

Femoral Nerve Block/3-in-1 Nerve Block

Femoral and/or 3-in-1 nerve blocks are used for surgical procedures on the front portion of the thigh down to the knee and postoperative analgesia. Both blocks are carried out in a similar manner. The differences will be discussed in the technique section.

Indications for Femoral/3-in-1 Nerve Block

Femoral Nerve Block

- Operations on the anterior thigh (i.e. lacerations, skin graft, muscle biopsy)
- Pin or plate insertion/removal (femur)
- Femur fractures
- Analgesia

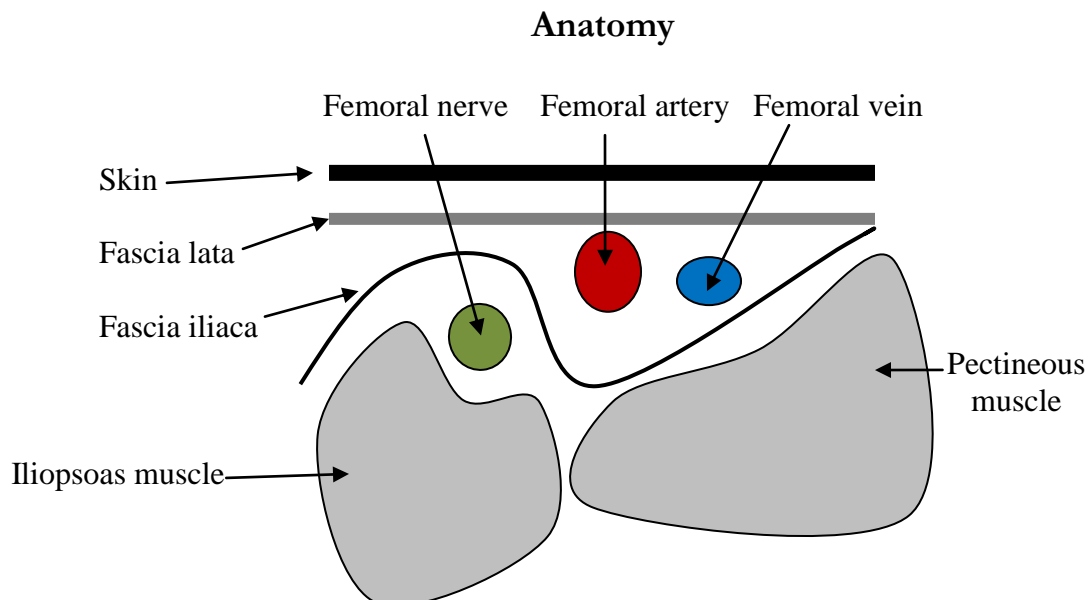
3-in-1 Nerve Block

- Same indications as femoral nerve block
- Analgesia and anesthesia of the hip (dislocations, femoral neck fractures)
- Analgesia of the knee

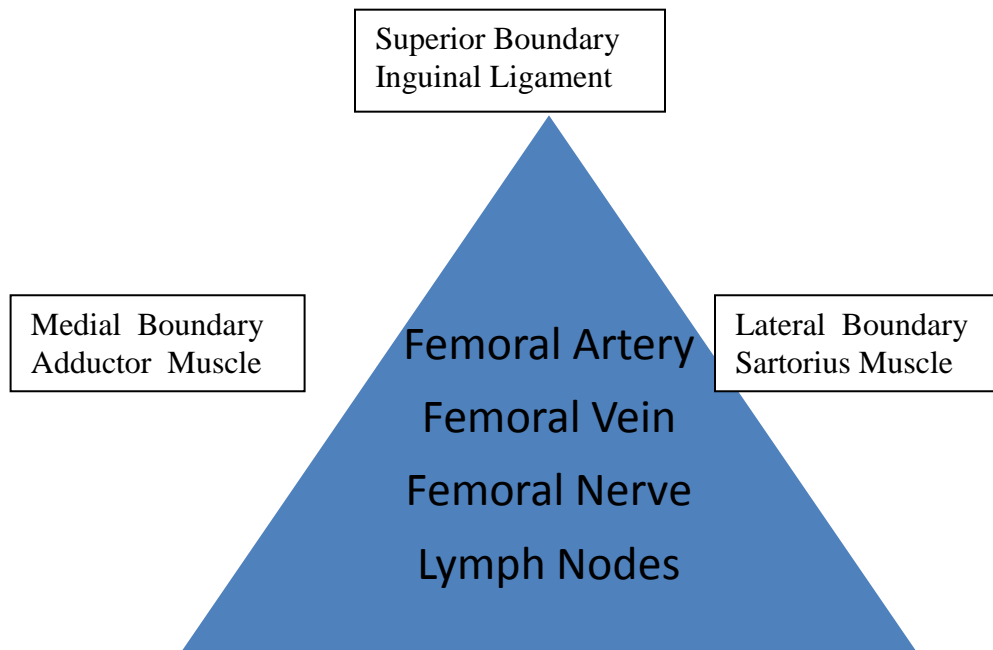
Depending on the surgical procedure, femoral/3-in-1 nerve blocks may cover only part of the knee joint. The knee joint is innervated by the femoral, obturator, and sciatic nerve. Portions of the knee innervated by the sciatic nerve will not be covered. The hip joint is primarily innervated by the femoral, obturator, and lateral femoral cutaneous nerve. There is a small contribution from the sciatic nerve. Additional analgesia with intravenous opioids should be sufficient to cover the small sciatic contribution.

Anatomy

The femoral nerve is created by contributions from L2, L3, and L4 and is the largest branch of the lumbar plexus. The femoral nerve enters the thigh under the inguinal ligament, between the psoas and iliacus muscle, and is located below the fascia iliaca.



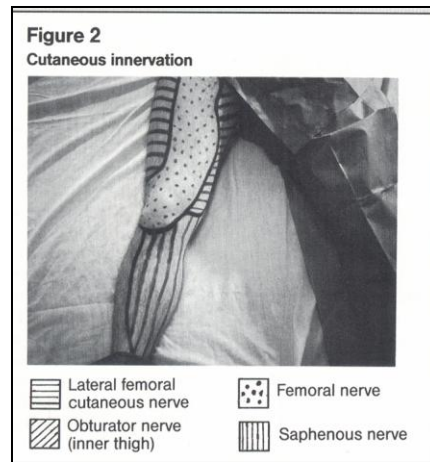
Below the inguinal ligament in the upper medial portion of the thigh is the femoral triangle. The femoral triangle contains the femoral nerve, artery, vein, and lymph nodes. The boundaries of the triangle include: superiorly – inguinal ligament, laterally- sartorius muscle, and medially- adductor muscle.



The lateral femoral cutaneous nerve is formed by contributions from L2 and L3. It is located more proximally than the femoral nerve, at the lateral border of the psoas muscle. The obturator nerve is formed from contributions of L2, L3, and L4. The obturator nerve is located at the medial border of the psoas muscle.

Innervations of the Femoral, Lateral Femoral Cutaneous, and Obturator Nerves

- Femoral Nerve- anterior and medial portion of the thigh and knee. Cutaneous innervation of the medial and lateral portion of the thigh. Periosteum of the femur.
- Lateral Femoral Cutaneous Nerve- sensory nerve to the lateral buttock, thigh, and knee joint.
- Obturator Nerve- sensory to the medial thigh, hip joint, and adductor muscle.



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Contraindications

- Burn or infection at injection site
- Inability to coagulate blood (congenital or acquired)
- Vascular graft of the femoral artery
- Neurological disease (relative contraindication)
- Patient refusal
- Local anesthetic allergy
- Inability to guarantee sterile equipment

Preparation

- Prepare the patient. Obtain a medical history, perform a brief physical exam, and review laboratory/other studies or tests. If elective, the patient should have fasted prior to surgery. General anesthesia may be required if the block fails. Carefully explain the procedure, risks/benefits. Obtain consent from the patient to perform the procedure.
- Monitor the patient continuously with an ECG, blood pressure, and pulse oximetry.
- Intravenous access with a running IV.
- Emergency medications, airway/intubation equipment, and an oxygen source should be immediately available.
- Assemble local anesthetics, sterile equipment, and antiseptic agents.
- Consider light sedation. Over sedation may result in an uncooperative patient. In addition, it may mask signs and symptoms of intravenous injection of local anesthetics and/or intraneural injection.

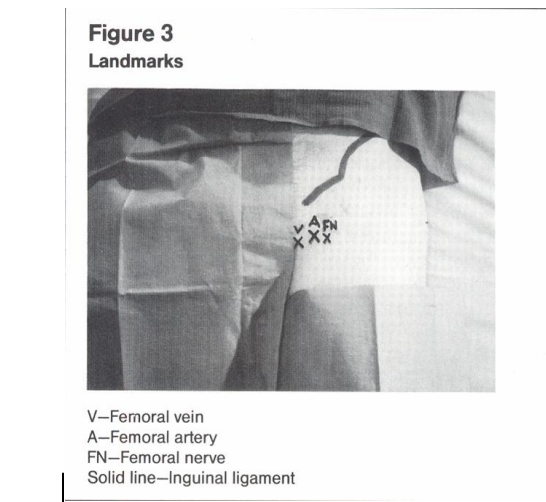
Technique for Femoral Nerve Block/3-in-1 Nerve Block

Techniques for both blocks are basically the same, with some minor alterations. There are several approaches to this block. Two techniques will be described here.

- Wash hands
- Position patient supine

Identify the landmarks.

- The femoral nerve is located just below the inguinal ligament. Locate the anterior superior iliac spine and the pubic tubercle. A line between these two structures is where the inguinal ligament is located.
- Next locate the pulsation of the femoral artery.
- The site for needle insertion is approximately 2 cm lateral to the pulsation. From medial to lateral the structures are femoral vein, femoral artery, and femoral nerve.



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- Prepare the site with antiseptic
- Use sterile gloves; drape area with sterile towels
- Use a 21-23 gauge needle (should be blunted). A sharp “cutting” needle can transect a nerve.

Paresthesia Technique

- Not an ideal technique. The availability of ultrasound or nerve stimulators should render the paresthesia technique obsolete.
- A small skin wheal of local anesthetic is placed at the identified injection site. The needle is inserted slowly in a perpendicular direction. The needle should be blunted to decrease the risk of neural trauma. As the needle is advanced, aspirate for blood. Once a paresthesia is noted in the distribution of the femoral nerve, withdraw the needle slightly and inject the local anesthetic. The patient should not feel pain during injection.
- If a depth of 4-5 cm has been reached with no paresthesia elicited, then withdraw the needle to the level of the skin and change the angle either slightly medially or laterally. Continue to seek a paresthesia.
- Always aspirate for blood during needle insertion before, during, and after injection to avoid an inadvertent intravascular injection.
- Paresthesia techniques carry a higher risk of nerve trauma than the two pop fascia iliaca technique.

Single Injection or “Two Pop” Technique (AKA Fascia Iliaca Block)

- Same landmarks as the femoral nerve block. First, identify the anterior superior iliac spine and draw a line to the outer portion of the pubic tubercle. Next, divide this line into thirds. Where the middle and lateral thirds meet move 2 cm down (below the line). This is the injection site.
- A small skin wheal of local anesthetic is placed at the identified injection site. A blunted needle should be used for this technique. If only “sharp” regular needles are available, then blunt the needle using the sterile plastic sheath that comes with the needle. Keep the needle sterile. The needle is inserted perpendicular. As the needle is advanced it is important to aspirate for blood.
- The needle should be held like a pencil. Short “jabs” will help to identify anatomical structures.
- As the needle is inserted there will be a slight increase in resistance, followed by a loss of resistance, or “pop”. This indicates that the fascia lata has been crossed.
- Continue to insert the needle. There should be a second slight increase in resistance, followed by a loss of resistance, or “pop”, which can be subtle and noted a few millimeters below the first “pop”. This indicates that the fascia iliaca has been crossed. The femoral nerve is in this fascial plane.
- Stabilize the needle with the free hand so the needle does not move out of the fascial plane.
- Always aspirate during needle insertion before, during, and after injection, to ensure that inadvertent intravascular injection does not occur.
- If aspiration is negative, inject the local anesthetic.
- Consider redefining the fascial plane after injecting half of the intended dose of local anesthetic. The volume of local anesthetic can potentially “push” the needle out of the fascial plane.
- If the patient experiences pain or paresthesia with injection, withdraw the needle slightly. Continue with injection as long as there is no pain or paresthesia.
- Never point the needle up. This may cause the needle to go through the inguinal ligament and into the abdomen.

Nerve Stimulator Technique

- Use a 22 gauge 2 inch insulated needle
- Insert the needle seeking a quadriceps contraction
- Decrease amplitude to 0.5 mA while seeking maximal quadriceps contraction. If there is continued quadriceps contraction when at 0.2 mA or less withdraw needle. Stimulation at this low level may indicate intraneural placement of the needle.
- After the injection of 1 ml of local anesthetic the contractions should start to fade.
- Always aspirate during needle insertion, before injection, during injection, and after injection to ensure that inadvertent intravascular injection has not occurred.
- If the aspiration for blood is negative, inject the local anesthetic.
- If the patient experiences pain or paresthesia with injection withdraw the needle slightly. Continue with injection as long as there is no pain or paresthesia.

Differences between Femoral Nerve Block and 3-in-1 Nerve Block

There are two main differences.

1. Volume of local anesthetic. For femoral nerve blocks, the volume of local anesthetic is generally 20 ml or less. For 3-in-1 nerve blocks, the volume of local anesthetic is 25-30 ml. This allows the local anesthetic to spread further in the tissue plane resulting in blockade of the femoral, lateral femoral cutaneous, and obturator nerve.
2. Slight alteration in technique. Once the needle has been placed in the correct area, pressure should be applied 2-4 cm below the injection site. Next, administer the local anesthetic. Applying distal pressure helps spread the local anesthetic to the obturator and lateral femoral cutaneous nerve, in addition to the femoral nerve.

Local Anesthetics

A number of local anesthetics may be used for femoral and 3-in-1 nerve blocks. In general, the volume of local anesthetic for a femoral nerve block will range from 15-20 ml. For 3-in-1 nerve block, the volume ranges from 25-30 ml. The addition of epinephrine 1:200,000 or 5 mcg/ml will reduce absorption of the local anesthetic and prolong the duration of action. In addition, epinephrine may alert the anesthesia provider to an inadvertent intravascular injection before major complications occur. The anesthesia provider should always be aware of the maximum dose of local anesthetic for each patient. 1-2% lidocaine will have an onset of 10-20 minutes and last 2-5 hours for anesthesia and up to 8 hours for analgesia. The maximum dose of plain lidocaine is 4.5 mg/kg, or a total of 300 mg. The maximum dose of lidocaine with 1:200,000 epinephrine is 7 mg/kg, or a total of 500 mg. 0.25-0.5% bupivacaine will have an onset of 15-30 minutes and last 5-15 hours for anesthesia and up to 30 hours for analgesia. The maximum dose of plain bupivacaine is 2.5 mg/kg, or a total of 175 mg. The maximum dose of bupivacaine with 1:200,000 epinephrine is 3 mg/kg, or a total of 225 mg. If available, ropivacaine is a safer alternative to bupivacaine.

Complications

Vigilance during block placement is essential. Monitor the patient continuously with ECG, blood pressure, and pulse oximetry. Communicate with the patient during the block. Be prepared for potential complications. Complications include the following:

- Intravascular injection
- Local anesthetic toxicity (central nervous system and cardiovascular toxicity)
- Nerve trauma to the femoral nerve, resulting in transient or permanent injury
- Prolonged motor blockade of the muscles of the thigh
- Hematoma formation
- Block failure

Controversies

The “3-in-1” nerve block is most likely not the correct term. The obturator nerve is blocked 4-78% of the time, depending on volume. Most likely the block is only effective for the femoral nerve and lateral femoral cutaneous nerve. In addition, cadaver studies have been unable to identify a sheath.

References

Burkard J, Lee Olson R., Vacchiano CA. Regional Anesthesia. In Nurse Anesthesia 3rd edition. Nagelhout, JJ & Zaglaniczny KL ed. Pages 977-1030.

Morgan, G.E. & Mikhail, M. (2006). Peripheral nerve blocks. In G.E. Morgan et al *Clinical Anesthesiology*, 4th edition. New York: Lange Medical Books.

Wedel, D.J. & Horlocker, T.T. Nerve blocks. In Miller's Anesthesia 6th edition. Miller, RD ed. Pages 1685-1715. Elsevier, Philadelphia, Penn. 2005.

Wedel, D.J. & Horlocker, T.T. (2008). Peripheral nerve blocks. In D.E. Longnecker et al (eds) *Anesthesiology*. New York: McGraw-Hill Medical.