

# Guideline

## Ultrasound-Guided Femoral nerve / Fascia iliaca compartment block

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Applicable to	Medical and Nursing staff working in Children's Health Queensland				
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### Purpose

The purpose of this guideline is to assist clinicians in understanding the indications, utility, and process involved in performing an ultrasound-guided Femoral nerve block (FNB) / Fascia iliaca compartment block (FICB), primarily in the Emergency Department (ED).

### Scope

This guideline primarily applies to all staff involved in the care and management of children who have sustained femoral fractures that would benefit from FNB/FICB for analgesia. While FNB was traditionally used for femur fractures FICB has gained popularity among physicians. Both techniques can be used to facilitate analgesia while managing femoral fractures.

### Related documents

#### Procedures, Guidelines, Protocols

- [CHQ-PROC-00302 Regional Analgesic Infusions](#)
- [CHQ-GDL-00731 Local Anaesthetic Systemic Toxicity](#)

### Guideline

An ultrasound-guided FNB/FICB are safe and rapid methods in attaining pain control for an injury to the lower extremity without having to administer large doses of intravenous opioids.<sup>2-6</sup> FNB/FICB were initially performed using the landmark-based method. The ultrasound-guided technique is now the standard of care and allows the visualization of needle placement and spread of local anaesthetic which in turn decreases the risk of vascular puncture and increases the success rate of femoral nerve blockade.<sup>7-11</sup>

FNB historically has been the preferred method of providing analgesia for femoral fractures. However, there are some theories that suggest FICB is a safer option as local anaesthetic is spread along the fascial plane rather than around the individual nerve<sup>1</sup> and therefore reducing potential complications of needle trauma. The use of ultrasound for nerve localization had reduced such risks and to date no studies showed that either block is inferior. The FICB can anaesthetise the lateral cutaneous nerve which may be a more suitable block for proximal femur fractures<sup>2</sup> and has the added benefit of blocking sensory innervation to the lateral thigh.

## Anatomy

### Femoral nerve

The femoral nerve arises from L2-L4 and is the largest branch of the lumbar plexus. It travels under the inguinal ligament, to the femoral artery (see Figure 1). It innervates the hip joint, femur, anteromedial thigh, knee, and the medial aspect of the leg from the knee to the foot.<sup>8</sup> It is important to note that this space does not include the lateral femoral cutaneous nerve.<sup>12</sup>

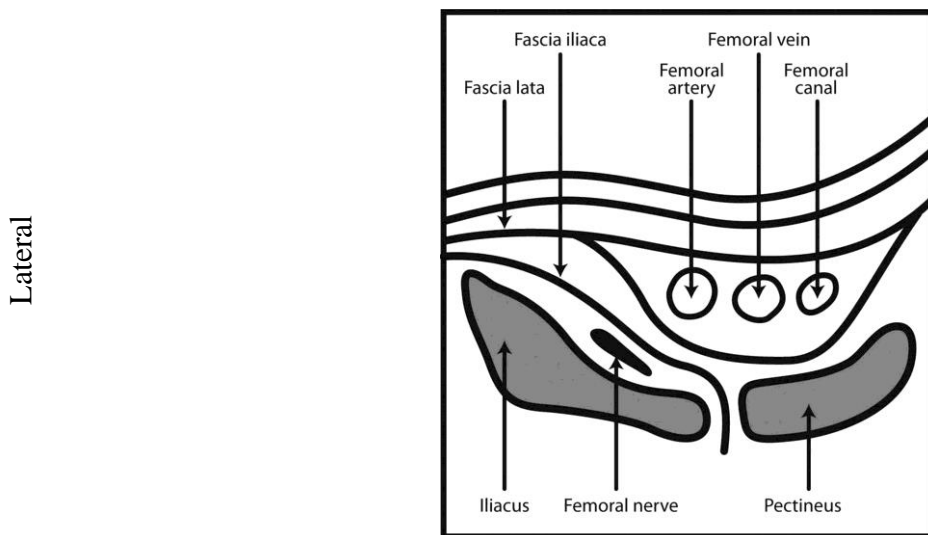


Figure 1. Femoral Nerve Anatomy<sup>13</sup>

### Fascia Iliaca

The fascia iliaca compartment is a potential space which borders are the fascia iliaca anteriorly and the iliopsoas posteriorly. Within this space lie three important nerves – the femoral nerve, the obturator nerve and the lateral cutaneous nerve. As a result, placement of local anesthesia beneath the fascia iliaca could, in theory, result in anaesthesia of all three nerves.<sup>13-14</sup>

As stated above, femoral nerve arises from L2-L4 and is the largest branch of the lumbar plexus. It travels under the inguinal ligament, to the femoral artery (see Figure 1). It innervates the hip joint, femur, anteromedial thigh, knee, and the medial aspect of the leg from the knee to the foot. The obturator nerve runs through the psoas muscle and wraps behind the common iliac vessels. It innervates a small portion of the medial aspect of the lower limb. The lateral aspect of the thigh is innervated by the lateral femoral cutaneous nerve which runs posterior to the inguinal ligament. The posterior segment of the thigh is innervated by the sciatic nerve and is not affected by a FICB<sup>13-14</sup>.

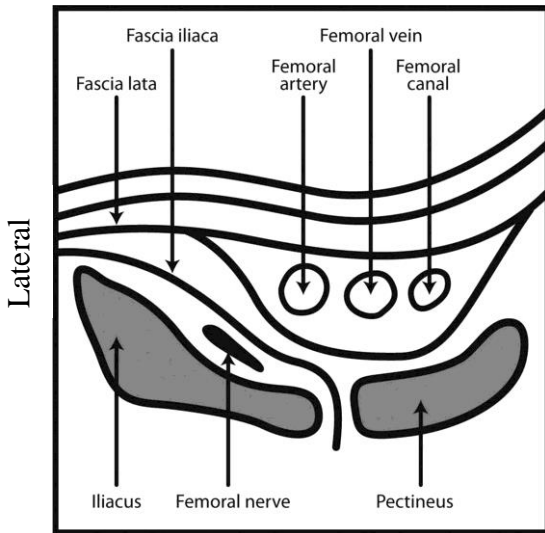


Figure 1. Femoral Nerve Anatomy<sup>15</sup>.

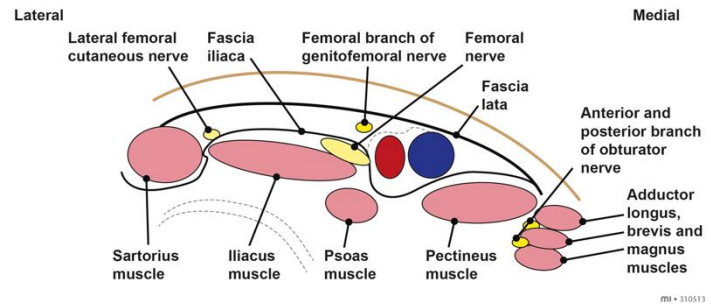


Figure 2. Fascia Iliaca compartment anatomy<sup>13</sup>

## Indications

FNB/FICB are ideal for patients with hip pain and proximal femur fractures (fractured neck or shaft of femur). It can also be used as an alternative to procedural sedation for patients who require a painful procedure (e.g. abscess drainage, burns or laceration repair) along the area of anterior thigh or knee.

The choice of which block to use depends largely on the physician experience and personal preferences.

## Contraindications

- Infection at the puncture site
- Nerve injury at the region
- High suspicion of compartment syndrome
- True allergy to local anaesthetic
- Previous femoral bypass surgery
- Relative contraindication– bleeding disorders or anticoagulant therapy<sup>1,8</sup>

## Preparation and Technique

### a) Consent

- For nerve block procedure (verbal) and for procedural sedation (written).
- Children ages 3-12 months must be discussed with anaesthetics prior to starting procedure process.

### b) Equipment

- Monitoring – continuous cardiac monitoring and SpO<sub>2</sub>.
- Ultrasound machine with a linear transducer (5-15 MHz) Figure 3.
- EMLA (topical anaesthetic cream) on site prior to procedure (although this should not delay procedure).

- Local anaesthetic by injection of the skin prior to the nerve block (unlikely to be necessary if EMLA and procedural sedation are utilised).
- Sterile dressing or suture pack.
- Chlorhexidine solution.
- Sterile drapes, sterile gloves.
- Clean ultrasound probe then cover with sterile ultrasound probe cover.
- Sterile gel (standard ultrasound gel is a potential source of infection).
- 10 mL syringe and blunt 18 Gauge needle.
- Nerve block needle or spinal needle (22 Gauge, with low pressure extension tubing)
  - 50 mm long is usually enough. In older patients, you may need it to be 90 mm long.
- Band-aid.
- Splint and traction equipment ready to apply.



**Fig 3: Ultrasound probe**

### c) Drugs

#### Considerations:

Dose should be based on ideal body weight (IBW)

IBW if 1 – 5 years: Weight (kg) = 2 x (age (years) + 5)

IBW if 5 – 14 years: Weight (kg) = 4 x age (years).<sup>19</sup>

Don't forget that if you use local anaesthetic for this and other procedures, the total amount of anaesthetic used and should not exceed the mg/kg maximum dose for the patient.

#### First Drug of choice: Ropivacaine

<b>Dose</b>	Femoral (FNB) - 0.2-0.4mL/kg of Ropivacaine 0.2% (max 2mg/kg) Fascia iliaca (FICB) - 0.5mL/kg of Ropivacaine 0.2% (max 2mg/kg)
<b>Considerations</b>	2 mg/kg (maximum 140mg or 30mL whichever smaller) if patient expected to go to theatre within 4-6 hours; if not can go up to 2.5-3 mg/kg



#### ALERT

**Lignocaine should not be used for nerve blockade**

### d) Patient preparation

Establish intravenous (IV) access<sup>1,8</sup>

#### Positioning

Place the patient in a supine position with slight external rotation of the hip if tolerated. The ultrasound machine should be placed opposite the operator, across the bed.

### Procedural sedation

Most patients will require procedural sedation, such as ketamine, to tolerate the nerve block, splinting and traction process. This can be decided if it is needed on a case by case basis.

### Splint and traction equipment

If procedural sedation has been utilised, every effort should be made to apply splinting and traction while the patient is still sedated, with the FNB/FICB in place. Ensure this equipment is at the bedside before starting this procedure.

### **e) Documentation**

1. Document procedure on FNB/FICB Procedure Details Form in FNB/FICB box (see [Appendix 3](#)).
2. Prior to starting the procedure, **ensure you have checked for femoral nerve injury and for signs suggestive of compartment syndrome**, and document this **before** starting procedure.<sup>1</sup> If there are any signs of nerve injury or compartment syndrome, do not start the procedure without speaking to the Emergency Consultant and the Orthopaedic team.

### **f) “STOP BEFORE YOU BLOCK”**

- Confirm patient identity.
- Confirm side and site to be blocked.<sup>20</sup>

### **g) Step-by-Step scanning and injection technique**

1. Ensure cardiac and SpO2 monitoring is applied.<sup>1,11</sup>
2. On the ultrasound machine, select the linear transducer with the nerve preset. To enhance your images, select 'needle profiling' from the right-hand column options (if you are using the SonoSite X-Porte).
3. Wash hands.
4. Wear sterile gloves.
5. Clean skin then drape the area.
6. Place gel on the ultrasound probe then place a sterile cover over it, then place sterile gel on the inguinal crease of the patient.
7. Place the ultrasound probe in the transverse orientation at the inguinal crease with the probe indicator pointing to the patient's right.

**For Femoral nerve block follow 8a-8c**

**For Fascia iliaca compartment block follow 9a-9c.**

### **8. FNB –**

1. Locate the femoral vein and artery. Move the probe slightly lateral to locate the femoral nerve. See [Figure 4](#) and [Figure 5](#)

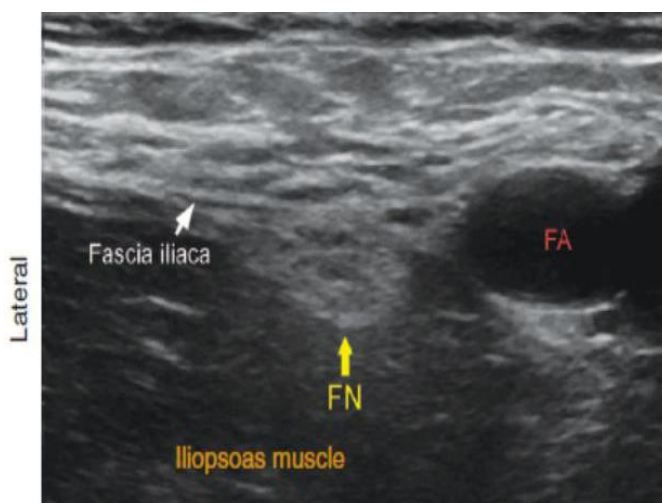


Figure 4. Ultrasound representation of femoral nerve. FN femoral nerve, FA femoral artery <sup>21,22</sup>

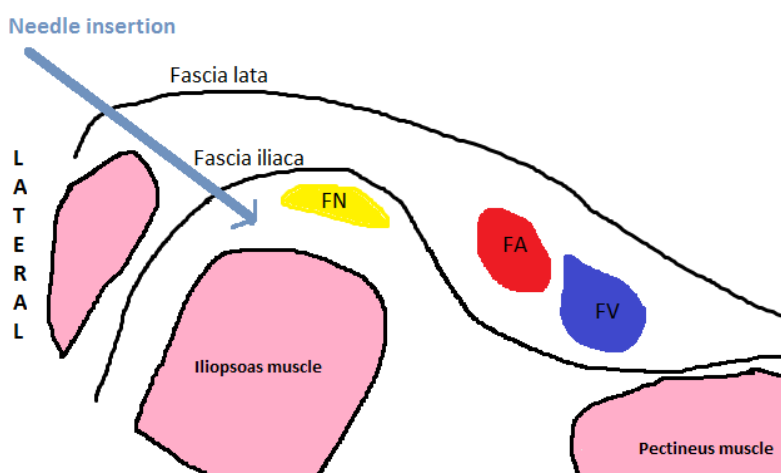


Figure 5. Anatomy around the femoral nerve. FN femoral nerve, FA femoral artery, FV femoral vein.

9. Other important landmarks to identify are the fascia iliaca (superior to the femoral neurovascular bundle) and the iliopsoas muscle (deep to the femoral nerve). See figure 4-5
10. Insert the needle at an approximately 30-degree angle with a lateral to medial in-plane technique so that the needle can be visualised during the **entire** procedure. Direct the needle tip to the lateral aspect of the femoral nerve with the goal of injecting the anaesthetic at the lateral aspect of the femoral nerve, under the fascia iliaca and above the iliopsoas muscle. This would enable the anaesthetic to spread and bathe the femoral nerve. See [Figure 6](#) and [Figure 7](#)



Figure 6. In plane technique<sup>22</sup>



- a) Remember to **aspirate prior to injecting** to ensure lack of vascular puncture.<sup>2,8,23</sup>
- b) Try injecting a small amount (1 mL) of anaesthetic first to ensure that the anechoic fluid is located under the fascia iliaca and above the iliopsoas muscle. If so, continue to inject local anaesthetic to bathe the femoral nerve. It is important to visualise the entire needle including the tip during the procedure.

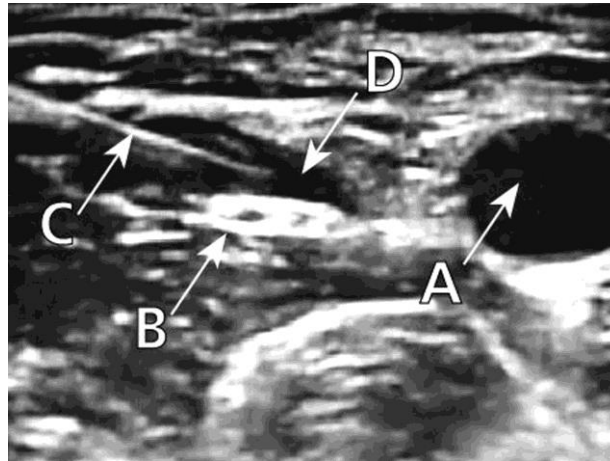


Figure 7. A femoral artery, B femoral nerve, C needle, and D local anaesthetic around the femoral nerve.<sup>15</sup>

**FICB –**

1. Locate the femoral vein and artery. Move the probe slightly lateral to locate the femoral nerve. See [Figure 8](#) and [Figure 9](#).

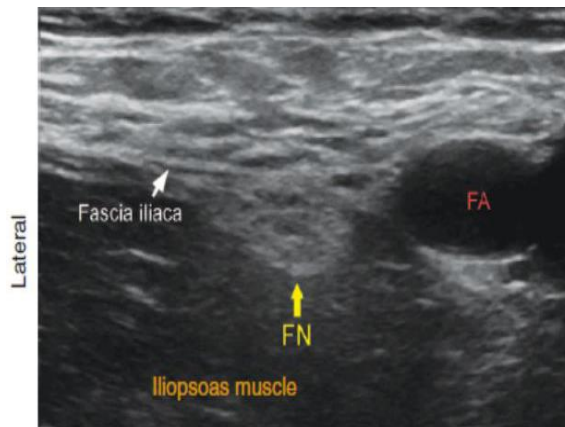


Figure 8. Ultrasound representation of femoral nerve. FN femoral nerve, FA femoral artery<sup>21,22</sup>

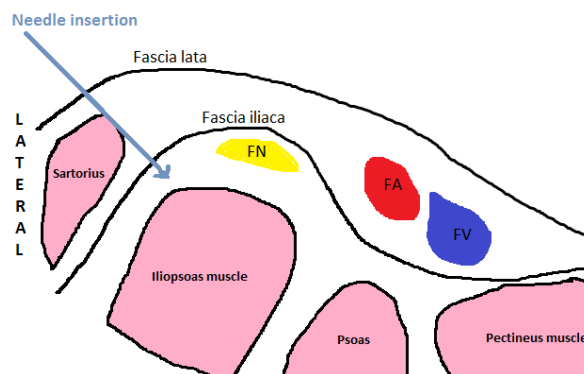


Figure 9. Injection site for FICB (FN femoral nerve, FA femoral artery, FV femoral vein).

2. Move the probe more laterally to identify the fascia lata, iliacus muscle and fascia iliaca (see Figure 8)
3. Introduce the needle (under ultrasound guidance using the in-plane approach, from the lateral side) inferior to the inguinal ligament, then advance through the fascia lata and then beneath the fascia iliaca. Make sure that the needle can be visualised during the **entire** procedure.
4. Aspirate. There should be no blood and no resistance to aspiration. Inject local anaesthetic (gentle aspiration after each few mL of injection). Spread the local anaesthetic in medial and lateral directions under the fascia iliaca (see Figure 11) Watch for separation of the fascia iliaca away from the iliopsoas muscle.



Figure 10. In plane technique<sup>22</sup>

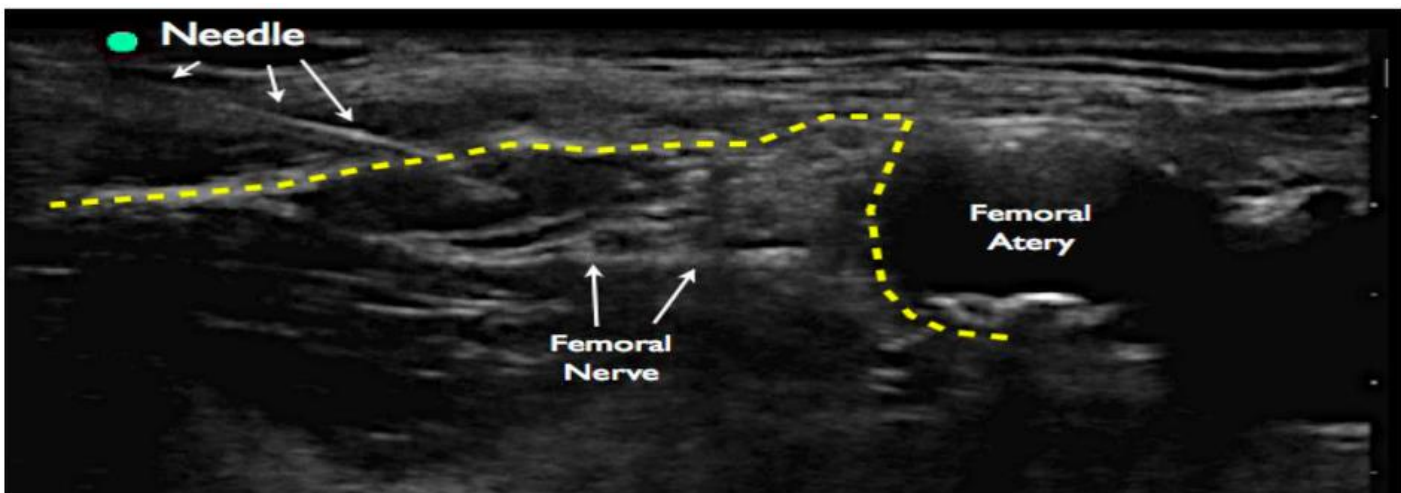


Figure 11. Fascia iliaca (yellow line), Needle in Fascia iliaca compartment (arrow), Femoral nerve (arrow) and Femoral artery (arrow)<sup>23</sup>



#### ALERT

It is important to visualise the entire needle including the tip during the procedure.

#### Post procedure cares

- Apply Thomas splint and traction.
- Monitor hourly for signs of compartment syndrome.<sup>1</sup>



- Keep on cardiac monitor for one (1) hour post procedure.

## Complications

- Nerve injury is rare, particularly when this procedure is performed under ultrasound guidance. Ensure documentation of neurological status before the procedure is performed.
- Local anaesthetic systemic toxicity is rare especially when the nerve block is performed under ultrasound guidance. It is important to visualise the needle tip to ensure that the anaesthetic is injected away from the femoral vessels. Toxicity can lead to cardiovascular collapse and seizures. See [Local Anaesthetic Toxicity Guideline](#) for details.<sup>24</sup>
- Compartment syndrome possibility should always be considered especially when the patient presents with a significant crush injury or burns. It is important to discuss with the orthopaedic surgeon prior to performing the femoral nerve blockade due to the theoretical possibility that a femoral nerve block may delay the diagnosis of compartment syndrome.
- Infection.
- Allergy.

## Conclusion

Ultrasound-guided FNB or FICB are important skillsets for emergency physicians to attain to provide adequate pain control to patients with femoral shaft fractures. The usage of ultrasound to perform a FNB/FICB decreases the rate of complications and increases the likelihood of a successful block.

## Consultation

Key stakeholders who reviewed this version:

- Consultant Paediatric Emergency Department, QCH
- Fellow Paediatric Emergency Department, QCH
- Pharmacist Lead Critical Care, QCH
- Consultant Paediatric Anaesthetics Department, QCH

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## Guideline revision and approval history

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1.0 (30/01/2019)	Deputy Director, Emergency, Critical Care	Divisional Director, Critical Care	Executive Director Clinical Services (QCH)
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<b>Accreditation references</b>	<b>NSQHS Standards (1-8):</b> <ul style="list-style-type: none"> <li>• 1, 5</li> </ul>

**Appendix 1: Documentation form**

**Femoral nerve block /Fascia iliaca compartment block checklist**

(to be scanned in to ieMR)

Pt sticker here

Indication for FNB/FICB \_\_\_\_\_

Prior to block commencement,

- is there any suspicion of nerve injury or are high risk factors for compartment syndrome present?

-  No  Yes (If yes, do not proceed with block and discuss with orthopaedics and ED consultant)

Consent obtained (verbal)  No  Yes

Procedural sedation used  Ketamine  Other  Nil

Type of block  FICB  FNB  Other

Ultrasound utilized  No  Yes

Sterile technique utilized  No  Yes

Date and time of procedure \_\_\_\_\_

Local anaesthetic \_\_\_\_\_ and dose \_\_\_\_\_

Traction and splint applied  No  Yes

Complications seen  No  Yes (If yes, document details in ieMR)

Clinical evidence that nerve block improved symptoms  No  Yes

Proceduralist name and signature \_\_\_\_\_

Supervisor/Consultant supervising \_\_\_\_\_