Techniques in Regional Anesthesia and Pain Management (2006) 10, 150-158

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Techniques in
Regional Anesthesia
& Pain Management

Lumbar plexus block (anterior approach)

Carlos A. Bollini, MD,[a] Carlos Sforsini, MD,[b] Luis Vascello, MD[c]

[a]*From the Instituto Argentino de Diagnostico y Tratamiento, Buenos Aires, Argentina;*
[b]*Department of Anesthesiology, Britannic Hospital, Buenos Aires, Argentina; and the*
[c]*Department of Anesthesiology, University of Kentucky, Lexington, Kentucky.*

KEYWORDS:
Lumbar plexus block;
Femoral;
Femorocutaneous;
Obturator

Femoral nerve block alone or combined with other nerve blocks is one of the most commonly used regional blockade techniques for lower extremity surgery. If the goal is to block all branches of the lumbar plexus, the lateral cutaneous and obturator nerves must be blocked as well. Blockade of the three nerves of the lumbar plexus that course to the lower extremity with a single injection is known as the '3-in-1' block and is discussed in this review. If the goal is to completely and unilaterally block the sensitivity of the leg, a combined blockade of femoral, lateral cutaneous, obturator, and sciatic nerves should be performed. The insertion site located directly on the inguinal fold is our preference. This technique is easy to perform. It produces very little discomfort in patients; although most of them, especially young patients, are somewhat uncomfortable about the insertion area and its proximity to the genital area. We prefer the peripheral nerve stimulation (PNS) technique. The search for an MR begins at an intensity of 1 mA, a duration of 0.1 msec and a frequency of 2 Hz. The needle is advanced until obtaining the appropriate muscular response: up and down movements of the patella (rotulian dance) and/or twitch of the entire quadriceps muscle, Grade II, with $<$0.5 mA, a pulse duration of 0.1 msec and a frequency of 2 Hz. Continuous femoral catheter infusions are frequently performed. With an understanding of the relevant anatomy and the use of the PNS, nerve blockade of the lumbar plexus via anterior or the isolated nerves is safe, effective and well tolerated.

This blockade was first described by Labat in 1912.[1] The femoral nerve may be blocked alone or together with other nerves. If the goal is to block all branches of the lumbar plexus[2] that course unilaterally to the lower extremity, the lateral femoral cutaneous and the obturator nerves must be blocked as well. Blockade of the three nerves of the lumbar plexus that course to the lower extremity with a single injection is known as the "3-in-1" block[3] and is discussed in this manuscript. If the goal is to completely and unilaterally block the sensitivity of the leg, a combined blockade of femoral, lateral cutaneous, obturator, and sciatic nerves should be performed. The high success rate of video-assisted surgery techniques has resulted in a constant increase of knee surgery as well as joint replacement surgeries.

Femoral blockade alone or combined is one of the most often used regional blockade techniques for lower extremity surgery.

Address reprint requests and correspondence: Carlos A. Bollini, MD, J. D. Peron 2375, 1629 Pilar, Buenos Aires, Argentina.
E-mail address: cabollini@fibertel.com.ar.

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doi:10.1053/j.trap.2006.10.003

Anatomy review

The femoral nerve is one of the terminal branches of the lumbar plexus. It arises from the posterior roots of L2-L3-L4. It courses the pelvis obliquely through the fibers of the psoas muscle, emerging from the psoas at the lower part of its border, and runs downward in the space between the psoas and iliac muscles (Figure 1).

It passes from the pelvis toward the thigh underneath the inguinal ligament behind and lateral to the femoral vessels, separated from them by the fascia iliaca.

At the level of the inguinal ligament or above it, the nerve ramifies into the anterior branches: lateral and medial and the posterior branch or quadriceps nerve (Figure 2).

The anterior lateral femoral cutaneous is more superficial. It is motor for the sartorius muscle and sensory for the skin surrounding the anteriomedial aspect of the thigh and the medial aspect of the knee. On the other hand, the anterior medial femoral cutaneous is motor for the pectineus and adductor longus muscles and sensory for the superior and medial aspect of the thigh.

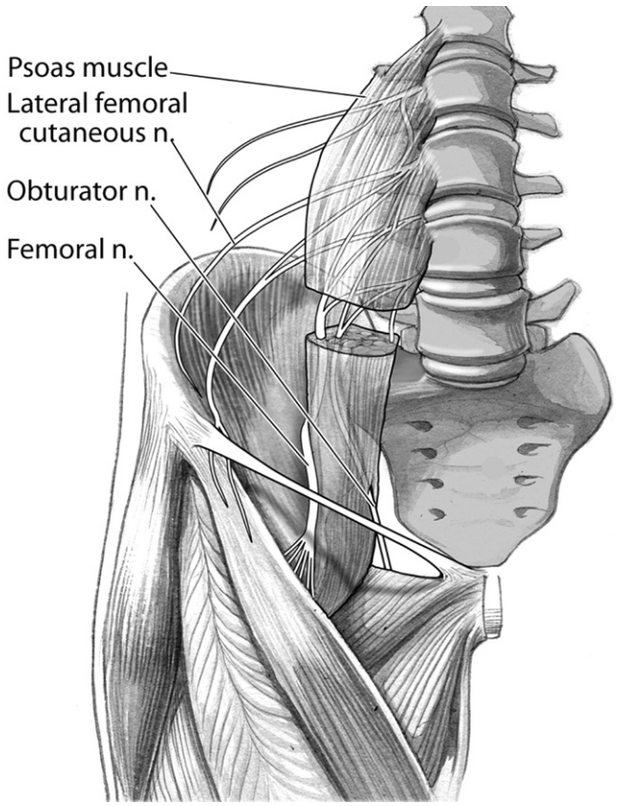

Figure 1 The femoral nerve courses the pelvis obliquely through the fibers of the psoas muscle, emerging from the psoas at the lower part of its border.

The posterior division or quadriceps nerve is deeper. It divides into four motor branches for the four muscles of the quadriceps and supplies a sensory branch or saphenous nerve, which supplies innervation to the anteromedial aspect of the knee and follows the saphenous vein along the anteromedial aspect of the leg down to the medial malleolus.

It is important to highlight that the femoral nerve is located in a different aponeurosis compartment and deeper than the crural vessels. The femoral artery and vein are located between the fascia lata and fascia iliaca, whereas the nerve is below the fascia iliaca.[4]

It is lateral (external) to the femoral artery and it is a *finger's slant* away from it (2 cm). Therefore, they are not part of a common vascular-nervous package, contrary to what happens in the axilla. This nerve is mainly motor (80%), thus localization is better performed with a peripheral nerve stimulator than with paresthesia techniques. It is useful to think of the mnemonic "VAN" (vein, artery, nerve) going from medial to lateral.

Indications

- Postoperative pain management for mid- and high-complexity knee pathologies.
- Patella fracture, rupture of quadriceps tendon, knee arthroscopy. Alone or in combination with other techniques, for ambulatory surgery post PCL.[5-9]
- Total knee replacement either alone or in combination with sciatic nerve blockade, as a single or continuous dose.[10-19]
- Preoperative pain management in patients with femur fracture up to the medial 1/3 and/or transportation from patient's room to the operating room or radiograph room, for placement and positioning in the operating table, before performing a peridural or subarachnoid blockade to these patients.[20,21]
- Post quadricepsplasty, for placement and withdrawal of plate and screws from femur or TKR in patients who need to be mobilized in the immediate postoperative by means of passive motion machines.
- These techniques facilitate assessment of acute knee injury in arthroscopy and other knee surgery, since blockade of both nerves with sufficient volume of local anesthetic blocks the sensitivity of the entire lower extremity.
- For muscle biopsy in patients who may develop malignant hyperthermia.[22]

Equipment

- Dermographic marker
- Millimetric ruler
- 20-mL syringe
- 25-G needle
- Local anesthetic
- Peripheral nerve stimulator
- Surface electrode
- 22-G, 50-mm insulated needle
- Catheter

Technique

- Patient in the supine position. The lower extremity positioned in slight adduction and external rotation between 10° and 20° or in neutral position. Mild sedation.
- The operator is located on the contralateral side.
- Anatomical landmarks are identified and marked: the inguinal ligament extends from the anterior superior iliac

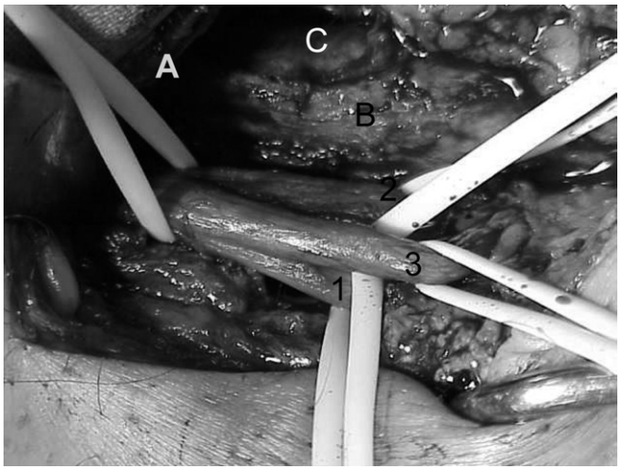

Figure 2 Disection at the inguinal level. 1, Femoral nerve deep branch; 2, medial branch; 3, lateral branch; A, inguinal ligament; B, femoral artery; C, femoral vein.