

UHL NNU guideline: Neonatal Peripheral Arterial Line Insertion

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Introduction and who this guideline applies to:

This guideline aims to inform the process behind the indication for and insertion of a peripheral arterial line (PAL) or arterial puncture in a neonate.

This guideline is aimed at all healthcare professionals involved in the care of infants within the Neonatal Service. Doctors or Advanced Neonatal Nurse Practitioners (ANNPs) who undertake this procedure must be authorized to do so by their line manager; this procedure should fall within their professional remit.

Key Points:

- PALs can be crucial in managing critically ill neonates, where haemodynamic monitoring and arterial blood sampling for physiological monitoring are required.
- A modified Allen's test should be undertaken before inserting a PAL.
- Risks associated with this procedure include artery spasm, haematoma formation, infection, thrombosis, thrombo-embolism, and soft tissue necrosis (**see appendix three:** flowchart of management of compromised circulation to a limb secondary to a PAL).

Related UHL documents:

[Extravasation UHL Neonatal Guideline](#) UHL ref: C33/2020

2. Peripheral Arterial Line Insertion

2.1 Indications:

- Assessment of ventilation status, acid-base balance and oxygenation
- To support point of care monitoring of critical blood parameters such as potassium, sodium, glucose and haemoglobin.
- Frequent need for blood sampling in preterm or ill neonates.
- Invasive blood pressure monitoring.
- Aspiration of blood during an exchange transfusion.

2.2 Cautions/Contraindications:

- Bleeding disorders (consider correcting clotting abnormalities before attempted insertion)
- Circulatory insufficiency to the extremity
- Skin breakdown or infection at the insertion site
- Malformation of the limb (e.g., radial club hand)
- Previous PAL attempt/insertion in the same limb

2.3 Pain Management:

- Use the smallest gauge of cannula appropriate for the baby's size.
- Use non-pharmacological measures such as containment holding.
- Consider the use of analgesia, where appropriate.

2.4 Sites for insertion:

PALs should be sited where there is good collateral circulation. A Modified Allen's test **MUST** be performed before an insertion attempt in the upper limbs (see Appendix one) (WHO 2010). Any other sites in upper limb should be avoided except in exceptional clinical situations. This is a clinical decision for senior medical staff only and **MUST** be documented.

Possible sites:

- Posterior tibial artery.
- Radial artery.

Sites to avoid:

- Temporal arteries
- Femoral arteries (except under consultant advice).
- Arteries in limbs previously attempted (secondary to an increased risk of complications).
- The brachial artery is rarely used and should only be attempted following discussion with a consultant neonatologist.
- If there is a failed Allen's test in the limb.

2.5 PAL Insertion Procedure:

Equipment:

- Clean blue tray
- Cold light.
- Sterile field (dressing pack)
- Sterile gloves
- Chlorhexidine wipe
- 24 or 26 G cannula
- 3mL syringe primed with 0.9% sodium chloride
- T-piece flushed with 0.9% sodium chloride
- Steri-strips and Tegaderm
- Gauze 50ml syringe and transducer set primed with heparinised 0.9%/0.45% sodium chloride as per UHL Neonatal Formulary
- Splint.
- Discuss the plan to undertake the procedure with the following:
 - Senior clinician (as appropriate) so that adequate support is available should complications arise.
 - The nurse looking after the baby who can provide containment holding, help with positioning and prepare fluids and equipment for infusion (where required).
- Identify and assess the artery using the modified Allen's test (see Appendix one).
- Transillumination may be a helpful tool to identify the artery.
- Consider the need for analgesia before undertaking the procedure.
- Wash and gel hands, and put on an apron.
- Place a sterile field underneath the limb.
- Clean the area with the chlorhexidine wipe and allow it to dry for 20 seconds.
- Reposition the limb and palpate the artery.
- Apply slight traction, and with the bevel uppermost, insert the cannula at a 30-degree angle.
- Insert slowly until a flashback is seen in the hub.

- Advance the sheath of the cannula while retracting the stylet. Arterial blood is bright red in appearance; the flow may not always be pulsatile in neonates but should be able to be aspirated.
- Blood gas analysis and connection to invasive monitoring can be helpful tools to help confirm arterial line placement.
- Attach the flushed T-piece to the cannula and carefully flush the cannula.
- There should be no resistance or swelling. However, there may be slight, transient blanching at the catheter tip.
- Assess the colour and perfusion of the limb and digits.
- Aspirate the cannula to check blood flashback.
- Secure the cannula, ensuring the insertion site and tip are visible, and perfusion and colour of all digits and the limb can be seen; apply a splint.
- Connect to a continuous infusion of heparinised sodium chloride (0.9% or 0.45% as per UHL Neonatal Formulary).
- Document the procedure, including the use of the Allen's test on the Neonatal Peripheral Arterial Line Documentation sticker.

3. Education & Training

None

4. Audit Standards:

1. Completed documentation of all PAL/arterial puncture attempts using the Neonatal PAL Sticker.

5. References:

Blackburn, J. and Walton, B., 2016. Risks associated with arterial lines; time for a National Safety Standard. *Journal of Anaesthesia Practice*.

World Health Organisation (WHO) 2010. WHO Guidelines on Drawing Blood: Best Practices in Phlebotomy. World health Organisation, Geneva. Accessed on: 20/10/2019 at https://www.euro.who.int/_data/assets/pdf_file/0005/268790/WHO-guidelines-on-drawing-blood-best-practices-in-phlebotomy-Eng.pdf

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Raeseide, L and Simpson, J. 2019. Peripheral arterial lines: insertion and care. NHS Greater Glasgow and Clyde. Accessed on the 06/11/2022 at https://www.perinatalnetwork.scot/wp-content/uploads/2022/06/Arterial-Lines-Peripheral-Insertion-and-Care_WoS.pdf

Bajaj, L. and Randolph, A.G., 2022. Arterial puncture and cannulation in children. In *UpToDate*. UpToDate, Waltham

Theodore, A.C., Manaker, S. and Hollingsworth, H. 2018. Arterial blood gases. In *UpToDate*. UpToDate, Waltham (MA).

Pillay, T., and Hobbs, S. 2014. Vascular Spasm and Thrombosis in the Neonatal period. Royal Wolverhampton Hospitals NHS Trust. Accessed on: 06/11/22 at: https://www.networks.nhs.uk/nhs-networks/staffordshire-shropshire-and-black-country-newborn/documents/Neonatal_arterial_thrombosisFINAL-1.pdf

6. Keywords:

Cannula, Limb, Modified Allen's Test

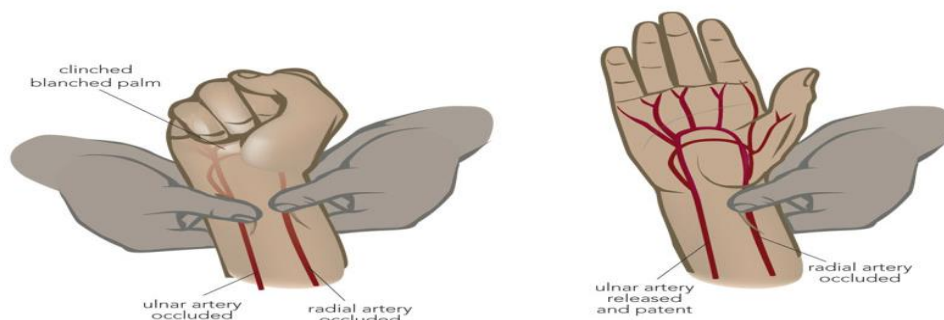
The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs. As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

Contact and review details			
Guideline Lead (Name and Title) Author: Alice Kavati, Andy Currie S Mittal – Consultant guidelines lead			Executive Lead Chief Medical Officer
Details of Changes made during review:			
Date	Issue Number	Reviewed By	Description Of Changes (If Any)
Oct 2019	1		
December 2022	2	A Currie Neonatal Guideline Meeting Neonatal Governance Meeting	Updated key points and indications Added section 2.3 – pain management 2.4 Sites for insertion – removed Ulnar artery as an option and replaced with ‘Any other sites in upper limb should be avoided except in exceptional clinical situations’ Sites to avoid now includes if there is a failed Allen’s test in the limb. Included undertake discussion for plan of insertion in insertion procedure section. Chlorhexidine wipe and allow it to dry for 20 seconds now (previously 30 seconds) Added indicators for confirming that arterial access is successful. Flow Chart added

Appendix One: The Modified Allen's test

Perform a modified Allen's test to check for adequacy of collateral circulation if using an upper limb. The Allen's test is a measurement of radial or ulnar patency. Performing the Allen's test in a neonate involves elevating the arm and simultaneously occluding the radial and ulnar arteries at the wrist, then rubbing the palm to cause blanching. Release the pressure on the ulnar artery (see Figure 1). If normal colour returns to the palm in < 10 seconds, adequate ulnar circulation is present. A neonate cannot voluntarily clench and release their fist as what would typically be required for this test.

Performing and reporting the results of the Allen's test must be documented in the medical record.



Appendix Two: Neonatal PAL Sticker

Neonatal PAL Documentation		
Date of attempt:		Time attempted:
Procedure attempted/inserted by:		
Signature:	Print name:	Designation:
Prior to Procedure:		
Modified Allen's Test performed:		Colour:
Capillary Refill Time:		Warm to touch:
Sedation/Analgesia: Yes/No		
During Procedure:		
Site of insertion/artery attempted:		
Was insertion attempt successful?: Yes/No		
All digits, insertion site and tip are clearly visible?: Yes/No		
Check are the fingers/toes well perfused?: Yes/No		
Removal:		
Removal Date and time:		
Reason for removal:		
Removed by:		
Signature:	Print name:	Designation:

(adapted from Crabtree and Sharkey 2016)

Appendix three: Flowchart of Management of Compromised Circulation Secondary to a PAL.

(Flowchart adapted from Pillay and Hobbs 2014).

- Arterial spasm may initially be difficult to distinguish from arterial thrombosis.
- Any signs of compromised circulation in a limb should be urgently addressed.
- Arterial thromboses are serious complications associated with potential dangers of ischemic injury to the affected limbs, infection, and embolization (Bajaj and Randolph 2022).

