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 Tunnelled Central Venous Catheters (CVC)
- 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 by the clinician.

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 skin-tunnelled catheters.
• Tunnelled CVCs should be inserted in an area where asepsis 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
  - the chance of permanent damage to the vein is increased when the cut-down method is used
  - the ability to ultrasonographically visualise the vein to be entered decreases the amount of dissection required to locate the vessel, minimising trauma to surrounding tissue
  - ultrasound imaging allows consistent selection of the best vein available, possibly leading to more stable catheters in higher-quality veins
  - open surgery is still indicated for difficult cases or small children.
• 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/pain.

**Catheter Types and Materials**

• The minimum necessary number of lumens, connectors and ports should be used.
• Clinicians should use the smallest diameter catheter possible to minimise the risk of catheter-related thrombosis and/or subsequent venous stenosis:
- triple-lumen catheters have been reported to show an increase in technical difficulties along with an apparent increase in complication rates; therefore place these larger catheters only if absolutely indicated e.g. stem cell transplantation or chemotherapy where a number of agents and blood products require simultaneous infusion.

- If total parenteral nutrition is being administered, clinicians should utilise one lumen exclusively for that use.

- 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 patients with tunnelled catheters, therefore the decision to use these should be based on local factors such as infection rates.

Prophylactic Antibiotics

- Evidence to support the routine use of prophylactic (parenteral) antibiotics at the time of insertion of a CVC to prevent catheter colonisation or bloodstream infection, is limited and there is currently not consensus within the published literature:
  - the need for antibiotic prophylaxis prior to vascular access should be determined by each facility after review of local factors including infection rates.
  - Anti-infective/microbial lock prophylaxis is not recommended due to concerns of toxicity and emergence of antimicrobial resistance.

Catheter Site Selection

- Clinicians should assess specific patient factors such as previous procedures, underlying medical problems, anatomic deformity, site restrictions, the relative risk of mechanical complications and the risk of infection.

- In 2011 the Centers for Disease Control and Prevention (CDC) made no recommendation for a preferred site of insertion to minimise infection risk for tunnelled CVC:
  - the subclavian, internal jugular and femoral veins can be used
  - for all three venous access sites, the right side of the patient is usually favoured because vessel anatomy allows direct access to the superior vena cava/inferior vena cava and provides the shorter and easier route for the practitioner inserting the device
  - lower infection rates have been reported with the subclavian approach compared to the femoral and internal jugular veins however, catheters placed via the subclavian vein are more likely to cause thrombosis
  - a low right internal jugular access has the least likelihood to develop catheter dysfunction, venous stenosis or occlusion
  - catheters may be inserted into a femoral vein, although infection rates and rates of deep vein thrombosis are higher.

- The use of ultrasound and image guided placement of CVC can reduce mechanical complications compared with the standard landmark placement technique.

Maximal Barrier Precautions

- Before placing a CVC, 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
  - place surgical cap on head to cover all hair, then don protective eyewear and surgical mask
- 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.

**Skin Preparation: Insertion Site**

- Hair at the insertion site should only be removed by clinicians (prior to antiseptic application), using clippers (not shaved) to improve adherence of the dressing.
- The skin should be physically cleaned (if necessary) by the clinician prior to applying the antiseptic solution and inserting the catheter.
- Removal of skin lipids (defatting) by the 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 the clinician for preparation of the insertion site:
  - non-sterile antiseptic applicators (e.g. swabsticks) should not be placed on the sterile field. However antiseptic liquid solutions are able to be poured into a pot on the sterile field
  - when using non-sterile antiseptic applicators, skin preparation is to be undertaken by an alternative staff member who is not gowned and gloved to insert the line.
- If CHG contraindicated (e.g. sensitivity, allergy) clinicians should use povidone-iodine 10% in 70% ethyl alcohol (ethanol) (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) clinicians 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 as alcohol 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:
  - 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.
- Palpation of the insertion site by clinicians should not be performed after the application of antiseptic, unless aseptic technique is maintained.
- Clinicians should not routinely use antimicrobial ointments or creams at the insertion site.5
- The length of the line used should be noted prior to insertion and clearly documented in the patients notes.

**Dressing Type and Replacement Intervals**

- Sterile transparent, semi-permeable, self-adhesive, (standard or hyperpermeable), polyurethane dressings should be used by clinicians to protect the site from extrinsic contamination, allow continuous observation of the insertion site, and to help stabilise and secure the catheter.
• A sterile gauze dressing (secured with adhesive tape) should only be used by clinicians if there is a true contraindication to the above including diaphoresis or excessive ooze from the insertion site:
  - a gauze dressing should be replaced by a transparent dressing as soon as possible.
• The dressing (including polyurethane types) should not be immersed or submerged in water:
  - showering is preferable to bathing, and swimming should be avoided with any external catheter, in order to prevent colonisation with Gram-negative organisms, especially \textit{Pseudomonas} spp.
• Until the sutures are removed, clinicians should replace semi-permeable dressings on exit site according to manufacturer’s recommendations OR every 7 days (if hyperpermeable) AND 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:
  - for longer-term catheter maintenance in home patients, less frequent dressing changes may be possible depending on patient characteristics relating to perspiration and cleanliness. Semi-permeable dressings generally begin to degrade 2 weeks after application.
• If gauze is used, it should be changed by the clinician at least every 48 hours OR if damp, no longer adherent or soiled:
  - if gauze is used in combination with a semi-permeable dressing, it is considered a gauze dressing and should be changed every 48 hours.
• Clinicians should utilise an aseptic technique including sterile dressing (or dressing change) pack with drape and sterile gloves when changing the dressing on a tunnelled CVC.
• Each catheter should be dressed by a clinician as a separate procedure.
• Tunnelled catheters that are well healed (following adherence of the cuff (usually within 3 weeks of insertion) may not require dressings. However, this should be reviewed on an individual basis; the line should remain looped and securely attached to the patient’s chest to prevent accidental removal of the catheter.

\textbf{Catheter Fixation}

• 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.

\textbf{Dressings: Skin Preparation}

• Alcoholic chlorhexidine is the preferred solution for skin preparation for dressings however, if contraindicated clinicians should use the same solution utilised for skin preparation prior to CVC insertion (refer: Skin Preparation-Insertion Site).
• Most CVC and other catheter materials are generally alcohol-resistant however, alcohol can damage some types of polyurethane and silicone CVC tubing (refer manufacturer’s instructions).
• Removal of skin lipids (defatting) by clinicians with alcohol, ether or acetone is not recommended.
•Clinicians should remove blood or ooze from catheter insertion site with sterile 0.9% sodium chloride.
• Clinicians should cleanse the area (the size of the final dressing) around the catheter including under the hub.
• Cleansing should be performed by clinicians using a circular motion moving in concentric circles from the site outward:
- repeat this step three times using a new swab for each application.
- Clinicians should apply the antiseptic solution vigorously for at least 30 seconds and allow to air dry; do not wipe or blot.
- Clinicians should not use antimicrobial ointments or creams at the insertion site.\(^5\)
- 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. The safety of these dressings/sponges has not been established in low birth weight neonates who may be at risk of skin or systemic toxicity.

**CVC Review**

- CVCs should be reviewed each shift and those that are no longer clearly needed should be promptly removed.
- The insertion site should be examined each shift by a clinician (or at each dressing change if gauze is used) for erythema, exudate, tenderness, pain, redness, swelling, suture integrity and catheter position:
  - site appearance should not be used as the only indicator of infection as local inflammation is uncommon with CVC-related infection caused by coagulase-negative staphylococci as this pathogen incites little local or systemic inflammation. The patient should also be examined for fever or other signs of sepsis e.g. tachycardia, tachypnoea, hypotension.
- Patients should be encouraged (where possible) to report any changes in their catheter site or any new discomfort.\(^5\)

**Catheter Duration and Replacement**

- Clinicians should replace CVCs only on clinical indications i.e. clinical infection +/- purulence at the insertion site.
- Patients transferring from other healthcare facilities with a tunnelled CVC in situ should have this device reviewed by a clinician upon arrival for infectious and mechanical complications.
- Clinicians should continually review the need for central venous access in individual patients.
- Clinicians should replace all fluid administration tubing and connectors when the CVC is replaced.

**Guide-wire Exchange**

- Guide-wire-assisted catheter exchange is not advised for cuffed tunnelled catheters when it may be technically easier and safer to insert a new catheter into a clean site.

**In-line Filters**

- In-line filters are not recommended for infection control purposes however, certain chemotherapeutic and immunological drugs require filtering for other reasons:
  - lines containing filters should be removed immediately following administration of the drug.

**Flushing and Locking of CVCs**

**General Information**

- Where possible, continuous intravenous fluids should be administered by a clinician using an infusion pump.
The optimal volume and frequency of flushing and/or locking of catheters for intermittent injections or infusions is unclear:
- the literature suggests the volume of the flush or lock should equal at least twice the volume of the catheter plus add-on devices¹ (if used)
- the catheter should be locked using the volume of solution recommended by the manufacturer (the volume is generally printed on the hub or lumen of the catheter)
- if using heparin lock, the volume should not exceed the recommended amount to avoid systemic heparinisation of the patient.

Only single-dose solutions should be used by clinicians.
Clinicians should use a 10mL (or larger) syringe to avoid excessive pressure and catheter rupture (syringes smaller than 10mL can produce higher pressure in the lumen and rupture the catheter):
- infusion pressure should never exceed 25 psi because pressures higher than that may also damage blood vessels
- a 3mL syringe generates pressure greater than 25 psi, whereas a 10mL syringe generates less than 10 psi.

Clinicians should flush in a pulsatile (push-pause or start-stop-start) motion.
Clinicians should use an aseptic technique including cleaning the access port(s) with a single–use 70% alcohol-impregnated swab and allowing to dry prior to accessing the system.
Disconnecting the flush syringe allows reflux of blood into the tip of the catheter to displace the space occupied by the syringe. To prevent this source of occlusion, the clinician should clamp the extension set or withdraw the syringe while administering the last 0.5mL of flush (positive pressure technique).
Positive displacement mechanical valves are designed to reduce retrograde flow into the catheter more effectively than standard luer connectors. The displacement action expels a small amount of the solution used to flush the catheter when the syringe used for flushing is disconnected from the luer. The displacement is a passive feature and occurs automatically.
- the positive displacement action accomplished with valve technology will not eliminate the problem of occlusion in all CVCs
- the evidence related to positive displacement mechanical valves is inconclusive regarding their effectiveness in preventing clot formation, particularly in the absence of heparin. Until there is more evidence, flushing or locking CVCs via a needleless access port using a positive pressure technique is recommended.

Flushing of CVCs
Flushing is recommended to promote and maintain patency and prevent the mixing of incompatible medications and solutions.
Sterile 0.9% sodium chloride for injection should be used by clinicians to flush a catheter unless the manufacturer recommends flushing with heparin sodium solution.
Clinicians should flush catheters immediately:
- after placement
- prior to and after fluid infusion or injection (as an empty fluid container lacks infusion pressure and will allow blood reflux into the catheter lumen from normal venous pressure)
- prior to and after blood drawing.
The flush solution and flushing intervals should be documented by the clinician in the patient record.
Locking of CVCs

- If it is necessary to lock a CVC the following recommendations should be considered by the clinician:
  - locking involves instilling a solution to prevent occlusion when the device is not in use
  - there is limited information concerning the most appropriate solution to lock a catheter. Heparinised saline has been used primarily due to the antithrombolytic properties of heparin. However, complications such as heparin-induced thrombocytopenia (HIT), altered coagulation studies and bleeding have been reported, particularly if other general anticoagulant therapy is administered. Additionally, heparin is incompatible with certain substances in solution e.g. gentamicin sulphate (refer to MIMS Online available from: https://www.mimsonline.com.au/Search/Search.aspx)
  - for CVCs not in regular use, in adults, sterile 0.9% sodium chloride for injection should be used by clinicians to lock a catheter in preparation for future use; unless the manufacturer recommends catheter lumens be locked with an alternate solution
  - the most important part of locking the catheter is the mechanical action of the procedure itself, designed to prevent backflow of blood into the catheter tip i.e. ‘pulsatile’ and ‘positive pressure’ flushing techniques
  - some CVCs integrate valve technology which restricts blood backflow and air embolism by remaining closed when not in use therefore eliminating the need for heparin flushing to maintain patency.

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, 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\(^3\), 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)\(^6\).
**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.
- 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 needleless 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 Tunnelled Catheters**

- Accurate and early diagnosis is essential. Blood cultures should be promptly collected by a clinician 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.
- 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 a 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%.7

• Taking blood cultures through a CVC is discouraged as the practice may cause occlusion and contribute to catheter lumen colonisation.

• Blood for culture should only be collected by a clinician 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.

• 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
  - first sample to be taken peripherally by the clinician; cleanse skin with alcoholic chlorhexidine and allow to dry prior to venepuncture
  - additional specimen(s) to be collected by the clinician from each lumen of the (old) catheter. If collecting directly from an indwelling line, the first few millilitres (mL) of blood should be discarded and a note of the collection site/lumen made on the request form
  - the blood culture bottle diaphragm should be swabbed by the clinician with a 70% alcohol-impregnated wipe prior to inoculating the bottle
  - there is no need to change the blood culture collection needle between venipuncture and bottle inoculation7 (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 for blood cultures.

• If further blood tubes are required for testing, they should be collected by the clinician after blood cultures are drawn.

**Culturing of CVC Tips**

• Routine culture 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. 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.
• 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 *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 are to be ordered on the patient medication chart by an appropriate clinician
  - the dwell time for an ethanol lock is four hours. The ethanol lock is to be repeated by clinicians daily 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: Flushing and Locking of CVCs for correct technique to access line.

**Removal of Tunnelled CVC**

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:
  - patient should be positioned supine, if possible
  - the clinician should perform hand hygiene and don non-sterile gloves
  - the clinician should clean the 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 e.g. hepatic vein, 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 needed to release/free the cuff prior to line removal. The incision is sutured and sutures should be removed after one week
  - the clinician should cover the site with gauze and a transparent dressing; the dressing should be changed and the access site assessed every 24 hours 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>
<thead>
<tr>
<th>Term</th>
<th>Definition / Explanation / Details</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<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)9</td>
</tr>
<tr>
<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 superiorly 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, 200610</td>
</tr>
<tr>
<td>Tunnel infection</td>
<td>Tunnel infection is a process of suppuration or erythema, tenderness and induration in the tissues overlying the catheter more than 2cm from the exit site.</td>
<td>NKF K/DOQI, 200610</td>
</tr>
<tr>
<td>Catheter-related bacteraemia (BSI)</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>
<td>NKF K/DOQI, 200610</td>
</tr>
</tbody>
</table>

5. References

6. Bibliography


7. Document Custodian
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Communicable Diseases Unit
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8. Approving Officer
Dr Michael Cleary
Deputy Director General

9. Approval Date
4 April 2013

10. Revision History

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<th>Date of Issue</th>
<th>Date of Next Revision</th>
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<td>Rescinded</td>
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<td>2.0</td>
<td>March 2013</td>
<td>March 2015</td>
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