The Mayo block: An efficacious block for hallux and first metatarsal surgery
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The Mayo block is an extremely efficacious regional anesthetic technique used to provide anesthesia of the forefoot. Patients requiring surgical correction of hallux deformity, bunionectomy, and first metatarsal surgery may benefit from this technique. The Mayo block is a field block that anesthetizes the specific nerves of the forefoot that innervate the surgical field. This technique requires less local anesthesia than that required by direct local anesthetic infiltration and does not distort the surgical tissue planes. The Mayo block is effective. This technique has been used at one military hospital on more than 275 patients. The failure rate of the block is less than 1%. Learning this technique adds to the anesthetist's armamentarium of regional anesthesia. Administration of the block requires little time and complements the needs of a busy practice in which many outpatient surgical procedures are performed.

This article describes the technique of administering the Mayo block, reviews the anatomy and distribution of peripheral nerves of the foot, and reviews the indications and contraindications for the block. Finally, the article describes the efficacy of more than 275 Mayo blocks administered over 3 years at one military hospital.

Safe, effective anesthesia is the goal for all patients undergoing any type of surgical procedure. Anesthetic techniques carry various risks. The risks of general anesthesia include potential airway complications, such as the inability to intubate, aspiration, cardiovascular depression, pulmonary dysfunction, and adverse drug reactions, including anaphylaxis, as well as other risks with less morbidity. Major conduction anesthesia involves risks as well. These include central nervous system toxicity, cardiovascular depression, allergic reaction to the local anesthetic, spinal headache, and a variety of potential nerve injuries.

Administration of local anesthesia near specific nerves can yield extremely favorable surgical conditions and minimize patient risks. The Mayo block is a type of field block that is both safe and effective for the surgical procedures listed in Table I.

Surgical procedures on the foot may be ac-
Table I
Surgical procedures for Mayo block
1. Bunionectomy
2. Osteotomy first metatarsal
3. Correct hallux deformity
4. Soft tissue surgery of forefoot

complished with a variety of anesthetic techniques. General anesthesia, major conduction blockade via subarachnoid or epidural block, and midtarsal nerve blocks at the ankle have all been used successfully to provide anesthesia for foot surgery.5,6

The Mayo block is easy to learn and can be performed quickly. The onset of the local anesthetic is rapid and provides a profound analgesic block. The technique involves infiltration of local anesthesia to all tissues proximal to the surgical site in a ring fashion. This technique is an intermediate procedure between specific nerve blocks at the ankle and local infiltration. The benefit of this procedure is that less local anesthetic is required than would be necessary for direct infiltration of the surgical site. A second important benefit is that surgical tissue planes are preserved.7

Discussion
Administration of the Mayo block requires detailed understanding of the peripheral distribution of the nerves to the foot. Five nerves innervate the foot distal to the ankle. Four of the nerves (deep peroneal, superficial peroneal, posterior tibial, and saphenous) are branches of the sciatic nerve. The fifth, the saphenous, is a branch of the femoral nerve.

The deep peroneal nerve is the continuation of the common peroneal nerve that arises in the upper leg. The deep peroneal nerve runs down the leg in the anterior compartment with the tibial vessels to the ankle joint. The deep peroneal nerve then divides into its terminal branches. The nerve then enters the foot just medial to the tendon of the hallucis longus muscle. The nerve supplies fibers to several extensor muscles, the tarsal and metatarsal joints, and the skin of the opposing sides of the hallux and the second toe (Figures 1 and 2).

The superficial peroneal nerve is a branch of the common peroneal nerve. It descends through the back of the calf deep into the soleus muscle. The nerve then moves medially, going between the Achilles tendon and the medial malleolus. The posterior tibial nerve then divides at the sole of the foot into the medial and lateral plantar nerves. This nerve supplies sensation to the skin of the heel and the sole of the foot (Figures 2 and 4).

The sural nerve branches from the posterior tibial nerve and descends in the posterior compartment of the leg. It enters the foot behind the lateral malleolus, between it and the Achilles tendon. The sural nerve provides sensation to the lateral aspect of the foot and the fifth toe. (Figure 5).

The saphenous nerve is the sensory terminal branch of the femoral nerve. It becomes subcutaneous at the lateral sides of the knee joint. It follows the saphenous vein to the medial malleolus and supplies the cutaneous sensory fibers over the medial side of the leg to the medial malleolus. Below the ankle, the saphenous nerve provides sensation to the medial portion of the foot as far forward as the midpoint. Occasionally the distribution extends to the metatarsophalangeal joint (Figures 2 and 3).

The Mayo block is safe. The anesthesia providers at the USAF 645th Medical Group Hospital, Wright-Patterson Air Force Base have administered more than 275 Mayo blocks over 3 years without complications (Figure 6). Few contraindications exist for this block. These include patient refusal, documented allergy to amide local anesthetics, and localized infection in the surgical foot.

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Procedure

The patient about to undergo a Mayo block is taken to a room set aside for regional anesthetic procedures. Alternatively, the patient is taken immediately into the operating room and the block is administered in the room. Usually, however, the block is placed while the patient is in the regional holding area. Once in the regional anesthetic holding area, patient monitors are established (electrocardiograph, noninvasive blood pressure, pulse oximetry). An intravenous line is established. The patient is placed on supplemental oxygen by face mask at 5 L/min during the administration of the block. The operative foot is prepped with povidone iodine paint at the needle insertion sites. Patients are sedated with 1 mL of fentanyl and 1 mL of midazolam, and then propofol is titrated in 1-2 mL (10-20 mg) increments until the patient fails to respond to voice commands. Once the patient is adequately sedated, the anesthetist proceeds with the block. Spontaneous breathing is maintained and patients tolerate administration of the block well.

The block is initiated using a standard 25-gauge, 1½ inch standard bevel needle on two 10-mL syringes. The local anesthetics used for this block are a combination of 1% lidocaine and 0.5% bupivacaine in a 1:1 ratio. Epinephrine is not used in any of the solutions. The first needle insertion is distal to the midfoot between the first and second metatarsal (Figure 7). The direction of the needle
the track that the needle has just made. Administration of the anesthetic blocks branches of the superficial peroneal and the saphenous nerve (Figure 8).

The needle is then withdrawn. At the medial edge of the midfoot, the needle is directed laterally, under the first metatarsal, the full length of the needle (Figure 9). After careful aspiration, the needle is slowly withdrawn depositing another 5-7 mL of the local anesthetic. This completes the block of the medial plantar branch of the posterior tibial nerve and the medial branches of the saphenous nerve.

To complete the procedure the deep peroneal nerve must be blocked. An additional 2-3 mL of local anesthetic is deposited distal to the first needle insertion in a “V” between the first and second metatarsal (Figure 10). Administration of the local anesthetic blocks the deep peroneal nerve as it exits the foot distally.

is toward the sole of the foot in a plane perpendicular to the sole. The needle is advanced until the tip nearly penetrates the sole. After careful aspiration, 5 mL of local anesthetic is deposited as the needle is slowly withdrawn to the dorsal aspect of the foot. Administration of the local anesthetic blocks the medial plantar branch of the posterior tibial nerve and a portion of the distal branches of the superficial peroneal nerve.

Using the initial puncture site on the dorsum of the foot, the needle is advanced medially toward the edge of the foot. A subcutaneous wheal of local anesthetic, 3-5 mL, is then administered along
Occasionally the medial aspect of the hallux is inadequately blocked. If it seems necessary to improve the density of the block, an additional needle entry is made proximal to the hallux-metatarsal joint and an additional 2 mL of local anesthetic deposited (Figure 11).

The Mayo block can be performed quickly. Once mastered, the block takes only minutes to administer. The volume for the block is 15-20 mL of the local anesthetic mixture. The onset of the block is tested with pinprick or pinch with a blunt nonpenetrating clamp. If the block is not dense enough by the time the foot is prepped and draped in the operating room, the surgeon can administer additional local anesthesia to the operative field. In 3 years of administering the blocks, only three patients have required general anesthesia because of inadequate surgical analgesia. We estimate that fewer than 5% of the blocks require supplementation by the surgeon.

The onset of the block is rapid. Figure 12 depicts the onset time for 10 patients undergoing the Mayo block in 1994.

The block has always outlasted the surgery at this institution. This is an excellent block for surgical procedures lasting less than 90 minutes, as tourniquet pain is a frequent complaint after 90 minutes. (The surgeons apply an ankle tourniquet at 225 torr during the case.) The Mayo block does not alleviate the sensation of the tourniquet. The incidence of tourniquet pain is not different than the incidence with midtarsal blocks in our opinion. The duration of that block is longer than 120 minutes.

The duration of the Mayo block extends beyond phase II recovery in most patients. Ten patients were evaluated prospectively to assess the duration of the block. Postoperatively, the patients were given a “pinch” on the blocked foot with a nonpenetrating clamp. Each patient’s reaction to the pinch was recorded every 15 minutes while recovering in the ambulatory care unit. The block was considered effective if the patient did not respond to the pinch and did not complain of postoperative pain. The time interval ended at the time of discharge from the ambulatory care unit. Patients reported continuous analgesia at the time of discharge without the need for other pain medications. Figure 13 shows the duration of the block from the time of administration until discharge for the 10 patients described above.

Midtarsal blocks using the same volume of local anesthetic have been found to be safe. The Mayo block requires similar volumes of local anesthetic as does a midtarsal block. The difference between the Mayo block and the midtarsal block is that with the Mayo block the sural nerve remains
unblocked. The Mayo block is very successful. There have been three failed blocks in the 3 years in which we have been recording data (Figure 6). The Mayo block is an extremely reliable regional anesthetic technique. With experience and patience there will be few failed blocks. The indications for this block include surgical repair of hallux deformity, bunionectomy, and first metatarsal surgery. The Mayo block is very effective. Administration of this block eliminates the risks associated with general anesthesia and major conduction anesthetics. Learning to perform this block adds to the anesthetist's armamentarium of regional anesthesia and may provide a unique alternative to other anesthetics for the surgical procedures mentioned above.

This article described the Mayo block, a type of field block, which anesthetizes the forefoot. The peripheral nerve distribution to the foot was reviewed. The technique used to administer the Mayo block was illustrated. It is the authors' hope that this technique will facilitate anesthetic management for the patient requiring surgery of the forefoot. Administration of the Mayo block provides profound, prolonged analgesia and is well tolerated in a wide patient population.

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