Guideline for the Insertion, Care and Removal of a Non-Tunnelled Central Venous Catheter (CVC) (Adult).

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Approved by:	NHS Lothian Vascular Working group		
Approval Date:	Click here to enter a date.		
Author/s:			
Executive Lead:			
Target Audience:	Registered Health Care Professionals (HCPs) are defined as a medical practitioner, registered nurse or other practitioners employed by NHS Lothian who are involved in the care of patients with central vascular access devices (CVAD), specifically non tunnelled short term CVC and who have been assessed as competent to care for this patient group.		
Supersedes:			
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Version Control

Date	Author	Version/Page	Reason for change
October 2019	NHS Lothian Vascular Access Working group	1	To update previous documents

Contents

1 Purpose

This guideline has been developed to promote and standardise the safe use, care and management of short-term non- tunnelled central venous catheter (CVC) delivered by registered Health Care Professionals (HCPs) in NHS Lothian. The guideline content is based on current best available evidence and recommendations for the management of a Central Vascular Access Devices (CVAD).

2 Scope

The guideline applies to all registered health care professionals (HCPs) defined as a medical practitioner, registered nurse or other practitioners employed by NHS Lothian who care for patients with a short term non tunnelled central venous catheter. Delivery of care should be performed by appropriately trained HCPs who have successfully undertaken the appropriate NHS Lothian training or equivalent and who have been assessed as competent in the practice of care of a CVC. The guideline should be used in conjunction with other relevant guidelines and standards including aseptic non touch technique (ANTT) and Standard Infection Control Precautions (SIPCs).

3 Roles and responsibilities

- **Health Care Professionals (HCP)** Each individual practitioner is accountable for their practice. HCPs should ensure they have the underpinning knowledge about the device, can demonstrate the required level of competency in the delivery of care, maintenance, and recognition of potential complications. HCPs should be aware of the need to request expert advice and assistance and where to access this.
- **Ward Managers and Clinical Leads** are responsible for overseeing the implementation of the guideline within their area of responsibility and ensuring staff operate within their scope of clinical practice.
- **Multi-disciplinary Vascular Access Device (VAD) Working Group** is responsible for communication, monitoring, update and review of the guideline.
- The HCPs in both hospital and community settings will work within the requirements and boundaries of their professional regulatory body and NHS Lothian employment policies and procedures.

4 Education and Training

NHS Lothian HCPs involved in the insertion, care and maintenance of any central vascular device including CVC device, should complete the NHS Lothian CVAD education programme or equivalent, and a period of supervised clinical practice and competency assessment. Prior to attending the CVAD training programme, HCP's must have successfully completed the NHS Lothian Intravenous Therapy training programme. The competency assessments for IV therapy and CVAD should be reviewed every 2 years.

5 Definitions

For the purpose of the document the following terminology will be used throughout the guideline:

- Short –term non–tunnelled central venous catheter (CVC)
- Aseptic Non Touch technique (ANTT)
- Central Vascular Access Devices (CVAD)
- Health Care Professionals (HCPs)
- 2% Chlorhexidine Gluconate /70% isopropyl alcohol (2% CHG /70% IPA)

Total Parenteral Nutrition (TPN)

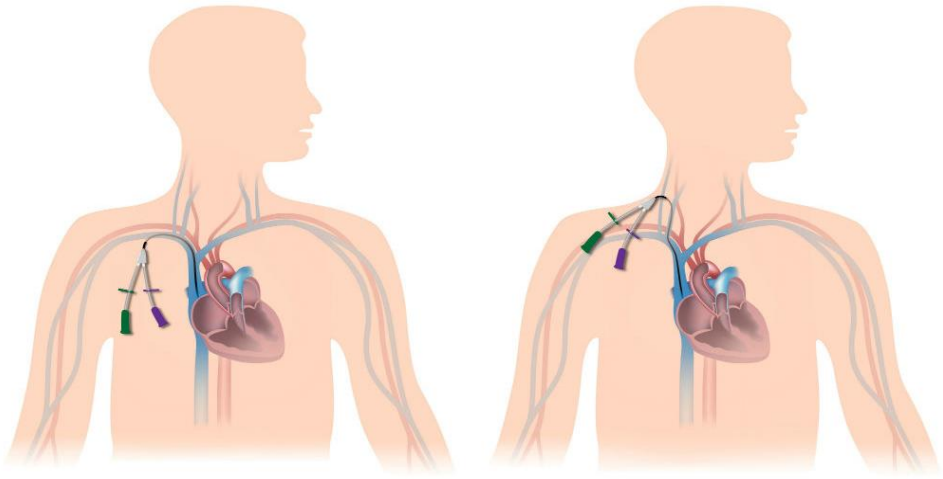
The term Total Parenteral Nutrition (TPN) is used when no significant nutrition is obtained by other routes. The term Parenteral Nutrition is used when nutrition is partially enteric. For the purpose of this document the term Total Parenteral Nutrition (TPN) will be used when referring to the administration of intravenous nutrition.

6 Description, clinical indications and contra-indications

6.1 Overview

Non- tunnelled short-term percutaneous Central Venous Catheter (CVC) are placed in the large veins of the central venous system, where the catheter tip resides in the lower third of the superior vena cava (SVC). A CVC provides temporary central venous access for acutely ill patients requiring administration of emergency intravenous fluid replacement; vesicant, irritant, hyperosmolar solutions; medications and monitoring of central venous pressure. CVCs are primarily used in clinical areas such as the emergency department, theatre, critical care and occasionally ward areas. Non-tunnelled short-term CVC use is associated with increased risk of infection, particularly if dwell times exceed the recommended period or care is suboptimal.

Figure 1: Non-Tunnelled Percutaneous Central Venous Catheter (CVC)



6.2 Product Description

CVCs are radio-opaque and made of polyurethane material which softens on insertion. CVC products are available with coated impregnated anti-microbial agents such as silver sulfadiazine and chlorhexidine which are intended to provide protection against catheter related blood stream infection. Customised kits are available which contain most of the products required for CVC insertion. Impregnated anti-microbial catheters are contraindicated in patients with known hypersensitivity or allergies to these agents.

6.2.1 Catheter Size and Length

CVCs are available in a range of sizes (French Gauge) and lengths. The choice of catheter will be made at the time of insertion based on the requirements for the individual patient.

6.2.2 Lumens

Usually up to four lumens are available which are colour coded and have clamps attached. The catheter is open ended and each lumen exits at a staggered position along the catheter. Each lumen provides independent access to the venous circulation and therefore enables the concurrent administration of several infusions and incompatible drugs. Each lumen should be assigned a designated use and labelled accordingly, to ensure consistency and optimal delivery of care. A designated lumen for Total Parenteral Nutrition (TPN) should be identified at the time of CVC insertion. In NHS Lothian the lumen is identified with a green Curos cap over the needle-free connector. The lumens are engraved proximal, medial and distal by the manufacturer.

6.2.3 Example of four lumen designations in Critical Care:

Proximal lumen: Bolus medications, blood product administration, blood sampling.

Medial lumen 1: TPN.

Medial lumen 2: Vesicant medications, crystalloid.

Distal lumen: Central venous pressure monitoring, irritant or vesicant medications, high volume fluids.

Alternatively, general clinical areas, may choose to label the lumens as follows (Lumen 1, Lumen 2, Lumen 3, Lumen 4) for the delivery of designated intravenous therapy.

6.2.4 Dwell Time: Short term: 7-10 days - refer to manufacturer instructions.

6.3 Clinical Indications

- Monitoring of central venous pressure (CVP).
- Administration of known vesicant, hyperosmolar or irritant medications including inotropes.
- Administration of Total Parenteral Nutrition
- Administration of high-volume fluid replacement.
- Provide access for temporary transvenous cardiac pacing.

6.4 Contra-indications/Considerations

There are few absolute contra-indications to central venous catheterisation, however care must be taken in patients who are anticoagulated, have significant respiratory compromise, hyperkalaemia, anatomical or pathological conditions affecting access to the neck veins or subclavian veins or thrombosis of the major chest veins.

6.5 Chlorhexidine Allergy

Medical devices (central venous catheters) and medical products (antiseptic solutions - ChloraPrep, antimicrobial dressings) containing Chlorhexidine carry a risk of allergy including life-threatening anaphylaxis. If an acute unexplained anaphylactic reaction occurs within one hour of a

chlorhexidine impregnated central catheter placement, immediate consideration should be given to the catheter removal.

Pre-Procedure

Check with the patient for allergies or known hypersensitivity to Chlorhexidine products. If a patient is susceptible to skin irritation, an appropriate alternative antiseptic should be considered to clean the insertion site (e.g. povidone iodine in alcohol). Prior to the use of medical products and devices e.g. CVAD's, labels and instructions should be checked to establish if they contain chlorhexidine.

Allergic reactions to products containing chlorhexidine should be reported to the MHRA.

https://www.gov.uk/drug-device-alerts/medical-device-alert-all-medical-devices-and-medicinal-products-containing-chlorhexidine-risk-of-anaphylactic-reaction-due-to-chlorhexidine-allergy.

7 Aseptic Non-Touch Technique (ANTT)

Aseptic Non Touch Technique (**ANTT®)** is a framework that standardises the procedures for maintaining aseptic technique. ANTT® should be applied to all procedures related to Vascular Access Devices from, insertion through to ongoing care and management, intravenous drug administration and infusions. The ANTT® approach involves a set of principles, rules, specific practices and procedures to support safe best practice for aseptic technique including, Non-Touch Technique (NTT), Standard Infection Control Precautions; hand hygiene, Personal Protective Equipment (PPE), aseptic field management and sterile supplies. The aim of ANTT® is asepsis

ANTT® Three Practice Terms explained

1. **Key Parts** are the critical parts (sterile) of the procedure equipment (e.g. tips of syringes, needles, spike of administration set, infusion solutions, decontaminated needle free connector.
2. **Key Sites** are any break in the patient's natural skin integrity that provides a direct route for the entry for micro-organisms (e.g., CVAD insertion site, surgical wounds, leg ulcer).
   Non-Touch technique (NTT): NTT is the action, technique and skill required to **NOT** touch the **Key Parts** and **Key Sites** during the clinical procedures. If a **Key Part** or a **Key Site** need touched sterile gloves must be worn. ***ANTT® involves the protection of Key Parts and Key Sites from contamination from microorganisms during clinical procedures.***

ANTT® Aseptic Fields - Two Types

1.General Aseptic Field: A decontaminated procedure tray or trolley or single use procedure kit /barrier that is used for simple procedures of short duration (e.g. administration of intravenous medications). **Key Parts** are managed individually with sterile caps and covers known as micro-critical aseptic fields

2. Critical Aseptic Field is used for invasive, complex procedures e.g. PICC line insertion. A large sterile drape/barrier is placed on a decontaminated trolley to protect the sterile procedure equipment placed on it which are managed collectively. Maximum barrier precautions are used to maintain asepsis (sterile gown, sterile gloves, mask, theatre cap).

The ANTT® Approach to Clinical Procedures - Two Types

1. **Standard -ANTT®** is used for technically simple clinical procedures of short duration that involve few and small Key Parts. A General Aseptic Field (decontaminated blue tray or trolley) is used Non-sterile gloves are worn (sterile gloves worn if the **Key-Parts** or **Key-Sites** need touched).
2. **Surgical -ANTT®** Used for technically complex procedures of long duration (>20minutes) that involve open Key Sites and a large number of Key Parts e.g., CVAD insertion. A Critical Aseptic field is used with maximum barrier precautions.

Five Actions for Safe ANTT® during clinical procedures

1. **Pre-Procedure Risk Assessment** to select the requirement for Standard or Surgical ANTT.
2. **Environmental Management**: remove or avoid contamination risks, work area visible clean.
3. **Decontamination and Protection:** Identify the type of infection control measures including barrier precautions, PPE required.
4. **Aseptic Field Selection and Management** of the General OR Critical Aseptic fields and **NTT**
5. **Preventing Cross Infection:** Safe clinical waste disposal, effective decontamination of equipment and hand hygiene.

8 Insertion

CVC insertion is normally performed in the operating theatre, Critical care, Emergency department and occasionally in a general ward area. It is preferable that the procedure is performed in a dedicated procedure room to minimise the risk of contamination. Fluoroscopy and/or portable ultrasound equipment should be available to provide guidance to locate vein and verify needle/guide wire catheter placement in the vessel.

8.1 Patient assessment/considerations prior to the procedure

- A full assessment of the patient's past medical history and current medications should be performed to identify factors that could influence alternative site for insertion.
- Pre procedure blood samples including electrolytes, full blood count, coagulation screen.
- The site of other lines or devices such as pacemakers.
- Provide patient information about the device including reasons for insertion, potential risks, and techniques that maybe required during the procedure including the Valsalva manoeuvre and supine position for the procedure (where appropriate).

8.2 Insertion site and Veins

- CVC are placed in large veins of the central venous system including:
  - Jugular - internal or external
  - Subclavian vein
  - Femoral vein (avoided where possible)

8.3 Procedure

- CVC is inserted using Surgical ANTT/ critical aseptic field and maximum barrier precautions (surgical scrub, theatre cap, mask, sterile gown, sterile gloves, sterile body drapes).
- It is recommended placement of CVC is undertaken using fluoroscopy and or ultrasound guidance to locate vein and verification of needle/guidewire/catheter in vessel.
- Patient is placed in the supine or Trendelenburg position (patient lies flat with the head lower than the feet) to promote venous engorgement for cannulation and reduce the risk of air embolism.
- Single use application 2% chlorhexidine / 70% isopropyl alcohol antiseptic agent (ChoraPrep 3mls) is used to clean the skin at the catheter insertion site (or

  Povidone iodine in alcohol where chlorhexidine sensitivity is present).
- There are one-centimetre markers on the external catheter surface to guide correct placement of the catheter tip.
- The distal tip of the catheter is positioned in the lower third of the superior vena cava (SVC).

- ❖ Insertion procedure should be in accordance with the specific manufacturer's instructions.

8.4 Immediate Securement of CVC catheter following placement

The catheter is secured with non-absorbable sutures and a specialised dressing.

8.5 Immediate post insertion CVC care

All lumens have primed needle free connectors (e.g. smart sites) applied and should be bled and flushed with sodium chloride 0.9% for injection 10mls.

8.6 Dressing following CVC placement

A CVC dressing should offer: full insertion site visibility, easy application and removal, catheter securement, secure adhesion to the skin and act as a barrier to microorganisms, yet be permeable to skin moisture and provide for patient comfort. All dressings should be kept clean dry and intact.

Type of dressing	1. **A sterile, transparent semi – permeable, film dressing** should be applied to cover the PICC catheter insertion site e.g. 3M™ Tegaderm™ IV Advanced Securement. 2. **A Sterile Gauze Dressing** under a sterile transparent semi-permeable dressing should be used **ONLY** in the presence of profuse perspiration, bleeding or oozing at the insertion site post insertion. Change the gauze dressing to a sterile transparent semi-permeable film dressing as soon as possible when the site is dry.
	
Refer to point 10.2 for maintenance dressing	

8.7 Confirmation of CVC catheter tip position

Assessment of catheter tip position may include, post- insertion chest x-ray and real-time fluoroscopy. A CVC should not be used until the distal tip position is confirmed and as directed by the responsible clinician. Baseline external markings on the CVC should be recorded to compare with future daily comparisons and at dressing changes.

8.8 Immediate post CVC insertion Care - Ward Area

Record Observations/NEWS2:

Perform recordings according to the clinical condition of the patient.

Routine NEWS 2 /observations should coincide with inspection of the insertion site every **30 minutes for 2 hours** and then **every 4 hours**.

Insertion site: Inspect the insertion site for bleeding, excess swelling **every 30 minutes for 2 hours** and then **every 4 hours**.

8.9 CVC Insertion related Complications

Bleeding /Haematoma at insertion site	Cardiac Arrhythmias
Pneumothorax /Haemothorax	Nerve Injury
Air embolus	Catheter tip misplacement /migration
Inadvertent Arterial access	Pain or swelling due to extravasation

8.10 Documentation of a CVC Insertion Procedure

Entry into medical records should include the follow:

Reasons for insertion of a CVC	The use of imaging
Medications administered, pain relief, local anaesthetic	Confirmation of CVC tip position
Description of the procedure, insertion site and the specific vein accessed	TPN lumen identified with Curos cap
Unexpected problems encountered during insertion and complications	Name and designation of the clinician
Type of dressing applied, date and time on label.	
Brand name, size/gauge, length, number of lumens, Lot/batch number and expiry date.	

9 Care and Maintenance of CVC

Maintenance and care of the CVC involves the delivery of evidence based care, at regular frequent intervals, to maintain catheter patency and prevent complications.

This includes the following:

Syringe size and type	Administration set changes
Assessing catheter patency	Total Parenteral Nutrition (TPN)
Maintenance flushing and technique	Personal Hygiene,
Infection prevention and control	Monitoring for potential complications
Management of catheter insertion site	Patient Education
Dressing changes	Needle free connector and cleaning
Needle free connector and cleaning	Daily assessment of CVC and recording (CVC Care Bundle)

9.1 Syringe Size

A 10ml Luer-lock size syringe or above (not less than10mls) should be used for accessing a CVC. A Small syringe size of less than 10mls generates high pressures within the catheter lumen that could potentially lead to catheter fracture or rupture. A Luer lock syringe prevents accidently disconnection during use, possible spray from the solution and potential contamination of the syringe tip and needle free connector.

9.2 Assessing Catheter Patency - blood return

- Routine assessment of CVC function involves checking for brisk blood return/flash back to confirm catheter tip placement and patency prior to each and every access by withdrawing 3-5mls blood.
- If resistance is met or if blood return is absent, **DO NOT USE**, follow the trouble shooting protocol and apply the appropriate interventions to restore patency prior to use.
- An alternative unused patent lumen may be used for treatments meantime.

9.3 Maintenance Flushing

Optimum flushing of a CVC is an essential requirement to maintain catheter maintenance and function and prevent catheter associated complications such as thrombosis, partial or total obstruction and infection. Intra-luminal catheter obstruction can result from precipitation of incompatible medications/solutions, parenteral nutrition and blood clots that adhere to the internal surface of the catheter wall and catheter tip. All of these will shorten the working life of the CVC. Optimum flushing technique can also minimise the potential risk of intra-luminal bacterial adhesion and colonisation that can lead to biofilm formation and catheter-related blood stream infection (CRBSI).

9.3.1 General Flushing principles

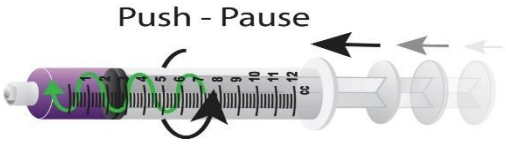
- **Syringe Size:** No smaller than a 10mls Luer-lock syringe is used when accessing the catheter. Smaller syringes generate excessive pressures and could lead to catheter fracture.
- **Flushing Solution & Volume:** 10mls sodium chloride 0.9% for injection.
- **Recommended volume** of flushing solution should be equal to at least twice the internal volume of the catheter and all add on extensions (if used). The regular flushing volume may need reviewed where there are requirements for a restricted fluid intake.
- **Multiple Lumens:** each lumen must be managed separately for bleeding flushing and locking
- **Frequency of Flushing**: flush each unused lumen **every 7 days** when not in regular use. Frequency should be increased if there are catheter patency problems.
- **Incompatible medications or infusions:** Flush the catheter lumen with a minimum of 10mls sodium chloride for injection, before and after the medication or infusion to avoid incompatibility and precipitation.
- **Warning**: In the presence of a potent medication in the catheter lumen e.g. following disconnection of an infusion or bolus injection, withdraw and discard residual 3-5mls of fluid / blood from the lumen prior to flushing, to avoid bolus dose injection and possible side-effects.
- **Resistance:** never forcibly flush the lumen in the presence of resistance. Forceful flushing can cause dislodgement of a thrombus from the internal catheter wall into the blood stream or cause a catheter fracture. Check for any mechanical related causes; kinked catheter, closed clamps, and consider repositioning patient (follow troubleshooting guide).
- If blood is visible in the needle free connector after flushing, replace it to reduce the risk of microbial contamination.

9.3.2 When to flush a CVC:

- **Flush after** blood withdrawal to confirm catheter patency.
- **Flush prior to** infusion and bolus injection to confirm catheter patency (pre-flush).
- **Flush after** completion of each infusion and bolus injection to clear catheter of residual medications and solutions.
- **Flush in between** multiple drug IV bolus injections (to prevent drug incompatibility and precipitation). Flush initially at the same rate of the prescribed medication to avoid the patient receiving a bolus of the drug.
- **Flush at regular intervals** to ensure catheter patency and to clear catheter of residual medications and solutions.

9.3.3 Flushing Technique – create a turbulent flow

*(The "**push – pause"** technique is designed to **create a swirling or turbulent flow** and assist with the removal of blood residue, medication precipitate, fibrin from the internal catheter wall and prevent occlusion).*



- Use a pulsating movement ***push –pause / stop-start technique*** when flushing
- Flush the lumen/s briskly by injecting 1ml boluses at time (10 x1mls) pausing briefly (1 second) between two boluses.
- Effectively clear the hub of any blood or residue. Use an additional sodium chloride 0.9% flush 10ml for injection as necessary.
- Complete the procedure using a **"positive pressure"** or **"locking technique"**

9.3.4 Positive Pressure or Locking Technique

Locking a catheter creates a column of fluid inside the lumen to maintain patency. Locking involves the mechanical technique of applying positive pressure to the syringe whilst injecting a locking solution (sodium chloride 0.9% for injection) to prevent reflux of blood in the catheter lumen and formation of fibrin sheath resulting in catheter occlusion.

- **To lock the catheter:** maintain a positive flush pressure on the syringe plunger, clamp the lumen, whilst simultaneously injecting the last 0.5 - 1ml of flushing solution. Remove the syringe.
- A locking solution of heparinised saline should **NEVER be** used with a non-tunnelled short-term CVC.

9.3.5 Clamping Sequence for CVC

- Clamp the catheter lumen before removing the syringe.
- Unclamp the catheter after the syringe is attached to access the lumen.
- Ensure all lumens are clamped when not in use on a multi-lumen CVC.

The Procedure for Bleeding and Flushing can be accessed via the Procedure Documents web page on this NHSL intranet Vascular Access Devices website. Quick Troubleshooting Guide and or Algorithm and can also be accessed via the Troubleshooting web page.

10 Catheter Site – Infection prevention, skin cleaning and dressing

10.1 Infection Prevention and Management

One of the major complications associated with any vascular access device is catheter related blood stream infection which can be life threatening. A key quality indicator in the management of all vascular access devices is the measurement of infection rates. The delivery of care is directed towards preventive measures, early recognition and prompt treatment should infection occur.

Preventative strategies

1. Maximum barrier precautions during insertion (Surgical ANTT)	2. Standard infection control precautions (SIPS)
3. Pre –procedure Key-Part/Site risk assessment to select appropriate ANTT technique (Standard or Surgical)	4. Adherence to the principles of ANTT during each and every access of the PICC line.
5. Avoid intermittent disconnection of administration sets and excessive manipulations of catheter lumen/s	6. Effective application of dressing, replace when compromised
7. Effective decontamination of needle free connection and replace when compromised.	8. CVC care bundle to standardise care delivery
9. Pulsatile flushing and positive pressure locking technique.	10. Patient education on infection risks and prevention

10.1.1 Suspected Infection

Infection of a CVC can be classified as local insertion site infection and systemic infection.

1. Local CVC insertion site

This is defined as the presence of local inflammation, redness, pain exudate, tenderness, or oedema and should be managed as follows:

- Obtain a wound swab for culture and sensitivity
- Escalate to the medical team
- Blood cultures taken peripherally (first) and then from one CVC lumen may be considered
- Increase monitoring of NEWS 2, ongoing and observations of symptoms
- Administer any prescribed anti-microbial therapy.
- CVC may be removed depending on medical assessment.

2. Systemic Infection/Sepsis

Clinical signs of systemic infection include pyrexia, hypothermia chills/rigors, tachycardia, malaise, hypotension raised or low WCC, NEWS 2 score greater than 5.

Management should be as follows:

- Prompt escalation to the medical team.
- Follow **Sepsis 6** protocol.
- Administer prescribed anti-microbial therapy.
- Increase monitoring of NEWS 2 and ongoing close observations of symptoms.
- Take Blood cultures peripherally (first) and then normally from one CVC lumen.
- Removal of CVC should be considered and the catheter tip should be sent for microbiological analysis.

10.1.2 Cleaning CVC insertion site

- Loose blood or exudates should be removed first using a sterile gauze swab and sterile sodium chloride 0.9% solution.
- Clean around the CVC insertion site with a single use application of 2% chlorhexidine/70% isopropyl alcohol (ChloraPrep) using cross hatch method (up and down back and forth motion) for a timed period of 30 seconds.
- Where there is allergy to chlorhexidine, replace with Povidone iodine in alcohol.
- Clean the area the size of the final dressing around the catheter.
- Allow the site to air dry completely before applying the dressing (may take up to 3 minutes)

10.2 Dressing

Apply the principles of ANTT by risk assessing the technical difficulty of the dressing change to determine Standard or Surgically ANTT. CVAD changes typically require Surgical ANTT (critical aseptic field, dressing pack, sterile gloves) since there are usually a number of **Key parts** and **Key sites** to manage aseptically including: site cleaning, application of new sterile dressing and fixation device.

Maintenance Dressing Guidance

Skin Antisepsis **at each dressing change** 	Clean insertion site and surrounding skin with single use application of 2% /70% of isopropyl alcohol e.g. ChloraPrep using cross-hatch or up and down technique. Where there is allergy to chlorhexidine, replace with Povidone iodine in alcohol

Maintenance Dressing (Insertion site) 	**A sterile, transparent semi-permeable, film dressing** should be used to cover the CVC insertion site e.g. 3M™ Tegaderm™ IV Advanced Securement Dressing.
Routine Frequency of dressing change	– Semi-permeable transparent film dressing - change every 7 days. – **Sterile Gauze Dressing** if used should be replaced with a transparent film dressing as soon as possible. A sterile gauze swab under a sterile transparent film dressing is considered a gauze dressing and must be **replaced every 24 hours.**
Replace all dressing types when	– The integrity of the dressing is compromised. – The outside of the dressing is visibly soiled, blood stained, damp, non-adherent or loosened. – There is accumulation of moisture, blood or drainage under the dressing. – There are signs of infection at the insertion site (redness, pain, exudate).
Date and time all dressing changes on label provided	

Scissors, scalpel or sharp instrument must **NEVER** be used near a CVAD to prevent inadvertent damage to either the catheter or lumen/s and the potential risk of air embolus. Lumens should never be wrapped with swabs and tape for any purpose. Unique Luer-lock caps (e.g. CUROS caps) should be used to identify the unused designated lumen for the administration of TPN.

10.2.1 Chlorhexidine Gluconate Impregnated (CHG) Dressings

This type of dressing covers the catheter insertion site and continually releases chlorhexidine over a period of up to seven days. They are designed to prevent and reduce bacterial skin colonisation at the insertion site and leading to catheter related blood stream infection (CRBSI). This type of dressing may be considered in selected patients where there is a high potential risk of infection. CHG sponge or gel dressings should be avoided in patients susceptible to skin irritation.

10.2.2 CHG dressing are available in two types:

3M™ Tegaderm™ Semi – permeable, polyurethane self-adhesive dressing incorporating a chlorhexidine gel patch.	
Single use BioPatch chlorhexidine sponge disc, secured with a separate transparent semi-permeable film dressing	

11 Needle-free Connector, Intravenous Administration sets and Total Parenteral Nutrition

11.1 Needle-free Connector

Needle-free access devices are self-sealing bungs which are designed to reduce catheter related blood-stream infection and needle-stick injuries. All needle-free connectors whether single, double and with or without an extension line must be primed before use with sodium chloride 0.9%. There are a range of needle free devices available and the manufacturer`s recommendations should be followed about the number of times they are accessed before replacement and the priming requirements before connection to a vascular access device. Needle-free connectors are recognised as a prime site for microbial contamination and must be thoroughly cleaned (for the recommended period of time) prior to each and every access and allowed to air dry. Needle-free access devices must never be pierced with a hypodermic needle as this can cause leakage and potential infection. There are a range of needle-free connectors available and this determines the clamping and disconnection sequence to be used. In NHS Lothian e.g. the BD Smart Site needle free connector is used, which is a negative-fluid displacement device, that requires positive – pressure flushing and a pre disconnection clamping technique. **Needle free connector (NFC)** **Clean NFC for 15 secs**

Figure 5: Needle free connector

Needle free connector (NFC) **Device Wipe** **Clean NFC for 15 secs**

11.1.1 Principles of care

- Effective hand hygiene and appropriate PPE should be used prior to all access of the needle-free connector.
- Follow the principles of ANTT during all needle-free connector access
- "**Scrub the Hub"** is the preferred or recommended technique for cleaning the needle free connector
  - Thoroughly clean /scrub the surface connection, tip/septum with friction.
  - Use multiple parts of single use 2% chlorhexidine /70% isopropyl alcohol device wipe.
  - Clean for **15 seconds** and allow to air dry at least **30 seconds** before each and every access of a lumen. *(A clean swipe of the HUB is not sufficient to prevent colonisation by micro-organisms).*

11.1.2 Replacement of a Needle-Free connector

- Check the catheter is securely clamped before removing the existing needle-free connector.
- Clean the outside of the existing needle-free connector with 2% chlorhexidine /70% isopropyl alcohol device wipe before removing it.
- With a new device wipe, thoroughly clean the external threads and groves of the catheter lumen for at least **15 seconds** and allow it to air dry **for 30 seconds.**
- Maintain an aseptic non-touch technique to prime the needle-free connector with sodium chloride 0.9% flush and connect it to the catheter lumen. Follow the procedure for bleeding and flushing as before.

The integrity of the needle - free connector should be examined before and after use and replaced as follows:

- if the needle-free connector is removed for any reason (**never** re-use the same connector).
- if there is residual blood or debris within the needle free connector.
- if an occlusion is suspected.
- If the connector is visibly contaminated and soiled (with debris or blood stained) the procedure for replacing a new sterile connector should be followed before proceeding with any catheter access.

The needle-free connector should be replaced **every 7 days** when not in regular use and or in accordance with the manufacturer's instructions**.**

The Procedure for changing the needle free connector can be accessed via the Procedure Document web page on this NHSL intranet Vascular Access website.

11.2 Intravenous Infusion Administration Sets

- Follow the principles of ANTT during all episodes of care associated with the infusion including priming, connection, disconnection of intravenous administration and extension sets.
- Administration sets are single use and should be discarded when disconnected.
- Intravenous administration sets should **not** be intermittently disconnected including during patient personal care or left hanging unconnected to the CVC line since this will increase the potential risk for contamination, the introduction of infection and occlusion
- Any change of any administration sets should include a change of add on devices e.g., extension set.
- Follow NHS Lothian policy for clearly labelling administration sets and drug additives with the date and time when an infusion is started.
- Sodium Chloride 0.9% of up to 20mls maybe required to optimally flush the lumen following disconnection of some infusions e.g. TPN or blood.

Frequency of Administration set changes can be accessed via the Procedure Document web page on this NHSL intranet Vascular Access website

11.3 Total Parenteral Nutrition (TPN)

- Follow the principles of ANTT during all TPN access procedures.
- Select Standard or Surgical ANTT according to the risk assessment and technical difficulties in achieving **Key-Part, Key-Site** asepsis protection, when priming, connecting, flushing and discontinuing a PN infusion. Surgical ANTT will require sterile gloves /sterile dressing pack.
- On CVC insertion, one lumen should be exclusively identified by the presence of a unique Luer-lock cap e.g. a Curos Cap (green) on the needle-free connector. This lumen should **only** ever be used for the administration of TPN in order to prevent catheter related infection.
- The administration set should be changed every 24 hours or when a new bag is started.
- The TPN lumen should be flushed with sodium chloride 0.9% 10mls on completion of the infusion.
- An additional 10ml volume of flush maybe required to fully flush the lumen.

Figure 7: Curos Cap

11.4 Blood Sampling

- Obtaining blood samples from a short –term non tunnelled CVC is **NOT** recommended due to the potential risk of catheter occlusion and an increased risk of microbial colonisation of the lumen.
- Obtaining blood samples from a CVC should only be taken in very exceptional circumstances where all other routes are exhausted.

The Procedure for obtaining blood samples from a CVAD can be accessed via the Procedure Document web page on this NHSL intranet Vascular Access website

11.5 Daily Assessment of CVC

The purpose of a daily assessment is to inspect, monitor and evaluate the CVC for potential complications including: patency, position, function and the ongoing medical requirement for the catheter. Assessments may need to be carried out more frequently based on the dependency of the patient and the therapeutic interventions.

Daily CVC Assessment should include:

- **Review and record daily** the need for the CVC. It should be promptly removed by appropriately trained staff when there is no longer a clinical requirement for it.
- **Inspect the catheter insertion site** and surrounding skin through the transparent dressing for signs of redness, swelling, moisture, leakage, and localised infection. Check with the patient for the presence of pain or tenderness.
- **Examine the integrity of the catheter** for kinks, breaks, cracks or faults.
- **Establish when the dressing should be changed**. Ensure the dressing is dry, clean and intact. Follow the guidelines for the use of the recommended dressing type and the frequency of dressing changes. Replace it promptly when the integrity of the dressing is compromised.
- **Check the CVC** is secure with the non-absorbable stitch/es.
- **Examine the integrity of the needle-free connectors.** If visibly soiled or contaminated, replace the connector.
- **Assess external length of the catheter** and at each dressing change the. An increase or decrease in external catheter length from initial placement should be recorded and escalated to medical team prior to ongoing use.

11.6 Documentation

The CVC maintenance care bundle should be completed and recorded daily in the patient's medical records as follows:

Ongoing requirement for the CVC	Date of last flushing and locking if not in use
Assessment of insertion site –signs of infection	Any extension set used – date last changed
Needle free connector integrity - date last changed	Pain or discomfort expressed by patient
Security of holding suture	Patient response to treatment
Type of dressing and date changed	Observation of external catheter length
Date and time of CVC removal and if tip sent for microbiological analysis	

12 Personal Hygiene and Patient Education

12.1 Personal Hygiene

- The dressing (including polyurethane types) should not be immersed or submerged in water to reduce the risks of contamination of the dressing and showering is preferable to a bath if the patient is mobile.
- Replace the dressing promptly if it becomes wet, damp or soiled.

12.2 Patient Education

- Explain the purpose of the CVC to the patient
- Inform the patient (where appropriate) of the precautions required to prevent infection, including hand hygiene and refraining from handling or touching the catheter and dressing.

13 Removal of a CVC

A CVC should be removed as soon as it is no longer clinically required. Removal of the CVC is performed by a practitioner who has attended the NHS Lothian CVAD training programme or equivalent and whose competency is up to date with current practice.

Pre-Procedure

- Optimise the procedure area by removing and avoiding any environmental risks
- Encourage the patient to practise the Valsalva manoeuvre prior to the removal of the CVC. This involves the patient taking a deep breath in, holding it, bearing down or breathing air out with mouth and nose closed against a closed glottis.

Pre procedure assessment

- History of complications associated with the CVC.
- History of bleeding and assessment of bleeding risks.
- A review of relevant medications and anticoagulants that could affect haemostasis.
- Check recent blood results and coagulation screen, as clinically indicated. Seek expert medical advice if blood results are abnormal which may cause issues with the CVC removal.

Peri-Procedure

- Procedure is performed using surgical ANTT/critical aseptic field.
- The patient is placed in the supine or Trendelenburg position (lying flat with one pillow with the head of the bed lower that the feet) to reduce the risk of air embolism during removal of the CVC.
- Optimise patient comfort and administer prescribed analgesia as required.
- The insertion site should be cleaned with single use 2% chlorhexidine/70% isopropyl alcohol e.g., ChloraPrep and allow to air dry.
- Sutures are removed
- The patient should perform Valsalva manoeuvre whilst the CVC is being removed
- On removal, immediate digital pressure is applied to the insertion site with a sterile gauze dressing **for at least 5 minutes** and until any bleeding stops
- An air-occlusive dressing should be applied for up to 36 hours and until the insertion site is healed.
- **Do not remove** the CVC if the patient is unable to perform Valsalva manoeuvre and lie in the Trendelenburg position without advice and input from the medical team.

Post-Procedure

- Optimise patient comfort and administer prescribed analgesia as required.
- The patient should **remain on bed rest for up 2 hours**, initially lying flat for **one hour** (not in Trendelenburg position) before gradually sitting up and remaining in bed for another hour or longer as their clinical condition indicates.
- Monitor NEWS2 according to local protocol **every 15 minutes** for the first hour, then every **30 minutes for 1 hour** and then every hour **for 2-4 hours**.
- Inspect the wound site (at time of observations) for bleeding, oozing or swelling and any evidence of a haematoma.
- The integrity of the catheter is inspected for cracks or ragged edges including the tip.
- The catheter tip should be sent for microbiological analysis if catheter-related infection is suspected
- The procedure details are documented in patient's medical records including the insertion site, catheter integrity, type of dressing application and the patient's clinical status during the procedure.

The Procedure for the removal of a CVC can be accessed via the Procedure Document web page on this NHSL intranet Vascular Access website

14 Complications

Immediate to short term	Medium to Long Term Complications
❖ Pneumothorax ❖ Bleeding /haematoma/exudate at insertion and exit sites	❖ Catheter related occlusion – total or partial occlusion - (persistent withdrawal occlusion) - no blood return, flushing with no resistance)
❖ Cardiac arrhythmias	❖ Catheter associated venous thrombosis
❖ Arterial Puncture	❖ Catheter tip misplacement /migration
❖ Air Embolus	❖ Pain or swelling due to extravasation
❖ Nerve damage	**Infection** – Local Insertion site – Catheter related Blood stream infection (CRBSI) – Systemic infection
Immediately escalate to the medical team the following. ❖ Inadvertent removal and dislodgement of the CVC ❖ Signs indicating problems with the integrity of the catheter - cracked or broken tubing or fluid leakage, or bleeding haematoma from the catheter insertion site. ❖ Possible air embolus ❖ Signs and Symptoms of potential local and systemic infection/sepsis ❖ Any problems unresolved by troubleshooting	

Information on potential complications associated with CVAD including CVC can be accessed via the Complications and Prevention web page, available on this NHS Lothian intranet Vascular Access website.
Problems with Troubleshooting also available on the site on a separate page

15 Good Practice Points

Perform a daily review and record the ongoing requirement for the CVC.
Promptly remove the CVC when it is no longer medically required**.**
ANTT -Risk assess the technical difficulties of protecting **Key–Parts/Sites asepsis**, to determine if Standard or Surgical ANTT should be used. Comply with the principles of ANTT during all CVC access procedures.
Perform effective hand hygiene before and after all contact with the CVC
Clean the needle-free connector vigorously with friction using 2% CHG /70% IPA device wipe for **15 seconds,** allowing to air dry for **30 seconds** prior to every access **"Scrub the HUB"**
Syringe Size: Always use 10 ml Luer-lock size syringe or above (not less than 10mls)
Flushing a CVC – Use a *Turbulent -Pulsatile push – pause* flushing technique, then **lock** the CVC when disconnecting the syringe at the end of every access.
Perform daily Inspection of the insertion site for signs of infection, integrity of the dressing and sutures, integrity and length of exposed catheter for migration, kinks and deficits.
Dressing Changes:

- Clean insertion site during dressing change with 2% CHG /70% IPA device e.g. ChloraPrep
- Ensure the dressing is always dry, clean and intact.
- Comply with recommended dressing type and frequency of changes as per chart**.

Frequency of accessing the CVC: Organise care delivery to minimise the number of multiple manipulations/access of the CVC to reduce the potential risk of infection.
Intravenous Administration Sets: should **NOT** be disconnected until it is time to change the administration set and should not be left hanging unconnected. They should be disposed of at disconnection. Follow guidance about the frequency of administration set changes.
Administration of TPN: At the time of CVC insertion, one unused lumen is exclusively dedicated for the administration of PN and should be clearly identified by e.g. a green Curos cap**.**
Administration of Blood Products: Use a volumetric pump with a filtered giving set when administering blood and blood products to avoid occlusion. Flush the CVC immediately after the transfusion is finished.
Presence of potent medications in the lumen: If there is a potent medication in the CVC lumen following disconnection of infusion or administration of a bolus injection, withdraw and discard 3-5mls of fluid/blood prior to flushing the CVC to avoid bolus injection of medication.
Monitor external CVC length of catheter at each dressing change. An increase or decrease in length from initial placement at any time, may require a chest x ray to confirm catheter tip position prior to ongoing use.
Administration of Contrast Medium: **Never use** a standard CVC for the administration of IV contrast medium as this may cause the catheter to fracture or split if pressure injected.
Clamping sequence: The CVC must be clamped after each access of the needle free connector if clamps are present.

16 Summary of Maintenance Care

Dressing Type	Frequency	Comments
1a. Transparent, semi-permeable, polyurethane, self-adhesive dressing 1b. Chlorhexidine gluconate impregnated dressing.	Change every **7 days**	Change sooner if moisture is collected under the dressing and when it becomes damp, detached at the edges, visibly soiled or blood stained and non- adherent.
Sterile Gauze dressing or Gauze under a transparent dressing (use only if indicated)	Change every **24 hours** Change to transparent dressing as soon as possible	Change sooner if the dressing becomes damp, loosened. visibly soiled , blood stained
Needle Free connector	Change every **7 days**	Change sooner if visibly soiled, contaminated or blood stained
Skin Antisepsis during dressing change: Clean insertion site during dressing change with 2% CHG /70% IPA e.g. ChloraPrep using cross –hatch or up and down technique.		
Date and time dressing change label and record on maintenance care bundle.		
Refer to Chart for frequency of changes to administration sets.		

Scissors, scalpel or sharp instrument must **NEVER** be used near a CVAD to prevent inadvertent damage to either the catheter or lumen/s and the potential risk of air embolus. Lumens should never be wrapped with swabs and tape for any purpose. Unique Luer lock caps (e.g. CUROS caps) should be used to identify the unused designated lumen for the administration of TPN.

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18 Stakeholder consultation

19 Monitoring and review