

Femoral Nerve Block in the Children’s Emergency Department - Full Paediatric Clinical Guideline – Derby only

CH CLIN C62/April 22/v001

Contents

1. Introduction	1
2. Scope.....	2
3. Main body of Guidelines	2
3.1 Background	2
3.2 Anatomy	3
3.3 Indications	3
3.4 Contraindications.....	3
3.5 Relative contraindications:.....	4
3.6 Complications.....	4
3.7 Preparation and Equipment.....	4
3.8 Local anaesthetic choice and preparation.....	4
3.9 Procedure.....	5
3.10 Ultrasound-guided technique.....	5
3.12 Post-procedure care	7
4.0 References.....	7-8
5.0 Documentation Controls	8-9
Appendix 1: Local anaesthetic systemic toxicity	9-10

1. Introduction

The purpose of this guideline is to assist clinicians in understanding the indications, practicalities and techniques for performing femoral nerve block (FNB) in children at the Royal Derby Hospital Children’s Emergency Department (CED). This guideline should be used in conjunction with the [Femoral Fracture Pathway](#) and other supporting videos regarding management of fractured femurs and traction. The FNB kit box including checklist can be found in CED resus.

2. Scope

This guideline is intended for use by clinicians caring for children in CED who have sustained a femoral shaft fracture and require regional anaesthesia as pain relief.

Traditionally, this procedure has been done using anatomical landmarks to guide administration of femoral nerve blockade. The ultrasound-guided method allows visualisation of needle placement and more focussed dispersion of local anaesthetic, reducing the risk of vascular puncture. This guideline covers both techniques, but the ultrasound-guided method is generally accepted to be easier, more effective and better tolerated by patients (1) (2). The USS-guided approach has been shown to provide prolonged duration of blockade with smaller volumes of local anaesthetic (3). It may also be safer overall as it carries a reduced risk of local anaesthetic systemic toxicity (4). It is rapidly becoming the standard and therefore is the recommended and preferred technique.

A femoral nerve block may be done by the CED senior team. If a child presents out of hours, support may be sought from an Adult ED registrar or consultant. If there is no one available or FNB is not felt to be suitable option for this child, IV morphine titrated to effect is an acceptable alternative to manage pain and facilitate application of traction. Lack of available staff to perform a nerve block should not delay application of traction as this will stabilise the fracture and provide pain relief for the child.

3. Main body of Guidelines

3.1 Background

Femoral fractures are common and very painful. Movement in order to obtain x-rays or to apply traction makes the pain worse. Prompt administration of effective analgesia is paramount. Opioid analgesia must be titrated against analgesic effect. Patients frequently require repeated doses of intravenous opioid analgesia to achieve adequate and sustained pain control. Regional anaesthesia through femoral nerve blockade is a safe and effective method for achieving rapid pain control for a femoral shaft fracture whilst avoiding repeated doses of systemic opioids.

3.2 Anatomy

The femoral nerve arises from the lumbar plexus at L2-4. After emerging from the psoas major muscle, it passes behind the inguinal ligament and enters the groin in the femoral triangle, lateral to the femoral vessels and separated from these by the lower part of psoas major. The femoral nerve lies deep to the fascia lata and the fascia iliaca, while the femoral vessels sit between the two. The femoral nerve innervates the hip joint, femur, anteromedial thigh, knee, and the medial aspect of the lower leg.

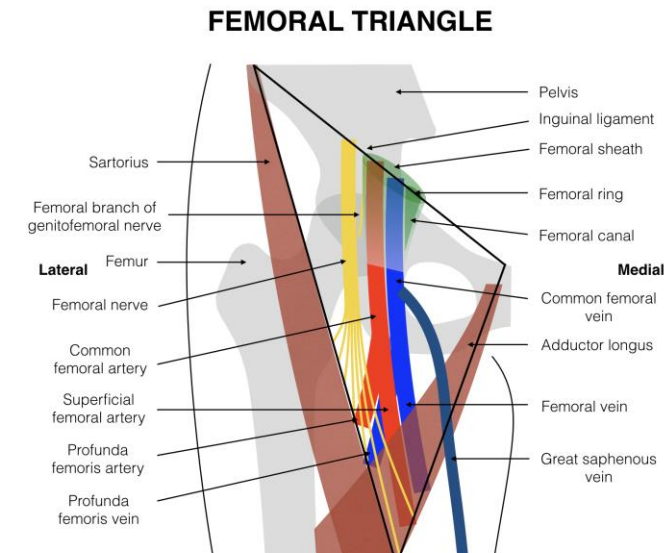


Figure 1 Femoral nerve anatomy (17)

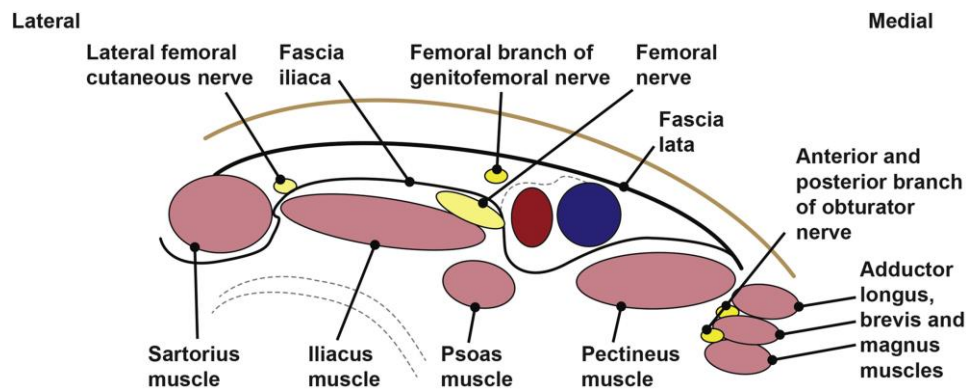


Figure 2 Cross-sectional view (11)

3.3 Indications

- Femoral shaft fractures

3.4 Contraindications

- Infection or open wound at the puncture site
- Femoral nerve injury
- Allergy to local anaesthetic

3.5 Relative contraindications:

- Age under 1 year (see note on local anaesthetic below)
- Bleeding disorders or anticoagulant therapy (1)
- High risk of compartment syndrome: significant crush injury or circumferential burns. The theoretical risk is that FNB will delay recognition of evolving compartment syndrome. However, there is no evidence-based data to indicate that the use of regional anaesthesia increases the risk or delays recognition of compartment syndrome in children. (5)

3.6 Complications

- Allergy/anaphylaxis
- Infection
- Nerve injury. Rare, especially when done under USS guidance.
- Local anaesthetic toxicity: venous/arterial infiltration causing secondary haemodynamic collapse +/- seizures. Rare, especially when done under USS guidance: visualise the needle tip throughout to ensure local anaesthetic is delivered away from the femoral vessels. See [Appendix 1](#) for management.
- Pseudoaneurysm from vascular injury.

3.7 Preparation and Equipment

- Obtain and document verbal consent from person with parental responsibility.
- Ensure adequate nursing support and correct setting i.e. resus
- Gather equipment. Most can be found in the FNB kit box in CED resus. You will need:
 - Cardiac and SpO2 monitoring
 - Ultrasound machine - linear transducer, gel
 - LMX cream applied to the site 20-30mins in advance (but do not delay procedure if not done)
 - Sterile dressing pack
 - Chlorhexidine solution
 - Sterile gloves
 - 2 x syringes (sizes according to dose and volume) 2x blunt fill needle (to prepare local anaesthetic)
 - 1 x yellow needle; 1 x green needle
 - Lidocaine 1% and/or levobupivacaine 0.25%
- Examine and document neurovascular status



Figure 3 Linear transducer

3.8 Local anaesthetic choice and preparation

Levobupivacaine is commonly used for femoral nerve blocks in children. Like lidocaine, it is predominantly metabolised by the CYP3A4/7 pathway, which is fully matured by the age of 1 year (6) (7). Some practitioners may elect to mix levobupivacaine with lidocaine by halving the dose of each in order to benefit from the rapid onset of the lidocaine plus the prolonged

action of the levobupivacaine. However, single agent levobupivacaine is safe and effective. Typical dose for a femoral nerve block is 0.5-1.5mg/kg Levobupivacaine, with a maximum dose of 2mg/kg (8) (9). Levobupivacaine 0.25% has a concentration of 2.5mg per ml.

For children under 25kg use 1.5mg/kg = 0.6ml/kg of 0.25% levobupivacaine

For children over 25kg use of 15ml of 0.25% levobupivacaine

Consider supplementary use of inhaled nitrous oxide (Entonox) in older children who can coordinate self-administration.

3.9 Procedure

1. Position patient supine with hip slightly externally rotated if tolerated.
2. Prepare ultrasound machine: correct probe, machine on opposite of bed to operator and block side.
3. Clean skin with Chloraprep/cleaning of choice. Allow to dry.
4. Locate the inguinal crease: ASIS to pubic symphysis.
5. Palpate femoral pulse (artery).
6. Infiltrate skin with 1-2ml lidocaine 1% via yellow needle. Administer superficially, lateral to artery.

3.10 Ultrasound-guided technique

1. Position probe in transverse plane with marker pointing to patient's right
2. Identify landmarks: locate the vein (compressible) and the artery (pulsatile) first; this can be confirmed using the Doppler function. Then move laterally to find the femoral nerve, which has a honeycomb appearance. Look for the fascia iliaca, which runs above the femoral nerve and below the vessels.
3. Insert the needle at a 30-45 degree angle so that the needle tip is easily visible. Advance slowly lateral to medial ensuring tip of needle is always visible.

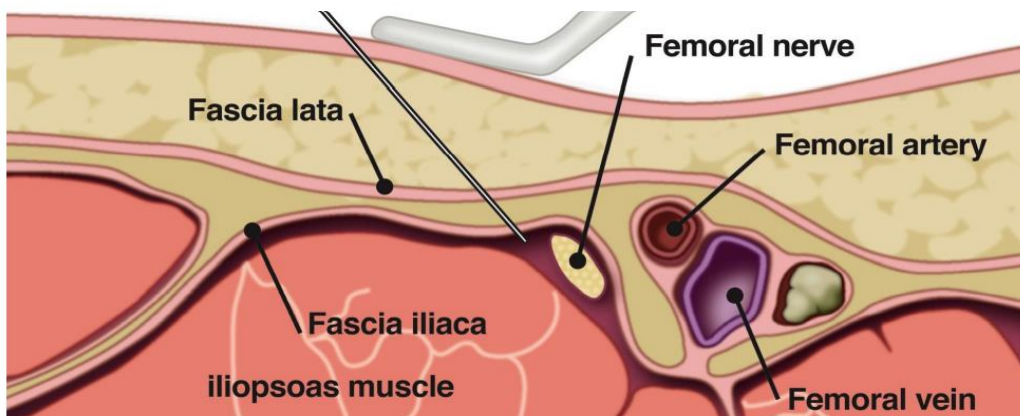


Figure 4 Cross-sectional diagram of USS guided approach

4. Before each infiltration, aspirate to check not in a vessel.
5. Infiltrate around the nerve, aiming for the lateral edge of the nerve, just under the fascia iliaca and above the iliopsoas muscle. This will allow the local anaesthetic to encircle the nerve fully. The local anaesthetic will be anechoic (black).
6. Visualisation of the spread of the local anaesthetic confirms correct needle placement. If the spread is not seen, the needle may be intraneural and should be repositioned.

! THE NEEDLE TIP SHOULD BE VISIBLE THROUGHOUT INFILTRATION !

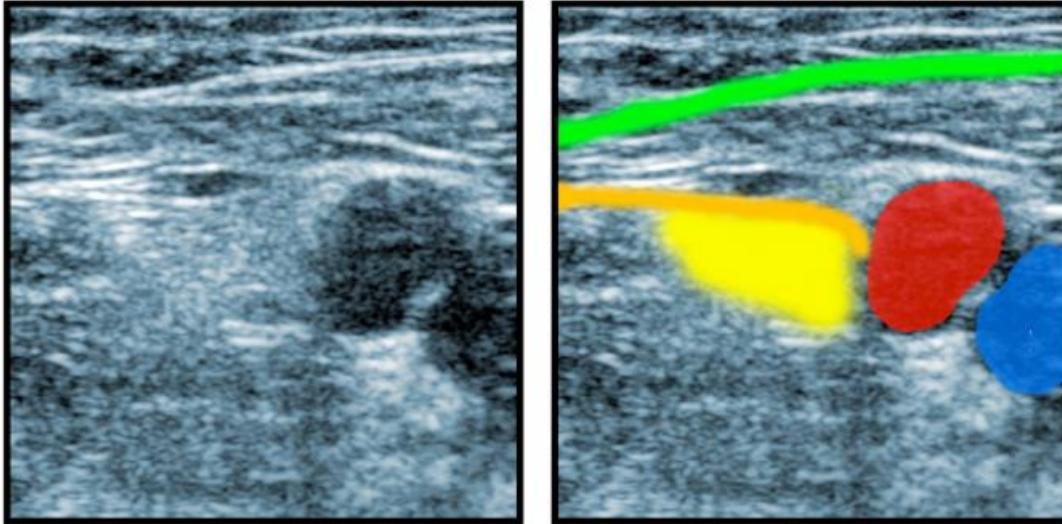


Figure 5 Ultrasound image of femoral artery (red), femoral vein (blue), femoral nerve compartment (yellow), fascia lata (green), fascia iliaca (orange)

3.11 Landmark-based technique

1. Draw/imagine a line from the pubic tubercle to the ASIS. The line represents the inguinal ligament.
2. Palpate the femoral artery. Site of **needle insertion is 1-2cm inferior to the line of the inguinal ligament and just immediately lateral to the femoral artery.**



Figure 6 Surface landmarks (15)

3. Insert the needle at a 30-45degree angle pointing towards the head, never aiming medially.
4. Infiltrate local anaesthetic slowly, aspirating to check not in a vessel each time the needle is advanced/repositioned.
5. Significant resistance to infiltration or pain on infiltration indicates incorrect positioning – try withdrawing slightly.

3.12 Post-procedure care

- Apply simple gauze dressing or plaster.
- Continue cardiac monitoring for 30 minutes post-procedure (10)
- Post-procedure observations should be done at 5, 10, 15 and 30 minutes post-procedure as a minimum. LA concentration peaks 15-30 mins post injection. Monitor for signs of LA toxicity [Appendix 1](#)
- Check injection site for signs of pseudoaneurysm development (usually within 2 hours of procedure).
- Allow 20-30 minutes time for analgesic effect before manoeuvring patient to apply traction.
- Apply splint and traction as directed by orthopaedic team.

4.0 References

1. *Ultrasound-Guided Femoral Nerve Blocks in the Initial Emergency Department Management of Pediatric Femur Fractures.* **Cross K, Warkentine F.** 1, s.l. : Clinical Pediatric Emergency Medicine, 2016, Vol. 17.
2. *Are peripheral and neuraxial blocks with ultrasound guidance more effective and safe in children?* **Rubin K, Sullivan D, Sadhasivam S.** 2, s.l. : Paediatr Anaesth, 2009, Vol. 19.
3. *Ultrasonographic guidance for sciatic and femoral nerve blocks in children.* **Oberndorfer U, MArhofer P, Bosenberg A, Kettner S et al.** 6, s.l. : British Journal of Anaesthesia, 2007, Vol. 989.
4. *Ultrasound guidance reduces the risk of local anesthetic systemic toxicity following peripheral nerve blockade.* **Barrington M, Kluger R.** 4, s.l. : Regional Anesthesia & Pain Medicine, 2013, Vol. 38.
5. *The European Society of Regional Anaesthesia and Pain Therapy and the American Society of Regional Anesthesia and Pain Medicine Joint Committee Practice Advisory on Controversial Topics in Pediatric Regional Anesthesia.* **Ivani G, Suresh S, Ecoffey C, et al.** 526-532, s.l. : Regional Anesthesia & Pain Medicine, 2015, Vol. 40.
6. *Evaluation of Child/Adult Pharmacokinetic Differences from a Database Derived from the Therapeutic Drug Literature.* **Ginsberg G, Hattis D, Sonawane B, Goble R et al.** 2, s.l. : Toxicological Sciences, 2002, Vol. 66.
7. *Regional anaesthesia in neonates, infants and children.* **M, Johr.** 5, s.l. : European Journal of Anaesthesiology, 2015, Vol. 32.
8. *The European society of regional anesthesia and pain therapy and the American society of regional anesthesia and pain medicine joint committee practice advisory on controversial topics in pediatric regional anesthesia I and II.* **Lönnqvist P, Ecoffey C, Bosenberg A, Suresh S, Ivani G.** 5, s.l. : Current Opinion in Anaesthesiology, 2017, Vol. 30.
9. *Ultrasound-guided upper and lower extremity nerve blocks in children.* **Merella F, Missetti V.** 2, s.l. : BJA Education, 2020, Vol. 20.

10. *Local anesthetic systemic toxicity: current perspectives*. El-Boghdadly K, Pawa A, Chin KJ. **Local anesthetic systemic toxicity: current perspectives**. *Local Reg Anesth*. 2018 and doi:10.2147/LRA.S154512, 11:35-44. Published 2018 Aug 8. 35-44, s.l. : Local Reg Anesth, 2018, Vol. 11.
11. *Fascia iliaca compartment block*. O-Reilly N, Desmet M, Kearns R. 6, s.l. : BJA Education, 2019, Vol. 19.
12. *Ultrasound Guided Fascia Iliaca Block: A Comparison With the Loss of Resistance Technique*. Dolan J, Williams A, Murney E, Smith M, Kenny G. 6, s.l. : Regional Anesthesia and Pain Medicine, 2008, Vol. 33.
13. **Ultrasound-Guided Fascia Iliaca Nerve Block**. *NYSORA*. [Online] 2021. <https://www.nysora.com/regional-anesthesia-for-specific-surgical-procedures/lower-extremity-regional-anesthesia-for-specific-surgical-procedures/ultrasound-guided-fascia-iliaca-block/>.
14. NICE. **Severe local anaesthetic-induced cardiovascular toxicity**. *BNFc*. [Online] 2021. <https://bnfc.nice.org.uk/treatment-summary/severe-local-anaesthetic-induced-cardiovascular-toxicity.html>.
15. *Implementing Regional Nerve Blocks in Hip Fracture Programs: A Review of Regional Nerve Blocks, Protocols in the Literature, and the Current Protocol at The Queen's Medical Center in Honolulu, HI. - Abstract - Europe PMC*.
16. *Postoperative pain management in children: Guidance from the pain committee of the European Society for Paediatric Anaesthesiology (ESPA Pain Management Ladder Initiative)*. Vittinghoff, M, Lönnqvist, P-A, Mossetti, V, et al. 493-506, 2018, Vol. 28.
17. *Femoral Nerve*. *Radiopaedia*. [Online] 2015. <https://radiopaedia.org/articles/femoral-nerve>.
18. **Fascia Iliaca Compartment Block: LANDMARK AND ULTRASOUND APPROACH**. *World Federation of Societies of Anaesthesiologists*. [Online] Aug 2010. <https://www.frca.co.uk/Documents/193%20Fascia%20Iliaca%20compartment%20block.pdf>.

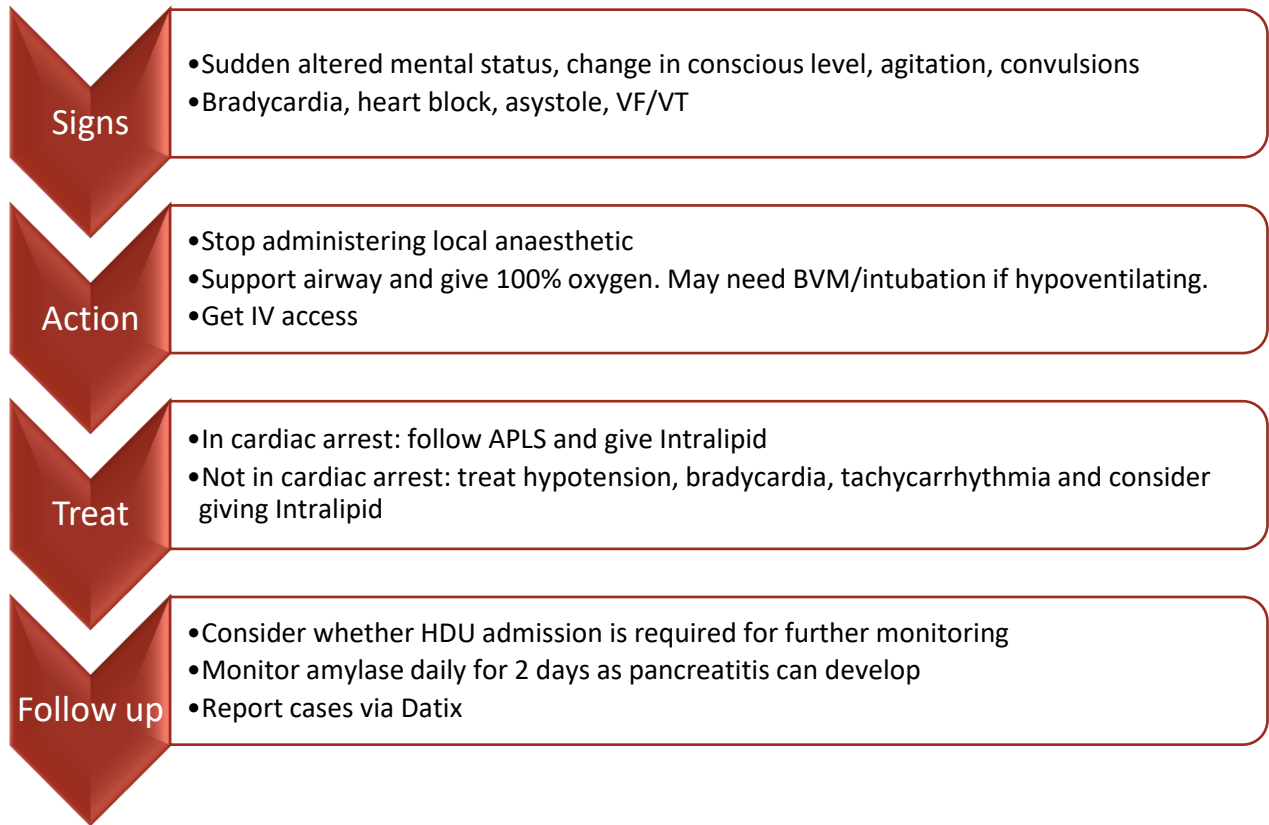
5.0 Documentation Controls

Reference Number From Library and Knowledge Service Manager	Version: V001		Status Final		
	Version	Date	Author	Reason	

Version / Amendment History	1	April 2022	Dr E Ivey	New guideline
Intended Recipients: Clinicians working in the Children's Emergency Department at RDH or seeing children in the Emergency Department at QHB.				
Training and Dissemination: To be circulated via email then will be accessible within the paediatric emergency guidelines on the intranet. No specific training required for guideline users but ED/CED consultants may train junior colleagues in the procedural elements as cases arise.				
Development of Guideline: Dr Elizabeth Ivey Job Title: Paediatric Emergency Medicine Registrar				
Consultation with: Dr Catherine Hearnshaw and all CED consultants				
Linked Documents: Femoral Fractures in Children guideline				
Keywords: femur, femoral, nerve block, regional anaesthesia				
Business Unit Sign Off		Group: Paediatrics Business Guidelines Group Date: 08/04/2022		
Divisional Sign Off		Group: Women's and Children's Clinical Governance Group Date: 26/04/2022		
Date of Upload		June 2022		
Review Date		April 2025		
Contact for Review		Paediatric Emergency Medicine Registrar		

Appendix 1: Local anaesthetic systemic toxicity

Local anaesthetic toxicity can occur at any time in the first hour after the injection of anaesthetic. Concentration peaks at 15-30minutes hence it is advised to observe patients closely for at least 30 minutes after administration. Early signs can include lightheadedness, perioral numbness or tingling and slurred speech – ask the patient about these during and after the procedure. This can progress to tachycardia, hypotension, seizures, coma, torsades de pointes and cardiac arrest. Arrhythmias induced by LA can be very refractory to treatment.



- Treat hypotension with fluid bolus(es).
- Treat seizures as per APLS.
- For torsades de pointes, give IV magnesium sulphate 40mg/kg (max 2g) over 20mins.
- **Intralipid is kept in the anaesthetic drug cupboard in Bay 1 of adult ED resus.** Give 1.5ml/kg of Intralipid 20% over 1 minute followed by an infusion at 15ml/kg/hour for at least 10 minutes after haemodynamic stability is achieved. After 5 minutes, if haemodynamic stability has not been restored or circulation deteriorates, give a maximum of two further bolus doses of 1.5 mL/kg over 1 minute, 5 minutes apart, and increase the infusion rate to 30 mL/kg/hour. Continue infusion until cardiovascular stability and adequate circulation are restored or maximum cumulative dose of 12 mL/kg is given (14).