Central Venous Access Devices (CVAD) and Long Peripheral Venous Catheter (PVC) Management - Clinical Practice Standard

1. Purpose

The purpose of this policy is to establish minimum practice standards for the insertion, management and removal of central venous access devices (CVAD) and long peripheral venous catheters (Long PVC) [also known as 'Midlines'] within the WA Country Health Service (WACHS).

Note: While this Clinical Practice Standard (CPS) is regarding **venous** access devices, a minor appendix relating to arterial ports is included in lieu of a separate policy document.

Excluded from this CPS:

- Short Peripheral IV Catheter – less than 8cms in length (refer to WACHS Peripheral Intravenous Cannulae Management Clinical Practice Standard
- Specimen collection (blood sampling) via PIVC (refer to WACHS Specimen Collection (including Phlebotomy) and Pathology Results Clinical Practice Standard)
- Removal procedure for tunnelled central venous catheters.

For paediatrics refer to the Perth Children's Hospital guidelines:

- Central Venous Access Device (CVAD) and Midline Insertion and Management Guideline
- TaurolockHep100® prophylactic lock for central venous access devices
- Taurolidine/Sodium citrate/Heparin100units (TaurolockHep100®) Monograph

2. Scope

All medical, nursing, midwifery and medical imaging staff employed within the WACHS and any students in those fields working under the direct supervision of those staff.

All health care professionals are to work within their scope of practice appropriate to their level of training and responsibility. Staff are to check with their line managers regarding education, training and assessment requirement for their area of practice.

Education packages and competency assessment information (via MyLearning) are available for CVAD, PICCS and Ports:

- CVAD, PICCS & PORTS Module 1: Principles of Central Venous Access Devices (CVAD1 EL2)
- CVAD, PICCS & PORTS Module 2: Patient Assessment and Education (CVAD2 EL2)
- CVAD, PICCS & PORTS Module 3: Care and Management of CVADs (CVAD3 EL2)

- (CVAD) Central Venous Access Device excluding IVP assessments (CVAD4 003)
- (CVAD) Implanted Venous Ports (IVP) assessments (CVAD5 003)
- (CVAD) Central Venous Access Device excluding IVP assessment for Medical Imaging Technicians (CVAD6 003)

Further information around scope of practice and registration requirements may be found via HealthPoint or the Australian Health Practitioner Regulation Agency as appropriate.

3. Procedural Information

- Device insertion
- Insertion site assessment
- Line maintenance
- Dressing and needle free connector (NFC) change
- Accessing, deaccessing, flushing and locking
- Blood sampling (including blood cultures)
- Device removal
- Discharge and transfer management
- Troubleshooting:
  - Long peripheral venous catheters
  - Peripherally inserted central catheters
  - Central venous catheters
- Arterial ports

4. Considerations

A written signed consent form is required prior to insertion of the device. In certain situations there may be exceptions to this (e.g. in an emergency) – refer to the WA Health OD 0657/16 Consent to Treatment Policy.

Do **not** use smaller than a 10ml syringe when accessing a CVAD to avoid excessive pressure and catheter rupture.

Staff are to avoid taking blood pressure on the arm with a PICC or Long PVC to avoid the risk of occlusion. If unavoidable, keep measurements to a minimum and only use manual cuff.

Not all CVADs or Long PVCs are rated for power/pressure injection e.g. for injection of contrast media for computed tomography (CT) scans. Staff are to check the lumen for the maximum flow rate that can be delivered or if the lumen indicates “No CT” (see Figure 1and 2 for examples). Refer to device manufacturer information.

If the lumen is not clearly rated for power injection, the device is not to be used for power injection and an appropriate gauge cannula needs to be inserted peripherally for use.
If difficulty in inserting a suitable peripheral cannula or patient known for difficult peripheral cannulation seek advice of requesting medical officer.

Documentation requirements - refer to Documentation section.

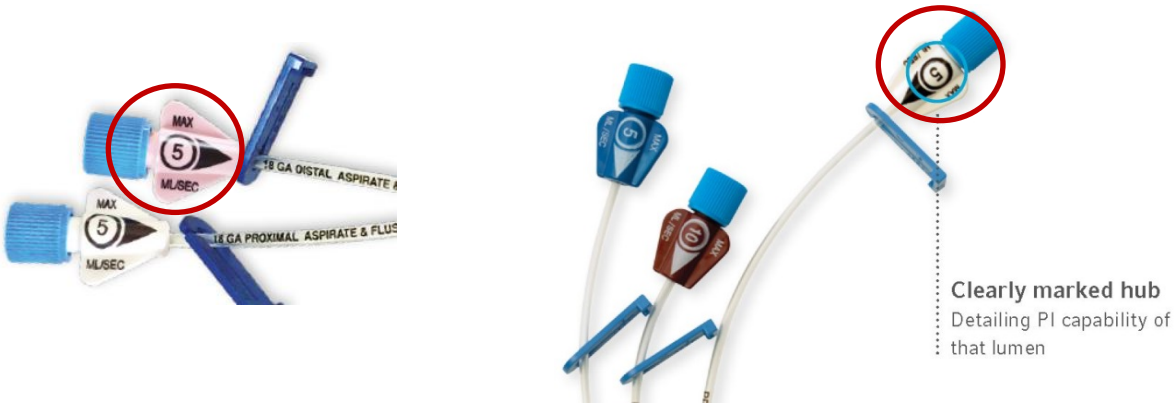

Figure 1: Example of pressure injection (PI) capability markings on hub of PICC (left) and CVC (right). Courtesy of Teleflex Incorporated[36]

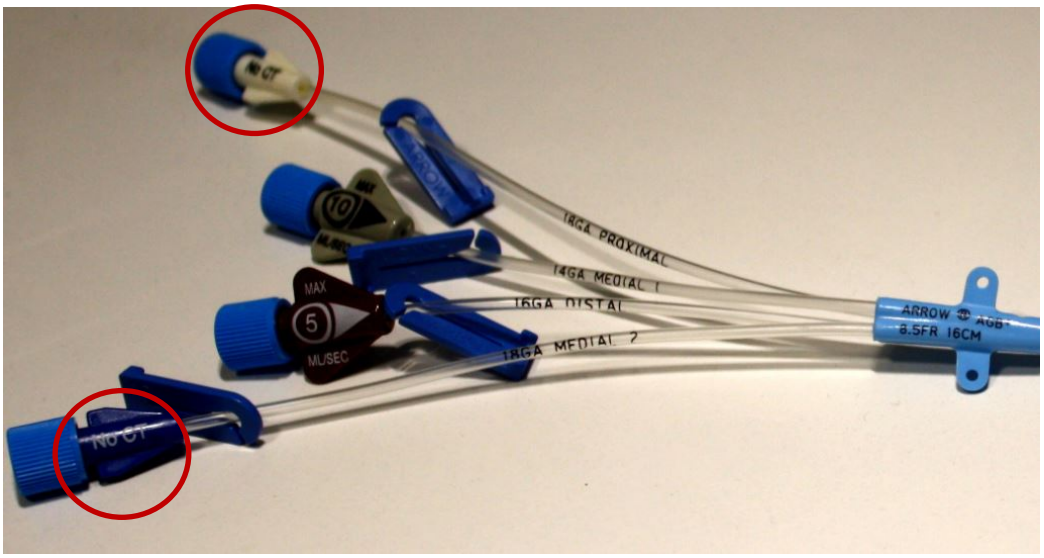

Figure 2: Example of 'No CT" labelling on CVC. Courtesy of Teleflex Incorporated[36]

4.1. Patients with chronic renal impairment

Renal dialysis physician / nephrologist are to determine and document the most appropriate type and site for venous access devices considering future dialysis access requirements.

Refer to the Guideline for Vein Preservation in Chronic Kidney Disease provided by the Renal Health Network for recommendations related to patient education; peripheral venous access; central venous access; prolonged intravenous access; and antibiotic use.

The veins of the forearm, upper arm and subclavian are not routinely used for venous access, and are of critical importance for the creation of arterio-venous fistula for haemodialysis.

Seek advice from senior medical officer on admitting team, renal team, and/or anaesthesia service if support with obtaining venous access is required.

4.2. Venous device selection

The choice of device is made based on a patient's diagnosis, length and type of therapy, patient preference, clinical status, availability and quality of patient veins, operator experience and previous device history.

All centrally inserted central venous access devices have the risks associated with insertion of bleeding, pneumothorax, arrhythmias and air embolism and carry a risk of catheter related blood stream infections. [31]

Refer to Appendix 1: Device types and Appendix 2: Venous Access Decision Pathway

Additional information regarding CVAD line selection is available from eviQ.

4.3. CVAD catheter position

The tip of the CVAD should lie in the lower third of the superior vena cava (SVC) near the junction of the right atrium where the blood flow around the catheter tip is most rapid with the least resistance to flow.

Position of a **CVC** to be checked, when possible, using at least three techniques:

- Xray[6]
- Blood gas analysis
- Waveform transducing

The methods used to check catheter position need to demonstrate the device has not been placed arterially. Once the CVC is deemed venous, it can be confirmed for use by the proceduralist and documented on the MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record.

Clinical incident reviews have shown that serious harm can occur when CVAD catheters placed in the artery have been used for patient treatment.

Refer to Patient Safety *Matters* - Central Venous Line Complication.

4.4. CVAD replacement[30]:

CVADs should only be replaced if clinically indicated under the direction of an Infectious Diseases (ID) team or if downgrading from a CVC to a PICC.

- Routine replacement is not recommended unless inserted under conditions where strict asepsis was not maintained. [3,9]

If not all aseptic technique requirements are met (i.e. a breach occurs) during insertion (as per the insertion checklist on the MR179A) the CVAD it is to be replaced within 24 hours once the patient is clinically stable.

If the patient is admitted with a CVAD in situ, confirm the insertion record

- If unable to find documentation request a review from the Medical team.

If device is being removed for presumed catheter related blood stream infection (CRBSI) a new central device should not be reinserted for a minimum of 24 hours or as directed by advice of an Infectious Diseases team.

4.5. CVAD Rewiring[30]:

Routine rewiring of a PICC or CVC is not recommended and should only be done as clinically indicated

Guidewire exchanges of PICC or CVC lines shall not occur in the presence of blood stream infection.

5. General Information

Staff are to comply with the WACHS Infection Prevention and Control Policy, WACHS Aseptic Technique Policy and the WACHS Hand Hygiene Policy.

Ensure patient identification and procedure matching processes are undertaken. Refer to the WACHS Patient Identification Policy

Ointments containing acetone and polyethylene glycol should not be used with polyurethane catheters, as these may cause failure of the device.[41]

Maintain patient privacy and dignity. Offer the presence of a chaperone where appropriate to patient and clinician requirements.

Provide the opportunity for an accredited interpreter and/ or Aboriginal Liaison Officer where appropriate to the patient's language or communication requirements (refer to WA Health System Language Services Policy).

5.1. Long Peripheral Venous Catheters (Long PVC)

Also referred to as 'Midline' catheters, Long PVCs are similar to PICC lines – inserted in the peripheral veins of the upper extremity, however unlike PICCs they terminate in the peripheral, not the central veins. By definition[53] the tip of the midline catheter should be located at or near the level of the axilla, distal to the shoulder.

As Long PVCs/midlines are longer than traditional peripheral intravenous catheters and reach the deeper veins of the arm, they are potentially able to dwell longer than standard peripheral intravenous catheters. They offer a convenient alternative to PICCs for certain indications.

Indications[41,43]

- Peripherally appropriate solutions that will likely exceed 6 days and no more than 28 days
- Patients with difficult intravenous access
- Ultrasound-guided peripheral access has failed
- Patients with limited sites for IV rotation
- Fluid resuscitation via wider bore peripheral lines

Considerations and Contraindications[41,46]

- History of venous thrombosis
- Presence of device-related infection, bacteraemia, or septicaemia is known or suspected

- Restricted blood flow to the extremities
- End-stage renal disease requiring peripheral vein preservation
- Chronic kidney disease, mastectomy with lymph node dissection, paralysis and other conditions that may preclude device placement
- Continuous vesicant therapy
- Total parenteral nutrition
- Solutions greater than 900 mOsm/L
- All infusates requiring central venous access
- Know /suspected allergy to materials contained in the device
- Patient preference and lifestyle

5.2. Central venous access devices (CVADs)

CVADs allow for long term venous access and multiple infusions of fluids, blood products, drugs or parenteral nutrition. CVADs can be tunnelled or non-tunnelled or in the case of an implanted venous port - placed in a subcutaneous pocket and accessed using a non-coring needle.[31]

CVADs can have single or multiple lumens; multiple lumens allow for independent access to simultaneously administer incompatible drugs/fluids. CVADs may also be valved (closed) or non-valved (open). [31]

The smallest gauge catheter with the least number of lumens is to be selected for the patient dependent on the therapeutic intent of the device.

Types of CVADs are covered in Appendix 1: Device Types.

5.3. Patient education

All patients will require education in relation to the inserted venous access device[1,2]. Patient, carer and/or family education to cover[31]:

- All venous access devices:
  - Details of appropriate and readily accessible 24-hour medical and nursing contact to whom patients can direct queries.
  - Patients to be supplied with any printed information currently available and must be given the opportunity to ask questions. Refer to consumer information section for patient handout information available.
- Long PVC:
  - Avoid blood pressure monitoring from the arm that has the Long PVC
  - Depending on the device used, staff may be able to access consumer information from the company's representative
- PICCS (as per eviQ patient education information[31]):
  - Avoid blood pressure monitoring from the arm that has the PICC line
  - Prevention and management of mechanical phlebitis: patients should be encouraged to place a warm compress on the upper part of their arm for 20 minutes 3 times a day for 4 days after insertion
  - Checking the exit site each day, and:
    - reporting any symptoms such as pain, redness, discharge, swelling, burning, stinging, pruritus, presence of a rash or leaking around the catheter exit site

    - palpating the exit site on top of the dressing for any tenderness
  - What to do in the event that the catheter ruptures, fractures or cracks
- Ports: How a port is accessed and any care while accessed.

6. Potential Issues During or Post Procedure

During Insertion: arterial injury, nerve damage, cardiac arrhythmias, haemorrhage, pneumothorax (CVC; Ports), arterial cannulation (CVC; Ports)

After insertion: catheter related: occlusion, malposition, migration, bleeding, breakages, thrombosis, infection; risk of needle dislodgement (ports)*

Refer to the appropriate troubleshooting appendices for actions in response to the above issues

*Needle dislodgement in ports: The port would need to be re accessed and then the entire needle and giving set would need to be replaced.

7. Clinical Communication

- **Clinical Handover**

Information exchange is to adhere to the WA Health Clinical Handover Policy using the iSoBAR framework.

At each opportunity of handover (beginning of each shift or where responsibility of care is transferred between staff) the site, documentation and infusion line (if in-situ) to be checked against orders.

Refer to WACHS Nursing Midwifery Shift to Shift Bedside Clinical Handover – Process Flowchart.

- **Critical Information**

Critical information, concerns or risks about a patient are communicated in a timely manner to clinicians who can make decisions about the care.

- **Documentation**

Failure to accurately and legibly record and understand what is recorded in patient health records contribute to a decrease in the quality and safety of patient care.

The CVAD suite of forms is used for CVADs and Long PVCs:

- MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record
- MR179B WACHS CVAD Insertion Site Assessment Continuation Sheet
- MR179C WACHS CVAD Access/Dressings Continuation Sheet

A number of patients may have had insertion of their CVAD outside of a WACHS facility. An insertion information section is to be completed on the MR179B WACHS CVAD Insertion Site Assessment Continuation Sheet and the MR179C WACHS CVAD Access/Dressings Continuation Sheet. This information will assist staff with planning care associated with the type of device insitu.

For patients attending WACHS medical imaging departments, the injection rate used on CVADs is to be documented on the medical imaging request form or IV contrast patient questionnaire.

For further information on documentation, refer to WACHS Documentation Clinical Practice Standard

- **Consumer information**

There are a number of ways consumers can obtain specific information relating to hospital admissions, transfers and discharge from hospital. Staff can locate relevant documents via:

- eviQ patient and carer resources:
  - Having treatment through a peripherally inserted central catheter (PICC)
  - Having treatment through a tunnelled (Hickman®) and non-tunnelled central venous catheter (CVC)
  - Having treatment through an implanted venous port (IVP/port)

Please note: The eviQ resources are primarily focused on patients receiving cancer treatments. Staff are to exercise caution in the use of these handouts for patients who do not have a cancer diagnosis.

If patient is being discharged home – refer to Appendix 10: CVAD – discharge and transfer management.

8. Compliance Monitoring

Monitor patient outcomes via Staphylococcal Aureus Blood Stream Infection (SABSI) Healthcare Infection Surveillance WA (HISWA) reports quarterly.

Monitor Aseptic Technique using the agreed WACHS audit tools related to insertion and access – frequency to be determined at the regional level using a risk assessment approach. Refer to WACHS Aseptic Technique Policy for further guidance.

Failure to comply with this policy may constitute a breach of the WA Health Code of Conduct (Code). The Code is part of the Integrity Policy Framework issued pursuant to section 26 of the *Health Services Act 2016* (WA) and is binding on all WACHS staff which for this purpose includes trainees, students, volunteers, researchers, contractors for service (including all visiting health professionals and agency staff) and persons delivering training or education within WACHS.

WACHS staff are reminded that compliance with all policies is mandatory.

9. Relevant Legislation

Carers Recognition Act 2004 (WA)
Disability Services Act 1993 (WA)
Equal Opportunity Act 1984 (WA)
Equal Opportunity Regulations 1986 (WA)
Guardianship and Administration Act 1990 (WA)

Health Practitioner Regulation National Law (WA) Act 2010 (WA)
Occupational Safety and Health Act 1984 (WA)
Occupational Safety and Health Regulations 1996 (WA)
Privacy Act 1988 (Commonwealth)
State Records Act 2000 (WA)

10. Relevant Standards

National Safety and Quality Health Services (NSQHS) Standards:
Clinical Governance Standard: 1.27
Preventing and Controlling Healthcare Associated Infections Standard: 3.9
Recognising and Responding to Acute Deterioration Standard: 8.4, 8.6, 8.8, 8.9 and 8.10

Australian Commission on Safety and Quality in Health Care (ACSQHC)
National Standard for User-applied Labelling of Injectable Medicines, Fluids and Lines

11. Relevant Forms

MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record
MR179B WACHS CVAD Insertion Site Assessment Continuation Sheet
MR179C WACHS CVAD Access/Dressings Continuation Sheet

12. Relevant Policy Documents

WACHS Aseptic Technique Policy
WACHS Cancer Institute NSW - Standard Cancer Treatments - eviQ - EUCP Policy
WACHS Clinical Observations and Assessments Clinical Practice Standard (physiological, neurovascular, neurological and fluid balance)
WACHS Decontamination of Diagnostic Ultrasound Transducers Clinical Practice Standard
WACHS Documentation Clinical Practice Standard
WACHS Hand Hygiene Policy
WACHS Infection Prevention and Control Policy
WACHS Medication Administration Policy
WACHS Patient Identification Policy
WACHS Specimen Collection (including Phlebotomy) and Pathology Results Clinical Practice Standard

13. Related WA Health System Policies

MP 0053/17 Clinical Alert (Med Alert) Policy
OD 0651/16 Clinical and Related Waste Management Policy
MP 0122/19 Clinical Incident Management Policy

OD 0657/16 Consent to Treatment Policy
MP 0038/16 Insertion and Management of Peripheral Intravenous Cannulae in Western Australian Healthcare Facilities

14. WA Health Policy Framework

Clinical Governance, Safety and Quality Policy Framework

15. References

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16. Definitions

Assistant	A medical officer or nurse who supports or aids the proceduralist, but does not physically take part in the procedure[28]
Carer	Carers provide unpaid care and support to family members and friends who have a disability, mental illness, chronic condition, terminal illness, an alcohol or other drug issue or who are frail aged (Carers Australia, 2015)
Consumer	A person who uses, or may potentially use, health services. Depending on the nature of the health service organisation, this person may be referred to as a patient, a client, a consumer, a customer or some other term. Consumers also include families, carers, friends and other support people, as well as representatives of consumer groups
NFC	Needle free connector: a device that connects to the end of vascular catheters and enables catheter access for infusion and aspiration
Pressure Injection	The transient flow of a moderately viscous aqueous fluid (3-12cP) injected via mechanical means capable of generating pressures up to\or in excess of 300 psi through any one lumen of a vascular catheter at a flow rate that is measured in ml or cc per second rather than per minute or per hour (cP = centipoise [a dynamic viscosity measurement unit])
Proceduralist	Health care professional performing the central line insertion, who has undergone specific training and education to perform this procedure. The proceduralist must have undertaken an appropriate training program or be supervised during the procedure[28]
Seldinger Technique	A method of percutaneous insertion of a catheter into a blood vessel or space, named after a Swedish Radiologist (Dr Sven-Ivar Seldinger). A needle is used to puncture the structure and a guide wire is threaded through the needle; when the needle is withdrawn, a catheter is threaded over the wire; the wire is then

	withdrawn, leaving the catheter in place.
Supervisor	An experienced clinician with a high level of competence in central line insertion and a comprehensive understanding of the management of the potential complications[28]

17. Appendices

This document can be made available in alternative formats on request for a person with a disability

Contact:	Program Officer - Clinical Practice Standards		
Directorate:	Medical Services	**TRIM Record #**	ED-CO-15-91394
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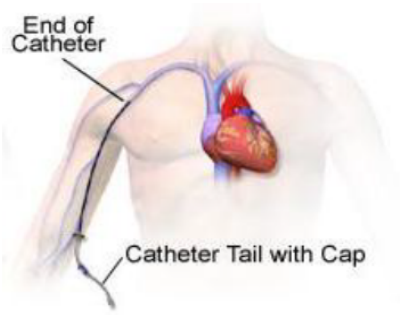
Appendix 1: Device Types

Long Peripheral Venous Catheter (Long PVC)

Also known as Midline catheters, Long PVCs are:

- Defined[41] as a flexible catheter often measuring from 8 cm up to 20 cm in length
- Constructed of either polyurethane or silicone
- Inserted through the peripheral veins of the arms (basilic vein, cephalic vein, brachial veins, and veins of antecubital area, including branches of the median cubital vein and cephalic veins at or below the antecubital crease) using ultrasound
- Able to be left insitu for up to 28 days



Midline Catheter[48]

The tip position of Long PVC is at or below the axillary line (the axillary fold is used to determine the axillary line).

Types of Central Venous Access Devices (CVADs)

Non-tunnelled central venous catheters:

- Peripherally Inserted Central venous Catheter (PICC)
  - Non-valved:
    - Catheter inserted into the upperarm using ultrasound guidence via the antecubital fossa usually extending approx 50-60 cm into the basilic, cephalic or brachial veins with the tip of the line ideally positioned in the superior vena cava
    - 1-12 months long-term access
    - Single and multi-lumen
  - Valved:
    - Single and multi-lumen
    - Example - Groshong® or Power PICC

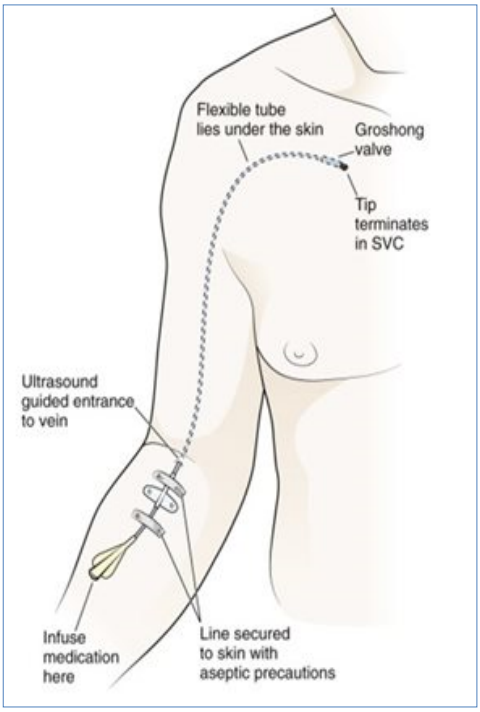


Figure 4: PICC placement[31]

- Central Venous Catheter (CVC)
  - Catheter inserted percutaneously via the subclavian, internal or external jugular, or femoral veins extending approx 15-30 cm with the tip positioned within the superior or inferior vena cava
  - 1- 3 weeks short term access[1]
  - Single and multi-lumen
  - Non-valved[31]:
    - Open ended catheters and require clamping and positive pressure locking
    - May require locking with heparinised saline
  - Valved[31]:
    - Closed end catheters
    - Have a valved opening and do not require clamping or locking with heparinised saline
    - Valved catheters allow the infusion of solutions and aspiration of blood but when not in use remain in a closed position preventing reflux of blood into the catheter.
- Vascath – non-valved
  - Single and multi-lumen
  - Indications: apheresis, haemodialysis

- **Tunnelled central venous catheter (Hickman®)[31]**
  - Tunnelled catheters are intended for patients who may require longer-term central venous access
  - The most common sites for placement are the subclavian and jugular veins. The catheter is tunnelled subcutaneously and exits at a convenient site (usually on the chest wall) where it is secured (see Figure 5)
  - There is a 'cuff' within the tunnel to allow for the adherence of fibrous tissue which helps to prevent accidental dislodgement and acts as a mechanical barrier to ascending bacteria.

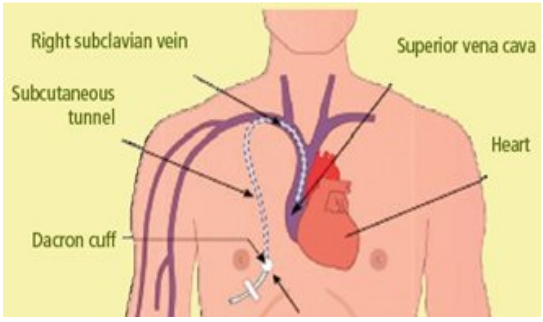


Figure 5: Placement of tunnelled catheter[31]

- **Implanted ports**
  - Subcutaneously implanted devices designed to provide repeated access (suitable for at least 2000 accesses) to the vascular system for the delivery of chemotherapy, blood products, intravenous fluids and parenteral nutrition

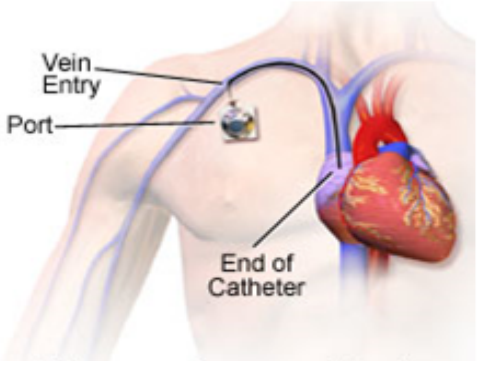
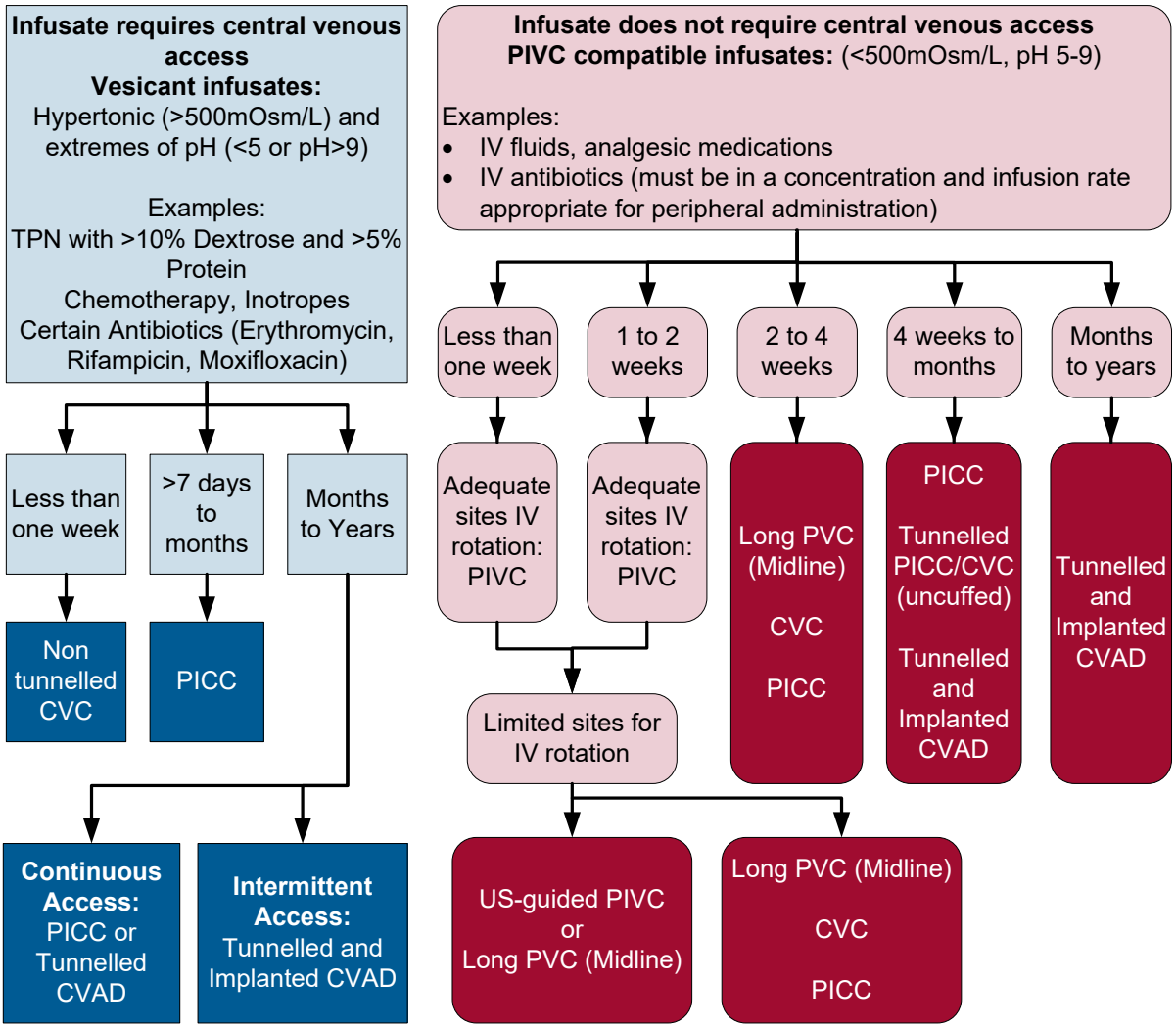


Figure 6: Venous access port[31]

- Placed in the subclavian vein; however some are placed in the hepatic artery (arterial ports are discussed in Appendix 13)
- Venous ports (used commonly) exit into the superior vena cava and port body usually located on the upper chest. Arterial Ports (used less frequently) exit into the common hepatic artery and port body often found in the sternum, lover ribs or hip
- Must be accessed using a non-coring needle and deaccessed and locked correctly using aseptic technique to ensure patency
- Consist of a titanium or plastic port with a self-sealing septum, accessible by percutaneous needle puncture, and a radiopaque catheter usually made in a well-tolerated long-term substance – silicone or polyurethane[34]
- Most are single lumen, some have two lumens (to enable separate administration of incompatible drugs)[34]
- Connection between the catheter and the port can either be sealed during the manufacturing process or made at the time of placement.[34]

Additional information can be accessed via eviQ regarding central venous access device line selection and the types of devices available.

Appendix 2: Vascular Access Decision Pathway



To minimise CLABSI, the following factors should be considered when selecting a CVAD:

- Number of catheter lumens should be kept to the minimum necessary for the management of the patient (CDC, 2016)
- Any solution containing lipid (e.g. TPN) should have a dedicated lumen
- The likely duration or dwell time

Factors to consider to decide type of CVAD for patients:

- Infusate characteristics
- Expected duration of treatment
- Patient factors (Age/Weight/Comorbidities/preferences)
- Indications: Difficult IV Access (DIVA) and requirements for blood draws
- Procedural management considerations of patient
- Vein status/venous health – any known abnormalities (thrombosis or stenosis)
- Medical history/chronicity of disease/course – includes need for multiple CVADs in future
- Inpatient or outpatient IV therapy

Source: Adapted from the Perth Children's Hospital "Vascular Access Decision Pathway" (CVAD and Midline Insertion and Management Guidelines, 2019)

Appendix 3: Device insertion

- **Pre-Procedure Key Points**
- Refer to the Australian and New Zealand Intensive Care Society, Central Line Insertion and Maintenance Guide for advice regarding percutaneous insertion of central lines in adults.[9]
- Device insertion must be performed by clinicians who are trained to do so and in accordance with their individual scope of practice
- Long PVCs require ultrasound to be used during insertion
- If technical difficulty experienced either before or during insertion, liaise with or defer to a more experienced colleague.
- CVADs:
    - Except in emergency situations, CVADs are best inserted in an area where maximum barrier precautions and strict aseptic technique can be maintained,[3] and ultrasound guidance is available[2] e.g. operating theatre, radiology department.
    - Proceduralist and Assistant to have a pre-procedure huddle to outline expectations as to how to alert to a breach during the procedure
    - Staffing for procedure:
        - A minimum of one staff member skilled to undertake the procedure.
        - Assistance will be required to maintain maximum barrier precautions.
    - Refer to CVC placement information for placement checks
    - Radiological examination is important to confirm absence of any adverse events related to the catheter location e.g. pneumothorax.
    - Once the CVAD is confirmed for use the proceduralist signs the MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record.
- Refer to the WACHS Decontamination of Diagnostic Ultrasound Transducers Clinical Practice Standard for aftercare of the ultrasound device used with insertion.

Line attachments

- A sutureless securement device should be used where available for CVCs, PICCs and Long PVCs
- Each lumen of the device requires a Needle Free Connector (NFC) to complete a closed system (except in high dependency areas where direct access may be indicated for some CVADs)
- NFC's appropriate for CVADs and Long PVCs include positive pressure valves or neutral pressure valves (negative displacement valves are not suitable)
- For those devices with slide clamps, do not routinely clamp lumen if not in use. Routine application of slide clamp when using positive pressure valves is discouraged as incorrect technique when discontinuing flush can contribute to blood reflux in lumen and occlusion of the line[29]. The clamp is not to be removed from the device

- For Long PVC devices that do not have a clamp on the device, they must have an extension (with clamp) attached at time of insertion with exception of areas where patients are known to be short stay (day) procedures
- Venous ports require specific non-coring needle to access – **do not** use a hypodermic needle to access a port.

Monitoring during insertion

Consider the clinical condition of the patient and ensure patient monitoring equipment is available.

For CVADs monitor:

- Heart rate, blood pressure, respiratory rate and oxygen saturation
- Cardiac monitoring (observing for potential cardiac arrhythmias)
- Pain and discomfort.

- **PORTS**

Insertion of venous port device typically constitutes day surgery and is usually performed in radiology theatre or operating theatre. Can be carried out under general anaesthetic, local anaesthetic or sedative and local anaesthetic.

Manage patient according to the WACHS Pre and Post Procedural Management Clinical Practice Standard.

Clip chest hair around planned insertion site/port pocket if excessive. **Do not** shave the site.

On occasion, venous port insertion may be synchronised with major surgery.

Insertion of device involves creating the subcutaneous pocket, connecting the port body to catheter (if not pre-attached) and suturing the port body to fascia.

Ensure the device is flushed and locked with normal saline 0.9%, heparinised saline, heparin or Taurolock as prescribed and recommended by the manufacturer.

- **Long PVC/PICC/CVC**

Equipment

Some sites may have specific pre-prepared packs to assist with insertion.

When considering using a combined chlorhexidine gluconate securement dressing, consult with product information for equipment requirements and procedure steps if utilised in preference to the dressing combination of:

- Sutureless securement device
- Chlorhexidine gluconate impregnated foam disk
- Sterile, transparent, semi-permeable IV dressing with site insertion details sticker.

You will need:

- Procedural trolley
- Long PVC/PICC/CVC set
- Epidural and draping pack (PICC) or CVC draping or basic ICU pack (CVC)
- Skin antiseptic of 2% chlorhexidine in 70% alcohol.

Serious chlorhexidine hypersensitivity can be a threat to life through anaphylaxis.

If use of chlorhexidine is contraindicated due to allergy/sensitivity, use Povidone Iodine 10% in 70% alcohol. If use of alcohol is contraindicated, use 10% Povidone Iodine aqueous solution

- Local Anaesthetic (+ 1x 3mL and 5mL syringes and 1x 21g and 25g needles if not in pre-prepared pack)
- Needle Free Connector (NFC) for each lumen (unless direct connection to line is undertaken - critical care areas only)
- 2x 20mL pre-filled Sodium Chloride 0.9% syringes, if available (If not available use 20mL syringes, drawing up needle and Sodium Chloride 0.9% ampoules)
- All in one securement dressing (e.g. Tegaderm™ CHG) or:
    - Chlorhexidine gluconate impregnated foam disk (If patient has chlorhexidine allergy, consider use of silver impregnated antimicrobial silver disk around the insertion site), and
    - Sterile, transparent, semi-permeable IV dressing with site insertion details sticker, and
    - Sutureless securement device
- Adhesive tape
- Ultrasound machine + sterile cover and sterile gel sachet
- Tubular bandage
- Sterile transparent, semi-permeable, bordered dressing
- Plastic backed absorbent sheet (e.g. ‘bluey’)

Additional equipment required for Long PVC insertion:

- Long PVC set
- Depending on product type additional items may be required – check with manufacturer recommendations

Additional equipment required for PICC insertion:

- Proceduralist PPE: surgical cap, mask and protective eye wear; Sterile gown, towel and gloves
- Assistant PPE: surgical cap and mask
- PICC set with appropriate number of lumens (as clinically indicated and depending on vessel size)

Additional equipment required for CVC insertion:

- Proceduralist PPE: surgical cap, mask and protective eye wear; Sterile gown, towel and gloves
- Assistant PPE: surgical cap and mask
- CVC set with appropriate number of lumens as clinically indicated
- Sterile gauze

- If sutureless securement device not used - suture material and kit.

- **Pre-Insertion**
  1. Check consent, any medical imaging request forms as needed.
  2. Medical Officer to check coagulation profile and full blood count, if indicated, and advise the proceduralist for consideration in context of the patient's condition and medical plan
  3. Assess the patient's local anaesthetic and sedation requirements and arrange prescription as needed.
  4. Patient does not need to fast unless having the procedure under a general anaesthetic (Long PVC/PICC/CVAD)
  5. Assemble required equipment:
     - Setup using aseptic technique
     - Prime NFC
     - Check required medications: local anaesthetic and/or sedative
     - Set up ultrasound equipment
  6. Position patient according to the device to be inserted:
     - Long PVC / PICC insertion - position supine and abduct arm 45-90° angle
     - CVC insertion - Supine head down position 10 degrees: if tolerated and clinically appropriate or supine (without hip flexion) for femoral approach.
  7. Provide oxygen therapy if clinically indicated.
  8. Ensure insertion site is free from hair (clip if required, **not** shaved).
  9. Measure the patient from the proposed insertion site to the proposed proximal end site (Long PVC/PICC).
  10. Assistant personnel responsibility is to commence the MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record and observe procedure, complete the checklist and advise Proceduralist if a breach in the procedural requirements has occurred.

Excepting emergency cases, the proceduralist, supervisor or assistant is to stop the procedure if asepsis is breached and an appropriate course of action determined to limit the risk of infection to the patient. This may include the need to plan a re-insertion of the device.

- **Procedure**
  11. Hand hygiene and PPE:
      - Proceduralist to surgically scrub (also supervisor if present). Ensure to don gown, gloves, eye wear, cap and mask.
  12. Clean insertion site with 2% chlorhexidine in 70% alcohol. **Allow to air dry** (no fanning)
  13. Drape the area for insertion.

14. Administer local anaesthetic to site.
15. Insert device:
    - Long PVC – using ultrasound guidance insert using a modified Seldinger technique (kit with individual pieces) or accelerated Seldinger technique (using all in one device)
    - Long PVC/PICC - using ultrasound guidance insert using a modified Seldinger technique
    - CVC – using Seldinger technique.
16. Secure the device.
17. Flush the device. Refer to Appendix 7: Accessing, flushing, deaccessing and locking
18. Dress insertion site. Refer to Appendix 6: Dressing and Needle Free Connector (NFC) Change
19. Dispose of equipment appropriately, remove gloves and perform hand hygiene.

- **Post-procedure**
    20. Perform and document patient observations as clinically indicated and to ensure safe post procedure progress. Monitor insertion site for excessive bleeding, escalate if indicated.
    21. Document details of procedure on MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record and patient healthcare record.
    22. Catheter position checks:
        - Long PVC: Placement confirmation can be verified by aspiration, flush and ultrasound visualisation of the catheter tip within the vein (the line must flush without resistance and adequate blood return should be obtained when the line is aspirated[47])
        - PICC/CVAD:
            - arrange for post-insertion checks to confirm placement is not intra-arterial (refer to section 4.2 CVAD catheter position)
            - Once catheter confirmed for use, the Proceduralist is to sign the MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record to confirm the CVAD catheter tip is in the correct position.
    23. Educate patient regarding the device, care and maintenance – encourage the patient to monitor for any redness, swelling or pain around insertion site or associated limb and whether the dressing is loose, wet or soiled. Advise the patient to report these concerns to the health care facility caring for the device.

Appendix 4: Insertion site assessment

For all types of CVADs and Long PVCs:

- Document details of assessment on the WACHS CVAD forms
- Assess area surrounding device insertion site and associated limb from hand to neck prior to each access, at least eight hourly (as inpatient), during access or dressing changes or as clinically indicated for[2,9]:
  - localised infection: tenderness, pain, redness and swelling
  - catheter position: signs of migration (note: some Long PVCs do not have markings)
  - securement and dressing integrity

  If indications of localised infection are observed, escalate for medical officer review. Removal of the device will need to be considered in conjunction with a risk assessment of continuation of therapy utilising the current device. The outcomes and actions/ongoing management plan are to be documented in the healthcare record
- Assess for signs of systemic infection (sepsis): tachycardia, tachypnoea, pyrexia, and hypotension. Document on the appropriate ORC, outpatient documentation or healthcare record. If indicated, escalate for review and document actions/ongoing management plan
- Assess patency of lumens, refer to Appendix 8: Accessing, deaccessing, flushing and locking
- Determine ongoing need for device access
- Provide patient education to report any changes to insertion site or discomfort.

Appendix 5: Line maintenance

Labelling is as per the ACSQHC National Recommendations for User-Applied Labelling of Injectable Medicines, Fluids and Lines.

The catheter hub, administration set connection or injection ports are to be decontaminated with 2% chlorhexidine in 70% alcohol for a minimum of 20 seconds, longer if soiled and then allowed to air dry prior to every access.[28]

If chlorhexidine in alcohol is contraindicated in the manufacturer's instructions, then either aqueous chlorhexidine gluconate or aqueous povidone iodine may be used [28]

Ensure specific therapies are infused through dedicated device lumens (if multiple lumens).

Consider medication compatibilities as per the Australian Injectable Drug Handbook when administering multiple medications.

- **Unused Lumens**
  - To prevent lumens becoming blocked, use all lumens for infusions or transducer if possible [28]

- Unused lumens of PICCs and CVCs to be flushed weekly when not in use to maintain patency – consider more frequent flushing if occlusion issues exist[29]
- Unused lumens of implanted ported ports are to be locked 4 weekly
- Blocked lumens to be closed with a red IV bung and clearly marked "Do Not Use" – discuss unblocking the lumen with the medical officer.

- **Administration sets**

Intravenous administration lines are single use items; they require routines standardised for replacement based on the following factors[2]:

- Type of solution infused
- Whether infusion continuous or intermittent
- Following suspected contamination
- Accidental disconnection.

Disconnection and reconnection of administration sets (and haemofiltration):

- Discard and **do not** reuse intravenous (IV) administration sets when they are disconnected e.g. for inter or intra-hospital transfers, medical imaging or procedures in other departments, or when central line is changed (irrespective of how recently they were changed). [28,29]

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.[35]

Recommended intravenous administration line replacement frequencies outside of 72 - 96 hourly for the following infusions[2,6,7,12,26]:

- Lipids: every 24 hours
- Propofol: every 6 - 12 hours, when the vial is changed or as per manufacturer
- Chemotherapeutic agents: remove immediately after use
- Heparin: every 24hours
- Total Parenteral Nutrition: every 24 hours
- Blood and Blood Products: every 8 – 12 hours.

All other Intravenous administration lines require replacing every 72 - 96 hourly[4,6,7]; this also includes the changing of add-on devices.[2]

Synchronise intravenous administration line and add-on device replacement with changes in intravenous infusion bags.[7]

When a CVAD is removed and replaced, new administration sets are required. Administration sets used on the removed device are not to be transferred to the new device.

Document intravenous administration line replacement details in healthcare record.

Appendix 6: Dressing and needle free connector (NFC) change

- **Pre-procedure Key Points**

Sterile, transparent semipermeable bordered dressings allow visualisation of the insertion site, and an additional anchor if properly maintained. Edges of the transparent dressing may need to be further secured (e.g. consider use of Fixomul® in diaphoretic patients).

Sterile gauze dressings may be used instead of the transparent dressing if the site is bleeding or the patient is diaphoretic[28] or sensitive to adhesive dressings.

Staff are to use the WACHS CVAD forms to document insertion site dressings and site assessment.

- **Catheter migration**

Not all Long PVC devices have catheter markings. For those that do have markings, follow the same procedure as for a PICC.

PICC lines can be measured without touching the line by reading the measurement on the PICC catheter.

Measure external PICC / CVC catheter length from insertion site to the last etched ‘cm’ marking on the device at each dressing change (see Figure 7 for example of where last etched marking is located).

If prior to or during the dressing it is suspected that catheter migration has occurred:

- Contact medical officer to review
- A chest X-ray will be required to confirm catheter tip position and device safety for prolonged treatment
- CVAD may need to be replaced if the patient is receiving vesicant medications or if required for long term treatment
- CVAD lines that measure greater than the insertion measurement are not to be advanced into the vein.

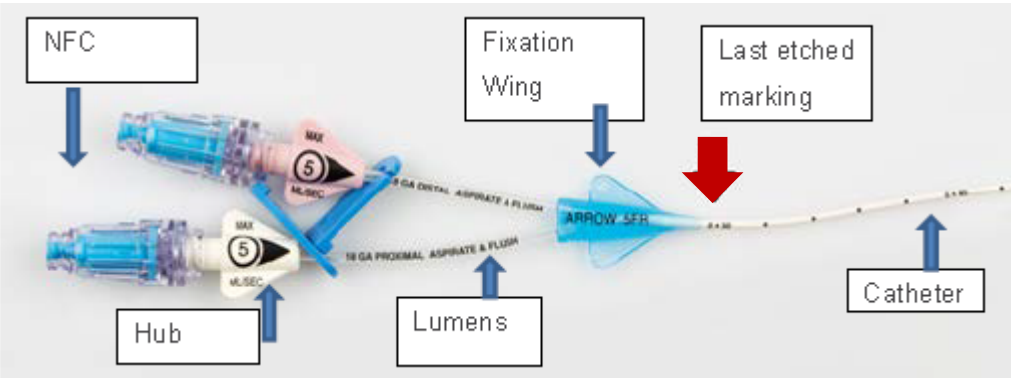
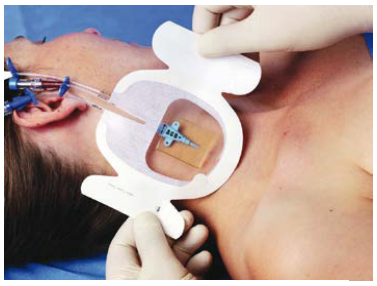


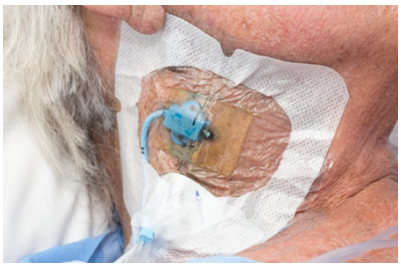
Figure 7: Red arrow indicates the last etched marking used when measuring external catheter length (picture: Fiona Standley Hospital[30])

Dressing Changes Examples of dressings:

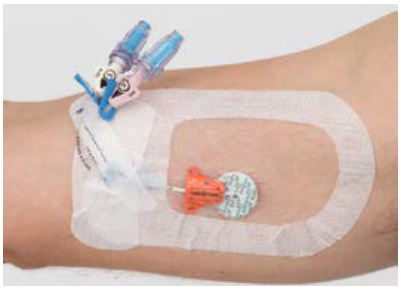


CVC - dressing insitu (RPH Bentley Group)

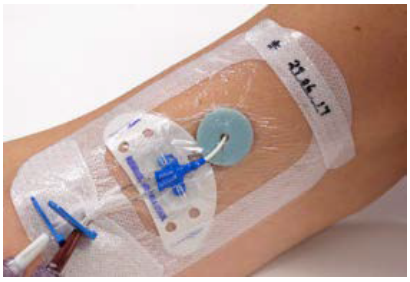
CVC - Placement of statlock for dressing (Fiona Stanley Fremantle Hospital Group)



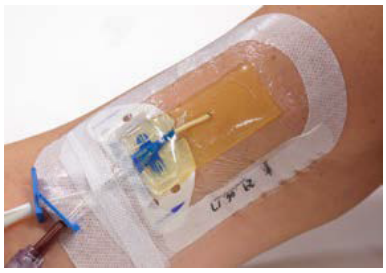
CVC - Angle lumens downward avoiding catheter kinks (Fiona Stanley Fremantle Hospital Group)



PICC dressing – SecurAcath securement device (Fiona Stanley Fremantle Hospital Group)



PICC – Silver acticoat disk with tegaderm advanced dressing (Fiona Stanley Fremantle Hospital Group)



PICC Dressing -Tegaderm CHG (Fiona Stanley Fremantle Hospital Group)

Figure 8**:** Sample dressings for PICC and CVC

For PICCs and non-tunnelled CVCs – change the dressing 24hs post insertion[31, 35] then as below.

Regular dressing frequency is determined by dressing type and condition[2,9]:

- Every 7 days for transparent, semipermeable bordered dressing
- Every 2 days for sterile gauze dressing
- Immediately if dressing integrity is compromised, moisture, blood or infection present.

The catheter insertion site to be visually inspected or palpated through the intact dressing to determine tenderness[2] during review.

The process of dressing changes provides the opportunity to closely review and cleanse the insertion site[2]. Inspect for visible abnormalities. If any signs of localised infection take a swab for bacterial investigation MC&S and refer to medical officer for review (refer to Appendix 4: Insertion Site Assessment). Document assessment information and any escalation on the CVAD forms.

When showering, the Long PVC device dressing must be protected with waterproof cover or if gauze dressing in place.

Sutureless securement device require changing every 7 days.

Where possible, align dressing changes with Needle Free Connector (NFC) change.

In case of excessive bleeding from insertion site, apply gauze pressure dressing over insertion site and cover with sterile transparent dressing. Direct manual pressure may be required. Notify medical officer for review. Remove gauze pressure dressing after 24 hours and replace with antimicrobial dressing.[30]

- **NFC Changes**

Needle free connectors should be changed as frequently as the giving set at a minimum weekly and not more frequently than 96 hours or as clinically indicated[37]or if contaminated or leaking.

Synchronise NFC change with flushing interval or administration set change, where appropriate.

If NFC found to be accidently disconnected, decontaminate lumen hub with a 2% chlorhexidine in 70% alcohol swab, attach new NFC and contact medical officer for review.

There are devices that may not have slide clamps e.g. some Long PVCs have no clamps (and must have an extension with clamp attached at insertion) and some PICC's have an internal valve instead of slide clamps.

- **Equipment and procedure – dressing and NFC change**

Refer to eviQ Clinical procedure - central venous access device - dressing and needleless injection cap change.

Additional WACHS specific information to be noted:

- "Needleless injection cap" (referred to in eviQ) is a needle free connector (NFC) in WACHS
- Cleansing solution used is 2% chlorhexidine in 70% alcohol sticks/swab/wipes or solution. If contraindicated use povidone iodine 10% in 70% alcohol. If alcohol is contraindicated use 10% povidone iodine aqueous solution
- When considering using a combined chlorhexidine gluconate securement dressing, consult with product information for equipment requirements and procedure steps if utilised in preference to the dressing combination of:
  - sutureless securement device
  - chlorhexidine gluconate impregnated foam disk
  - sterile, transparent, semi-permeable IV dressing with site insertion details sticker.

  If patient has chlorhexidine allergy consider use of silver impregnated antimicrobial silver disk around the insertion site.
- Devices **with no device clamp in-situ**: where instructed to close the clamp during the NFC change – close the clamp on the extension set, where instructed to clean the catheter hub – this will be the free end of the extension set.

Appendix 7: Accessing, flushing, deaccessing and locking

- **Flushing**

Sodium Chloride 0.9% (up to 30ml for adults, as per the WACHS Medication Administration Policy) may be administered without prescription to maintain venous access patency and flushing, prior to and post prescribed medication, consider compatible diluents.[29]

Regular flushing regimes for Long PVC, PICC and CVC to be determined based on considerations regarding the individual device and attachments being used, and the clinical requirements and situation of the patient.[2,6,7]

Minimum frequency of flushing[29]:

- Immediately post insertion
- Weekly if not in use to maintain patency unless occlusive problems indicate otherwise
- Post-bolus medication administration
- On completion of infusion
- Prior to and after blood sampling
- On changing NFC - ensure NFC is primed before connection.

Administer flush 1 mL at a time, using a pulsating action (brisk push-pause – see Figure 8) to create turbulence within the catheter, and end with applying positive pressure within the lumen[8] (for non-valved catheters).

If strong resistance felt, do not forcibly administer flush.[2] Consult with medical officer for advice.

CVAD lumens that are unable to be aspirated can be flushed (if migration has been excluded), EXCEPT for lumens containing vesicant medications Inotropes or Heparin.[30]

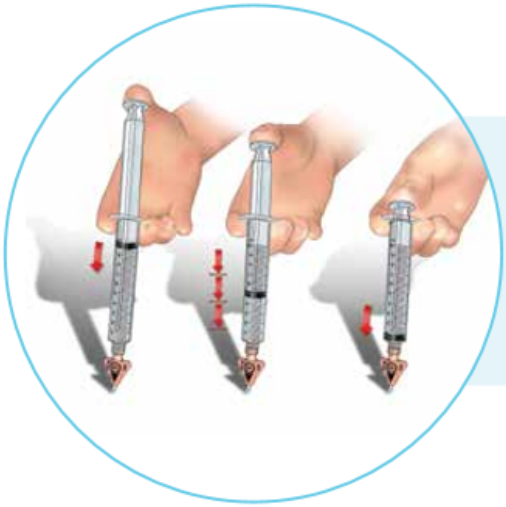


Figure 8: Push-pause technique[41]

Pulsatile Flushing Technique
Rapidly advance the syringe piston by 1-2 mL each pulse ensuring that thumb pressure remains on the piston. Do this continuously until the syringe is nearly empty. Allowing a small amount of fluid to remain in the syringe further prevents reflux of blood into the catheter. The pulsatile flushing technique produces turbulent flow inside the lumen that enhances the removal of debris from the lumen.

Monitor for complaints of pain and signs of infiltration or leakage from the insertion site. Report all concerns.[30]

If unable to flush CVAD refer to:

- the appropriate troubleshooting appendix
- Appendix 8: CVAD – restoring patency – partial and complete occlusion as relevant

Use a 2% chlorhexidine in 70% alcohol swab to decontaminate the NFC or hub post flush. If blood remains within the NFC despite clearing the lumen, change NFC.

- **Central venous catheter/PICC/Long PVC – accessing and flushing**

Equipment and procedure refer to eviQ Clinical procedure - central venous catheter - accessing.

- WACHS specific information: for Long PVC aspiration of blood prior to flushing is not required.

- **Central venous catheter/PICC – deaccessing**

Equipment and procedure refer to eviQ Clinical procedure - central venous catheter – deaccessing.

- **Implanted venous ports - accessing and locking**

Confirm the port is venous prior to use.

- Coring and non-coring needles:
  - Only non-coring needles of the appropriate length are to be used to access an implanted venous port
  - Hypodermic needles are not to be used to access ports, they will "core" or take pieces out of the septum with each access, where as non-coring needles will part the septum of the port and not damage it
    - 19G or 20G non-coring needles are used for blood sampling, blood product infusion or high rate infusion procedures such as medical imaging power injections
    - 22G non-coring needles are used for routine infusions or continuous infusion via ambulatory pumps

If using Power Port[33] for **Power Injectable Contrast**, use of the appropriate pressure tested port needle is required (refer to manufactures information).

- Needle length:
  - the needle should allow for penetration of subcutaneous tissue and the port septum into the port reservoir
  - If accessing port immediately post insertion allow for a longer length needle to accommodate post insertion swelling
  - Palpate the port to locate its depth. Choose the gauge and length of non-coring needle as indicated, commonly used lengths:
    - ¾" length for superficial ports
    - 1 ¼" length for deep ports
- Frequency of locking and needle changes:
  - As per manufacturer's recommendations (can vary between 4-8 weeks) when device not in use i.e. "heparin locked"
  - Re-needle every 7 days if having intermittent infusions or bolus medications
  - Re-needle every 14 days if having continuous infusions, i.e. via ambulatory infusion device where line is interrupted weekly, in consultation with medical staff

Heparin is contraindicated in patients with Heparin-induced thrombocytopenia [HIT] all patients are to be observed closely for signs is "HIT". If present or suspected, discontinue use of heparin.

- Pre Procedure, Equipment and Procedure:
  Refer to eviQ Clinical procedure - implanted venous port (IVP) - accessing and locking

- **Implanted venous port – deaccessing and locking**

Equipment and procedure:
Refer to eviQ Clinical procedure - implanted venous port (IVP) - deaccessing and locking.

Appendix 8: Blood sampling (including blood cultures)

- **Pre-Procedure General Key Points**

If taking blood for blood cultures – do not flush the catheter or discard withdraw volume as this may alter the culture result [29]

Use safety engineered devices where available e.g. needleless blood collection and transfer devices.

Refer to PathWest's Recommended Order of Draw.

- **Implanted venous port**

Refer to eviQ Clinical procedure - implanted venous port (IVP) - blood sampling.

- **CVC, PICC and Long PVC**

Where possible, blood is not to be taken from central lines for blood tests.
If there is no alternative, it must be done using aseptic technique and appropriate PPE.

Utilise the largest lumen available.[2] If multiple lumen catheter insitu, dedicate one lumen to purpose. Undertake blood sampling from lumen with no continuous infusion in progress.

To determine suspected blood stream infection, undertake:

- one set collected from existing device (one from each lumen if multiple lumens) and,
- one set collected from separate peripheral venepuncture (refer to Specimen Collection (including Phlebotomy) and Pathology Results Clinical Practice Standard)
- Both aerobic and anaerobic bottles are to be collected - they require approximately 10mL each

Equipment

- Trolley
- Blood transfer device
- Luer-lock syringes – enough for sampling +/- blood cultures and flushing volumes (10mL minimum size)
- 2% chlorhexidine in 70% alcohol sticks/swabs/wipes/solution
- Non-sterile gloves
- Needle free connector (NFC)
- Sodium Chloride 0.9% for injection - 20mls minimum for flushing (use prefilled syringes if available)

- Specimen request form
- Blood vials for sampling required
- Additionally, for blood cultures:
    - vacuumed aerobic and anaerobic blood culture specimen bottles
    - alcohol swabs

Procedure

1. Perform patient identification and procedure matching with details of pathology request form.
2. Perform hand hygiene, decontaminate trolley surface and assemble equipment
   For blood cultures:
    - Remove the plastic seals from the blood culture bottles. Disinfect the rubber septum of the blood culture bottle with the alcohol swabs by rubbing for 20 seconds and **allow to air dry.**
3. Cease infusion if in progress and if clinically appropriate.
4. Perform hand hygiene. Don gloves.
5. Clean NFC with 2% chlorhexidine in 70% alcohol sticks/swabs/wipes/ solution. **Allow to air dry.**
6. Refer to table (next page):

Blood sampling only	Blood cultures only	Blood cultures followed by blood sampling
6.1 Attach 10mL syringe to NFC and aspirate 5mls of blood to discard (prevents dilution of blood sample from solution sitting within the lumen) 6.2 Attach appropriate sized syringe/s for the sample volume required to the NFC then and aspirate the required blood volume	6.0 Attach a 20mL syringe to NFC and aspirate 20mLs (blood culture bottles require approximately 10mL each)	6.1 Attach a 20mL syringe to NFC and aspirate 20mLs (blood culture bottles require approximately 10mL each) 6.2 Attach appropriate sized syringe/s for the sample volume required to the NFC then and aspirate the required blood volume

7. Connect syringe to transfer device and place on the trolley surface.
8. Flush with 20mL Sodium Chloride 0.9% using push-pause technique until line is clear to prevent the risk of occlusion and infection (if locking required – refer to Appendix 7: Accessing, deaccessing, flushing and locking)
9. Using a 2% chlorhexidine in 70% alcohol sticks/swabs/wipes/solution, decontaminate the NFC post flush to remove any macroscopic contaminants (change the NFC if blood contaminate is evident after flushing the lumen).
10. Transfer blood into appropriate blood vials in correct order of draw
    For blood cultures:
    - Use aseptic technique to fill the aerobic bottle, followed by the anaerobic bottle with 10mls in each bottle (the fill line is indicated on the side of the bottle)
    - If insufficient volume to fill all the bottles, the aerobic bottle is the first priority
    - Do not fill any individual bottle with more than 10 mls
    - Gently invert the bottles once filled to ensure mixing of the blood with the blood culture broth.
11. Dispose of sharps and waste as per WACHS Waste Management Policy.
12. Perform hand hygiene.
13. Label samples with patient identification sticker, date/time sample taken
    - For blood cultures, label sample with the collection site. Patient labels should not obscure the bottle bar code.
14. Complete request from and send samples to laboratory.
15. Document details of procedure in the healthcare record.

Appendix 9: Device removal

Air embolism[37]

Air embolism is a preventable patient safety event.

Patient outcomes from air embolism range from no harm, to neurological impairment and death. It takes only a relatively small volume of air to cause an air embolism, and it also only takes a relatively small amount of time - just one to two seconds to occur.

Two circumstances must be present for an air embolism to occur:

1. Direct communication between the atmosphere and blood vessels [for the purpose of this CPS, this circumstance is met by a central venous access device (CVAD), or a patent venous tract after removal of a CVAD]; and
2. A pressure gradient which favours air entry into the vessel, that is the venous or intrathoracic pressure is lower than atmospheric pressure. This occurs during normal breathing and can be influenced by patient factors.

The signs and symptoms of an air embolism can be non-specific, subclinical and transient in nature, making diagnosis difficult.

Clinicians should be aware that if there is a temporal relationship between a patient's sudden/unexpected deterioration and a CVAD clinical care activity (e.g. insertion, removal), a high index of suspicion between the two events should be considered.

Patient positioning influences the degree of the pressure gradient.

Patients should be supine and if possible head slightly down (Trendelenburg) for insertion and removal of CVADs inserted to the neck or chest.

This positioning increases the central venous pressure at the insertion site and reduces risk of air entrainment. When patients are sitting up the pressure gradient favours air entry into the circulation.

- **Removal of implanted port**

  Ports require surgical removal[37] in theatre or equivalent:
  - 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
  - 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.

- **Removal of Long PVC, PICC and CVC**

Encountering resistance during removal

- Generally PICCs can be removed with little resistance
- If resistance occurs, pause for 10-30 seconds before trying again
- If resistance continues, consider relaxation techniques such as: apply a warm compress to the insertion site and upper arm; offer a warm beverage; deep breathing exercise; administer a slow Sodium Chloride 0.9% flush then try again
- If resistance persists contact medical officer for review.

Pre-procedure key points

- Review coagulation status
- Confirm the reason for and order for removal
- When localised and/or systemic infection suspected, liaise with medical officer and consider obtaining insertion site MC&S and device tip culture and/or blood cultures. Refer to Blood Sampling (including blood cultures) section for requirements
- Routine replacement of Long PVC is not recommended, unless inserted under conditions where strict asepsis was not maintained
- Ensure alternative venous access is gained prior to removal if required for ongoing clinical need
- Refer to insertion record prior to removal to determine details of catheter type and length of device
- Ensure correct patient positioning to prevent air embolus and bleeding
- Explain procedure and educate patient in the breathing technique used during removal
- Ensure all lumens are clamped prior to removal.

Equipment and procedure

For Long PVC – follow the procedure for PICC via link below.

Refer to eviQ:

- Clinical procedure - non tunnelled central venous catheter (CVC) - removal
- Clinical procedure - peripherally inserted central venous catheter (PICC) – removal

Post procedure documentation

- Inpatient - complete removal section of the MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record
- Outpatient or for an inpatient where device was not inserted during current admission – complete the removal section in the red box on the MR179B WACHS CVAD Insertion Site Assessment Continuation Sheet / MR179C WACHS CVAD Access/Dressings Continuation Sheet.

Appendix 10: Discharge and transfer management

Patients being discharged with a Long PVC or CVAD in situ will require ongoing care and management of the device.

Prior to discharge, assess the patient's physical and cognitive ability to care for the device. Consider caregiver involvement as appropriate.

Ensure patients have been educated regarding the care and management of their device as well as signs and symptoms of complications that must be reported urgently.

Ensure follow up appointments are booked or referrals sent to an appropriate community service to facilitate ongoing care of the device.

Encourage the patient to report any concerns regarding their device to the discharge facility or GP.

Confirm the patient has received relevant consumer information.

Document details of follow up appointments or referral and education provided to the patient/ carer in the healthcare record.

If being transferred to another facility, ensure a copy of the MR179A WACHS Central Venous Access Device (CVAD) Insertion and Assessment Record, and if used, any of the CVAD Continuation Sheets are sent with the patient.

Appendix 11: Troubleshooting

- Long peripheral venous catheter troubleshooting
- Peripherally inserted central catheter troubleshooting
- Central venous catheter troubleshooting

For management of extravasation

- Refer to the WACHS Peripheral Intravenous Cannulae (PIVC) Management Clinical Practice Standard (Appendix 5: Complication – Extravasation)

CVAD – restoring patency – partial and complete occlusion

Occasionally CVADs can become difficult to aspirate/flush and are blocked. If this occurs there are several strategies that can be used to unblock them.

- **Assess the possible causes:**
  - Kinked or clamped tubing
  - Equipment failure
  - Needle not inserted fully (implanted port)
  - NFC not fully engaged
  - Catheter may be blocked by drug precipitate or blood
  - Catheter may be blocked by fibrin formation at tip or intraluminal clot
  - Catheter may be wedged up against the blood vessel wall or have migrated to a smaller vessel

- Catheter may be fractured or kinked.

- **Possible solutions to these problems include:**
  - Open clamps and check tubing and equipment
  - Check position of needle (implanted port) and reinsert if needed
  - Reposition patient's head and shoulders (this may change the position of the catheter in the vessel).
  - Ask the patient to:
    - Cough
    - Take a deep breath
    - Raise arms above head (this will attempt to change the position of the catheter in the vessel)
  - Attempt to flush the catheter with a 10mL syringe containing sodium chloride 0.9%. **Do not use a syringe smaller than 10mL and do not use excessive force**
  - Alternate between gentle flushing and irrigation, to attempt to loosen the occluding material
  - Aspirate loosened material into the syringe; this procedure can take 5 to 10 minutes of persistence
  - If those methods are unsuccessful, then the instillation of a thrombolytic agent, maybe used if prescribed by a Medical Officer
  - Order a chest x-ray +/- a linogram with contrast medium
  - Order an ultrasound of the affected vessels to identify deep vein thrombus.

Refer to eviQ Clinical procedure - restoring patency to a central venous access device (CVAD) - partial and complete occlusion.

Additional information relating to occlusions can also be found in the tables below:

- Long peripheral venous catheter troubleshooting
- Peripherally inserted central catheter troubleshooting
- Central venous catheter troubleshooting

Long Peripheral Venous Catheter (Long PVC)			
Signs and Symptoms	**Possible Cause**	**Actions**	**Prevention**
Drainage, redness, pain, swelling around insertion site, fever chills	Infection	• Medical Review • Document infection signs on MR179A (or MR179B if in use)	• Maintaining aseptic technique during procedures • Keep sterile dressing over site • Appropriate hand hygiene • Meticulous hub care • Effective catheter stabilisation

Long PVC cont.			
Signs and Symptoms	**Possible Cause**	**Actions**	**Prevention**
Arm or shoulder swelling, swishing in ear on same side of body where catheter is located while medication given	Catheter position change	• Medical Review • Do not inject any solutions into catheter until medical review	Inject flushing solution slowly
Inability to inject	Catheter clotted or kinked	• Medical review. • Document last time able to inject	• Reposition the patient (e.g., position arm at 90-degree angle form body)[8] • Flush catheter well before and after medications • Flushing with pulsatile technique
Leaking from external catheter	Break in catheter material, hub separation	• Medical review • Fold catheter together below leaking area and tape securely	• Do not use alcohol or acetone (as in nail polish or tape remover) on catheter • Do not pull on catheter
Pain on injection	Inflammation of vein	Medical review	Medications should be given slowly

Peripherally Inserted Central Catheters (PICCs)		
Signs / Symptoms	**Possible Causes**	**Suggested Actions**
May observe blood or precipitate in lumen	• Thrombus formation can originate outside or inside the catheter lumen • Cause included venous stasis, vessel wall trauma or stenosis and hypercoagulable states[13,14] • Performing blood pressure readings (utilizing a cuff) on the arm with a PICC insitu. Cuff pressure can cause bleeding at the insertion site, increasing the risk of thrombus formation and cause retrograde blood flow raising risk of catheter occlusion[16]	• Ensure regular flushing of lumens, using 10mL sodium chloride 0.9% and push/pause technique[13,14] until blood or precipitate is removed. • Ensure NFC is connected to the device • Contact MO • If unsuccessful consider fibrinolytic agent (e.g. Alteplase).[13,14] Seek specialist advice during consideration process

PICCs cont.		
Signs / Symptoms	**Possible Causes**	**Suggested Actions**
Partial Occlusion Reduced flow of infusion Difficulty in flushing lumen/s	• Tip resting against a vein valve/wall • Fibrin sheath formation • Position of catheter	• Request patient to cough, take deep breaths, hunch shoulders, or change position. • Document in patient healthcare record. • Liaise with MO • PICC may be rewired within 24 hours by appropriately trained medical officer to avoid reinsertion if malfunction present without infection4
Pain, visible swelling or fluid leaking from site: when PICC is flushed [17,18]	• Malposition of catheter • Fibrin sheath • Internal or external catheter fracture • Extravasation	• Stop infusion of fluids • Notify MO • Document in patient healthcare record • Chest x-ray or venogram may be ordered • Consider removal of PICC – Liaise with MO
Infection - systemic Pyrexia temperature 38oC +/- rigors after flushing lumens Tachycardia Hypotension Shock	• All venous access devices hold the potential risk for patients developing localised site and systemic bloodstream infections either at the time of insertion or whilst being maintained[3] • Catheter Related Blood Stream Infection	• Liaise with Medical Officer • MO to consider removal of PICC[15] and/or alternative IV access – consult with senior medical officer/specialist to discuss • Document findings and actions taken in healthcare record • Take blood cultures from line and peripherally[19,20,21] • Monitor patient TPR, BP, $Sp0_2$, responsiveness – frequency determined by patient condition – escalate as indicated

PICCs cont.		
Signs/Symptoms	**Possible Causes**	**Suggested Actions**
Insertion Site Infection Inflammation Redness Tenderness +/- Discharge at exit site[19]	• Breach in aseptic technique	• Take swab of exit site • Contact Medical Officer for review • MO to consider removal of PICC[15] and/or alternative IV access – consult with senior medical officer/specialist to discuss • Document findings and actions taken in healthcare record • Ensure insertion site is dressed with chlorhexidine bio-patch
PICC line migration Increased external catheter measurement	• Over exertion, e.g. excessive coughing • Lifting heavy weights • Dressing insecure, or during dressing changes • Unknown	• Access line and compare to insertion details • If discrepancy, escalate to MO for review • Do not push in extra external length
Bleeding at exit site	• Difficult insertion/ number of punctures at site • Coagulation abnormalities • Consider comorbidities, e.g. patients with liver abnormalities may continue to bleed following insertion	• Apply digital pressure or pressure dressing to site for 5-15 minutes or as clinically indicated • Consider topical thrombin dressing as prescribed • Correction of coagulation – one or all of the following may be given: platelets/FFP/ Vitamin K[21] as prescribed • Document bleeding in healthcare record • Inform MO and shift coordinator if prolonged bleeding

PICCs cont.		
Signs/Symptoms	**Possible Causes**	**Suggested Actions**
Extravasation: Where a vesicant solution breaches the venous wall and leaks into the surrounding tissues[6] leading to tissue damage with potential for further harm.	The degree of patient harm is directly related to the infusions vesicant properties, the volume and length of time the infusion infiltrated the surrounding tissues Symptoms near the insertion site: • burning or stinging pain, sudden 'heat' • taut skin and oedema • blanching and coolness of skin • slow or ceased infusion • damp or wet dressing.	• Refer to Appendix 4: Complication - Extravasation of the Peripheral Intravenous Cannulae Management CPS

Table contents with edits: Royal Perth Hospital: Nursing Practice Standard Central Line Insertion and Management, October 2016.

Central Venous Catheters (CVCs)			
Complications	**Signs and symptoms**	**During insertion**	**Post insertion**
Pneumothorax	• Restlessness or anxiety • Dyspnoea • Cyanosis • Pain on breathing • Oxygen desaturation • Wheeze	Monitor patient's respiratory rate and general condition If concerned, discontinue procedure Obtain urgent CXR	• Monitor patient's respiratory rate and general condition • Routine post insertion CXR if subclavian or jugular vein insertion • If signs or symptoms evident: ○ Sit patient upright ○ Administer high flow oxygen ○ Seek urgent medical review
Arterial cannulation	• Pulsatile blood flow • Bright red flashback • Large haematoma at injection site • patient complains of neurological symptoms (especially after injection of fluid/medicines)	• Remove line • Apply firm compression (but not bilateral neck compression) • Observe the patient closely for haematoma development Datix CIMS form	• CXR shows CVC crossing the midline • Blood returns into CVC line despite flushing • Actions as for during insertion • Monitor neurological signs closely for for at least 12 hours Datix CIMS form

CVCs cont.			
Complications	**Signs and symptoms**	**During insertion**	**Post insertion**
Air embolism/ catheter disconnect or post-removal	• Restlessness or anxiety dysponea/cyanosis hypertension/ dizziness • Tachycardia/week pulse Altered consciousness (e.g. confusion) • Visible catheter damage or leakage from line during use	During insertion: • Position patient supine (with head down 30 degree tilt where possible) • Ensure all CVC connections are secure	• Check all CVC connections and prevent further air entry (cap line with new positive pressure valve) • Position patient in left Trendelenburg (head down at 30 degree tilt) • Administer high flow oxygen • Seek urgent medical review • Monitor vital signs • Complete Clinical Incident Notification via Datix CIMS If visible damage: • Clamp CVC between patient and damaged area, cover with sterile gauze • Minimise patient movement • Seek medical review and expert advice on management • NB. Removal or repair of tunnelled catheters to be undertaken only by specialist staff
Arterial puncture	• Bright red blood • Syringe fills more quickly than expected (when compared to venous) • Blood leaves in a pulsing mode	• Apply direct pressure to site for 5 minutes to limit haematoma formation • Monitor and document vital signs • Inform medical staff if tachycardia or hypotension occurs	N/A

CVCs cont.			
Complications	**Signs and symptoms**	**During insertion**	**Post insertion**
Cardiac tamponade	• Chest tightness or pain • Shortness of breath • Muffled heart sounds • Altered consciousness (as tamponade impairs myocardial contractility and result in loss of cardiac output)	• Administer high flow oxygen • Monitor vital signs • Documented in healthcare record • Activate MET/MER response if appropriate. • Prepare for pericardio-centesis (as directed by MO)	• Monitor clinical conditions and vital signs as indicated • Request MO review as indicated by patient's condition
Catheter occlusion	• Inability to flush catheter • Blood in lumen • Inability to aspirate blood • Note: partial obstruction may allow infusion of fluid but not aspiration • Cause of internal occlusion: • CVC migration to smaller vein or resting on vein wall • Compression of CVC in superior vena cava between the clavicle and the first rib - Constant wearing may result in damage to the integrity of the catheter[22] • Other causes include chemical precipitation, lipid disposition or thrombus formation	•	• Routine use of push/pause technique for lumen flushes External occlusion: • Check for kinks (or clamp) and reassure line if indicated Internal occlusion: • Ask patient to cough, take deep breaths, hunch shoulders or reposition • Attempt gentle irrigation with sodium chloride 0.9% using push/pause method alternating flushing and aspirating; do not exert excessive pressure or suction • If unable to remedy, or patient has signs or symptoms of a thrombus seek urgent MO review • CXR may be required to confirm tip position/exclude migration[22] • If thrombus suspected – see next section

CVCs cont.			
Complications	**Signs and symptoms**	**During insertion**	**Post insertion**
Thrombus	• Swelling • Pain, numbness or tingling • Coolness, swelling or venous engorgement, discoloration of neck, chest or arm (on side of CVC)		• Seek urgent MO review • Monitor vital signs • Consider need for oxygen therapy • Consider fibrinolytic agent (e.g. Alteplase). Seek specialist advice during consideration process.
Infection All venous access devices hold the potential risk for patients developing localised site and systemic bloodstream infections either at the time of insertion or whilst being maintained[3]	• Site infection and tunnel infection: • Local pain or inflammation • Cellulitis or tracking within 2cm of exit site • Exudate or purulent discharge at site • Fever • Systemic infection: • Fever (usually >38°C, not attributed to any other causes) • Malaise • Rigors (particularly on flushing line) • Chills • Hypotension • Other signs of shock may develop so close observation is required	• Compliance with MR179A CVAD Insertion and Assessment Record – insertion checklist • Maximal barrier precautions on insertion (use of mask, cap, sterile gloves and large drape) • Hand hygiene • Skin anti-sepsis with 2% chlorhexidine in • 70% alcohol[15] • Optimal selection insertion site; avoid femoral approach • Use chlorhexidine bio-patch to reduce the regrowth of microbes after skin antisepsis[24]	• Review need for CVC daily • Minimise breaks in the closed circuit • Other routine care including hand hygiene, site monitoring, line change/lumen flushing as detailed in CPS If local infection is suspected: • Inform MO and Shift Coordinator, review management plan and need for CVC • Take swab of site if exudate present • Consider antibiotic therapy • Document in health record If signs of systemic infection: • Inform MO and Shift Coordinator and review management plan Cont. next page

CVCs cont.			
Complications	**Signs and symptoms**	**During insertion**	**Post insertion**
Infection Cont.			• Monitor closely for signs of shock Remove CVC if no longer needed • Obtain paired blood cultures (from CVC and peripheral vein) prior to commencing antibiotics[15,25] • Notify infection control and complete Datix CIMS
Extravasation: Where a vesicant solution breaches the venous wall and leaks into the surrounding tissues[6] leading to tissue damage with potential for further harm.	The degree of patient harm is directly related to the infusions vesicant properties, the volume and length of time the infusion infiltrated the surrounding tissues Symptoms near the insertion site: • burning or stinging pain, sudden 'heat' • taut skin and oedema • blanching and coolness of skin • slow or ceased infusion. • damp or wet dressing.	•	• Refer to Appendix 4: Complication - Extravasation of the WACHS Peripheral Intravenous Cannulae Management CPS

Table content from: Royal Perth Hospital: Nursing Practice Standard Central Line Insertion and Management, October 2016.

Appendix 12: Arterial Ports

- **General Information**

Always confirm the type of port before accessing it.

Arterial ports are:

- Used less frequently
- Usually exit into the common hepatic artery for a specific drug or radioisotope therapy, with the port body often found in the sternum, lower ribs or hip
- Always single lumen ports
- Used for the administration of chemotherapy or radioisotopes, however trans-arterial chemotherapy and/or radioisotopes are not administered at WACHS sites

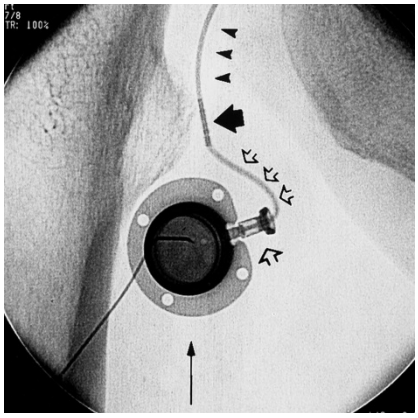


Figure 9: Femoral arterial access port

- **Insertion**

Arterial ports are inserted in theatre under a general anaesthetic by laparotomy or laparoscopy, and require a general anaesthetic to remove them. Removal is not covered in this CPS.

- **Accessing/needling, flushing and deaccessing**
  - **Coring and non-coring needles:**
    - Hypodermic needles will “core” or take pieces out of the septum with each access, where as non-coring needles will part the septum of the port and not damage it.
    - 19G or 20G needles are used for blood sampling, blood product infusion or high rate infusion
    - 22G needles are used for routine infusions or continuous infusion via ambulatory pumps.

  - **Needle length**
    - The needle should allow for penetration of subcutaneous tissue into port reservoir
    - If accessing port immediately post insertion allow for a longer length needle to accommodate post insertion swelling.
    - ¾” length for superficial ports
    - 1 ¼” length for deep ports

  - **Frequency of locking and needle changes**
    - Every week for “heparin lock”
    - Needles are not to remain in situ without an infusion in progress

Heparin is contraindicated in patients with Heparin-induced thrombocytopenia [HIT] all patients are be observed closely for signs is “HIT”. If present or suspected, discontinue use of heparin.

- **Flushing**

Arterial ports are **NEVER** to be aspirated.

Once correct needle position is established it is to be flushed with 20ml of 0.9% sodium chloride using a push pause technique.

If accessed and needle remains in situ, ensure a continuous infusion is in progress via a dedicated pump to maintain catheter patency.

- **Equipment and procedure**

  The equipment and procedure is the same as for venous ports – refer to eviQ:

  - Clinical procedure - implanted venous port (IVP) - accessing and locking
  - Clinical procedure - implanted venous port (IVP) - deaccessing and locking.