1. Introduction
This guideline has been developed as part of the I-CARE intervention bundle for the management of intravascular devices (IVDs). The guideline is intended to be used by Hospital and Health Services (HHS) to support a system for the use and management of invasive devices based on current best practice and evidence for the prevention and control of healthcare associated infection (HAI).

**KEY CRITICAL POINTS**
- Only competent staff (or training staff supervised by competent staff) are to insert Haemodialysis Catheters
- Accurate documentation and record keeping should be maintained to ensure patient safety

2. General Requirements
- The clinician should choose an appropriate Intravascular Device (IVD) – consider catheter type, number of lumens, length, type of therapy, site of insertion, risk of complications including infection, and patient factors.
- Only competent staff (or training staff supervised by competent staff) should insert IVDs to minimise infection and other complications.
- The clinician should explain to the patient (if possible) or parent/guardian the procedure and need for catheterisation.
- All sterile fields should be set up immediately prior to any procedure by the clinician or suitably trained assistant:
  - trolleys/carts that include all necessary supplies should be dedicated for CVC insertion.
- Accurate documentation and record keeping should be maintained by the clinician to ensure patient safety, to allow for audits, and to track outbreaks of infection. The documentation should include the date and time of insertion including type of IVD, gauge, length of line on insertion and removal, anatomical site, skin preparation solution used, name of operator, site observations and device removal/replacement details.

**Education and Competency Assessment**
- All staff involved in the insertion and maintenance of IVDs should complete all competency assessments as required by the healthcare facility. A record of this should be maintained by the facility.
- A proportion of patients will be responsible for their own catheter care when discharged from hospital in between treatment regimens. Patients should be provided with theoretical and practical training by a clinician. This should include step-by-step instructions in text and images, of clinical procedures needed for care, including principles and techniques i.e. hygiene, dressing changes, flushing techniques and manipulation of the catheter. Where possible, controlled testing of the patient’s knowledge as well as their practical execution of the techniques should be undertaken.

**Hand Hygiene**
- Healthcare workers should perform hand hygiene with an antiseptic-containing soap solution or use an alcohol-based waterless cleanser:
  - before and after palpating catheter insertion sites
  - before and after accessing, repairing, or dressing an intravascular catheter; this includes associated components such as administration sets and access ports.
- The use of gloves does not obviate the need for hand hygiene.
The clinician should educate patients and carers about the importance of hand hygiene and ask that they remind all caregivers to clean their hands.

**Surveillance**

Surveillance should be conducted in high-risk patient populations by a facility appointed person to determine healthcare associated (HCA) IVD-related Bloodstream Infection (BSI) rates, monitor trends in rates and assist in identifying lapses in infection control practices.

A facility-appointed person should:
- report HCA IVD-related BSIs at least monthly to all stakeholders
- investigate all clusters of HCA IVD-related BSIs for common cause problems

The introduction of new products or processes should be monitored to identify any increase or decrease in the occurrence of device associated infection.

### 3. Insertion & Management Requirements

#### Insertion Location

- Imaging facilities (fluoroscopy, intravenous contrast studies and standard radiography) should be available for the insertion of tunnelled central venous catheters (CVC).
- Tunnelled CVCs should be inserted by a clinician in an area where sterile conditions can be maintained (e.g. interventional radiology suite, surgical operating room) and where the patient can be monitored (i.e. ECG and pulse oximetry):
  - tunnelled catheters have traditionally been inserted by a surgical service using either a percutaneous puncture or cut-down technique guided by anatomic landmarks. Increasingly interventional radiology services are inserting CVCs using ultrasound image-guided percutaneous technique. Radiologic insertion, in both adult and paediatric populations, has been found to increase procedure success, decrease acute complications, and result in long-term safety comparable with or better than that achieved surgically.
- Non-tunnelled CVCs should be inserted by a clinician in an area where asepsis can be maintained (e.g. Radiology Suite, Operating Theatre or Recovery Unit) and where the patient can be monitored:
  - ultrasound-guided access of short-term catheters also minimises insertion complications.
- A chest x-ray should be performed post-CVC insertion. A further chest x-ray will be required if the patient becomes dyspnoeic or complains of lateral chest wall discomfort.

#### Catheter Types and Materials

- Catheters capable of a rapid blood flow rate (BFR) are preferred.
- Very little data have been published on novel surfaces (e.g. antimicrobial [antibiotic or antiseptic] coated or impregnated catheters) for long-term devices. Additional studies are required before antimicrobial catheters can be recommended as a strategy for preventing BSIs among haemodialysis patients.
- Catheter choice should be based on local experience, goals for use, and cost.
**Prophylactic Antibiotics**

- There is currently no data specifically related to the haemodialysis patient population that recommends routine parenteral antibiotics at the time of insertion of a CVC to prevent catheter colonisation or bloodstream infection:
  - the need for antibiotic prophylaxis prior to vascular access should be determined by each facility after review of local factors including infection rates
  - there is evidence of the benefit of eliminating *Staphylococcus aureus* nasal carriage using intranasal mupirocin ointment during the maintenance phase of dialysis, however wide-spread usage is not recommended due to the potential for emergence of mupirocin-resistant organisms.
- Anti-infective/microbial lock prophylaxis is not recommended due to concerns of toxicity and emergence of antimicrobial resistance.

**Catheter Site Selection: Tunnelled Cuffed Catheters**

The 2012 Caring for Australasia’s with Renal Impairment (CARI) and the 2006 National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF/KDOQI) Guidelines provide extensive clinical practice guidelines for vascular access including central venous catheters. The following points reinforce practices for reducing the risk of complication including infection.

- The right internal jugular vein (IJV) is the preferred insertion site for tunnelled cuffed venous dialysis catheters.\(^5,6\)
  - the right external jugular vein, the left internal and external jugular veins, subclavian veins, femoral veins or translumbar access to the inferior vena cava, are other sites available for insertion of these catheters\(^6\)
  - the subclavian vein should not be used unless other options are unavailable,\(^6\) because subclavian placement invariably leads to stenosis of the vessel and hampers future placement of an AV fistula or graft in that extremity
  - femoral and translumbar vein placement are associated with the greatest infection rates compared to other sites.\(^6\)
- Optimal blood flow is important during dialysis; this may be achieved by adjusting the catheter tip to the level of the caval-atrial junction or into the midatrium, with the arterial lumen facing the mediastinum.
- The position of the catheter tip should be verified radiologically by an appropriate clinician.

**Catheter Site Selection: Non-Tunnelled Non-Cuffed Catheters**

Short-term CVCs are suitable for immediate use, but have a finite use-life and therefore should not be inserted until they are needed.

- Short-term non-cuffed non-tunnelled catheters can be inserted in the internal jugular, subclavian or femoral veins:
  - the femoral vein is the preferred site for short-term cannulation
  - non-cuffed femoral catheters should be used in bed-bound patients only\(^6\)
  - the infraclavicular subclavian approach is not considered a suitable access site due to the higher short- and long-term complication rate, however, in urgent cases or where other access sites are unavailable; its use may occasionally be required.
- The position of the catheter tip should be verified radiologically.
- Due to the risk of complications (infection, inadvertent removal, haemorrhage, and air embolism) a patient with a short-term femoral catheter should not be discharged home.
- A short-term catheter can be converted to a long-term catheter if there is no evidence of active infection.
Maximal Barrier Precautions

Before placing a CVC (including guide-wire exchanges), the operator and any person who enters the sterile field to assist in the procedure, should use maximal barrier precautions including a cap, mask, sterile gown, sterile gloves, and a sterile full body drape. The patient’s hair should be entirely covered with a surgical cap (tunnelled catheters only).

- place surgical cap on head to cover all hair, then don protective eyewear and surgical mask (the mask should cover the nose and mouth tightly)
- wash hands and forearms for at least three minutes using an antiseptic soap solution and dry with a sterile towel
- aseptically don sterile long-sleeved gown
- aseptically don sterile surgical gloves (ensure gloves cover cuff of gown)
- prep catheter insertion site, allow to dry (refer: Skin Preparation-Insertion Site)
- drape the entire body of the patient (while maintaining a sterile field) with a large sterile fenestrated drape leaving only a small opening at the insertion site. The wide arc of the guide-wire and the subsequent need to control its free end, require adequate draping well beyond its radius
- non-tunnelled CVC - a surgical cap should be used to contain hair that may fall across the operator’s face during the procedure.

Skin Preparation: Insertion Site

- Hair at the insertion site should only be removed by a clinician (prior to antiseptic application), using clippers (not shaved) to improve adherence of the dressing.
- The skin should be physically cleaned (if necessary) prior to applying the antiseptic solution and inserting the catheter.
- Removal of skin lipids (defatting) by a clinician with alcohol, ether or acetone is not recommended.
- A solution containing 1-2% chlorhexidine gluconate (CHG) in ≥ 70% ethyl or isopropyl alcohol (alcoholic chlorhexidine) should be used by clinicians for preparation of the insertion site:
  - non-sterile antiseptic applicators (e.g. swabsticks) should not be placed on the sterile field. Antiseptic liquid solutions are able to be poured into a sterile pot on the sterile field
  - when using non-sterile antiseptic applicators, skin preparation should be undertaken by an alternative staff member who is not gowned and gloved to insert the line.
- If CHG is contraindicated (e.g. sensitivity, allergy) povidone-iodine 10% in 70% ethyl alcohol (ethanol) should be used by the clinician (povidone-iodine should remain on the skin for at least 2 minutes or until dry before inserting the catheter).
- If alcohol is contraindicated (e.g. sensitivity, allergy, skin condition) the clinician should use aqueous povidone-iodine 10%* or sterile normal saline 0.9% (*NB: the drying time for aqueous based antiseptics is longer than alcohol based products).
- 70% alcohol solution (including alcohol-impregnated swabs) should not be used by clinicians as it has no residual antimicrobial activity on the skin.
- The solution should be applied vigorously by the clinician to an area of skin approximately 30cm in diameter, in a circular motion beginning in the centre of the proposed site and moving outward, for at least 30 seconds. Do not use a forward and backward movement.
  - the clinician should repeat this step three times using a new swab for each application.
- The clinician should allow the antiseptic to air dry completely prior to inserting the catheter; do not wipe or blot.
• Clinicians should not palpate the insertion site after the application of antiseptic, unless aseptic technique is maintained.
• The length of the line used should be noted prior to insertion and clearly documented in the patients notes.

**Catheter Fixation**

• Tunnelled cuffed catheters:
  - suture at the insertion and anterior chest wall puncture sites
  - the suture at the insertion site is usually removed at 7-10 days; the second suture at the exit site should be removed after 3 weeks.
• Non-tunnelled non-cuffed catheters:
  - suture to the skin or utilise a sutureless fixation/securement device
  - a catheter that has migrated externally should not be readvanced prior to restabilisation.

**Dressing Type and Replacement Intervals**

• Only trained dialysis staff should change haemodialysis catheter dressings and manipulate catheters that access the patient’s bloodstream.
• There is currently no recommendation for the optimum dressing and frequency of change for haemodialysis catheters. Until further evidence is available, the following dressings should be used by the clinician, (patient as well as environmental factors should be considered when selecting the most appropriate dressing):
  - transparent, semi-permeable, self-adhesive, (standard or hyperpermeable), polyurethane dressings. Benefits include protecting the site from extrinsic contamination, allowing continuous observation of the insertion site, and helping stabilise and secure the catheter
    - the clinician should inspect the dressing on the exit site at each haemodialysis treatment AND replace when the dressing becomes damp, loosened, no longer occlusive or adherent, soiled, if there is evidence of inflammation, or excessive accumulation of fluid (especially blood) under the dressing.
  - sterile gauze dressing secured with adhesive tape or semi-permeable dressing
    - gauze dressings should be replaced at each haemodialysis treatment AND when the dressing becomes damp, loosened, no longer occlusive or adherent, etc
    - if gauze is used in combination with a semi-permeable dressing, it is considered a gauze dressing and should be changed at each haemodialysis treatment.
• The dressing (including polyurethane types) should not be immersed or submerged in water:
  - showering is preferable to bathing, and swimming or spa bathing should be avoided with any external catheter, in order to prevent colonisation with Gram negative organisms, especially *Pseudomonas* spp.

**Dressings: Skin Preparation and Connection**

Each catheter should be dressed as a separate procedure.

**Dressing (Step 1)**

1. Alcoholic chlorhexidine should be used by clinicians for skin preparation for dressings however, if contraindicated the same solution utilised for skin preparation prior to CVC insertion should be used (refer: Skin Preparation-Insertion Site).
2. Most CVC and other catheter materials are generally alcohol-resistant however, alcohol can damage some types of polyurethane and silicone CVC tubing, clinicians should refer to manufacturer’s instructions.
3. The clinician should not remove skin lipids (defatting) with alcohol, ether or acetone.
4. The clinician should utilise an aseptic technique including sterile dressing (or dressing change) pack with drape and sterile gloves, when changing the dressing on a haemodialysis catheter
   - if the patient is coughing or cannot turn their head away from the access site, consider having them wear a face mask.
5. The clinician should remove blood or ooze from catheter insertion site with sterile 0.9% sodium chloride
6. Clinicians should cleanse the area (the size of the final dressing) around the catheter including under the hub; repeat this step three times
   - cleansing should be performed using a circular motion moving in concentric circles from the site outward
   - apply the antiseptic solution using friction, for at least 30 seconds and allow to air dry; do not wipe or blot.
7. The clinician should cleanse the area (the size of the final dressing) around the catheter including under the hub; repeat this step three times
   - cleansing should be performed using a circular motion moving in concentric circles from the site outward
   - apply the antiseptic solution using friction, for at least 30 seconds and allow to air dry; do not wipe or blot.
8. The clinician should cleanse the section of the catheter that lies adjacent to the skin (which will be covered by the dressing), by gently swabbing the top and undersides of the catheter starting at the exit site and working outwards.
9. Apply antimicrobial ointment if required (refer: Antimicrobial Ointments).
10. The clinician should apply dressing (refer: Dressing Type and Replacement Interval).

**Connection (Step 2) – also refer: Circulation Access**

The clinician should:
1. Don a new pair of sterile gloves.
2. Use two sterile gauze swabs impregnated with alcoholic chlorhexidine to meticulously clean the CVC hub and cap; repeat this step at least twice and allow to dry.
3. Do not drop a connection site once it is cleaned.
4. Remove and discard caps, aspirate and/or flush catheter lumens as per hospital procedure.
5. Connect lines and commence dialysis.

**Antimicrobial Ointments**
- The application of antimicrobial ointments or creams under the dressing at the insertion site is recommended:
  - whilst there is evidence to support not using antimicrobial ointments or creams on the site of other central venous access devices, there is currently no published literature supporting not using these products for haemodialysis catheters
  - the decision to use no antimicrobial ointment or cream should be determined by each facility based on local factors including infection rates.
- Single-use or single patient use sachets of ointment or cream should be used.
- The antimicrobial ointment/cream should be compatible with the catheter material (refer manufacturer’s instructions). For example, ointments containing polyethylene glycol (PEG) should not be placed on long-term polyurethane dialysis catheters. The ointment may cause the polyurethane material to become opaque, swell and crack. PEG is a common constituent of most antimicrobial ointments including povidone-iodine and mupirocin:
- **povidone-iodine 10% ointment:**
  - povidone-iodine ointment has been shown to be effective in reducing the incidence of exit-site and bloodstream infections\(^5\)
  - povidone-iodine ointment should be applied to the catheter exit-site after catheter placement and each dialysis treatment\(^5,8\)
  - povidone-iodine may adversely affect the integrity of polyurethane catheters.

- **Bacterial honey:**
  - selected honeys have been found to be highly effective against fungi as well as Gram-negative and Gram-positive bacteria
  - bacterial honey has been demonstrated to be as effective as mupirocin in reducing catheter infection and has a lower likelihood for selecting out resistant organisms
  - thrice-weekly application of antibacterial honey to haemodialysis catheter exit sites is required.\(^7\)

- **mupirocin ointment:**
  - recommended to reduce skin and catheter colonisation as well as local and systemic infections in patients colonised with *S. aureus* (nasal carriers)
  - mupirocin ointment can be applied to the exit site (also refer: Antimicrobial Prophylaxis)
  - mupirocin should be continued long-term because recolonisation occurs in a high proportion of patients
  - wide-spread mupirocin usage amongst dialysis patients is not recommended due to the potential for emergence of mupirocin-resistant organisms
  - mupirocin may also adversely affect the integrity of polyurethane catheters.

- **chlorhexidine gluconate ointment:**
  - not recommended due to limited spectrum of activity.

- **neosporin (triple) antibiotic ointment (polymyxin, bacitracin and neomycin):**
  - not available on the list of approved medications (LAM)
  - not recommended due to the increase in the incidence of fungal infections with its use and the presence of hypersensitivity.

- *Antiseptic-impregnated dressings/sponges are effective in reducing vascular catheter bacterial colonisation. However, additional studies are required before dressings/sponges can be recommended for routine use.*

### Catheter Exit Site Review
- CVCs should be reviewed for signs of infection at each haemodialysis treatment or whenever accessed.
- The insertion site should be examined by the clinician for erythema, exudate, tenderness, pain, redness, swelling, suture integrity and catheter position.
- Patients should be encouraged (where possible) by clinicians to report any changes in their catheter site or any new discomfort.

### Circulation Access
- All persons handling or entering the system should first perform hand hygiene.
- During catheter connect and disconnect, clinicians should wear personal protective equipment including face protection (eyewear/goggles and mask, or face shield) and sterile gloves.
- Clinicians should maintain an aseptic technique when accessing the catheter.
• When clinicians access the catheter, it should be kept sterile and the lumen should never be left open to the air to prevent complications.
  - needleless access ports/connector should be used according to manufacturer’s recommendations
  - whilst a needleless connector potentially eliminates ‘opening’ the catheter hub, an aseptic technique should be used when accessing the catheter including vigorously cleaning the hub and access port/connector (refer: Dressings-Site Preparation and Connection).

• Add-on equipment should be of luer-lock design.
• Anytime a cap is removed from a catheter, it should be discarded by the clinician, and a new sterile cap should be attached.
• Connection:
  - refer Dressings: Site Preparation and Connection.

Disconnection
1. Clamp catheter lumens.
2. The clinician should utilise an aseptic technique including sterile dressing (or dressing change) pack with drape and sterile gloves, for catheter disconnection
   - consider having the patient wear a surgical mask or turn their head away from the catheter exit site during the procedure.
3. The clinician should use 2 sterile gauze swabs impregnated with alcoholic chlorhexidine to vigorously clean the CVC hub and connection; repeat this step at least twice and allow to dry.
4. The clinician should disconnect line.
5. The clinician should flush and lock catheter as per hospital procedure (also refer: Locking of Haemodialysis Catheter).
6. Clinicians should not use adhesive tape as a means of junction securement between the hub and cap because it can harbour microbes and the adherent glue is difficult to clean effectively.

Locking of Haemodialysis Catheters
• All catheters should be locked by the clinician with an anticoagulant.
• The purpose of the lock is to prevent thrombosis.
• Strong solutions of heparin have traditionally been used to maintain patency of tunnelled and non-tunnelled haemodialysis catheters (e.g. 5,000 units per ml of heparin).
• Published reports have indicated:
  - heparin has never been shown to prevent infectious complications
  - the efficacy of heparin in preventing clotting may be no better than saline
  - complications such as heparin-induced thrombocytopenia (HIT), altered coagulation studies and bleeding have been reported, particularly if other anticoagulant therapy is administered
  - newer flush/lock solutions with both anti-infective and antithrombotic properties (e.g. Citrate-Gentamicin, Minocycline-EDTA) have been described however, larger randomised controlled trials need to be undertaken to demonstrate increased catheter survival and decreased catheter infection rates
  - heparin mixed with various antibiotics (e.g. cefazolin, vancomycin and ceftazidime at 10mg/ml and gentamicin at 5mg/ml) have been trialled to reduce infection rates however; more data are required prior to their routine use.
• Until further information is available, heparin should be used by the clinician to lock the catheter lumens after each dialysis session:
- flush with sterile 0.9% sodium chloride for injection (normal saline)
- the volume of the flush should equal at least twice the volume of the catheter (plus any add on devices)
- the catheter should be locked by the clinician using the volume of heparin recommended by the manufacturer (the volume is generally printed on the hub or lumen of the catheter)
- the volume of heparin flush should not exceed the recommended amount to avoid systemic heparinisation of the patient
- only single-dose solutions should be used.

• Low-dose oral warfarin should not be prescribed for prophylaxis.

**IV Admixtures**

- Clinicians should admix all intravenous fluids using an aseptic technique.
- Clinicians should not use containers of intravenous fluid that have visible turbidity, leaks, cracks or particulate matter, or if the manufacturer’s expiration date has passed.
- Clinicians should use single-dose vials for parenteral additives or medications when possible.
- Clinicians should use the recommended needle gauge for injecting additives into infusion bags and/or burettes.

**Replacement of IV fluids**

- Clinicians should replace infusions of:
  - standard (crystalloid) and non-lipid parenteral solutions every 24 hours
  - lipid-containing solutions within 24 hours of hanging the solution
  - lipid emulsions alone within 12 hours of hanging the emulsion (if volume considerations require more time, the infusion should be completed within 24 hours)
  - all blood components should be infused within 4 hours unless otherwise specified on product information sheet (with the exception of factor VIII or IX prepared for continuous infusion)
  - drug infusions (e.g. heparin, insulin) every 24 hours.

- When any IVD is resited, both the infusion and administration set should be replaced by the clinician regardless of when the infusion was initially commenced. It is not acceptable to attach a new line to an infusion less than 24 hours old, nor place a device, e.g. a capped needle, over the line in the interim.
- All IV fluids should be stored by facilities according to manufacturer’s guidelines.
- Bags or bottles of intravenous solution should not be used as a common source of supply for multiple patients.

**Administration Set Changes**

- Clinicians should ensure all components of the administration system are compatible (this includes burettes), including needleless intravascular devices to minimise leaks and breaks in the system:
  - add-on equipment should be of luer-lock design.
- Clinicians should leave administration sets that do not contain lipids, blood or blood products in place for intervals of up to 4 days, unless they become disconnected or the catheter is changed.
- Clinicians should change administration sets used for lipid/lipid-containing parenteral nutrition within 24 hours of initiating the infusion.
- Administration sets used for chemotherapeutic agents should be removed by the clinician immediately after use.
• Clinicians should change administration sets used to infuse propofol at a minimum of 12 hours or as per the manufacturers guidelines.³

**Blood components:** must be transfused using an administration set approved for this purpose. This must incorporate a standard filter which removes clots and small clumps of debris that may form during collection and storage. The recommended filter pore size is 170-200 micron.⁴

• Any number of red cell units may be transfused during a 12-hour period provided the flow rate remains adequate.⁴ However specific manufacturer’s recommendations defining the maximum number of units per blood administration set must not be exceeded.⁴ Administration sets should be removed by the clinician immediately after use.

• **Heparin infusions:** Clinicians should change extension tubing with every syringe change. Both should be changed every 24 hours and when the catheter is changed, to prevent risk of BSI associated with heparin infusions.

• **Other infusions:** extension tubing should be changed when the catheter is changed or following disconnection of the tubing from the catheter.

• Clinicians should not intermittently disconnect administration sets used for continuous infusions, due to the increased risk of infection through manipulation of the hub and occlusion due to reflux of blood into the catheter tip when the line is disconnected.

• Intermittent administration sets should be discarded after each use if disconnected.¹
  - If the administration set is disconnected from the intravascular device the set is to be discarded and a new administration set connected using aseptic technique and observing standard precautions.
  - The set should be disconnected immediately upon suspected contamination and discarded when the integrity of the product or system has been compromised.¹

• Administration sets should not be disconnected (and reconnected at a later time) for the purpose of the patient showering or toileting as this may increase the risk of complications such as infection and catheter occlusion.²

**Medication Labelling**

• Clinicians should abide by labelling recommendations for ALL injectable products prepared in the ward or clinical area, including recommendations for labelling containers (bags, bottles and syringes) and conduits (lines and catheters).⁹


**Intravenous Access Ports**

• Clinicians should minimise catheter manipulation (e.g. number of intermittent infusions).

• Clinicians can use central venous catheters for blood sampling, but it is advisable to limit or avoid this practice because of the increased risk of occlusion (clotting) and infection in the catheter from any residual blood; if necessary clinicians should minimise blood sampling by batching laboratory specimen draws.

• Needleless access ports should be used by clinicians according to manufacturer’s recommendations.

• Needleless components should be changed as frequently as the administration set.¹³

• All persons handling or accessing the intravascular system should first perform hand hygiene.
All intravenous access ports should be meticulously cleaned by the clinician with a single-use 70% alcohol-impregnated swab and allowed to dry prior to accessing the system. For example a typical intermittent infusion of medication may involve:
- swabbing the port before the initial saline injection to assess catheter patency
- before attaching the sterile infusion tubing or syringe, and
- before flushing and/or locking the catheter with saline after administering the medication.

The intravenous port should be accessed by the clinician with a sterile single-use device.

Stopcocks should be end-capped when not in use.

For continuous infusions, clinicians should:
- change stopcocks at least as frequently as administration set changes
- change needless access ports per manufacturer’s instructions AND if the integrity of the port is compromised.

For catheters left in situ or lumens with no infusion, clinicians should:
- change luer caps per manufacturer’s instructions AND after each manipulation
- change needleless or closed (IV bung) access ports with no infusion per manufacturer’s instructions OR if the integrity of the port is compromised.

Anytime an access port is removed from a catheter, the clinician should discard it and a new sterile access port should be attached:
- the integrity of the access port should be confirmed by the clinician before and immediately after each use. If the integrity of the port is compromised or if residual blood remains within the port, it should be replaced immediately and consideration given to changing the administration set.

Clinicians should not use adhesive tape as a means of junction securement between the hub and access port or infusion line.

Management of Infected Haemodialysis Catheters

Definitions-Refer: Glossary of terms
• General management principles:
  - accurate and early diagnosis is essential. Blood cultures should be promptly collected by clinicians on suspicion of catheter-related BSI
  - exit site infections without clinical or microbiological evidence of BSI may be able to be treated with catheter retention and local exit site care with or without systemic antibiotic therapy
  - tunnel infections usually require catheter removal and systemic antibiotic therapy, and may involve excision of the tunnel site
  - catheter-related BSIs require prompt initiation of empiric systemic antibiotic therapy, subsequent modification of antibiotic therapy based upon microbiological results, consideration of catheter removal, and investigation for metastatic infective complications (e.g. endocarditis)
  - in some situations the use of ethanol lock therapy can preserve a CVC. (Refer: Ethanol Lock Therapy)
  - the duration of antibiotic therapy depends upon clinical response, culture results, and the presence of metastatic infective complications.

Blood Culture Collection for Diagnosis of BSI

• Blood cultures should always be collected by a clinician from a peripheral vessel:
  - approximately 20 mL is required and 10 mL should be placed in each of the anaerobic and aerobic blood culture bottles
  - staff should read the instructions on the blood culture bottle as different blood culture systems have different requirements
  - each anaerobic and aerobic bottle constitutes a blood culture ‘set’. No more than 3 sets are required in one episode. Two sets has a sensitivity of >90% while collecting 3 sets will increase that to >98%.

• The practice of taking blood cultures through a CVC is discouraged due to the risk of catheter lumen colonisation and the interpretation difficulties that arise from this.

• Blood for culture should only be collected in addition to peripheral blood from a CVC where:
  - there is no other access available, or
  - following placement of a new CVC and only by the operator, or
  - attempting to determine if the catheter (lumen) is contaminated
  - 10 mL draws are suggested for each bottle. There is no need to collect more than 2 bottles per lumen.

• If catheter-related bloodstream infection is suspected:
  - the clinician should use strict aseptic technique and hand hygiene prior to blood culture collection to reduce the risk of microbial contamination
  - the clinician should utilise sterile collection equipment
  - the clinician should use standard precautions when collecting blood cultures including sterile gloves and eye protection
  - the first sample is to be taken peripherally by the clinician; cleanse skin with alcoholic chlorhexidine and allow to dry prior to venipuncture
  - if a catheter-related BSI is suspected, additional specimens can be collected by the clinician from each lumen of the catheter as above:
    ▪ if the patient presents with a suspected BSI when not dialysing, a catheter lumen specimen should only be collected by experienced haemodialysis staff
    ▪ the volume of the heparin lock should be removed by the clinician prior to blood culture collection
    ▪ clinicians should not use the heparin lock specimen for blood cultures. Heparin provides a suitable growth medium for microorganisms and a positive result will likely indicate ‘lock’ colonisation as opposed to ‘catheter’ colonisation
    ▪ the catheter should be re-locked by the clinician as per Locking of Haemodialysis Catheters
    ▪ if the patient is dialysing, a specimen can be collected from the arterial line port by the clinician as above, because this is the easiest site to access
    ▪ note that this will not sample blood returning from the machine. If the machine is considered to be the source of the patient reaction, an alternative method of culture surveillance is required
    ▪ the collection site as well as the patient’s clinical and demographic data should be recorded on the request form by the clinician.
  - the blood culture bottle diaphragm should be swabbed by the clinician with a single-use 70% alcohol-impregnated swab prior to inoculating the bottle
  - there is no need for the clinician to change the blood culture collection needle between venipuncture and bottle inoculation (careful skin preparation is a more important factor than changing needles in reducing contamination during blood culture collection).

• Catheter discard blood, arterial line blood, intravenous catheter blood, “left over” blood from blood gas or other analyses should not be used by the clinician for blood cultures.
If further blood tubes are required for testing, they should be collected after the blood cultures are drawn.10

**Culturing of CVC Tips**

- Routine culturing of catheter tips is not recommended however, periodic sampling could be considered in the context of measuring the effectiveness of interventions, this should only occur in consultation with Infection Prevention and Control and the Microbiology Laboratory.
- Culture of vascular catheter tips may be useful in confirming the source of line related bacteraemia when performed concurrently with peripheral blood cultures. Depending on local laboratory practice, vascular catheter tips are only processed if there is an associated positive blood culture.8 Consult with local laboratory.
- If pus is present at the insertion site, the clinician should swab the site prior to cleaning and send for culture.
- If catheter-related sepsis is suspected:
  - the clinician should clean the skin at the skin-catheter junction with alcoholic chlorhexidine and allow the solution to dry prior to catheter removal – this will minimise skin contamination of the catheter tip
  - the clinician should remove the catheter aseptically
  - a segment of the tip of the catheter (optimum length 5cm) should be submitted. The tip should be aseptically cut from the end of the catheter directly into a sterile specimen container. Transport to laboratory as quickly as possible to prevent excessive drying.11
- The clinician should ensure the site and type of catheter are noted on the request form as well as the required clinical and demographic data.

**Ethanol Lock Therapy**

Antibiotics may be ineffective in the treatment of infected central venous catheters this is due to the formation of a biofilm on the internal lumen of the catheter. Biofilm prevents antibiotics penetration to the surface of the inner lumen of the catheter despite appropriate antibiotic therapy. Ethanol locks have been proven to be effective in treating catheter infections and prolonging the life of the central venous catheter.

- Commencement of ethanol lock therapy should only occur after the patient has been reviewed by the infectious diseases team and following discussion with the treating consultant.
- Ethanol lock therapy should not be used:
  - if the patient is unstable
  - if the patient has an exit site or tunnel infection
  - if the patient is pregnant or breast feeding
  - if the patient has a *Staphylococcus aureus* bacteraemia, known multi-resistant organism present or fungaemia (including candidaemia).
- Ethanol lock therapy can be used:
  - if the patient is stable
  - if the patient has a catheter-associated bloodstream infection
  - if there is no evidence of exit site or tunnel infection
  - if appropriate antibiotic therapy has been initiated
  - if the infectious diseases team and treating consultant agree to commence treatment.
- Prescribing instructions:
  - ethanol installation volume and withdrawal volumes and sodium chloride 0.9% flushes including the frequency of locks should be ordered by an appropriate clinician on the patient medication chart
- the dwell time for an ethanol lock is four hours. The ethanol lock should be repeated daily by clinicians for 4-5 days
- the clinician should aspirate the instilled volume at the conclusion of the dwell time and record this in the patient chart
- the volume of ethanol to be instilled equals the volume of the lumen plus any connecting tubing. This volume is determined by the CVC type. Refer to the patient chart notes for the Manufacturer and Serial Number of the inserted CVC. Refer to the Manufacturer’s reference tables for lumen volume.

- Dilution:
  - the clinician should draw up 3.5mL of alcohol 100% (ethanol) and 1.5mL sterile water for injection in a 10mL syringe (makes a total of 5mL of 70%)
  - the clinician should discard excess drug to leave the required volume for the catheter lumen volume
  - the clinician should flush the CVC pre and post ethanol lock with sodium chloride 0.9%. Post flushing of the line should only occur after the alcohol volume has been withdrawn from the CVC at the conclusion of the four hour dwell time.

- Refer to: Locking of Haemodialysis Catheters for correct technique to access line.

**Catheter Duration and Replacement**

- Patients transferring from other healthcare facilities with a CVC in situ should have this device reviewed upon arrival by a clinician for infectious and mechanical complications.
- Short-term catheters:
  - short-term non-tunnelled, non-cuffed catheters should be used for acute dialysis and for a limited duration in hospitalised patients
  - there should be a plan to:
    - discontinue, or
    - convert any short-term catheter to a long-term catheter as soon as possible as the risk of infection increases exponentially after 5 days.
  - short-term catheters should be removed when infected
  - there is no conclusive evidence to support a rationale for scheduled replacement except for those in the femoral area.
- Long-term catheters:
  - replace tunnelled cuffed CVCs only on clinical indications (refer: Management of Infected Haemodialysis Catheters).

**Guide-Wire Exchanges**

- Guide-wire assisted catheter exchange is not advised for haemodialysis catheters when it may be technically easier and safer to insert a new catheter into a clean site (refer: Management of Infected Haemodialysis Catheters).

**Removal of Tunnelled Catheters**

- Also refer to local hospital procedure for removal of tunnelled CVC.
- Indications for catheter removal include:
  - catheter-related infection
  - persistent catheter occlusion
  - catheter-related thrombus
  - damaged catheter
  - end of treatment.
- Removal should be undertaken by experienced personnel.
- Removal of a skin-tunnelled catheter requires local anaesthetic and minor surgical cut-down to remove the cuff if the catheter has been in situ for more than approximately three weeks:
  - the clinician should position patient supine, if possible
  - the clinician should perform hand hygiene and don non-sterile gloves
  - the clinician should clean site thoroughly with alcoholic chlorhexidine and allow to dry prior to removal of catheter
  - simple traction by the clinician can remove the catheter and cuff in catheters which have been in less than three weeks. Digital pressure should be applied by the clinician until haemostasis is achieved
  - some target vessels cannot be compressed during CVC removal, therefore special precautions should be taken by the clinician to observe the patient after removal for signs and symptoms of bleeding
  - otherwise, a cut-down procedure (small incision) is used by the clinician to release/free the cuff prior to line removal. The incision is sutured and sutures should be removed after one week by a clinician
  - cover site with gauze and a transparent dressing; the dressing should be changed and the access site assessed every 24 hours by a clinician until the sutures are removed and the site epithelialised
  - on removal the clinician should visually check the integrity of the line to ensure that the tip is present, the complete line has been removed and no breakage has occurred
  - the removed line should be measured and its length documented and checked against the length documented on insertion.
4. Glossary of Terms

<table>
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<tr>
<th>Term</th>
<th>Definition / Explanation / Details</th>
<th>Source</th>
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<tr>
<td>Healthcare Associated Infection (HAI)</td>
<td>Healthcare associated infections (HAI) are those infections that are not present or incubating at the time of admission to a healthcare program or facility, but develop within a healthcare organisation, or are produced by micro-organisms acquired during admission.</td>
<td>Australian Commission on Safety and Quality in Healthcare (ACSQHC)(^{12})</td>
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<td>Exit-site infection:</td>
<td>Inflammation (erythema, warmth, tenderness, induration within 2cm of the exit site) or purulence, confined to the area surrounding the catheter exit site, not extending superiority beyond the cuff if the catheter is tunnelled, with exudate confirmed to be positive by microscopy/culture and no systemic symptoms or positive blood cultures.</td>
<td>(NKF K/DOQI, 2006)(^{6})</td>
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<td>Tunnel infection:</td>
<td>The catheter tunnel superior to the cuff is inflamed, painful, and may have drainage through the exit site that is culture positive.</td>
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<td>Catheter-related bacteraemia</td>
<td>Blood cultures are positive for the presence of bacteria with or without the accompanying symptom of fever, and no apparent source for the infection other than the catheter.</td>
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5. References


6. Bibliography

7. Document Custodian
Director
Centre for Healthcare Related Infection Surveillance and Prevention
& Tuberculosis Control
Communicable Diseases Unit
Branch of the Chief Health Officer

8. Approving Officer
Dr Michael Cleary
Deputy Director General

9. Approval Date
4 April 2013

10. Revision History

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