West Yorkshire & Harrogate Cancer Alliance

Regional Chemotherapy Nurses Group

Guidance for the Management of Central Venous Access Devices for Adults

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i Document Control

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ii Information Reader Box

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1 Introduction

The Manual of Cancer Services (Department of Health (DH 2011)) states that guidance for the care of central venous access devices (CVAD) including management of line complications should be available in all Chemotherapy Services. These guidelines remain within the remit of the West Yorkshire & Harrogate Cancer Alliance, Regional Chemotherapy Nurses Group (RCNG).

The guidance provides recommendations for practice as opposed to step by step procedures. Procedures can be agreed at local level with involvement of all relevant personnel.

A quick reference troubleshooting guide is supplied in Appendix 9.1.

There are a number of different types of CVAD produced by different companies. It would make the guidelines lengthy to address all the specific requirements for each line. CVAD's used across the region are specific to each individual Trust. Local information should reflect the specific requirements of CVAD's used in their clinical area.

This guidance should be used in conjunction with the local policy/guidelines for management of CVADs along with the regional policy for Administration of Systemic Anti-Cancer Treatment (SACT).

These guidelines will inform decision making but are not intended to replace clinical judgement in individual cases.

1.1 Objectives

The key objective of the guidance is:

To provide uniform evidence based guidance across the region for safe and effective CVAD management.

2 Scope

The guidelines are predominately aimed at nurses caring for oncology or haematology adult patients within the RCN, but it is recognised they may be of benefit to other health professionals.

- Peripherally inserted central catheters (PICCs; open-ended or valved (Groshong)
- Long term tunnelled catheters (e.g. open-ended or valved (Groshong)
- Implanted port systems (e.g. Portacath)

These guidelines do not address insertion of CVADs.

3 Evidence Review

The evidence base for this document is

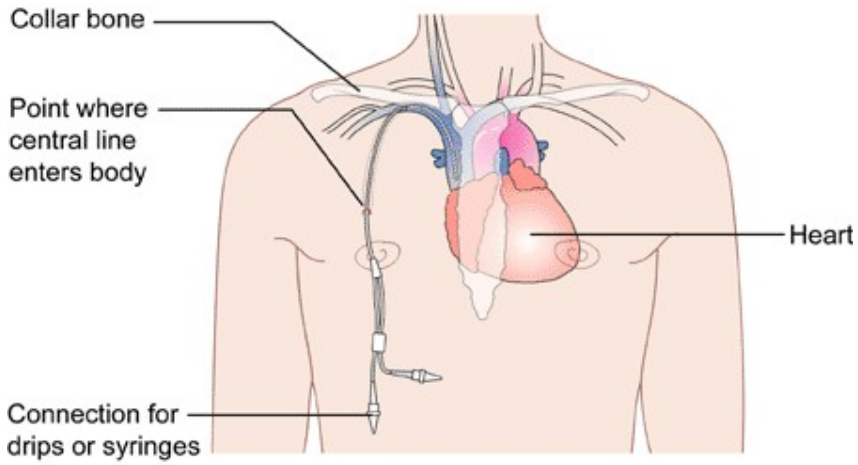
- Epic3 guidelines
- Saving Lives Central Venous Catheter Care Bundle (2006)
- NHS Evidence
  http://www.evidence.nhs.uk/search.aspx?t=central%20venous%20catheters&AspxAutoDetectCookieSupport=1
- Royal College of Nursing issued 'Standards for Infusion Therapy 2010
- Nivas – www.nivas.org.uk
- Plus other references cited in the document

Medline, Cinahl and Cochrane were searched when further clarification was required. Members of the group appraised the evidence. If no evidence could be located expert opinion of the group members and that of the RCNG were drawn upon.

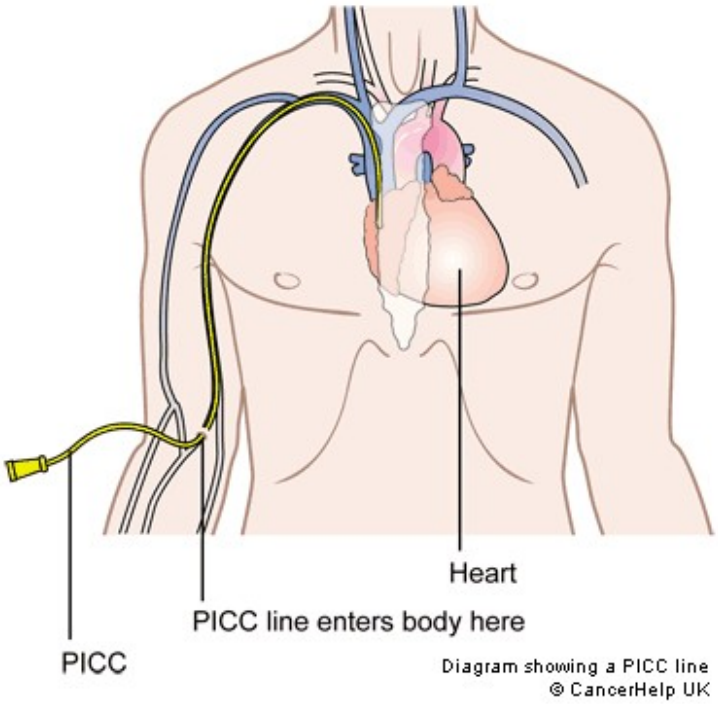
4 Guidelines

4.1 Catheter Selection

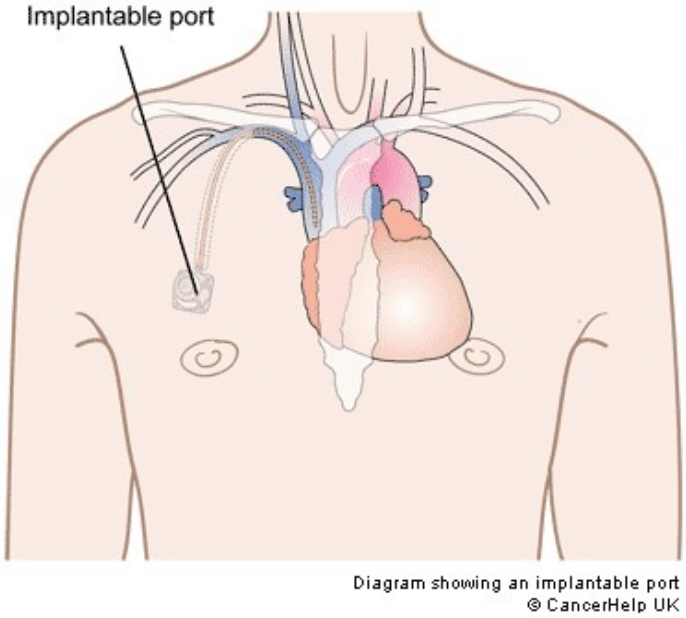
There are 3 types of CVAD commonly used within Oncology & Haematology.



Tunnelled line (e.g. Hickman)



Peripherally inserted line (PICC)



Implanted port (e.g. Portacath)

Selection of the best method of venous access is the starting point of the episode of care for all patients receiving Systemic Anti-Cancer Treatment

Individual circumstances should be taken into account when deciding which CVAD is going to be used.

4.2 General Asepsis

Good standards of hand hygiene and aseptic technique are vital to reduce the risk of infection (EPIC3, 2014).

1. An aseptic technique must always be used for accessing CVAD's
2. Aseptic Non-touch Technique (ANTT) alone may used
3. Before accessing or dressing a CVAD hands must be cleaned by washing with an anti-microbial soap and water.
4. Aseptic technique, including the principle of non-touch technique, must be employed to ensure that equipment which comes into direct contact with infusate remains sterile. This includes:
    - Needles
    - Syringe tips
    - Intravenous line connections
    - CVAD lumens
5. Gloves should always be worn when accessing lines for the prevention of blood borne pathogen exposure (CDC 2002; EPIC3, 2014)
6. On removing gloves at the end of the procedure, hands should be washed with soap and water.

4.3 Catheter Site Dressings

It should be noted there may be two dressings in place after insertion of a tunneled line, entry site and exit site. The entry site dressing is generally removed within 48 hours and the suture is left exposed. The exit site dressing generally stays in place until the wound has healed.

Sutures from lines should be removed as per local protocol from cancer centre/unit. On tunneled lines, after the sutures are removed (or dissolved) from the exit site a dressing is no longer required unless it is the patient's/ carer preference.

After CVAD placement, the following dressings are recommended (EPIC3,2014):

- All inclusive sterile dry dressings (e.g. primapore, softpore) or Sterile transparent semi permeable polyurethane dressings.
- If blood is oozing from the catheter site sterile gauze should be applied secured by a semi permeable dressing. Gauze dressings should be changed every 24 hours whilst oozing is present.
- Gauze dressings should be replaced with a transparent dressing as soon as possible after oozing has stopped.
- Transparent dressings should be changed every 7 days, when they are no longer intact or moisture collects under the dressing.
- Dressings can be removed from tunneled lines when the exit sutures have been removed/dissolved and the site is healed. The line should be looped and secured to prevent pulling.
- Self-adhesive anchoring devices or Securacaths can be used to secure the line and prevent migration or pulling (Dougherty & Lamb 2008) on both PICC & open ended skin tunneled catheters. Please note: it is best practice that a PICC

always has an anchoring device.

There is currently no evidence that demonstrates one dressing is preferable to another in reducing infection rates (Maki et al 1991, Gillies et al 2003). However polyurethane dressings have the advantage that the line can be seen through the dressing and fully secured.

Impregnated dressings (Chlorhexidine) are available. EPIC3 (2014) identified one systematic review and meta-analysis into CHG-impregnated sponge dressings and concluded that they were effective in preventing CR-BSI and catheter colonisation (Chan et al,2012) but didn't recommend them as a standard

4.4 Cleaning Solutions

Microorganisms that colonise catheter hubs and the skin surrounding the CVAD insertion site are the cause of most catheter related blood stream infections. Skin cleansing and antisepsis of the insertion site is therefore one of the most important measures for preventing catheter related infections (EPIC3, 2014).

1. An alcoholic chlorhexidine gluconate solution (2% chlorhexidine gluconate in 70% isopropyl alcohol) should be used to
    - clean the catheter insertion site during dressing changes
    - decontaminate skin prior to port needle access.
2. Cleaning of the hub should be performed for 30 seconds and allowed to air dry (Dougherty & Lamb 2008).
3. Individual single use sachets of antiseptic solution or individual packages of single use antiseptic impregnated swabs or wipes should be used to disinfect the insertion site EPIC3, 2014).
4. Do not apply antimicrobial ointment to catheter insertion sites as part of routine catheter site care (EPIC3, 2014).

4.5 Accessing the CVAD

1. Prior to flushing, the exit site should be checked for any signs of infection and possible line migration. Assess the patient for
    - Pain in tunnel site, neck, shoulder or chest
    - Swelling of chest wall, arm, neck
    - Shortness of breath
    - Line migration (i.e. line longer at exit site than it was on insertion)

If no problems are identified proceed.

2. A single patient use application of 2% chlorhexidine gluconate in 70% isopropyl alcohol (wipe) should be used and allowed to dry when decontaminating the injection port / needle free device / catheter hub before and after it has been used to access the system.
3. Do not allow organic solvent-based solutions to come into contact with the catheter

tubing.

4. Catheter patency can be checked prior to administration of drugs by attaching a 10mL luer lock syringe containing 10 mls of 0.9% Sodium Chloride and aspirating back to obtain a 'flash back'. Please note this is essential prior to administration of Systemic Anti Cancer Therapy (SACT).
5. RCNG group advocates as best practice that prior to accessing a CVAD that hasn't been accessed within the last 7 days that 5 to 10mLs of blood is withdrawn in a 10mL syringe and discarded.
6. Needle free devices should be used for line access.
7. The needle free components should be changed every 7 days.
8. Ensure that all components of the system are compatible and secured, to minimise the leaks and breaks in the system.
9. Flushing with 10mls 0.9% sodium chloride should be performed between and after administration of drugs to prevent mixing of drugs/ solutions (RCN 2010).

4.6 Intravenous Administration Sets

1. It is best practice that administration sets are maintained as a closed system.
2. Administration sets should be replaced every 72 hours.
4. Administration sets used for Total Parenteral Nutrition (TPN) infusions should be changed every 24 hours.
5. If an administration set becomes disconnected it must be replaced regardless of the time in use.

4.7 Syringe Size

- Syringes for administering drugs through a CVAD should not be any smaller than 10mls.

4.8 Taking Blood Samples

1. When sampling a line for routine blood a discard of at least twice the line volume should take place (approximately 5-10mL).
2. If obtaining blood for cultures, the initial blood withdrawn from the CVAD gives important microbiological information and therefore should not be discarded.
3. If other blood samples are to be taken at the same time as culture samples, the culture sample must always be taken first.
4. The catheter should be flushed after the sample has been taken.
5. If a blood sample is to be taken from a CVAD which has recently been used for the administration of drugs or fluids, then care must be taken to ensure that inaccurate results are not obtained. If this is the only route from which to obtain the blood sample then the infusion should be stopped and at least 10mLs of blood withdrawn and discarded before aspirating the blood sample (RCN 2010, Dougherty & Lamb 2008).
6. Please note if the patient has a double lumen CVAD and one lumen is available for sampling than care must be taken to ensure that any blood sample doesn't become contaminated by any infusion being administered via the other lumen. Any infusion

should be stopped; IV giving set clamped and CVAD lumen clamped before proceeding to obtain the blood sample from the other lumen.

4.9 Maintaining Catheter 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.

1. Prior to flushing the exit site should be checked for any signs of infection and possible line migration. Assess the patient for;
    - Pain in tunnel site, neck, shoulder or chest
    - Swelling of chest wall, arm, neck
    - Shortness of breath
    - Line migration (i.e. line longer at exit site than it was on insertion)

If no problems are identified proceed;

2. Lines should be flushed/locked off on completion of IV therapy.
3. Lines not in use should be flushed at least weekly apart from port a caths which can be flushed monthly
4. The volume of flush should be twice that of the catheter; 10mls 0.9% Sodium Chloride is usually sufficient.
5. The pulsated flush technique should be used to flush; this creates turbulence within the catheter lumen, removing debris from the internal catheter wall (Goodwin and Carlson 1993, Todd 1998).
6. The flush should be finished with positive pressure. This prevents the reflux of blood back into the lumen (INS 2000, Dougherty & Lister 2008). Maintain pressure on the plunger of the syringe until it is removed (or whilst applying the clamp on Hickman lines or portacaths).
7. Heparin is no more beneficial than flushing with sodium chloride 0.9% alone (NICE 2003; EPIC3,2014). Practice varies: refer to local policy.
8. Each lumen of the line should be treated separately

4.10 Management of Blocked CVAD's

If resistance is felt when flushing a CVAD, the guidance below should be followed.

- Check obvious causes for a blockage (Kinked line, clamped)
- Check for a positional cause (seating position, deep breathing, coughing)
- Try aspirating vigorously with a 20ml syringe.

If the CVAD is still blocked, seek advice from an experience practitioner, who should:

- Assess for pain, swelling or discomfort at the entry site/neck/chest/arm.
- Assess for line migration

A Chest x-ray should be requested if either of the above are present. Then:

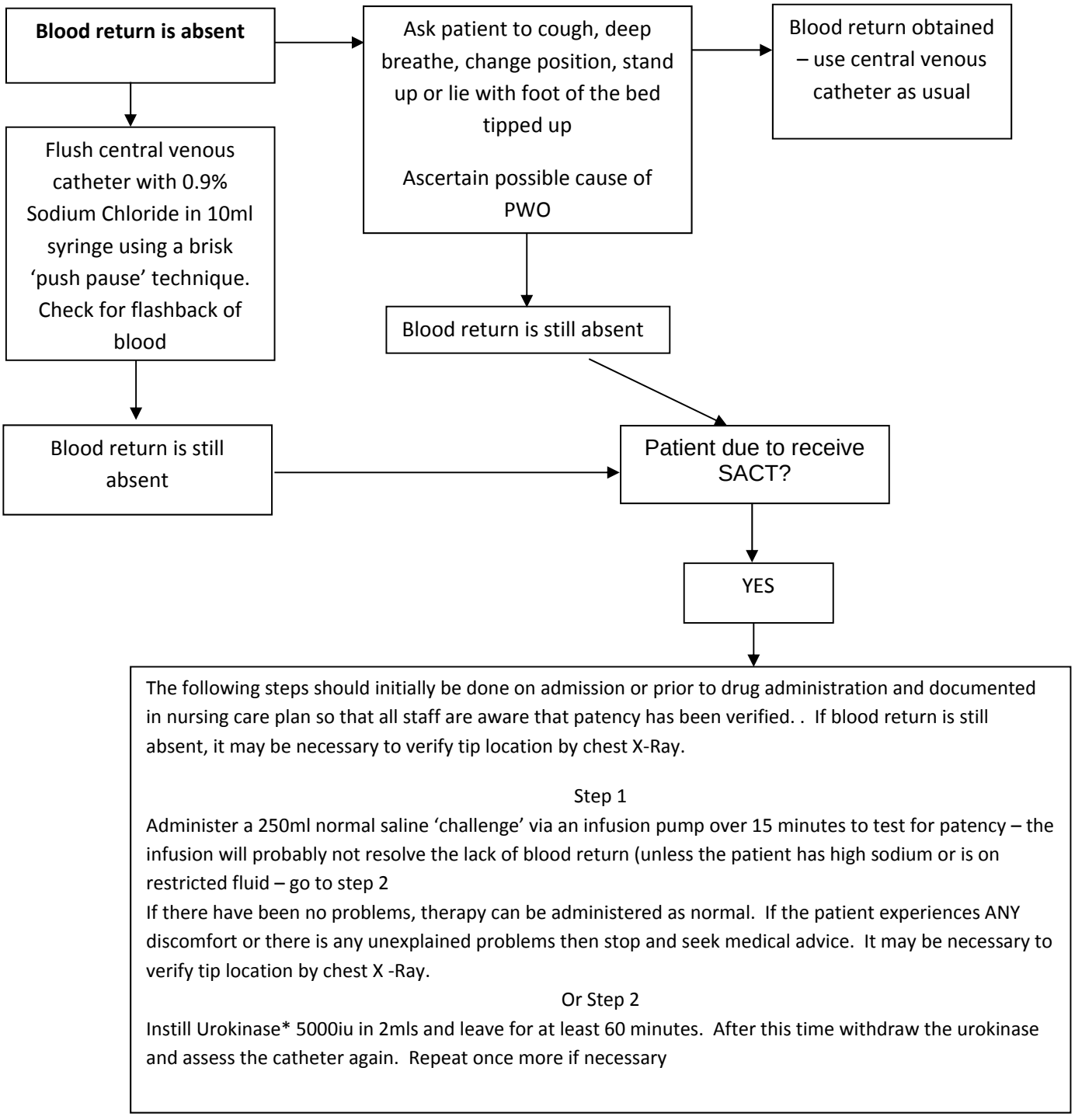
- Assess for pinch off syndrome in Hickman lines – consider removal, discuss with the practitioner who inserted the line.
- Assess for malposition – remove line if not in the correct place.

- Assess whether blockage has been caused by a drug or TPN. If this is the cause of the blockage use a precipitate clearing agent according to manufacturer's instructions.
- Check if there is any line discomfort or malposition – if NOT, Urokinase (or Trust approved equivalent) can be prescribed and used, as per local policy.
- If the line is still blocked after two attempts at using Urokinase (must be prescribed) - remove the line.

4.11 Persistent Withdrawal Occlusion (PWO)

Definition: Fluids can be flushed / infused freely but blood cannot be withdrawn. This is usually either due to tip position against a vessel wall, or the formation of a fibrin sheath over the tip of the line.

The following algorithm is recommended if PWO is present (adapted from the Royal College of Nursing 2016)



*Urokinase needs to be prescribed (or Trust approved alternative)

4.12 Line-associated infection indications

1. Inflammation or discharge at exit site, with or without tracking up the line
2. Fever, rigors, sepsis, especially those related to line flushing
3. A high index of suspicion of line-associated infection should be maintained in cancer patients with a line and a fever but without an obvious source, especially if the patient does not respond to apparently appropriate antimicrobial therapy.
4. Blood cultures which grow bacteria frequently associated with line infection, such as coagulase-negative staphylococci and diphtheroids, may indicate infection of a line. Cultures positive for other types of bacteria or yeasts where there is no immediately recognisable focus of infection may indicate infection of a line.
5. Resolution of signs or symptoms of infection following line removal provides circumstantial evidence of a line-related infection; however culture of the tip following removal of the device may give a definitive answer.
6. A line infection should be considered in cancer patients with a CVAD where there is no other obvious source.

Suspected infection in long term lines should ideally be established via microbiological diagnosis through blood cultures, obtained aseptically from each lumen and from a peripheral vein.

Exit site swabs can be beneficial if there are localised signs of infection i.e. erythema or discharge at the exit site.

Removal of the central should only be done when;

1. A definitive microbiological diagnosis has not been achieved and line infection cannot be excluded
2. There is a tunnel infection or
3. In cases of infection with particular microorganisms such as Pseudomonas aeruginosa, Bacillus spp., fungi and mycobacteria.

Line salvage may be possible using antibiotic or alcohol locks. Senior expert microbiology advice should be sought. Local protocols should be agreed for management of line infections.

4.13 Management of Damaged Catheters

When the external portion of a CVAD is damaged, the device may be repaired according to the manufacturer's guidelines, within the cancer centre or unit using aseptic technique and observing universal precautions (Reed and Philips 1996).

All damaged CVADs should be referred immediately for expert advice from operator/inserter of device or a senior clinician.

1. Immediate management of damaged catheter: clamp between the break and skin to avoid back bleeding and air entry into the negative pressure central veins. If clamp unavailable pinch the catheter between the finger and thumb or use a device to 'kink' it e.g. paper clip.

2. Establish what fluid is leaking. If cytotoxic follow local guidance (hazardous waste/ spillage policy) to manage the spillage. Take all necessary measures to protect the patient, carer and staff.
3. If the CVAD has a clamp, move it to a point above the point of leakage.
4. Switch off and disconnect any infusion device.
5. Patients with damaged CVADs should not be discharged home with a temporary clamp in place due to risks of bleeding or air embolism.
6. Document incident in patient's notes

When the external portion of a CVAD is damaged, the device may be repaired according to the manufacturer's guidelines, and using a 'Repair' kit provided by the manufacturer. This should always be undertaken using aseptic technique and observing universal precautions. CVADs that can be repaired include some (sliastic) PICC's and tunnelled central catheters.

4.14 Catheter related thrombosis

The presence of a CVAD in a vein can result in damage to the lining and thrombosis formation.

Thrombus can occur in large vessels after long term catheterization in patients.

4.14.1 Symptoms

- Pain, swelling and oedema in the neck and upper limb.
- Distension of peripheral, neck and chest veins.

4.14.2 Diagnosis

Doppler ultrasound or contrast venography.

4.14.3 Management

- Patients diagnosed with a CVAD related thrombosis should be anticoagulated usually this is with low molecular weight heparin.
- The line can usually be left in situ and continue to be used. Advice on this should be sought from an experienced practitioner.

4.15 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 carers need to be confident and proficient in infection prevention practices and be aware of the signs and symptoms of infection (EPIC3, 2014).

1. All health care professionals using and caring for CVAD should be trained and assessed as competent to do so.
2. Patients and carers should be taught how to safely manage their CVAD and written

guidance should be provided. Ongoing support should be available.

3. All patient and carers should be educated on potential line complications and how to access support inside and outside of normal working hours.
4. There should be clear local guidelines relating to the education and ability of patients and carers accessing and flushing their lines.

4.16 Education and Training

Health professionals must be able to demonstrate their competency before accessing/ managing CVAD. Local training and competencies should incorporate these guidelines and include the following;

- Accountability and responsibility in relation to CVAD care and use.
- Anatomy and physiology of venous system and CVAD.
- Maintenance and safe use of lines including infection control policy and procedures.
- Common complications and how to manage them.
- Information and educational needs of patients and carers.
- Understanding of the physical and psychological impact on patient and carers.

5 Dissemination

Following ratification by the Regional Chemotherapy Group the guidelines will be made available to each Lead Cancer Nurse in the acute Trusts and the West Yorkshire & Harrogate Cancer Alliance for circulation via their established routes.

The document will be held on the West Yorkshire & Harrogate Cancer Alliance - Sustainability and Transformation Partnerships website.

Each Lead Chemotherapy Nurse will be expected to work with relevant parties to ensure the guidance is adopted into clinical practice.

6 Monitoring/ Audit

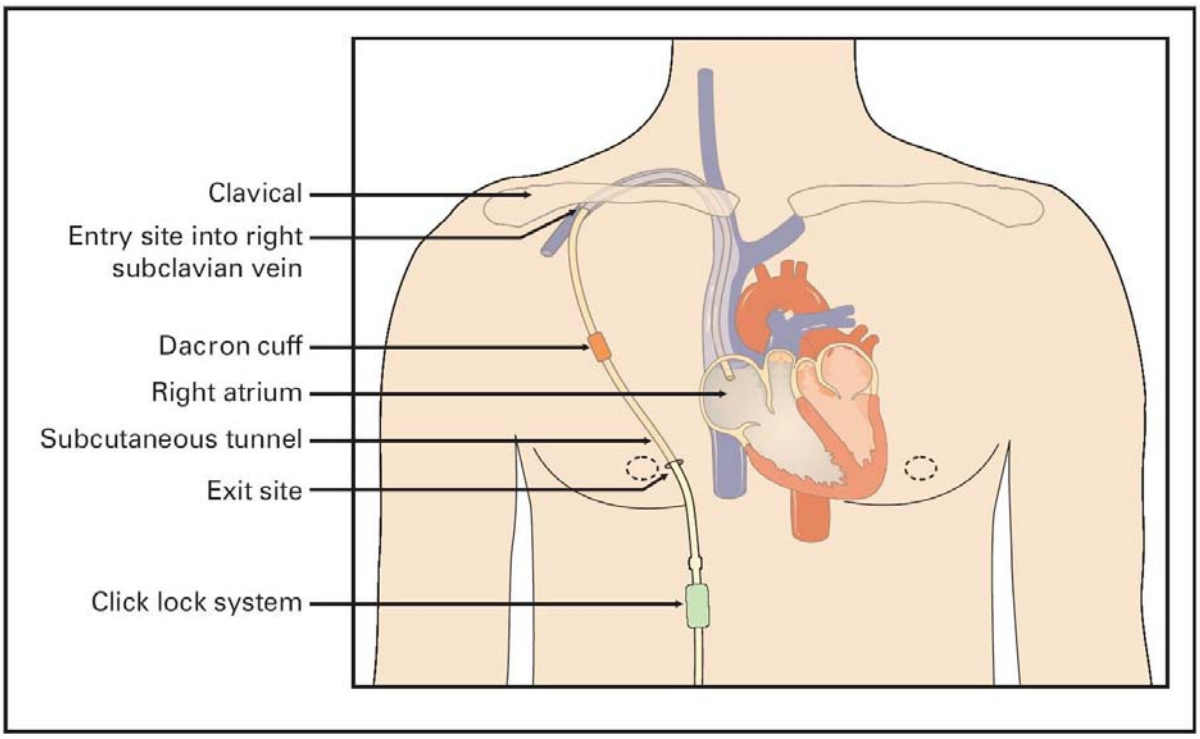
Audits should be agreed and facilitated by lead nurses to measure compliance against the guidance within their area. The frequency of audit should be determined by clinical need, an annual audit is recommended.

Where new evidence affects the content of this guidance, the regional Chemotherapy Group will develop an addendum document which will be communicated locally and submitted to WY&HCA.

7 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, Groshong – 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. Portacath – 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 key parts 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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9 Appendices

9.1 Trouble Shooting

A Quick Reference Guide for Managing Problems with CVAD's

Presenting symptom/s	Potential problem	Possible cause	Recommended actions
Chest pain Dyspnoea Tachycardia/ irregular pulse Hypotension	Air embolism or Atrial fibrillation	Air entering the venous system during insertion or catheter use	Seek urgent medical advice/emergency admission
Pain on inspiration and expiration, dyspnoea	Pneumothorax	Air entering the space between the plural lining and the lung	Seek urgent medical advice/ emergency admission
Tingling Loss of movement down part or all of the affected limb Shooting pain	Nerve injury	Damage to the nerves in the local area can occur	Contact the cancer centre/unit for medical advice
Coughing Ear/ neck pain on the side of insertion/ palpitations or arrhythmia's Inability or difficulty aspirating blood. Swelling of neck, chest arm or leg. Shoulder tip pain	Catheter malposition	Catheter in the wrong place	Contact the cancer centre/unit x-ray may be required
Swelling of neck, chest, arm or leg Skin discoloration Skin temperature changes Infusion difficulties Inability to aspirate blood	Thrombosis in vein	Thought to be caused by damage to vein wall causing the release of thromboplastic substances that cause platelets to collect at injury site. These may grow into a larger thrombus or small bits break away and cause occlusion of a vessel elsewhere	Seek urgent medical advice/ emergency admission
Pain redness along the vein, tracking and swelling: For PICC lines – if post 10days insertion consider whether chemical phlebitis or infection. Mechanical phlebitis less likely after 10 days insertion	Mechanical phlebitis/ infection	Irritation of the vein due to movement of the catheter in the vein (not associated with tunnelled CVAD's but can occur with PICC's)	Ensure the line is appropriately secured. If less than 10 days ensure the patient is applying heat packs as advised. Refer to Cancer centre/unit for advice, may require anti-inflammatory or antibiotic medication

Presenting symptom/s	Potential problem	Possible cause	Recommended actions
Continuous back flow of blood into the catheter	Blood present in the lumen of the catheter	Fault in catheter, or line flushed incorrectly	Flush the line using correct technique. If back flow continue seek advice from the Cancer Centre/unit
Inability to flush the line	Catheter occlusion	Line adhered together near clamp. Line kinked or twisted. Clot or fibrin sheath in catheter. Drug precipitate blocking catheter Lipids from TPN feed blocking catheter.	Refer to the Cancer Centre/unit who will assess
	Pinch off syndrome	When the catheter is compressed between the clavicle and the first rib	Refer to the Cancer centre/unit who will assess
Difficulty in aspirating blood	Catheter occlusion	Line adhered together near clamp. Clot or fibrin sheath in catheter. Line kinked or twisted. Drug precipitate blocking catheter Lipids from TPN feed blocking catheter.	Refer to the Cancer centre/unit
	Pinch off syndrome	When the catheter is compressed between the clavicle and the first rib.	Refer to the Cancer centre/unit who will assess
	Fibrin sheath formation	Sheath has formed around the catheter tip.	Cancer centre/unit to consider venogram to confirm patency dependant on the chemotherapy regimen. Medical consultation required.
Redness and tracking at site. Purulent discharge at site.	Infection at insertion site	Infection at insertion site.	Refer to the Cancer Centre/unit,
Pyrexia of unknown origin, rigors. These may occur up to one hour after line has been flushed and should be investigated	Infection associated with the catheter	Infection	Refer to the cancer centre/unit. Inform the theatre where the line was placed.
Leakage from the catheter when used. Damage visible	Damage to catheter	Use of a sharp object near the catheter or movement twisting of the catheter (PICC's are vulnerable to fracture). High pressure on the syringe as injecting into the catheter.	Refer to the cancer centre/unit for advice. (NB Many CVAD's can be repaired by cancer centre/ unit)

Presenting symptom/s	Potential problem	Possible cause	Recommended actions
Line appears longer at the exit site or the cuff is visible. On measurement the length is on longer than upon insertion.	Line migration (Common problem for PICC's)	Can occur with general activity, caution should be taken when removing dressings specifically PICC's not to pull the line.	Refer to the cancer centre/unit for advice. X- ray to confirm the catheter tip may be required.
Skin changes at insertion site - thickening of skin at point of insertion pink/ red in colour.	Skin over granulation	Unknown - possibly due to inflammatory response of injured tissue, as prolonged and excessive inflammation can lead to over granulation (Dunford et al 1999) The presence of a foreign body interfering with healing may also contribute (Harris and Rolstad 1994	Discuss with the cancer unit/ centre. A change of dressing may be indicated. Polyurethane foam dressings e.g. Lyofoam are suggested for over granulation (Harris and Rolstad 1994).