Chapter 17

Ankle Block

- Ankle Block




ANKLE BLOCK

Introduction

Ankle block is very widely practiced for distal foot surgery (1). It is also a commonly failed block, for two main reasons: first, the fascia layers and the relative positions of the five nerves to these layers around the ankle are not widely understood; second, practitioners sometimes neglect to block all five nerves in disregard of the fact that the areas of the foot's sensory nerve supply overlap, and this overlap is not consistent.

The most common indication for ankle block is diabetic foot surgery. Practitioners should be careful in diabetic patients because the skin around the ankle tends to be fragile, and ankle block often leads to skin necrosis. Furthermore, these patients often have neuropathy, which gives the anesthesiologist a false sense of success with this block until he or she attempts an ankle block for bunion or rheumatoid arthritis surgery on a patient with normal nerves.

The other common indications for ankle block are for the management of postoperative pain after bunion surgery, and for surgery for rheumatoid arthritis. The ankle block can be used for most distal foot surgery, but it is not suitable for ankle surgery.

It can be painful to place an ankle block, and liberal use of skin infiltration with a fast-acting local anesthetic agent such as lidocaine, injected slowly through a fine needle, is advised. There should be no problem placing an ankle block in a heavily sedated or even anesthetized patient.

Specific Anatomic Considerations

Figure 11-8 shows that the nerve supply of the bones of the foot originates from all the lumbar and most of the sacral roots. Selective nerve blocks around the ankle therefore almost always result in some degree of failure. The diagram demonstrates that all five nerves around the ankle should be blocked for every foot operation except the most superficial skin surgery, for which local field blocks may in any case be a better choice.

It can also be seen that the dermatomal supply of the foot originates from an extensive area in the lumbar and sacral spine—from L4 to S2, at least (see Fig. 11-9).

The medial aspect of the foot receives its sensory supply from the saphenous nerve, which is a branch of the femoral nerve (see Fig. 16-2).The deep peroneal nerve supplies the area between the first and second toe, whereas most of the dorsal aspect of the foot gets its sensory nerve supply from the superficial peroneal nerve.

The lateral aspect of the foot is supplied by the lateral dorsal cutaneous and lateral calcaneal branches of the sural nerve, which in turn originates from the tibial nerve in the popliteal fossa behind the knee. The medial and posterior aspects of the heel receive their sensory nerve supply from the medical calcaneal branch of the tibial nerve.

Figure 16-1 shows that three nerves run superficial to the fascia, which is represented by a *purple line* in the image.These nerves are the superficial peroneal nerve, the saphenous nerve, and the sural nerve. Note that the names of all three of these nerves start with the letter "S."

Anterior, deep to this fascia and between the tendons of the hallucis longus and anterior tibial muscles, is the deep peroneal nerve running close to the tibia, and posterior, adjacent to the tibial artery and vein, in a complex array of fascia compartments, is the tibial nerve.The tibial nerve is a motor nerve, which makes its identification with a stimulating needle and nerve stimulator relatively easy. The anesthesiologist must keep in mind that local anesthetic agents do not cross fascia layers readily, and it is thus important to place the needle in the same fascial compartment as the nerve.The method, described in many older textbooks, of approaching the tibial nerve from posterior until the tibia itself is encountered, and then withdrawing the needle slightly, is outdated and possibly an important reason why many ankle blocks fail.The tibial nerve supplies nearly the entire sole of the foot.

Technique

With the patient in the supine position, the knee slightly flexed, and the foot externally rotated, the posterior tibial artery can usually be palpated behind the medial malleolus (Fig. 17-1).The tibial nerve is just posterior to the artery. If the artery

FIGURE 17-1 The medial malleolus and Achilles tendon are marked. Needle entry is halfway between these two landmarks for blockage of the posterior tibial nerve.

FIGURE 17-2 A small skin wheal is raised, taking care not to penetrate the fascia with this needle.

FIGURE 17-3 A 50-mm stimulating needle attached to a nerve stimulator is now advanced through the fascia until plantar flexion of the toes is caused by stimulation of the posterior tibial nerve.

cannot be palpated, the surface landmark of the nerve is usually halfway between the medial malleolus and the Achilles tendon.

The skin and subcutaneous tissue is infiltrated with 1% to 2% lidocaine, with care taken not to penetrate the fascia with the fine needle at this stage (Fig. 17-2).

A 22-gauge, 2-inch stimulating needle, attached to a nerve stimulator set at a current output of 1 to 2 mA, a frequency of 2 Hz, and a pulse width of 200 to 300 μsec, is used to locate the nerve (Fig. 17-3). Ultrasound can also be used. Toe flexion indicates that the nerve has been encountered. The nerve stimulator is now turned down until

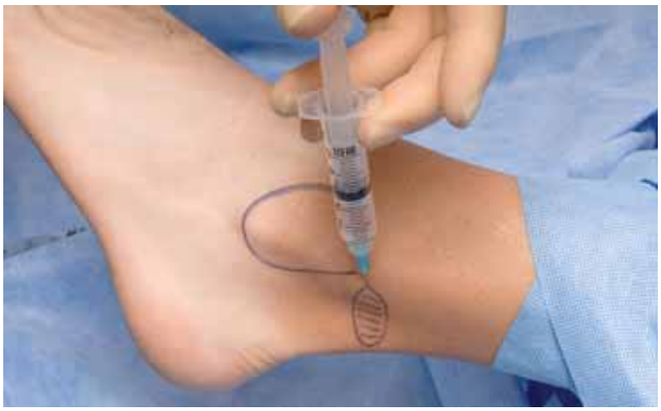

FIGURE 17-4 The lateral malleolus and Achilles tendon are identified and marked, and an area between the two landmarks superficial to the fascia is anesthetized.

FIGURE 17-5 The area is now injected with local anesthetic agent to block the sural nerve.

brisk motor twitches of the toes can still be observed at a current output of 0.3 to 0.5 mA. This may not be possible in diabetic patients because of diabetic neuropathy, and higher currents may be required.

The motor response will immediately cease on injection of local anesthetic agent.

The foot is internally rotated, and the "valley" from the lateral malleolus to the Achilles tendon on the lateral side of the ankle is turned into a "hill" (Fig. 17-4). It is necessary to remain superficial to the fascia with the needle and to ensure that a skin wheal is observed when the sural nerve is blocked. This is a pure sensory nerve and it does not matter if the skin infiltration also blocks the nerve.

The main dose of the local anesthetic agent is now injected subcutaneously and superficial to the fascia, again ensuring that a skin wheal is raised (Fig. 17-5).

With care taken to remain proximal to the retinaculum that approximately joins the medial and lateral malleoli, the tendons of the anterior tibial muscle and extensor of the big toe are palpated (Fig. 17-6). Lidocaine is injected all the way down to the bone of the tibia between these two tendons.

The same needle entry site is used to inject lidocaine to the subcutaneous area lateral to the fibula (Fig. 17-7).

The area around the saphenous vein is also anesthetized using the same needle entry point (Fig. 17-8).

A 25-gauge needle attached to a syringe with local anesthetic agent is inserted between the tendons of the anterior tibial muscle and the extensor hallucis longus until it encounters the tibia (Fig. 17-9). It is then slightly withdrawn and 3 to 7 mL of local anesthetic agent is injected.

FIGURE 17-6 The two tendons are separated by the index and middle fingers of the nonoperative hand, and the skin and subcutaneous tissues are anesthetized.

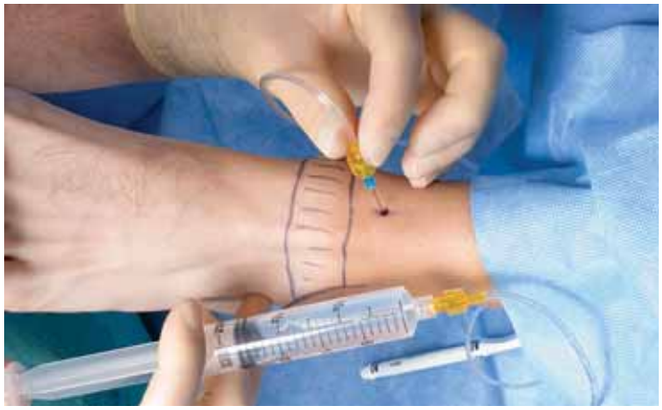

FIGURE 17-7 The local anesthetic is injected all the way down to the tibia to anesthetize the deep peroneal nerve.

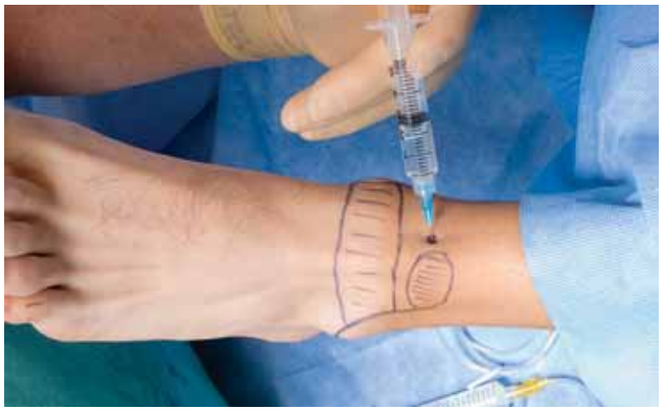

FIGURE 17-8 The area from the approach to the deep peroneal nerve to the fibula is anesthetized.

Without withdrawing the needle from the skin, it is now directed laterally between the skin and fascia layer toward the fibula (Fig. 17-10). The skin wheal raised during injection indicates that the injection is subcutaneous, yet superficial to the fascia. Like injection deep to the fascia, intradermal injection will lead to failed block.

The needle is now directed medially and subcutaneously toward the anterior aspect of the medial malleolus (Fig. 17-11). A skin wheal should be observed during injection on the

FIGURE 17-9 Local anesthetic agent is injected superficial to the fascia in the area indicated.

FIGURE 17-10 The area of the medial malleolus is anesthetized.

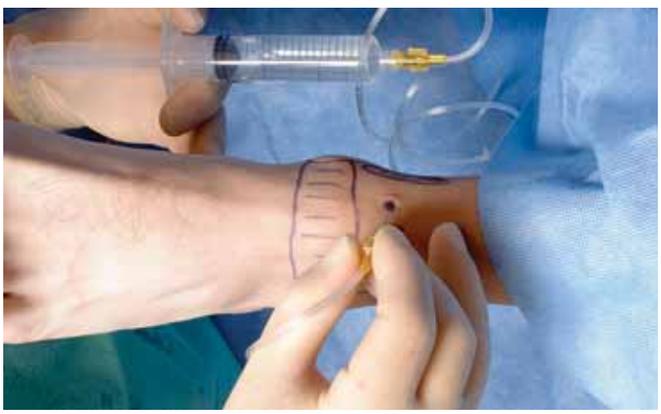

FIGURE 17-11 Local anesthetic is injected around the saphenous vein to anesthetize the saphenous nerve.

saphenous nerve subcutaneously and superficial to the fascia, around the saphenous vein.

Local Anesthetic Agent Choice

If a nerve stimulator is used to identify the tibial nerve at the ankle, 5 to 7 mL of 0.75% or 0.5% ropivacaine, or 0.5% bupivacaine, can be injected on each of the five nerves. It is important to remember that addition of epinephrine to the local anesthetic agent is absolutely contraindicated with an ankle block because this can seriously threaten the integrity of the blood supply to the foot, with devastating effects. Figure 16-1 shows

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that the main blood supply to the foot (i.e., the dorsal pedal artery and the posterior tibial artery) is situated close to the tibial nerve and the deep peroneal nerve.

(See ankle block movie on DVD.)

REFERENCES

1. Rickelman T, Boezaart AP: Ankle block. In Boezaart AP (ed): Anesthesia and Orthopaedic Surgery. New York, McGraw-Hill, 2006, pp 253-257.