GUIDELINE

Central Venous Access Device: CVC / Femoral Vein

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

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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 access is required for multiple infusions, multiple blood products, the patient is unstable or is anticipated to become unstable such as with surgery. CVCs may also be used where insertion of a PICC line is not possible or feasible. In neonates, CVCs are commonly inserted in the jugular or femoral veins. Cannulating the femoral vein may be done by the neonatology team. Use of the internal jugular vein is reserved for anaesthetists or radiologists.

Complications

Specific complications from CVC insertion include:

- Infection
- Catheter malposition
- Thrombosis
- Bleeding or haematoma
- Arterial puncture or injury
- Pneumothorax or hemothorax
- Air embolism
- Catheter occlusion
- Catheter breakage or fracture
- Extravasation or tissue infiltration
- Cardiac arrhythmia
- Pericardial effusion or tamponade
- Phlebitis or vessel irritation

- Catheter migration or dislodgement
- Vessel perforation
- Nerve injury

Prior to Procedure

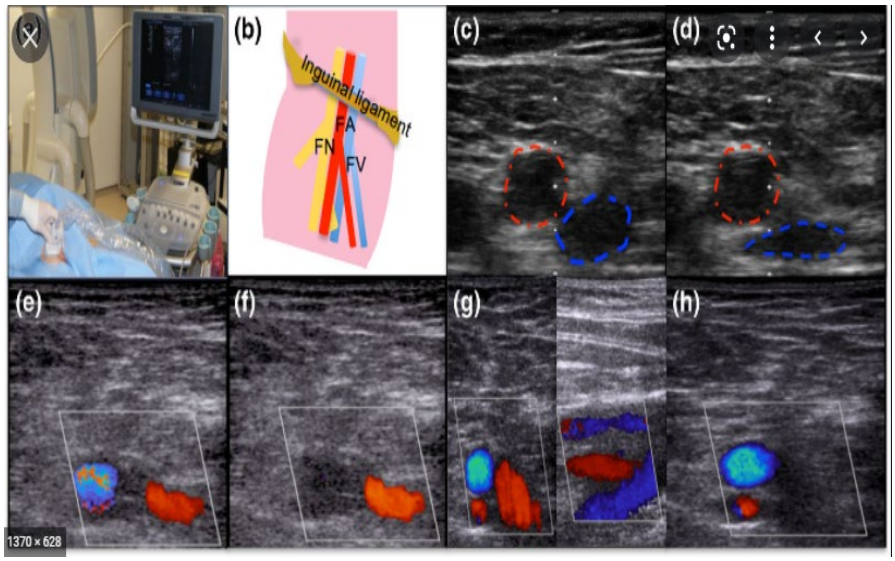
- The clinician performing the procedure must have appropriate training or supervision during the procedure, including the use of ultrasound guidance for CVC insertion.
- For neonates with cardiac conditions, discuss with the cardiologist prior to insertion as the femoral vein may be required for future cardiac catheterisation. If going for cardiac procedure in the following days, jugular CVC may be more appropriate as it will be required for the procedure.
    - See Pain Assessment and Management for sedation recommendations
- For anatomical landmarks, refer to Appendix 1.

Equipment List

Common equipment	Femoral catheter specific
• Surgical gown x 1 • Sterile pair of gloves x 2 Mask x1 Surgical hat x1 Face Shield (as required) x1 • Antiseptic solution: >27 weeks gestation: 1% chlorhexidine solution; ≤27 weeks gestation: Povidone-iodine solution **UVC/PICC placement kit** (see picture & contents below) • Sterile 0.9% Sodium chloride ampoules x2 Sterile absorbent towel X1 Multiple large sterile fields Bin (consider small easily accessible paper bag)	Ultrasound machine with a high frequency, linear array probe (transducer). • **Sterile probe cover kit** **CVC set** Consider 1% Lidocaine (without epinephrine) with 1ml syringe and drawing up needle Suture,3.0 silk • Sterile instrument pack 3ml 'slip' (non-luer lock) syringe 3-way taps for number of lumens Smartsite™ valves x2 (for each 3-way tap)

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



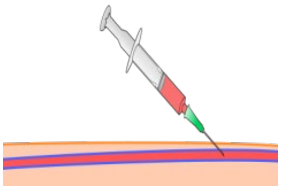
Ultrasound-guided identification of the femoral vein. a Preparation of the patient, the ultrasound machine and the sterile ultrasound probe. b The usual anatomical relationship of the femoral vein (FV), femoral artery (FA), femoral nerve (FN) and inguinal ligament. c Ultrasound appearance of the usual relationship between the right FA (red dashed line) and FV (blue dashed line). d Manual pressure on the skin results in compression of the FV, whilst the FA is relatively unchanged in diameter (same patient as in c). e, f Doppler flow in the artery is seen to be pulsatile. This can help in distinguishing FA and FV in difficult cases. g Bifurcation of the femoral vein is seen at this level, demonstrated with the imaging plane both perpendicular and parallel to the vessel. h The FV is very small compared to the FA. This was not felt to be a good target vessel and the other leg was used.

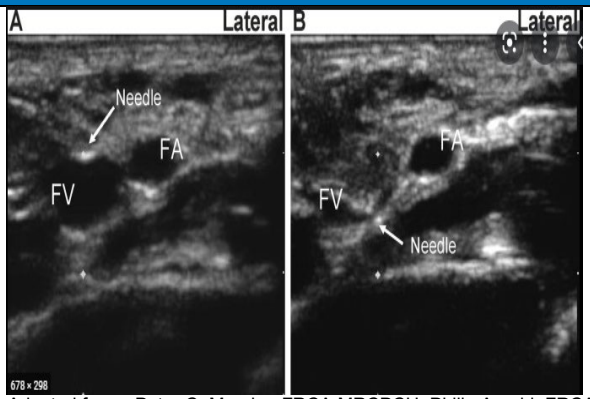
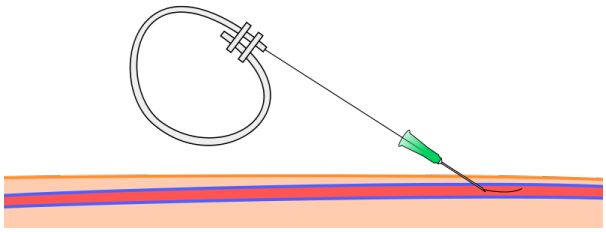
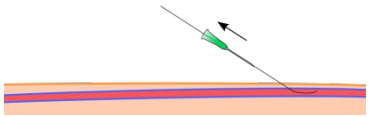
Adopted from: Wiles BM, Child N, Roberts PR. How to achieve ultrasound-guided femoral venous access: the new standard of care in the electrophysiology laboratory. J Interv Card Electrophysiol. 2017 Jun;49(1):3-9. doi: 10.1007/s10840-017-0227-9. Epub 2017 Feb 7. PMID: 2816844

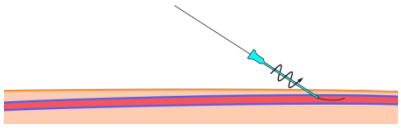
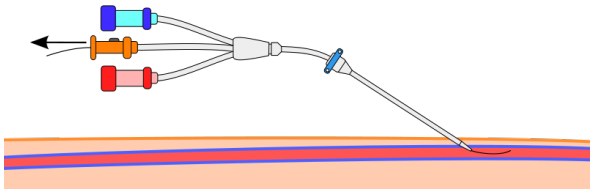
Insertion Procedure

Steps	Additional Information
1. Open all equipment onto a sterile drape that fully covers the trolley then arrange the equipment in a systematic manner.	
2. Consider drawing up local anaesthetic	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.	

Steps	Additional Information
5. Place a blue absorbent towel under the baby to avoid chemical burns to the back due to antiseptic solution	
6. 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
7. Cut a hole in the clear plastic drape and place over the insertion site. Alternatively, use a fenestrated drape.	
8. Consider injecting local anaesthetic around the estimated point of insertion and where the catheter will be sutured.	1% Lignocaine MAXIMUM of 0.3mL/kg
9. Prepare the ultrasound device Position the ultrasound machine in the room to avoid turning head during the procedure 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.	

Steps	Additional Information
10. Identify femoral vein using short axis view on ultrasound and measure the depth to the centre of the vein	
11. Initially advance the **introducer needle** with the bevel upwards into the skin at a 30-45° angle directed toward the midpoint of the probe, consider keeping a gentle negative pressure on the syringe plunger	
12. Maintain ultrasound visualization of the needle tip as you advance. As the needle enters the lumen of the vein a pop may be felt and flash of dark red blood in the syringe may be seen	
13. 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**	

Steps	Additional Information
	 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
14. Insert the guidewire into the introducer needle. 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
15. 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.	
16. After successful insertion of the guidewire, **remove the introducer needle**	

Steps	Additional Information
17. Advance the tissue dilator over the guidewire.	
18. **Remove the dilator**- securely hold the guidewire distal to the dilator and pull the dilator from the skin	
19. 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
20. **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
21. Advance the entire length of the femoral catheter in increments of few centimetres until the hub is flush with the skin entry site	
22. Use ultrasonography to verify intravenous placement of the catheter.	Maintain your grasp on both the guidewire and the catheter.
23. Make sure all ports bleed back and flush easily ensuring no air enters the line	
24. Place a flushed three-way tap on the end of each port.	

Steps	Additional Information
25. Suture the line to the skin.	
26. Clean the surrounding skin with water and dry	To avoid chemical burns from the cleaning solution
27. Place a small piece of Duoderm between the plastic and the skin then apply a large Tegaderm and secure around the edges with Fixomull dressing	
28. Commence Heparinised 0.9% Sodium Chloride Solution infusion through each port at 1ml/hr until X-ray	To ensure lumen patency
29. Remove all equipment and drapes from the infant.	
30. Always use a **'sharps-safe'** technique –dispose in a sharps bin.	
31. Doff gown, gloves, mask, goggles	Maintain 5 moments of hand hygiene
32. Confirm placement with abdominal x-ray (AP and lateral)	Central Line Imaging in Neonates: Radiographic Views, and Acceptable Line Positions
33. Complete documentation on MR422.01 and medical records	

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®)
- ± scissors (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.

Steps	Additional Information
	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.	
• 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 medical records.	

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
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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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Document Owner:	Neonatology		
Reviewer / Team:	Neonatology		
Date First Issued:	February 2022	Last Reviewed:	September 2026
Amendment Dates:		Next Review Date:	September 2029
Approved by:	Neonatal Coordinating Group	Date:	22nd September 2026
Endorsed by:	Neonatal Coordinating Group	Date:	
Aboriginal Impact Statement and Declaration (ISD)		Date:	September 2026
Standards Applicable:	NSQHS Standards: NSQPCH Standards: Child Safe Principles: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10		

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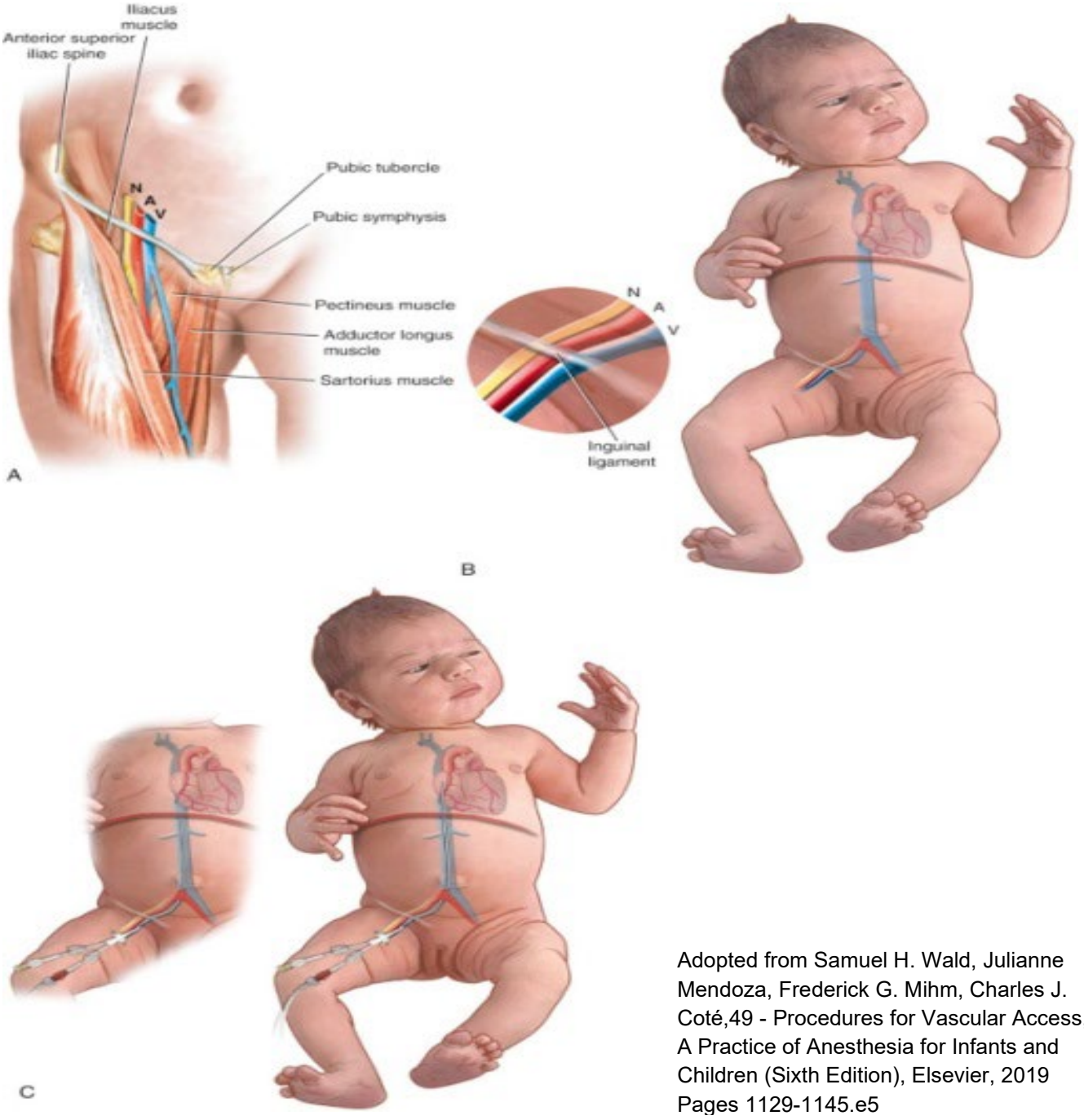
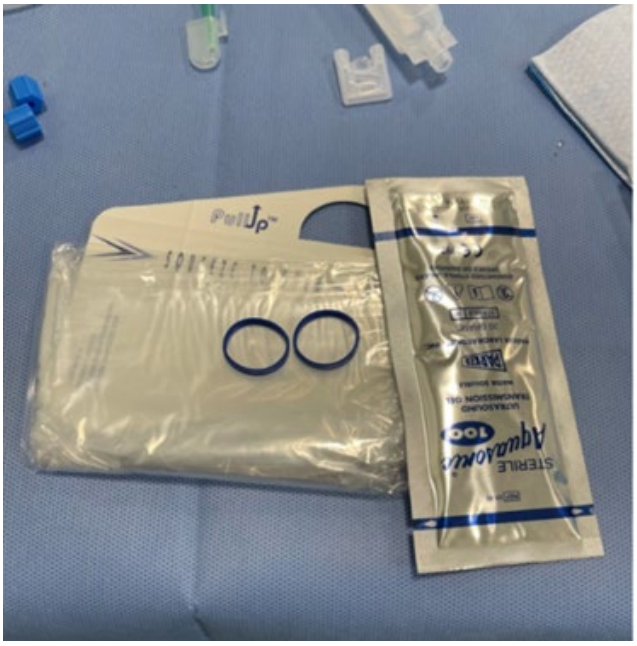
Appendix 1: Anatomical Landmarks

- 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: Sterile Probe Cover Kit

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