Guidelines for Care and Management of Central Venous Catheters

IC/246/10

Supersedes: IC/246/07

**Executive Summary**

This policy is designed as a resource to direct all staff in the management and care of the various forms of Central Venous Catheter (CVC) placed in patients within Basingstoke and North Hampshire NHS Foundation Trust.

CVC are inserted:
- To monitor central venous pressure
- 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, sodium bicarbonate, Parenteral Nutrition, chemotherapy etc.)
- To provide long term accesses for frequent or prolonged use (e.g. chemotherapy, antibiotics, blood sampling, haemodialysis etc.).

The implementation of this policy will be monitored using clinical audit including the Saving Lives Care Bundles / CVC Insertion and Management Form (Appendix VIII).
Summary of changes
This policy contains guidance for Central Vascular Access Devices only. Peripheral Venous Cannula has been removed from the policy. The previous policy has been reviewed and streamlined.

Implementation Plan

Action needed and owner of action

Staff are required to adhere to new Trust Guidelines, in order to ensure staff comply:

- There will be a week long launch of the policy, including teaching sessions for staff
- Managers and Link Personnel to disseminate policy to non-attenders of teaching sessions
- Information regarding the new policy will be issued in PULSE
- Posters will be displayed in all clinical areas outlining the basis of Central Vascular Catheter care and assessment tools
- Implementation of Central Venous Catheter care plans
- Regular Audits of Central Venous Catheter care (including documentation)

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1. Scope

This policy applies to all health care professionals involved in the management of patients with central venous catheters in-situ.
2. **Definitions**

**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.

**Aseptic Technique**
Clinical practices used to protect the patient from micro-organisms by preventing contamination of wounds, manipulated devices and other susceptible sites. Aseptic technique involves the use of appropriate hand hygiene, use of sterile equipment, no touch technique and robust patient skin / site disinfection.

**Health care professional**
A registered or trained member of staff, including but not exclusively nurses, doctors and operating department practitioners.

**Infection**
Entry of a harmful microbe into the body and its multiplication in the tissues. Further information can be found in the Appendices.

3. **Clinical Practice**

See Appendices:
- I. Principles of Care (p5)
- III. Overview and Specific Care for Different Types of Catheter (p9)
- IV. Management of Complications (p24)
- V. Using Thrombolytics

4. **Purpose**

To inform best practice from the existing evidence on the care and management of CVC lines. The implementation of this policy will reduce the risks associated with these devices including thrombosis, pain, local or systemic infection and occupational sharps injury.

5. **Responsibilities**

1. **All Managers** - To be aware of Trust Policy and Guidelines and to ensure their Staff comply with the requirements of these documents.
2. **Supervisors of clinical practice** will be responsible for monitoring compliance with the policies on an ongoing basis.
3. **Individual members of Staff** must ensure they follow this policy to ensure safe practice.
4. **Wards and Clinical Areas** will routinely audit compliance against the Care bundle form for ongoing management of CVCs as per Infection Prevention and Control guidance (Appendix VIII).
5. **IV Therapy Nurse Specialist** - Quality control audits to ensure continued standards and adherence of Policy during care and management of CVCs will be undertaken cyclically.

6. **Training**

**Nursing staff** will be taught at on the IV Therapy Study Day. Clinical Educators, Practice Development Nurses and Clinical Nurse Specialists will support learning and the gaining and maintaining of competencies. Additional training can be offered by the IV Therapy Nurse Specialist.

**Medical Staff** who handle and care for CVCs should be competent to do so. This should be assessed by their Educational Supervisor. Additional training can be offered by the IV Therapy Nurse.
7. Associated documentation and references (including related policies and procedures)

This policy should be read in conjunction with the following BNHFT policies:

1. Safe handling and disposal of sharps  Prevention and Management of sharps and contamination injuries
2. Standard Infection Control Precautions  Infection Control Standard Precautions policy
3. Aseptic Technique  Aseptic Technique Policy
4. Hand Hygiene Policy  Hand Hygiene Policy

See also Appendix VIII: References (p42)

8. Contributors

Dr Andrew Wade
**Appendix 1:**

**Central venous catheter insertion procedure**

Healthcare personnel caring for a patient with a central venous catheter should be trained and assessed as competent in using and consistently adhering to the infection prevention practices described in this guideline.

Patients should receive clear and comprehensive information explaining the risks, benefits and care of the catheter. Signed consent should be obtained prior to catheter insertion (if the patient is able to do so).

**Choice and site of catheter**

Nontunnelled catheters are indicated for short-term use when peripheral venous access is impractical.

Tunnelled central venous catheters are indicated for the repeated administration of chemotherapy, antibiotics, parenteral feeding and blood products, and for frequent blood sampling. They are recommended for patients in whom long-term (>30 days) central venous access is anticipated.

Fully implanted catheters (ports) are more suitable for children and for less frequent accessing but long-term use, whereas skin-tunnelled catheters are recommended for intensive access.

Polyurethane Peripherally inserted central catheters (PICC) allow easier infusion of blood products as greater flow rates are achieved because the thinner walls provide a larger internal diameter of the catheter. The decision to use polyurethane catheters should be balanced against the higher risk of thrombosis with these catheters compared with silicone catheters.

The number of lumina and diameter of catheters should be kept to the minimum.

**Insertion**

It is strongly recommended that CVCs should be inserted in designated clean areas, eg treatment rooms, critical care units, operating theatres. **Insertion should be performed by trained and competent staff regardless of specialty.** - this reduces the mechanical and infection risks associated with insertion.

Ultrasound guided insertion is recommended for all routes of central venous catheterization. The use of ultrasound is also recommended for the insertion of PICC when the peripheral veins are not visible or palpable.

Hands should be decontaminated using alcohol hand rub on visibly clean hands (apply 1 shot, cover all surfaces, rub hands together until dry). Alternatively, using an antimicrobial liquid soap eg Hibiscrub, Povidone iodine, hands should be thoroughly washed, using a technique, which aims to cover all surfaces of the hands. Hands should be rinsed in running water before and after applying the cleansing agent and dried well –this reduces the risk of cross infection from the operators' hands during the procedure.

Use optimum aseptic technique, including a sterile gown, gloves, hat and mask, and a large sterile drape (dedicated CVP insertion packs should be used where available)
Evidence has identified that using maximal barrier precautions reduces the risk of subsequent CVC related infection.

Effective skin preparation will remove bacteria from both hair and skin, avoiding the need for shaving, which can result in microscopic damage and thus microbial colonisation. If hair removal is considered necessary, clipping is the preferred option using a disposable clipper head.

- Evidence suggests that shaving results in microscopic damage and thus microbial colonisation of the skin.

Using Chlorhexidine 2% in 70% alcohol (1-2 applicators of Chloraprep 3mls) applying gentle friction, disinfect the skin insertion site for 30 seconds. Allow the antiseptic to dry before inserting the catheter. Use an alcoholic povidone-iodine solution for patients with a history of chlorhexidine sensitivity.

-Skin cleansing/antisepsis of the insertion site is one of the most important measures for preventing catheter related infection. EPIC (2006) recommends an alcoholic solution of chlorhexidine gluconate 2% as this combines the benefits of rapid action and excellent residual (ongoing) activity.

Antibiotic/antimicrobial impregnated catheters, for example, chlorhexidine and silver sulfadiazine impregnated catheters should be considered for appropriate risk groups of patients to minimize infection risk.

Routine antibiotic prophylaxis is not recommended.

Routine replacement, for example, weekly change, of short-term catheters as a means to reduce infection rates is not recommended.

Guidewire-assisted catheter exchange to replace a malfunctioning catheter is acceptable if there is no evidence of infection. However, if infection is suspected the existing catheter should be removed and a new catheter inserted at a different site. This technique is generally impractical for cuffed tunnelled catheters or ports when it may be technically easier and safer to insert a new catheter into a clean site. It is usually preferable to insert a new catheter into a clean site.

The CVC should be firmly anchored to prevent movement using a mono filament suture
- CVCs readily become colonised and carry micro-organisms from the skin into the insertion tract.

Use a sterile, transparent, semi permeable polyurethane dressing CVC dressing ie IV 3000.
- This allows for continuous inspection of the site.

If total parenteral nutrition is being administered use one central venous catheter or lumen exclusively for that purpose.

The procedure must be documented in the nursing and medical records, stating the name of the person inserting the CVC, the date of insertion, site, catheter size and reason for insertion (insert product label into patient’s notes)
To meet legal and patient care requirements/facilitate audit.

Radiological confirmation of the position of the catheter tip must be undertaken
To confirm precise location of the catheter tip and exclude immediate complications such as pneumothorax.
References:

Guidelines on the insertion and management of central venous access devices in adults
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Appendix II:

Principles of Care

(i) General Principles

- **Use an aseptic technique following BNHFT Asepsis Policy** whenever the CVC is accessed and during procedures involving exit sites. *To prevent infection. A strong correlation exists between bacteraemia and the presence of a CVC*.

- **Wear sterile gloves when carrying out dressing changes and when accessing the catheter.** Gloves should be worn to prevent descaling of bacteria onto key parts.

- **Monitor temperature, pulse, blood pressure, respiratory rate and O₂ saturations** at least a minimum of 12hourly. *To detect infection*

- **Do not allow air to enter the catheter.** 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.*

- **Cap off the catheter with a needle-free access device** when not in use (except Neonates). This will minimise interruptions to the closed system. Unless manufacturer’s instructions vary, this should be changed every 7 days or every 200 uses, whichever is the sooner. In adult inpatients with long-term vascular access devices the bungs should be changed on a set day (Sunday) to ensure continuity within and between units. *Risk of contamination increases with every interruption to the closed system.*

- **Whenever the bung/access device is removed** from the catheter then it must be replaced with a new, needleless access device/bung. *To prevent infection.*

- **If the catheter possesses an integral 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 (except Hickmans). *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.*

- **Always take signs of systemic or local infection seriously** and refer to a member of the medical staff. *"Infection continues to be one of the most frequent and most serious complications associated with CVC Catheters."*

- **The practice of administering prophylactic antibiotics** at the time of CVC insertion should NOT be routinely followed. *The Department of Health’s Epic2 Guidelines on the prevention of infection in Central Venous Catheters* specifically states that this practice is not supported by research and may encourage resistant organisms.

- **The practice of administering prophylactic mini-dose Warfarin** to patients with CVCs should NOT be followed. *Mini-dose Warfarin has recently been shown to be ineffective in the prevention of thrombosis in cancer patients with CVCs.* (NB dose adjusted Warfarin did show some efficacy but with an increased risk of serious bleeding).

- **Should the catheter fracture or be accidentally cut**, clamp it 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** away from the exit site with tape or with a dedicated device such as ‘Statlock’. *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.*
(ii) Accessing the Catheter

Before it is used for administering therapeutic drugs or fluids, the patency and correct functioning of the catheter should be established26 (except Neonates when this should only be done immediately following catheter insertion). 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 – eg complete blockage or thrombosis27.

- **Nurses using CVCs 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 (not Neonates).
  - The patient experiences no discomfort during flushing/infusion and there are no other complications

If any of these criteria are not met you should refer to *Management of Complications* (page 24).

- **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.
  - Assessing CVCs in neonates and in patients requiring blood processing (e.g. haemodialysis / apheresis) requires specialist knowledge: refer to *Overview and Specific Care for Different Types of Catheter* (starting page 11) for care of these patients.
  - In adults and children over 1 year who are due to receive intravenous fluids, a useful technique is to attach an infusion of 0.9% saline, open the clamp on the giving set fully and observe for free-flow. You will soon learn to recognise what is a normal free-flow for a particular type of CVC (for example the flow on a Non-tunnelled CVC will be much faster than you would expect from a PICC which is a much longer thinner catheter.) Dropping the bag of fluid briefly below the patient’s heart with any clamps open will allow you to check for flashback of blood without interrupting the closed system. **As soon as** blood is seen in the tubing, the bag can be replaced on the drip stand and prescribed infusion started. (NB this technique for checking flashback does not always work with valved catheters). **Ensure to stop the free flow to ensure no unnecessary bolus of fluid.**

Checking for flashback of blood does not necessarily mean you have to discard blood. For example, attach a syringe containing 10ml 0.9% sodium chloride to the catheter, flush a couple of ml 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 sodium chloride into the line using the push-pause technique as described in (iii) a) below (page 7).

(iii) Flushing After and Between Uses (except Neonates)

(a) Flushing Technique:

- **Where possible, do not use syringes smaller than 10 ml** for infusion into the catheter16. 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 applied to overcome it, catheter fracture could result regardless of the syringe size…” 27.
• **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\(^{16, 26}\).

• 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 needle free bung) while injecting the last ml: but note that to avoid any spray from the syringe you should hold sterile gauze around the connector while doing this. Maintaining positive pressure helps prevent blood entering the catheter after flushing, which might lead to occlusion or thrombus formation\(^{16}\).

• Do not routinely withdraw and discard blood from the catheter before flushing (except Renal Dialysis Catheters) in an attempt to avoid flushing bacteria and clots into the patient\(^{26}\). There is no evidence that withdrawing prior to flushing reduces infection or embolism. **But 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 (page 6).

(b) Frequency of flushing and flushing solutions:

• This varies depending on the device. See Overview and Specific Care for Different Types of CVC (starting page 11).

, Please note that Hepsal and Heparinised Saline must be prescribed.

(iv) Care of the Exit Site (Except Neonates)

   a) **Dressings Immediately post insertion:**

• As with any surgical wound, the exit site should ideally be left undisturbed for 1-2 days. Routine taking down of the dressing post-insertion to inspect the site merely exposes the patient to increased risk of infection. On the other hand most exit sites bleed to some extent following insertion. If this leads to "strike-through" on a dry dressing, (i.e. exudate/blood/serous fluid observed on the outside of a dry dressing) it should be changed immediately since a wet surface provides "a liquid pathway for bacteria to travel" to the wound.

• **The ideal dressing immediately post-insertion** is a dry dressing covered and sealed with a transparent dressing (IV 3000). In most cases this will absorb any oozing but not necessitate changing the dressing. Ideally this dressing should be left undisturbed for at 1-2 days. If there is excessive bleeding and the gauze becomes soggy the dressing should be changed.

• **If a dry dressing alone is used post-insertion**, it should again ideally be left undisturbed for 1-2 days but should always be changed as soon as any “strike-through” occurs using an aseptic technique.

• **If bleeding is excessive** the dressing should be changed every time strike-through occurs and replaced with a more absorbent or thicker dressing. Pressure should then be applied to the site and the patient encouraged to lie fairly still until the bleeding settles. It is not acceptable to add more dressings on top of blood-soaked dressings which have been in contact with a moist outer surface, because of the infection risk.

b) **On-going Dressing Regimes after the first 1-2 days:**

• As a general principle, where a dressing is used it should be inspected regularly and renewed immediately should it become soiled, wet or detached\(^{24}\). A moist environment is one in which bacteria readily multiply\(^{28}\).
• If the exit site is reddened, painful, exudating or infected, increase the frequency of dressing change depending on the amount of exudate.

• The most suitable dressing will depend on the setting, the type of CVC and the individual patient’s needs. See Overview and Specific Care for Different Types of CVC (starting page 11) for recommendations. The main options for dressings are:
  o IV-dedicated occlusive transparent dressing, changed every 7 days26 except patients on dialysis and neonates. Some researchers have found iv-dedicated transparent dressings to be associated with a lower risk of infection than other transparent dressings29.
  o Sterile dry dressing taping in situ, changed at least twice a week26.
  o 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. "No dressing" performed just as well as 3 types of dressing in one study comparing infection rates22,30,31

c) Cleaning of Exit Site:

• At dressing changes, the exit site should be cleaned using Chloraprep using a criss cross motion to avoid transferring bacteria to the exit site.
• Cleaning should be carried out using an aseptic technique.

• Loose blood, exudate or other debris which might provide a focus or infection or might impair inspection of the wound may be gently removed by cleaning in the above manner with sterile 0.9% sodium chloride prior to cleaning with Chloraprep32.

(v) Removal
If a short-term CVC has not been used for >24 hours consideration should be given to its removal. Some CVCs are simple and relatively safe to remove. With others, there is high risk of air embolism33 and so removal requires a higher level of training and skill. See Overview and Specific Care for Different Types of CVC (page 11) for guidelines on removal.
Appendix III:
Overview of Central Venous Catheters

(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 concept that the tip of the catheter floats freely within the bloodstream in a large vein 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 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.

- Superior vena cava (SVC)
- RA / SVC junction
- Right atrium (RA)
- 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.

In neonatal care, right atrial placement is contraindicated because of the risk of cardiac tamponade. In PICCs, right atrial placement is considered to be inadvisable because the PICC may move into the right ventricle when the patient moves his/her arm, leading to an increased risk of arrhythmias.

(ii) Indications
- To monitor central venous pressure
- To administer large amounts of intravenous fluids in emergency situations (e.g. colloids, blood products etc.)
- To administer irritant, vesicant or hyper-osmolar drugs / fluids (for example Noradrenaline/Adrenaline, sodium bicarbonate, Parenteral Nutrition, chemotherapy etc)
- To provide long term access for frequent or prolonged use (e.g. chemotherapy, antibiotics, blood sampling, haemodialysis etc.)

(iii) Insertion and Removal
Insertion of a CVC is an invasive procedure which must only be performed by trained, competent personnel using “optimal aseptic technique, including a sterile gown, gloves, and a large sterile drape”11. The use of ultrasound to achieve venous access is recommended by NICE guidelines11 but this relies upon the availability of appropriate equipment and training. 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. Guidelines for the insertion of Central Venous Catheters are not covered here.

Techniques for the removal of a CVC vary depending on the type of catheter and this is addressed in Appendix III: Overview and Specific Care for Different Types of Catheter (page11).
(iv) Choice of Catheter

Various different types of CVCs are available and these are described below.

The choice of device will depend chiefly on the purpose for which it is intended, though patient preference may be a key factor with long-term catheters. As a general principle the lumen diameter and the number of lumens should be kept to a minimum, since larger bore catheters and multiple lumens are associated with higher infection and thrombosis risks\textsuperscript{11,13}. Clearly there are many other factors to be weighed against these risks – e.g. in high dependency settings large bore catheters and multiple lumens tend to be used as they are essential for management of the acutely ill patient. Where Parenteral Nutrition is to be administered, ideally a single-lumen catheter should be used. If multiple lumens are essential, then one lumen should be dedicated “exclusively for that purpose” (except in Neonates).\textsuperscript{11}. 
Appendix IV: Overview and Specific Care for Different Types of Catheter

Care of Centrally-Inserted, Non-tunnelled CVCs

Often called Central Lines / Neck Lines / CVP lines.

- Centrally Inserted Non-tunnelled CVCs are most commonly found in **acute settings**. They are not suitable for long-term use because they rarely remain free of infection for longer than 7 – 10 days, and also because they are relatively uncomfortable and unsightly.

- The catheter is usually inserted via the subclavian, jugular or femoral veins with the tip positioned in the Right Atrium, the Superior or Inferior Vena Cava. It is attached to the patient’s skin using non-dissoluble sutures.

- Non-tunnelled CVCs 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.

**Flushing**

- Before flushing
  - If there are infusional vasoactive drugs in the lumen, withdraw prior to flushing to avoid bolus dose.
  - **Technique:**
    - Brisk push-pause technique with positive pressure finish
  - **What to flush with:**
    - 0.9% sodium chloride between incompatible drugs / infusions and after blood sampling (if sodium chloride 0.9% incompatible use suitable alternative).
    - Lock with 10ml 0.9% sodium chloride if catheter is to be accessed again within 1 day.
    - Lock with 5ml Hepsal 10 U/ml if catheter **not** to be used again within 1 day.
  - **Frequency of flushing:**
    - Flush **unused** lumens at least once a week (10ml 0.9% sodium chloride then lock with 5 ml hepsal 10 U/ml).

**Exit site Care**

- **Securement:**
  - Lines are sutured in place, alternatives such as a Statlock can be used.
- **Sutures:**
  - Leave in place as long as the catheter is in situ.
- **Cleaning:**
  - Clean exit site at dressing changes using Chloraprep using a criss cross method.
- **Dressings:**
  - Post-insertion: gauze under transparent dressing for 24 hrs.
  - After 24 hrs: Transparent dressing recommended. Change every 7 days unless soiled or loose in these cases change when required.
- **Bathing & showering**
  - The exit site must not be allowed to get wet.
Removal

Who can remove Non-tunnelled CVCs?
- Any qualified nurse who has been assessed as competent and who follows these guidelines.

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 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 aseptic technique throughout.
- 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 any stitches.
- Ask patient to perform Valsalva's manoeuvre (ie 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 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).
- 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 (ITU all tips sent for culture).
- Apply a sterile occlusive dressing to prevent air from entering the venous system.
- Advise the patient to lie flat for 30 minutes.
- During this time observe patient for signs of haematoma (ie, swelling, pain, altered voice, airway obstruction).
- The wound should be kept dry for 5 to 7 days and the wound monitored until healed.
### ii) Care of Tunnelled CVCs often called Hickman lines

Tunnelled CVCs are intended for longer-term use in patients who 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 last for much longer.

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 sutures. There is a ‘cuff’ within the tunnel to allow for the adherence of fibrous tissue which helps to prevent accidental dislodgement after the removal of the sutures and acts as a mechanical barrier to ascending bacteria 14,15

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. Valved catheters vary in design: the valve may be at the **internal** or **external** end of each lumen (e.g. Groshong catheters have a valve at the internal end, whereas PASV catheters contain a valve at the external end). The clamp (or valve) serves to seal the catheter and guard against air entry, haemorrhage and infection.

Patients with tunnelled CVCs may be discharged home with the catheter in situ. In these cases 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 Tunnelled CVC, but liaison with the primary health-care team remains vital.

**Flushing**

**Technique:**
- Brisk push-pause technique with positive pressure finish

**What to flush with:**
- 0.9% sodium chloride between incompatible drugs / infusions and after blood sampling (if sodium chloride 0.9% incompatible use suitable alternative).
- Lock with 10ml 0.9% sodium chloride if catheter to be used again within 1 day.
- Lock with 5ml Hepsal 10 U/ml if catheter **not** to be used within 1 day.
- Paediatrics – 5ml Hepsal 10u/ml flush if not to be used within 8 hours.

**Frequency of flushing:**
- Flush unused lumens once a week with 5ml Hepsal 10 U/ml.

**Exit Site Care**

**Securement:**
- When stitches removed no further securement required – Paediatrics tape lines to patient.

**Sutures:**
- **Exit site:** remove at 21 days
- **Venepuncture site:** Remove stitches / Steristrips at 7 days (unless dissolvable)

**Cleaning:**
- Clean exit site at dressing changes using **Chloraprep** using a criss cross method
- **Dressings:**
- **Exit site:**
  - **Post-insertion:** gauze under transparent dressing for 24 hrs
  - **After 24 hrs** choose between
    - Transparent dressing (changed every 7 days)
    - OR dry dressing (changed at least every 7 days)
  - **After 21 days:** choose between
    - transparent dressing (change every 7 days)
    - OR dry dressing (change at least twice a week)
    - OR no dressing.
- **Venepuncture Site:**
  - Dry dressing and/or transparent dressing until sutures removed / dissolve.

### Bathing, showering & swimming
- **Bathing:** Patient should not submerge exit site in bathwater. For clean water juggled from tap see "showering" below.
- **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 advised – Paediatrics liaise with Clinical Nurse Specialists.

### Patient Education
- If patient is discharged with catheter in situ
  - Ideally, teach patient / carer to care for their own catheter
  - Refer to Community Nursing Staff if necessary
  - Provide two weeks’ dressing and flushing supplies unless there are local arrangements with Community teams. Provide emergency clamp kits for paediatric patients.
  - 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

### Removal
- Do not remove Tunnelled CVCs unless you have been specifically trained to do so.
(iii) Care of PICCs

PICCs (Peripherally Inserted Central Catheters), like Tunnelled CVCs, are intended for mid to long-term use (up to 6 months, sometimes longer) in patients who require multiple infusions of fluids, blood products (not neonates), drugs or Parenteral Nutrition. They may also provide access for routine blood sampling. PICCs are a common choice for central access in Neonatal care.

A PICC is a fine bore CVC inserted into a peripheral vein – usually the basilic or cephalic vein – and threaded upwards towards the heart. Tip position is verified by Chest X-ray following insertion (unless the tip has been screened during insertion using Fluoroscopy).

Unlike Tunnelled CVCs, PICCs do not possess 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 sutures, Steristrips or a dedicated fixing device. Checking the external length of the PICC should be a routine part of care before administering drugs or fluids.

PICCs can 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 is equipped either with an integral clamp, or a 3-way valve. Valved PICCs vary in design: the valve may be at the internal tip of each lumen (e.g. the Groshong PICC). The clamp (or valve) serves to seal the catheter and guard against air entry, haemorrhage, backtracking of blood and infection.

Patients may return home with a PICC in situ, and therefore patient education regarding the recognition and reporting of complications is of great importance. The PICC usually exits onto the patient’s arm and so it is not always practical for the patient to care for the catheter him/herself. Liaison with the IV Nurse Specialist is vital.

Placement is contraindicated following axillary node dissection or irradiation, or in the case of lymphoedema of the arm, axillary node disease or skin infection at the insertion site.

A PICC should not be confused with a “midline catheter” which is usually “20cm in length, with the tip terminating in the region of the axillary vein, and is designed for short-term peripheral drug delivery”.

General points

- Assess external length of PICC before use: if it has increased by more than 2cm see Management of Complications page 24.
- Take care at all times not to pull PICC out. Unless there are sutures remember there’s nothing to keep the PICC in apart from the dressing and Statlock.
- 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.
### Flushing

**Technique:**
- Brisk push-pause technique with positive pressure finish

**What to flush with:**
- **Bard Groshong valved**
  - 0.9% sodium chloride between incompatible drugs / infusions or after blood sampling (if sodium chloride 0.9% incompatible use suitable alternative).
  - Lock with 10ml 0.9% sodium chloride
- **Cook / Kimal open-ended**
  - 0.9% sodium chloride between / after incompatible drugs / infusions or after blood sampling (if sodium chloride 0.9% incompatible use suitable alternative).
  - Lock with 5ml Hepsal once a day.

**Frequency of flushing:**
- **Bard Groshong valved**
  - Flush unused lumens a weekly with 10ml 0.9% sodium chloride
- **Cook / Kimal open-ended**
  - Flush unused lumens daily with 5ml Hepsal 10U/ml.
  - **Do not** disconnect continuous infusions to give daily Hepsal 10U/ml.

### Exit Site Care

**Securement:**
- Always fix catheter firmly to patient's skin (e.g. using Steristrips or dedicated device e.g. Statlock.)

**Sutures (if any):**
- Leave in situ as long as the PICC is in situ.

**Cleaning:**
- Clean exit site at dressing changes with Chloraprep using a criss cross method.

**Dressings:**
- **Post-insertion:** gauze under transparent dressing for 24 hrs
- **After 24 hrs:** transparent dressing (change every 7 days together with Steristrips and any dedicated fixing device (e.g. Statlock dressing)

**Bathing, showering & swimming:**
- **Bathing & Showering:** Patient should not get the dressing wet as bath/shower water can reach the exit site where the PICC protrudes from the dressing. If possible provide a waterproof covering for bathing and showering (e.g. Bathguard or similar).
- **Swimming:** not advised.

### Patient Education

- **For PICCs placed in the inner elbow**, advise patient to keep upper arm warm.
- **If patient is discharged with catheter in situ**
  - Refer to Community Nursing Staff if necessary for ongoing care
  - Provide two weeks' dressing and flushing supplies.
  - 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
  - If appropriate, teach a carer / member of the patient's family to care for the PICC

### Removal

**Who can remove PICCs?**
- Any qualified nurse who follows these guidelines.

**Procedure:**
- **Patient should be sitting/lying** with the PICC exit site below the level of the heart (this will help prevent air embolism)
- **Remove the dressing** & any stitches. (Take swab if signs of infection)

- 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. If this happens, apply warm packs to the patient’s arm for about 5 minutes before resuming.

- 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 exit site wound dry for 1 to 2 days or until healed.
(iv) Care of Implantable Ports (TIVAD / Portacaths)

A Totally Implantable Venous Access Device (TIVAD) is similar to a Tunnelled CVC 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.

Some patients find an Implantable Port more discreet and less intrusive than a Tunnelled CVC19. Ports require less maintenance when not in use than other types of catheter. They may also offer a lower risk of infection when not in use 18,19.

Implantable Ports are suitable for patients who require long-term frequent and intermittent venous access. Arguably they are less than ideal for long-running continuous infusions because of the risk of needle dislodgement20. The patient may return home with the port in situ, and therefore patient education regarding the recognition and reporting of complications is of great importance, as is liaison with the primary health-care team.

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.

Placement is not recommended in obese or cachexic patients, before or after chest irradiation, or at mastectomy sites18.

General Points
- Only access port using a dedicated non-coring needle with integral extension set with clamp /stopcock.
- Following insertion there may be oedema and tenderness around port. This may make accessing port painful and more difficult than usual. Ideally port should be accessed while patient is in theatre if it is to be used immediately afterwards. A longer needle may need to be used due to swelling.
- If patient undergoes MRI scan, inform scanning personnel about the port.
- If patient requires defibrillation do not place paddles directly over the port.
- Never use port for administering contrast medium as this may cause the catheter to split.
• Sometimes it is not possible to bleed back ports despite easy flushing.

**Inserting the Non-coring Needle**

• Which needle?
  - **Style**: For infusions, boluses, blood-taking and flushing a 90° non-coring needle with extension set should be used.
  - **Gauge**: A 22-gauge needle will suffice for most uses. Use a 20-gauge needle for blood administration and withdrawal.
  - **Length**: Where a 90° 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 3/4” needle is suitable for most adult patients. Deeper or more superficial ports will require longer or shorter needles.

• Technique:
  - **Use Aseptic Non-touch Technique**.
  - **Numb skin over the port** if required using topical anaesthetic before skin prep (min. 60 minutes before) or subcutaneous Lidocaine 1% (after skin prep).
  - **Prepare skin over the port using Chloraprep** using a criss cross method and allow to dry.
  - **Prime needle and/or giving set** with 0.9% sodium chloride.
  - **Put on sterile gloves if you need to palpate the port** to ensure you are confident of its position.
  - **Hold port firmly 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 firmly** until it is felt to contact the back of the port.
  - **Verify correct position** by flushing with 20 ml 0.9% sodium chloride and checking for aspiration of blood.
  - **If there is any local discomfort and/or oedema** in the tissues around or over the port this indicates 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 1 further attempt if it has not become contaminated or damaged.) The skin will need re-cleaning after 3 minutes if not successful.
  - **If unsuccessful after 2 attempts please refer to IV Therapy Nurse Specialist**.
  - **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. Refer to **Management of Complications** (page 24).

**Flushing**

• **Non-accessed ports**:
  - **Flush at least every four to six weeks** with 20ml 0.9% sodium chloride and lock with 4-5 ml Heparinised saline 100 U/ml (not 10U/ml)

• **Accessed ports**:
  - **Technique**:
    - Brisk push-pause technique
  - **What to flush with**:
    - **0.9% sodium chloride 5ml between incompatible drugs** / infusions or after blood sampling (if sodium chloride 0.9% incompatible use suitable alternative).
    - **If needle to be removed**: lock with 5 ml Heparinised saline 100 U/ml
    - **If needle to remain in situ** and port to be used within 1 day: lock with 10ml 0.9% Sodium chloride and follow with 5ml Hepsal 10U/ml.
    - **If needle to remain in situ** and port not to be used within 1 day: lock with 10ml 0.9% Sodium chloride and follow with 5ml Hepsal 10U/ml.
Removing the Needle

**Technique:**
- Lock port with 5ml heparinised saline 100 U/ml.
- 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

**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.
- Needles are changed every 14 days in paediatric Cystic Fibrosis patients.

**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.)
- **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 – confirm with IV Therapy Nurse Specialist.
  - **Swimming:** not advised while needle is in situ.

Patient Education

- If patient is discharged with port in situ:
  - Ideally, teach patient to care for their own port
  - Refer to Community Nursing Staff if necessary. If community staff need training in use of the port, contact CNS for IV Therapy.
  - Provide access needles and flushing supplies for the first month.
  - 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

Removal

- Do not remove ports unless you have been specifically trained to do so.
(v) Care of CVCs used for Blood Processing (eg Haemodialysis, Apheresis etc)

Often called Permacaths/Vascaths.

CVCs used for blood processing – e.g. Haemodialysis and Apheresis - are very similar to the catheters described in a) and b) above. They can be non-tunnelled (e.g. Vascaths) or tunnelled (e.g. Permacaths).

Patients needing haemodialysis often require central venous access repeatedly and for long periods of time, and so **insertion via the jugular vein is preferred to the subclavian approach** because of the high risk of stenosis with a subclavian approach.

These catheters differ from other CVCs in the following respects:

- Larger lumen size compared to other CVCs.
- The internal tip of the catheter is designed differently so as to allow blood to be withdrawn freely via one lumen and returned via the other lumen downstream of the blood being withdrawn (thus avoiding recirculation of the treated blood). Confusingly, the lumens are often colour-coded red and blue and referred to as the “arterial” and “venous” lumens. In fact both lumens lead into a vein and not an artery.
- In all settings these catheters are locked between uses with an exact volume of solution, usually Taurolock or rarely concentrated heparin solution to minimise the risk of occlusion and line colonisation. This varies depending on the patient’s clinical status and local guidelines. If a lock is used a red bung must be used to signify that the lock must be withdrawn from the catheter before use otherwise the patient will receive an unwanted dose of the locking solution or emboli of clotted blood.

**Accessing the Catheter**

Locking solutions will vary according to local guidelines and practices. **If Taurolock or a concentrated solution of heparin is used to lock the catheter, always remove indwelling solution** by withdrawing and discarding at least the volume of the lumen before accessing the catheter.

- If withdrawal is not possible or there are other patency problems:
  - See Management of Complications (page 24).

**Flushing**

- Technique:
  - Brisk push-pause technique with positive pressure finish
- Flushing between incompatible drugs / infusions:
  - Flush with 0.9% sodium chloride (if sodium chloride 0.9% incompatible use suitable alternative).
- Flushing after use:
  - Flush both lumens with 10ml 0.9% sodium chloride in 10ml syringes using a push-pause technique, then lock according to local guidelines and practices.
- Unused lumens:
  - Flush at least weekly: withdraw and discard if necessary (as above), then flush with 10ml 0.9% sodium chloride and lock according to local guidelines and practices.
**Exit Site Care**

- **Securement:**
  - Following removal of sutures for tunnelled lines no securement device is needed.

- **Sutures:**
  - **Tunnelled catheters:**
    - Exit site: remove at 21 days
    - Venepuncture site: Remove sutures or Steristrips at 7 days (unless dissolvable)
  - **Non-tunnelled catheters:**
    - Leave in place as long as the catheter is in situ

- **Cleaning:**
  - Clean exit site at dressing changes with Chloraprep using a criss cross method.

- **Dressings:**
  - Dressings as for Non-tunnelled or Tunnelled CVCs, whichever applies.

- **Bathing, showering & swimming**
  - As for Non-tunnelled or Tunnelled CVCs, whichever applies.

**Patient Education**

- If patient is discharged with catheter in situ
  - Ideally, teach patient to care for their own catheter
  - Refer to Community Nursing Staff for ongoing care if necessary
  - Provide two weeks’ dressing and flushing supplies
  - Ensure patient is aware of care required
  - Ensure patient knows to report any complications and has contact number for this purpose.

**Removal**

- As for tunnelled or Non-tunnelled catheters, whichever applies.
(vi) Care in Neonates

General Points
- There are two main types of CVC used in neonatal care:
  - PICCs (also known as long lines) and
  - Tunnelled CVCs (also known as Hickman lines).
- Do not use CVCs for blood sampling (except blood cultures): use peripheral or arterial access instead.
- Do not use flashback of blood to assess patency of CVC except immediately following insertion.

Flushing
- 0.5-1ml 0.9% / 0.45% sodium chloride between incompatible drugs / infusions (if sodium chloride 0.9% / 0.45% incompatible use suitable alternative).
- After blood sampling flush catheter straight away with 1-2ml 0.9% / 0.45% sodium chloride.

Exit Site Care
- Sutures (if any):
  - Leave in situ as long as the catheter is needed.
- Dressings:
  - Leave dressings undisturbed in order to avoid trauma to the baby’s skin.
- Cleaning:
  - If any cleaning is deemed necessary, use only sterile gauze and sterile 0.9% sodium chloride using gentle outward "single-swipe" motion to avoid transferring bacteria to the exit site. Redress exit site.

Removal
- Who can remove neonatal CVCs?
  - Tunnelled CVCs (i.e. Hickman lines): Removed by Medical Staff.
  - PICCs: Must only be removed by competent Medical Staff. Procedure:
    - Check the baby’s coagulation status. If there is an increased risk of bleeding discuss with medical team before proceeding.
    - Be aware that the risk of air embolism increases if the baby is dehydrated or has a cough.
    - Arrange baby so the PICC exit site below the level of the heart (this will help prevent air embolism)
    - Remove the dressing & any stitches.
    - 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. If this happens, wait 5 minutes before resuming.
    - Once PICC is out, apply gentle pressure to exit site with sterile gauze until bleeding stops.
    - Check the length of the internal portion of the catheter and compare to the recorded length. If you suspect there is a portion of the catheter left in the baby, inform senior medical staff immediately.
    - Send tip of line to Microbiology: use sterile scissors to cut off the tip of the catheter and without contaminating it drop it into a dry sterile specimen pot.
  - Apply gauze dressing.
Appendix V: Management of Complications

Page 25  Pyrexia
Page 25  Inflammation / tenderness at exit site
Page 25  No flashback of blood (but line flushes well)
Page 26  Catheter sluggish / intermittent free flow of fluids
Page 26  Catheter completely blocked
Page 26  Pain / visible swelling / leakage when catheter used
Page 27  Leakage from external portion of catheter
Page 27  Cuff protrudes from exit site (tunnelled catheters)
Page 27  Increase in external length of a PICC
Page 27  Swelling of shoulder / neck / arm or face
Page 28  Pain / warmth / hardness / redness along vein path (PICCs)
Page 28  Cardiopulmonary symptoms
Page 28  Palpitations / Abnormal ECG
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 IV Therapy Nurse Specialist / medical staff. May be treatable without catheter removal depending on patient’s clinical status and colonising organism.
  - Take blood cultures from each lumen and peripherally. Follow BNHFT Standards in phlebotomy procedures when taking blood cultures. (Neonates and Paediatrics: only take peripheral blood cultures if requested by Microbiology/Medical Team).
  - 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 / skin tunnel / port pocket plus or minus exudate

- **Possible cause:**
  - Infection

- **Management:**
  - Take a swab
  - Refer to IV Therapy Nurse Specialist / medical staff. May resolve with antibiotics, especially in tunnelled catheters and PICCs. (But NB infections involving the skin tunnel above the cuff or a port pocket are very difficult to treat – Do not access in Paediatrics.)
  - In Neonates, CVC will probably need to be removed.
  - Increase frequency of dressing change & cleaning depending on amount of exudate.
  - 4 hourly TPR & BP if patient in hospital.

No flashback of blood at every use but catheter flushes well without pain. (Not Neonates)

- **Possible causes:**
  - Clotted blood in catheter
  - Fibrin sheath
  - Malpositioned catheter
  - Build up of lipids (Parenteral Nutrition)
  - Drug Precipitation

- **Management:**
  - Try asking patient to take deep breath and try different positions. Flush briskly using 20ml sodium chloride. In a recently inserted line, check the position of the line on X-ray to ensure the end is not against a heart valve or has not moved. If position satisfactory, the problem may be due to a very small clot at the end of the line acting as a ball valve.
  - If this fails to restore flashback use a thrombolytic eg Urokinase 5000 units in 2ml per lumen (see Using Thrombolytics page 29) – except Paediatrics, Neonates & Dialysis patients: follow local guidelines.
  - If you have no time to wait for thrombolytic to work you can still use the catheter, but not if you are giving vesicants / irritant drugs. First test the catheter with 250ml 0.9% sodium chloride over 15 minutes (50–100ml in Paediatric patients). Arrange thrombolytic as soon as practicable.
  - If thrombolytic fails, see Using Thrombolytics (page 29).
**Catheter is sluggish** or there is only intermittent free flow of fluids.

**Possible causes:**
- Clotted blood in catheter
- Malpositioned catheter
- Build up of lipids (Parenteral Nutrition)
- Drug Precipitation
- ‘Pinch off’ syndrome
- **NB: In Implantable Ports** needle may be incorrectly positioned: check before taking any other action.

**Management:**
- Try asking patient to take deep breath and try different positions. **Flush briskly** using 20ml sodium chloride. **If this fails to restore function flashback use a thrombolytic** eg Urokinase 5000 units in 2ml per lumen (see *Using Thrombolytics* page 29) – except Paediatrics, Neonates & Dialysis patients: follow local guidelines.
- If thrombolytic fails, see *Using Thrombolytics* (page 29).

<table>
<thead>
<tr>
<th>Catheter is completely blocked.</th>
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<tr>
<td><strong>Possible causes:</strong></td>
</tr>
<tr>
<td>- Clotted blood in catheter</td>
</tr>
<tr>
<td>- Build up of lipids (Parenteral Nutrition)</td>
</tr>
<tr>
<td>- Drug Precipitation</td>
</tr>
<tr>
<td>- <strong>NB: In Implantable Ports</strong> needle may be incorrectly positioned: check before taking any other action. Consider using new needle.</td>
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**Management:**
- Consider changing bung/needle-free device
- Use 3-way tap technique to instil thrombolytic into catheter (see *Using Thrombolytics* page 29) except Paediatrics, Neonates & Dialysis patients: follow local guidelines.
- If lipids / drug precipitation suspected consult pharmacy advice for suitable agent to dissolve occlusion. Use 3-way tap technique to instil into catheter (see *Using Thrombolytics* page 29).

**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
- Separation of port and catheter (Implantable ports)
- **NB: In Implantable Ports** needle may be incorrectly positioned: check before taking any other action.

**Management:**
- Refer to IV Therapy Nurse Specialist / medical staff: 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 will usually be removed.
- **Neonates:** refer to Plastic Surgeon if extravasation occurs.
- Chemotherapy: follow Guidelines for the prevention and management of extravasation of Cytotoxic chemotherapy if extravasation occurs.
- If catheter is fractured or faulty complete Adverse Incident Form and retain the catheter to send to **IV Therapy Nurse Specialist** for return to manufacturer.
**Leakage from external portion of catheter** when flushed.

<table>
<thead>
<tr>
<th>Possible cause:</th>
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<tbody>
<tr>
<td>o External catheter fracture/ damage to external switch mechanism.</td>
</tr>
<tr>
<td>Management:</td>
</tr>
<tr>
<td>o Clamp catheter above leak to prevent air entry.</td>
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<tr>
<td>o Paediatrics follow Local Guidelines regarding prophylactic antibiotics.</td>
</tr>
<tr>
<td>o Catheter must be repaired or removed as soon as possible, contact the IV Therapy Nurse Specialist / medical team. Some catheters can be repaired if equipment &amp; expertise available. The advisability of repair will depend on the patient’s clinical status as it carries a risk of infection.</td>
</tr>
<tr>
<td>o Complete Adverse Incident Form and retain the catheter if removed to send to IV Therapy Nurse Specialist for return to manufacturer.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Cuff protrudes from exit site (tunnelled catheters)</th>
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<tbody>
<tr>
<td>Possible cause:</td>
</tr>
<tr>
<td>o Tissues within tunnel have failed to adhere to cuff &amp; catheter has migrated out.</td>
</tr>
<tr>
<td>Management:</td>
</tr>
<tr>
<td>o Stop any infusions</td>
</tr>
<tr>
<td>o Tape catheter firmly to skin at exit site</td>
</tr>
<tr>
<td>o Refer to medical staff for catheter removal.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Increase in external length of a PICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause:</td>
</tr>
<tr>
<td>o PICC has migrated out</td>
</tr>
<tr>
<td>Management:</td>
</tr>
<tr>
<td>o Do NOT push the catheter back in</td>
</tr>
<tr>
<td>o Neonates: discuss action with medical team.</td>
</tr>
<tr>
<td>o Other patients:</td>
</tr>
<tr>
<td>▪ If PICC has come out by less than 2cm, no action needed.</td>
</tr>
<tr>
<td>▪ If PICC has come out by more than 2cm, refer to specialist team who inserted the PICC. Examination of the post-insertion CXR may reveal whether or not the tip is likely to still be in an acceptable place. Otherwise a CXR will need to be carried out to check tip position.</td>
</tr>
<tr>
<td>▪ If PICC has come out by more than 10cm the PICC should be secured and not used and the IV Therapy Nurse Specialist contacted to replace it over a guidewire at earliest opportunity.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Swelling of shoulder, neck, arm or face, with or without pain, inflammation, distension of neck veins/peripheral vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible cause:</td>
</tr>
<tr>
<td>o Thrombosis.</td>
</tr>
<tr>
<td>o Surgical (subcutaneous) Emphysema.</td>
</tr>
<tr>
<td>Management:</td>
</tr>
<tr>
<td>o Refer to IV Therapy Nurse Specialist / medical staff for investigation of suspected thrombosis or surgical emphysema. It may or may not be possible to treat thrombosis without catheter removal.</td>
</tr>
<tr>
<td>o Thrombosis and infection often occur together so blood cultures may be necessary.</td>
</tr>
</tbody>
</table>
Patient with PICC develops pain, warmth, hardness and redness confined to path of vein.

<table>
<thead>
<tr>
<th>Possible cause:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Mechanical (or Infective) Phlebitis</td>
</tr>
<tr>
<td>o Thrombosis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Refer to IV Therapy Nurse Specialist or medical staff for investigation of suspected thrombosis (and/or infection). It may be possible to avoid catheter removal.</td>
</tr>
<tr>
<td>o In meantime, it may be worth trying heat packs, gentle arms exercises, NSAIDs (i.e. ibuprofen, diclofenac) and elevation of the arm. These sometimes resolve symptoms within 24 hrs.</td>
</tr>
<tr>
<td>o For a heat pack use 250ml bag of 0.9% sodium chloride that has been removed from outer packaging and heated for short (15 second) bursts (60 seconds maximum) in a microwave until warm but not too hot to place on tender skin – test on own forearm. Get patient to hold over affected area until bag cooled. Repeat TDS using a new unopened bag each time to prevent risk of infection.</td>
</tr>
</tbody>
</table>

Cardiopulmonary symptoms including any of the following: respiratory distress / failure apnoea, reduced o2 saturation levels, tachycardia, Bradycardia, hypotension, pallor, cyanosis, anxiety, chest pain, loss of consciousness

<table>
<thead>
<tr>
<th>Possible causes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Pneumothorax</td>
</tr>
<tr>
<td>o Air or catheter embolism</td>
</tr>
<tr>
<td>o Pulmonary embolism</td>
</tr>
<tr>
<td>o Cardiac tamponade / pericardial effusion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Call for medical assistance / Outreach / resuscitation team</td>
</tr>
<tr>
<td>o Administer O2</td>
</tr>
<tr>
<td>o Monitor vital signs</td>
</tr>
</tbody>
</table>

Palpitations / Abnormal ECG immediately post line placement

<table>
<thead>
<tr>
<th>Possible causes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Cardiac arrhythmias related to CVC tip placement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management:</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Call for urgent medical assessment</td>
</tr>
<tr>
<td>o Monitor vital signs</td>
</tr>
<tr>
<td>o PICCs: Pulling PICC out by 2cm may resolve the problem immediately.</td>
</tr>
</tbody>
</table>
### Appendix VI: Using Thrombolytics

<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
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<tbody>
<tr>
<td>30</td>
<td>What is a thrombolytic?</td>
</tr>
<tr>
<td>30</td>
<td>When should you use a thrombolytic?</td>
</tr>
<tr>
<td>30</td>
<td>What if the thrombolytic fails to restore function?</td>
</tr>
<tr>
<td>30</td>
<td>How to use a thrombolytic</td>
</tr>
<tr>
<td>31</td>
<td>Using a Thrombolytic in a Completely Blocked Catheter</td>
</tr>
</tbody>
</table>
What is a thrombolytic?

- A thrombolytic is a drug **capable of breaking up a thrombus**.
- **Urokinase** is the most common thrombolytic used for unblocking CVCs: 5000iu in 2ml per lumen.
- A thrombolytic must always be **prescribed**.
- **Heparin and Hepsal** are NOT thrombolytics: they are capable only of inhibiting thrombus formation.

When should you use a thrombolytic?

Outside of specialist areas or if you have not used a thrombolytic before please contact the **IV Therapy Nurse Specialist** Bleep 2370

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 failure to bleed back is the ONLY problem** then you can use the catheter but a Chest X-Ray should be carried out as soon as practicable to check the position of the line. However, if you are giving irritant / vesicant medication, you should test the catheter first by infusing 250ml 0.9% sodium chloride over 15 minutes (50 – 100ml in Paediatrics) and check position on Chest x-ray. If the patient experiences no discomfort during this time and there are no other complications, you can proceed.
- **If free-flow of fluids is still sluggish or intermittent or if resistance is still felt when flushing** despite use of a thrombolytic a Chest X-Ray +/- contrast should be carried out to check for malposition or kinking of the catheter.
- **Line may need replacing.**

How to use a thrombolytic

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

b) **Draw up the thrombolytic as per manufacturer’s instruction** eg for Urokinase: reconstitute 25,000 unit vial with 2ml water for injection and dilute further to 10 ml. Use 2ml (5000 units) per lumen.

c) **Instil the thrombolytic into the catheter and wait 1-2 hours.** 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** (page 31).

d) **Assess the catheter again.** NB if the thrombolytic cannot be withdrawn don’t worry: this very small dose can be flushed into the patient without danger unless the patient has severely deranged clotting or is on high doses of an anticoagulant.

e) **If full function has not returned** instil the thrombolytic again and leave in for longer – several hours or overnight if possible.

f) **If the procedure fails to restore function** consider whether lipids / drug precipitation could be causing a blockage. If not, refer to medical staff: Chest X-Ray may reveal malpositioned or catheter.
Using a Thrombolytic in a Completely Blocked Catheter.

(a) Attach 3-way-tap & syringes see right. (available from ITU)
(b) Open clamp (if there is one).
(c) Open stopcock to the empty syringe and the blocked catheter.
(d) Pull back on the plunger of the empty syringe to create a vacuum in the catheter. You will need to pull quite forcibly.
(e) 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.
(f) Leave for 1-2 hours. DO NOT CLAMP CATHETER as this will prevent the thrombolytic from penetrating into the line.
(g) After this time, attempt withdrawal of blood. If this is not possible, attempt to flush the catheter using 0.9% Sodium chloride in a 10ml syringe. Do not use excessive force.
(h) This procedure often needs to be repeated several times before it works: sometimes leaving the thrombolytic in overnight seems to help. Don’t worry about overdosing the patient: if the catheter is blocked they won’t actually have received any of the drug.
(i) If the procedure fails despite repeated attempts consult IV Therapy Nurse Specialist or medical team with a view to removing the catheter.
Appendix VII: Glossary of Complications

(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 person inserting the catheter is not always aware that this has happened, so it is essential to screen for pneumothorax by carrying out a routine CXR four hours after insertion.

A pneumothorax may be clinically silent and only noticed on the routine X-Ray, 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
Infection is the most common complication associated with central venous access and one of the most serious with estimated mortality rates ranging from 1 – 35%.

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: i.e. colonisation is either extraluminal or intraluminal. Extraluminal infections usually begin at the exit site and may remain confined to that area or may track along the catheter into the bloodstream. Intraluminal infections are caused by contamination via the hub of the catheter.

Exit site infections can often be treated successfully with antibiotics, especially in tunnelled CVCs where the vein and the exit site are separated by the tunnel. In non-tunnelled centrally inserted CVCs, however, treatment is less likely to be successful, as there is less distance between the exit site and the bloodstream. By the same token, infections in tunnelled CVCs involving the skin tunnel itself 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 Aseptic Technique. Intravenous tubing and stopcocks should be changed according the PHT Intravenous Therapy Guidelines. If Parenteral Nutrition is to be given, one lumen should be used exclusively for this purpose (except Neonates).

(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. It used to be thought that minidose Warfarin might reduce the risk of thrombosis in Cancer patients, but this has recently been disproved.
Patients who develop thrombosis are at increased risk of pulmonary embolism and infection. A large proportion of patients with CVCs have thromboses which are never detected. When a thrombosis does become symptomatic, it will usually cause swelling of the arm, neck and/or face. There may be associated pain, tingling or numbness, distended neck or peripheral veins. The presence of a thrombosis can usually be confirmed by use of Doppler ultrasound.

Unless the catheter is incorrectly positioned, it is often possible to treat a thrombosis using anticoagulants without removing the catheter. This is probably the best course of action for a patient who still requires a CVC, because taking the catheter out will expose him/her to the added risks of another catheter insertion, including, of course, thrombosis.

(iv) Mechanical Phlebitis (PICCs)
In PICC patients, so-called “mechanical phlebitis” is a well-known complication in the first 10 days following insertion, particularly in PICCs placed in the crease of the elbow. Experience in this Trust suggests that it seems to be much less likely in PICCs placed above the elbow. Mechanical phlebitis is probably caused by damage to the vein during insertion and movement of the catheter within the vein. The patient develops “pain, redness, warmth, venous cord (a hard, palpable, thrombosed vein), induration and swelling” along the path of the vein, usually within 14 days of PICC insertion. "Mechanical phlebitis" probably represents the first stages of thrombosis development but with careful management using heat to dilate the vein, gentle exercises and elevation of the arm may resolve the problem before a thrombosis occurs. It is possible that applying heat to the upper arm and ensuring adequate hydration during the first 14 days following PICC insertion may reduce the risk of mechanical phlebitis. This does not seem to be necessary with PICCs placed above the elbow.

(v) Air Embolism
An air embolism is a potentially fatal complication. It can happen at any stage if air is allowed to enter the catheter – eg 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.
As with pneumothorax, air embolism may be clinically silent or may be accompanied by any or all of the following: anxiety, cyanosis, dyspnoea, tachycardia, hypotension, chest pain, loss of consciousness and death.

(vi) Cardiac Arrhythmias
Atrial or ventricular arrhythmias can occur when the tip of the CVC is placed within the heart. In practice, CVC tips correctly placed in the right atrium rarely cause arrhythmias. PICCs are probably most likely to cause problems because the PICC can 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 palpitations or arrhythmias should be assessed by a medical team as soon as possible.

(vii) 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 cardiorespiratory 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.

(viii) Patency Impairment
Patency should be considered 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 with cannot then be easily rectified – eg complete blockage or thrombosis. The causes of patency problems include:

**Clotted blood within the catheter:** This can be avoided by good flushing techniques as described in these guidelines. When problems do arise, they can usually be solved relatively easily by use of a thrombolytic such as Urokinase: see *Using Thrombolytics* (page 29).

**Fibrin Sheath:** Fibrin sheaths are thought to occur in most CVCs left in place for over 7 days. 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 tissues. Fibrin sheaths are associated with an increased risk of infection as they provide an ideal medium for the proliferation of bacteria.

**Mechanical obstruction:** A mechanical obstruction can occur internally or externally. Internal obstruction may be due the catheter being incorrectly positioned: e.g. there is an internal kink or the tip of the catheter is resting against a vessel wall rather than floating free within the bloodstream (see *Incorrect Position* below). This might be because of poor insertion technique, or it might be that the catheter was put in correctly but has subsequently become dislodged. 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, consult Medical/Pharmacy advice for a suitable agent to dissolve occlusion.

**(ix) 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 Vena Cava 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 be the result of poor insertion technique 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.” 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\textsuperscript{19,50}. 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 tunnellled CVC protrudes from the exit site\textsuperscript{51}.

A malpositioned, kinked or pinched catheter should be repositioned, replaced or removed as soon as practicable (except PICCs and in Neonates in certain situations discussed below). Leaving it in place for any length of time represents a high risk of thrombosis and/or catheter fracture / 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\% sodium chloride and then repeating the X-ray as the PICC will often move into the Superior Vena Cava\textsuperscript{52,53}. Discuss with the person inserting the PICC and patient's medical team.

NB In Neonatal care if a PICC has become displaced it may sometimes be appropriate to leave the catheter in situ and use as a peripheral catheter. Discuss with the baby's medical team.

(x) 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 (Diagram 6). If the needle is not inserted far enough into the port or if the needle misses the port altogether fluids/drugs may be 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 BNHFT Guidelines for the prevention and management of extravasation of Cytotoxic chemotherapy.\textsuperscript{54}

(xi) 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).

An external 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 to prevent air embolism. Sometimes the catheter can be repaired or replaced over a guidewire but the advisability of this will depend on the patient's clinical status. In addition, 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 itself will
embolise. If this occurs there may be no symptoms at all or there may be signs of pulmonary embolism. i.e. acute onset of any or all of the following - anxiety, pallor, cyanosis, shortness of breath, rapid weak pulse, hypotension, chest pain, loss of consciousness.

(xii) Separation of port and catheter (in Implantable Ports)
This is rare 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 (xi) above) there is a risk that the catheter may embolise. Surgical removal or repair of the port and catheter is essential if separation is confirmed.

(xiii) Surgical (Subcutaneous) Emphysema
If air enters the tissues of the body, particularly in the loose cellular tissue immediately under the skin, its presence is detected by a crackling sensation as the skin surface is palpated. The area of surgical emphysema may spread with alarming rapidity beneath the skin over the chest, extending well up into the neck and down onto the abdominal wall.

Surgical emphysema usually occurs after an invasive procedure and is a rare but distressing complication of CVC placement.
VAD Insertion and Management Form

Patient

Hospital Number

Date of Birth

Consultant

Date & time inserted

By

Signature

Date & time of removal

By

Signature

Ward/ Theatre/ED

CONSENT

Informed □ Implied □ Unable □

INSERTION REASON

IV Antibiotics □ Medications □ TPN □

Blood Sampling □ Blood Products □ CVP Monitor □

Chemotherapy □ Other □

ADHERED TO

Hand Hygiene □ Gown & Gloves □ Skin Prep □

Aseptic Technique □ Sharps Disposal □ Dressing □

Local Anaesthetic □

X-RAY REQUESTED AND REVIEWED Yes □ No □

ULTRASOUND GUIDANCE

Type of Line

- Quad Lumen CVC □
- Dual Lumen CVC □
- Hickman line □
- Vascath □
- Arterial line □
- Subclavian and Internal Jugular sites are preferable
- Single lumen catheters are preferable to multi-lumen catheters
- Dedicated lumen required for TPN

Please mark successful CVC placement with an X and failed placement with an F

Removal Reason

- Not required □
- Leaking □
- Lumen Blocked □
- Site Infected V.I.P. □
- Score on removal □

COMMENTS

Affix Central Line Sticker Here:

DO NOT REMOVE PICC LINES ON D7
# VAD Insertion and Management Form

**Basingstoke and North Hampshire NHS**

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<th>Time</th>
<th>Clinical Indication</th>
<th>Site inspected</th>
<th>V.I.P. Score</th>
<th>Dressing Intact</th>
<th>Administration set replacement</th>
<th>Aseptic access</th>
<th>Initial &amp; Date</th>
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**DO NOT REMOVE BICC LINES ON DAY**

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**DO NOT REMOVE BICC LINES ON DAY**
Appendix IX: References

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