

Guideline

Totally implantable central venous access ports

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

- [Totally implantable central venous access ports: maintenance – Point of care tool](#)

4. Guideline for totally implantable central venous access ports

Contents

Key critical points	3
General recommendations	3
Education and competency assessment	3
Hand hygiene.....	3
Surveillance	4
Insertion and management requirements	4
Insertion location.....	4
Catheter types and materials	4
Prophylactic antibiotics.....	5
Catheter and port site selection.....	5
Maximal barrier precautions	6
Skin preparation: insertion site	6
Post-insertion care, dressing type and replacement interval.....	7
Dressings: skin preparation.....	8
Port review	8
Accessing and de-accessing ports	9
General	9

Totally implantable central venous access ports

Accessing ports.....	9
De-accessing ports	10
In-line filters.....	11
Flushing and locking of ports.....	11
Flushing of ports	11
Locking ports.....	12
IV admixtures.....	12
Replacement of IV fluids	13
Administration set changes	13
Disconnection of administration sets	14
Needleless access ports	14
Management of infected ports.....	15
General management recommendations:.....	15
Blood culture collection for diagnosis of BSI.....	16
Culturing of ports.....	17
Ethanol lock therapy.....	17
Catheter duration and replacement	18
Removal of a port.....	19
References	20
Bibliography.....	24

Key critical points

- Only competent staff (or training staff supervised by competent staff) are to insert Totally Implantable Central Venous Access Ports (Ports).
- Accurate documentation and record keeping should be maintained to ensure patient safety.

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 eliminate environmental risk factors for all procedures involving ports.⁽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 port 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, length of line on insertion, anatomical site, skin preparation solution used, name of operator, site observations and device removal/replacement details.^(5, 6)

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.^(7, 8)

- 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, 4, 6, 9-15)
- A proportion of patients will be responsible for their own catheter care when discharged from hospital in between treatment regimens. It is recommended that patients be provided with theoretical and practical training by a clinician.^(10, 12, 14) 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.^(5, 13) Where possible, controlled testing of the patient's knowledge as well as their practical execution of the techniques should be undertaken.

Hand hygiene

- It is recommended that healthcare workers perform hand hygiene with an antiseptic-containing soap solution or use an alcohol-based waterless cleanser:

Totally implantable central venous access ports

- before and after palpating port sites
- before and after accessing, or dressing an intravascular catheter; this includes associated components such as administration sets and access ports.^(1, 3, 4, 10, 12-19)
- 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 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>.
- The introduction of new products or processes should be monitored to identify any increase or decrease in the occurrence of device associated infection.⁽²⁾

Insertion and management requirements

Insertion location

- Ports should be inserted by a clinician in an area where asepsis can be maintained (e.g. interventional radiology suite or operating theatre) and where the patient can be monitored.⁽¹⁰⁾
- Imaging facilities (fluoroscopy, intravenous contrast studies and standard radiography) should be available for the insertion of ports.
- A chest x-ray or other imaging modality should be performed post insertion to confirm placement.^(9, 20) 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

- Catheters are made of radiopaque silicone rubber or polyurethane.⁽¹⁰⁾
- Ports are made of various materials including plastic, titanium, silicone rubber, polyurethane, and a combination of these substances.⁽¹⁰⁾
 - The life of the septum depends on the gauge of needles used to access the port and the type of needle used i.e. if a larger needle is used, the septum will wear out after fewer punctures than when a smaller gauge needle is used.
 - Low and high profile ports are available.⁽⁹⁾
- A non-coring (Huber) needle should be used by clinicians to access the port^(6, 9, 10, 12, 13, 20-22) (also refer: [Accessing and de-accessing ports](#)).

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 port to prevent catheter colonisation or bloodstream infection.^(3, 11, 14, 15, 23, 24)
- 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.^(11, 14, 23, 25-29)

Catheter and port site selection

- Clinicians should assess specific patient factors such as patient's age and size, previous procedures, underlying medical problems, anatomic deformity, site restrictions, the relative risk of mechanical complications and the risk of infection.⁽¹⁴⁾ This should also include a vein assessment and history of previous central venous catheterisations.
- The catheter can be inserted into the subclavian, internal jugular,⁽¹²⁾ external jugular, basilic or brachial veins by qualified clinicians^(9, 10, 20) in the same way as tunnelled catheters (refer: [Guideline for Tunnelled CVC](#)).
- Port pocket site selection by clinicians should allow for port placement in an anatomic area that provides good port stability, does not interfere with patient mobility, does not create pressure points or interfere with clothing.
 - Insertion of the port should be such that it lies against bony structures for easy access.
 - Ports near the sternum provide better needle stability and ease of access.
 - If patients are accessing their own port, the port is usually located low on the anterior chest wall or upper arm, for easy access.
 - When patients are not accessing their own port, the port is usually located on the upper rib cage near the clavicle.
- Clinicians should consider the amount of cutaneous tissue over the port:
 - too thin a layer of tissue may lead to port erosion
 - if the port is placed too deeply or there is excess adipose tissue, it can make access difficult⁽⁹⁾
 - a tissue thickness of 0.5cm to 2 cm is appropriate
 - placement under the arm, in the breast or the soft tissue of the abdomen should be avoided.
- The port pocket should be made as small and tight as possible and the port sutured to the deep fascia.
- The suture line closing the port should not be located over the septum of the port.
- The catheter tip should be positioned at the junction of the superior vena cava and right atrium.^(23, 27)

Maximal barrier precautions

Before placing a port, it is recommended that 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, 11, 13-15, 18, 23-25, 30)

- The patient's hair should be entirely covered with a surgical cap.
- Place surgical cap on operator's head to cover all hair, then don protective eyewear and surgical mask (the mask should cover the nose and mouth tightly).
- Port insertion requires surgical aseptic technique⁽²⁾ and therefore a surgical scrub should be performed prior to the procedure.⁽³¹⁾
- The clinician should aseptically don sterile long-sleeved gown.
- The clinician should aseptically don sterile surgical gloves (ensure gloves cover cuff of gown).
- The clinician should prep catheter insertion site, allow to dry (Refer: [Skin preparation: insertion site](#)).
- The clinician should 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.

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, 30)
- 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.⁽³⁰⁾
- 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 $\geq 70\%$ (ethyl or isopropyl) alcohol (alcoholic chlorhexidine) should be used by clinicians for preparation of the insertion site.^(5, 19, 32)

or

- A solution containing povidone-iodine 10% in 70% ethyl alcohol (ethanol)⁽³³⁾ (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.⁽³⁰⁾
 - 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.

Totally implantable central venous access ports

- If alcohol is contraindicated (e.g. allergy, sensitivity, skin condition) clinicians should use aqueous povidone-iodine⁽³⁴⁾ 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.⁽³⁵⁾
- 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.^(1, 10)
- Clinicians should not palpate the insertion site after the application of antiseptic, unless aseptic technique is maintained.^(1, 12)
- Clinicians should not routinely use antimicrobial ointments or creams under the dressing at the insertion site.^(1, 11, 13-15, 23, 24)
- The length of the line used should be noted prior to insertion and clearly documented in the patient's notes.^(5, 10)

Post-insertion care, dressing type and replacement interval

- Post-insertion care for implantable devices is required only until the incision has healed.
- Care depends in part on the closure used:
 - if external sutures are placed, the incision should be kept dry and covered for as long as two weeks or until the sutures are removed (usually 7 - 10 days)
 - if internal sutures or surgical adhesive (glue) are used to close the skin, the incision can get wet the next day. However, it is generally best to keep the incision covered for one week if no external sutures have been used.

Table 1: Dressing types and replacement intervals

Dressing type	Replacement interval
Transparent, semi-permeable, self-adhesive polyurethane	Weekly ^{*(1, 3, 6, 12, 14-16, 18, 19, 23, 24, 30, 36)}
Gauze	Second daily ^{*(1, 3, 15, 16, 30)}
<p>*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, 14-16, 18, 19, 23, 24, 30, 36)</p>	

- Transparent, semi-permeable, self-adhesive, (standard or hyperpermeable), polyurethane dressings⁽¹⁴⁾ are to be used by the clinician to protect the site from extrinsic contamination,

allow continuous observation of the insertion site, and to help stabilise and secure the access needle.

- 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.^(14, 30)
 - If gauze is used to stabilise the access needle but not obscure the catheter-skin junction, the dressing is not considered a gauze dressing and should be changed at least every 7 days.
- The dressing (including polyurethane types) should not be immersed or submerged in water.⁽¹⁾
- Clinicians should utilise an aseptic technique^(6, 14, 36) including sterile dressing (or dressing change) pack with drape and sterile gloves when changing the dressing on the insertion site.

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 port insertion (refer: [Skin preparation: insertion site](#)).^(1, 3, 5, 6, 13, 14, 17-19, 23, 30, 37)
- Removal of skin lipids (defatting) by clinicians with alcohol, ether or acetone is not recommended.⁽³⁰⁾
- The clinician should remove blood or ooze from catheter insertion site with sterile 0.9% sodium chloride.
- 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 at the dressing at the port site.^(1, 11, 13, 14, 18, 30)

Port review

- Ports should be reviewed each shift by clinicians, and arrangements should be made to remove those no longer required.^(3, 4, 12, 13)
 - port site
 - The port site should be examined daily by the clinician⁽¹⁹⁾ (or at each dressing change if gauze is used) for erythema, exudate, tenderness, pain, redness and swelling.^(6, 15)
 - 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⁽³⁰⁾

- Patients should be encouraged (where possible) by clinicians to report any changes in their port site or any new discomfort.

Accessing and de-accessing ports

General

- Only specially trained clinicians should access and de-access implantable ports.^(1, 9-13)
- Clinicians should perform hand hygiene with an antiseptic containing solution before and after accessing and de-accessing the port.^(9, 10, 12, 36)
- Due to the long-term nature of these devices, clinicians should take care not to damage the septum of the port. If damaged, the entire port needs to be replaced.
 - A needle designed to be non-coring (Huber needle) which will not damage the port, is the only needle to be used on an implanted port.^(6, 9, 10, 12, 13, 20-22, 36)
 - There is currently no consensus on the optimal time frame for the initiation of port access in the post-placement period.
 - If the port is to be used immediately, the needle should be left in place and dressed occlusively, as post-operative oedema and tenderness of the incision make post-surgical access difficult.
 - If the port is not used immediately, the needle is removed and a dressing applied over the port pocket incision and the catheter entry site.
 - Ideally, the port should not be accessed for several days to allow oedema and tenderness to resolve.

Accessing ports

- A small ice pack over the site for 10 minutes or application of topical local anaesthetic^(6, 22, 36, 38) e.g. 'eutectic mixture of local anaesthetics' (EMLA) - lignocaine with prilocaine, for at least one hour prior to skin disinfection, can be used by clinicians to reduce pain associated with accessing the port.
 - Creams can leave a lipid residue that may create a focus for microbial growth; therefore residue of topical anaesthesia should be removed with a soap and water scrub, prior to skin preparation (disinfection).
 - Soap and water has been found to be superior to alcohol-impregnated swabs for removing residual lipid from the skin.
- The site of needle placement is determined by palpation of the port by the clinician.^(21, 22, 36)
- The clinician should place the patient in a supine position if possible.
- If the patient is coughing or cannot turn their head away from the access site,⁽²¹⁾ the clinician should consider having them wear a face mask.
- The clinician should utilise an aseptic technique^(6, 14) including sterile dressing (or dressing change) pack with drape and sterile gloves when accessing the port.^(9, 12, 20, 22, 36)
- Prior to needle insertion, the skin should be disinfected by the clinician with 2% alcoholic chlorhexidine unless contraindicated^(3, 12, 20, 22) (refer: [Skin preparation: insertion site](#)).

Totally implantable central venous access ports

- Clean meticulously in a circular motion, beginning in the centre, for a radius of approximately 4cm. Repeat three times using a new swab for each application. Allow to air dry, do not wipe or blot.
- The smallest size non-coring needle that can accommodate the prescribed therapy should be used by the clinician to access the implanted port⁽²²⁾ – 19 to 22 gauge.
 - A safety, non-coring needle designed to prevent needlestick injuries when de-accessing the port, is available on Queensland public health system standing offer arrangement (SOA).
- The access needle and extension set should be primed by the clinician with 0.9% normal saline, using a sterile technique; the priming syringe should be left attached.^(6, 12, 21, 22)
 - The needle should not be left open to the air when in the port.
- Correct needle placement in ports should be verified by positive aspiration of blood by the clinician prior to administration of medications and solutions.^(12, 21, 22, 36) If there is doubt regarding proper needle placement a radiographic dye procedure should be performed to confirm placement.
 - Discard the initial fluid to reduce the risk of septic emboli.
- After needle insertion, and if proceeding with infusion, the clinician should cover the site with a sterile semi-permeable dressing^(10, 12, 21) (refer: [Post-insertion care, dressing type and replacement interval](#)).
 - Sterile gauze squares can be used under the semi-permeable dressing to support the access needle at a 90 degree angle, taking care not to obscure the needle insertion site.^(6, 22)
- To avoid damage to the septum once a port is accessed, the needle should not be 'rocked or tilted'.
- Needle changes should be undertaken by clinicians every 7 days and as necessary, depending on individual patient circumstances, treatment regime or routine line changes.^(10, 12, 21, 22)
- The rotation of insertion points of the access needle reduces the risk of skin breakdown and pocket infection.
- A new needle should be used by the clinician for each access attempt.

De-accessing ports

- Clinicians should use clean non-sterile gloves when de-accessing a port.⁽³⁶⁾
- The clinician should flush catheter with 0.9% sodium chloride to clear it of blood, IV solution, or medication^(21, 36) (refer: [Flushing and locking of ports](#)).
- Because of potential resistance, the port should be stabilised in place with the clinician's gloved, non-dominant hand during needle removal.^(21, 22, 36) However, this places the gloved hand in a hazardous position as the contaminated, potentially blood-filled needle is withdrawn from the device due to rebound response.⁽¹⁰⁾
 - Barbing of the needle after placement in the port can also make the needle harder to withdraw.
 - A protective or safety device to prevent a rebound needlestick injury should be used, or an approved needle removal device.

Totally implantable central venous access ports

- To reduce the potential for blood backflow into the catheter tip of a port, after clamping the infusion set and stabilising the port, the non-coring needle should be removed slowly straight upward by the clinician.
- After needle removal, the clinician should apply a small sterile dressing over the site for approximately one hour.

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 ports

- The optimal volume and frequency of flushing and/or locking of ports used for intermittent injections or infusions is unclear. Until further evidence becomes available clinicians should refer to the manufacturer's recommendations for flushing volumes.
- Only single-dose solutions should be used.
- 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).^(16, 36)
 - 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.⁽⁶⁾
 - 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.^(6, 16, 36, 39)
- Clinicians should use an aseptic technique^(6, 14) including cleaning the access port(s) with a single-use 70% alcohol-impregnated swab and allowing to dry prior to accessing the system.^(16, 36)
- 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).^(6, 10, 16, 36, 39)
- 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.^(30, 40-42)

Flushing of ports

- Flushing is recommended to promote and maintain patency and prevent the mixing of incompatible medications and solutions.

Totally implantable central venous access ports

- Sterile 0.9% sodium chloride for injection should be used by clinicians to flush a port unless the manufacturer recommends flushing with heparin sodium solution.⁽¹⁴⁾
- Ports should be flushed by clinicians immediately:
 - after placement
 - prior to and after fluid infusion (as an empty fluid container lacks infusion pressure and will allow blood reflux into the catheter lumen from normal venous pressure) or injection
 - prior to and after blood drawing.
- The flush solution and flushing intervals should be documented by the clinician in the patient record.

Locking ports

- 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 port. Heparinised saline has been used primarily due to the antithrombotic 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.^(17, 43) 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, clinicians should use 5mL of sterile heparinised saline (10 Units in 1mL) to lock a port that is no longer used for continuous infusions in preparation for future use; unless the manufacturer recommends catheter lumens be locked with an alternate solution.
- Ports not being accessed should be flushed and locked every four weeks by a clinician.^(10, 12, 21, 36)
 - 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.^(6, 16, 39)
- 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.^(11, 13, 14)

IV admixtures

It is recommended that:

- Clinicians should admix all intravenous fluids using an aseptic technique.⁽¹⁴⁾
- 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, 18, 44)

- When the port needle is changed, it is recommended that both the infusion and administration set be replaced by the clinician regardless of when the infusion was initially commenced.⁽³⁰⁾
- IV administration sets should be spiked into IV fluid bags the whole way.⁽⁴⁵⁾
- Each bag of IV fluid should only be spiked once.⁽⁴⁶⁾
- 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, 14, 38)}
Lipid/lipid-containing parenteral nutrition	Within 24 hours ^{*(1, 14, 18, 30, 38, 47)}
Chemotherapeutic agents	Remove immediately after use*
Propofol	Within 12 hours or as per manufacturer ^{*(1, 2, 38)}
Heparin	Every 24 hours ^(5, 18, 44)
Other infusions (not including blood products)	When disconnected or new catheter ^{*(30)}

^{*}All administration sets should be replaced when disconnected or if the catheter is changed^(1, 18, 30, 47) When an administration set is changed, the IV fluid bag should also be changed.⁽⁴⁶⁾

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, 44)
- 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.⁽⁴⁴⁾ Administration sets should be removed by the clinician immediately after use.^(14, 19)

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, 10, 30)

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).^(5, 48)

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

<http://www.safetyandquality.gov.au/publications/national-recommendations-for-user-applied-labelling-of-injectable-medicines-fluids-and-lines/>.

Needleless access ports

- Clinicians should minimise catheter manipulation (e.g. number of intermittent infusions).⁽³⁸⁾
- 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/cap when not in use.^(1, 25)
- All persons handling or accessing the intravascular system should first perform hand hygiene.^(19, 23, 24, 30, 36)
- 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 needleless 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, 14, 36) For example a typical intermittent infusion of medication may involve swabbing the access ports:
 - before the initial saline injection to assess port patency,

Totally implantable central venous access ports

- before attaching the sterile infusion tubing or syringe, and
- before flushing and/or locking the port with saline after administering the medication.
- The port should be accessed by the clinician with a sterile single-use device.
- Anytime an needleless access port is removed from a catheter, the clinician should discard it and a new sterile needleless access port should be attached.
- The integrity of the needleless access port should be confirmed by the clinician before and immediately after each use. If the integrity of the needleless access port is compromised or if residual blood remains within the needleless 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 needleless access 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.⁽³⁶⁾
 - 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.⁽⁴⁹⁾
 - More frequent changing of needleless access ports may reduce the burden of needleless access port contamination that could lead to bloodstream infection, however more frequent manipulation of the port for needleless access port changes could increase the risk of infection.⁽⁴⁹⁾

Management of infected ports

General management recommendations:

- 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.
- Blood cultures should be promptly collected by clinicians on suspicion of catheter-related BSI.⁽¹¹⁾
- In some situations the use of ethanol lock therapy can preserve a CVC. (Refer: [Ethanol lock therapy](#)).
- The duration of antibiotic therapy depends on clinical response, culture results, and the presence of metastatic infective complications.⁽²⁰⁾
- The management of catheter-related infection depends on a number of factors including:^(10, 11, 15)
 - patient factors
 - the type of organism involved
 - the requirement for the CVAD
 - the type of infection.
- Port removal is not always feasible (e.g. haemorrhagic hazards associated with reimplantation, or absence of other vascular access sites).⁽¹⁵⁾ In such cases, intravenous antimicrobial therapy may be required for longer periods.⁽¹¹⁾

- Port pocket infections without clinical or microbiological evidence of BSI may be able to be treated with local wound care and systemic antibiotics. Port pocket infections often require device removal and systemic antibiotic therapy,^(11, 15, 20, 28) and may involve incision and drainage.⁽⁵⁰⁾
- Catheter-related BSIs require prompt initiation of empiric systemic antibiotic therapy, subsequent modification of antibiotic therapy based on microbiological results, consideration of port removal, and investigation for metastatic complications (e.g. endocarditis).^(11, 15)

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.⁽⁵¹⁻⁵³⁾
 - 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%.⁽⁵⁴⁾
- 10mL draws are suggested for each bottle. There is no need to collect more than two bottles per lumen. Taking blood cultures through a CVC is discouraged as the practice may cause occlusion and contribute to catheter lumen colonisation.⁽⁵³⁾
- 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 device is contaminated.^(15, 50, 55)
- 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⁽⁵⁶⁾
 - 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.⁽⁵⁶⁾ 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.⁽⁵⁷⁻⁵⁹⁾ Cost vs benefit should be considered.^(56, 60)
 - the first sample is to be taken peripherally by the clinician; cleanse skin with alcoholic chlorhexidine or ≥70% alcohol^(56, 61-64) and allow to dry prior to venepuncture
 - additional specimens can be collected by the clinician from each port (if applicable) as above.^(15, 24, 51, 52)

Totally implantable central venous access ports

- The blood culture bottle diaphragm should be swabbed by the clinician with a single-use 70% alcohol-impregnated swab prior to inoculating the bottle.⁽⁵⁶⁾
- There is no need for the clinician to change the blood culture collection needle between venepuncture and bottle inoculation⁽⁵⁴⁾ (careful skin preparation is a more important factor than changing needles in reducing contamination during blood culture collection).⁽⁵²⁾
- 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.^(54, 56)
- The collection site as well as the patient’s clinical and demographic data should be recorded on the request form by the clinician.⁽⁵³⁾

Culturing of ports

- Routine culturing of port sites, reservoirs or catheter tips is not recommended^(24, 50, 51) however, periodic sampling could be considered in the context of measuring the effectiveness of interventions 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.⁽⁶⁵⁾ Consult with local laboratory.
- If pus is present at the port site, clinicians should swab the site prior to cleaning and send for culture.
- If catheter-related sepsis is suspected:
 - consult with the patient’s medical team
 - a segment of the tip of the catheter (optimum length 5cm) should be submitted.^(24, 50) The tip should be aseptically cut from the end of the catheter directly into a sterile specimen container.⁽⁵¹⁾ Transport to laboratory as quickly as possible to prevent excessive drying⁽⁶⁵⁾
 - swabs should be collected from the subcutaneous pocket by the clinician.
- The clinician should ensure the site and type of device are noted on the request form as well as the required clinical and demographic data.⁽⁶⁵⁾

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.^(29, 66, 67)

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

Totally implantable central venous access ports

- 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
 - appropriate antibiotic therapy has been initiated
 - the infectious diseases team and treating consultant agree to commence treatment.
- Prescribing recommendations:
 - Ethanol installation volume, withdrawal volumes and sodium chloride 0.9% flushes and the frequency of locks are to be ordered by an appropriate clinician on the patient medication chart.
 - The dwell time for ethanol lock is four hours. The ethanol lock is to be repeated by clinicians daily for 4-5 days.
 - Clinicians 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 device 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 device should only occur after the clinician has withdrawn the alcohol volume from the port at the conclusion of the four hour dwell time.

Catheter duration and replacement

- The maximum length of time a port can remain in place has not yet been determined but have been reported to be used for as long as 5 years or up to 2000 needle punctures.
 - Replace ports only on clinical indications i.e. clinical infection.
 - Patients transferring from other healthcare facilities with a port 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 port needle is changed.

Removal of a port

- Also refer to local hospital procedure for removal of implanted ports.
- Ports require surgical removal⁽⁶⁸⁾ in theatre or equivalent:⁽⁶⁹⁾
 - Port removal, like insertion, requires meticulous technique to prevent air embolism and to maintain sterile conditions.
 - Generally, the port pocket is incised, sutures holding the port body removed and the catheter is withdrawn from the vein.^(69, 70)
 - 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.
- Upon removal, digital pressure should be applied by the clinician until haemostasis is achieved.
 - A sterile occlusive dressing should be applied to the site.
 - After port removal, the dressing should be changed and the site assessed every 24 hours by the clinician until the site is epithelialised.

References

1. O'Grady N, Alexander M, Burns L, Dellinger E, Garland J, Heard S, et al. Healthcare Infection Control Practices Advisory Committee (HICPAC). Guidelines for the prevention of intravascular catheter-related infections. 2011.
2. ACSQHC. Australian Guidelines for the Prevention and Control of Infection in Healthcare. National Health and Medical Research Council; 2010.
3. Marschall J, Mermel L, Fakih M, Hadaway L, Kallen A, O'Grady N, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. *Infection Control and Hospital Epidemiology*. 2014;35(7):753-71.
4. Sacks G, Diggs B, Hadjizacharia P, Green D, Salim A, Malinoski D. Reducing the rate of catheter-associated bloodstream infections in a surgical intensive care unit using the Institute for Healthcare Improvement central line bundle. *The American Journal of Surgery*. 2014;207(6):817-23.
5. Dougherty L, Bravery K, Gabriel J, Kayley J, Malster M, Scales K, et al. Standards for infusion therapy (third edition). Royal College of Nursing; 2010.
6. Ho A, Bravery K. Central venous access devices (long term). London: Great Ormond Street Hospital for Children NHS Foundation Trust. 2013.
7. ACSQHC. Standard for credentialing and defining the scope of clinical practice. Australian Commission on Safety and Quality in Health Care. 2004.
8. Queensland Government. Health service directive # QH-HSD-034:2014 Credentialing and defining the scope of clinical practice. 2014.
9. Teichgraber U, Pfitzmann R, Hofmann H. Central venous port systems as an integral part of chemotherapy. *Deutsches Arzteblatt International*. 2011;108(9):147-54.
10. Adams S, Barrett L, Brooks S, Dahler A, Jansens W, Shaw H. Central venous access devices: principles for nursing practice and education. Cancer Nurses Society of Australia; 2007.
11. Schiffer C, Mangu P, Wade J, Camp-Sorrell D, Cope D, El-Rayes B, et al. Central venous catheter care for the patient with cancer: American Society of Clinical Oncology Clinical Practice Guideline. *Journal of Clinical Oncology*. 2013;31(10):1357-70.
12. Bowe-Geddes L. Planning for and successfully managing long-term venous access devices. *Mosby's Nursing Consult*. 2013 Dec 20, 2013.
13. Camp-Sorrell D. State of the science of oncology vascular access devices. *Seminars in Oncology Nursing*. 2010;26(2):80-7.
14. Loveday H, Wilson J, Pratt R, Golsorkhi M, Tingle A, Bak A, et al. epic3: national evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *Journal of Hospital Infection*. 2014(86S1):S1-S70.
15. Hentrich M, Schalk E, Schmidt-Hieber M, Chaberny I, Mousset S, Buchheidt D, et al. Central venous catheter-related infections in hematology and oncology: 2012 updated guidelines on diagnosis, management and prevention by the Infectious Diseases Working Party of the German Society of Hematology and Medical Oncology. *Annals of Oncology*. 2014;25(5):936-47.
16. Nailon R, O'Neill S, Cowdery P, Wardian Hartung S, Tyner K, Tomb P, et al. Standardizing central venous catheter care: hospital to home. Rockville MD: Agency for Healthcare Research and Quality (AHRQ); 2012.

17. Bhola C, Lok C. Central venous catheters: optimizing the suboptimal. *Nephrology News and Issues*. 2011 April 27, 2011.
18. Zingg W, Cartier-Fassler V, Walder B. Central venous catheter-associated infections. *Best Practice and Research: Clinical Anaesthesiology*. 2008;22(3):407-21.
19. McIntyre H, Raw A, Stephenson J, Bradley A, Dawson J, Fay M, et al. NICE quality standard 61: Infection prevention and control. National Institute for Health and Care Excellence; 2014.
20. Vescia S, Baumgartner A, Jacobs V, Kiechle-Bahat M, Rody A, Loibl S, et al. Management of venous port systems in oncology: a review of current evidence. *Annals of Oncology*. 2008;19:9-15.
21. Infusion Nurses Society. Policies and procedures for infusion nursing (4th edition). Norwood, MA: Infusion Nurses Society (INS); 2011.
22. Weinstein S, Hagle M. *Plumer's principles and practice of infusion therapy* (9th edition). Philadelphia, PA: Lippincott Williams & Wilkins; 2014.
23. Smith R, Nolan J. Central venous catheters. *BMJ*. 2013;347:28-32.
24. Cameron J, Cameron A. Central line-associated bloodstream infections. In: Cameron C, Cameron A, editors. *Current Surgical Therapy*, eleventh edition. Philadelphia, PA: Saunders; 2014.
25. Rupp S, Apfelbaum J, Blitt C, Caplan R, Connis R, Domino K, et al. Practice guidelines for central venous access: a report by the American Society of Anesthesiologists Task Force on Central Venous Access. *Anesthesiology*. 2012;116(3):539-73.
26. van de Wetering M, van Woensel J, Lawrie T. Prophylactic antibiotics for preventing gram positive infections associated with long-term central venous catheters in oncology patients (review). *The Cochrane Library*. 2013(11).
27. Akahane A, Sone M, Ehara S, Kato K, Suzuki M, Tanaka R, et al. Central venous port-related infection in patients with malignant tumors: an observational study. *Upsala Journal of Medical Sciences*. 2012;117:300-8.
28. Natarajan S, Narayan S, Liu Yin J. Update on the management of febrile neutropenia. *European Oncology & Haematology*. 2011;7(4):263-9.
29. Chaudhury A, Rangineni J, Venkatramana B. Catheter lock technique: in vitro efficacy of ethanol for eradication of methicillin-resistant staphylococcal biofilm compared with other agents. *Federation of European Microbiological Societies: Immunology & Medical Microbiology*. 2012;65:305-8.
30. Australian and New Zealand Intensive Care Society (ANZICS). Central line insertion and maintenance guideline. Australian Commission on Safety and Quality in Health Care. 2012 April 2012.
31. Grayson L, Russo P, K R, S H, K H. Five moments for hand hygiene. *Hand Hygiene Australia*. 2013.
32. NSW Ministry of Health. Guideline for Peripheral Intravenous Cannula (PIVC) insertion and post insertion care in adult patients. 2013.
33. Morris W, Tay M. Strategies for preventing peripheral intravenous cannula infection. *British Journal of Nursing*. 2008;17(19):S14-S21.

34. American Society of Anesthesiologists Task Force (ASA). Practice guidelines for central venous access. *Anesthesiology*. 2012;116(3):539-73.
35. Australian College of Operating Room Nurses (ACORN). 2014-2015. Standards for perioperative nursing.
36. Centers for Disease Control and Prevention (CDC). Basic infection control and prevention plan for outpatient oncology settings. Atlanta, GA: Division of Healthcare Quality Promotion (DHQP); 2011.
37. Bilir A, Yelken B, Erkan A. Chlorhexidine, octenidine or providone iodine for catheter related infections: a randomized controlled trial. *Journal of Research in Medical Sciences*. 2013;18(6):510-2.
38. Davis M. Pediatric central venous catheter management: a review of current practice. *Journal of the Association for Vascular Access*. 2013;18(2):93-8.
39. Chong L, Chow Y, Kong S, Ang E. Maintenance of patency of central venous access devices by registered nurses in an acute ambulatory setting: an evidence utilisation project. *International Journal of Evidence Based Healthcare*. 2013;11(1):20-5.
40. Jarvis W. Choosing the best design for intravenous needleless connectors to prevent healthcare-associated bloodstream infections. *Infection Control Today*. 2010;14(8).
41. Jarvis W, Murphy C, Hall K, Fogle P, Karchmer T, Harrington G, et al. Health care-associated bloodstream infections associated with negative- or positive-pressure or displacement mechanical valve needleless connectors. *Clinical Infectious Diseases*. 2009;49:1821-7.
42. Btaiche I, Kovacevich D, Khalidi N, Papke L. The effects of needleless connectors on catheter-related bloodstream infections. *American Journal of Infection Control*. 2011;39(4):277-83.
43. Sona C, Prentice D, Schallom L. National survey of central venous catheter flushing in the intensive care unit. *American Association of Critical-Care Nurses*. 2012;32(1):e12-e9.
44. Australian and New Zealand Society of Blood Transfusion Ltd. Guidelines for the administration of blood products, 2nd edition. Royal College of Nursing, Australia; 2011.
45. Baxter Healthcare Pty Ltd. Correct intravenous practices. Email to Communicable Diseases and Infection Management (CDIM_Infection_Management@health.qld.gov.au) 2014 Dec 1.
46. O'Connell D. Findings of inquest into the death of Ruby Yan Chen. Office of the State Coroner, Queensland Courts. 2014.
47. Ullman A, Cooke M, Gillies D, Marsh N, Daud A, McGrail M, et al. Optimal timing for intravascular administration set replacement (review). *The Cochrane Library*. 2013(9).
48. ACSQHC. National recommendations for user-applied labelling of injectable medicines, fluids and lines. Australian Commission on Safety and Quality in Health Care; 2012.
49. Sandora T, Graham D, Conway M, Dodson B, Potter-Bynoe G, Margossian S. Impact of needleless connector change frequency on central line-associated bloodstream infection rate. *American Journal of Infection Control*. 2014;42:485-9.
50. Mermel L, Allon M, Bouza E, Craven D, Flynn P, O'Grady N, et al. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 update by the Infectious Diseases Society of America. *Clinical Infectious Diseases*. 2009;49:1-45.

51. Septimus E. Clinician guide for collecting cultures. Centers for Disease Control and Prevention. 2014.
52. Pfenninger J, Fowler G. Drawing blood cultures. In: Pfenninger J, Fowler G, editors. Pfenninger and Fowler's Procedures for Primary Care, third edition. Philadelphia, PA: Elsevier Mosby; 2011.
53. Halm M, Hickson T, Stein D, Tanner M, VandeGraaf S. Blood cultures and central catheters: is the "easiest way" best practice? *American Journal of Critical Care*. 2011;20:335-8.
54. Heney C. Pathology Queensland/CHRISP recommendations for blood culture collections - adults. Queensland Health; 2014.
55. Schoot R, Dalen E, Ommen C, van de Wetering M. Antibiotic and other lock treatments for tunnelled central venous catheter-related infections, in children with cancer (review). *The Cochrane Library*. 2013(6).
56. Health Protection Scotland. Targeted literature review: what are the key infection prevention and control recommendations to inform a prevention of blood culture contamination quality improvement tool? Version 2.0: September 2014.
57. Kim N, Kim M, Lee S, Yun N, Kim K, Park S, et al. Effect of routine sterile gloving on contamination rates in blood culture: a cluster randomized trial. *Annals of Internal Medicine*. 2011;154(3):145-51.
58. Self W, Speroff T, Grijalva C, McNaughton C, Ashburn J, Liu D, et al. Reducing blood culture contamination in the emergency department: an interrupted time series quality improvement study. *Academic Emergency Medicine*. 2013;20:89-97.
59. Self W, Mickanin J, Grijalva C, Grant F, Henderson M, Corley G, et al. Reducing blood culture contamination in community hospital emergency departments: a multicenter evaluation of a quality improvement intervention. *Academic Emergency Medicine*. 2014;21(3):274-82.
60. Dawson S. Blood culture contaminants. *Journal of Hospital Infection*. 2014;87:1-10.
61. Caldeira D, David C, Sampaio C. Skin antiseptics in venous puncture-site disinfection for prevention of blood culture contamination: systematic review with meta-analysis. *Journal of Hospital Infection*. 2011;77:223-32.
62. Maiwald M, Chan E. The forgotten role of alcohol: a systematic review and meta-analysis of the clinical efficacy and perceived role of chlorhexidine in skin antisepsis. *PLoS One*. 2012;7(9).
63. Maiwald M, Chan E. Pitfalls in evidence assessment: the case of chlorhexidine and alcohol in skin antisepsis. *Journal of Antimicrobial Chemotherapy*. 2014;69(8):2017-21.
64. Washer L, Chenoweth C, Kim H, Rogers M, Malani A, Riddell J, et al. Blood culture contamination: a randomized trial evaluating the comparative effectiveness of 3 skin antiseptic interventions. *Infection Control and Hospital Epidemiology*. 2013;34(1):15-21.
65. Harper J. Culture of tips and related devices (Pathology Queensland). Queensland Health; 2014.
66. Rajpurkar M, McGrath E, Joyce J, Boldt-MacDonald K, Chitlur M, Lusher J. Therapeutic and prophylactic ethanol lock therapy in patients with bleeding disorders. *Haemophilia*. 2014;20:52-7.

67. Tan M, Lau J, Guglielmo B. Ethanol locks in the prevention and treatment of catheter-related bloodstream infections. *Annals of Pharmacotherapy*. 2014;48(5):607-15.
68. Huang F, Abrahm J. Chapter 89: Indwelling access devices. In: Hoffman R, Benz E, Silberstein L, Heslop H, Weitz J, Anastasi J, editors. *Hematology: Basic principles and practice* (6th edition). Philadelphia, PA: Elsevier Saunders; 2013.
69. Kandarpa K, Machan L. *Handbook of interventional radiologic procedures*. Philadelphia, PA: Lippincott Williams & Wilkins; 2011.
70. Kaufman J. Chapter 7: Upper extremity, neck and central thoracic veins. In: Kaufman J, Lee M, editors. *Vascular and interventional radiology* (2nd edition). Philadelphia, PA: Elsevier Saunders; 2014.
71. National Kidney Foundation. KDOQI clinical practice guidelines and clinical practice recommendations for 2006 updates: haemodialysis adequacy, peritoneal dialysis adequacy and vascular access. *American Journal of Kidney Disease*. 2006;48(S1-S322).
72. FDA Drug Safety communication: FDA requests label changes and single-use packaging for some over-the-counter topical antiseptic products to decrease risk of infection. U.S. Food and Drug Administration; 2013. Available from <http://www.fda.gov/downloads/Drugs/DrugSafety/UCM374870.pdf>.

Bibliography

1. Australia. Australian Council for Safety and Quality in Health Care. *National Strategy to Address Health Care Associated Infection*: 2003.
2. Bernath V. *Tourniquets in phlebotomy*. Australia: Monash University:2006.
3. Australia. NSW Health. Cancer Institute NSW CI-SCaT. *Central Venous Access Devices*: 2005.
4. Australia. Queensland Health. Queensland Health Pathology and Scientific Services. *2005 Pathology Manual*: 2005.
5. Australia. The Canberra Hospital. Lever D, Dahler A, Boland M. *Central Venous Catheter Manual*: 2005.
6. Australia. The Royal College of Pathologists of Australasia (RCPA). *The RCPA Manual Version 4.0*: 2004. Available from: <http://www.rcpamanual.edu.au>
7. Canada. Registered Nurses Association of Ontario. *Nursing Best Practice Guideline. Care and Maintenance to Reduce Vascular Access Complications*: April 2005.
8. United States. Centers for Disease Control and Prevention. *Guidelines for the Prevention of Intravascular Catheter-Related Infections*: 2011.
9. Crnich C, Maki D. The Promise of Novel Technology for the Prevention of Intravascular Device-Related Bloodstream Infection. I. Pathogenesis and Short-Term Devices. *Healthcare Epidemiology* 2002; 34: 1232-1242.
10. Crnich C, Maki D. The Promise of Novel Technology for the Prevention of Intravascular Device-Related Bloodstream Infection. II. Long-Term Devices. *Healthcare Epidemiology* 2002; 34: 1362-1368.
11. Crowley J. *Vascular Access. Techniques in Vascular and Interventional Radiology* 2003; 6(4): 176-181.

12. Dudrick S. History of Vascular Access. *Journal of Parenteral and Enteral Nutrition* 2006; 30(1): S47-S56.
13. Ewenstein B, Valentino L, Journeycake J, Tarantino M, Shapiro A, Blanchette S, Hoots W, Buchanan G, Manco-Johnson M, Rivard G, Miller L, Geraghty S, Maahs J, Stuart R, Dunham T, Navickis R. Consensus recommendations for the use of central venous devices in haemophilia. *Haemophilia* 2004; 10(5): 629-648.
14. Fellowes C, Kerstein R, Clark J, Azadian B. MRSA on tourniquets and keyboards. *Journal of Hospital Infection* 2006; 64(1): 87-88.
15. Forseter G, Joline C, Wormser G. Blood contamination of tourniquets used in routine phlebotomy. *American Journal of Infection Control* 1990; 18(8): 389-390.
16. Frey A, Schears G. Why Are We Stuck on Tape and Suture?: A Review of Catheter Securement Devices. *Journal of Infusion Nursing* 2006; 29(1): 34-38.
17. Galloway S, Bodenham A. Long-term central venous access. *British Journal of Anaesthesia* 2004; 92(5): 722-734.
18. Ganeshan A, Warakaulle D, Uberoi R. Central Venous Access. *Cardio Vascular and Interventional Radiology* 2007; 30: 26-33.
19. Gillies D, O'Riordan L, Wallen M, Morrison A, Rankin K, Nagy S. Optimal timing for intravenous administration set replacement. *The Cochrane Database of Systematic Reviews* 2005, Issue 4. Art. No.: CD003588.pub2. DOI: 10.1002/14651858.CD003588.pub2.
20. Gillies D, O'Riordan L, Wallen M, Rankin K, Morrison A & Nagy S. Timing Of Intravenous Administration Set Changes: A Systematic Review. *Infection Control and Hospital Epidemiology* 2004; 25(3): 240-250.
21. Grant J. Anatomy and Physiology of Venous System Vascular Access: Implications. *Journal of Parenteral and Enteral Nutrition* 2006; 30(1): S7-S12.
22. Guidelines on Paediatric Parenteral Nutrition. Chapter 9. Venous Access. *Journal of Pediatric Gastroenterology and Nutrition* 2005; 41: S54-62.
23. Hadaway L. Prevent occlusions with these flushing pointers. *Nursing* 2003; 33(1): 28.
24. Infusion Nurses Standards of Practice. *Journal of Infusion Nursing* 2006; 29(1) (Supplement): S1-S62.
25. Isaacman D, Karasic R. Lack of effect of changing needles on contamination of blood cultures. *The Pediatric Infectious Disease Journal* 1990; 9(4): 274-278.
26. Lyon S. Vascular Access Devices and the Oncology Patient. *Cancer Forum* 2005; 29(3): 140-144.
27. Moureau N. Vascular Access Devices. *Nursing* 2001; 31(7): 52-55.
28. Playford E, Looke D, Whitby M, Stackelroth J, Harrison K, Watts A. Endemic Nosocomial Gram-negative Bacteraemias Resulting from Contamination of Intravenous Heparin Infusions. *Journal of Hospital Infection* 1999; 42(1): 21-26.
29. Pratt RJ, Pellowe C, Loveday HP, Robinson N, Smith G, Barrett S, Davey P, Loveday C, McDougall C, Mulhall A, Privett S, Smales C, Taylor L, Weller B, Wilcox MI. The epic Project: Developing National Evidence-based Guidelines for Preventing Healthcare Associated Infections. Guidelines for preventing infections associated with the insertion and maintenance of central venous catheters. *Journal of Hospital Infection*, 2001; 47 (Supplement): S47-S67.

Totally implantable central venous access ports

30. Pratt R, Pellowe C, Wilson J, Loveday H, Harper P, Jones S, McDougall C, Wilcox M. epic2 National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. *Journal of Hospital Infection* 2007; 65S: S1-S64.
31. Rickard C, Lipman J, Courtney M, Siverson R, Daley P. Routine Changing Of Intravenous Administration Sets Does Not Reduce Colonization Or Infection In Central Venous Catheters. *Infection Control and Hospital Epidemiology* 2004; 25(8): 650-655.
32. Rosenthal K. Pinpointing intravascular device infections. *Nursing Management* 2003; 34(6): 35-43.
33. Rosenthal K. Optimal infusion therapy? Overcome occlusions. *Nursing Management* 2002; 33(2): 49-50.
34. Rourke C, Bates C, Read R. Poor hospital infection control practice in venepuncture and the use of tourniquets. *Journal of Hospital Infection* 2001; 49: 59-61.
35. Rubinson L, Wu A, Haponik E, Diette G. Why Is It That Internists Do Not Follow Guidelines For Preventing Intravascular Catheter Infections? *Infection Control and Hospital Epidemiology* 2005; 26(6): 525-533.
36. Sacar S, Turgut H, Kaleli I, Cevahir N, Asan, Sacar M, Tekin K. Poor hospital infection control practice in hand hygiene, glove utilization, and usage of tourniquets. *American Journal of Infection Control* 2006; 34(9): 606-609.
37. Safdar N, Maki D. Inflammation at the insertion site is not predictive of catheter-related bloodstream infection with short-term, noncuffed central venous catheters. *Critical Care Medicine* 2002; 30(12): 2632-2635.
38. Sansivero G. Venous Anatomy and Physiology: Considerations for Vascular Access Device Placement and Function. *Journal of Infusion Nursing* 1998; 21(5S): S107-S114.
39. United States. Infection Control Today. Hanchett M. Needleless Connectors and Bacteremia: Is There a Relationship? [online] 1 November 2005. Available from: http://www.infectioncontrolday.com/articles/410/410_5b1feat2.html (Internet Access Required)
40. United States. Infection Control Today. Schmidt M. Preventing Intravenous Catheter-Associated Infections: An Update: 2001.
41. United Kingdom. National Patient Safety Agency. Learning through action to reduce infection: 2006.
42. United States. eMedicine. Larson S, Hebra A. Vascular Access: A Surgical Perspective: 2006. Available from: <http://www.emedicine.com/ped/topic3050.htm> (Internet Access Required)
43. United States. Institute for Healthcare Improvement (IHI). Getting Started Kit: Prevent Central Line Infections. How-to Guide: 2006. Available from: <http://www.ihl.org/IHI/Programs/Campaign/> (Internet Access Required)
44. Waitt C, Waitt P, Pirmohamed M. Intravenous therapy. *Postgrad Med J* 2004; 80: 1-6.
45. Biffi R, Pozzi S, Agazzi A, Pace U, Floridi A, Cenciarelli S, Peveri V, Cocquio A, Andreoni B, Martinelli G. Use of totally implantable central venous access ports for high-dose chemotherapy and peripheral blood cell transplantation: results of a monocentre series of 276 patients. *Annals of Oncology* 2004; 15: 296-300.
46. Carroll P. Reducing the Risk of Needlestick Injury Associated with Implanted Ports. *Home Healthcare Nurse* 2001; 19(2): 84-93.

Totally implantable central venous access ports

47. Komvilaisak P, Connolly B, Naqvi A, Blanchette V. Overview of the use of implantable venous access devices in the management of children with inherited bleeding disorders. *Haemophilia* 2006; 12 (Supplement 6): 87-93.
48. Kurul S, Saip P, Aydin T. Totally implantable venous-access ports: local problems and extravasation injury. *The Lancet Oncology* 2002; 3(11): 864-892.
49. Larouere E. The Art of Accessing an Implanted Port. *Nursing* 1999; 29(5): 56- 58.
50. Larouere E. Deaccessing an Implanted Port. *Nursing* 1999; 29(6): 60-61.
51. Laurenzi L, Natoli S, Benedetti C, Marcelli M, Tirelli W, DiEmidio L, Arcuri E. Cutaneous bacterial colonization, modalities of chemotherapeutic infusion, and catheter-related bloodstream infection in totally implanted venous access devices. *Support Care Cancer* 2004; 12(11): 805- 809.
52. United Kingdom. Clinical Guidelines Committee. University College London Hospitals. Central Venous Catheter Care for Nurses and Allied Health Professionals: 2006.

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 ⁽⁷¹⁾
Exit-site infection	Localised at the skin wound or in the needle-access site over the port and manifested by local tenderness, pain, erythema, induration and oedema.	ACSQHC ⁽³⁰⁾
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, but develop within a healthcare organisation, or are produced by micro-organisms acquired during admission.	ACSQHC ⁽³⁰⁾
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 ⁽⁷²⁾
Port-pocket infection	Infected fluid in the subcutaneous pocket of a totally implanted intravascular device; often associated with tenderness, erythema, and/or induration over the pocket; spontaneous rupture and drainage, or necrosis of the overlying skin, with or without concomitant bloodstream infection	Mermel, 2009 ⁽⁵⁰⁾

6. Approval and Implementation

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7. Version Control

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1.0	2012	CHRISP	[QH-GDL-321-6-6:2012] Rescinded
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3.0	January 2015	CDIM	