Plymouth Hospitals NHS
NHS Trust

Central Venous Catheter Care Guidelines






A Reference Document for the Care of Central Venous Access Devices and Midline Catheters in Adult Patients *by*

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Preface and Acknowledgements

These guidelines are designed as a resource for staff involved in the selection, placement ongoing management and removal of various forms of Central Venous Catheter (CVC).

No attempt has been made to address the many other issues which may face patients with CVCs - e.g. anxiety or altered body image.

Thanks are due to Liz Simcock, Clinical Nurse Specialist for Central Venous Access (and colleagues) at UCL Hospitals NHS Foundation Trust and the Yorkshire Cancer Network (YCN) Chemotherapy Nurses Group for their generosity in sharing their Guidelines.

The document was ratified by the Infection Control Committee - 8 November 2011

1 Introduction

This guidance provides recommendations for practice rather than step by step procedures. Where procedures developed with the involvement of all relevant personnel are available, links will be provided where possible to these documents.
This Guideline should be read in conjunction with PHNT documents Management of Central Venous Catheters, Guidelines for Aseptic Technique, Hand Hygiene Guidelines and with the PHNT Injectable Drug Administration Policy.

A quick reference troubleshooting guide is supplied in the Appendix.

There are a number of different types of central vascular access devices produced by different companies. Every effort has been made to standardise the devices used within the Trust , however local information should reflect the specific devices used in each clinical area.
These guidelines will inform decision making but are not intended to replace clinical judgement in individual cases.

Advice and support can be sought by contacting the Vascular Access Clinical Nurse Specialist on (4)31454 or via Bleep 89985, weekdays. If unavailable please contact the Critical Care Outreach Team on Bleep 89048 or Hospital @ Night .

1.1 Objectives

The key objectives of the guidance are:

- To provide evidence based guidance across the Trust for safe and effective CVAD management.

1.2 Scope

These guidelines are aimed at staff involved in the selection, placement, ongoing management and removal of various forms of Central Venous Catheter (CVC) in patients within PHNT. They will address care of short, and medium to long term central vascular access devices (CVAD's). Midline catheters have been included within this guideline, as although not by definition a central vascular access device they are medium term devices requiring special consideration. Peripheral *cannulae* are excluded.
Devices covered include:

- Short term central venous catheters (CVC's)
- Peripherally inserted central catheters (PICC's),
- Long term tunnelled catheters (e.g. Hickman, Groshong) and dialysis lines (Vas Cath's)
- Implanted port systems (e.g. TIVAD, Portacath)
- Midline catheters

These guidelines do not address in detail catheter insertion technique, training and supervision. For more information please see **PHNT Infection Protection and Control** Management of Central Venous Catheters, and any Standard Operating Procedure (SOP) that applies regarding this process.

The principles and practice of infusion therapy should be included in the basic IV education curriculum, be available as continuing education, be provided in orientation to new employees and be made available through continuing professional development opportunities.

2 Background Information

(i) Definition of a Central Venous Catheter (CVC)

The term Central Venous Catheter (CVC) refers to an **intravenous catheter whose internal tip lies in a large central vein**. There are various different types of CVC but common to all is the idea that the **tip of the catheter floats freely within the bloodstream in a large vein** and parallel to the vein wall. Blood flow around the catheter is maximised, and physical and chemical damage to the internal walls of the vein are minimised.

Opinions vary about the ideal place for the tip of a CVC (2) but it is generally accepted that for a catheter to be considered a "central catheter" the internal tip should be in one of the following positions.

a. Superior vena cava
b. Junction of the right atrium and the superior vena cava (also known as the atrio-caval junction)
c. Right atrium
d. Inferior vena cava above the diaphragm (femoral catheters)

Tip positions outside these areas are thought to be related to a significantly higher risk of complications, notably thrombosis (3,4,5,6,7)

In practice, CVC tips are not static and their position varies depending on the patient's position, arm movements etc (2)

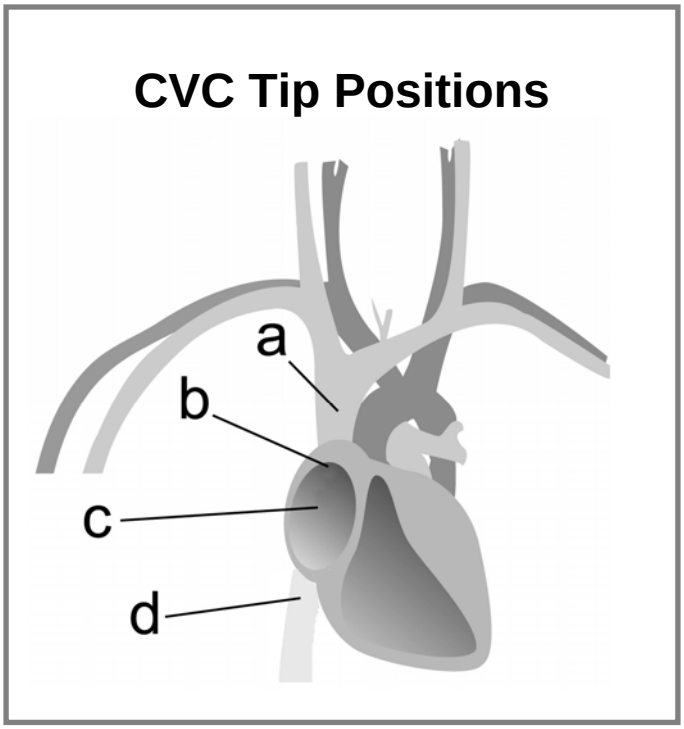


Diagram 1;CVC Tip Positions

(ii) Indications

- To monitor **central venous pressure, Sv02.**
- To administer **large amounts** of intravenous fluids (e.g. colloids, blood products etc.)
- To administer **irritant, vesicant or hyper-osmolar** drugs / fluids (for example Noradrenaline/Adrenaline, NaHCO3, Parenteral Nutrition, chemotherapy etc.)
- To provide **long term access** for frequent or prolonged use (e.g. chemotherapy, antibiotics, blood sampling, apheresis, continuous renal replacement therapy (CRRT), haemodialysis etc.).

(iii) Line Insertion and Removal

Insertion of a CVC is an invasive procedure which must only be performed by personnel trained and assessed as competent to do so. Placement should comply with current best practice guidelines , including using optimal aseptic technique, including full barrier precautions, Chloraprep 2% as skin preparation (except in cases of hypersensitivity), as outlined in reference documents such as the PHNT Management of Central Venous Catheters, HII Central venous Catheter Care Bundle and HII Renal Haemodialysis Catheter Care Bundle (8,9,10)

Whether the catheter is inserted under general anaesthetic, sedation or simple local anaesthetic will depend upon the situation, the patient, the type of catheter to be inserted and local practice.

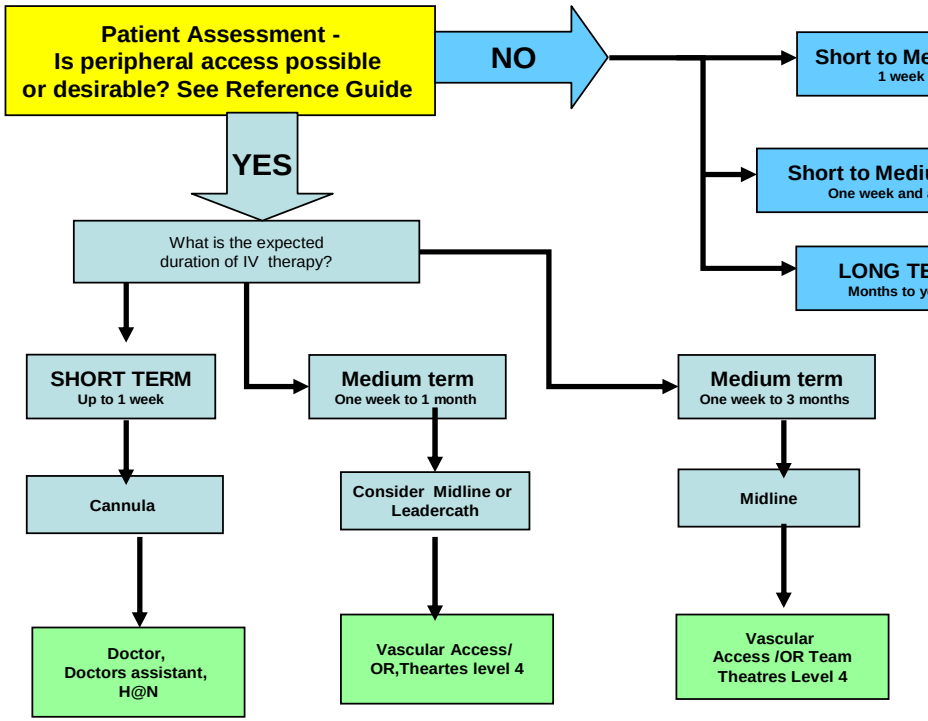
- Catheter tip position and any complication are verified by chest x-ray following insertion unless the tip has been screened during insertion using Fluoroscopy i.e. in the Radiology Department.
- Lines placed via the femoral routes do not need a post procedure x-ray.
- Line tip position must be clearly documented before the line is used.

Central Venous Catheters should be removed as soon as possible if they are not needed. Central line removal should only be attempted by those assessed as competent to do so.
Various different types of CVC's are available and these are described below. **The techniques used for the removal of a CVC** will depend on the type of catheter.

(iv) Device Selection

The choice of device will depend chiefly on the purpose for which it is intended, although patient preference and lifestyle are a key factor when selecting long-term catheters. As a general principle **the lumen diameter and the number of lumens should be kept to a minimum**. Larger bore catheters and multiple lumens are associated with increased risk of infection and thrombosis (9,11).
For advice on line selection please contact the Vascular Access Nurse Specialist on (4)31454 or Bleep 89985.
When central venous access is required for **total parenteral nutrition (TPN),** ideally a single-lumen central catheter should be used. If multiple lumens are essential, then a naive lumen should be dedicated exclusively for that purpose (9). Please contact the **Nutrition Team Clinical Nurse Specialist (Bleep - Julie Morley 89755, or Emma Tyler 89760)** for further advice.

Vascular Access Device Selection



For support & advice please contact -

- **Vascular Access** weekdays 8-4 excluding Bank Holidays, on 31454 or Bleep 89985,
- **Outreach** on 89048
- **H@N** out of hours and weekend Bleep 0690
- **Anaesthetic department** level 4 telephone
- **Interventional Radiology**

Quick Reference To Vascular Access Selection
Consider *patient* factors & *therapy* factors

Examples	Peripheral IV catheter	Leadercath	MIDLINE	PICC	Alternative e.g.. Tunnelled/ TIVAD/Port
IV Therapy (< 7 days) *dependent on drug type.* *No* risk of intimal damage	y	y	y	y	y
IV Therapy (> 7 days to 4 weeks) & *No* risk of intimal damage		y *No* risk of intimal damage	y *No* risk of intimal damage	y	y
IV Therapy (> 7 days to 4 weeks)		y *No* risk of intimal damage	y *No* risk of intimal damage	y	y
IV Therapy (> 7 days to 6 to 12 weeks)			y *No* risk of intimal damage	y	y
Long Term IV (> than 6 weeks)				y	y
Irritant or vesicant drugs i.e. Vancomycin, TPN, ,inotropes, blood sampling				y	y

Diagram 2. Vascular Access Device Selection Flow Chart to aid device selection

3 Types of Central Vascular Access Devices

3.1 Non-Tunnelled CVC Often called Central Lines / Neck Lines / CVP Line

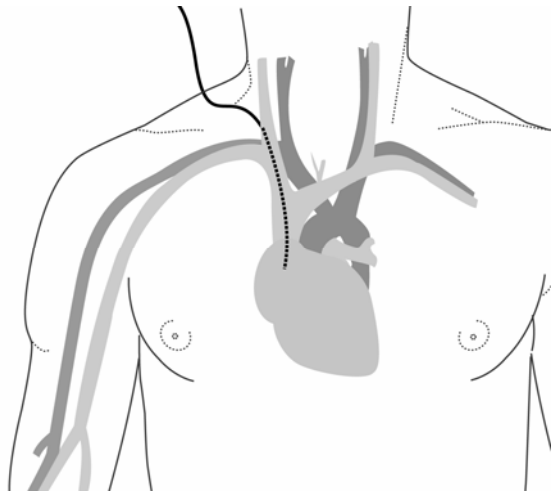
- Non-tunnelled CVC's are most commonly found in **acute-care settings.** They are not suitable for long-term use (nominally greater than 28 days).

- Although routine replacement is not recommended - ideally CVC's are removed within 7-10days of insertion because of the relatively high risk of infection. They tend to be uncomfortable, difficult to dress and unsightly, (HII Central venous Catheter Care Bundle).

- **A daily review of ongoing CVC requirement should be made and documented. If a CVC remains in situ at day 5, consider a plan for alternative access if requirement is likely to exceed 7-10 days.**

- **The catheter is usually inserted via the subclavian, internal jugular or femoral veins** with the tip positioned in the right atrium, the superior or inferior vena cava.

Diagram 3- Centrally Inserted Non-tunnelled CVC



- The catheter should be secured with sutures or a GripLok . See Infection Control Management of Central Venous Catheters.

- **Non-tunnelled CVC's may have single or multiple lumens**. Each lumen provides independent access to the venous circulation, so that incompatible drugs/fluids may be administered simultaneously.

- **Each lumen is equipped with an integral clamp** to seal the catheter and guard against air entry, haemorrhage and infection.

3.2 Peripherally Inserted Central Catheter (PICC).

- PICC's (Peripherally Inserted Central Catheters), like tunnelled lines, are intended for **mid to long-term use** in patients who require multiple infusions of fluids, blood products, drugs. They are the preferred route for Parenteral Nutrition. They may also provide access for routine blood sampling, although do not *always* "give" blood.

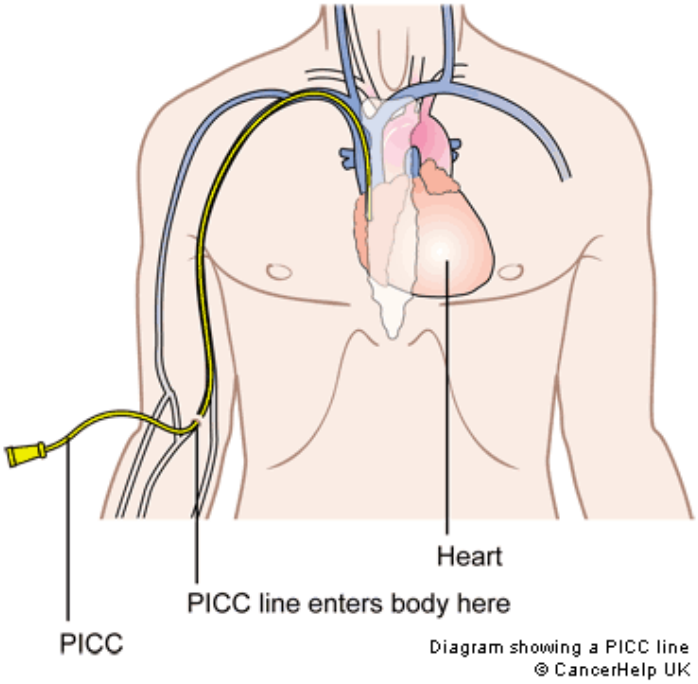


Diagram 4. Adult PICC

- **A PICC is a fine bore CVC** inserted into a peripheral vein – usually the basilic or brachial vein – and threaded upwards towards the heart and may be placed by a doctor or specialist nurse. Catheter tip position is verified by chest x-ray following insertion (unless the tip has been screened during insertion using Fluoroscopy i.e. in the Radiology Department.

- **Placement is contraindicated** following ipsilateral axillary node dissection or irradiation, or in the case of lymphoedema of the arm, axillary node disease, or skin infection at the insertion site (13).

- **PICC's do not have a "cuff" to secure the** catheter**.** There is nothing to keep the PICC in place unless it is secured to the skin of the patient's arm using steri-strips and a GripLok. See Changing a PICC Dressing Storyboard for "How to" guide. In some Trusts PICC's may be sutured in position but this is not currently recommended in PHNT.

- **Assess external length of the PICC** before use. The external measurement should be recorded on the Trust Care Plan. If it has migrated see **Managing Complications**.

- **PICC's may be single or double lumen**. Each lumen provides independent access to the venous circulation, so that incompatible drugs/fluids may be administered simultaneously.

- **Each lumen of a PICC has *either* an integral clamp, or a valve**. The clamp (or valve) serves to seal the catheter and guard against air entry, haemorrhage and infection. Valved PICC's vary in design: the valve may be at the **internal** or **distal** tip of each lumen (e.g. the *Groshong* PICC) or may be situated in the **external** or **proximal** end of the catheter (e.g. the *PASV* PICC).

- **Patients may be discharged home with a PICC in situ**. Patient education regarding the recognition and reporting of complications is of great importance. The PICC usually exits onto

the patient's inner arm and so it is generally not practical for the patient to care for the catheter him/herself. Liaison with the primary health-care team is vital. Aftercare should be arranged by the team responsible for the patient's care. Refer to Discharging a Patient with a PICC or Hickman (*document link coming soon*).

3.3 Midline Catheter

- The **PICC** should not be confused with a **"midline catheter"** which is usually 20cm to 25 cm in length, with the tip terminating in the region of the axillary vein. A Midline is can be used for any drug that can be given through a cannula and is recommended for patients requiring IV therapy for greater 10 days (63). Intravenous drugs suitable for **peripheral infusion** may be given via a Midline.

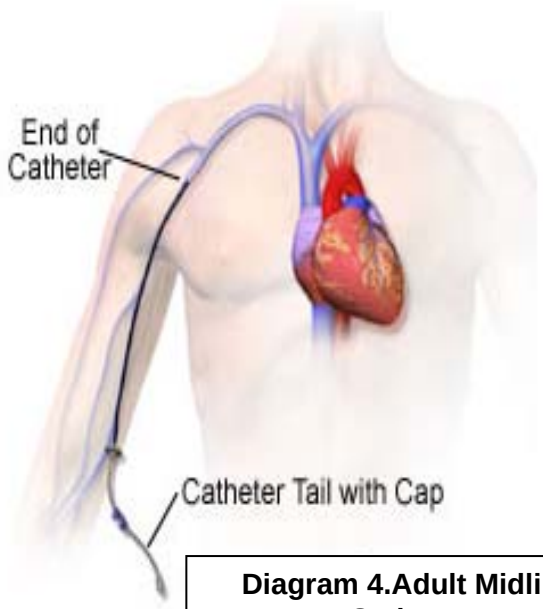


Diagram 4.Adult Midline Catheter

- A **PICC line** should not be confused with a **"midline catheter"** which is usually 20cm to 25 cm in length, with the tip terminating in the region of the **auxiliary vein.** The placement procedure is similar to PICC placement.
- A **Midline** is recommended for patients requiring IV therapy for greater 10 days, minimising vein trauma caused by repeated cannulation.
- One benefit of a Midline is that **no check x-ray** is required following insertion to check line tip position.
- Intravenous drugs suitable for **peripheral infusion** may be given via a Midline.

- Although a midline catheter is not a central venous catheter, they are included here as **due to their prolonged dwell time, the risk for complications such as infection require scrupulous aseptic clinical care.**

- As with PICC lines **patients may be discharged home with a Midline in situ**. Patient education regarding the recognition and reporting of complications is of great importance. A midline usually exits onto the patient's arm and so it is generally not practical for the patient to care for the catheter him/herself. Liaison with the primary health-care team is vital. Aftercare should be arranged by the team responsible for the patient's care. Refer to Discharging a Patient with a PICC, Midline or Hickman (*link coming soon*).

- There are two types of Midline used in the Trust, the Leaderflex (dwell time up to 30days) and the Lifecath (dwell time duration of therapy) . It is important to establish which device has been placed (see illustration below), by checking the insertion record.

Featured Products

Leaderflex

Leaderflex 20cm is a radiopaque polyurethane catheter which remains stiff during insertion, then softens at body temperature.

Key Features

- Suitable for use up to 30 days
- One-piece catheter
- Flexible guidewire
- Integral extension

Lifecath Midline

Lifecath Midline is a radiopaque polyurethane catheter for use in patients who require mid-long term IV therapy.

- Depth markings
- Integral extension
- Supplied with Bionector
- Supplied with a GripLok catheter fixation securement device

3.4. Tunnelled CVC

- **Tunnelled CVC's (e.g. Hickman, Broviac lines) are intended for long-term use** in patients who often require multiple infusions of fluids, blood products, drugs or parenteral nutrition. They also provide easy access for routine blood sampling. They are more comfortable and discreet than the non-tunnelled CVCs described in a) above, and can stay in situ for much longer because of the tunnel that separates skin exit site and the vein entry site (see below).

- The **tunnelled CVC** is inserted via the subclavian, jugular or femoral veins. **The catheter is tunnelled subcutaneously and exits at a convenient site** (usually on the chest wall) where it is secured with temporary sutures. There is a 'cuff' within the tunnel to which fibrous tissue will adhere, usually in the 2 to 3 weeks following insertion. At the end of this time, the sutures can be removed. The embedded 'cuff' helps to prevent accidental dislodgement and also acts as a mechanical barrier to ascending bacteria (14, 15).

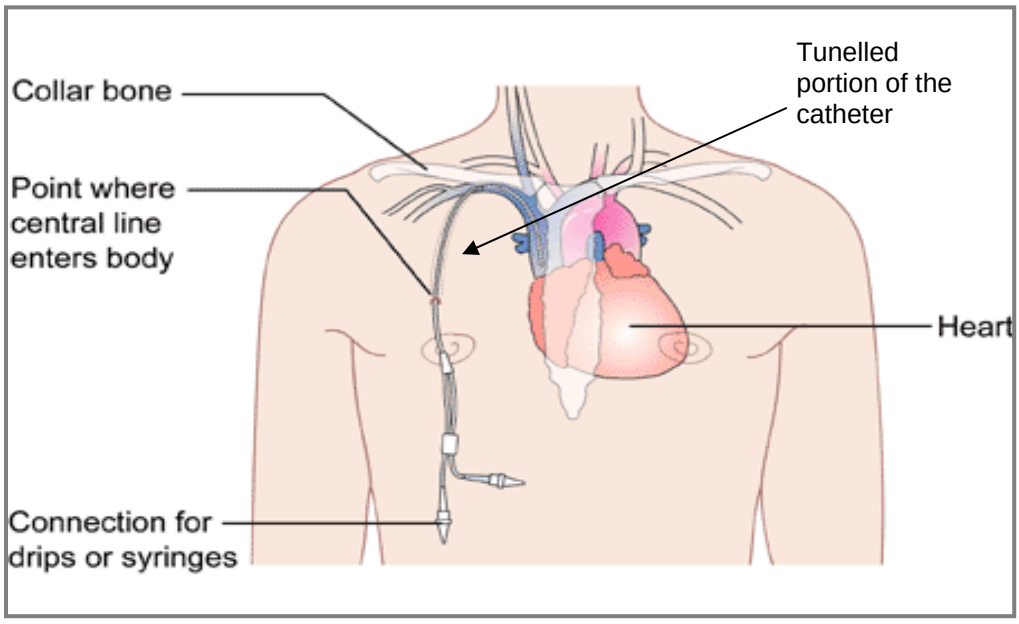


Diagram 4 Tunnelled line (e.g. Hickman)

- **Single, double and triple lumen catheters are available**. Each lumen provides independent access to the venous circulation, so that incompatible drugs/fluids may be administered simultaneously.

- **Each lumen of the catheter is equipped either with an integral clamp, or a 3-way valve**. The clamp (or valve) serves to seal the catheter and guard against air entry, haemorrhage and infection. Valved catheters vary in design: the valve may be at the **distal (or internal**) (e.g. *Groshong* catheters) or **external** (or **proximal**) end of each lumen (e.g. *PASV* catheters).

- **Patients with tunnelled CVC's may be discharged home with the catheter in situ**. Patient education regarding the recognition and reporting of complications is of great importance. Where possible, care in hospital should be aimed at the promotion of independence in caring for the line, but liaison with the primary health-care team remains vital. Aftercare should be arranged by the team responsible for the patient's care. Refer to Discharging a Patient with a PICC or Hickman *(ink coming soon)*

3.5 Totally Implantable Vascular Access Devices (TIVADs) or Ports / Portacaths

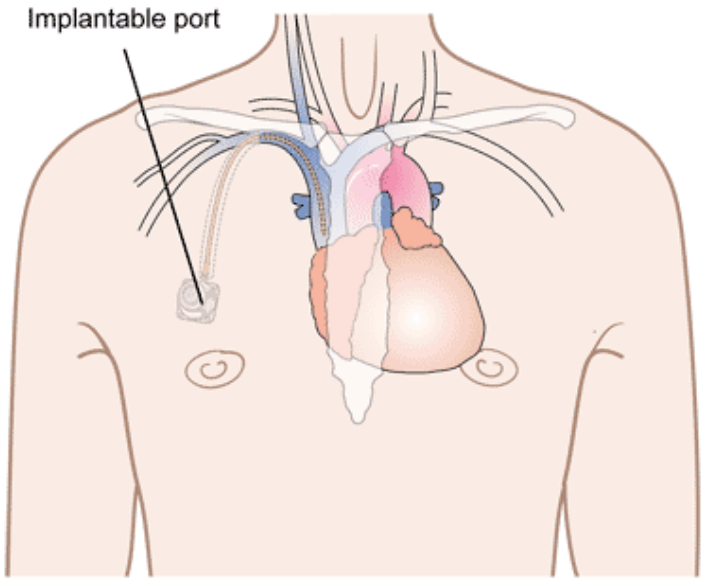


Diagram showing an implantable port
© CancerHelp UK

Diagram 5. Implantable Port

The Implantable Port is similar to a tunnelled line but instead of protruding from the patient's chest, the catheter terminates in a self-sealing injection port which is implanted under the skin. **There are therefore no external parts.** The port is accessed through the skin using a dedicated non-coring needle by those assessed as competent to do so

- Some patients find an Implantable Port **more discreet and less intrusive** than a tunnelled CVC (16) .Ports **require less maintenance** when not in use than other types of catheter. They may also offer a lower risk of infection (17,18)

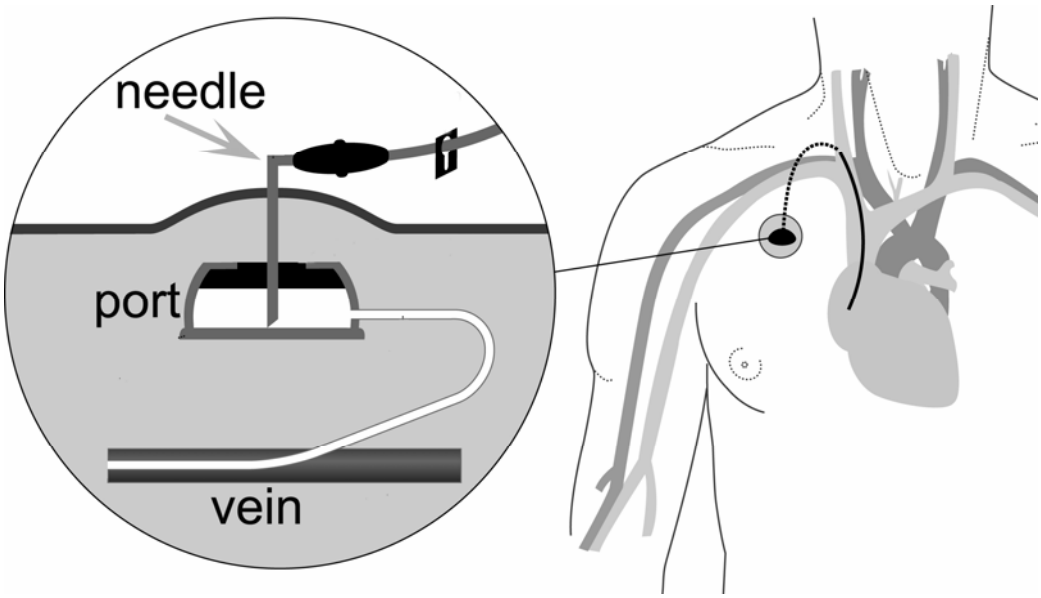
- Implantable Ports are suitable for patients who require **long-term frequent and intermittent venous access**. They are less than ideal for long-running continuous infusions because of the risk of needle dislodgement (19). **The patient is often discharged home with the port in situ**, and therefore patient education regarding the recognition and reporting of complications and adequate support is of great importance. Aftercare should be arranged by the team responsible for the patient's care.

- **Although usually single lumen, Dual lumen devices are available.** These are equipped with two access ports side-by-side which can be accessed separately using two different needles. Each lumen provides independent access to the venous circulation, so that incompatible drugs/fluids may be administered simultaneously.

- Ports may also be used as **an alternative to subcutaneous administration** of long-term maintenance therapies when the subcutaneous route has become unacceptable to the patient or unreliable – e.g. due to subcutaneous nodule formation.

- **Ports are usually placed by the Interventional Radiology Team . Placement is not recommended** in obese or cachexic patients, before or after chest irradiation, or at mastectomy sites (17).

Diagram 6.Accessing an Implantable Port



A special **Huber or "non-coring" needle** is used to access the port. A separate competency and assessment is required before undertaking this procedure. If training is required please contact Caroline Whitton, Tel.31493 or Bleep 89151.

3.6 CVC's used for Blood Processing (e.g. Apheresis, Dialysis) *Often called Permacaths / Vascaths.*

- CVC's used for blood processing – e.g. apheresis - are very similar to the catheters described in 3.1 and 3.4 above. **They can be non-tunnelled (e.g. *Vascaths*) or tunnelled (e.g. *Permacaths*).**

- **These catheters differ from other CVCs in the following respects**:

- **They are Larger lumen size** compared to other CVC's.

- **The internal tip of the catheter is designed** to allow blood to be withdrawn freely via one lumen which sits higher in the vein, and returned via the other lumen further downstream .This avoids recycling of the treated blood. Confusingly, the lumens are often colour-coded red (blood access line) and blue (blood return lumen) and may be referred to as the "arterial" and "venous" lumens, although both lumens lead into a vein and not an artery.

Once flushed catheters are locked between uses with an exact volume of anti-coagulant to minimise the risk of occlusion. The exact volume varies and will be marked on the catheter lumen. The lock solution will vary depending on the patient's clinical status, and speciality, and in line with PHNT Injectable Drug Administration Policy.

- If heparin **is** used as a lock, the lumen must be clearly labelled and the heparin must be withdrawn from the catheter prior to use to avoid an unacceptably high bolus dose of heparin.

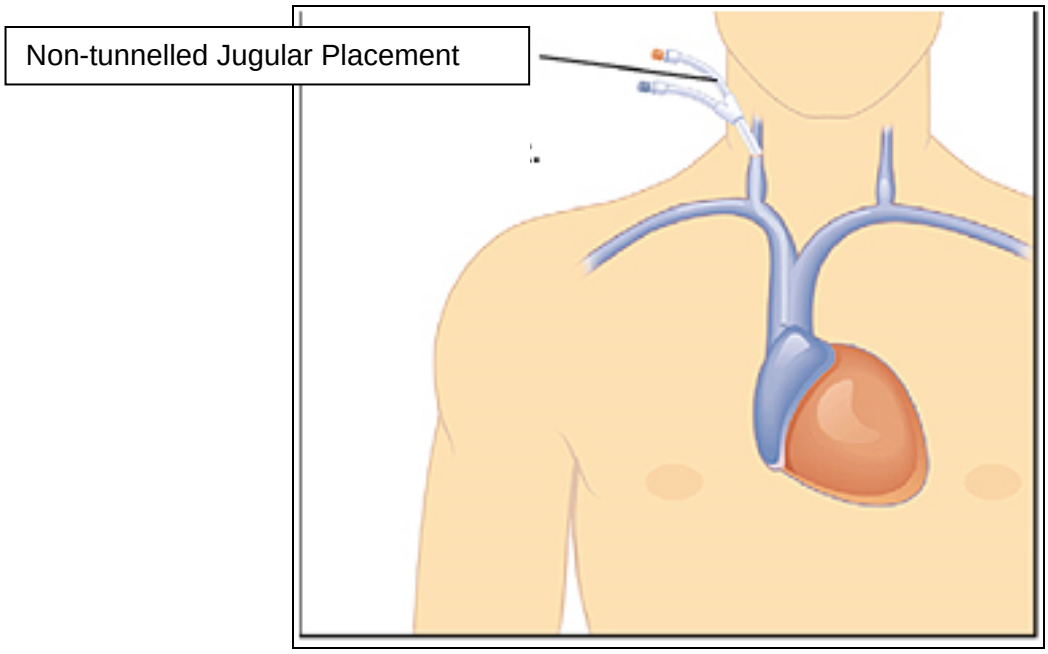


Diagram 7. Non-tunnelled Vascath

4 Principles of Care

(i) General Principles

- **Infection i**s the most common complication associated with central venous access devices and one of the most serious. You must be familiar with the latest Management of Central Venous Catheters Guidelines and apply these principles when caring for patients with CVCs.

- **Decontaminate hands** before and after each patient contact using correct Hand Hygiene Guidelines procedure.

- **Use an aseptic, non-touch technique (ANTT) following** Guidelines for Aseptic Technique whenever accessing a CVC and during any procedures related to central venous devices e.g whenever preparing drugs for administration, and during procedures involving exit site care or removal to *prevent infection. A strong correlation exists between bacteraemia and the presence of a CVC (24).*

- **Inspect for signs of infection**, ideally each shift (at least daily if patient is in hospital) including inspection of exit site and monitoring of temperature, pulse and blood pressure at least daily when the patient is in hospital. Assess and record CCAT score daily. *To detect infection*

- **Take action immediately** if there are signs of CVC-related infection. These include:
    - Pyrexia, rigor, malaise (see Managing Complications)
    - Tenderness, inflammation and or pain at exit site (see Managing Complications).

- **Wear gloves when carrying out dressing changes and when accessing the catheter**. Whether or not these should be sterile will depend on the task: always refer to PHNT ANTT Guidelines. *Gloves should be worn to prevent descaling of bacteria onto key part* (21) .

- **Consider** - BIOPATCH® can be used in addition to skin antisepsis and can deliver CHG over a seven day period to the skin around the CVAD insertion site, thus reducing the risk of microbial colonisation leading to catheter related bloodstream infections, whilst absorbing exudate and covering the wound.
  Whilst the introduction of BIOPATCH® would introduce an extra cost, the patient groups where BIOPATCH® may prove beneficial tend to be more vulnerable groups (by the nature of their requirement for a CVAD) such as those with a weak immune system, or a high risk CVAd such as femoral placement. Each avoidable healthcare associated infection is estimated to cost the NHS £5,000, the cost of over 1,000 BIOPATCH® dressings, and the cost of treating a bloodstream infection is likely to be higher as length of stay is much longer.
(Government Showcase Hospitals Technology Review Report)

- **The routine of administration of prophylactic antibiotics** at the time of CVC insertion is not recommended. (The exception is if the patient's MRSA status is unknown or positive, in which case follow current PHNT guidelines). *The Department of Health's Epic Guidelines on the prevention of infection in Central Venous Catheters (phase 2) specifically states that this practice is not supported by research and may encourage resistant organism (9).*

- **Do not allow air to enter the catheter**. The catheter should never be left open to air entry and all syringes and intravenous administration sets must be carefully primed to *prevent air embolism. The negative pressure within the chest may suck air into the catheter during inspiration especially if the patient is sitting up (22).*

- **Cap off the catheter with a needle-free access device** (e.g. *Clave* ®) when not in use This will minimise interruptions to the closed system. This should be changed every 7 days or every 100 uses, whichever is the sooner according to manufacturer's guideline. *Risk of contamination increases with every interruption to the closed system (22)*

- **When accessing the catheter through the needle-free device, always decontaminate the device using Chlorhexidine 2% in alcohol and using ANTT (see (ii) Accessing the Catheter below)**. The device should be cleaned each time using a 30-second vigorous friction rub and allowed to dry before inserting a sterile syringe-tip.

- **Whenever the bung/access device is removed** from the catheter then it must be replaced with a new, sterile device. *To prevent infection.* (National Patient safety Goals 2011).

- **If the catheter possesses an integral in-line clamp, keep it closed** whenever the cap is removed and at all other times except when administering or withdrawing fluids. Clamping should always take place at the designated area and never at the thickened area near the hub. *The clamp will prevent air entry and bleeding should the luer lock cap become unattached. Repeated clamping away from the specially reinforced area may result in damage to the catheter.*

- **Administration of prophylactic low-dose Warfarin** to patients with CVCs is not recommended *(23).*

- However certain patients with a high risk of venous thromboembolism may require prophylactic treatment , for example with LMW Heparin , see NICE Risk Assessment for VTE.

- **Should the catheter fracture or be accidentally cut**, clamp it atraumatically without delay proximal to the break. Specialist advice should be sought immediately to consider removal or repair of the catheter. *To prevent haemorrhage, air embolism and infection.*

- **Always secure the catheter firmly to the skin**. *For patient's comfort, to prevent tension or accidental dislodgement, and to reduce 'to and fro' motion which increases the risk of catheter related sepsis (27).*

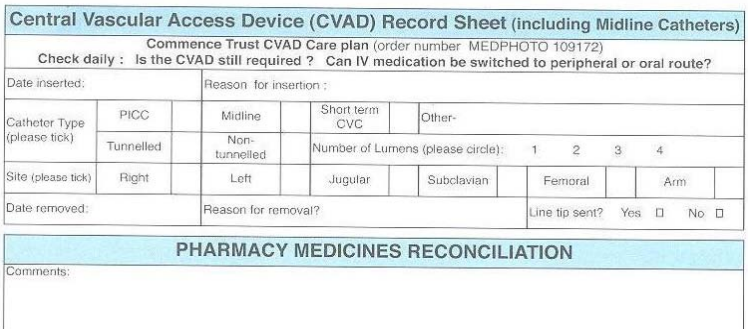
- **Central Venous Catheters** should be removed as soon as possible if they are not needed. Requirement for ongoing need should be reviewed daily if patient is in hospital.

- Practitioners are required to maintain contemporaneous records, which are unambiguous and legible and conform to both Trust Policy and that of their professional governing body e.g. NMC.

- Insertion documentation should include full details of the insertion procedure, including any complications, number of passes, confirmation of guidewire removal (as PHNT Standard Operating Procedure) , batch number and any special instructions. Documentation of acceptable line tip position, and exclusion of pneumothorax if appropriate, should be completed following x-ray review , prior to use .

- Midline catheters usually terminate in the auxiliary vein and do not need x-ray verification prior to use. A CVC placed using Fluoroscopy (Interventional Radiology) or via the femoral route will not normally require post insertion x-ray.

- The PHNT CVC careplan and the CVC section on the PHNT Drug Chart were developed to aid good documentation.



Central Vascular Access Device (CVAD) Record Sheet (including Midline Catheters)

Commence Trust CVAD Care plan (order number MEDPHOTO 109172)
Check daily : Is the CVAD still required ? Can IV medication be switched to peripheral or oral route?

Date inserted:		Reason for insertion :									
Catheter Type (please tick)	PICC		Midline		Short term CVC		Other-				
	Tunnelled		Non-tunnelled		Number of Lumens (please circle):		1	2	3	4	
Site (please tick)	Right		Left		Jugular		Subclavian		Femoral		Arm
Date removed:		Reason for removal?							Line tip sent?	Yes ☐	No ☐

PHARMACY MEDICINES RECONCILIATION

Comments:

Diagram 9. Page 19 of the PHNT Drug Chart: Central Vascular Access Device Record Sheet

Note that this section is not intended as a record of the line insertion, but rather to aid day to day management by allowing easy overview of catheter dwell time.
The PHNT CVC careplan should be completed at least daily. Daily evaluation should include –

- Assessment of insertion site and the area around the site
- Why line remains in situ
- Dressing changes
- Closed connector eg Clave, Bionnector change.
- That sutures or fixation device are intact, and no significant change in external length of catheter.
- Any other complications, changes to the line care of that patient, or interventions.

Clinical observations of patient with an indwelling catheter should be recorded and documented at least daily.

(ii) Accessing the Catheter

- **Decontaminate hub using Chlorhexidine 2% in alcohol (eg *Clinell* wipe) using a 30-second friction rub and allow to dry before accessing any lumen. Use an aseptic, non-touch technique (ANTT) following** Guidelines for Aseptic Technique whenever the CVC is accessed. *To prevent bacteria from entering the blood stream. A strong correlation exists between bacteraemia and the presence of a CVC (24).*

- **Before it is used for administering therapeutic drugs or fluids, the patency and correct functioning of the catheter should be established (25).** Signs of catheter occlusion, whether partial or complete, should be taken seriously and action should be taken earlier rather than later to restore full patency. Ignoring the early signs may lead to the development of more serious problems which cannot then be easily rectified – e.g. complete blockage (26). In addition unresolved patency problems may mask a malpositioned catheter which carries and increased risk of thrombosis.

- **When using a CVC you can be confident of access** if all three of the following apply

    - The catheter can be **flushed with ease**.
    - **Blood can be withdrawn** from the catheter (see below for technique)
    - The patient experiences **no discomfort** during flushing/infusion and there are no other complications

- **If any of these criteria are not met** see Managing Complications.

- **Ways of assessing these three criteria will vary with the setting**. Here are some points to note:

    - **A proper assessment of the catheter involves observing the exit site and the area around** as this may reveal any signs of thrombosis, leakage, infection etc. While this is not necessarily appropriate every time the catheter is used it should be a regular part of your practice.

    - **When checking for flashback of blood, do not discard blood unnecessarily. To assess for flashback you can either**
        - attach a syringe containing 10mls 0.9% saline (must be prescribed) to the catheter, flush a couple of mls into the line and then withdraw. As soon as you see a trace of blood in the catheter or syringe just flush the rest of the saline into the line using the push-pause technique as described below.
        - or use a gravity technique (i.e. with clamps open briefly hold an attached infusion below the level of the patient's heart until you see flashback of blood). NB this may not work for valved PICCs (eg PASV or Groshong).
        - BUT note that if there are infusional vasoactive drugs in the lumen, *always withdraw* prior to flushing to avoid bolus dose.

    - **For patients receiving parenteral nutrition (PN)**, testing for flashback via the PN lumen on a regular basis is not advised as it may increased the infection risk (30). Note that a full assessment of any central venous catheter is advised if there are doubts about patency or if malposition is suspected.

    - **Assessing a CVC in patients requiring blood processing (eg apheresis) requires specialist knowledge**: refer to Care of CVCs used for Blood Processing for care of these patients.

(iii) Flushing After and Between Uses

(a) Flushing Technique:

- **It is recommended that a syringe smaller than 10 mls** is not used for infusion into the catheter *(29,16). To prevent excessive pressure being exerted on the lumen which might cause it to rupture. Smaller syringes exert greater pressure. But please note that syringe size alone is not sufficient to prevent rupture. "When resistance is felt, if more pressure is applied to overcome it, catheter fracture could result regardless of the syringe size (26).*

- **Use a brisk 'push-pause' flushing technique** routinely when flushing the catheter - i.e. flush briskly, pausing briefly after approximately each ml of fluid. *The 'push-pause' technique causes turbulence within the catheter, which helps to flush away any debris and prevent occlusion of the lumen (13, 25)*

- **If the catheter possesses a clamp, clamp the line while the final ml of the flush is being injected**. If there is no clamp you can achieve a "positive pressure finish" by removing the syringe from the *Clave* (or similar) while injecting the last ml, being careful to avoid any spray from the syringe. *Maintaining positive pressure helps prevent blood entering the catheter after flushing, which might lead to occlusion or thrombus formation (25). Specially designed positive pressure needle free devices are available(.25)*

- **Do not routinely withdraw and discard blood from the catheter before flushing** in an attempt to avoid flushing bacteria and clots into the patient (*25*). *There is no evidence that withdrawing prior to flushing reduces infection or embolism.* Note **that if the catheter is to be used for administering drugs or fluids, checking for "flashback" should be a routine part of catheter assessment**: see ii) Accessing the Catheter (above).

- **For patients receiving parenteral nutrition (PN)**, testing for flashback via the PN lumen on a regular basis is not advised as it may increased the infection risk (12, 30). However a full assessment of any central venous catheter is advised if there are doubts about patency or if malposition is suspected.

(b) All Midlines and CVADs should be flushed with 0.9% saline for injection (Must be prescribed). Frequency of flushing and locking solutions may vary:

This varies depending on the device type. See care of individual catheter types, and PHNT PHNT Injectable Drug Administration Policy.

(iv) Care Of The Exit Site

a) Dressings: IV 3000 as Management of Central Venous Catheters -

- **Insertion site should be covered with the appropriate IV 3000** dressing (if no allergy) and should changed every 7 days, or sooner if the dressing becomes detached, loose or soiled (9).

- **Patients who cannot tolerate a transparent dressing:** use a sterile gauze and tape dressing (9) replaced **immediately if it becomes damp, loosened, or soiled, or when inspection of the insertion site is necessary (24-48hours) (34). .** *A moist environment is one in which bacteria readily multiply (35).*

- **No dressing**. This may be suitable for some patients with tunnelled CVCs from 21 days post insertion once the tissues have fibrosed around the cuff and in the absence of exudate or signs of infection when ***outside the hospital environment*** *(31,32,33).* The area should be covered if an in patient.

- **If the exit site is reddened, painful, exudating or infected**, take a swab and inform the patient's medical team with a view to investigate the need for antibiotics and / or removal of the device. Note that a tunnelled line or port may be tender post insertion, or in the very thin patient.

- Increase the frequency of dressing change depending on the amount of exudate.

b) **Dressings Immediately Post Insertion:**

- Exit sites may bleed immediately post insertion. In this case a gauze pad covered with an IV-3000 transparent may be used and replaced at 24-48hours..

c) Cleaning of Exit Site:

- **Cleaning should be carried out using ANTT**; see Management of Central Venous Catheters, Guidelines for Aseptic Technique

- **Clean exit site at dressing changes** with a sterile single-use *Chloraprep 3mls* and using a 30-second back and forth action. Allow to dry. (NB *Chloraprep*® can be used for patients aged 2 months and over.)

- **Loose blood, exudate or other debris** which might provide a focus or infection or might impair inspection of the wound may be gently removed with sterile gauze soaked with 0.9% saline* prior to cleaning with Chloraprep (36).

(v) Removal

Some CVCS are simple and relatively safe to remove. However this procedure should only be undertaken by staff assessed as competent to do so. With others, there is high risk of air embolism (37) and so removal requires a higher level of training and skill. See care guidelines for guidelines on removal.
Those most commonly removed by nurses include midlines, PICCs and non-tunnelled CVCs (25).

5. Complications of CVC's

(i) Pneumothorax

A pneumothorax is the presence of air in the pleural space between the lungs and the chest wall. It can occur during the insertion of a CVC when a needle used to access the subclavian or jugular veins inadvertently punctures the lung. The risk of pneumothorax is considerably reduced when ultrasound guidance is used to access the veins. Since most CVCs are inserted in this way,there is less likelihood of this complication, although a chest x-ray to screen for pneumothorax following insertion is routinely carried out. If the catheter has been inserted **without** fluoroscopy **a post-insertion chest x-ray will still be required** to check the line tip position. The exception is with short term femoral CVCs. Here there is no risk of pneumothorax and the tip position is not routinely checked.

If the catheter has been inserted **with fluoroscopy** to screen the tip position, **there will be no need for a post insertion chest x-ray**.

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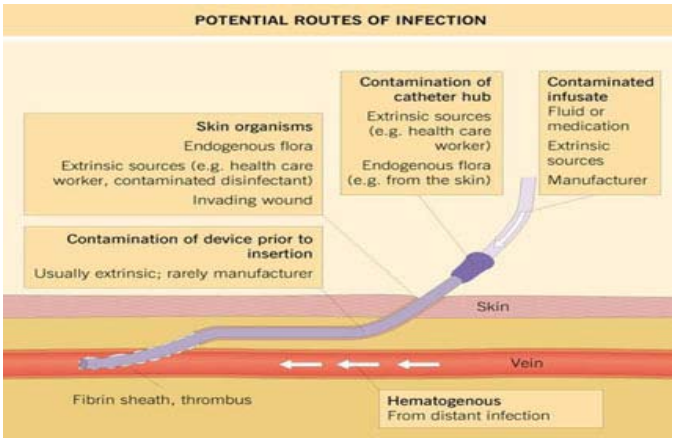
A pneumothorax may be clinically silent, or may lead to a life-threatening emergency situation with respiratory distress, reduced oxygen saturation levels, tachycardia or hypotension. A small pneumothorax may resolve spontaneously. In severe cases a chest drain may be necessary.

(ii) Infection – Central Line Associated Blood Stream Infection (CLABS)

Infection is the most common complication associated with central venous access (38), represents around 40% of blood stream infections (39), and is one of the most serious with an estimated mortality rates ranging from 1 – 35% (40)

There are four recognised routes for contamination of catheters (39)



- Migration of skin organisms at the insertion site into the cutaneous tract and along the catheter surface
- Direct contamination of the catheter or hub by contact with hands or contaminated fluids or devices
- Haematological seeding from another focus of infection (less common)
- Infusate contamination (rarely)

Diagram 8 Routes of Infection

Much effort has been put into reducing CVC infections across PHNT over recent years, including the implementation of a "**Central Venous Catheter Care Bundle**" based on the Department of Health Saving Lives HII Central venous Catheter Care Bundle and focusing on measures to reduce infection including skin preparation, use of standardised insertion packs, choice of catheters, securement techniques, exit site care, documentation and removal of CVCs as soon as they are no longer needed . While early infections are now relatively rare, any CLABSI is a cause for concern, and each occurrence requires investigation. For further information see the Infection Control page on the internal website Management of Central Venous Catheters.

Contamination can occur during insertion of the CVC or at a later stage via the hands of healthcare workers, or transferred from the patient's skin or other anatomical sites. Infection may be relatively minor or may be life-threatening.

Bacteria can colonise a CVC either on its exterior or interior surface: ie colonisation is either **extra**luminal or **intra**luminal. **Extra**luminal infections usually begin at the exit site and may remain confined to that area or may track along the catheter into the bloodstream. **Intralu**minal infections are caused by contamination via the hub of the catheter (42, 44).

If a catheter-related blood stream infection is suspected paired blood cultures should be obtained from peripheral site and catheter (44), which should be taken following Trust Guidelines. Consider and investigate any other likely sources.
A Microbiology opinion should usually be sought in deciding the best action to take in the event of signs of infection, along with the patient's lead clinician.

Short term CVC, PICC or arterial catheter; patient with a short term CVC with related bacteraemia or fungemia (44)

Uncomplicated - If *mildly* unwell consider antimicrobial therapy and await blood culture results. If no other source of infection is identified, remove catheter and replace at a new site if safe to do so.

Complicated - If *seriously* unwell (i.e. hypotensive, hypoperfusion) remove catheter and replace at a new site if safe to do so. Initiate antimicrobial therapy. Send line tip for culture.
Guidewire exchange, although not ideal, can be considered in patients with difficult vascular access.

Long term catheters – patient with a long term CVC or port with related bacteraemia or fungemia (44)

Uncomplicated- May retain catheter or port and attempt salvage under microbiology advice. If there is a clinical deteriation, persistent, or relapsing infection treat as complicated infection.

Complicated – tunnel infection (see below), port abscess, septic thrombosis, endocarditis, osteomyelitis –remove CVC or port as soon as it is safe to do so and treat according to microbiology advice.

Exit site infections can often be treated successfully with antibiotics, especially in PICCs, and in tunnelled CVC's (Hickman lines) where the vein and the exit site are separated by the tunnel. In non-tunnelled centrally inserted CVC's, however, treatment is less likely to be successful, as there is less distance between the exit site and the blood stream . Infections in tunnelled CVC's involving the skin tunnel *above* the cuff are notoriously difficult to treat and the same applies in implantable ports where there is infection of the port pocket.

The risk of infection can be reduced by strict adherence to the, Guidelines for Aseptic Technique and Hand Hygiene Guidelines and PHNT Management of Central Venous Catheters (including the Saving Lives High Impact Care Bundles for renal catheters (HII Renal Haemodialysis Catheter Care Bundle) and CVC's (HII Central venous Catheter Care Bundle).
Intravenous tubing and stopcocks should be changed according the PHNT Infection Control Guidelines.
If Parenteral Nutrition is to be given, one naïve lumen should be dedicated and used exclusively for this purpose.

(iii) Thrombosis

Thrombosis occurs when a clot develops within the vein around the catheter. Unless the clot is at the internal tip of the catheter, it will not usually affect the patency of the catheter. Thrombosis formation is a natural response to vascular injury. Damage to the vessel wall can occur during catheter insertion, or may be due to mechanical or chemical irritation in an incorrectly placed catheter e.g. where the tip of the catheter is in too small a vein, or rubbing against the vein wall instead of floating parallel to it.

The risk of thrombosis is increased in patients who are pregnant or immobile or who have diabetes or cancer. Surgery, chemotherapy, hormonal agents, haemodialysis and CVC-related infection are all thought to be risk factors (10, 25, 46, 47). The use of low dose Warfarin reduce the risk of thrombosis in Cancer patients is not recommended (22).
Patients who develop thrombosis are at increased risk of pulmonary embolism and infection (45).

A large proportion of cancer patients with CVCs have thromboses which are never detected (48, 49)
When a thrombosis does become symptomatic, it will usually cause swelling of the arm, neck, face or lower limb. There may be associated pain, tingling or numbness, distended neck or peripheral veins (50, 51). The presence of a thrombosis can usually be confirmed by use of Doppler ultrasound.

Clinically evident thrombosis is more common in cancer patients with PICC's than with tunnelled CVC's or implantable ports, probably because they occupy smaller veins which are more easily occluded.

Unless the catheter is incorrectly positioned, it may be possible/ preferable to treat a thrombosis using anticoagulants without removing the catheter.

(iv) Air Embolism

An air embolism is a potentially fatal complication. It can happen at any stage if air is allowed to enter the catheter – e.g. if a catheter is left unclamped when the cap is removed – but is most likely to occur during the insertion or removal of the catheter. The risk is increased if the patient is dehydrated, is unable to lie flat, or has an uncontrolled cough at the time of insertion or removal.

Signs and Symptoms:
As with pneumothorax, air embolism may be clinically silent or may be accompanied by any or all of the following:
Tachypnoea, cyanosis, dyspnoea,
Chest Pain, tachycardia, hypotension
'Mill Wheel' heart sounds on auscultation over heart
Anxiety, loss of consciousness and death

Prevention:
Ensure all IV lines are primed before attaching to the patient
Remove short term CVAD's using the correct technique (refer to procedure for removal of short term CVC'S)
Ensure clamps are closed on lines

Treatment:
Call for urgent assistance
Administer 100% Oxygen
Lie on left side head tilting downwards (Trendelenburg position)
Document in patient records and incident form to be completed

(v) Cardiac Arrhythmias

Atrial or ventricular arrhythmias can occur when the tip of the CVC is placed within the heart (52, 53). In practice, non-tunnelled and tunnelled CVC tips correctly placed in the right atrium rarely cause arrhythmias. PICCs are probably most likely to cause problems because the PICCs are more floppy and more likely to move within the vein than other CVCs. They can also move further into the heart as the patient moves his / her arm. Arrhythmias caused in this way will usually resolve when the catheter is pulled back by a few centimetres. Any patient experiencing unresolved palpitations or arrhythmias should be assessed by a medical team as soon as possible.

(vi) Cardiac Tamponade

This is a rare complication of CVCs, seen mainly in neonates. Cardiac tamponade arises when fluid (in this case blood) accumulates in the pericardial space around the heart and impairs cardiac function. This is a catastrophic, often fatal event. The patient is likely to exhibit a sudden onset of severe cardio-respiratory symptoms.

Cardiac tamponade can arise in a patient with a CVC if the heart is punctured either during insertion or subsequently by a malpositioned catheter.

(vii) Patency Impairment

Patency is said to be impaired in any of the following situations:

- The catheter is completely blocked and cannot be flushed at all.
- The catheter can be flushed using a syringe but there is sluggish, absent or intermittent free-flow when infusion of fluids by gravity is attempted.
- The catheter flushes easily but aspiration of blood is sluggish or absent.

Patency problems should be taken seriously. Ignoring the early signs may lead to the development of more serious problems which cannot then be easily rectified – e.g. complete blockage or thrombosis (54) . See Guideline for unblocking a PICC, and Guideline for unblocking a Midline for help with these lines. The same principle can be applied to similar central vascular access devices, for example tunnelled lines. Guideline for management of port patency problems is available. (link will be added soon).

The causes of patency problems include-

Clotted blood within the catheter: This can be avoided by good flushing techniques. When problems do arise, they can usually be solved relatively easily by use of a thrombolytic such as Urokinase: see Maintaining Patency.
Catheter blockage is caused by thrombus or precipitation in the lumen. Both these problems are avoided by careful flushing with the appropriate substance and technique, see Administration of medication through a CVC.

Fibrin Sheath: Fibrin sheaths are thought to occur in most CVCs left in place for over 7 days (55). A fibrin sheath is a kind of sleeve made of a fibrous collagen substance which can form around the catheter within the blood stream. It may extend to form a kind of “sock” protruding beyond the tip of the catheter, and if this happens it may impair the patency of the catheter: most commonly it will prevent blood from being withdrawn from the catheter because the fibrin sheath is sucked against the tip of the catheter. In severe cases a fibrin sheath may also lead to backtracking of infused fluids between the fibrin sheath and the catheter, causing leakage of those fluids into the tissue (56). Fibrin sheaths may be diagnosed using fluoroscopy and are associated with an increased risk of infection (57) as they provide an ideal medium for the proliferation of bacteria. They can sometimes be removed by stripping under imaging or by an infusion of a thrombolytic.

Mechanical obstruction: A mechanical obstruction can occur internally or externally. Internal obstruction may be due the catheter being incorrectly positioned: e.g. it may be kinked or the tip of the catheter may be resting against a vessel wall rather than floating free within the bloodstream (see Incorrect Position below). This might be due to poor insertion technique, or due to catheter dislodgement. A simple chest x-ray will often reveal an incorrectly positioned catheter. External kinking of the catheter can also cause patency problems: its’ worth checking for a bra-strap or an over-tight stitch before looking for a more complicated cause!

Build up of lipids from parenteral nutrition or drug precipitation within the catheter caused by too high a concentration or incompatibility of drugs: If this appears to be a likely cause of occlusion, seek advice from the Nutrition Team/Pharmacy regarding a suitable agent to dissolve occlusion.

(viii) Incorrect Position

A CVC should be considered to be in an incorrect position when any of the following apply:

- The tip is not in the right atrium, the superior or the inferior vena cava.
- The tip of the catheter is not floating freely parallel to the vein wall.
- The catheter is kinked within the body or pinched between internal structures

Incorrect position may occur at insertion or may occur spontaneously in a previously well-positioned catheter. It is not unknown for a CVC to "migrate" within the venous system for no apparent reason. Hadaway reports that "Changes in intrathoracic pressure, coughing, sneezing, Valsalva manoeuvre such as during heavy lifting, vigorous extremity use, forceful flushing, or congestive heart failure could lead to migration of the tip (54). In addition the catheter may become dislodged if it is not correctly secured in place, or is accidentally pulled.

If a CVC is incorrectly positioned there is a high risk of thrombosis and patency impairment (58). If it is kinked internally there is also the risk that the catheter may split, leading to extravasation of drugs / fluids and in serious cases, embolisation of the catheter itself.

You should suspect incorrect position if there are patency problems despite the use of a thrombolytic, if the patient complains of pain on flushing, if the external length of the catheter increases, if the patient develops a thrombosis, or if the cuff of a tunnelled CVC protrudes from the exit site (59).

A malpositioned, kinked or pinched catheter should be repositioned, replaced or removed as soon as practicable (except PICCs in certain situations discussed below). Leaving it in place for any length of time represents a high risk of thrombosis and/or catheter fracture and potential embolism.

Immediately following insertion, PICCs are sometimes found on X-ray to have fed up into the jugular vein, across into the opposite subclavian, or back down an arm vein. In these cases it may be worth leaving the PICC in overnight or flushing briskly with 20ml 0.9% saline* and then repeating the X-ray as the PICC will often move into the Superior Vena Cava (60, 61). Discuss with the person inserting the PICC and patient's medical team.

(ix) Extravasation of Fluids / Drugs due to Incorrect Needle Position or Needle Dislodgement (in Implantable Ports)

The non-coring needle should be correctly placed into the port (see Diagram 6). If the needle is not inserted far enough into the port or if the needle misses the port altogether this may lead to fluids or drugs being infused into the subcutaneous tissues.

The needle may become dislodged if it is inadequately secured with dressing tape, if there is tension on the extension tubing or if the needle used is of insufficient length, causing the patient's normal movements to loosen the needle. The problem will usually be noticed when there is discomfort and/or oedema at the entry site combined with lack of free-flow of fluids.

If extravasation has occurred or is suspected, the needle should be removed and a fresh needle used to access the port correctly. If vesicant or irritant solutions (e.g. chemotherapy) are extravasated, seek medical / pharmacy advice and refer to the PHNT Cytotoxic Policy and (PHNT Injectable Drug Administration Policy.

(x) Catheter Fracture

This may occur **externally** or **internally** and may result from over-forceful flushing, trauma to the catheter or incorrect position (e.g. kinking leading to wear-and-tear or use of scissors at dressing changes).

An **externa**l fracture will result in leakage of blood or fluids from the catheter. Sometimes there is an obvious fracture. The line must be clamped or folded over on itself immediately and secured to prevent air embolism and haemorrhage. Sometimes the catheter can be repaired or replaced over a guidewire but the advisability of this will depend on the patient's clinical status. However, unless the correct equipment and expertise are available for a repair to be carried out, the catheter should be removed immediately, as there is a high risk of infection and air embolism.

Internal fracture will usually result in patency impairment and / or pain, redness and swelling when the catheter is flushed. There is a risk that the catheter will split completely and embolise. If this occurs there may be no symptoms at all or there may be signs of pulmonary embolism, ie acute onset of any or all of the following - anxiety, pallor, cyanosis, shortness of breath, rapid weak pulse, hypotension, chest pain, loss of consciousness. Seek urgent medical assistance.

(xi) Separation of port and catheter (in Implantable Ports)

This is rare (62) but should always be considered when problems arise with patency of the port or there is extravasation with associated discomfort and oedema despite proper position of needle.

As with catheter fracture (see (x) above) there is a risk that the catheter may embolise. Seek medical advice. Surgical removal or repair of the port and catheter is essential if separation is confirmed.

• Education of Health Care Personnel, Patients & Carers

To improve patient outcomes in relation to reduction of infection risk, education of those involved in caring for the line is essential. Health care personnel, patients and their carer's need to be confident and proficient in both infection prevention practices and be aware of the signs and symptoms of infection if they arise (Pratt et al 2007). An awareness of potential line complications and how to seek advice, if suspected, should also be established.

3.2.1 Staff Competency and Training

Staff involved in the insertion, care and maintenance of central vascular access devices must be able to demonstrate their competency in these skills (Centre for Disease Control (Guidelines for the Prevention of Intravascular Catheter-Related Infections (2011) , Saving Lives HII Central venous Catheter Care Bundle .

1. All health care professionals involved in caring for a patient with a CVAD must undergo theoretical and practical training and be assessed as competent in using, and consistently adhering to current guidelines (25).
   The theoretical and practical component of this training will be provided as part of the Intravenous Drug Administration training. Practice assessment will be undertaken at ward

or department level by CVAD Assessors, who are available in all areas. It is the responsibility of the individual practitioner to seek assessment from the CVAD assessor. Once fully assessed, the individuals name should be returned to the Workforce Development Department to be added to their records.

2. All staff have a professional responsibility to maintain their knowledge and skills (64,65, 66).

3. Resources, including links to the competencies for CVAD assessment are available on the Trust Website.

3.2.2 Patient and Caregiver Education

1 Before discharge from hospital, patients and/or carers should be taught how to safely manage their central venous catheter (CVAD) and be provided with written guidance to support this.

4. There should be clear local guidelines relating to the education and ability of patients and carers accessing and flushing their lines.

5. Ongoing support should be available to patients with CVAD's and their carer's.

6. Each local area should provide information for patients and carers on how to access support both during and outside normal working hours e.g. access to their speciality ward.

7. The Lead Medical Team caring for the patient has ultimate responsibility for decisions

8. regarding the their care.

CARE DOCUMENTS
Care of Non-Tunnelled CVCs

Infection Prevention & Management — Non-Tunnelled CVCs

- **Infection i**s the most common complication associated with CVCs and one of the most serious.
- You must be familiar with the latest Guidelines for Aseptic Technique and Guidelines for the Management of Central Venous Catheters , when caring for patients with CVC's.
- **Decontaminate hands** before and after each patient contact using correct Hand Hygiene Guidelines procedure.
- **Always use ANTT** when accessing the CVC.
- **Regularly inspect for signs of infection** (at least daily if patient is in hospital)
- **Take action immediately** if there are signs of CVC-related infection. These include:
    - Pyrexia, rigor, malaise (see Managing Complications)
    - Tenderness, inflammation and or pain at exit site (see Managing Complications)
- **Central Venous Catheters** should be removed as soon as possible if they are not needed.

Assessing Patency — Non-Tunnelled CVCs

NB Always use ANTT when accessing the CVC

- **Do not administer chemotherapy, drugs or fluids unless the line is fully patent. F*ully patent* means that:**
    - The line can be flushed easily
    - There is flashback of blood
- **If the catheter is not fully patent see Maintaining Patency.**
- **Testing for patency:**
    - Test for flashback of blood before administering IV medication but note that you should not discard blood unnecessarily. To assess for flashback you can either:
        - attach a syringe containing 10mls 0.9% saline* to the catheter, flush a couple of mls into the line and then withdraw. As soon as you see a trace of blood in the catheter or syringe just flush the rest of the saline* into the line.
        - or use a gravity technique (ie with all clamps open briefly hold an attached infusion below the level of the patient's heart until you see flashback of blood).
    - BUT NB: if there are infusional vasoactive or anaesthetic drugs in the lumen, withdraw prior to flushing to avoid bolus dose.

Flushing — Non-Tunnelled CVCs

NB Always use ANTT when accessing the CVC

- **Before flushing**
    - If there are infusional vasoactive or anaesthetic drugs in lumen, withdraw prior to flushing to avoid bolus dose.
- **Technique:**
    - Brisk push-pause flush technique to clear the lumen. Give the final 2mls slowly and clamping as the final ml is given , to prevent catheter occlusion.
- **What to flush with:**
    - 10 mls (minimum) 0.9% saline* between incompatible drugs / infusions and after blood sampling
    - Lock with a further 10mls 0.9% saline*
- **Frequency of flushing:**
    - Flush **unused** lumens at least once a week (2 x 10mls 0.9% saline*) ***must be prescribed**

Exit Site Care — Non-Tunnelled CVCs

NB Always use ANTT for exit site care

- **Securement**:
  - Always check that catheter is secure. Fix catheter firmly to patient's skin with *Griplok* dressing. If sutured, check these are intact.
- **Cleaning**:
  - Clean exit site at dressing changes with *Chloraprep 3mls*® using a 30-second back and forth rub. Allow to dry.
  - NB If there is loose blood or exudate present, this should be removed first using sterile gauze and 0.9% sterile saline.

Dressings: see IV 3000

- If *Griplok* dressing used, change this plus the *IV 3000* dressing .Change every 7 days (or sooner if dressing becomes wet, or soiled or loose or detached).
- If patient cannot tolerate *IV 3000,* try a plain transparent dressing *or gauze* Change every 7 days (or sooner if dressing becomes wet, soiled or detached).
- Consider adding *Biopatch*® under IV3000 in patients at high risk of infection, i.e. femoral lines.
- If patient cannot tolerate a transparent dressing at all, use gauze-type dressing (eg *Mepore*®). Inspect and change daily if patient at high risk of exit site infection. (Change sooner if dressing becomes wet, soiled or detached).

- **Bathing & showering**
  - The exit site must not be allowed to get wet.

Removal — Non-Tunnelled CVCs

- **Central Venous Catheters** should be removed as soon as possible if they are not needed.
- **Who can remove non-tunnelled CVCs?**
- Any qualified nurse who is IV trained and has been assessed as competent in CVAD management and who follows these guidelines (see Competencies link)

- **Procedure**:
  - **You will need assistance** during this procedure: do not attempt it alone.
  - **Check patient's coagulation status**. If there is an increased risk of bleeding discuss with medical team before proceeding. If platelets are < 50, platelets should be prescribed and administered immediately prior to the procedure. If the patient is anticoagulated, this should be managed as for surgery.
  - **The risk of air embolism increases if patient is dehydrated, is unable to lie flat, or has an uncontrolled cough**. Assess for these risks. Only proceed if satisfied that it is safe to do so.
  - **Use ANTT** throughout.
  - **Stop all infusions and ensure that all lumens are capped off and clamped.**
  - **Unless contraindicated (eg head injury or respiratory difficulties), lie the patient flat and tip the head of the bed downward** to reduce the risk of air embolism (except femoral catheters).
  - **Remove the dressing**. If there is any sign of infection, take a swab of the exit site.
  - **Remove *GripLok or sutures and* dressing**.
  - **Clean the area with** *Chloraprep 3mls*® using a 30-second back and forth rub. Allow to dry.
  - **Ask patient to perform Valsalva manoeuvre** (i.e. take a deep breath, hold it, and bear down). If patient unable to do this, remove the catheter during expiration and NEVER when the patient is breathing in, as this will increase the risk of air being sucked into the venous system.
  - **Gently and swiftly pull out the catheter** and immediately apply pressure to the site using sterile

gauze. The patient they can now breathe normally and the bed can be returned to the flat position.

- **Continue applying pressure to the exit site for three minutes** (or longer in cases of deranged clotting) until bleeding has stopped.
- **If systemic infection is suspected**, use sterile scissors to cut off the tip of the catheter and without contaminating it drop it into a dry sterile specimen pot. Send it to microbiology for culture.
- **Apply sterile gauze covered with an occlusive dressing** to prevent air from entering the venous system.
- **Advise the patient to stay in bed for 30 minutes to allow any bleeding to stop**. **During this time observe patient** for signs of haematoma (i.e., swelling, pain, altered voice, airway obstruction).
- **The exit site should remain covered with an occlusive dressing for 72 hours following catheter removal due to the risk of late air embolism.**

Care of Tunnelled CVCs (Hickman Lines)

Infection Prevention & Management — Tunnelled CVCs

- Infection is the most common complication associated with CVCs and one of the most serious.
- You must be familiar with the latest Guidelines for Aseptic Technique and Guidelines for the Management of Central Venous Catheters ,when caring for patients with CVCs.
- Decontaminate hands before and after each patient contact using correct Hand Hygiene Guidelines procedure.
- Always use ANTT when accessing the CVC.
- **Regularly inspect for signs of infection** (at least daily if patient is in hospital)
- Take action immediately if there are signs of CVC-related infection. These include:
    - Pyrexia, rigor, malaise (see Managing Complications)
    - Tenderness, inflammation and or pain at exit site (see Managing Complications)
- **Tunnelled lines** should be removed as soon as possible if they are not needed.

Assessing Patency — Tunnelled CVCs

NB Always use ANTT when accessing the CVC

- **Do not administer chemotherapy, drugs or fluids unless the line is fully patent. By *fully patent* we mean that:**
    - The line can be flushed easily
    - There is flashback of blood
- **If the catheter is not fully patent see Maintaining Patency** but note that community nurses administering a weekly flush to an unused lumen are not routinely required to check for flashback.
- **Testing for patency:**
    - Test for flashback of blood before administering IV medication but note that you should not discard blood unnecessarily. To assess for flashback you can either:
        - attach a syringe containing 10mls 0.9% saline* to the catheter, flush a couple of mls into the line and then withdraw. As soon as you see a trace of blood in the catheter or syringe just flush the rest of the saline* into the line.
        - or use a gravity technique (ie with all clamps open briefly hold an attached infusion below the level of the patient's heart until you see flashback of blood). NB this may not work for valved PICCs (e.g. *PASV*® or *Groshong*®).
    - BUT note that if there are infusional vasoactive or anaesthetic drugs in the lumen, withdraw prior to flushing to avoid bolus dose.

Flushing — Tunnelled CVCs

NB Always use ANTT when accessing the CVC

- **Before flushing**
    - If there are infusional or vasoactive or anaesthetic drugs in the lumen, withdraw prior to flushing to avoid bolus dose.
- **Technique:**
    - Brisk push-pause flush technique to clear the lumen. Give the final 2mls slowly and clamping as the final ml is given , to prevent catheter occlusion.
- **What to flush with:**
    - 10 mls 0.9% saline* between incompatible drugs / infusions and after blood sampling
    - Lock with a further 10mls 0.9% saline*.
- **Frequency of flushing:** Flush unused lumens once or twice a week (2 x 10mls 0.9% saline*).

*must be prescribed

Exit Site Care — Tunnelled CVCs

NB Always use ANTT for exit site care.

- **Securement**:
  - In addition to the exit site dressing, always fix catheter firmly to patient's skin (eg using tape or dedicated device e.g. S*kinfix.*)
- **Sutures**:
  - **Exit site**: remove at 21 days
  - **Venepuncture site**: Remove stitches / Steri-strips at 7 days (unless dissolvable) (see CVC careplan)
- **Cleaning**:
  - Clean exit site at dressing changes using *Chloraprep® 3mls* using a 30-second back and forth rub. Allow to dry
  - NB If there is loose blood or exudate present, this should be removed first using sterile gauze and 0.9% sterile saline.

- **Dressings**:
  - **Exit site**:
    - **Post-insertion**: gauze under transparent dressing for 1 day or until bleeding stops.
    - **After 1 day:**
      - Apply *IV 3000* dressing. Change every 7 days (or sooner if dressing becomes wet, soiled or detached).
      - If patient cannot tolerate *IV 3000* try a plain transparent dressing. Change every 7 days (or sooner if dressing becomes wet, soiled or detached).
      - Consider adding *Biopatch®* under IV3000 in patients at high risk of infection.
      - If patient cannot tolerate a transparent dressing at all, use gauze-type dressing - eg *Mepore®* . Change every 7 days or more frequently if at high risk of exit site infection. (Change sooner if dressing becomes wet, soiled or detached).
    - **After 21 days**: choose between
      - Continuing with same dressing OR no dressing if appropriate for patient (i.e. is an out-patient)
  - **Venepuncture site**:
    - Dry dressing and/or transparent dressing until sutures removed / dissolve.
- **Bathing, showering & swimming**
  - **Bathing**: Patient should not submerge exit site in bathwater.
  - **Showering**: If transparent dressing is intact patient can shower. If patient has dry dressing or no dressing, s/he can shower after 21 days as follows:
    - Remove dry dressing (if any) immediately before or after showering
    - Dry exit site after shower using sterile gauze and non-touch technique.
    - Clean exit site as usual & apply new dressing (if any).
  - **Swimming**: Not generally advised because of the infection risk but if patient wishes to swim after 21 days it may be considered depending on other patient risk factors.

Patient Education and Discharge Planning — Tunnelled CVCs

- **If a patient is discharged with a catheter in situ written** information for patients and carers on complications ,and how to access support both during and outside normal working hours e.g. access to their speciality ward **should be provided.** Any arrangements for ongoing care should be made by the discharging team. **If the patient is to be discharged home with the catheter in situ arrangements must be made for** catheter flushing and dressing changes when not in use**. The patient will remain under the Lead Consultant in charge of their care.**
- **This may be done as an outpatient or by the District Nursing Team. This must be arranged by the Team responsible for the patient's care**
    - **Ensure patient is aware of the care** required
    - **Ensure patient is aware of the importance of reporting complications** and has a contact number for this purpose
-

Removal — Tunnelled CVCs

- **Tunnelled CVCs** should be removed as soon as possible if they are not needed.
- Removal of a tunnelled line is a specialised procedure.
- **Do not remove tunnelled CVCs unless you have been specifically trained to do so**. Contact Vascular Access Team if advice required.

Care of PICCs

Infection Prevention & Management — PICCs

- **Infection i**s the most common complication associated with CVCs and one of the most serious.
- You must be familiar with the latest Guidelines for Aseptic Technique and Guidelines for the Management of Central Venous Catheters ,when caring for patients with CVCs.
- Decontaminate hands before and after each patient contact as Hand Hygiene Guidelines.
- Always use ANTT when accessing the CVC.
- **Regularly inspect for signs of infection** (at least daily if patient is in hospital)
- Take action immediately if there are signs of CVC-related infection. These include:
  - Pyrexia, rigor, malaise (see Managing Complications)
  - Tenderness, inflammation and or pain at exit site (see Chapter Managing Complications)
- **PICCs** should be removed as soon as possible if they are not needed.

General Points — PICCs

- **Assess external length of PICC before use**: the external length should be recorded on the Trust Careplan. If it has increased since insertion see Managing Complications. See PICC Care Sheet ;How to Measure a PICC on VAT web page.(to be added).
- **Take care at all times not to pull PICC out**. Remember there's nothing to keep the PICC in apart from the dressing and GripLok.
- **Avoid compression to vein containing the PICC**. Do not use blood pressure cuff. Any bandage / tubular dressing must be loose.
- **Use volumetric pump with a filtered giving set when infusing blood products** to avoid blockage.
- **Never use PICC for administering contrast medium** as this will cause the PICC to split (unless the patient has a CT-Rated PICC).
- **Always pump non-bolus drugs and infusions, to prevent catheter occlusion.**
- **Disconnect and flush line promptly on completion of treatment** to avoid blockage

Assessing Patency — PICCs

NB Always use ANTT when accessing the CVC

- **Do not administer chemotherapy, drugs or fluids unless the line is fully patent. By *fully patent* we mean that:**
  - The line can be flushed easily
  - There is flashback of blood
- **If the PICC is not fully patent see Maintaining Patency** but note that community nurses administering a weekly flush (valved PASV PICC) or twice weekly (Non-valved PICC) to an unused lumen are not routinely required to check for flashback.
- **Testing for patency:**
  - Test for flashback of blood before administering IV medication but note that you should not discard blood unnecessarily. To assess for flashback you can either:
    - attach a syringe containing 10mls 0.9% saline* to the catheter, flush a couple of mls into the line and then withdraw. As soon as you see a trace of blood in the catheter or syringe just flush the rest of the saline* into the line.
    - or use a gravity technique (ie with all clamps open briefly hold an attached infusion below the level of the patient's heart until you see flashback of blood). NB this may not work for valved PICCs (eg *PASV*® or *Groshong*®).
  - BUT if there are infusional vasoactive drugs in the lumen, withdraw prior to flushing to avoid bolus dose.

Flushing — PICCs

NB Always use ANTT when accessing the PICC

- **Before flushing**
  - If there are infusional vasoactive or anaesthetic drugs in the lumen, withdraw prior to flushing to avoid bolus dose.
- **Technique:**
  - Brisk push-pause flush technique to clear the lumen. Give the final 2mls slowly and clamping as the final ml is given , to prevent catheter occlusion.
- **What to flush with:**
  - 10 mls 0.9% saline* between incompatible drugs / infusions and after blood sampling
  - Lock with a further 10mls 0.9% saline*.
  - drugs / infusions or after blood sampling
  - Lock with a further 10mls 0.9% saline*
- **Frequency of flushing**:
  - Flush unused lumens at least once a week (2 x 10mls 0.9% saline*). Increase to twice weekly if there are patency problems. Usual regime is weekly flush (valved PASV PICC) or twice weekly for Non-valved (e.g. Vygon) PICC.

Exit Site Care — PICCs

NB Always use ANTT for exit site care

- **Refer to PICC Dressing Change on the PHNT web site** for detailed guidelines on PICC exit site care.
- **Securement**:

Always fix catheter firmly to patient's skin using steri-strips, Grip-Lok and a transparent dressing (IV 3000)

- **Cleaning:**
  - Clean exit site at dressing changes with *Chloraprep 3ml applicator* using a 30-second back and forth rub. Allow to dry.
  - There is no need to clean the actual PICC itself. This is unnecessary and risks dislodging the PICC.
  - NB If there is loose blood or exudate present, this should be removed first using sterile gauze and 0.9% sterile saline.
- **Dressings:**
  - **Post-insertion**: gauze, steristrips and *GripLok* dressing under a transparent dressing for 1 day (may be longer for outpatients).
  - **After 1 day**:
    - GripLok dressing steristrips and plus *IV 3000* dressing. Change every 7 days (or sooner if dressing becomes wet, soiled loose or detached).
    - If patient cannot tolerate *IV 3000*, try a *Mepore*® or gauze and tape dressing. Change every 24-48 hours (or sooner if dressing becomes wet, soiled or detached). Date dressing.

*must be prescribed

- **Bathing, showering & swimming**:
  - **Bathing & Showering**: Patient should not get the dressing wet. If possible provide a waterproof covering for bathing and showering e.g. cling film or plastic bag with bottom cut out and taped in position.
  - **Out patients may be recommended to purchase a** *Limbo*® or *Bathguard*™ protector.
  - **Swimming**: not advised unless using completely waterproof cover can be applied (see above)

*must be prescribed

Patient Education & Discharge Planning — PICCs

- **If a patient is discharged with a catheter in situ written** information for patients and carers on complications, and how to access support both during and outside normal working hours e.g. access to their speciality ward **should be provided.** Any arrangements for ongoing care should be made by the discharging team. A**rrangements must be made for** catheter flushing and dressing changes when not in use**. The patient will remain under the Lead Consultant in charge of their care**
- **Line maintenance may be done as an outpatient or by the District Nursing Team. This must be arranged by the Team responsible for the patient's care**
    - **Ensure patient is aware of the care** required
    - **Ensure patient is aware of the importance of reporting complications** and has a contact number for this purpose
- **Refer to the Vascular Access Team web page for latest resources on care of PICCs.**

Removal — PICCs

- **PICCs** should be removed as soon as possible if they are not needed.
- **Who can remove PICCs?**
- Any qualified nurse who is IV trained and has been assessed as competent in CVAD care and who follows these guidelines (see Competencies link)
- **Procedure**:
    - **Always use ANTT when removing a PICC**
    - **Patient should be sitting/lying** with the PICC exit site below the level of the heart (this will help prevent air embolism)
    - **Stop all infusions and ensure that all lumens are capped off and clamped.**
    - **Remove the dressing** & any stitches. (Take swab if signs of infection)
    - **Clean site with Chloraprep, allow to dry.**
    - **Pull PICC out slowly and gently** an inch or two at a time. As each inch goes by, change the position of your hand so that your fingers are close to the exit site. This will reduce the likelihood of the catheter breaking.
    - **If you meet resistance, STOP**. Resistance may be due to venospasm or thrombus. If this happens, apply warm packs to the patient's arm for about 5 minutes before resuming. If there is still resistance, call the central venous access team for advice.
    - **Once PICC is out, apply pressure to exit site** with sterile gauze for 3 minutes.
    - **If systemic infection is suspected**, use sterile scissors to cut off the tip of the catheter and without contaminating it drop it into a dry sterile specimen pot. Send it to microbiology for culture.
    - **Apply sterile occlusive dressing** to prevent air from entering the venous system.
    - **Keep wound dry and covered by an occlusive dressing for 72 hours.**

Care of Midlines

Infection Prevention & Management — Midlines

- **Infection i**s the most common complication associated with CVCs and one of the most serious.
- You must be familiar with the latest Guidelines for Aseptic Technique and Guidelines for the Management of Central Venous Catheters ,when caring for patients with CVCs.
- Decontaminate hands before and after each patient contact as Hand Hygiene Guidelines.
- Always use ANTT when accessing the Midline.
- **Regularly inspect for signs of infection** (at least daily if patient is in hospital)
- Take action immediately if there are signs of catheter-related infection. These include:
  - Pyrexia, rigor, malaise (see Managing Complications)
  - Tenderness, inflammation and or pain at exit site (see Chapter 6 Managing Complications)
- **Midlines** should be removed as soon as possible if they are not needed.

General Points — Midlines

- **Midlines are suitable for most drugs that can be given via a peripheral cannula. If in doubt check .**
- **The dwell time of Midlines vary. The Vygon Leadercath is recommended for up to 28 days. The** Vygon Lifecath can stay in situ for duration of therapy, unless complications arise.
- **Assess external length of Midline before use**: the external length should be recorded on the Trust Careplan. If it has increased since insertion see Managing Complications. See How to Measure a Midline on VAT web page.(to be added shortly)
- **Take care at all times not to pull Midline out**. Remember there's nothing to keep the catheter in apart from the dressing and GripLok.
- **Avoid compression to vein containing the Midline**. Do not use blood pressure cuff. Any bandage / tubular dressing must be loose.
- **Use volumetric pump with a filtered giving set when infusing blood products** to avoid blockage.
- **Pump all non-bolus drugs**
- **Never use Midline for administering contrast medium** as this will cause the line to rupture.
- **Always pump non-bolus drugs and infusions.**
- **Disconnect and flush line promptly on completion of treatment** to avoid blockage

Assessing Patency — Midlines

NB Always use ANTT when accessing the Midline

- **Only administer drugs suitable for peripheral administration. Do not administer chemotherapy, drugs or fluids requiring central delivery. Do not administer drugs unless the line is fully patent. By *fully patent* we mean that:**
  - The line can be flushed easily
  - There is flashback of blood
- **If the Midline is not fully patent see Maintaining Patency** but note that community nurses administering a twice weekly flush to an unused lumen are not routinely required to check for flashback.
- **Testing for patency:**
  - Test for flashback of blood before administering IV medication but note that you should not discard blood unnecessarily. To assess for flashback you can either:
    - attach a syringe containing 10mls 0.9% saline* to the catheter, flush a couple of mls into the line and then withdraw. As soon as you see a trace of blood in the catheter or syringe just flush the rest of the saline* into the line.
    - or use a gravity technique (ie with all clamps open briefly hold an attached infusion below the level of

the patient's heart until you see flashback of blood).

Flushing — Midlines

NB Always use ANTT when accessing the Midline

- **Technique:**
  - Brisk push-pause flush technique to clear the lumen. Give the final 2mls slowly and clamping as the final ml is given , to prevent catheter occlusion.
- **What to flush with:**
  - *At least* 10 mls 0.9% saline* between incompatible drugs / infusions or after blood sampling
  - Lock with a further 10mls 0.9% saline*
- **Frequency of flushing**:
  - Flush unused lumens at least twice a week (2 x 10mls 0.9% saline*).

Exit Site Care — Midlines

NB Always use ANTT for exit site care

Refer to PICC Dressing Change on the PHNT web site (link) for detailed guidelines on Midline exit site care.

- **Securement**:
  - Always fix catheter firmly to patient's skin using steri-strips, *GripLok* and a transparent IV 3000 dressing.
  - **Cleaning:**
  - Clean exit site dressing changes with *Chloraprep 3ml applicator* using a 30-second back and forth rub. Allow to dry.
  - There is no need to clean the actual Midline itself. This is unnecessary and risks dislodging the line.
  - NB If there is loose blood or exudate present, this should be removed first using sterile gauze and 0.9% sterile saline.
- **Dressings:**
  - **Post-insertion**: gauze, steristrips and *GripLok* dressing under a transparent dressing for 1 day (may be longer for outpatients).
  - **After 1 day**:
    - GripLok dressing steri-strips and plus *IV 3000* dressing. Change every 7 days (or sooner if dressing becomes wet, soiled loose or detached).
    - If patient cannot tolerate *IV 3000*, try a *Mepore*® or gauze and tape dressing. Change every 24-48 hours (or sooner if dressing becomes wet, soiled or detached). .

*must be prescribed

- **Bathing, showering & swimming**:
  - **Bathing & Showering**: Patient should not get the dressing wet. If possible provide a waterproof covering for bathing and showering e.g. cling film or plastic bag with bottom cut out and taped in position.
  - **Out patients may be recommended to purchase a** *Limbo*® or *Bathguard*™ protector. (See Macmillan website)
  - **Swimming**: not advised unless using completely waterproof cover can be applied (see above)

*must be prescribed

Patient Education & Discharge Planning — Midlines

- **If a patient is discharged with a catheter in situ written** information for patients and carers on complications ,and how to access support both during and outside normal working hours e.g. access to their speciality ward **should be provided.** Any arrangements for ongoing care should be made by the discharging team. **If the patient is to be discharged home with the catheter in situ arrangements must be made for** catheter flushing and dressing changes when not in use**.**
- **This may be done as an outpatient or by the District Nursing Team. This must be arranged by the Team responsible for the patient's care. The patient will remain under the Lead Consultant in charge of their care.**
    - **Ensure patient is aware of the care** required
    - **Ensure patient is aware of the importance of reporting complications** and has a contact number for this purpose
- **Refer to the Vascular Access Team web page for latest resources on care of PICCs.**

Removal Midlines

- **Midlines** should be removed as soon as possible if they are not needed.
- **Who can remove Midlines?**
- Any qualified nurse who is IV trained and has been assessed as competent to do so and who follows these guidelines (see Competencies link)
-
- **Procedure**:
    - **Always use ANTT when removing a Midline**
    - **Patient should be sitting/lying** with the Midline exit site below the level of the heart (this will help prevent air embolism)
    - **Stop all infusions and ensure that all lumens are capped off and clamped.**
    - **Remove the dressing** & any stitches. (Take swab if signs of infection)
    - **Clean site with Chloraprep, allow to dry.**
    - **Pull Midline out slowly and gently** an inch or two at a time. As each inch goes by, change the position of your hand so that your fingers are close to the exit site. This will reduce the likelihood of the catheter breaking.
    - **If you meet resistance, STOP**. Resistance may be due to venospasm. If this happens, apply warm packs to the patient's arm for about 5 minutes before resuming. If there is still resistance, call medical team for advice.
    - **Once Midline is out, apply pressure to exit site** with sterile gauze for 3 minutes.
    - **If systemic infection is suspected**, use sterile scissors to cut off the tip of the catheter and without contaminating it drop it into a dry sterile specimen pot. Send it to microbiology for culture.
    - **Apply sterile occlusive dressing** over gauze to prevent air from entering the venous system.
    - **Keep wound dry for 1 to 2** days or until healed

Care of Implantable Ports (Portacaths)

Infection Prevention and Management — Ports

- **Infection i**s the most common complication associated with CVCs and one of the most serious.
- You must be familiar with the latest Guidelines for Aseptic Technique and Guidelines for the Management of Central Venous Catheters ,when caring for patients with CVCs, and have been assessed as competent in the management of CVCs .
- Decontaminate hands before and after each patient contact using correct Hand Hygiene Guidelines procedure.
- Always use ANTT and follow Guidelines for Aseptic Technique when accessing the CVC.
- **Regularly inspect for signs of infection** (at least daily if patient is in hospital)
- Take action immediately if there are signs of CVC-related infection. These include:
    - Pyrexia, rigor, malaise (see Managing Complications)
    - Tenderness, inflammation and or pain at exit site (see Managing Complications)

General Points — Ports

- **The insertion and removal of a needle into a Port requires a separate competency to be undertaken. Please contact Caroline Whitton, Cystic Fibrosis Clinical Nurse Specialist ,for advice or training.**
- **Only access port using a dedicated non-coring needle** with integral extension set with clamp / stopcock.
- **Following insertion of the port there may be oedema and tenderness around the site**. This may make accessing port painful and more difficult than usual. Ideally port should be accessed while patient is in Interventional Radiology if it is to be used immediately afterwards.
- **Use volumetric pump with a filtered giving set when infusing blood products** to avoid blockage
- **If patient undergoes MRI scan**, inform scanning personnel about the port.
- **If patient requires defibrillation** do not place paddles directly over the port.
- **The port should never be used for power-injection of contrast medium** as this may cause the catheter to split (unless the patient has a CT-Rated Port).

Inserting the Non-coring Needle — Ports

- **Which needle?**
    - **Style**: For infusions, a 90^{o} non-coring needle with extension set should be used. For boluses, blood-taking and flushing, a straight non-coring needle with extension set may be used instead if preferred.
    - **Gauge**: A 20 or 22-gauge needle will suffice for most uses including blood administration and withdrawal.
    - **Length**: Where a 90^{o} needle is used, the length will depend on the amount of subcutaneous tissue between the skin surface and the port. The external part of the needle should not exert pressure on the skin but equally it should not stand too proud. **Hint**: a 1" needle is suitable for most adult patients. Deeper or more superficial ports will require longer or shorter needles.
- **Technique:**
    - **Always use ANTT when accessing the port**
    - **Numb skin over the port** if required using topical anaesthetic (before skin prep) or subcutaneous Lignocaine 1% (after skin prep).
    - **Prepare skin over the port using** *Chloraprep 3mls*® and using a 30-second back and forth motion. Allow to dry. Do not touch the proposed needle insertion site again except with totally sterile gloves.
    - **Prime needle and/or giving set** with 0.9% saline*.
    - **Put on sterile gloves if you need to palpate the port** to ensure you are confident of its

position (otherwise you can wear non-sterile gloves).

- **Hold port firmly (e.g. with thumb and two fingers)** and stretch skin taut during insertion of the needle to prevent the port sliding out of the way of the needle, and to reduce the risk of the port becoming dislodged within the subcutaneous pocket.
- **Insert needle swiftly and firmly** until it is felt to contact the back of the port.
- **Verify correct position** by flushing with 10 mls 0.9% saline* and checking for aspiration of blood.
- **If there is any local discomfort and/ or oedema** in the tissues around or over the port this may indicate incorrect position of the needle. In this case needle should be removed (see below for technique) and a fresh attempt made. (You can use the same needle for up to 2 further attempts if it has not become contaminated or damaged.)
- **If the port flushes easily without any local discomfort/oedema but there is no flashback of blood**, this suggests that needle position is correct but that the catheter itself is not fully functional. See Maintaining Patency.

Assessing Patency — Ports

NB Always use ANTT when accessing the port

- **Do not administer chemotherapy, drugs or fluids unless the line is fully patent. By *fully patent* we mean that:**
  - The line can be flushed easily
  - There is flashback of blood
- **If the port is not fully patent see Maintaining Patency.**
- **Testing for patency:**
  - Test for flashback of blood before administering IV medication but note that you should not discard blood unnecessarily. To assess for flashback you can either:
    - attach a syringe containing 10mls 0.9% saline* to the giving set, flush a couple of mls into the line and then withdraw. As soon as you see a trace of blood in the catheter or syringe just flush the rest of the saline* into the line.
    - or use a gravity technique (ie with all clamps open briefly hold an attached infusion below the level of the patient's heart until you see flashback of blood).
    - BUT note that if there are infusional vasoactive drugs in the lumen, withdraw prior to flushing to avoid bolus dose.

Flushing — Ports

NB Always use ANTT when accessing the CVC

- **Non-accessed ports:**
  - **Flush at least every four weeks** with 10mls 0.9% saline* and lock with 4-5 mls Heparinised saline* 100 U/ml. (See Injectable Drug Administration Policy.)
- **Accessed ports**:
  - **Technique:**
    - Brisk push-pause technique
  - **What to flush with**:
    - **10 mls 0.9% saline* between incompatible drugs** / infusions or after blood sampling
    - **If needle to be removed:** lock with 5 mls Heparinised saline 100 U/ml*
    - **If needle to remain in situ**: lock with a further 10mls 0.9% saline*

*must be prescribed

Removing the Needle — Ports

NB Always use ANTT when removing the needle

- **Technique**:
  - **Lock port** with 5mls heparinised saline 100 U/ml* as. Injectable Drug Administration Policy. Ideally, remove needle while injecting last ml to achieve positive pressure finish but use gauze to prevent spray. You will need to ask the patient or a third party to inject because you will need two hands for removing the needle. (NB If this is not possible, you can achieve a positive pressure finish by clamping the infusion set while injecting the final ml of flush and then remove needle as below.)
  - **Stabilise the port** with one hand during needle withdrawal to avoid trauma to tissues. Take care to avoid a needle-stick injury.
  - **Apply gentle pressure** to needle site with sterile gauze until minor bleeding has ceased. A plaster may be applied if necessary / desired.

Exit Site Care — Ports

NB Always use ANTT for exit site care

- **Sutures**:
  - To side of port: remove at 7-10 days (unless dissolvable)
  - Venepuncture site: Remove at 7 - 10 days (unless dissolvable)
- **Frequency of needle change:**
  - If port in constant use for more than a week, change needle weekly using different puncture site.
- **Dressings**
  - **Non-accessed ports:**
    - No dressing or exit site care required (except immediately following insertion of the port when wound should be kept covered until stitches removed and wound healed.)
  - **Accessed ports**:
    - Pad needle with sterile gauze if necessary and cover with transparent iv dedicated dressing. Needle site should be visible for inspection.
    - Tape tubing firmly to skin to prevent pulling on the needle.
    - Inspect needle entry site at least daily.
    - Advise patient to report any discomfort or swelling at the puncture site immediately.
- **Bathing, showering & swimming**
  - **Non-accessed ports**:
    - Patient may bath, shower or swim freely once wound has healed.
  - **Accessed ports**:
    - **Bathing**: Patient should not submerge exit site in bathwater.
    - **Showering**: Patient may shower if needle site is completely covered with an occlusive dressing, taking care not to dislodge needle.
    - **Swimming**: not advised while needle is in situ.

*must be prescribed

Patient Education — Ports

- If patient is discharged with port in situ:
  - **Ensure patient is aware of care** required
  - **Ensure patient is aware of the importance of reporting complications** and has a contact number for this purpose
  - **Make arrangements for the port to be flushed every 4 weeks if not in use. This is usually best done as an Out Patient and should be arranged by the Team in charge of the patients care. The patient will remain under the Lead Consultant in charge of their care**
- **Note that Community Nursing Staff** are rarely trained to access ports. If community staff need training in use of the port, contact the central venous access team. **Contact Caroline Whitton, Cystic Fibrosis Clinical Nurse Specialist, for advice or training.**
-
  - **Patients may wish to learn to flush their own ports.** The may be able to assist in teaching.

Removal — Ports

- Implantable ports are usually inserted and removed by Interventional Radiology.

For Locking solutions see PHNT Injectable Drug Administration Policy.

Care of CVCs used for Blood processing (e.g. Apheresis)

Infection Prevention and Management — CVCs used for Blood Processing

- **As for tunnelled or non-tunnelled CVCs**, whichever applies.
- **If a patient is admitted to another clinical area with a renal line in situ, please *do not* use and contact the Renal Team.**

Information About Locking Solutions — CVCs used for Blood Processing

NB Always use ANTT when accessing the CVC

For Locking solutions see PHNT Injectable Drug Administration Policy.

- Flush lumens with 2 x 10 mls 0.9% saline* using vigorous push-pause flush and positive pressure clamp finish.
- **If the catheter is NOT to be used again within 12 hours,** flush with 10 mls 0.9% saline* as above and then lock each lumen with anti-coagulant . The anti-coagulant used may vary between clinical areas; please see link above).
- **The volume of anti-coagulant should be exactly the priming volume of the lumen in question (this is marked on each lumen)**. Each lumen locked in this way must be clearly labelled, for example "***Locked with heparin 1000 u/ml".***
- **When the catheter comes to be used again, always withdraw and discard the indwelling anti-coagulant prior to using the catheter.** If you are unable to withdraw the anti-coagulant it may be necessary to flush the catheter without withdrawing but you must never do this without discussion with the patient's medical team. This is because in effect you will be delivering a bolus may have clinical implications for the patient.

Assessing patency — CVCs used for Blood Processing

- **As for tunnelled or non-tunnelled CVCs**, whichever applies but note you must always remove any indwelling anti-coagulant prior to assessing patency. If you are unable to withdraw the line lock it may be necessary to flush the catheter without withdrawing but you must never do this without discussion with the patient's medical team. This is because in effect you will be delivering a bolus of anti-coagulant which might have clinical implications for the patient.

Flushing — CVCs used for Blood Processing

- **As for tunnelled or non-tunnelled CVCs**, whichever applies but see "Information about locking solutions" above

Exit Site Care — CVCs used for Blood Processing

- **As for tunnelled or non-tunnelled CVCs**, whichever applies.

Patient Education (tunnelled lines) — CVCs used for Blood Processing

- **As for tunnelled CVCs**.

Removal — CVCs used for Blood Processing

- **As for tunnelled or non-tunnelled CVCs**, whichever applies.

*must be prescribed

APPENDIX

Managing Complications

Pyrexia plus or minus: rigor after flushing, sore throat, generally feeling unwell, hypotension, tachycardia, shock, exit site / tunnel infection

- **Possible cause:**
  - Catheter Related Blood Stream Infection
- **Management:**
  - **Refer to medical staff**. May be treatable without catheter removal depending on patient's clinical status and colonising organism. Microbiology opinion should usually be sought.
  - **Take paired blood cultures** from central line and peripherally as per PHNT guidelines/ HII Taking Blood Cultures .
  - **TPR & BP.** Frequency will depend on patient's clinical status.
  - **If there are signs of exit site infection** see below.

Inflammation and tenderness at the exit site / insertion site / skin tunnel / port pocket plus or minus exudate

- **Possible cause:**
  - Infection
- **Management:**
  - **Take a swab**
  - **Refer to medical staff.** In non-tunnelled CVCs, exit site infections involving pus should probably be removed to prevent infection spreading to the blood stream. In tunnelled CVCs and PICCs, a superficial exit site infection will often resolve with antibiotics, but infections involving the skin tunnel above the cuff or a port pocket are very difficult to treat. Microbiology opinion should usually be sought.
  - **Consider - Stop using** *IV 3000* **dressing** until symptoms resolve.
  - **Increase frequency of dressing change & cleaning** depending on amount of exudate**.**
  - **4 hourly TPR & BP** if patient in hospital
  - **If patient also shows signs of systemic infection,** see also above**.**

The catheter is sluggish, or there is no flashback of blood, or there is complete blockage .

- **Possible causes:**
  - Clotted blood in catheter
  - Fibrin sheath (which may be diagnosed using fluoroscopy)
  - Malpositioned catheter
  - Build up of lipids (Parenteral Nutrition)
  - Drug Precipitation
  - NB: In Implantable Ports needle may be incorrectly positioned: check before taking any other action.
- **Management:**
  - See Maintaining Patency.

Pain or visible swelling when catheter is used **or** fluid leaks from exit site when catheter is flushed.

- **Possible causes:**
    - Malposition of catheter
    - Internal catheter fracture
    - Fibrin Sheath (which may be diagnosed using fluoroscopy)
    - Separation of port and catheter (Implantable ports)
    - NB: In Implantable Ports needle may be incorrectly positioned: check before taking any other action.
- **Management:**
    - **Stop using the catheter.**
    - **Refer to the medical staff** *or* Vascular Access Team for advice. A malpositioned catheter should usually be removed. Internal fracture cannot be repaired. If there is a fibrin sheath severe enough to cause leakage the catheter should be removed.
    - **Chemotherapy**: follow Cytotoxic Policy if extravasation occurs.
    - **If catheter is fractured or faulty complete Adverse Incident Form**. Do not retain the catheter but if possible record the make and lot number on the incident form.

Leakage from external portion of catheter when flushed.

- **Possible cause:**
    - External catheter fracture
- **Management:**
    - **Clamp or fold catheter** between the exit site and the leak to prevent air entry. If using a clamp (e.g. artery forceps) pad with gauze to avoid trauma to the catheter.
    - **Catheter must be repaired or removed as soon as possible**. Some catheters can be repaired if equipment & expertise is available. The advisability of repair will depend on the patient's clinical status as it carries a risk of infection. *Or* Contact the medical team or Vascular access Team for advice.
    - **Complete Adverse Incident Form.** Do not retain the catheter but if possible record the make and lot number on the incident form.

Cuff protrudes from exit site (Tunnelled CVCs)

- **Possible cause:**
    - Tissues within tunnel have failed to adhere to cuff & catheter has migrated out.
- **Management:**
    - **Stop** using the catheter.
    - **Tape catheter** firmly to skin at exit site
    - **Refer to the medical staff** for catheter removal *or* Vascular Access Team for advice.

Increase in external length of a PICC

- **Possible cause:**
    - PICC has migrated out
- **Management:**
    - **Do NOT push the catheter back in**
    - **Refer to insertion documentation which may indicate how many far PICC can safely**

migrate out.

- **If PICC has come out by more than indicated as acceptable on insertion documentation,** consult the central venous access team or medical team. Examination of the post-insertion CXR may reveal whether or not a CXR will need to be carried out to check tip position.

Pain or swelling of arm, neck or shoulder, with or without distension of neck / peripheral veins

- **Possible cause:**
  - Thrombosis.
- **Management:**
  - **Refer to the medical staff** for investigation of suspected thrombosis *or* Contact Vascular Access Team for advice. It may or may not be possible to treat thrombosis without catheter removal.
  - Thrombosis and infection often occur. If patient shows signs of infection, see guidance on managing infection above.

Palpitations / Abnormal ECG

- **Possible causes:**
  - Cardiac arrhythmias related to CVC
- **Management:**
  - **If patient is distressed or unwell as a result of abnormal rhythm, call for urgent medical assessment** and monitor vital signs
  - **PICCs:** Pulling PICC out by 1 - 2cm may resolve the problem immediately. If possible, liaise with the central venous access team to check that this will not result in too high a tip position. If there is any reason to suspect that the palpitations may have another cause, check tip position before retracting the line.

Cardiopulmonary symptoms including any of the following: respiratory distress / failure apnoea, reduced o^2 saturation levels, tachycardia, bradycardia, hypotension, pallor, cyanosis, anxiety, chest pain, loss of consciousness

- **Possible causes:**
  - Pneumothorax
  - Air or catheter embolism
  - Pulmonary embolism
  - Cardiac tamponade / pericardial effusion
- **Management:**
  - **Call for medical assistance** / Outreach Team / resuscitation team
  - **Administer O^2**
  - **Monitor vital signs**

Maintaining Patency

Patency Problems

- **Patency problems are common** in Central Venous Catheters and include:
    - no flashback of blood
    - sluggish flow
    - complete blockage
- **Possible causes**
    - clotted blood in the catheter (most likely cause)
    - fibrin sheath
    - malpositioned catheter
    - drug precipitation
    - build up of lipids (parenteral nutrition)
    - incorrectly positioned needle in an implantable port: check before taking any other action.

Preventing Patency Problems: good flushing techniques

- **Use a brisk 'push-pause' flushing technique** routinely when flushing the catheter – i.e. flush briskly, pausing briefly after approximately each ml of fluid.
- **Use a "positive pressure finish" when you lock the catheter –** i.e. clamp the line while you are flushing in the final ml. If there is no clamp remove the syringe from the *Clave* ® (or similar) while you are still injecting the final ml.

Managing Patency Problems

- **No flashback of blood**
    - Ask the patient to take deep breaths and try different positions. Flush briskly using 10mls saline*. If this fails use a thrombolytic (see below).
    - If lipids/drug precipitation suspected consult pharmacy advice for suitable agent to dissolve occlusion
- **Catheter flow is sluggish**
    - Ask the patient to take deep breaths and try different positions. Flush briskly with 10mls saline*. If this fails use a thrombolytic (see below).
    - If lipids/drug precipitation suspected consult pharmacy advice for suitable agent to dissolve occlusion
- **Catheter is completely blocked**
    - Use a 3-way tap technique to instil thrombolytic into catheter (see below).

*must be prescribed

What is a thrombolytic?

- **A thrombolytic** is a drug capable of breaking up a thrombus.
- **Urokinase** is a thrombolytic used for unblocking CVCs. Use 5000 units in 1.5 mls per lumen.
- **A thrombolytic should always be prescribed**.
- **Heparin and Hepsal are NOT thrombolytics**: they are capable only of inhibiting thrombus formation.

When should you use a thrombolytic?

Use a thrombolytic to improve patency in the following situations:

- flashback of blood is absent
- free-flow of fluids is sluggish or intermittent
- resistance is felt when flushing
- the catheter/lumen is completely blocked

What if the thrombolytic fails to restore function?

- **If a thrombolytic used correctly (see below) fails to restore function, contact the central venous access team and / or medical team.** A chest x-ray may need to be carried out to check the position of the line. If a chest x-ray shows that the catheter is correctly placed, it may be worth investigating further using fluoroscopy which may reveal a fibrin sheath.
- **If the cause could be a build up of lipids from Parenteral Nutrition or drug precipitation** consult pharmacy advice for a suitable agent to dissolve occlusion.

How to use a thrombolytic

Arrange prescription. (Caution if patient's clotting is severely deranged or if high doses of an anticoagulant are being given concurrently.)

Draw up the thrombolytic as per manufacturer's instruction e.g. for Urokinase: reconstitute 10,000 unit vial with 3mls 0.9% saline for injection. Use 1. 5 mls (5000 units) per lumen.

Instil the thrombolytic into the catheter and wait 2 hours (or preferably longer if possible). But note that if the lumen is completely blocked do NOT force the thrombolytic into the catheter: see Using a Thrombolytic in a Completely Blocked Catheter (below).

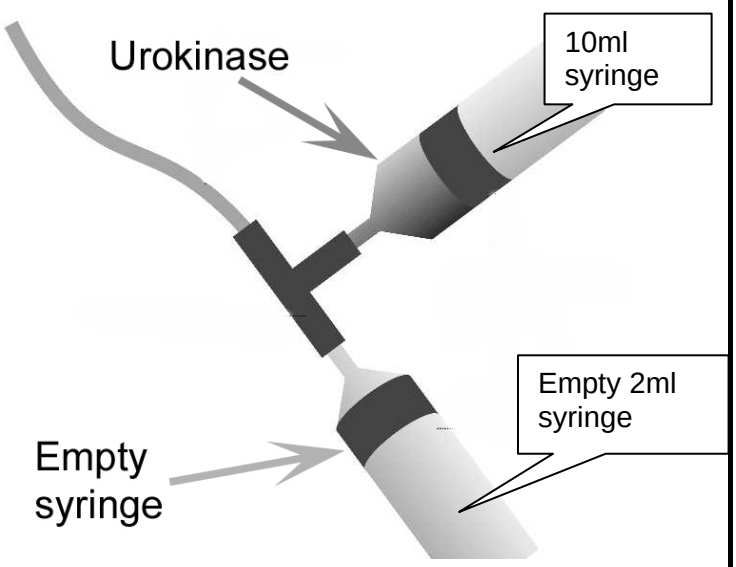
Assess the catheter again. NB It is best to flush the catheter with 0.9% saline (must be prescribed) prior to attempting to obtain flashback, otherwise there is a risk of creating a further blockage in the line before you have cleared it. NB There is no need to worry that you are flushing the thrombolytic into the patient: small doses can be flushed into the patient without danger unless the patient has exceptionally deranged clotting.

If full function has not returned instil the thrombolytic again and leave in for longer – several hours or overnight if possible. NB the fact that urokinase has a half life of 20 minutes once it is in the patient's system is irrelevant to how long it carries on working while still in the catheter. This explains why leaving it in longer is often more effective.
If the procedure fails to restore function consider whether lipids / drug precipitation could be causing a blockage. If not, refer to the central venous access team and / or medical staff: a chest x-ray may reveal malposition of the line**.**

Using a Thrombolytic in a Completely Blocked Catheter.

Attach 3-way-tap & syringes see right. (NB 3-way taps are now contraindicated for routine IV use but are still available for this procedure. Always use a 3-way tap *without* an extension set)
Open clamp (if there is one).
Open stopcock to the empty syringe and the blocked catheter.

Diagram 1.
Three-way Tap Technique



Pull back on the plunger of the empty syringe to create a vacuum in the catheter. You will need to pull quite forcibly.

Maintain suction with one hand and with the other hand turn stopcock so it is closed to the empty syringe and open to the syringe containing thrombolytic, which will be sucked into the catheter. Don't worry if it seems that very little thrombolytic is sucked in: even a tiny volume will reach several cm into the catheter.

Leave for several hours or overnight. DO NOT CLAMP CATHETER as this will prevent the thrombolytic from penetrating into the line.

After this time, assess the catheter by attempting to flush it catheter using 0.9% saline* in a 10ml syringe. Do not use excessive force. (It is best NOT to try aspirating before flushing at this stage as you may block the catheter again).

If the catheter is still completely blocked, repeat the procedure: sometimes you will need to do it several times before it works. Sometimes leaving the thrombolytic in overnight seems to help (1). Don't worry about overdosing the patient: if the catheter is blocked none of the drug will actually have been flushed into the blood stream.

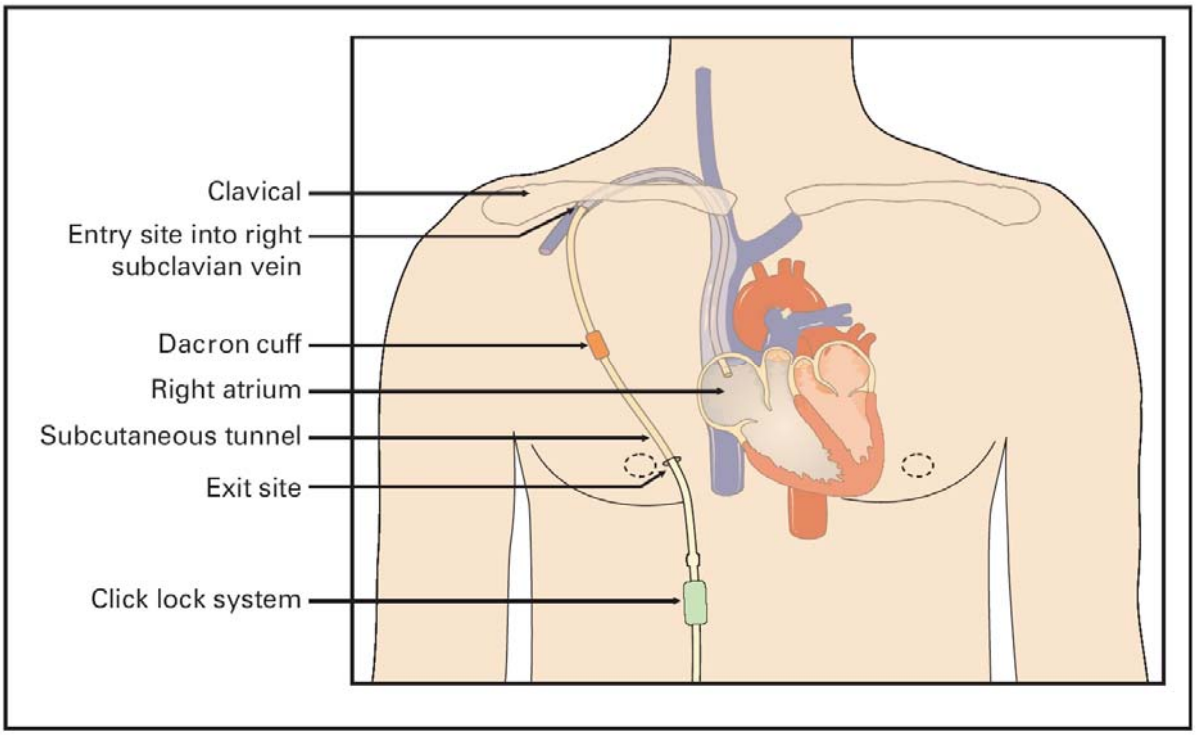
Once the catheter can be flushed, and only then, check for flashback. If flashback is absent, administer thrombolytic as described above.

If the procedure fails despite a repeated attempt consult the central venous access team and / or medical team with a view to removing the catheter.

Glossary

Entry site – site of insertion of the central line

Exit site – site where the central line exits the body (e.g. chest wall)



External device e.g. Hickman, Groschong – single, double or triple lumen lines, usually inserted into the subclavian vein or the internal jugular vein.

Fibrin sheath –Fibrin grows along the catheter's length and extends past the catheter's tip. Withdrawal occlusion or extravasation of IV fluids may occur causing serious and sometimes life threatening complications. Bacteria embedded in the fibrin increase the risk of persistent catheter related sepsis.

Implanted devices e.g. Porta cath – A catheter surgically placed into a vessel or cavity and attached to a reservoir located under the skin.

Line migration – movement of the line from its original position, common in PICC lines.

Lumen – Interior space of a tubular structure, such as blood vessel or catheter.

No touch technique – A method used to avoid touching the catheter directly with hands.

Phlebitis –Inflammation of the vein; may be accompanied by pain, erythema, oedema, a streak formation and/or palpable cord; rated by a standard scale can be caused by movement of the catheter.

Chemical Phlebitis – Phlebitis caused by chemical solutions such as chemotherapy drug.

Mechanical phlebitis – Phlebitis caused by movement of the catheter on the vessel wall.

Peripherally inserted central catheter (PICC line) – Soft, flexible central venous catheter inserted into an extremity and advanced until the tip is positioned in the lower third of the superior vena cava.

Pinch off syndrome – When catheter is compressed between clavicle and first rib.

Positive pressure - Constant, even force within a catheter lumen that prevents reflux of blood; achieved by clamping while injecting or by withdrawing from the catheter while injecting.

Push pause/ Pulsated flush – a flush using a push pause technique, creating turbulence within the lumen thus preventing adherence of debris to the vessel wall, aiming to reduce the incidence of line blockage.

Tunnelled line – applies to external devices. The catheter is tunnelled under the skin of the shoulder area for extra security.

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For more information see The Marsden Manual