GUIDELINE

Central Venous Access Device: CVC / Femoral Vein

Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this disclaimer

Contents

Aim

The aim of this guideline is to outline insertion and management of central venous catheters (CVC) in neonates. This is a supplementary guideline to the Central Venous Access Device Bundle.

Risk

There are risks associated with central venous access if this guideline is not followed which includes thrombosis, skin infection at the site of insertion, trauma, distorted anatomy and coagulopathy.

Background

Central venous catheters (CVCs) may be used in neonates when other CVADs cannot be inserted, and central access is required. CVCs are commonly inserted in the jugular, subclavian or femoral veins. Cannulating the femoral vein may be done by the neonatology team. Use of the jugular and subclavian regions in neonates are reserved for anaesthetist or radiologists.

Complications

Specific complications from CVC insertion include:

- Arterial puncture could result in the formation of a hematoma
- Hematoma formation could also result from routine placement
- Bladder puncture (femoral CVC)
- Haemorrhage
- Catheter fragment resulting in a guidewire embolism

Prior to Procedure

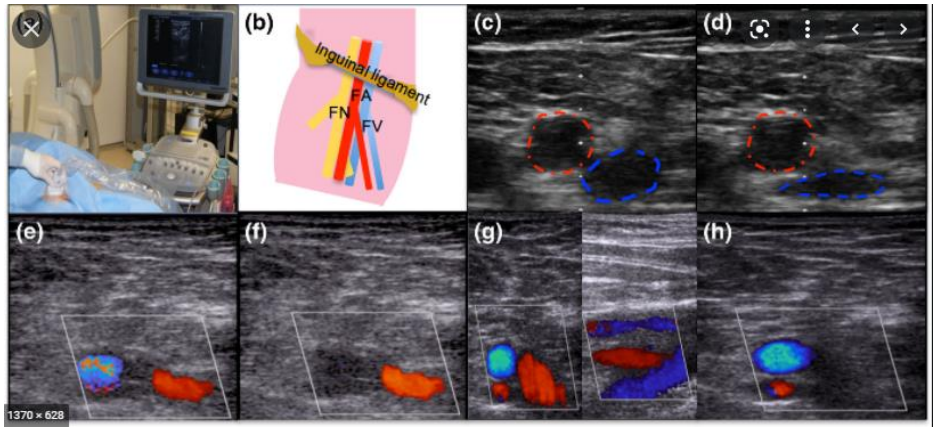
- The clinician performing the procedure must have appropriate training or supervision during the procedure, including the use of ultrasound guidance for CVC insertion.
- For neonates with cardiac conditions, discuss with the cardiologist prior to insertion as the femoral vein may be required for future cardiac catheterisation.
    - See CVAD bundle for sedation recommendations
- For anatomical landmarks, refer to Appendix 1.

Equipment List - Refer to Appendix 2 for kit contents

Common equipment	Femoral catheter specific
• Surgical gown x 1 • Sterile pair of gloves x 2 • Mask x1 • Face Shield (as required) x1 • Antiseptic solution: >27 weeks gestation: 1% chlorhexidine solution; ≤27 weeks gestation: Povidone-iodine solution • **PICC placement kit** (see picture & contents below) • Sterile 0.9% Sodium chloride ampoules x2 • Sterile absorbent towel X1 • 3-way taps x 3 • Smartsite™ valves x2 (for each 3-way tap)	• Ultrasound machine with a high frequency (5 to 12 MHz), linear array probe (transducer). • **Sterile probe cover kit** • **CVC set**: preferred size for neonates 4F (8 cm long) x1 • 1% Lidocaine (without epinephrine) • Suture- 3.0 prolene /3.0 silk • Sterile instrument pack • 3ml syringes x3 • 1ml syringe x 1

Pre-Insertion Review

- Complete the CVAD pre-insertion and insertion checklist (M422.01)
- Position the infant in in reverse Trendelenburg position (bed tilted with the head up) to distend the femoral vein and prevent air embolism. Place a small role under the pelvis to extend the hips. The legs should be lying symmetrically in external rotation and slightly flexed (**frog leg posture**).
- Non-sterile ultrasound inspection of the femoral vein, 1 to 2 cm inferior to the inguinal ligament to identify suitable vein location for cannulation

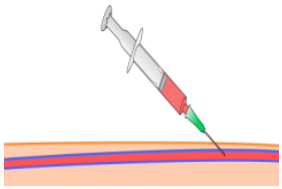
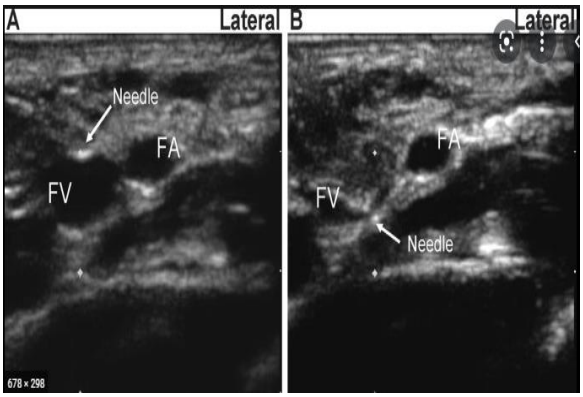


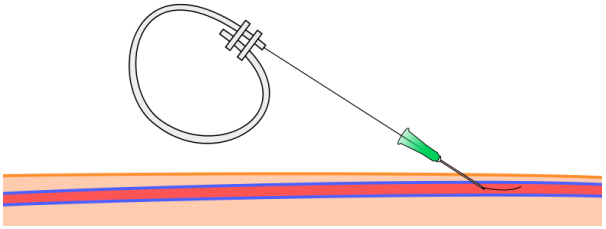
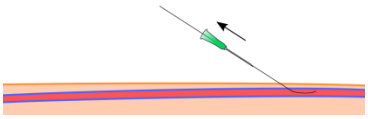
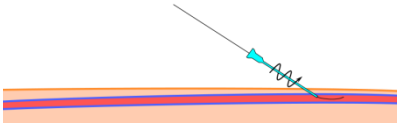
Adopted from: Wiles BM, Child N, Roberts PR. How to achieve ultrasound-guided femoral venous access: the new standard of care in the electrophysiology laboratory. J Interv Card Electrophysiol. 2017 Jun;49(1):3-9. doi: 10.1007/s10840-017-0227-9. Epub 2017 Feb 7. PMID: 28168447

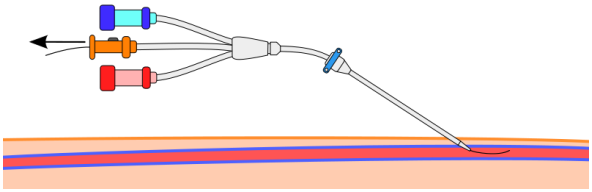
Insertion Procedure

Steps	Additional Information
1. Once surgical scrub and donning complete, arrange equipment on the procedure trolley in a systematic manner with the help of an assistant, ensuring equipment remains sterile.	
2. Draw up local anaesthetic into a 1ml syringe	Lidocaine (Lignocaine)
3. Pre-flush all lines of the CVC with sterile saline) and then close all but the distal port with the clamps.	The distal port must be left unclamped as this is where the wire will be fed over
4. Attach the introducer needle to a 3-mL slip syringe. Align the bevel of the needle upwards.	
5. Place CVC, needle and dilator in the kidney dish allowing for sterility of line during insertion	
6. Place a blue absorbent towel under the baby to avoid chemical burns to the back due to antiseptic solution	
7. Clean a broad area of skin around the insertion point with antiseptic solution. Allow the antiseptic solution to air-dry for at least 1 minute	1% Chlorhexidine with 70% Alcohol solution
8. Cut a hole in the clear plastic drape and place over the insertion site.	
9. Inject the local anaesthetic around the estimated point of insertion and where the catheter will be sutured.	0.5ml-1ml of 1% Lignocaine

Steps	Additional Information
10. Prepare the ultrasound device • Place sterile ultrasound gel into the probe cover • Ask your assistant to drop the probe into the probe cover. • Grab the sterile covered probe tip and ask the assistant to pull the distal probe cover over the length of the probe cord without touching the sterile field. Pull the cover tightly over the probe tip to eliminate all air bubbles and secure with sterile rubber bands. • The covered probe may now rest on the sterile drapes. • Slide the rubber bands to the desired locations to secure the probe • Apply sterile ultrasound gel to the covered probe tip.	  
11. Identify femoral vein using short axis view on ultrasound and measure the depth to the centre of the vein	

Steps	Additional Information
12. Initially advance the **introducer needle** with the bevel upwards into the skin at a 30-45° angle directed toward the midpoint of the probe, keeping a gentle negative pressure on the syringe plunger	
13. Maintain ultrasound visualization of the needle tip as you advance. As the needle enter the lumen of the vein a pop is felt and flash of dark red blood in the syringe is seen	
14. Remove the syringe from the needle hub and briefly let blood flow out: venous blood is dark red and non-pulsatile **Then immediately cover the hub with your thumb to prevent air embolism**	 Adopted from : Peter C. Murphy, FRCA MRCPCH, Philip Arnold, FRCA, Ultrasound-assisted vascular access in children, *Continuing Education in Anaesthesia Critical Care & Pain*, Volume 11, Issue 2, April 2011, Pages 44–49 Infants with low blood pressure and hypoxia, arterial blood may be dark and not pulsatile and may be mistaken for venous blood

Steps	Additional Information
15. Insert the J-curved end of the guidewire into the introducer needle, with the J curve facing up. Advance the guidewire through the needle and into the vein. **Do not force the wire**; it should slide easily and smoothly. Advance the wire 10-20cm.	 Adopted from Wikipedia – Seldinger technique If you feel any resistance as you advance the guidewire, stop, and use ultrasound guidance to check the position of the wire and the needle. Re-establish the needle tip within the vein (confirmed by venous blood return), and then reinsert the wire
16. Once the guidewire has been inserted, continue to hold it securely in place with one hand and maintain control of it throughout the remainder of the procedure.	
17. After successful insertion of the guidewire, **remove the introducer needle**	
18. Advance the tissue dilator over the guidewire.	
19. **Remove the dilator**- securely hold the guidewire distal to the dilator and pull the dilator from the skin	**If femoral artery is inadvertently cannulated by either the tissue dilator or the CVC, leave the dilator or catheter in place and obtain surgical consultation for possible surgical removal.**
20. Place gauze over skin and press gently as the dilated entrance to the vein will bleed until the catheter is threaded.	To prevent excessive blood loss and to keep the insertion site clean

Steps	Additional Information
21. **Advance the catheter** over the guidewire to the skin surface- thread the catheter tip over the distal end of the guidewire and slide the catheter down to the skin surface.	 The distal end of the guidewire should now be protruding from the port hub
22. Advance the entire length of the femoral catheter in increments of few centimetres until the hub is flush with the skin entry site	
23. Use ultrasonography to verify intravenous placement of the catheter.	Maintain your grasp on both the guidewire and the catheter.
24. Make sure all ports bleed back and flush easily ensuring no air enters the line	
25. Place a flushed 3-way tap on the end of each port.	
26. Suture the line to the skin.	
27. Clean the surrounding skin with water and dry	To avoid chemical burns from the cleaning solution
28. Apply a large Tegaderm and secure around the edges with Fixomull dressing	
29. Commence Heparinised 0.9% Sodium Chloride Solution infusion through each port at 1ml/hr until X-ray	To ensure lumen patency
30. Remove all equipment and drapes	

Steps	Additional Information
from the infant.	
31. Always use a **'sharps-safe'** technique –dispose in a sharps bin.	
32. Doff gown, gloves, mask, goggles	Maintain 5 moments of hand hygiene
33. Confirm placement with abdominal x-ray	Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions
34. Complete documentation on MR422.01	

CVC Maintenance

Refer to MR422.01 for maintenance documentation

Central lines must be reviewed daily and assess for removal. Refer to CVAD Bundle for further information on maintenance.

CVC related thrombosis

Refer to CVAD Bundle and MR422.01 for occlusion and thrombosis management.

Removal of CVC

Key points

- Document removal on the CVAD Insertion and Maintenance Form (MR422.01)
- Removal is a two-person procedure. One staff member holds the baby whilst the trained staff member attends to the removal of the line.
- Ensure the order for removal of CVC is clearly documented by the treating team.
- Inform the parents/caregiver of the procedure and provide comfort measures for the neonate.

Equipment

- Dressing pack
- PPE: Gloves; goggles (if risk of blood splash)
- Adhesive tape remover
- Cleansing swabs or solution: 1% chlorhexidine gluconate in 70% isopropyl alcohol
- Sterile occlusive dressing: (e.g. Tegaderm®)
- ± stitch cutter (if catheter secured with sutures)

- ± blunt tip sterile scissors (if catheter tip required)
- ± specimen container

Steps	Additional Information
1. Position the patient supine flat.	For patient with a Femoral CVC ensure leg is outstretched
2. Clamp the catheter (and administration sets if present).	
3. Wash hands and prepare equipment using aseptic technique	
4. Don PPE	
5. Loosen edges of dressing ± sutureless securement device with adhesive tape remover ± alcohol swabs and remove (do not use scissors on CVAD dressings)	If sutures present lift away from the catheter with forceps and cut the suture away from the catheter.
6. Cleanse the skin with 1% CHG/ 70% alcohol swabs and allow to dry.	
7. If catheter tip required for culture, wash hands and don sterile gloves and/or use sterile forceps to remove the catheter.	
8. Hold sterile gauze over the insertion site and using gentle even pressure, slowly withdraw catheter	Attempt to remove the catheter on expiration. If resistance is felt, pause, and gently try again. ***If resistance is still encountered contact senior medical or nursing staff.*** ***Do not use force***
9. Once catheter removed apply continual pressure over the exit site until haemostasis is achieved.	
10. Apply occlusive dressing and leave in place for 24 hours	
11. Observe the site for bleeding for a minimum of 4 hours.	
12. Check the catheter integrity following removal to ensure no remnants are left behind	Refer to catheter length on insertion record
If catheter tip is required for culture: Catheter tip (last 2-3 centimetres) is only sent for microbiological culture if clinically indicated i.e. unexplained fever, significant erythema or exudate at the insertion site.	

Steps	Additional Information
• Once catheter removed from patient, ensure the tip does not become contaminated e.g. by hands, clothing, bedding	
• Using sterile scissors cut the last 2-3cm of the catheter and place directly into the specimen container.	
• Label specimen with patient details and send with pathology request form to Microbiology	
Document Removal on the Neonatal CVAD Insertion and Removal Record MR 422 and/or CAHS MR852.01 CVAD Insertion and Removal Record. Notation of removal should be documented in the MR822 progress notes.	

Related CAHS internal policies, procedures and guidelines

CVAD: Central Venous Access Device Bundle

PCH Clinical Practice Manual CVAD guideline

PCH Perioperative Manual Surgical Hand Antisepsis (Scrubbing) Gowning and Gloving.

Neonatology Clinical Guideline Aseptic Technique in the Neonatal Unit

References and related external legislation, policies, and guidelines *(if required)*

1. Wiles BM, Child N, Roberts PR. How to achieve ultrasound-guided femoral venous access: the new standard of care in the electrophysiology laboratory. J Interv Card Electrophysiol. 2017 Jun;49(1):3-9. doi: 10.1007/s10840-017-0227-9. Epub 2017 Feb 7. PMID: 28168447
2. Peter C. Murphy, FRCA MRCPCH, Philip Arnold, FRCA, Ultrasound-assisted vascular access in children, *Continuing Education in Anaesthesia Critical Care & Pain*, Volume 11, Issue 2, April 2011, Pages 44–49, https://doi.org/10.1093/bjaceaccp/mkq056
3. Butler-O'Hara M, D'Angio CT, Hoey H, Stevens TP. An evidence-based catheter bundle alters central venous catheter strategy in newborn infants. Journal of Pediatrics 2012; 160: 972-7
4. Park, Christina & Paes, Bosco & Nagel, Kim & Chan, Anthony & Murthy, Prashanth. (2016). Neonatal central venous catheter thrombosis: diagnosis, management, and outcome. Blood coagulation & fibrinolysis : an international journal in haemostasis and thrombosis. 10.1097/MBC.0000000000000082.
5. Sol, J.J., van de Loo, M., Boerma, M. et al. NEOnatal Central-venous Line Observational study on Thrombosis (NEOCLOT): evaluation of a national guideline on management of neonatal catheter-related thrombosis. BMC Pediatr **18,** 84 (2018).

https://doi.org/10.1186/s12887-018-1000-7

6. Mehta S, Connors AF Jr, Danish EH, Grisoni E. Incidence of thrombosis during central venous catheterization of newborns: a prospective study. J Pediatr Surg 1992; 27:18–22.
7. Monagle P, Chan AK, Goldenberg NA, Ichord RN, Journeycake JM, Nowak-Go¨ ttl U, et al. Antithrombotic therapy in neonates and children:antithrombotic therapy and prevention of thrombosis, 9th ed: AmericanCollege of Chest Physicians Evidence-Based Clinical Practice Guidelines.Chest 2012; 141:e737S–801S
8. Garcia DA, Baglin TP, Weitz JI, Samama MM. Parenteral anticoagulants: antithrombotic therapy and prevention of thrombosis, 9th ed: American college of chest physicians evidence-based clinical practice guidelines. Chest. 2012;141(2 Suppl):e24S–43S.

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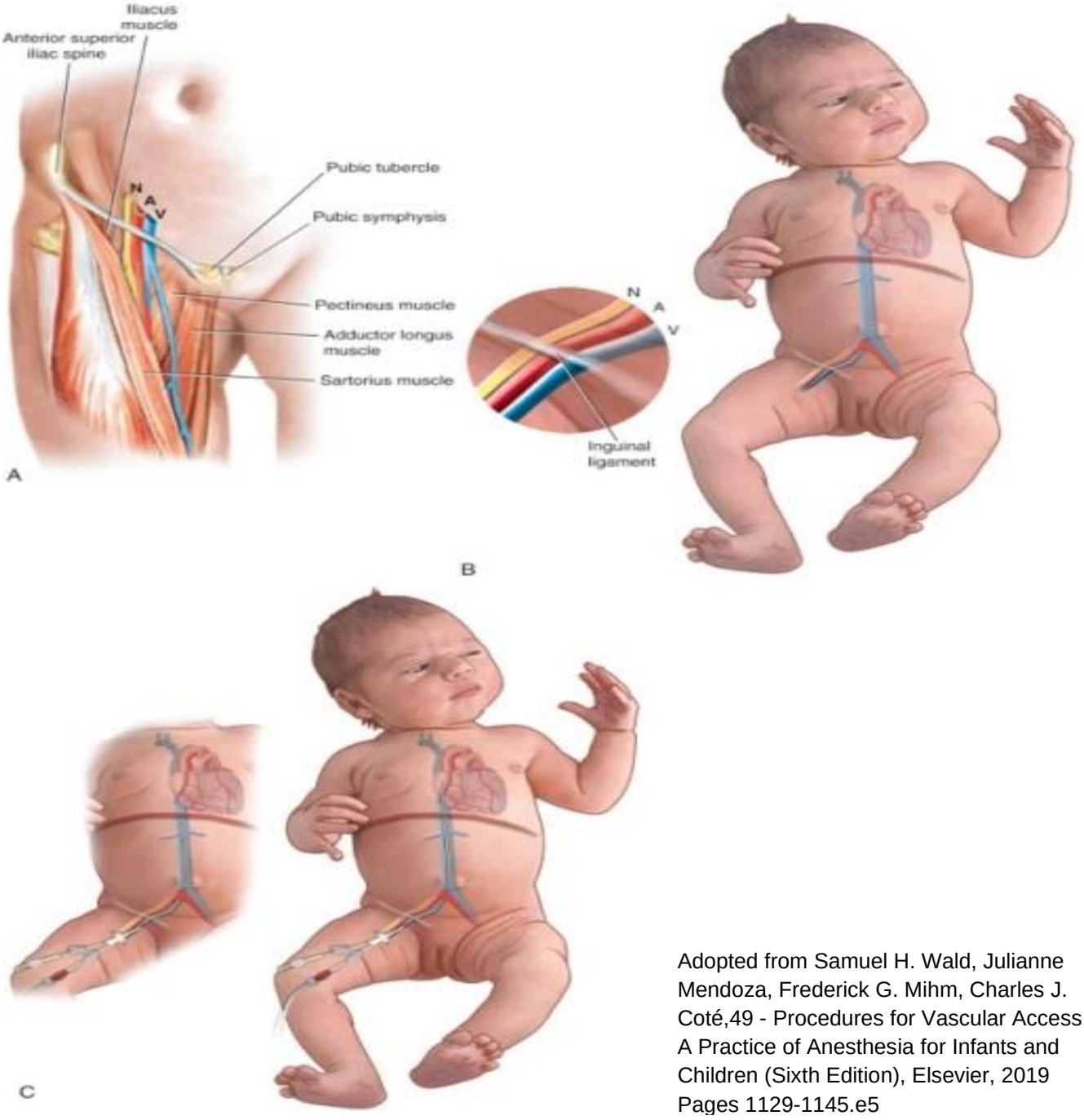
Appendix 1: Anatomical Landmarks

- The femoral vein and artery are accessible within the femoral triangle
- Femoral triangle is defined by the inguinal ligament superiorly, the adductor longus muscle medially, and the Sartorius muscle laterally.
- The inguinal ligament is defined as a line drawn between the symphysis pubis and the anterior superior iliac spine.
- The femoral artery is imaged inferior to the midpoint of the inguinal ligament.



Adopted from Samuel H. Wald, Julianne Mendoza, Frederick G. Mihm, Charles J. Coté,49 - Procedures for Vascular Access, A Practice of Anesthesia for Infants and Children (Sixth Edition), Elsevier, 2019 Pages 1129-1145.e5

Appendix 2: Equipment Kits and Sets

PICC Placement Kit

1 x outer wrap 75 x 90 cm

2 x drape towels 75 x 45 cm (absorbent/impermeable)

2 x blue prep forceps 12 cm

2 x measuring tapes 60 cm

2 x Tegaderm™ dressing 4 x 4 cm

1 x syringe 10 ml Luer-lock

1 x silicone neonatal tourniquet 9 x 180 mm

4 x ball swabs XRO

2 x hand towels

1 x peelable fenestrated transparent drape with "Easy-Peel" 50 x 50 cm (opening Ø 4 cm)

1 x straight Reynolds scissors 9 cm

1 x straight Iris forceps 10 cm

1 x curved Iris forceps 10 cm

5 x swabs 7.5 x 7.5 cm - 4 ply white

2 x gallipots 60 ml

1x tray 20 x 15 x 4 cm

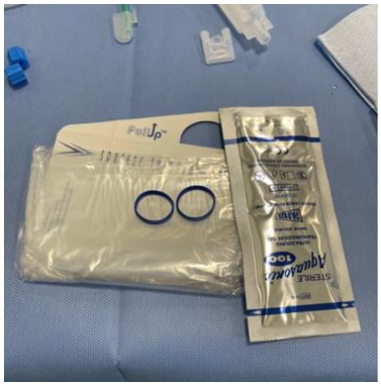
1 x pack of small Steri-Strip™ 6 x 38 mm (x6)

CVC Set

- 4F, 8cm, double or triple lumen catheter x1
- Needle introducer/cannula x2
- Guidewire x1
- Dilator x2
- 3ml syringe x1

Sterile Probe Cover Kit

- Ensheathe the cover probe head and cord
- sterile gel x1
- sterile rubber bands x2



Appendix 3: CVC Thrombosis Follow-up

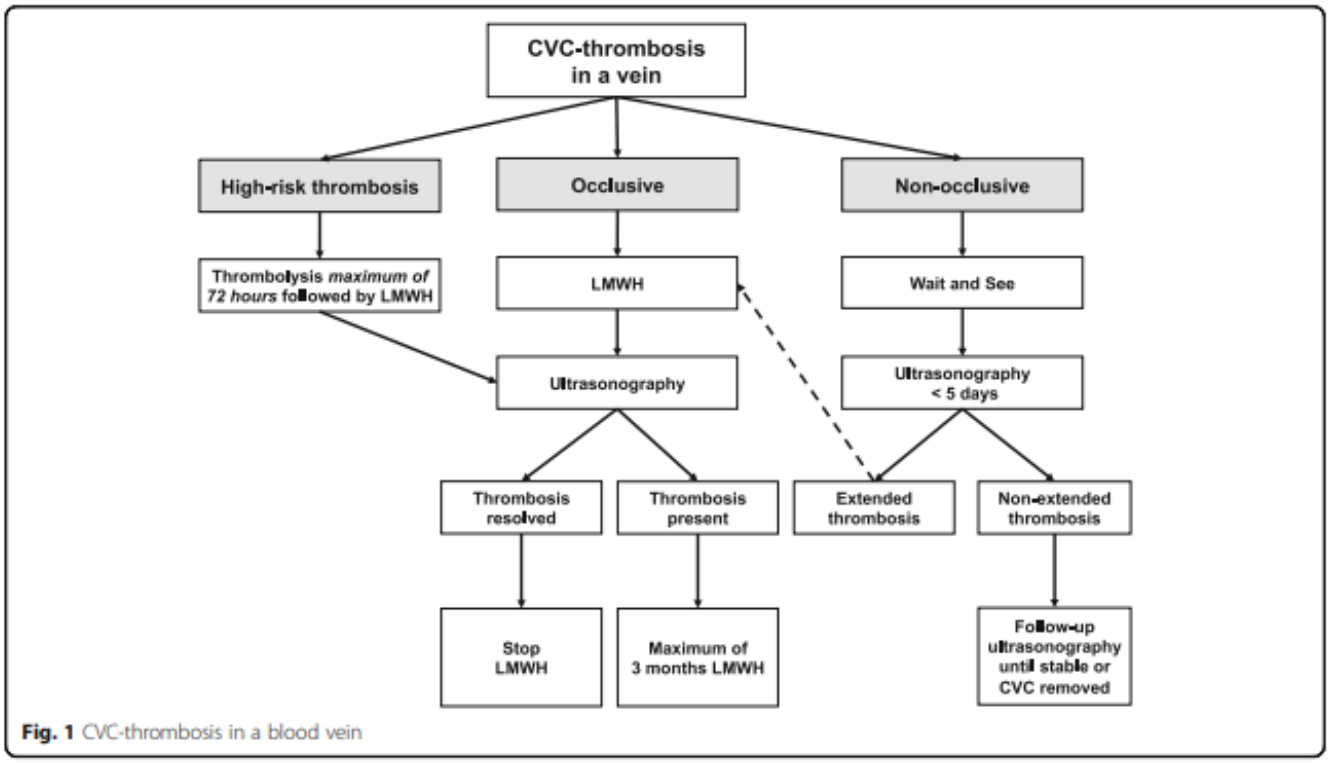


Fig. 1 CVC-thrombosis in a blood vein

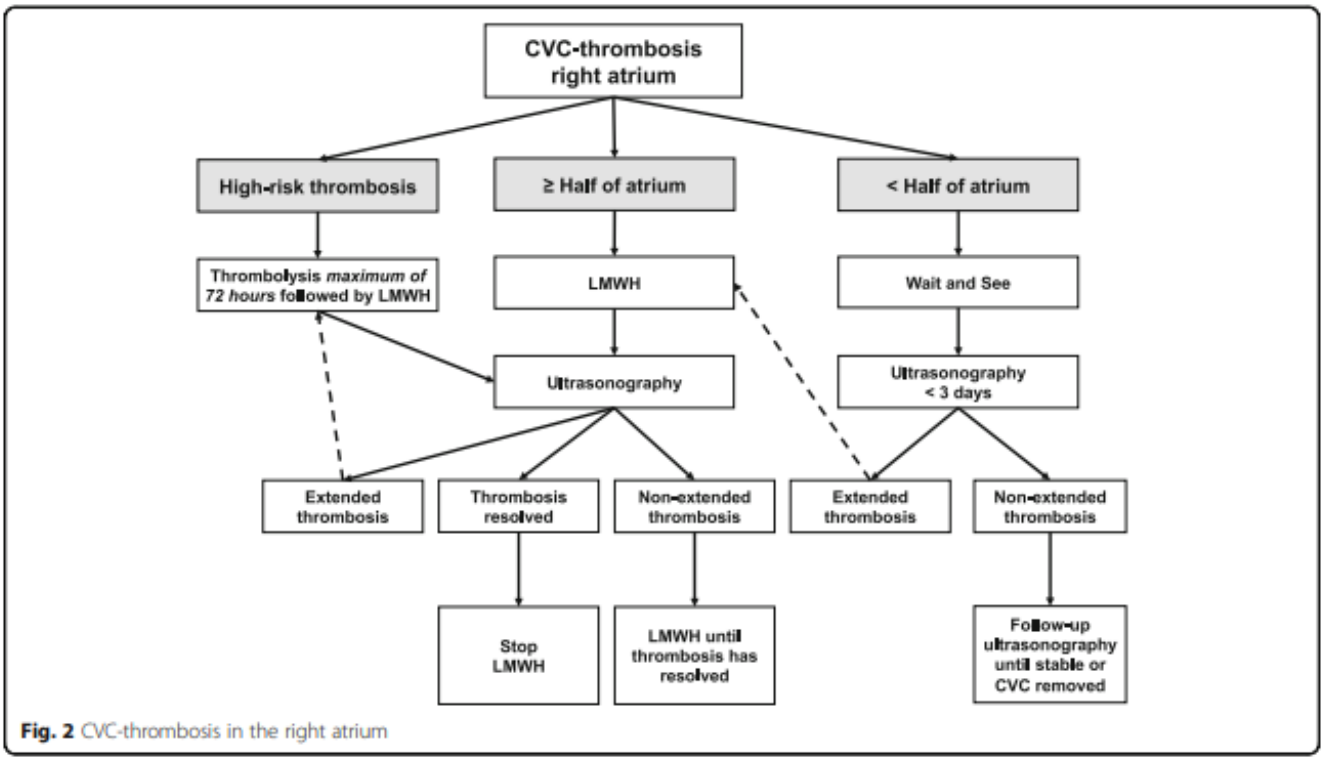


Fig. 2 CVC-thrombosis in the right atrium

NEOnatal Central-venous Line Observational study on Thrombosis (NEOCLOT), 2018