

# **Arterial Lines (Peripheral) Insertion and Care of, Neonatal Clinical Guideline**

**V2.0**

**September 2024**

## 1. Aim/Purpose of this Guideline

- 1.1. Outline the process for peripheral arterial lines insertion in neonates in NNU (Neonatal Unit) by the Neonatal Team.
- 1.2. Outline the management and the maintenance of the arterial cannula.
- 1.3. Outline the equipment needed and used in the process of peripheral arterial cannulation.
- 1.4. Outline the different complications of arterial cannulae and how to approach them.
- 1.5. This version supersedes any previous versions of this document.

### **Data Protection Act 2018 (UK General Data Protection Regulation – GDPR) Legislation.**

The Trust has a duty under the Data Protection Act 2018 and UK General Data Protection Regulations 2016/679 to ensure that there is a valid legal basis to process personal and sensitive data. The legal basis for processing must be identified and documented before the processing begins. In many cases we may need consent; this must be explicit, informed, and documented. We cannot rely on opt out, it must be opt in.

Data Protection Act 2018 and UK General Data Protection Regulations 2016/679 is applicable to all staff; this includes those working as contractors and providers of services.

For more information about your obligations under the Data Protection Act 2018 and UK General Data Protection Regulations 2016/679 please see the Information Use Framework Policy or contact the Information Governance Team.

Royal Cornwall Hospital Trust      [rch-tr.infogov@nhs.net](mailto:rch-tr.infogov@nhs.net)

## 2. The Guidance

### 2.1. Introduction

- In the emergency and critical situations, a need to establish a reliable means to monitor systemic blood pressure and withdraw blood samples. The default option for this, in most neonatal cases, is an umbilical arterial line. This can sometimes be difficult to achieve as in neonates older than 48 hours and when a concern is raised about a diagnosis of necrotising enterocolitis (NEC).
- Peripheral arterial cannulation is not a common procedure in neonatal units but only needed in critical situations when no other means could be achieved.
- It should be discussed with a consultant and the decision should be documented before performing the procedure.

## 2.2. Indications

When umbilical arterial catheterisation is not possible or contraindicated and there is need to:

- Frequent blood sampling.
- Accurate invasive blood pressure monitoring in neonates with cardiovascular instability to guide fluid and inotrope management.
- Exchange blood transfusion.

## 2.3. Contraindications

- Evidence of inadequate collateral flow (unsuccessful modified Allen's test).
- Inadequate circulation to the extremity.
- Uncorrected coagulopathy.
- Local skin infection.
- Recent cannulation or attempt of another artery in the same limb.

## 2.4. Acceptable sites of Peripheral Artery Cannulation

2.4.1. The following sites are recommended and arranged in order of preference:

- Radial artery.
- Posterior tibial artery.
- Dorsalis pedis artery (absent in some infants).

There is a risk of approximately 5% of ischaemia secondary to radial arterial cannulation. The risk becomes greater with proximity i.e. cannulating the brachial or the femoral artery. Hence, they should be avoided.

2.4.2. Modified Allen's test

Perform a modified Allen's test to check for adequacy of collateral circulation if using an upper limb. The test is a measurement of radial or ulnar patency. To perform the Allen's test in a neonate elevate the arm and simultaneously occlude the radial and ulnar arteries at the wrist, then rub the palm to cause blanching. Release the pressure on the ulnar artery. If normal colour returns to the palm in < 10 seconds, adequate ulnar circulation is present.

Performing and reporting the results of the Allen's test must be documented in the medical record on the peripheral arterial line form.

## 2.5. Equipment

The following equipment is needed for peripheral arterial cannulation:

- Clean procedure trolley.
- Infrared trans-illuminator (operator dependent).
- Sterile dressing pack, sterile gloves, disposable apron and protective eyewear.
- Antiseptic solution (i.e. 2% chlorhexidine and 70% alcohol).
- 24G intravenous cannula.
- 5 mL luer lock syringe with sodium chloride 0.9%.
- T piece connector (IV cannula extension) with 3-way tap primed with 0.9% sodium chloride. Green/Red arterial connector on open end of three-way tap.
- Prepared IV (intravenous) giving set primed with heparinised sodium chloride 0.9% (30 units of heparin diluted in 30 ml of 0.9% saline) (0.45% sodium chloride if <28 weeks CGA (corrected gestational age)).
- Arterial line set primed using ANTT (aseptic non touch technique) with sodium chloride 0.9%.
- Tapes for securing the line, splint/ arm-board- steri-strips, tapes and Tegaderm (or equivalent).
- Long extension line- minimum volume extension tubing.
- Transducer set and cable.
- Syringe pump.

## 2.6. Analgesia and pain management

This is a painful procedure. In most cases a neonate requiring an arterial line is unwell and will usually have morphine. A bolus may be required prior to starting the procedure.

Other options are:

- Oral sucrose can be given if no contraindications apply.
- Swaddling (with affected limb exposed for access) during procedure and offering non-nutritive sucking for comfort if appropriate.

## 2.7. Procedure precautions

- Maintain thermoregulation throughout procedure.
- Avoid hyperextension of the joint as it may occlude the artery.

- Attempt insertion only once per artery.
- Seek senior help before further attempts.
- Keep the tips of the fingers and toes exposed to be able to check perfusion.
- Do not infuse blood, medications or hypertonic solutions via a peripheral arterial line.

## 2.8. Performing the procedure

- Prepare work surface and equipment.
- Perform the modified Allen's test to check for adequacy of collateral circulation.
- Slightly extend the wrist/ankle to bring the artery closer to the surface.
- Identify the artery by palpation +/- trans-illumination.
- Wash hands and don the apron and sterile gloves.
- Clean the skin with chlorhexidine solution.
- Insert the 24G cannula over the artery at an angle of 30- 45 degrees.
- Puncture the artery and watch for blood in the hub of the cannula.
- Withdraw the stylet while advancing the cannula slowly.
- There may be an initial spasm from the artery; hence blood return may be delayed.
- Attach the cannula to the arterial connector and three-way tap and slowly flush sodium chloride 0.9%.
- Turn off the three-way tap and secure the cannula with tape and a splint.
- Connect the 10 cm luer-lock, transducer set up and heparinised (one unit of heparin per mL) sodium chloride 0.9% 30 mL syringe (Should be primed and set up by a member of the nursing staff).
- Place a red arterial line sticker on the infusion line to identify the line as an arterial line.
- **Observe the fingers/toes post procedure to confirm peripheral perfusion.**
- Level and zero the pressure transducer if in use and set MEAN alarm limits as per medical preference.
- The transducer must be at level with the right atrium. To find the correct position using the mid clavicle as a guide, locate the fourth intercostal space and follow this space across the chest wall to the mid axillary line.

- Secure with splint and strapping. Ensure that all digits are visible for ongoing assessment.
- Dispose of sharps in sharps bin.
- Prescribe the heparinised sodium chloride infusion in the fluid prescription chart.
- Document procedure in the medical notes.
- **Arterial lines must always have fluids running through them to reduce the risk of thrombus formation.**
- **Unsuccessful attempts should be documented to avoid additional attempts on the same limb and potentially compromising perfusion.**



Figure 1: Securing of peripheral arterial line. (Jill Luck; Neonatal Unit)



Figure 2: Securing of peripheral arterial line. (Jill Luck; Neonatal Unit)

### 2.9. Nursing management

- Careful positioning and mild elevation of the limb with the arterial line in-situ.
- Ensure the tips of the fingers/toes are exposed at all times.
- Ensure digits and limb are pink, warm and well perfused.
- Inspect and document hourly the area distal and proximal to the insertion site for blanching, redness, cyanosis and changes in temperature and perfusion.
- Report to nurse in charge and medical team if there are changes to circulation of the limb or digits demonstrated by a change in colour or temperature.
- Level and zero arterial line at commencement of every shift and if neonate is turned/ moved.
- Heparinised (one unit of heparin per mL) sodium chloride 0.9% only to be administered as a continual infusion at 0.5–1.0 mL/hour.
- Change heparinised (one unit of heparin per mL) sodium chloride 0.9% infusion syringe and minimal extension line every 24 hours, transducer set every 72 hours.
- Arterial line is only to be used for blood sampling and blood pressure monitoring. Do NOT administer bolus medications or other infusions via this line.

### 2.9.1. Blood sampling from peripheral arterial lines:

All staff should have had training on arterial line sampling prior to sampling from an arterial line. Nursing staff should have completed the appropriate competency pack(s).

The following equipment is needed:

- 2mL syringe x 2.
- Blood gas syringe +/- syringe for blood collection.
- 0.9% sodium chloride.
- Antiseptic swab x 2.

For sampling:

- Wash hands and prepare work surface.
- Don gloves (non-sterile). Maintain non-touch technique of key sites throughout.
- Turn three-way tap 45 degrees ensuring no port will be open to air.
- Attach 2 mL syringe to exit port of three-way tap after wiping the port with antiseptic swab.
- Turn three-way tap off to infusion line and open to neonate and exit port then aspirate blood slowly from the neonate into the syringe.
- Withdraw into the syringe about 2 mL of blood to clear the arterial connector line of heparinised sodium chloride 0.9%.
- Turn three-way tap to 45 degrees ensuring no port will be open to air.
- Remove syringe from three-way tap and connect blood gas syringe or syringe for blood sample collection.
- Turn three-way tap so that blood can be aspirated from neonate into the syringe.
- Once sufficient blood is collected, turn three-way tap 45 degrees ensuring no port will be open to air.
- Attach a syringe with 2 mL syringe containing sodium chloride 0.9%.
- Slowly flush the arterial connector and line with sodium chloride 0.9% until the line is cleared of blood, observing for signs of arterial spasm such as blanching.
- Turn three-way tap to 45 degrees ensuring no port will be open to air.
- Clean the exit port after removing using antiseptic swab.

- Turn three-way tap open to infusion of heparinised (one unit of heparin per mL) sodium chloride 0.9% and neonate and closed to the exit port and commence infusion.
- Attach the original syringe of aspirated blood and heparinised sodium chloride 0.9% to a venous point of access (Peripheral venous cannula or umbilical venous catheter).
- Slowly return the contents of this syringe back to the neonate. Ensure no air is introduced.
- Observe digits and limb for colour, warmth and circulation and record on observation chart.
- Send blood samples as required.
- Document procedure and investigations on observation chart.

### **2.9.2. Loss of BP (blood pressure) trace or unable to sample from the line.**

- Check colour and perfusion distal to insertion site.
- Ensure line has not dislodged.
- Notify Nurse in Charge before going forward with the next steps.
- Check giving set and BP transducer for back flow.
- Try and gently aspirate then flush the line.
- Check and/or adjust BP scale on monitor.
- Allow artery time to recover- may be in vasospasm from previous attempt. Check colour and perfusion of limb and digits after 2-3 minutes. If satisfactory, gently try to aspirate/ flush again.
- Notify the registrar or the consultant (consultant/registrar to consider removing dressing to check and/or reposition cannula if needed)
- Remove line if BP will still not trace or sample.

### **2.10. Removal of peripheral arterial line**

- Wash hands and prepare work surface. Don gloves (non-sterile).
- Remove tapes carefully to ensure skin integrity using Apeel or similar products to facilitate.
- Withdraw the cannula and apply pressure to the site for 5 minutes with a piece of sterile gauze ensuring circulation to the hand/ foot is maintained.
- Check to see if the bleeding has stopped. If it has not, apply pressure for a further 2- 3 minutes before checking again. Repeat this step if needed.

- Once bleeding has stopped, cover the site with a small piece of gauze and tape/ film dressing.
- Observe the digits and limb for adequate circulation and continue to monitor for the next four hours.
- Document procedure in the medical record.

### 2.11. Complications

The risk of complications is higher in:

- Premature babies.
- Low birth weight especially < 2kg.

Most common complications are:

- Thromboembolism/ vasospasm/ thrombosis:

Can compromise circulation leading to blanching and possible necrosis or gangrene of tissues and extremities.

- Damage to peripheral nerves:
  - Median.
  - Posterior tibial.
- Infection.
- Emboli.
- Haematoma.
- Aneurysm of punctured artery.

### 3. Monitoring compliance and effectiveness

| Information Category                        | Detail of process and methodology for monitoring compliance                    |
|---|--|
| Element to be monitored                     | Insertion of peripheral arterial lines in neonates.                            |
| Lead  | Dr Christopher Bell; Neonatal Consultant.                                      |
| Tool  | Audit recorded on Excel.   |
| Frequency                                   | As directed by audit findings.   |
| Reporting arrangements                      | Neonatal Audit and Guidelines Group.   |
| Acting on recommendations and Lead(s)       | Neonatal Audit and Guidelines Group.   |
| Change in practice and lessons to be shared | Required changes in practice will be identified and actioned within 3 months . |

### 4. Equality and Diversity

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the [Equality Diversity And Inclusion Policy](#) or the [Equality and Diversity website](#).

4.2. Equality Impact Assessment

The Initial Equality Impact Assessment Screening Form is at Appendix 2.

## Appendix 1. Governance Information

| Information Category  | Detailed Information  |
|---|---|
| <b>Document Title:</b>  | Arterial Lines (Peripheral) Insertion and Care of, Neonatal Clinical Guideline V2.0           |
| <b>This document replaces (exact title of previous version):</b>                        | Arterial Lines (Peripheral) Insertion and Care of, Neonatal Clinical Guideline V1.0           |
| <b>Date Issued/Approved:</b>  | September 2024  |
| <b>Date Valid From:</b>   | September 2024  |
| <b>Date Valid To:</b>   | September 2027  |
| <b>Directorate / Department responsible (author/owner):</b>                             | Dr. Chris Bell; Consultant Paediatrician  |
| <b>Contact details:</b>   | 01872 252667  |
| <b>Brief summary of contents:</b>   | Approach to peripheral arterial cannulation, management of complications and troubleshooting. |
| <b>Suggested Keywords:</b>  | Neonatal, arterial, cannulation, blood sampling, monitoring.                                  |
| <b>Target Audience:</b>   | <b>RCHT:</b> Yes<br><b>CFT:</b> No<br><b>CIOS ICB:</b> No                                     |
| <b>Executive Director responsible for Policy:</b>                                       | Chief Medical Officer   |
| <b>Approval route for consultation and ratification:</b>                                | Neonatal Audit and Guidelines Group   |
| <b>Manager confirming approval processes:</b>   | Caroline Chappell   |
| <b>Name of Governance Lead confirming consultation and ratification:</b>                | Tamara Thirlby  |
| <b>Links to key external standards:</b>   | None required   |
| <b>Related Documents:</b>   | None required   |
| <b>Training Need Identified?</b>  | No  |
| <b>Publication Location (refer to Policy on Policies – Approvals and Ratification):</b> | Internet and Intranet   |

| Information Category                | Detailed Information |
|-------------------------------------|----------------------|
| Document Library Folder/Sub Folder: | Clinical/ Neonatal   |

### Version Control Table

| Date           | Version Number | Summary of Changes  | Changes Made by                     |
|----------------|----------------|---|-------------------------------------|
| August 2021    | V1.0           | Initial issue.  | Chris Bell;<br>Neonatal Consultant. |
| September 2024 | V2.0           | Full review and update to formatting.<br>No amendment to guidance required. | Chris Bell;<br>Neonatal Consultant. |

**All or part of this document can be released under the Freedom of Information Act 2000.**

**All Policies, Strategies and Operating Procedures, including Business Plans, are to be kept for the lifetime of the organisation plus 6 years.**

**This document is only valid on the day of printing.**

### Controlled Document.

This document has been created following the Royal Cornwall Hospitals NHS Trust [The Policy on Policies \(Development and Management of Knowledge Procedural and Web Documents Policy\)](#). It should not be altered in any way without the express permission of the author or their Line Manager.

## Appendix 2. Equality Impact Assessment

### Section 1: Equality Impact Assessment (EIA) Form

The EIA process allows the Trust to identify where a policy or service may have a negative impact on an individual or particular group of people.

For guidance please refer to the Equality Impact Assessment Policy (available from the document library) or contact the Equality, Diversity, and Inclusion Team  
[rcht.inclusion@nhs.net](mailto:rcht.inclusion@nhs.net)

| Information Category  | Detailed Information  |
|---|---|
| <b>Name of the strategy / policy / proposal / service function to be assessed:</b>  | Arterial Lines (Peripheral) Insertion and Care of, Neonatal Clinical Guideline V2.0 |
| <b>Directorate and service area:</b>  | Neonatal  |
| <b>Is this a new or existing Policy?</b>  | Existing  |
| <b>Name of individual completing EIA</b><br>(Should be completed by an individual with a good understanding of the Service/Policy): | Neonatal Audit and Guidelines Group   |
| <b>Contact details:</b>   | 01872 252667  |

| Information Category  | Detailed Information  |
|---|---|
| <b>1. Policy Aim - Who is the Policy aimed at?</b><br><br>(The Policy is the Strategy, Policy, Proposal or Service Change to be assessed) | Aimed at clinical staff who manage newborns.  |
| <b>2. Policy Objectives</b>   | Outline the process for peripheral arterial lines insertion in neonates in NNU by the neonatal team.<br><br>Outline the management and the maintenance of the arterial cannula.<br><br>Outline the equipment needed and used in the process of peripheral arterial cannulation.<br><br>Outline the different complications of arterial cannulae and how to approach them. |
| <b>3. Policy Intended Outcomes</b>  | As above.   |
| <b>4. How will you measure each outcome?</b>  | Audit.  |
| <b>5. Who is intended to benefit from the policy?</b>   | Neonatal patients.  |

| Information Category   | Detailed Information   |
|--|--|
| <b>6a. Who did you consult with?</b><br>(Please select Yes or No for each category)      | <ul style="list-style-type: none"> <li>• Workforce: Yes</li> <li>• Patients/ visitors: No</li> <li>• Local groups/ system partners: No</li> <li>• External organisations: No</li> <li>• Other: No</li> </ul> |
| <b>6b. Please list the individuals/groups who have been consulted about this policy.</b> | <b>Please record specific names of individuals/ groups:</b><br>Neonatal Audit and Guidelines Group.  |
| <b>6c. What was the outcome of the consultation?</b>                                     | Approved.  |
| <b>6d. Have you used any of the following to assist your assessment?</b>                 | <b>National or local statistics, audits, activity reports, process maps, complaints, staff, or patient surveys:</b><br>No.   |

## 7. The Impact

Following consultation with key groups, has a negative impact been identified for any protected characteristic? Please note that a rationale is required for each one.

Where a negative impact is identified without rationale, the key groups will need to be consulted again.

| Protected Characteristic   | (Yes or No) | Rationale   |
|--|-------------|---|
| <b>Age</b>   | No          |   |
| <b>Sex</b> (male or female)  | No          |   |
| <b>Gender reassignment</b><br>(Transgender, non-binary, gender fluid etc.) | No          |   |
| <b>Race</b>  | No          | Any information provided should be in an accessible format for the parent/ carer's needs- i.e., available in different languages if required/ access to an interpreter if required. |

| Protected Characteristic  | (Yes or No) | Rationale   |
|---|-------------|---|
| <b>Disability</b> (e.g. physical or cognitive impairment, mental health, long term conditions etc.) | No          | Those parent/carers with any identified additional needs will be referred for additional support as appropriate- i.e., to the Liaison Team or for specialised equipment.<br><br>Written information will be provided in a format to meet the family's needs e.g., easy read, audio etc. |
| <b>Religion or belief</b>   | No          | All staff should be aware of any beliefs that may impact on the decision to treat.  |
| <b>Marriage and civil partnership</b>   | No          |   |
| <b>Pregnancy and maternity</b>  | No          |   |
| <b>Sexual orientation</b> (e.g. gay, straight, bisexual, lesbian etc.)                              | No          |   |

**A robust rationale must be in place for all protected characteristics. If a negative impact has been identified, please complete section 2. If no negative impact has been identified and if this is not a major service change, you can end the assessment here.**

I am confident that section 2 of this EIA does not need completing as there are no highlighted risks of negative impact occurring because of this policy.

Name of person confirming result of initial impact assessment: Neonatal Audit and Guidelines Group

**If a negative impact has been identified above OR this is a major service change, you will need to complete section 2 of the EIA form available here:**  
[Section 2. Full Equality Analysis](#)