Guideline

# Percutaneous central venous catheters

## 1. Purpose

This guideline has been developed as part of the I-Care intervention bundle for the management of intravascular devices (IVDs). This guideline provides recommendations regarding best practice for the use and management of invasive devices based on current evidence for the prevention and control of healthcare associated infection (HAI).

## 2. Scope

This guideline provides information for all employees, contractors and consultants within the Hospital and Health Services, divisions and commercialised business units within the Queensland public health system.

## 3. Related documents

### Authorising Policy and Standard/s

- NSQHS Standard 3 – Preventing and Controlling Healthcare Associated Infections

### Standards, procedures, guidelines

- Australian guidelines for the prevention and control of infection in healthcare
- Guideline for surveillance of healthcare associated infection
- Hand hygiene guideline

### Forms, templates:

- Percutaneous central venous catheter: maintenance – Point of care tool

## 4. Guideline for Percutaneous Central Venous Catheters

## Contents



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**Key critical points**

- Only competent staff (or training staff supervised by competent staff) are to insert Percutaneous Central Venous Catheters (CVC).
- Accurate documentation and record keeping should be maintained to ensure patient safety.
- IVD requirements should be constantly reassessed and any non-essential intravenous devices should be promptly removed.

## General recommendations

- 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.[1]
- Only competent staff (or training staff supervised by competent staff) should insert IVDs to minimise infection and other complications.[1, 2]
- The clinician should explain to the patient (if possible) or parent/guardian the procedure and need for catheterisation.
- Environmental control measures (e.g. pulled curtains, closed door) should be taken to minimise environmental risk factors for all procedures involving CVCs.[2]
- 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.[3, 4]
- 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.[5]

## Education and competency assessment

All clinicians involved in the insertion and maintenance of IVDs must ensure that this is within their scope of clinical practice, determined by the individual's credentials, education, training, competence and maintenance of performance at an expected level of safety and quality. The clinician's scope of practice is also dependent upon the capacity and capability of the service in which they are working.[6, 7]

- 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.[1, 3-5, 8-10]
- Simulation training of catheter insertion procedures including infection prevention strategies has been shown to be successful in reducing rates of Central Line Associated Bloodstream Infection (CLABSI).[3, 10-12]

## 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.[1, 3, 4, 8-10, 13-18]
- The use of gloves does not obviate the need for hand hygiene.
- It is recommended that the clinician educate patients and carers about the importance of hand hygiene and ask that they remind all caregivers to clean their hands.[2]

### Surveillance

It is recommended that surveillance 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
  - investigate all episodes of HCA IVD-related *Staphylococcus aureus* BSI using an Investigation Checklist[1] e.g. The *Staphylococcus aureus* BSI Checklist available from: https://www.health.qld.gov.au/publications/clinical-practice/guidelines-procedures/diseases-infection/infection-prevention/icare-bsi-checklist.pdf
- It is recommended that the introduction of new products or processes be monitored to identify any increase or decrease in the occurrence of device associated infection.[2]

## Insertion & management requirements

### Insertion location

- Percutaneous CVCs should be inserted in an area where asepsis can be maintained[18] (e.g. Radiology Suite, Intensive Care Unit [ICU], Operating Theatre or Recovery Unit) and where the patient can be monitored (i.e. ECG and pulse oximetry).
- Ultrasound guided central venous access should be considered to minimise complications.[1, 10, 18-23]
- A chest x-ray should be performed post-CVC insertion.[18]

### Catheter types and materials

- The minimum necessary number of lumens, connectors and ports should be used.[1, 9, 21, 24-26]
- If total parenteral nutrition is being administered, clinicians should utilise one lumen exclusively for that use.[9, 25]
- Heparin-coated catheters are not recommended.
- There is evidence supporting the use of antimicrobial coated or impregnated catheters to reduce catheter colonisation and associated bloodstream infection.[1, 24, 27] Further clinical trials are required to determine the benefits of these catheters in terms of overall patient morbidity and mortality before they can be recommended across all settings.[28-31] The overall benefits of antimicrobial-impregnated CVCs are uncertain and therefore caution should be exercised before considering the use of these catheters across all settings.[3, 10, 18, 24, 32]
  - It is recommended that an antiseptic-impregnated CVC be considered by clinicians for adults whose catheter is expected to remain in place > 5 days if, after implementing a comprehensive strategy to reduce rates of CVC-related BSI, the CVC-related BSI rate

remains above the goal set by the individual institution based on benchmark rates and local factors.[1, 9, 21, 26]

## Prophylactic antibiotics

- Prophylactic antibacterial or antifungal agents (oral, intranasal or parenteral) are not recommended for routine use at the time of insertion or during use of a CVC to prevent catheter colonisation or bloodstream infection.[3, 9, 10, 18, 21, 24, 26]
- Anti-infective/microbial lock prophylaxis - additional studies are required before antimicrobial lock solutions instilled into the catheter lumen(s) can be recommended for preventing BSIs due to concerns of toxicity and emergence of antimicrobial resistance.[9, 19, 21, 24, 33]

## Catheter site selection

- Clinicians should assess specific patient factors such as pre-existing catheters, anatomic deformity, site restrictions, the relative risk of mechanical complications and the risk of infection.[9, 18, 21]
- The subclavian vein is the preferred site for percutaneous CVCs in (uncomplicated) adults and should be used whenever possible by clinicians instead of the internal jugular or femoral vein, to minimise infective complications.[1, 4, 5, 16, 18, 26]
    - Lower rates of catheter colonisation have been reported with the subclavian approach when compared to the internal jugular approach; however both are superior to the femoral insertion site.[10, 24, 26]
    - Clinicians should consider using the external jugular vein before the internal jugular for central venous access if possible.
    - There is an increased risk of catheter colonisation when the femoral site is used for central venous catheterisation; an upper body site should be used if possible.[9, 21]
    - 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.
    - Where possible, any catheter inserted into a jugular vein should be replaced with a subclavian or peripherally inserted central catheter, as the risk of infection increases exponentially after two days.
    - Subclavian vein catheterisation should be avoided for temporary access in all patients with chronic renal failure due to the risk of central vein stenosis.[1, 34]
- The creation of a deliberately lengthened subcutaneous tract during catheter insertion is not recommended.
- Clinicians should consider using ultrasound guided central venous access for line placement.[1, 18, 22, 26]

## 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.[1, 3-5, 8-10, 16, 18, 19, 21, 24-26]

- Don protective eyewear and surgical mask (the mask should cover the nose and mouth tightly).
- CVC insertion requires surgical aseptic technique[2] and therefore a surgical scrub should be performed prior to the procedure.[35]

- 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.
- A surgical cap should be used to contain hair that may fall across the operator's face during the procedure.

## Skin preparation: insertion site

It is recommended that:

- 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.[5, 25]
- 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.[25]
- Use alcohol-containing skin preparatory agents if no contraindication exists. The most effective disinfectant (chlorhexidine or povidone iodine) to combine with alcohol has not been established in the literature (be aware that either agent may be contraindicated e.g. sensitivity, allergy)
    - A solution containing 2% chlorhexidine gluconate (CHG) in ≥ 70% (ethyl or isopropyl) alcohol (alcoholic chlorhexidine) should be used by clinicians for preparation of the insertion site.[5, 17, 36]

    or

    - A solution containing povidone-iodine 10% in 70% ethyl alcohol (ethanol)[37] (povidone-iodine should remain on the skin for at least two minutes and until dry before inserting the catheter).
        - 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.[25]
        - If 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 alcohol is contraindicated (e.g. allergy, sensitivity, skin condition) clinicians should use aqueous povidone-iodine[18] 10%* or sterile normal saline 0.9% (*NB: the drying time for aqueous based antiseptics is longer than alcohol based products).
- Note: The same antimicrobial agent shall be used for all phases of the patient's skin preparation, to ensure full residual benefit and consistent action.[38]
- 70% alcohol solution (including alcohol-impregnated swabs) should not be used 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:[5]

  - this step should be repeated a total of 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.[5]
- Clinicians should not palpate the insertion site after the application of antiseptic, unless aseptic technique is maintained.[1]
- Clinicians should not routinely use antimicrobial ointments or creams under the dressing at the insertion site.[1, 8-10, 21, 24-26]
- The length of the line used should be noted prior to insertion and clearly documented in the patient's notes.[5]

## Catheter fixation

- Adhesive tape (alone) should not be used by clinicians to secure CVCs.
- Secure the catheter by:
  - suturing at the hub and three-way bifurcation anchor point, or
  - utilising a sutureless fixation/securement device.
    - A sutureless securement device has been shown to be superior in reducing infection risk,[10, 39] length of time required to secure the catheter to the skin and avoiding the additional risk of needlestick injury associated with suturing.[1]
    - The potential for this device to reduce infection may derive from the elimination of skin suture wounds that are contiguous to the newly inserted catheter and from minimisation of the to-and-fro positioning of the catheter, which may promote invasion of the tract by cutaneous microorganisms through capillary action.[1, 10, 40]
    - Sutureless securement devices should be used in accordance with manufacturer's instructions.
- A catheter that has migrated externally should not be readvanced prior to re-stabilisation.[5]

## Dressing type and replacement intervals

- CVC dressings should be changed [41, 42] as below:

**Table 1: Dressing types and replacement intervals**

| Dressing type | Replacement interval |
|---|---|
| Transparent, semi-permeable, self-adhesive polyurethane | Weekly*[1, 3, 9, 10, 13, 16, 17, 21, 25, 26, 41] |
| Gauze | Second daily*[3, 26] |
| Chlorhexidine-impregnated | Weekly*[1, 13, 16] |
| *All dressings should be replaced routinely as well as when the dressing becomes damp, loosened, no longer occlusive or adherent, soiled, if there is evidence of inflammation, or excessive accumulation of fluid. Manufacturer's recommendations should be followed. [1, 3, 9, 10, 13, 16, 17, 21, 25, 26, 41] | |

- 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 two weeks after application.
- Patient as well as environmental factors should be considered when selecting the most appropriate dressing for use on a percutaneous central venous catheter. The following recommendations should be considered:
  - Transparent, semi-permeable, self-adhesive, (standard or hyperpermeable), polyurethane dressings:[9, 16, 18, 19, 25, 43]
    - Benefits include protecting the site from extrinsic contamination, allowing continuous observation of the insertion site, and helping stabilise and secure the catheter.[25, 43]
    - The clinician should inspect the dressing on the exit site each shift.[17]
  - Sterile gauze dressing secured with adhesive tape or semi-permeable dressing:[16, 43]
    - Gauze dressings should only be used by clinicians if there is a true contraindication to polyurethane dressings including diaphoresis or excessive ooze from the insertion site and should be replaced by a transparent dressing as soon as possible.[9, 25]
    - If gauze is used in combination with a semi-permeable dressing, it is considered a gauze dressing and should be changed every 48 hours.[1, 10, 13, 25]
  - Chlorhexidine-impregnated dressings and sponges have been shown to reduce the risk of exit site infection and catheter-related bacteraemia.[9, 10, 18, 19, 25, 26, 44-46]
    - The safety of chlorhexidine-impregnated dressings/sponges has not been established in low birth weight neonates who may be at risk of skin or systemic toxicity.
- The dressing (including polyurethane types) should not be immersed or submerged in water:[1]
  - Showering is preferable to bathing, and swimming or spa bathing should be avoided with any external catheter,[21] in order to prevent colonisation with Gram negative organisms, especially *Pseudomonas* spp.
- Clinicians should utilise an aseptic technique[9, 41] including sterile dressing (or dressing change) pack with drape and sterile gloves when changing the dressing on a CVC.
  - If the patient is coughing or cannot turn their head away from the exit site, consider having them wear a face mask.
- Clinicians should dress each catheter as a separate procedure.

## Dressings: skin preparation

- 2% 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).[1, 3, 5, 8, 9, 15-17, 21, 25, 47]
- Most CVC and other catheter materials are generally alcohol-resistant, however alcohol can damage some types of polyurethane and silicone CVC tubing (refer to manufacturer's instructions).[1, 5, 9]
- Removal of skin lipids (defatting) by clinicians with alcohol, ether or acetone is not recommended.[25]
- 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 using a circular motion moving in concentric circles from the site outward.
  - Clinicians should repeat this step a total of three times using a new swab for each application.[1]
- 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 under the dressing at the insertion site.[1, 8, 9, 16, 24, 25]
- Antiseptic-impregnated (chlorhexidine gluconate) dressings/sponges have been shown to be effective in reducing vascular catheter bacterial colonisation and bacteraemia.[19, 44, 45]
  - 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.

## Chlorhexidine bathing

For information regarding chlorhexidine bathing please refer to appendix two of the Guideline for the management of multi-resistant organisms.

## CVC review

- CVCs should be reviewed each shift by clinicians, and those that are no longer clearly needed should be promptly removed.[1, 4, 18, 21, 26]
- Insertion site
  - The insertion site should be examined each shift by the clinician[17] (or at each dressing change if gauze is used) for erythema, exudate, tenderness, pain, redness, swelling, suture integrity and catheter position.[10, 18]
- Signs of systemic infection
  - Site appearance should not be used as the only indicator of infection. 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.
- Patency of lumens[25]
- Patients should be encouraged (where possible) by clinicians to report any changes in their catheter site or any new discomfort.

## In-line filters

- In-line filters are not recommended for infection control purposes, however certain chemotherapeutic and immunological drugs require filtering for other reasons.[5]
  - Lines containing filters should be removed by clinicians immediately following administration of the drug.

# Flushing and locking of CVCs

## General information

- Where possible, continuous intravenous fluids should be administered by clinicians 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 devices (if used).[5, 13]
    - If using heparin lock, the volume should not exceed the recommended amount to avoid systemic heparinisation of the patient.
    - The volume of a lumen is generally less than 1mL and a needleless access device 0.1mL, therefore a (minimum) 2-3mL of solution should be sufficient.
- Only single-dose solutions should be used.[41]
- Clinicians should use a syringe with the internal diameter of a 10mL syringe (or larger), to avoid excessive pressure and catheter rupture (the diameter of 10mL syringes varies slightly between manufacturers but is usually around 14.5-15.5mm). Syringes with an internal diameter smaller than that of a 10mL syringe can produce higher pressure in the lumen and rupture the catheter).[13, 41, 48]
    - Infusion pressure should never exceed 25 psi because pressures higher than that may also damage blood vessels.
    - The internal diameter of a standard 3mL syringe generates pressure greater than 25 psi, whereas a syringe with the internal diameter of a 10mL syringe generates less than 10 psi.[48]
    - 3mL syringes with the internal diameter of a 10mL syringe do not produce higher pressure and are acceptable for use.
- Clinicians should flush in a pulsatile (push-pause or start-stop-start) motion.[13, 41, 48, 49]
- Clinicians should use an aseptic technique[9] including meticulously cleaning the access port(s) with a single–use 70% alcohol-impregnated swab or 2% alcoholic chlorhexidine vigorously for at least 15 seconds and allowing to dry prior to accessing the system.[3, 9, 13, 18, 41]
- 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 clinicians should clamp the extension set or withdraw the syringe while administering the last 0.5mL of flush (positive pressure technique).[13, 41, 49, 50]
- Positive- or negative-pressure mechanical valve needleless connectors have been associated with increases in rates of catheter-related bacteraemia and therefore are not recommended for use.[25, 51-53]

## 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.[9]

- 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. Drawing bloods through a CVC is discouraged as the practice may cause occlusion and contribute to catheter lumen colonisation.[54, 55]
- The flush solution and flushing intervals should be documented by the clinician in the patient record.

## Locking of CVCs

- 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.[15, 56] Additionally, heparin is incompatible with certain substances in solution e.g. gentamicin sulphate (refer MIMS Online available from: https://www.mimsonline.com.au/Search/Search.aspx).
- Until there is further evidence, sterile sodium chloride 0.9% should be used by clinicians to lock a catheter that is no longer required for continuous infusions 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.[13, 41, 49]
  - 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.
- Low-dose oral warfarin or other systemic anticoagulants should not be prescribed for prophylaxis of catheter occlusion.[8, 9, 24]

## IV admixtures

It is recommended that:

- Clinicians should admix all intravenous fluids using an aseptic technique.[9]
- 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.[5]

## Replacement of IV fluids

**Table 2: IV fluid replacement intervals**

| Fluid | Replacement interval |
|---|---|
| Standard (crystalloid) and non-lipid parenteral solutions | Every 24 hours |
| Lipid-containing solutions | Within 24 hours |
| Lipid emulsions | Within 12 hours |
| All blood components (excluding factor VIII or IX for continuous infusion) | Within 4 hours |
| Drug infusions (e.g. heparin, insulin) | Every 24 hours[5, 16, 57] |

- When any IVD is resited, it is recommended that both the infusion and administration set be replaced by the clinician regardless of when the infusion was initially commenced.[25]
- IV administration sets should be spiked into IV fluid bags the whole way.[58]
- Each bag of IV fluid should only be spiked once.[59]
- It is recommended that all IV fluids be stored by facilities according to manufacturer's guidelines.
- It is recommended that bags or bottles of intravenous solution should not be used as a common source of supply for multiple patients.[2]

## Administration set changes

It is recommended that:

- 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.[5]

**Table 3: Administration set replacement intervals**

| Administration set | Replacement interval |
|---|---|
| Not containing lipids, blood or blood products | Up to 96 hours*[2, 3, 9, 42] |
| Lipid/lipid-containing parenteral nutrition | Within 24 hours*[1, 9, 16, 25, 42, 60] |
| Chemotherapeutic agents | Remove immediately after use* |
| Propofol | Within 12 hours or as per manufacturer*[1, 2, 42] |
| Heparin | Every 24 hours*[5, 16, 57] |
| Other infusions (not including blood products) | When disconnected or new catheter*[25] |
| *All administration sets should be replaced when disconnected or if the catheter is changed.[1, 16, 25, 60] When an administration set is changed, the IV fluid bag should also be changed.[59] | |

Blood components

- Must be transfused using an administration set approved for this purpose, incorporating 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.[5, 57]
- Any number of red cell units may be transfused during a 12-hour period provided the flow rate remains adequate. However specific manufacturer's recommendations defining the maximum number of units per blood administration set must not be exceeded.[57] Administration sets should be removed by the clinician immediately after use.[9, 17]

Disconnection of administration sets

- Administration sets should not be intermittently disconnected (including for patient showering/toileting).[2]
- If administration sets are disconnected from the intravascular device, the set should be discarded and a new administration set connected using aseptic technique and observing standard precautions.
- Intermittent disconnection of administration sets increases risk of infection through manipulation of the hub and contamination, and occlusion due to reflux of blood into the catheter tip.[5, 25, 50]

## Medication labelling

- It is recommended that clinicians 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).[2, 5]
- It is recommended that clinicians ensure labelling complies with the national recommendations for user-applied labelling of injectable medicines, fluids and lines (current edition) as set out by The Australian Commission on Safety and Quality in Healthcare.

## Needleless access ports

- Clinicians should minimise catheter manipulation (e.g. number of intermittent infusions).[42]
- Closed catheter access systems are associated with fewer CRBSIs than open systems.[1] Therefore, needleless access ports should be used on all lumens.
  - Stopcocks should be end-capped with a needleless access port when not in use.[1, 19]
- All persons handling or accessing the intravascular system should first perform hand hygiene.[17, 21, 25, 26, 41]
- Needleless access ports should be used by clinicians according to manufacturer's recommendations.
- Clinicians should not use adhesive tape as a means of junction securement between the hub and connector or infusion line.
- All intravenous access ports should be meticulously cleaned by the clinician with a single-use 70% alcohol-impregnated swab or 2% alcoholic chlorhexidine vigorously for a minimum of 15 seconds and allowed to dry prior to accessing the system.[5, 9, 41] For example a typical intermittent infusion of medication may involve swabbing the access 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 catheter should be accessed by the clinician with a sterile single-use device.
- 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 access port is compromised or if residual blood remains within the access port, it should be replaced immediately and consideration given to changing the administration set.[5]
- Needleless access ports should be changed as per manufacturer's instructions, or if the integrity of the port is compromised.[5] In general, a lot of manufacturers recommend that their needleless components be changed weekly or when there are signs of blood, precipitate, leaks or other defects.[41]
  - CDC guidelines currently recommend that needleless components be changed at least as frequently as the administration set, but no more frequently than every 72 hours.[1] A recent study has identified an increased CLABSI rate when needleless access ports were changed every 24 hours with lines containing blood products or lipids.[61]
  - More frequent changing of connectors may reduce the burden of access port contamination that could lead to bloodstream infection, however more frequent manipulation of the catheter for access port changes could increase the risk of infection.[61]
- Clinicians can use central venous catheters for blood sampling; it is advisable to follow manufacturers' instructions as to the best practise for their device. With some devices 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;[54, 62] if necessary clinicians should minimise blood sampling by batching laboratory specimen draws.[42]

## Blood culture collection for diagnosis of BSI

Refer to local hospital procedure for blood culture collection and Pathology Queensland and CHRISP Recommendations for Blood Culture Collection – Adults (Queensland Health Intranet access only)

It is recommended that:

- Blood cultures should always be collected by a clinician from a peripheral vessel:
  - Approximately 20mL is required and 10mL should be placed in each of the anaerobic and aerobic blood culture bottles.[54, 63, 64]
  - 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 three sets are required in one episode. Two sets has a sensitivity of >90% while collecting three sets will increase that to >98%.[55]
- 10mL draws are suggested for each bottle. There is no need to collect more than two bottles per lumen.[54]
  - Taking blood cultures through a CVC is discouraged as the practice may cause occlusion and contribute to catheter lumen colonisation.[54, 55]
  - Blood for culture should only be collected from a CVC in addition to peripheral blood 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, 65, 66]

- 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[67]
  - the clinician should utilise sterile collection equipment
  - the clinician should use standard precautions when collecting blood cultures, including eye protection
    - Non-sterile gloves can be used in accordance with aseptic technique. If key parts or key sites are touched, sterile gloves should be used.[67] If there is a high rate of contamination, routine sterile gloving and/or sterile blood culture kits have been shown to significantly decrease contamination rates.[68-70] Cost vs benefit should be considered.[67, 71]
  - the first sample is to be taken peripherally by the clinician; cleanse skin with alcoholic chlorhexidine or ≥70% alcohol[67, 72-75] and allow to dry prior to venepuncture
  - additional specimens can be collected by the clinician from each lumen of the catheter as above.[10, 26, 63, 64]

- The blood culture bottle diaphragm should be swabbed by the clinician with a single-use 70% alcohol-impregnated swab prior to inoculating the bottle.[67]
- There is no need for the clinician to change the blood culture collection needle/safety engineered medical device between venepuncture and bottle inoculation[55] (careful skin preparation is a more important factor in reducing contamination during blood culture collection).[63]
- 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.[55, 67]
- The collection site as well as the patient’s clinical and demographic data should be recorded on the request form by the clinician.[54]

## Culturing of CVC tips

- Routine culture of catheter tips is not recommended,[26, 64, 65] 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.[76] Consult with local laboratory.
- If pus is present at the insertion site, clinicians 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.[26, 65] The tip should be aseptically cut from the end of the catheter directly into a sterile specimen container.[64] Transport to laboratory as quickly as possible to prevent excessive drying.[76]
- 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.[76]

## 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 antibiotic 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.[33, 77-79]

Recommendations regarding ethanol lock therapy:

- 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
  - the patient has an exit site or tunnel infection
  - the patient is pregnant or breast feeding
  - 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
  - the patient has a catheter-associated bloodstream infection
  - there is no evidence of exit site or tunnel infection
  - appropriate antibiotic therapy has been initiated
  - the infectious diseases team and treating consultant agree to commence treatment.
- Prescribing recommendations:
  - 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: Flushing and locking of CVCs for correct technique to access line.

## Catheter duration and replacement

- Accurate and early diagnosis of infection is essential. Clinicians should monitor for signs of infection including erythema, pain, exudate, heat, tenderness, swelling and systemic signs of sepsis.
- The CVC should only be replaced on clinical indications i.e. clinical infection +/- purulence at the insertion site.[1, 10, 24]
- CVCs should not be routinely replaced.[9, 10]
- Because breaches in sterile technique are more likely during emergency procedures, CVCs inserted during a medical emergency should be replaced as soon as possible[2, 25] and no longer than 48 hours.
- 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.
- CVCs should be reviewed each shift by clinicians, and those that are no longer clearly needed should be promptly removed.[1, 3, 8, 17, 21, 25, 26]
- Clinicians should replace all fluid administration tubing and connectors when the CVC is replaced.[1, 16, 60]

## Guide-wire exchanges

- Clinicians should not use guide-wire exchanges routinely for percutaneous catheters to prevent infection.[1, 3, 9, 10, 25] The exception may be early failure of the device in a situation where a new central venous puncture would be hazardous to the patient.
- Guide-wire exchanges of temporary CVCs should not occur in the presence of BSI.
- For guide-wire exchanges, clinicians should use the same meticulous aseptic technique and use of full sterile barriers as used during the insertion of any new CVC.
- After vigorously cleansing the site with the antiseptic solution, inserting the guide-wire, removing the old catheter, and cleaning the site once more with the antiseptic solution, the operator should re-glove and re-drape the site, as the original gloves and drapes are likely to have become contaminated from manipulation of the old catheter.[1, 25]

## Removal of CVC

Also refer to local hospital procedure for removal of percutaneous CVC.

- The clinician should:
  - perform hand hygiene and don non-sterile gloves
  - position the patient supine, if possible[5, 80]
  - 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.[80, 81]
- Digital pressure should be applied by the clinician until haemostasis is achieved.[5, 80]
- 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 site is 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.

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## 5. Definitions of terms used in the policy and supporting documents

| Term | Definition / Explanation / Details | Source |
|---|---|---|
| Central line associated blood stream infection (CLABSI) / Catheter-related bacteraemia | 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. | NKF K/DOQI, 2006[62] |
| Exit-site infection | 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. | NKF K/DOQI, 2006[62] |
| Healthcare Associated Infection (HAI) | Healthcare associated infections (HAI) are those infections that are not present or incubating at the time of admission to a healthcare program or facility, develop within a healthcare organisation or are produced by micro-organisms acquired during admission. | ACSQHC[2] |
| Non-sterile antiseptic applicators (e.g. swabsticks) | Topical antiseptic applicators containing antiseptic solution (e.g. isopropyl alcohol, chlorhexidine gluconate). These applicators are single use only and are not usually manufactured as sterile products. Refer to manufacturer's recommendations and labelling. | U.S. Food and Drug Administration[82] |

## 6 . Document approval details

### Document custodian

Dr Heidi Carroll, Senior Medical Officer, Communicable Diseases Branch

### Approval officer

Dr Sonya Bennett, Executive Director, Communicable Diseases Branch

**Approval date:** 10 June 2015

**Review date:** 10 June 2018

## 7. Version Control

| Version | Date | Prepared by | Comments |
|---|---|---|---|
| 1.0 | 2012 | CHRISP | [QH-GDL-321-6-2:2012] Rescinded |
| 2.0 | March 2013 | CHRISP | |
| 3.0 | January 2015 | CDIM | |