.
• MRSA is more likely to be present if the patient has recently been an inpatient in hospital, either in Nottingham or elsewhere.
• In all cases microbiology results should be reviewed as soon as available and antibiotic treatment adjusted accordingly. Any previous microbiology results should also be reviewed. If in doubt discuss with Microbiology.
PREVENTING CATHETER RELATED SEPSIS

- Tunnelled catheter use should be minimised as far as possible. Patients should be referred in a timely manner for vascular access. Patients suitable for the construction of a primary AV fistula should be referred for surgical review within 6 months of the anticipated need for dialysis. All patients with a tunnelled line should have an access plan. The number of patients in whom tunnelled catheters are their only method of access should be kept to a minimum.

- The clinical guideline ‘Care Bundle for Insertion and Maintenance of Central Venous Catheters within the Renal and Transplant Unit’ describes in more detail the strategies in place to reduce the risk of central venous catheter (CVC) related infection and should be read in conjunction with this document.

TEMPORARY DIALYSIS LINES (JUGULAR AND FEMORAL CATHETERS)

- Temporary lines are indicated for short-term vascular access only (less than 3 weeks).
- Patients requiring (or who are likely to require) central venous access for more than 3 weeks should have a tunnelled catheter (Permcath) inserted.

Exit site infection

This is a clinical diagnosis and is characterised by:

- Purulent discharge
- Erythema / Induration around exit site
- Pain around exit site

Exit sites in patients with temporary catheters should be assessed daily using the Mr Victor tool. This gives a graded score from 0 (no signs of infection) to 4 (signs of advanced infection).

Catheter related bacteraemia

Line related blood stream infections should be suspected in the following circumstances:

- Positive blood cultures
- Pyrexia > 38°C
- Rigors, in particular whilst on dialysis

Management

1. Take exit site and nasal swab for culture and sensitivity (send to microbiology).
2. Two sets of blood cultures should be taken, which can consist of a single peripheral drawn blood sample and a second sample obtained from the dialysis catheter or two samples drawn from separate peripheral sites (avoid veins that could be utilised for future vascular access). However, if blood cannot be obtained from a peripheral vein, two separate samples taken 10 to 15 minutes apart from the dialysis catheter or dialysis tubing should be obtained before antibiotics are administered. Check FBC and C-reactive protein. Staff accessing dialysis lines should have the relevant competencies to allow them to safely undertake this procedure.
3. The patient should be seen and assessed by a doctor, with particular attention to signs of seeding of infection, e.g. endocarditis or osteomyelitis.
4. **The line should be removed immediately infection is suspected.**
5. Line tip should be sent for culture.
6. Empirical antibiotics should be given. Prescribe:
- Vancomycin 20mg/kg IV (rounded to the nearest 250mg; maximum dose 2g). Vancomycin should be administered at a maximum rate of 10mg/minute (i.e. dose of 1g over 100 minutes, 1.5g over 150 minutes and 2g over at least 200 minutes).
- Gentamicin 2mg/kg IV (maximum dose 200mg) given post-dialysis (Inject slowly over 3-5 mins if dose <160mg or infusion over 60 mins).

7. Patients who are clinically septic (high fever, persistent shaking or chills, low blood pressure) or where there is a concern about metastatic complications should be admitted. Those with milder symptoms can often be managed as outpatients.

8. Further antibiotics should be guided by microbiology results, patient progress and discussed with microbiology:
   - Exit site infections with negative blood cultures should generally be treated with 7 days oral antibiotics.
   - Uncomplicated *Staph aureus* bacteraemia should be treated for 2 weeks.
   - Bacteraemia due to non-*Staph aureus* species should generally be treated for 1 week.

### TUNNELLED LINES: PERMCATHS

#### Practice Tips
- Exit site infections usually respond to oral antibiotics alone, tunnel infections require treatment with parenteral antibiotics.
- **A temperature / rigor on dialysis in a patient with a tunnelled line should be treated as catheter related bacteraemia, unless an alternative source of infection is obvious clinically.**
- Treatment of infection requires appropriate cultures, and a decision as to whether the catheter requires immediate removal or, whether a period of observation with appropriate treatment is required.
- Temporary access via the femoral route may be required until a further catheter can be resited centrally.
- Catheters can be exchanged over a guidewire providing the exit site and tunnel are not infected.

#### A. Exit site & Tunnel Infections

Exit site infection is characterised by exudates, erythema and induration at the exit site in the absence of positive blood cultures or systemic symptoms. Tunnel infection is characterised by erythema and inflammation along the line of the tunnel.

Exit sites should be inspected at each dialysis session and scored using the Mr Victor tool. These scores should be recorded on the renal information system as part of the dialysis nursing assessment.

#### Investigation
- Take exit site and nasal swab for culture and sensitivity (send to microbiology).
- Obtain peripheral and line cultures if signs of advanced infection (Mr Victor Score 4).
- If catheter related bacteraemia is suspected (pyrexia >38°C, rigors) then manage as per catheter related bacteraemia section below.

#### Management

Exit site infection
- Treatment should be considered for Mr Victor scores of 2 and initiated for scores of 3 and 4.
- In most cases exit site infections should respond to antibiotic treatment alone. Do not remove catheter.
• Prescribe flucloxacillin PO 500mg qds for 14 days (Doxycycline 200mg day one then 100mg od for remaining 13 days if penicillin allergic).
• In patients known to carry MRSA prescribe vancomycin 20mg/kg IV (rounded to nearest 250mg; maximum dose 2g). Vancomycin should be administered during the last 60-90 minutes of dialysis. Vancomycin should be administered at a maximum rate of 10mg/minute (i.e dose of 1g over 100 minutes, 1.5g over 150 minutes and 2g over at least 200 minutes).
• For patients with advanced signs of infection (Mr Victor score 4) IV antibiotic therapy is generally required.
• Definitive treatment should be based on culture results.
• Consider adding rifampicin PO 300mg bd if recurrent Staphylococcal infection.
• Assess response after 14 days. An additional 2 weeks treatment may be necessary.
• Remove catheter if:
  o Failure to respond to 4 weeks antibiotics
  o Relapse or re-infection within 3 months
  o Pseudomonas or fungal infection not responding to treatment
  o Ideally new catheter should be placed with a new venotomy site, new tunnel and exit site avoiding the infected skin area.

**Tunnel Infection**

• Treat with parenteral antibiotics.
• Initial empirical treatment with
  • Vancomycin 20mg/kg IV (rounded to the nearest 250mg; maximum dose 2g). Vancomycin should be administered at a maximum rate of 10mg/minute (i.e dose of 1g over 100 minutes, 1.5g over 150 minutes and 2g over at least 200 minutes).
  • Gentamicin 2mg/kg (max 200mg) IV given post-dialysis (Inject slowly over 3-5mins if dose <160mg or infusion over 60 mins).
• Definitive therapy should be based on culture results.
• Consider adding rifampicin PO 300mg bd if Staphylococcal infection.
• If the infection fails to respond to therapy, remove the catheter and replace it using a different tunnel and exit site.
• Tunnel infections that extend beyond the cuff are best treated by catheter removal and replacement at a new venotomy site.
• Continue antibiotics for 14 days if no evidence of bacteraemia.

**Exit site granulation**

This may promote colonisation and increase the risk of subsequent infection. A swab should be taken and if positive for *Staph. aureus*, topical mupirocin 2% (*Bactroban nasal ointment*) treatment should be given.

If negative, consider silver nitrate until the granuloma has resolved. If granulation is severe consider catheter exchange over guidewire with new exit site.

**Colonisation**

This is defined as a positive swab without clinical signs of exit site or systemic infection and may come to light because someone has taken a swab (even though the reason may not be apparent). The exit site should be examined for signs of infection.

Remember: If the exit site looks infected, start treatment immediately. Do not wait for the swab result to come back.
Colonisation is associated with a higher incidence of subsequent infection. If the site is colonised with *Staph. aureus*, topical mupirocin 2% (*Bactroban nasal ointment*) should be given. Treatment is not, in general required for other colonising agents; if in doubt discuss with microbiology.

**B. Catheter-related bacteraemia**

Line related blood stream infections should be suspected in the following circumstances:

- Positive blood cultures
- Pyrexia > 38°C
- Rigors, in particular whilst on dialysis

**Investigation**

- Take exit site and nasal swab for culture and sensitivity (send to microbiology).
- Two sets of blood cultures should be taken, which can consist of a single peripheral drawn blood sample and a second sample obtained from the dialysis catheter or two samples drawn from separate peripheral sites (avoid veins that could be utilised for future vascular access). However, if blood cannot be obtained from a peripheral vein, two separate samples taken 10 to 15 minutes apart from the dialysis catheter or dialysis tubing should be obtained before antibiotics are administered. Check FBC and C-reactive protein. Staff accessing tunnelled dialysis lines should have the relevant competencies to allow them to safely undertake this procedure.
- Assess patient clinically, especially for signs of osteomyelitis and endocarditis, as well as their general condition.

**Management options for proven catheter-related bacteraemia**

- Leave catheter in.
- Change catheter over a guidewire.
- Change catheter over a guidewire with a new tunnel and exit site.
- Remove catheter and delay replacement until the infection has been treated.

The optimal treatment has not been delineated but in part depends on the causative organism and the options for alternative vascular access in an individual patient. The following approach is recommended.

1. **Initiate empirical antibiotic therapy**
   - Vancomycin 20mg/kg IV (rounded to the nearest 250mg; maximum dose 2g). Vancomycin should be administered at a maximum rate of 10mg/minute (i.e. dose of 1g over 100 minutes, 1.5g over 150 minutes and 2g over at least 200 minutes).
   - Gentamicin 2mg/kg (max 200mg) IV given post-dialysis (Inject slowly over 3-5mins if dose <160mg or infusion over 60 mins).

2. **Lock dialysis line with a vancomycin (100 micrograms/mL), gentamicin (20 micrograms/mL) and heparin (3500 IU/ml) antibiotic lock**. Locking volumes of 2mls or 2.5mls per lumen should be used depending on the length of the catheter.

3. Patients who are clinically septic (high fever, persistent shaking or chills, low blood pressure) or where there is a concern about metastatic complications should be admitted. Those with milder symptoms (low grade fever and stable pulse / BP) can often be managed as outpatients.

4. Blood culture results should be used to guide the choice of systemic antibiotics.

5. **The catheter should be removed:**
• immediately in patients with severe symptoms or if there is persistent clinical signs of infection or haemodynamic instability 48 hours after the initiation of appropriate antibiotic therapy.
• in patients with positive blood cultures with pseudomonas, multi-resistant organisms or fungi
• in patients with tunnel infections and fever
• in patients with confirmed metastatic infections (e.g. osteomyelitis/endocarditis)

On occasions there may be exceptions to this “line out” rule particularly in patients with limited vascular access options, but the patient’s consultant should determine these. These patients will require catheter exchange over a guidewire. A new permanent access should not be placed until the patient has been afebrile and blood cultures have been negative for at least 48 hours.

6. Subsequent management should be tailored to the organism as detailed below:

**Staphylococcus aureus associated bacteraemia**

• Treatment failure rates for strategies that do not involve catheter replacement are high even when utilising antibiotic locks. Staph aureus bacteraemia in dialysis patients is a serious illness with reported mortality rates of up to 30%. A number of serious complications can develop including discitis, endocarditis and osteomyelitis.
• Catheters should be removed immediately in patients with severe symptoms or if there is persistent fever or haemodynamic instability 48 hours after institution of appropriate treatment.
• Catheters should be removed in patients with infected tunnels and in those with significant exit site infections.
• If the catheter is removed, replacement should be delayed until the patient has been afebrile for 48-72 hours with negative blood cultures.
• For patients with mild symptoms and a normal exit site and tunnel, catheter exchange over a guidewire should be undertaken 72 hours later provided:
  • the patient is afebrile 48 hours after initiation of an appropriate and effective antibiotic and remain clinically stable
  • repeat blood cultures are negative.
• For patients with mild symptoms and exit site infection, catheter can be exchanged but a new tunnel and exit site should be created.
• Staph aureus bacteraemia should be treated with 4 weeks antibiotic therapy. Antibiotic/heparin line locks should be continued for 2 weeks only.
• Patients with a persistent temperature/ positive blood cultures should be evaluated carefully for metastatic infection.

**Non-Staphylococcus aureus associated bacteraemia**

Provided infection is with an organism other than *S. aureus, Pseudomonas aeruginosa*, multiresistant organisms or fungus and there are no signs of metastatic infection and no evidence of tunnel infection and no evidence of severe sepsis catheter salvage can be attempted.

• Systemic antibiotics should be continued for 3 weeks and antibiotic line locks for 2 weeks.
• Repeat blood cultures at 72 hours (if positive catheter should be removed)
• A surveillance set of line cultures should be obtained 1 week after the antibiotic course is completed (if positive catheter should be removed).

Reported success rates for systemic antibiotics and antibiotic locks vary according to the organism (87-100% for gram negative organisms, 75-84% for Staph. epidermidis, 61% for enterococcus and 40-55% for Staph. aureus). Patients who fail the antibiotic lock protocol or develop recurrent
infection within 3 months of their primary episode should be treated initially with systemic antibiotics. Catheter exchange over a guidewire should be undertaken at least 72 hours after they have become afebrile.

**Antibiotic Duration**

- Antibiotic choice should be narrowed once culture results are available in discussion with microbiology.
- Staph aureus bacteraemia should be treated with 4 weeks antibiotic therapy. Non-Staph. aureus bacteraemia should be treated with 3 weeks antibiotic therapy.
- 6 weeks antibiotic therapy should be considered if bacteraemia persists 48-72 hours post catheter removal, since it is very likely that metastatic infections are present.
- For patients with proven metastatic infections antibiotics should be continued for 6 weeks and 8 weeks in the case of osteomyelitis.

**ANTIBIOTIC DOSING GUIDELINES**

Vancomycin and gentamicin are used as empirical therapy as they offer a broad spectrum of cover. Subsequent antibiotic therapy should be adjusted according to the organism grown, sensitivities and microbiological advice. On-going therapy with vancomycin should not be used just because it offers more convenient dosing for dialysis patients. Standard practice for the administration of vancomycin has been to provide a loading dose, followed by weekly dosing. This was based on literature that intradialytic clearance of vancomycin was trivial. More recent studies using synthetic membranes with larger surface area indicate significant intradialytic clearances (around 33-39%). Pharmacokinetic studies also indicate a rebound in vancomycin plasma levels occurring after dialysis. Vancomycin trough (pre-dose) levels should therefore be taken before the start of dialysis.

**Vancomycin**

- A loading dose of 20mg/kg IV (round to nearest 250mg, maximum dose 2g) should be administered such that the end of the infusion corresponds to the end of dialysis. Vancomycin should be administered at a maximum rate of 10mg/minute (i.e dose of 1g over 100 minutes, 1.5g over 150 minutes and 2g over at least 200 minutes). In patients who show signs of severe sepsis, antibiotics should be administered immediately and not delayed to correspond to the end of dialysis treatment.
- Following the loading dose, 500 mg of Vancomycin should be administered during the last 60 minutes of each subsequent dialysis, for the appropriate number of weeks. **A pre-dose level should be obtained pre-dialysis at least weekly.**
- The results do not need to be reviewed prior to the dose. Toxicity is very unlikely with this dosing regime. **Trough levels of 10-15 mg/L are acceptable.**
- If the trough level is <10 mg/L then increase maintenance dose to 1g. If trough level >15 mg/L omit one dose of vancomycin.
- Infusion related events (i.e flushing, itching, light-headedness or red-man syndrome) may occur at any rate or concentration. Treatment with antihistamines may be required depending on the severity of the reaction.

**Gentamicin**

- **Loading dose of 2mg/kg (max 200mg) IV (Inject slowly over 3-5mins if dose <160mg or infusion over 60 mins).**
- **For patients who require on-going treatment with gentamicin, 1mg/kg should be given at the end of each subsequent dialysis.**
- In obese patients, gentamicin dose should be based on dose determining weight rather than actual body weight. A calculator is available on the antibiotic website.
  - Calculate ideal body weight (IBW) (kg):
    - IBW for males = [(height (cm) -154) x 0.9] + 50
    - IBW for females = [(height (cm) -154) x 0.9] + 45.5
- Calculate dose determining weight (DDW) (kg):
  - DDW = IBW + 0.4 (actual body weight (kg) – IBW).
- Prior to the first maintenance dose of gentamicin a post dialysis pre-dose level should be obtained, gentamicin given and a 1-hour post dose peak level taken. Patients undergoing outpatient treatment will have to remain at the unit for an extra hour after dialysis to allow this peak sample to be taken.
- Post dialysis pre-dose levels **only** should usually be checked after every subsequent dialysis session and used to guide subsequent gentamicin dosing.
- Remember four hours dialysis reduces serum gentamicin levels by about 30%.
- Gentamicin doses should be individualised aiming for trough levels <2 mg/L and peak levels of 5-10 mg/L. Sustained peaks of >10 mg/L should be avoided.

**Vancomycin / gentamicin / heparin locks**

- Antibiotic / heparin locks containing vancomycin (100 micrograms/mL), gentamicin (20 micrograms/mL) and heparin (3500 units/mL) are produced by pharmacy sterile production (SPU) on a weekly basis. Each pre-filled syringe contains 3 mLs of the antibiotic / heparin locking solution. Locks should be inserted into each lumen of the dialysis catheter in the same way as a standard heparin lock. Before commencing dialysis aspirate and discard the antibiotic lock and replace at the end of the dialysis session.

**Other antibiotics**

- Consult Renal Drugs Handbook, Renal Pharmacist or Medicines Information.

**Patients treated in peripheral satellite units**

The general approach to the management of patients dialysing in peripheral satellite units with suspected catheter related infection is the same as patients treated at Nottingham City Hospital. Specific standard operating protocols exist to facilitate the safe remote prescribing of antibiotics using the renal IT system. Due to the lack of on-site medical cover at Ilkeston Community Hospital and the Diaverum Clinic at Lings Bar Hospital, patients who require admission with suspected catheter related sepsis will need to be transferred to the City Hospital Campus. Occasionally Kings Mill patients may be admitted to a medical ward at Kings Mill but ideally they should also be transferred to NUH.
**Guidelines for the Diagnosis and Treatment of Central Venous Catheter Related Infections in Haemodialysis Patients**

This is a summary of the guidelines – refer to the full text for further information.

### Investigation of suspected catheter-related infection

- Check temperature, pulse and blood pressure
- Exit site and nasal swab for culture and sensitivity (send to microbiology)
- 2 sets of blood cultures (line + peripheral, or if peripheral cultures can’t be obtained 2 sets of line cultures separated by 10-15 minutes) FBC and CRP.
- Medical assessment – consider complications e.g. endocarditis (new murmur?), vertebral abscess (back pain?), osteomyelitis

### Non-tunnelled Catheters

#### Suspected Exit Site and Catheter-related bacteraemia

- Remove catheter (send tip for C&S)
- Start empirical IV antibiotics
- Duration of treatment
  - Exit site infection, negative blood culture → 7 days oral antibiotic therapy
  - Staph aureus bacteraemia → 14 days therapy
  - Non Staph aureus bacteraemia → 7 days therapy

### Tunnelled Catheters (Permcaps)

#### Exit Site Infection

- Flucloxacillin 500mg PO qds 14 days (or Doxycycline 200mg day one then 100mg od for remaining 13 days if penicillin allergic)
- Do not remove catheter

#### Tunnel Infection

- Parenteral antibiotics for 14 days
- Consider adding rifampicin PO 300mg bd if recurrent Staphylococcal infection
- Do not remove catheter unless infection fails to respond

#### Catheter-related bacteraemia

- Parenteral antibiotics + antibiotic line locks: vancomycin (100 mcg/mL), gentamicin (20 mcg/mL) and heparin (3500 units/mL)
- Subsequent management is described in flowchart below

### Empirical Antibiotic Therapy

- Vancomycin 20mg/kg (round to nearest 250mg; maximum 2g) IV. Vancomycin should be administered at a maximum rate of 10mg/minute (i.e dose of 1g over 100 minutes, 1.5g over 150 minutes and 2g over at least 200 minutes).
- Gentamicin 2mg/kg (max 200mg) IV post dialysis (Inject slowly over 3-5mins if dose <160mg or infusion over 60 mins).

### Definitive Antibiotic Therapy

- Microbiology results should be reviewed as soon as available and antibiotic treatment adjusted accordingly. Close collaboration with microbiology is essential.
Suspected catheter infection

Exit site infection without fever: start oral antibiotics

If infection does not resolve

Tunnel infection without fever

Start systemic antibiotics + antibiotic line locks

- Infection with S. Aureus, P. aeruginosa, multiresistant organisms or fungi
- Metastatic infections
  - Endocarditis
  - Osteomyelitis
- Sepsis
- Tunnel infection with fever

- Infection with organism other than S. Aureus, P. aeruginosa, multiresistant organisms or fungi
- No metastatic infections
- No sepsis
- No tunnel infection

First choice:
Removal of catheter and culturing of catheter tip

Immediate catheter removal impossible or contra-indicated

Exchange catheter over guidewire after 2-3 days of successful antibiotic therapy

If guidewire replacement undesirable or impossible

Maintain catheter in place (salvage) coupled to antibiotic lock in catheter

Repeat blood cultures at 72 hours and check for persistence of clinical signs

If positive: remove catheter

Repeat blood cultures 1 week after completion of antibiotic course

Flow chart summarising a step wise approach in case of suspected or proven catheter related infection, including strategies for catheter removal or salvage of the catheter.
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<tbody>
<tr>
<td>No signs of infection</td>
<td>Central venous exit site appears healthy</td>
<td>Central venous exit site infected</td>
<td>Central venous exit site very infected</td>
<td>Central venous exit site extremely infected</td>
<td>Central venous exit site critically infected</td>
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<td>Swab exit site</td>
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### MR VICTOR Tool

**African/Caribbean/Asian Skins**

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### MR VICTOR Tool

**White/Pale/Asian Skins**

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<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR VICTOR Tool</td>
<td>No signs of infection</td>
<td>Central venous exit site appears healthy</td>
<td>Central venous exit site infected</td>
<td>Central venous exit site very infected</td>
<td>Central venous exit site extremely infected</td>
</tr>
<tr>
<td>Possible signs of infection</td>
<td>None of the above may be apparent</td>
<td>Ask the patient if the exit site is not or painful</td>
<td>Ask the patient if the exit site is not or painful</td>
<td>Ask the patient if the exit site is not or painful</td>
<td>Ask the patient if the exit site is not or painful</td>
</tr>
<tr>
<td>Action</td>
<td>Take dressing down</td>
<td>Swab exit site</td>
<td>Change dress</td>
<td>Change dress</td>
<td>Change dress</td>
</tr>
<tr>
<td>Action</td>
<td>Dressing intact</td>
<td>Dressing intact</td>
<td>Dressing intact</td>
<td>Dressing intact</td>
<td>Dressing intact</td>
</tr>
<tr>
<td>Action</td>
<td>Observe daily</td>
<td>Observe exit site document</td>
<td>Observe exit site document</td>
<td>Observe exit site document</td>
<td>Observe exit site document</td>
</tr>
</tbody>
</table>

### MR VICTOR Tool

**Review May 2020**

### MR VICTOR Tool

**Revised May 2017**

### MR VICTOR Tool

**Author: Dr SD Roe**

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