Peripheral Foot Blockade Versus Popliteal Fossa Nerve Block: A Prospective Randomized Trial in 51 Patients

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The majority of foot and ankle operations are performed on an outpatient basis and often under some form of regional anesthesia. In this prospective, randomized study of 51 patients undergoing elective unilateral forefoot procedures, we compared 2 different anesthetic techniques: the peripheral foot blockade and the popliteal sciatic nerve block. Variables assessed included the quality of surgical anesthesia, postoperative analgesia, and the incidence of postoperative complications. The anesthesia was classified as effective if it was the sole anesthetic technique for the forefoot surgery. We found successful results in both groups: 92% in the foot block group and 96% in the popliteal block group. Analysis of time required to perform the anesthetic procedure showed a significant difference between the 2 groups, with foot block being considerably faster (14.3 minutes vs 19.2 minutes for popliteal block) (P = .0078). Foot block patients demonstrated 10.96 hours of analgesia, whereas popliteal block patients exhibited 14.32 hours (P = .132). With a mean follow-up of 5.7 months, we did not find anesthesia-related complications in any of the patients. Both techniques showed a high level of safety and efficacy, with no significant difference detected between them. Our patients showed a high rate of satisfaction with both procedures (96% for foot block patients and 96.1% for popliteal block patients) and reported a good discharge disposition. These data show that both procedures are safe and effective anesthetic techniques and well suited to forefoot ambulatory surgery. (The Journal of Foot & Ankle Surgery 44(5): 354-357, 2005)

Key Words: regional anesthesia, foot, popliteal, ankle block

Foot surgery induces moderate to severe pain acutely and often produces prolonged postoperative pain that requires large doses of parenteral opioids (1). Therefore, pain management plays an important role in length of postoperative stay and patient satisfaction (2).

A variety of anesthetic techniques including general, spinal, epidural, intravenous, regional, and local anesthesia are readily available to the surgeon performing procedures on the foot and ankle (3–5). General anesthesia is often associated with a higher level of postoperative nausea and vomiting and pain, causing a delay in the patient's discharge or unanticipated admission to the hospital (6). Spinal and epidural anesthesia are complicated by urinary retention, hypotension, and postdural puncture headache and backache (7, 8). Intravenous regional anesthesia carries the risk of acute toxicity as a result of venous leakage under the tourniquet cuff (9).

The majority of foot and ankle operations are now performed on an outpatient basis, and often under some form of regional anesthesia. The use of this anesthesia has been supported by successful outcomes reported in literature (3, 5). Peripheral blockade of the foot (FB) and the popliteal sciatic nerve block (PB) are probably 2 of the most popular anesthetic techniques for foot and ankle surgery. Both have shown to be safe and effective for these surgical procedures (1–4, 10, 11). However, the optimal block technique has yet to be clearly defined, because there is no evidence that one technique is superior to the other.

To our knowledge, there have been no prospective, randomized trials comparing the FB and the PB. In this prospective and randomized study, we investigated if one

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of the two anesthetic techniques is superior by assessing the quality of surgical anesthesia, postoperative analgesia, and the incidence of postoperative complications.

Materials and Methods

Between January 2003 and April 2003, two types of regional anesthesia were used in patients undergoing forefoot procedures: FB and PB. All elective, unilateral forefoot procedures performed consecutively on an outpatient basis during this period were included. Exclusions consisted of patients undergoing midfoot and hindfoot procedures, those who had iliac crest bone grafts at the same time, and those with a history of peripheral neuropathy, alcoholism, rheumatoid arthritis, or substance abuse.

After approval from the institutional review board and with informed consent, patients were randomized (random numbers table, sealed envelopes) to receive the corresponding anesthetic block. Resident, fellow, and attending anesthesiologists performed the blockades. All patients were operated on by the senior author (A.M.). Ankle tourniquet hemostasis was used whenever necessary.

Surgical procedures were performed for the following conditions: hallux valgus (metatarsal osteotomies and soft tissue realignement), hallux rigidus (arthrodesis, cheilectomy, and osteotomies), hammer toes (arthrodesis), Mortons neuroma, hallux varus, and a phalanx fracture (open reduction and internal fixation).

The anesthesia was classified as effective if it was the sole anesthetic technique required for the forefoot surgery. If a previously blocked patient required additional anesthesia, either in the form of local supplementation by the surgeon or conversion to general anesthesia, the block was classified as unsuccessful. The onset of anesthesia was determined when the patient verbally responded "none" when cutaneous pressure was applied to the involved foot.

Variables assessed included patient age and sex, time required to perform the anesthetic block, surgical procedure, latency period of the block (minutes elapsed between finishing the anesthetic block to the onset of anesthesia), surgery time, and tourniquet time. Patients were asked if they were satisfied with the procedure and if they had any complaint in returning home during the same day (discharge disposition). Pain was evaluated at 6, 12, 18, and 24 hours postoperatively with a visual analogue scale that was provided to the patients. This scale required patients to make a mark on a 10-cm horizontal line, ranging from no pain at one end to worst possible pain at the other end, according to the amount of pain they were experiencing. The average analgesia time (hours elapsed between the end of the surgical procedure and the onset of pain) was also documented, as was the time until the first postoperative pain medication was taken and any associated complications.

All patients were followed up for a minimum of 4 months and a maximum of 8 months. At that time, an independent orthopedic surgeon (G.S.), who did not know the patient's designated group, performed a neurological physical examination (sensory and motor responses) to assess for any postoperative neurological complications.

For statistical analysis, continued variables were expressed as means and standard deviations (SD) and were compared with *t* test or Mann-Whitney *U* test according to their distribution. Discrete variables were expressed as percentages with a 95% confidence interval (CI) and were compared with chi-square test with Fisher transformation. The level of significance was set at $P < .05$.

Techniques

Foot Block

The blockade was performed with the patient lying in supine position. Intravenous midazolam (1-2 mg) was administered to assist in improving patient cooperation and comfort. The posterior tibial nerve was blocked approximately 2-finger breadths proximal to the medial malleolus, 1 to 1.5 cm anterior to the Achilles tendon. The posterior tibial artery was palpated, and a 25-gauge (25-mm) short bevel Stimuplex needle (B. Braun Medical, Inc., Bethlehem, PA) was inserted just posterior to it. The needle was advanced slowly, attached to a Braun Stimuplex-DIG nerve stimulator (B. Braun Medical, Inc.) to elicit an evoked motor response. An electrical current of 1.5 mA at 2 Hz was used initially, until a plantarflexion response was elicited. Then it was decreased to 0.5 mA, and the position of the needle was optimized to maintain the above motor response. After careful aspiration, 4 mL of 0.5% bupivacaine and 4 mL of 2% lidocaine without epinephrine were injected.

The common peroneal nerve (deep peroneal nerve and superficial peroneal nerve) was blocked posterolateral to the fibular neck. A 25-gauge (25-mm) short bevel Stimuplex needle was inserted just distal to it, attached to a Braun Stimuplex-DIG nerve stimulator, with an electrical current of 1.5 mA at 2 Hz, until a motor response in the foot was observed: eversion (superficial peroneal nerve) and dorsiflexion (deep peroneal nerve). It was important to identify both motor responses to obtain a successful block. Then, 2 mL of 0.5% bupivacaine and 2 mL of 2% lidocaine without epinephrine were injected into each nerve. Finally, the saphenous nerve was blocked at the groin if a tourniquet was used intraoperatively.

Popliteal Sciatic Nerve Block

The patient was placed in a prone position with the foot slightly raised and supported on a roller to allow free foot

TABLE 1 Demographic and clinical data

	Group FB n = 26	Group PB n = 25
Female sex (%)	23 (88.5%)	23 (92%)
Age: y (SD)	61 y (11)	56 y (17)
Tourniquet time: min (SD)	47 (15)	53 (19)
Surgery time: min (SD)	52.7 (19.2)	56.8 (20.1)

movement. Intravenous midazolam (1-2 mg) was administered to assist in improving patient cooperation and comfort. A line was drawn across the popliteal crease, extending between the tendons of the biceps femoris and the semitendinosus muscles, and the midline of the crease was identified. The needle puncture site was identified by measuring exactly 7 cm cephalad along a midline axis and then 1 cm lateral to the axis. A 25-gauge (50-mm) short bevel Stimuplex needle was inserted and attached to a Braun Stimuplex-DIG nerve stimulator with an electrical current of 1.5 mA at 2 Hz to elicit an evoked motor response of inversion (tibial nerve) or dorsiflexion (common peroneal nerve). The current was decreased from the initial 3 mA to 0.5 mA, and then 7.5 mL of 0.5% bupivacaine and 7.5 mL of 2% lidocaine without epinephrine were infiltrated around the tibial nerve, and 5 mL of 0.5% bupivacaine and 5 mL of 2% lidocaine without epinephrine were infiltrated around the common peroneal nerve. The saphenous nerve was blocked at the groin if a tourniquet was used intraoperatively.

Results

The anesthesia blocks were the sole anesthetic technique for the forefoot surgery (effective) in 24 of 26 patients (92.3%) (interval confidence [IC] 74.8-99.05) in the FB group and in 24 of 25 patients (96%) (IC, 79.6-99.8) in the PB group ($P = .972$). Table 1 shows the patient distribution according to anesthetic technique (age, sex, type of procedure, surgery time, and tourniquet time).

The anesthetic procedure was accomplished within 14.3 minutes (SD ± 5.67) in the FB group and 19.2 minutes (SD ± 6.68) in the PB group ($P = .0078$). The latency period of the block was 8.6 minutes (SD ± 5) in the FP group and 10.48 minutes (SD ± 6) in the PB group ($P = .244$). Overall patient satisfaction was 96.1% (IC, 80.4-99.9) in the FB group and 96% (IC, 79.6-99.8) in the PB group ($P = 1.00$). A good discharge disposition was observed in 96.1% of patients in the FP group and 100% of the PB group patients ($P = 1.00$).

Analysis of pain scores at 6, 12, 18, and 24 hours postoperatively with the visual analogue scale (Figure 1) showed no significant difference between the 2 groups. The average analgesia time was 10.96 hours (SD ± 7.56) in the FB group and 14.32 hours (SD ± 7.73) in the PB group

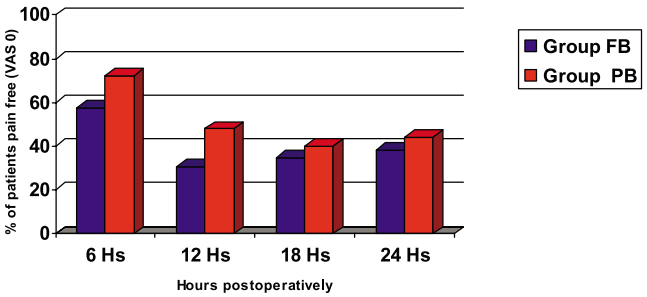

FIGURE 1 Percentages of patients pain free (VAS=0) at 6, 12, 18, and 24 hours postoperatively.

($P = .123$). The average time interval between the block placement and the first intake of analgesics was 9.96 hours (SD ± 5.99) in group FB and 11.92 hours (SD ± 6.46) in group PB ($P = .267$).

The mean follow-up time was 5.7 months. Follow-up physical examinations did not demonstrate neurological complications in any of the patients included in the study.

Discussion

The results obtained in this prospective, randomized study suggest that both anesthesia blocks are safe and effective and well suited to forefoot ambulatory surgery settings. Furthermore, they also provide good postoperative analgesia, reducing the need for opioids and minimizing the risk of side effects.

In this study, both techniques showed a high level of efficacy; no significant difference could be detected between them. These results are similar to those previously reported (1–5, 10, 11). High foot-block success rates have been reported by various authors (Myerson, 95% (5); Ptaszek, 98% (10). With the use of popliteal block, Rongstad et al (2) and Hansen et al (3) reported 97% and 95% success rates, respectively. Provenzano et al (1) showed a lower rate (79%). We believe that some of the blocks considered to be unsuccessful probably had a delayed onset of action and were not given sufficient time for the anesthetic agents to be gauged effective.

Analysis of the time required to perform the anesthetic procedure showed a difference between the 2 groups, with FB being considerably faster ($P < .05$). This difference is probably due to the deeper location of the sciatic nerve in the popliteal fossa, making it more difficult to identify. Although this block (PB) requires only 1 injection, it is necessary to elicit 2 different motor responses (tibial nerve and common peroneal nerve). The latency period of both blocks was similar to that found in previous series (3, 4). This short period, and the short time required to perform both blocks, make these techniques more efficient and less

costly, because they may decrease turnover time between surgical procedures in the operating room.

The average analgesia time was more than 10 hours with both blocks, which is also similar to other studies (3–5). Consequently, it provides for adequate postoperative analgesia, which is required for outpatient surgical procedures. In a prospective, randomized controlled study, Clough et al (11) reported a mean 12 hours before patients reported first pain. They concluded that although the foot block prolongs the time to first-perceived pain, it does not improve patient satisfaction. We were not able to address this difference in the current study, because we did not include a control group.

Our patients showed a high rate of satisfaction with both procedures and demonstrated a good discharge disposition. No significant difference in satisfaction could be detected between the 2 groups in the current study. We also did not observe any anesthesia complications. Although the small sample size could be a limitation of this study, we believe that performing the blockade with the patient awake and with the use of a nerve stimulator explains the absence of neurological problems and the few complications reported in the literature (1–5). The current study's prospective assessment of variables such as pain, latency, and complications provides objective and stronger evidence for the efficacy of these blocks.

Besides sample size, the diversity of surgical procedures included in this study appears to be another limitation in comparing the 2 different anesthetic techniques. On the other hand, we feel that this heterogenous group of pathologies reflects the typical scenario of forefoot surgery found in daily practice.

To our knowledge, there have been no previous reports of prospective and randomized trials comparing FB and PB. In summary, both procedures provide efficient postoperative analgesia, with low complication rates and high patient acceptance rates. We conclude that both procedures are safe and effective anesthetic techniques and well suited to forefoot ambulatory surgery.

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