Case Report

Occasional fascia iliaca nerve block

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INTRODUCTION

The majority of patients presenting with hip fractures in emergent setting are over than 85 years of age.[1] It can be difficult to choose an adequate modality of analgesia from the standard analgesic ladder in this patient population due to the high degree of pain, patient comorbidities and medication side effects.[2-5] Non-steroidal anti-inflammatory drugs (NSAIDs) can cause gastrointestinal bleeding and are associated with renal impairment or worsening existing renal impairment, and opioids can cause a host of side effects including increased risk of delirium, respiratory depression and hypotension.[3-6]

The fascia iliaca block (FIB) is a regional nerve block that provides pre- and post-operative analgesia for patients with orthopaedic trauma to the hip, knee and thigh and can also be used in patients with lower extremity pain due to cancer or burns.[7,8] The FIB has a rapid onset of adequate pain control that can limit the need for traditional systemic analgesics such as NSAIDs and opioids, thus minimising potentially harmful side effects.[2,5,6,9] It must be noted that patients with delirium or dementia may feel well enough to walk after a FIB and, thus, must be closely monitored.

Anatomy

Four main nerves innervate the lower extremity:

1. Femoral nerve
2. Lateral femoral cutaneous nerve (LFCN)
3. Obturator nerve
4. Sciatic nerve.

Above the inguinal ligament, the femoral nerve lies anterior to the iliacus muscle and lateral to the femoral artery [Figure 1].[10] The femoral nerve is separated from the femoral artery by the fascia iliaca. The femoral artery and vein, along with the sartorius muscle, are situated between the fascia lata anteriorly and the fascia iliaca posteriorly. The fascia iliaca attaches to the iliac crest laterally and the pelvic brim medially.[10] Located beneath the fascia iliaca (listed lateral to medial) are the LFCN, iliacus muscle, femoral nerve, psoas muscle, pectineus muscle, obturator nerve branches and adductor muscles. Theoretically, local anaesthetic (LA) injected into the fascia iliaca compartment can spread laterally, medially, superiorly and inferiorly to block the femoral, LFCN and obturator nerve. In reality, obturator nerve blockade can be variable due to the deep fold of the fascia iliaca between the iliacus muscle and psoas muscle, preventing the spread of LA.[2,10]

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The femoral nerve provides sensory innervation to the anteromedial thigh, patella and periosteum of the femoral head, femoral neck and femoral proximal shaft, and medial aspect of the leg until the medial malleolus [Figure 2]. The femoral nerve also provides motor innervation to muscles involved in hip flexion (pectineus, iliacus and sartorius) and knee extension (quadriceps femoris).[2,3,8,11,12] The LFCN provides sensory innervation to the skin overlying the lateral thigh.[3,12,13] The obturator nerve provides sensory innervation to the medial thigh.[3,12] The sciatic nerve innervates the posterior compartment of the thigh and will not be blocked by an anterior nerve block such as the FIB.[3,12]

During a FIB, LA is injected in the fascia iliaca compartment, a potential space between the fascia iliaca and the iliacus muscle. Major nerves in the fascia iliaca compartment are the femoral nerve and LFCN. Unlike femoral nerve blocks or LFCN blocks, the FIB simultaneously blocks the femoral and LFCN. The FIB provides better analgesia, reduces the need for multiple nerve blocks and reduces the risk of nerve injury from a needle when compared to other methods.[6,7,8,11]

Indications

The FIB can simultaneously block the femoral nerve and LFCN, making it suitable for patients with the following needs:

1. Pre-operative or post-operative anaesthesia to the knee, femoral shaft or hip[4-6]
2. Management of pain in the lower extremity from burns, cancer or inflammatory conditions of the lumbar plexus[4-6]

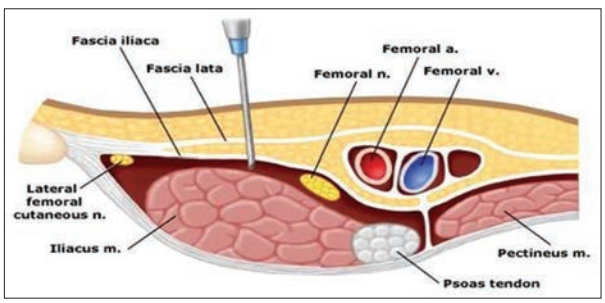


Figure 1: Cross-section of the fascia iliaca compartment illustrating the nerves and muscles housed beneath the fascia iliaca. Reproduced from Attia J, Zein, A. Effects of Adjuvant in Potentiating the Analgesic Effect of Fascia Iliaca Compartment Block. J Anesth Surg 2017, 4 (2), 86-92. Licensed under CC BY 4.0.

FIB should be considered the first line in patients with trauma to the lower extremity within the nervous distribution of the femoral nerve and LFCN, and the following comorbidities, as these patient populations are at the greatest risk of experiencing side effects of opioids:

1. Patients at risk of respiratory depression (e.g. chronic obstructive pulmonary disorder, obesity with body mass index >30 kg/m^2,[14] obstructive sleep apnoea and age ≥60)[6]
2. Patients with chronic opioid use or opioid intolerance[6]
3. Patients with pain that is being poorly managed with traditional analgesics[6]
4. Patients who would like to decrease the risks of systemic medications (e.g. pregnancy).[6]

Contraindications

Absolute contraindications for FIB include:

1. Patient refusal[3,6]
2. Patient's inability to cooperate (e.g. intoxication from alcohol or illicit drugs and severe pain).[3,6,15] In patients unable to cooperate due to severe pain, combination therapy with another approach such as NSAID and/or opioid use should be considered to relieve the patient's acute discomfort and to reduce the amount of NSAIDs and opioids required.
3. Allergy to LAs[3,6]
4. LA injection that is already close to the maximum dosage[3,6]
5. Previous femoral bypass surgery[3,8]
6. Active infection at the site of injection[3,6]



Figure 2: Distribution of sensory innervation provided by nerves housed within the fascia iliaca compartment. Source: NYSORA.com.[13] Permission to use this figure was granted by NYSORA.

7. Lack of availability of lipid emulsion therapy for the treatment of LA systemic toxicity (LAST)

Relative contraindications for FIB may include:

1. Pre-existing neural deficits in the distribution of the femoral nerve and LFCN as these conditions may predispose the patient to further neural injury and deficit post-FIB[6]
2. Trauma-related nerve injury or suspected compartment syndrome as FIB may mask these symptoms[15]
3. Multiple severe injuries. FIB may be inappropriate in this case to control pain in one extremity when systemic medications will be needed to control pain in other areas of the body.[15]

Complications

One of the possible serious adverse events of any nerve block, including FIB, is LAST. Symptoms of LAST include central nervous system (CNS) excitement (agitation, auditory changes, metallic taste and visual disturbances), seizures, CNS depression (drowsiness, coma and respiratory arrest), cardiac toxicity (hypertension, tachycardia and ventricular arrhythmias) and cardiac depression.[16] In the event that a patient experiences symptoms of LAST, guidelines from the American Society of Regional Anaesthesia and Pain Medicine recommend cardiorespiratory management and IV administration of 20% lipid emulsion therapy. Lipid emulsion therapy is often available in hospitals for nutritional support[17] and is the standard of care in the treatment of overdoses of non-dihydropyridine calcium channel blockers, beta-blockers, bupropion, lamotrigine and tricyclic antidepressants.[18]

Lipid emulsion therapy can be administered through a bolus or infusion:

- For patients >70 kg, bolus dosing is 100 mL over 2–3 min[16]
- For patients <70 kg, bolus dosing is 1.5 mL/kg over 2–3 min (based on ideal body weight).[16]

If patients are unstable after lipid emulsion treatment, administering an additional bolus of 0.5 ml/kg/min can be considered.[16]

Complications of FIB are uncommon as the needle is advanced into the fascia iliaca compartment rather than in proximity to a nerve or blood vessels. However, complications such as nerve injury, hematoma, LAST, allergic reaction to LA, myotoxicity and secondary injury can still arise due to inadvertent puncture of nerves or vessels, and exposure to LA.[6,8] These complications can be limited by the use of ultrasound guidance, administration of the smallest amounts of LA recommended to achieve analgesia and patient monitoring.[8] In addition, the practitioner should ensure that resuscitative equipment and lipid emulsion 20% are available before performing FIB.[3,19] Patients undergoing FIB should be advised to ask for help from staff before mobilising, as patients are still at risk of falls. Close monitoring is required for all patients, but especially those with dementia, delirium or lack of awareness of their surroundings, as relief of their pain may make them feel able to walk on their injured lower extremity.

Equipment: Figure 3:

- Clean gloves (1 pair)
- Sterile gloves (1 pair)
- Personal protective equipment (PPE)
- Skin marker
- Chlorhexidine sticks or chlorhexidine applied to sterile gauze
- sterile drapes
- Two 20 mL vials of 0.25% bupivacaine with 5 mcg/mL epinephrine
- Normal saline (only needed if patient <40 kg)
- Alcohol wipe
- 1.5-inch 25-gauge needle
- 3-mL syringe
- One 5-mL container of 1% lidocaine
- 1.5-inch 18-gauge needle
- 3-inch 21-gauge block needle OR 2-inch 21-gauge needle with IV-line extension set
- Two 20 mL syringes
- Dressing: 2 × 2 inches of dry gauze and a transparent adhesive film dressing such as 3M™ Tegaderm™, 6 cm × 7 cm
- Minimum 100 mL of lipid emulsion 20% on hand in case of LAST[16]
- Resuscitative equipment is available.

Additional equipment for ultrasound-guided fascia iliaca block

- An assistant wearing clean gloves will be required to perform this procedure
- Ultrasound machine with high-frequency

linear ultrasound transducer (6–14 Hz) capable of imaging to approximately 4 cm depth, or a lower frequency curvilinear probe (allowing deeper penetration in larger patients)
- Ultrasound cover: sterile ultrasound cover or sterile 3M™ Tegaderm™ [Figure 3], 6 cm × 7 cm
- Sterile ultrasound gel

Landmark-based method fascia iliaca block

1. Obtain informed signed consent. Collect equipment. Make sure the patient is in a gown with underwear removed and appropriately draped
2. Don clean gloves and PPE
3. Lay out equipment [Figure 4]. Place the patient in supine position[11]
4. Palpate for the femoral artery in the femoral triangle at the medial thigh and mark the location of the femoral artery using a surgical marking pen[8,11,20]
5. With the surgical marking pen, draw a line from the pubic tubercle to the anterior superior iliac spine (ASIS)[8,11,20]
6. With the surgical marking pen, divide the drawn line into thirds[8,11,20]
7. Mark the point 2 cm inferior to the line/border that separates the middle and lateral thirds [Figure 5]. This is the needle puncture site[8,11,20]
8. Remove the clean gloves and don sterile gloves
9. Prepare the needle puncture site. Clean the skin with an alcohol wipe. Attach the 25-gauge needle to the 3-mL syringe. Draw up 3 mL 1% lidocaine. Inject the 3 mL of 1% lidocaine under the skin, forming a bleb
10. Clean the skin around the point of insertion using chlorhexidine (×3) and drape the patient with sterile drapes
11. Prepare LA. For adults, 30–40 mL of LA is needed for nerve blockade.[4,8] For children, LA volume should be 0.7 mL/kg.[8,13,20]
    - Attach the 18-gauge needle to the 20-mL syringe and draw 20 mL of LA solution. Then, fill the second 20-mL syringe with 20 mL of LA (total of 40 mL of LA). If your patient has a low body weight of <40 kg, instead of the above, dilute 20 mL of LA with 20 mL of normal saline. As the FIB depends on the spread of LA underneath the fascia iliaca, the goal is to inject as much LA as possible (40 mL LA) while staying under 2.5 mg/kg of bupivacaine.
12. Cap the 18-gauge needle and remove it from the syringe. Attach the 2-inch 21-gauge needle and IV-line extension set onto the syringe
13. Position the 21-gauge needle at a 45° angle cephalad and insert the needle at the marked needle puncture site[11,20]
14. Advance the needle until loss of resistance is felt. This is the needle passing through the fascia lata



Figure 3: Sterile plastic covering such as 3MTM TegadermTM used as an ultrasound probe cover. Reproduced from Macias, M. Ultrasound Leadership Academy: Introduction to Procedural Ultrasound http://www.emcurious.com/blog-1/2014/12/7/ultrasound-leadership-academy-introduction-to-procedural-ultrasound (accessed Sep 6, 2021). Licensed under CC BY 4.0.



Figure 4: Photo of equipment (labelled A-M) required to perform fascia iliaca block. (A) clean gloves, (B) sterile gloves, (C) chlorhexidine sticks, (D) two 20 mL vials of 0.25% bupivacaine with 5mcg/mL epinephrine, (E) normal saline (only needed if patient <40kg), (F) alcohol wipe, (G) 1.5 inch 25-gauge needle, (H) 3 mL syringe, (I) one 5 mL container of 1% lidocaine, (J) 1.5 inch 18-guage needle, (K) 3 inch 21-gauge block needle, (L) two 20 mL syringes, (M) dressing: 2 × 2 inches of dry gauze and a 6cm × 7cm transparent adhesive film dressing.

15. Continue to advance the needle until another loss of resistance is felt. This is the needle passing through the fascia iliaca. The experience of passing through the fascia lata and fascia iliaca is often described as two "pops"[8,11,13,20]
16. Aspirate to ensure that the needle is not intravascular. Once negative aspiration is confirmed, inject 5-mL LA solution and continue to aspirate, then inject 5 mL quantities until all of the LA solution is administered from both syringes[11,20]
17. Place dressing and tape over the needle injection site and apply pressure for a few minutes

Ultrasound-guided method fascia iliaca block

1. Perform steps 1–4 as stated previously for the landmark-based FIB method

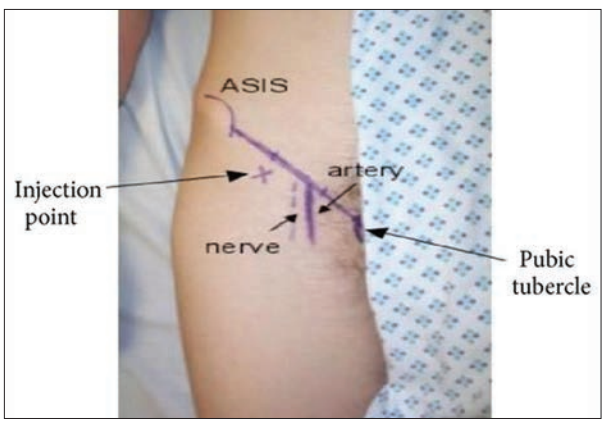


Figure 5: Marking of the line between the ASIS and pubic tubercle and location of the femoral artery and needle puncture site. Reproduced from Hanna, L.; Gulati, A.; Graham, A. The Role of Fascia Iliaca Blocks in Hip Fractures: A Prospective Case–Control Study and Feasibility Assessment of a Junior-Doctor-Delivered Service. ISRN Orthop. 2014, 2014, 1–5. Licensed under CC BY 3.0.

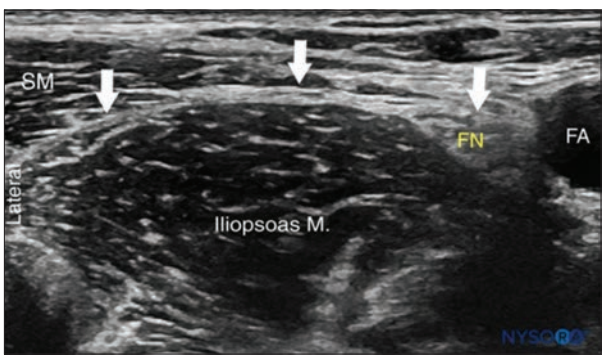


Figure 7: Ultrasound image at the level of the inguinal ligament of the femoral nerve situated lateral to the femoral artery, above the iliopsoas muscle, and beneath the fascia iliaca. Source: NYSORA.com.[13] Permission to use this figure was granted by NYSORA.

2. Use the ultrasound machine to identify the anatomy before the procedure. Place the high-frequency linear transducer (or the lower frequency curvilinear probe in patients with larger body habitus if deeper penetration is needed) in transverse position, caudal to the femoral crease and over the inguinal ligament [Figure 6][7,8]
3. Move the transducer medially into the inguinal crease and locate the femoral artery.[7] Slowly move the transducer laterally until the probe is at the line/border that separates the middle and



Figure 6: Ultrasound and needle positioning during performance of fascia iliaca block. Reproduced from Dangle J, Kukreja, P, Kalagara, H. Review of Current Practices of Peripheral Nerve Blocks for Hip Fracture and Surgery. Curr Anesthesiol Rep. 2020, 10 (3), 259-266. Licensed under CC BY 4.0.

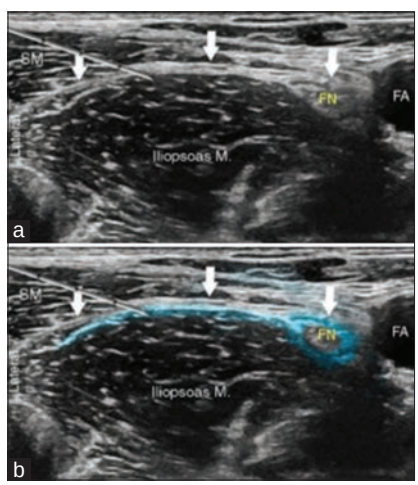


Figure 8: (a) Ultrasound image of correct needle positioning for the fascia iliaca block. The needle pierces the fascia iliaca lateral to the femoral nerve and femoral artery. The needle does not pierce through the underlying muscle. Source: NYSORA.com.[13] Permission to use this figure was granted by NYSORA. (b) Ultrasound image with a simulation of the distribution of local anesthetic administered during the fascia iliaca block. Source: NYSORA.com.[13] Permission to use this figure was granted by NYSORA.

lateral thirds of the line drawn from the ASIS to the pubic tubercle.[8,11] Locate the hyperechoic fascia lata, hyperechoic fascia iliaca and hypoechoic iliacus muscle [Figure 7][7,8]

4. Remove the clean gloves and don sterile gloves
5. Prepare the needle puncture site as stated in step 9 of landmark-based FIB method
6. Clean the skin around the point of insertion using chlorhexidine sticks ×3 and drape the patient with sterile drapes
7. Have an assistant with clean gloves take the ultrasound probe and pour some gel on the probe. In your sterile gloves, hold the sterile ultrasound cover open while your assistant places the probe into the cover. Then, have your assistant place sterile ultrasound gel on the patient
8. Prepare LA and needle as stated above in steps 10–12 of landmark-based FIB method
9. Repeat step 2 to revisualise the anatomy
10. Insert the needle in the plane with the ultrasound transducer, inferior to the inguinal ligament. Guide and visualise the needle below the fascia iliaca. Two "pops" or loss of resistance is felt as the needle advances through the fascia lata and the fascia iliaca[7,8,11] [Figure 8a and b]
11. Inject LA as stated above in step 14 for the landmark-based FIB method
12. Place dressing and tape over the needle injection site and apply pressure for a few minutes.

CONCLUSION

The FIB is a regional nerve block that serves as an effective option for pre- and post-operative analgesia in patients with orthopaedic trauma to the hip, knee and thigh and for those with burns or cancer-related pain. A particular consideration for FIB use should be given to elderly patients and patients with comorbidities for whom traditional systemic analgesics can cause problems. The FIB can be performed with equipment found in rural and emergent settings but, as with any procedure, does require training and practice. Complications from FIB are rare but the risk can be minimised with the use of ultrasound, minimal LA uses, appropriate monitoring and having resuscitation equipment readily available.[3,8]

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REFERENCES

1. Jean S, O'Donnell S, Lagacé C, Walsh P, Bancej C, Brown JP, *et al.* Trends in hip fracture rates in Canada: An age-period-cohort analysis. J Bone Miner Res 2013;28:1283-9.
2. Godoy Monzon D, Iserson KV, Vazquez JA. Single fascia iliaca compartment block for post-hip fracture pain relief. J Emerg Med 2007;32:257-62.
3. Pepe J, Ausman C, Madhani NB. Ultrasound-Guided Fascia Iliaca Compartment Block. Treasure Island: StatPearls Publishinig; 2021.
4. Høgh A, Dremstrup L, Jensen SS, Lindholt J. Fascia iliaca compartment block performed by junior registrars as a supplement to pre-operative analgesia for patients with hip fracture. Strategies Trauma Limb Reconstr 2008;3:65-70.
5. Chesters A, Atkinson P. Fascia iliaca block for pain relief from proximal femoral fracture in the emergency department: A review of the literature. Emerg Med J 2014;31:e84-7.
6. Jeng CL, Torrillo TM, Rosenblatt MA. Complications of peripheral nerve blocks. Br J Anaesth 2010;105 Suppl 1:i97-107.
7. Hebbard P, Ivanusic J, Sha S. Ultrasound-guided supra-inguinal fascia iliaca block: A cadaveric evaluation of a novel approach. Anaesthesia 2011;66:300-5.
8. Jones MR, Novitch MB, Hall OM, Bourgeois AP, Jeha GM, Kaye RJ, *et al.* Fascia iliaca block, history, technique, and efficacy in clinical practice. Best Pract Res Clin Anaesthesiol 2019;33:407-13.
9. Steenberg J, Møller AM. Systematic review of the effects of fascia iliaca compartment block on hip fracture patients before operation. Br J Anaesth 2018;120:1368-80.
10. Xu Z, Mei B, Liu M, Tu L, Zhang H, Zhang M. Fibrous configuration of the fascia iliaca compartment: An epoxy sheet plastination and confocal microscopy study. Sci Rep 2020;10:1548.
11. Jeng CL, Rosenblatt MA. Lower Extremity Nerve Blocks: Techniques. Available from: https://www.uptodate.com/contents/lower-extremity-nerve-blocks-techniques?search=feemoral-nerve-block&source=search_result&selectedTitle=1~21&usage_type=default&display_rank=1. [Last accessed on 2022 Jul 11].
12. O'Reilly N, Desmet M, Kearns R. Fascia iliaca compartment block. BJA Educ 2019;19:191-7.
13. Atchabahian A, Leunen I, Vandepitte C, Lopez MA. Ultrasound-Guided Fascia Iliaca Nerve Block. Available from: https://www.nysora.com/regional-anesthesia-for-specific-surgical-procedures/lower-extremity-regional-anesthesia-for-specific-surgical-procedures/ultrasound-guided-fascia-iliaca-block/. [Last accessed on 2022 Jul 11].
14. Nagappa M, Weingarten TN, Montandon G, Sprung J, Chung F. Opioids, respiratory depression, and sleep-disordered breathing. Best Pract Res Clin Anaesthesiol 2017;31:469-85.
15. Lucas SD, Le-Wendling L, Enneking FK. Regional anesthesia for the trauma patient. In: Pain Management – Current Issues and Opinions. InTech; 2012. p. 264.
16. Neal JM, Barrington MJ, Fettiplace MR, Gitman M, Memtsoudis SG, Mörwald EE, *et al.* The Third American Society of regional anesthesia and pain medicine practice advisory on local anesthetic systemic toxicity: Executive summary 2017. Reg Anesth Pain Med 2018;43:113-23.
17. Warren L, Pak A. Local Anesthetic System Toxicity. Available from: https://www.uptodate.com/contents/local-anesthetic-systemic-toxicity. [Last accessed on 2021 Jul 19].
18. Ozcan MS, Weinberg G. Intravenous lipid emulsion for the treatment of drug toxicity. J Intensive Care Med 2014;29:59-70.
19. Edgar L. Fascia Iliaca Nerve Block. Available from: http://sjrhem.ca/fascia-iliaca-nerve-block/. [Last accessed on 2021 Mar 24].
20. Dalens B, Vanneuville G, Tanguy A. Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. Anesth Analg 1989;69:705-13.