POLICY FOR THE INSERTION AND CARE OF CENTRAL VENOUS ACCESS DEVICES (CVAD) IN HOSPITAL

Summary

This policy provides an overview of central venous access devices used within the Trust and includes selection, insertion and removal, training, documentation, care and management of the device and any resulting complications.

Royal Marsden - CVAD policy: a real world example
This local policy is an example used in the NICE medical technology guidance adoption support resource for SecurAcath for securing percutaneous catheters, and was not produced, commissioned or sanctioned by NICE.

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1. DEFINITION AND TYPES

DEFINITION

A central venous access device is a device that is inserted via a vein where the catheter tip is located in a central vein, usually the superior vena cava or caval atrial junction. It is inserted for:

- Short and long term therapy
- Central venous pressure (CVP) readings
- Emergency use, e.g. fluid replacement
- Absence of peripheral veins
- Repeated blood sampling
- Administration of all types of medications

TYPES

Types of CVADs include peripherally inserted central catheters (PICCs), non cuffed central venous catheters, long term tunnelled (LTS) catheters, skin tunnelled catheters and implanted ports (see Appendix 1). It is recommended that a single lumen CVAD is inserted unless indicated otherwise. Antimicrobial impregnated catheter (short term non cuffed) should be considered if duration of 1 to 3 weeks and if the risk of catheter-related blood stream infection (CrBSI) is high.

Multi-lumen CVADs are available and these can be from dual lumen PICCs and tunnelled catheters to triple, quad and quin lumen Central venous catheters (CVCs). The advantage of a multi-lumen catheter is the ability to infuse incompatible mediations and solutions at the same time. The catheters are designed to ensure that there is no mixing of medications either within the catheter, OR once they exit from the tip (located in superior vena cava or right atrium) into the rapid blood flow. When single lumen catheters are in situ and the patient requires multiple therapies, consideration should be given to either inserting a peripheral device or an additional CVAD. Guidance as to which medications can be given concurrently should be sought from pharmacy and the type of medication prioritised e.g. parenteral nutrition or other medications that must be given centrally.

2. CVADs AND DIAGNOSTIC IMAGING

2.1 All PICCs and ports inserted at The Royal Marsden are suitable for use with a contrast pump injector.

2.2 Some nuclear medicine tests can be injected via PICCs. Please refer to the Nuclear Medicine Intranet page (Nuclear Medicine and PET/CT page is under the All documents feature then select: Departments > General Protocols > General Protocols \ Use of CVAD for Radiopharmaceuticals administration).

2.3 Short term CVCs inserted in the RM are not pressure pump compatible. If venous access cannot be obtained via a peripheral cannula then the use of these catheters should be by hand injection only. The catheter will only be used with a contrast pump injector if arterial contrast medium is needed. The safe use of the catheter must be assessed and supervised by the clinician attending with the patient.

2.4 On occasions a patient will have had a port inserted outside of the RM. A thorough check should be made by the radiographer to ascertain the type of port placed prior to using it. Pump compatible ports are identified by a patient wrist band, ID card or a radiopaque marker on the most recent chest X-ray. If these are not available, the surgical notes should be requested from the organisation who inserted it to confirm compatibility with a contrast pump injector.

2.5 Pump compatible PICCs are identified by the PICC stating ‘pump injectable’ in the insertion notes (or on the catheter itself).

3. INSERTION AND REMOVAL (see Appendix 2)

3.1 Consent

All adult patients undergoing the *elective* placement of a CVAD must be consented prior to the procedure where it is possible e.g. not always possible in the critical care setting or in an emergency.

Young people aged 16 years and 17 years (with capacity) can consent for insertion of a CVAD. People aged 16 or over are assumed to have capacity to consent to their own treatment, unless there is significant evidence to suggest otherwise, this can only be overruled in exceptional circumstances.

For children under 16 years an adult with parental responsibility consents for them. Children under the age of 16 are presumed to lack capacity, but can consent to their own treatment if it is thought that they have enough intelligence, competence and understanding to fully appreciate what is involved in their treatment. Otherwise, someone with parental responsibility consents for them.

3.2 Training and maintaining competency

3.2.1 Nursing staff

Nursing staff are permitted to insert and remove certain types of central venous access devices (CVAD) or access an implanted port after completion of a planned programme of theory and practice (see Royal Marsden Manual (2015) for procedures). Skills and knowledge must be maintained in accordance with The Code (NMC 2015).

3.2.1.1 Insertion of Peripherally inserted central catheters (PICCs)

On successful completion of the planned programme of theory and practice utilising a reflective practice workbook entitled 'Role Development Profile – Midline and PICC insertion'; staff who have completed the relevant workbook and who have had their workbook signed by the Nurse Consultant IV Therapy (or relevant designated practitioner), as well as their manager, are able to practice the relevant procedure. The member of staff will be permitted to perform PICC insertion in accordance with the procedure set out in The Royal Marsden Manual of Clinical Nursing Procedures, 9th edition, 2015, chapter 14.

3.2.1.2 Insertion of Central venous catheters (CVC), skin tunnelled catheters and ports

On successful completion of a recognised programme (e.g. CVC insertion training programme), and achieving the required competencies, the member of staff will work under supervision of a designated consultant anaesthetist or surgeon until the nurse deems her/himself competent to practice unsupervised within the Trust.

3.2.1.3 Removal of skin tunnelled catheter (STC)

On successful completion of the planned programme of theory and practice utilising a reflective practice workbook entitled 'Role Development Profile – Removal of skin tunnelled catheter'; Staff who have completed the relevant workbook and who have had their workbook signed by the Nurse Consultant IV Therapy (or relevant designated practitioner), as well as their manager, are able to practice the relevant procedure. The member of staff will be permitted to perform STC removal in accordance with the hospital procedure (The Royal Marsden Manual of Clinical Nursing Procedures, 9th edition, 2015, chapter 14).

3.2.1.4 Accessing an implanted port

On successful completion of the planned programme of theory and practice utilising a reflective practice workbook entitled 'Role Development Profile – Accessing an implanted port'; staff who have completed the relevant workbook and who have had their workbook signed by the Nurse Consultant IV Therapy (or relevant designated practitioner), as well as their manager, are able to practice the relevant procedure. Their names will then be added to the list of competent practitioners on the intranet.

The member of staff will be permitted to access implanted ports in accordance with the hospital procedure (The Royal Marsden Hospital Manual of Clinical Nursing Procedures, 9th edition, 2015, chapter 14).

3.2.1.5 Deaccessing an implanted port

Any nurse or radiographer, who has been shown how to deaccess a port and how to activate the safety mechanism of the port needle by a nurse/radiographer competent in port accessing, can deaccess a port. The nurse/radiographer can then deaccess a port, in accordance with the procedure set out in The Royal Marsden Manual of Clinical Nursing Procedures, 9th edition, 2015, chapter 14. They do not have to have undergone the port accessing training prior to this.

3.2.2 Medical Staff

3.2.2.1 Insertion of short term CVCs

All insertions must take place under the supervision of the Anaesthetic Department unless the individual concerned has been specifically signed off as competent by a consultant anaesthetist. Medical staff will be assessed by a consultant anaesthetist as competent to perform insertion.
Individuals requiring training in the insertion of CVCs will have the opportunity to participate in a simulation based learning programme. This programme will include the recognition and management of complications.

3.3 Insertion Site

It is recommended that the subclavian or internal jugular veins are used for short term non cuffed CVC, and the femoral vein is only used where clinically indicated. Subclavian is associated with less infection but higher rate of pneumothorax. The jugular has higher rate of infection and risk of arterial puncture (Parienti et al 2015). For PICC placement the basilic or brachial vein in the upper arm are most suitable.

3.4 Insertion Procedure (to be performed in line with CVC care bundle)

All patients undergoing CVAD insertion should have had MRSA swabs taken within 4 weeks of the procedure and had Octenisan body wash for 5 days prior to procedure (see MRSA and MSSA Screening Policy for details).

3.4.1 Location of performing procedure (see Appendix 2)

PICCs can be inserted at bedside or appropriate unit e.g. Medical Day Unit (MDU). Short term CVC insertions must take place in operating theatres or CCU in Chelsea or in the minor procedures suite or operating theatres in Sutton. Tunnelled catheters and ports to be inserted in operating theatres.

3.4.2 Personal protective equipment/maximal barriers

Sterile gown, gloves and large drapes must be used for the insertion of CVADs. Gloves are single-use items and should be removed and discarded immediately after the care activity. Eye/face protection is indicated if there is a risk of splashing with blood or body fluids.

3.4.3 Hand hygiene
Decontaminate hands before and after each patient contact. Use correct hand hygiene procedure.

3.4.4 Skin cleansing
Use 2% chlorhexidine gluconate in 70% isopropyl alcohol and allow it to dry. If the patient has a sensitivity use a single patient use povidone-iodine application.

3.4.5 Use of ultrasound
Ultrasound must be used for assessing veins and performing all insertions via the jugular vein and is recommended for all PICC insertions.

3.4.6 Monitoring during insertion
Transduction must be used for all catheters during insertion to verify venous and no arterial placement (excluding PICCs). PICCs should be placed using Sherlock 3CG tracking system to verify tip location (NICE 2015a).

3.4.7 Equipment
All insertions must utilise the pre-prepared kit which can be located in CCU or in theatres or in MDU/Minor Procedure Suite (MPS).

3.4.8 Securement following insertion
- PICCs will be secured using a SecurAcath© or a Statlock dressing.
- Non cuffed catheters will be secured with sutures.
- Skin tunnelled catheters will be secured with sutures.
- LTS catheters are sutured.

3.5 Post insertion

Patients must not be discharged until a post-procedure check chest X-ray (CXR) has been reviewed by the individual who performed the procedure. The tip of a CVAD should be verified on chest x-ray prior to use and the exact location of the tip documented in the medical notes, unless a tip location device e.g. Sherlock 3CG has been used to verify tip location (when a CXR not required).

4. DOCUMENTATION

4.1 Required information

The following information must be recorded in the patient's medical notes:

- The name and designation of the operator
- The type of CVAD, brand name and batch no
- A description of the insertion technique
- The use of imaging
- Confirmation of the position of the catheter tip (NCEPOD 2010)

A care plan (specific to the device inserted) should be initiated.

4.2 CVAD database

All CVADs inserted within the Trust must be entered into the central database on the computer using ICIP (Clinical Information System) in order to ensure audit data is collected.

5. CARE AND MANAGEMENT OF CVAD

Nurses undertaking the care and management of a CVAD must have completed the IV workbook and undergone supervised practice in the practical aspects of care.
Paediatric nursing staff will need to adhere to the local training requirements alongside attending the paediatric oncology education and skills 2 day foundations programme provided at The Royal Marsden to comply with national peer review guidance. This will include a competency domain in CVAD care.
A film aimed at patients and carers on care of a PICC (flushing and dressing), and deaccessing a port can be found on The Royal Marsden website and can be used by nurses as an aide memoir.

Where patients have a variety of intravenous devices in situ it is recommended that each device is clearly labelled e.g. PICC, cannula. If other routes are used as well e.g. arterial, PEG then these should be clearly labelled to avoid confusion when administering medications or feeds.
Hands must be decontaminated before and after each patient contact. Use correct hand hygiene procedure.

5.1 Catheter site inspection

There should be regular observation of the site for signs of infection or any other complication, at least daily and documented.

5.2 Catheter access

Use aseptic technique and swab ports or hub with 2% chlorhexidine gluconate in 70% isopropyl alcohol prior to accessing the CVAD for administering fluids or medications or withdrawing blood (see Manual chapter 10). Needlefree injection caps must be changed weekly. Port needles must be changed every 7 days.

5.3 Cleaning site

All catheter insertion sites should be cleaned at least weekly with 2% chlorhexidine in alcohol. Ports should be cleaned with 2% chlorhexidine in alcohol prior to accessing (DH 2008).

5.4 Securement and dressings

- PICCs are secured using a SecurAcath© securing device which is attached at insertion and does not require replacement whilst PICC is in situ. If a Statlock dressing is used it will need to be changed as required usually weekly.
- Non cuffed catheters are secured with sutures which are not removed until the catheter is removed.

- Skin tunnelled catheters are secured with sutures. The top skin suture will be removed after 1 week and the exit site sutures will be removed after 3-4 weeks. Where possible loop the catheter under the dressing to prevent pulling.
- LTS catheter - no top suture, exit sutures to be removed after 4 weeks
- Port insertion site has absorbable skin sutures.

PICCs and non cuffed CVCs should be dressed with a sterile, transparent, semi-permeable dressing to allow observation of insertion site - Opsite IV 3000. This dressing should also be used when a port has been accessed. In the case of an allergy to Opsite IV 3000, cavilon should be applied or the dressing changed to Tegaderm IV.
The dressing must be intact and not lifting (DH 2008). The dressing must be labelled to indicate the date it was changed (date labels are available on the side panels of the Opsite IV 3000 dressing).

5.5 Patency

5.5.1 Indications

a) To maintain patency of an intravenous pathway, without the use of a continuous infusion, when intermittent administration of medications of therapy is prescribed or may be required urgently.

b) To maintain patency of an indwelling vascular access device, over a period of weeks or months for intermittent treatment or supportive therapy.

5.5.2 Procedure

Refer to The Royal Marsden Manual of Clinical Nursing Procedures (2015) 9th edition, chapter 14.

a) Flush catheter with Sodium chloride 0.9% (in a 10ml or larger syringe) to confirm patency.

b) Inject medication/commence infusion as prescribed.

c) Flush with Sodium chloride 0.9%, 5-10mls to ensure patient received all prescribed medication.

d) Flush catheter *(see below for solution and frequency)* ***using the push - pause method (injecting 1ml at a time to create turbulent flow)*** with the designated flushing solution (see below) through the needleless injection cap to fill the catheter dead space with the correct volume and solution in order to maintain patency.

e) ***Finish using the positive pressure technique***, that is, maintain pressure on the syringe plunger whilst disconnecting the syringe from the needleless injection cap. **Do not** clamp catheter until after syringe has been disconnected.

f) If any device becomes sluggish or there are problems when using 0.9% sodium chloride then change to heparinised saline after each use or instil urokinase overnight (see Manual chapter 14).

5.5.3 Flushing solutions and frequency as per CVAD type

a) PICC

Inpatient
Flush with 10ml 0.9% sodium chloride after each use with medications and 20ml 0.9% sodium chloride after blood sampling. Flush all lumens each time and at least once a week even if not used.

Outpatient
Flush with 10ml 0.9% sodium chloride once a week using a 10ml syringe. Flush all lumens even if not used.

b) Skin tunnelled catheters

Inpatient
Flush with 10ml 0.9% sodium chloride after each use unless used less than 3 times a day – then use 5ml Heparinised saline (50 international units Heparin in 5ml 0.9% sodium chloride) after each use.

Outpatient
Flush with Heparinised saline (50 international units Heparin in 5ml 0.9% sodium chloride) once a week using a 10ml syringe.

c) Short term non cuffed CVC

Inpatient
Flush with 10mls 0.9% Sodium Chloride after each use.

d) Implanted ports (always use a 10ml syringe or larger for all administration)

Inpatient
Flush with 10ml 0.9% sodium chloride after each use unless used less than 3 times a day – then use 5ml Heparinised saline (50 international units Heparin in 5ml 0.9% sodium chloride) after each use.

Outpatient
Flush with 5ml Heparinised saline (500 international units Heparin in 5ml 0.9% sodium chloride) once every 8 weeks (draw up total of 6ml as 1ml left in extension set). The exception to this is for shared care of paediatric patients where it remains monthly in line with shared care guidelines.

e) Long term silicone (LTS) tunnelled CVC (mainly used in Haematology only)

It must be flushed with 10mls 0.9% sodium chloride followed by an intraluminal dose (volume of each lumen) of strong heparin solution (1000 international units/ml) in each lumen. The intraluminal dose can vary dependent on the type of CVC but currently this is 1.3ml per lumen. Intraluminal doses MUST be discarded each time prior to using the catheter.

5.6 Blood sampling

5.6.1 Blood sampling from a central venous access device (CVAD) is a procedure that is frequently performed by nurses. It reduces the number of peripheral venepunctures that a patient may require.

5.6.2 The procedure has been devised to provide nursing staff with the safest method of obtaining blood samples from a CVAD. Blood sampling from a CVAD MUST always be performed using a vacuum adaptor system e.g. Vacutainer. The ONLY exception is if blood cannot be obtained using the vacuum system - then a syringe may be used. Where possible, the sampling should be carried out via a needleless injection cap in order to maintain a closed system and prevent contamination of practitioner with blood. Refer to The Royal Marsden Manual of Clinical Procedures (2015), 9th Edition, chapter 10).

5.6.3 Flush with at least 20ml 0.9% sodium chloride after blood sampling.

5.7 Administration set replacement

Administration sets should be labelled with a change date and changed immediately following administration of blood, blood products, after 24 hours following parenteral nutrition and every 96 hours if continuous fluids (see Infusion Administration Sets policy).

5.8 Restriction on use

No CVAD should be used for the injection of CT contrast by pump unless it has been confirmed that the patient has a CT compatible device in situ. All implanted ports inserted after 1st October 2011 in the Royal Marsden are CT compatible and these ports can be identified by 3 palpation points on the septum and on CXR the letters CT are visible on the port. Patients will receive written information highlighting the type of port they have in situ. CT compatible PICCs are purple.

5.9 Removal

CVADs should be removed as soon as they are no longer required and the necessity should be reviewed on a regular basis. Routine catheter replacement is not recommended and the catheter should only be changed when clinically indicated (or within manufacturers guidelines) (DH 2008).

Nurses can remove PICCs and non cuffed CVC (see the Royal Marsden Manual of Clinical Nursing Procedures chapter 14, pages 902-903, 909-910). Nurses and doctors may remove skin tunnelled catheters and LTS catheters using surgical technique (see the Royal Marsden Manual of Clinical Nursing Procedures chapter 14, pages 912-914), if they have received appropriate training. Implanted ports will be removed by surgeons, anaesthetists or trained nurses. FBC and Coagulation screens are required to be taken and checked prior to removal of non cuffed, cuffed CVCs and ports. Anticoagulants should be reviewed in case they need to be stopped or reduced prior to removal.

If the patient has a SecurAcath©, assess ease of removal using table in Appendix 3. If a simple removal then remove as per instructions. If a difficult removal contact IV Team/MDU for advice or follow the guidance in the table.

5.10 Discharge Planning

If the care of the CVAD is to be provided by community staff, the relevant documentation must be completed and sent to the nurse prior to discharge. A checklist of all the equipment sent home with the patient should also be completed, along with contact details of who the community nurse should contact with any queries. Relevant equipment e.g. dressings and flushing kit must be sent home with patient or CVAD safety pack for parents and children. A discharge summary must be done and emailed or faxed to GP for all day case PICC insertions (see Intravenous Therapy at Home Policy)

6. DETECTION AND MANAGEMENT OF COMPLICATIONS

6.1 Occlusion

Prevention of occlusion can be achieved by correct use of flushing solutions, frequency and method and not allowing infusions to 'run dry'. A PWO (persistent withdrawal occlusion – when can inject in but cannot get blood return) may be resolved using push lock protocol by bolus or infusion (see Appendix 4). Only 10ml syringes or larger should be used.
If a total occlusion does occur - do not use heparin as this will not unblock an occluded catheter. Urokinase (Syner KINASE) can be instilled to unblock the device using the 3 way tap method (see Manual chapter 14 pages 872-874 for procedure). Never use small syringes (under 10ml) as this causes damage to the catheter e.g. splitting.

6.2 Infection

If a patient develops a local site infection then a swab should be taken and the patients commenced on antibiotics. If the patient has signs and symptoms of a systemic infection and/or the patient has a rigor when flushing the CVAD then blood cultures should be taken from both the CVAD (all lumens) and a peripheral sample. The patient can then be commenced on antibiotics. The CVAD may need to be removed and the tip should be sent to microbiology.
See section entitled Management of Vascular-Access Device (VAD) Infection in DTC Antimicrobial Guidelines for details of antibiotics.

6.3 Thrombosis

If thrombosis occurs, it is recommended that the patient has an ultrasound to ascertain the size and location of the thrombosis and then is commenced on anticoagulant therapy as per DTC guidelines (see Appendix 5). If patients have any haematological conditions that may have resulted in the thrombosis then refer to haematologist for guidance.
If the catheter is to be removed it should be 72 hours after commencing anticoagulants (Pittaruti 2015). If a patient has a thrombosis but the catheter lumen is still patent then it can be used for IV therapy. The exception to this would be if the thrombosis is occluding the tip of the catheter.

6.4 Others

6.4.1 Damage

If a skin tunnelled catheter becomes damaged then depending on where the damage occurs it may be repaired e.g. catheters. Repairs can be carried out by those trained in how to repair by Nurse Consultant IV Therapy (done on individual basis as required) – contact Nurse Consultant IV Therapy or Minor Procedure Suite. Out of hours repair kits for the current tunnelled catheters used by the Trust can be obtained in Bud Flanagan East or Minor Procedure Suite. These contain instructions for use if repair required as an emergency. PICCs must be replaced where appropriate over a guidewire.

6.4.2 Infiltration/Extravasation – see 'Extravasation and Infiltration, Policy for the Management of'.

7. MONITORING AND AUDIT

Audits of the following will be carried out:

- CVAD complications
- Synbiotix/Saving Lives High Impact Intervention care bundles
- Adherence to policy (NCEPOD) (through annual IV audit)

Central venous catheter insertion and care are audited throughout the Trust using the DH Saving Lives High Impact Interventions. Clinical areas inserting or accessing CVADs are required to complete a minimum number of observations per month on the Trust's Synbiotix System which holds a central dashboard for clinical and quality indicators. This system can be accessed directly from The Royal Marsden intranet main page, Trust compliance information may be accessed without a password. For training and information please contact the Infection Prevention and Control Team.

8. REFERENCES

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NICE (2015b) The 3M Tegaderm CHG IV securement dressing for central venous and arterial catheter insertion sites, NICE, London 22 July 2015. nice.org.uk/guidance/mtg25

NMC (2015) The Code, NMC London

Parienti, JJ et al (2015) Intravascular complications of central venous catheterisation by insertion site, NEJM, 24th September
http://www.nejm.org/doi/full/10.1056/NEJMoa1500964

Pittiruti, M (2015) What the world needs now is an insertion bundle to prevent catheter related thrombosis, presentation at Association of Vascular Access conference Dallas, USA September 26 - 29

9. RELATED POLICIES

Non Royal Marsden Patients who require Care of a Vascular Access Device or Administration of Medication

Extravasation and Infiltration, Policy for the Management of

Infusion Administration Sets

Intravenous Therapy at Home Policy

MRSA and MSSA Screening Policy

Parenteral Nutrition - Policy and Guidelines for Administration

Appendix 1

Central Venous access devices

Type of device	Material	Features	Common insertion site (veins)	Recommended indwelling life and common uses
Long term silicone (LTS) skin tunnelled catheter	Polyurethane	Dual lumen		These are placed if the patient is undergoing autologous transplant and has unsuitable veins for stem cell harvest. The LTS is a long-term catheter which is cuffed and can be used for apheresis/dialysis and transplantation
Peripherally inserted central catheters	Polyurethane Silicone	Dual lumen Single lumen Valved	Antecubital fossa Basilic Cephalic Brachial	Used primarily for patients requiring several weeks or months of intravenous access
Short-term percutaneous central venous catheters (non-cuffed)	Polyurethane Silicone	Heparin, antibiotic and antiseptic coatings, multiple lumen (Up to 5 lumens)	Jugular Subclavian Femoral	Intended for days to weeks of intravenous access
Skin-tunnelled catheters	Polyurethane Silicone	Multiple lumen (1-3 lumens)	Jugular Axillary Subclavian Femoral	Indefinite. Used for long-term intermittent, continuous or daily intravenous access. May be appropriate for short-term use if reliable access needed
Implanted ports	*Catheter*	Single or Dual ports	Jugular	Indefinite. Used for long-term
	Silicone	CT compatible	Subclavian Femoral	Intermittent, continuous or daily intravenous access
	Port			
	Titanium			
	Plastic			

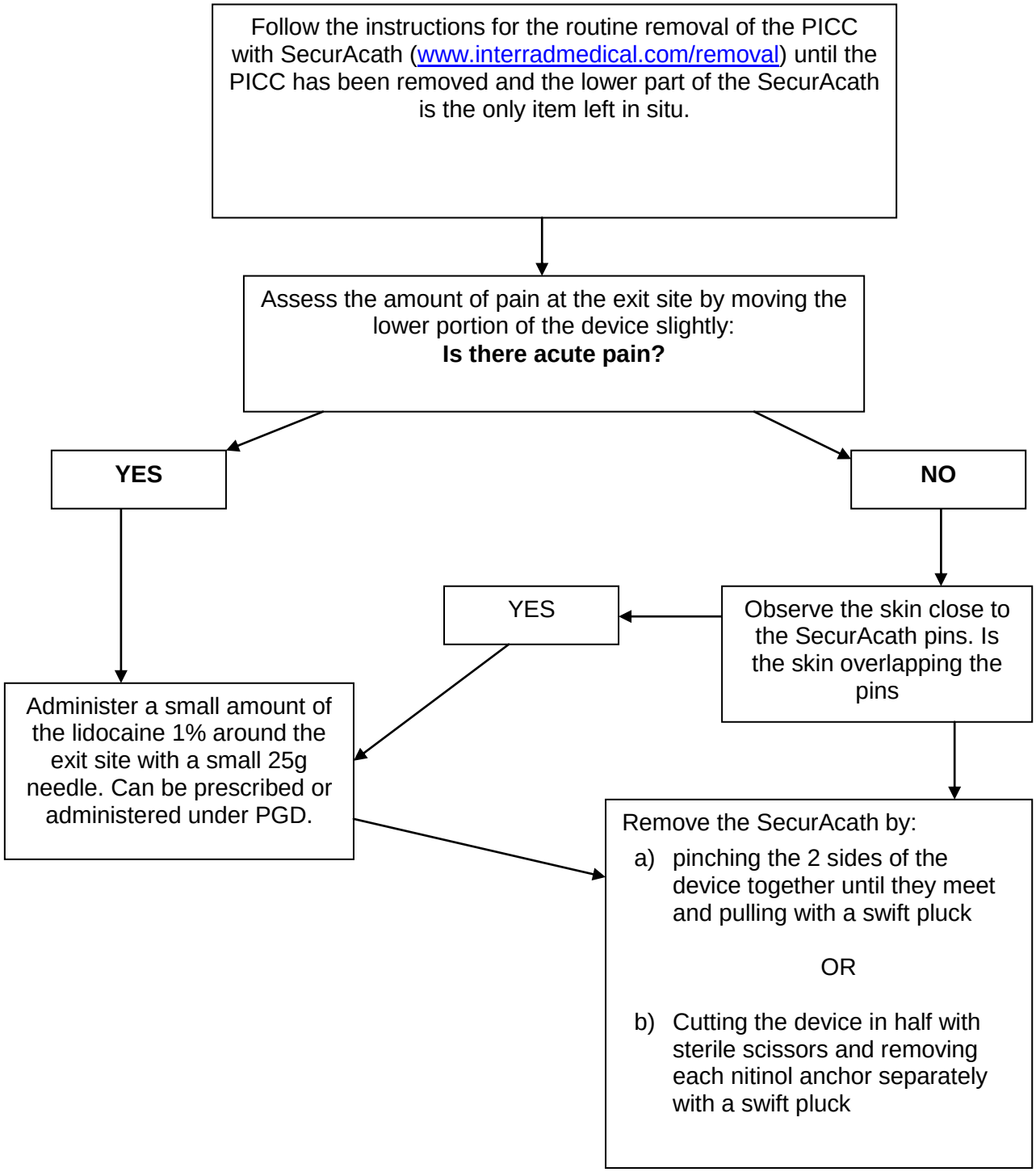
Appendix 2

Performing procedure

Device	By whom	Where	Investigation requirements prior to elective insertion and removal (* these may depend on the diagnosis or clinical condition of the patient)	Contact for booking
PICCs	**Insertion:** Specifically trained nurses Anaesthetists **Removal:** Nurses	Bedside MDU MPS Interventional radiology	Recent Full Blood Count (FBC)	MDU (both sites) Minor procedure suite
Non cuffed Central venous catheter	**Insertion:** Specifically trained nurses Anaesthetists **Removal:** Nurses	Theatres CCU MPS Interventional radiology	FBC, coagulation	
Long term silicone (LTS) skin tunnelled	**Insertion:** Anaesthetists **Removal:** Anaesthetists	Theatres	FBC, coagulation*	Theatres
Skin tunnelled catheters	**Insertion:** Anaesthetists **Removal:** Specifically trained nurses	Theatres Interventional radiology	FBC coagulation* Ultrasound if had previous CVADs	Theatres
Implanted ports	**Insertion:** Specifically trained nurses Anaesthetists Surgeons **Removal:** Specifically trained nurses Anaesthetists Surgeons	Theatres	FBC coagulation* ECG*	CVAD clinic, or via individuals such as specifically trained nurses Anaesthetists or Surgeons
Vascaths	Anaesthetists	CCU Theatres	FBC coagulation*	Theatres

Appendix 3

Removal Flowchart



Adapted from Hughes (2014)

Appendix 4

RM Protocol for Resolving Patency Problems with Central Venous Access Devices

Patency problems are common in CVADs and include:

- Poor or no blood return
- Sluggish flow
- Complete occlusion

Possible causes:

- Clotted blood in the catheter (most likely cause)
- Fibrin sheath
- Malpositioned catheter
- Drug precipitation
- Build-up of lipids (parenteral nutrition)

Prevention:

a) Flush catheter ***using the push - pause method (injecting 1ml at a time to create turbulent flow)*** with the designated flushing solution through the needleless injection cap to fill the catheter dead space with the correct volume and solution in order to maintain patency.

b) ***Finish using the positive pressure technique***, that is, maintain pressure on the syringe plunger whilst disconnecting the syringe from the needleless injection cap. **Do not** clamp catheter until after syringe has been disconnected.

Initial Management:

Poor or no blood return

- Ask the patient to take deep breaths and try different positions. Flush briskly using 10mls 0.9% sodium chloride. If this fails consider use of a thrombolytic (see below)
- If lipids/drug precipitation suspected consult pharmacy advice for suitable agent to dissolve occlusion

Catheter flow is sluggish

- Ask the patient to take deep breaths and try different positions. Flush briskly with 10mls 0.9% sodium chloride. If this fails consider use of a thrombolytic (see below)
- If lipids/drug precipitation suspected consult pharmacy advice for suitable agent to dissolve occlusion

Catheter is completed occluded

- Use a 3-way tap technique to instil thrombolytic into catheter (see below).

What is a thrombolytic?

A thrombolytic is a drug capable of breaking up a thrombus. Syner KINASE reconstituted in 0.9% sodium chloride is the thrombolytic used for unblocking CVADs. Heparin and Heparinised saline are NOT thrombolytics. Syner KINASE has a half-life of 20 minutes.

DO NOT EXCEED 25000 international units per lumen.

What if the thrombolytic fails to restore function?

If a thrombolytic fails to restore function, contact the IV Team / MDU, Matron Day Services or Nurse Consultant IV Therapy.

A chest x-ray may need to be carried out to check the tip position of the CVAD. If a chest x-ray shows that the catheter is correctly placed, it may be worth considering fluoroscopy which may reveal a fibrin sheath.

How to use a thrombolytic for Persistent Withdrawal Occlusion (PWO)

Push Lock Protocol

Bolus for PWO:-

Priming volumes:
PICC = 0.5ml
Skin tunnelled Catheter = 1ml
Port = 3ml

1. **Reconstitute**
   Reconstitute Syner KINASE 10 000 units with the priming volume of the CVAD plus an additional 1.5ml of 0.9% NaCl.

2. **1st Lock**
   Inject the priming volume + 0.5ml into the CVAD.
   'Lock' the solution into the CVAD and leave the syringe attached to the lumen.
   Wait 10 minutes

3. **2nd Lock**
   Inject another 0.5mls of solution and lock again
   Wait 10 minutes

4. **3rd Lock**
   Inject another 0.5mls of solution and lock again
   Wait 10 minutes

5. **Aspirate**
   Aspirate CVAD lumen and flush with 0.9% sodium chloride to establish flow. If it cannot be aspirated it is safe to flush into patient.

If unblocking a dual lumen catheter then inject 10 000 international units down each lumen.

For a total occlusion:-
Instil using the above protocol via a 3 way tap. See page 872-874 in the Royal Marsden Manual (2015) for procedure.

If unsuccessful:
If unsuccessful using 10 000 international units for either PWO or total occlusion then consider escalating dose and repeat the Syner KINASE push protocol using 25 000 international units. This will need to be prescribed and not administered under a PGD.

If not required the same day then don't aspirate and leave Syner KINASE in for several hours or overnight if possible. Then if still unsuccessful then move to infusion or for 'repeat offenders' where patients have a PWO that requires regular Syner KINASE administration to obtain blood samples and/or verification of a functioning CVAD, where a prophylactic infusion of 25 000 international units would resolve this problem.

Syner KINASE Infusion Protocol

Syner KINASE infusion is contraindicated in patients with:

- Active GI bleeding or a bleed in the last month
- Haemorrhagic stroke or any other cerebrovascular accident in the last month
- Major surgery or trauma in the last two weeks
- Coagulation defects
- Known Urokinase allergy
- Hypertension

Syner KINASE infusion should be used with caution in patients receiving antiangiogenic medication e.g. Bevacizumab.

Procedure:

Take a blood sample from the patient and check FBC to ensure platelets are >100 and Clotting Screen to ensure that clotting parameters are within the therapeutic range. Take baseline observations (Pulse and Blood pressure).

The infusion will need to be prescribed and not administered under a PGD.

Reconstitute Syner KINASE 25 000 international units (in 2ml of 0.9% sodium chloride) and add to 50ml bag of 0.9% Sodium chloride. Connect an administration set to the affected lumen of the catheter and set it to infusion over 100 minutes. This is only required to be administered via one lumen.

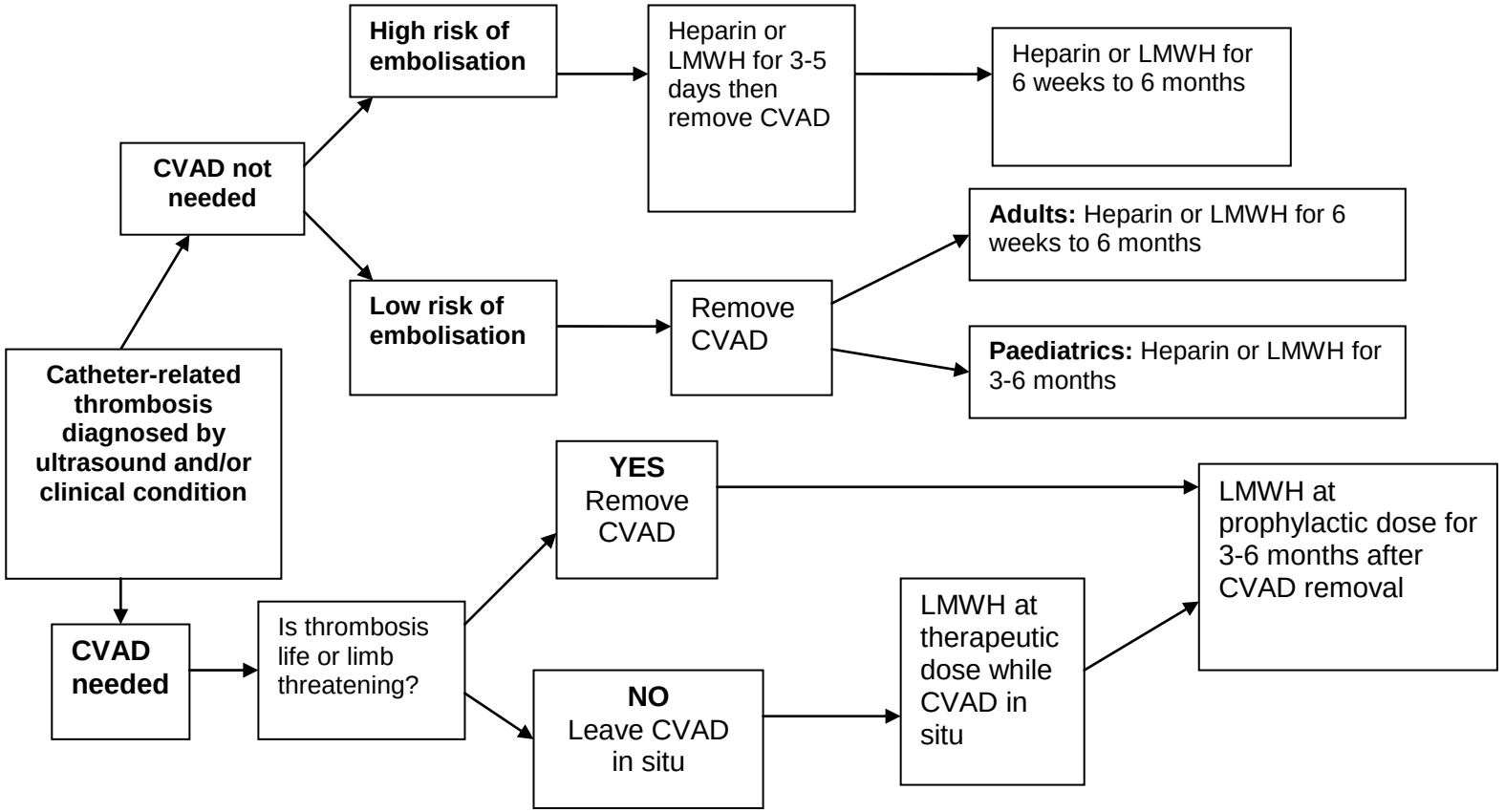
Check the patients pulse and blood pressure every 20 minutes during infusion. Check for any signs of bleeding from the catheter exit site. If bleeding is present, stop the infusion and discuss with senior medical staff.

On completion of the infusion, attempt to aspirate from the CVAD. If a PWO is still an issue then discuss with Nurse Consultant IV Therapy.

If the CVAD is totally occluded then use 3-way tap protocol. If remains totally occluded then the CVAD will need to be removed and replaced.

Appendix 5

Algorithm for managing CVAD related thrombosis



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