Lateral popliteal sciatic nerve block compared with ankle block for analgesia following foot surgery

David H. McLeod MB BS FFARCSI FANZCA,
David H.W. Wong MB BS FRCPC,
Himat Vaghadia MB ChB FRCPC,
Richard J. Claridge MD FRCSC, Pamela M. Merrick BSN

The purpose of this study was to compare postoperative analgesia after foot surgery in patients anaesthetised either with popliteal sciatic nerve block or ankle block. In a prospective study, 40 patients scheduled for foot surgery involving osteotomies were allocated randomly into one of two groups. Following induction of general anaesthesia, Group PS (n = 21) received a lateral popliteal sciatic nerve block and Group AB (n = 19) received an ankle block. Both groups received 20 ml bupivacaine 0.5% plain. In group PS 43% required morphine analgesia in the Post Anaesthetic Recovery Room (PAR) compared with 16% in group AB. Postoperative analgesia was assessed using VAS and a pain scale in the PAR and a questionnaire by telephone follow-up on the day after surgery. The ankle block appeared to be more reliable, providing more consistent analgesia in the PAR. Postoperative analgesia in Group PS lasted a median of 18.0 hr and in Group AB lasted 11.5 hr (P < 0.05). Both techniques provided effective analgesia after discharge home and high levels of patient satisfaction.

Cette étude compare, pour la chirurgie du pied, l'analgésie postopératoire réalisée soit par un bloc de la cheville, soit par un bloc du nerf sciatique poplité. Au cours d'une étude prospective, 40 patients programmés pour une chirurgie du pied comportant des ostéotomies sont répartis aléatoirement entre deux groupes. Après l'induction de l'anesthésie générale, le groupe SP (n = 21) reçoit un bloc du nerf sciatique poplité externe alors que le groupe BC (n = 19) reçoit un bloc de la cheville. On administre aux deux groupes 20 ml de bupivacaïne 0,5%. Quarante-trois p. cent des sujets du groupe SP ont besoin de morphine pour l'analgésie comparativement à 16% du groupe BC. L'évaluation de la douleur postopératoire se fait sur EVA et sur une échelle de douleur en salle de réveil (S de R) et par un questionnaire téléphonique le lendemain. Le bloc de cheville semble plus fiable et procure une anesthésie plus constante en S de R. Dans le groupe SP, l'analgésie postopératoire persiste pour 18 h (médiane) et dans le groupe BC, pour 11,5 h (P < 0,05). Les deux techniques procurent au patient une anesthésie efficace et un degré élevé de satisfaction après son congé hospitalier.

Key words

ANAESTHETIC TECHNIQUES, REGIONAL: sciatic nerve block, ankle block;
SURGERY: orthopaedic.

From the Department of Anaesthesia, Faculty of Medicine, University of British Columbia, Vancouver, British Columbia.

Address correspondence to: Dr. David McLeod, Department of Anaesthesia, Flinders Medical Centre, Bedford Park, South Australia, Australia 5042.

Accepted for publication 7th April, 1995.

Surgery of the foot involving osteotomies is often performed in day surgical units. The pain that follows can be moderate to severe and difficult to manage with standard oral analgesic regimens. In a recent study[1] we showed that a new lateral approach to the sciatic nerve in the popliteal fossa[2] provided effective analgesia following foot surgery, and had a high level of patient satisfaction. Analgesia with this technique lasted a median time of 18 hr compared with 6.2 hr following subcutaneous infiltration of the surgical wound with local anaesthetic. The lateral popliteal sciatic nerve block has the advantage over more proximal sciatic blocks of being inserted with patients supine and preserving hamstring function which allows early ambulation with crutches. As most anaesthetists have little expertise in placing sciatic nerve blocks we were interested in evaluating alternative techniques. A similar approach is to block the terminal branches of the sciatic nerve at the ankle where the nerves are more superficial and accessible. Ankle blocks can be combined with light general anaesthesia to provide a very valuable period of postoperative analgesia that is longer lasting than subcutaneous infiltration with local anaesthetic and perhaps approaches that obtained from sciatic nerve blocks.[3]

This study compared the postoperative analgesic benefit of the lateral popliteal sciatic nerve block with the ankle block.

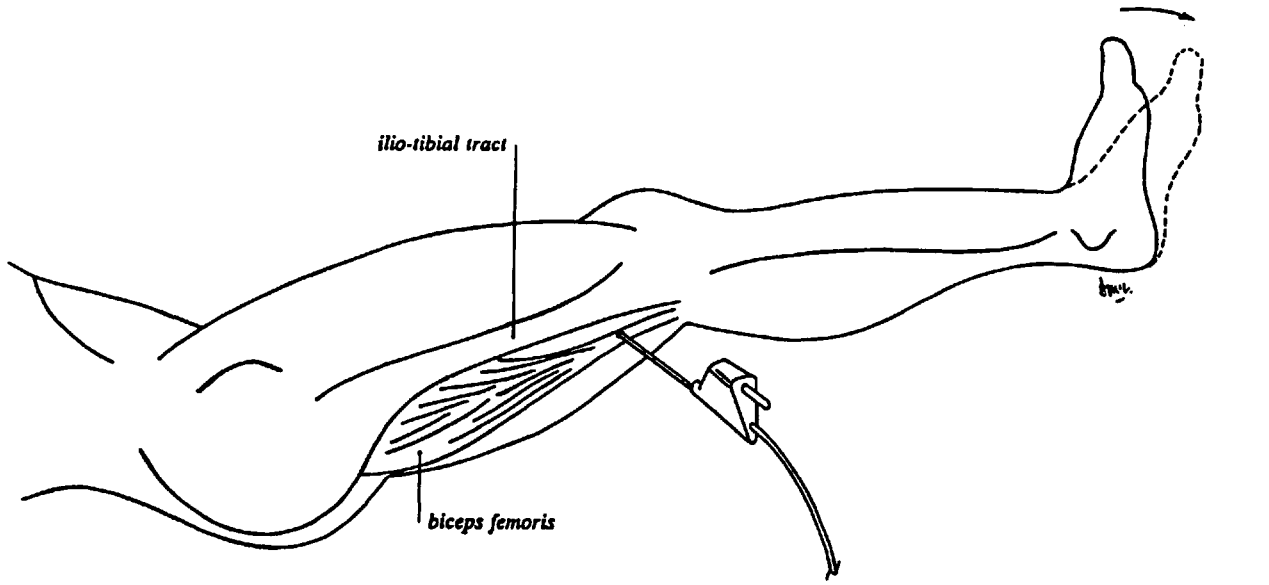

FIGURE 1 Needle placement for lateral popliteal sciatic nerve block. Lateral aspect of right leg.

Methods

After Ethics committee approval and informed consent, 40 ASA 1 and 2 female patients aged 16 to 80 yr were studied in a single blind prospective manner. Patients were ambulatory cases undergoing foot surgery involving osteotomies. Those suffering neurological or neuromuscular disease, sciatica, infection at the proposed block site, a history of hypersensitivity to amide local anaesthetics or those in whom a laryngeal mask was deemed to be contraindicated were excluded from the study. A standardised general anaesthetic consisting of induction with propofol 2 to 3 $mg \cdot kg^{-1}$, fentanyl 1–2 $\mu \cdot kg^{-1}$, and spontaneous respiration with $N_2O/O_2/$ isoflurane via a laryngeal mask was used. Patients were then randomly assigned to receive either a lateral popliteal sciatic nerve block (group PS) or an ankle block (group AB). In both groups the total local anaesthetic consisted of 20 ml bupivacaine 0.5% plain. The technique used for the lateral popliteal sciatic nerve block was that described by McLeod.[1] With the patient supine and lower leg elevated on a pillow the biceps femoris tendon on the lateral aspect of the lower thigh was identified at a point where it meets the popliteal fossa skin crease. The tendon was traced proximally for 5 cm. A 22-gauge, 7.3 cm, insulated, block needle (Neuro-trace®) was inserted immediately anterior to the tendon in a horizontal plane with slight cephalad angulation (Figure 1). A low output peripheral nerve stimulator produced plantar flexion with minimal current from excitation of the posterior tibial nerve component of the sciatic nerve. Correct location of the needle was confirmed by abolition of foot twitching immediately following a 1 ml test dose of local anaesthetic. Following this 15 ml bupivacaine 0.5% plain were injected. In addition the saphenous nerve was blocked using a below knee subcutaneous field block following the technique described by Scott[4] (Figure 2). This involved infiltration of local anaesthetic between the tibial tuberosity and the medial head of the gastrocnemius muscle. For this infiltration the remaining 4 ml bupivacaine 0.5% plain were diluted with 4 ml normal saline, to produce 8 ml bupivacaine 0.25% plain.

Ankle blocks were performed using a standard 23-gauge hypodermic needle (B-D®). The saphenous and superficial peroneal nerves were blocked by subcutaneous infiltration from the malleolus to the anterior tibia and from the anterior tibia to the lateral malleolus respectively. The deep peroneal nerve was blocked by inserting the needle between the tendon of tibialis anterior and extensor hallucis longus, and depositing local anaesthetic between bone and skin. The posterior tibial nerve was identified by palpating it postero-inferior to the medial malleolus at a point one-third of the way from the medial malleolus to the posterior apex of the heel (Figure 3).

The posterior tibial, saphenous, deep and peroneal nerves were blocked with 8 ml, 4 ml, 4 ml, and 4 ml bupivacaine 0.5% plain respectively. Blocks were placed by one of the three anaesthetists (DM, DW, HV) all of whom had some previous experience with both techniques.

Postoperative pain assessment was completed by post-

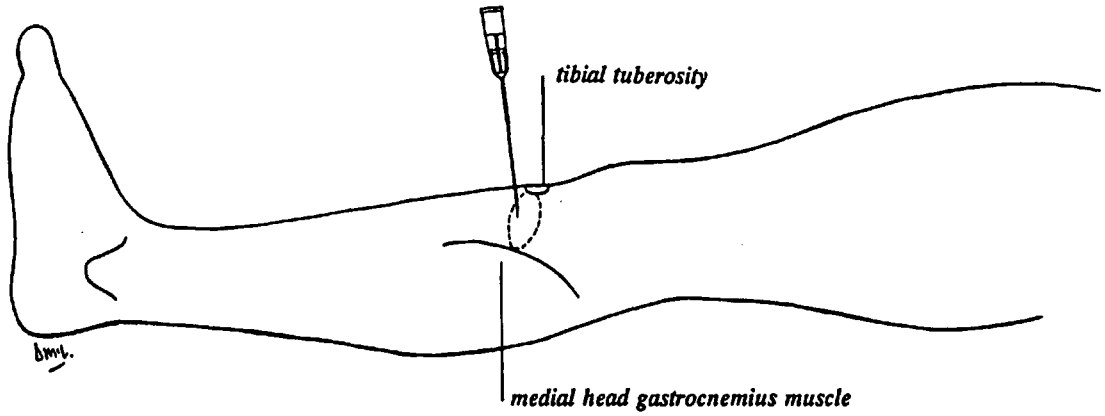

FIGURE 2 Needle placement for saphenous nerve block. Medial aspect of right leg.

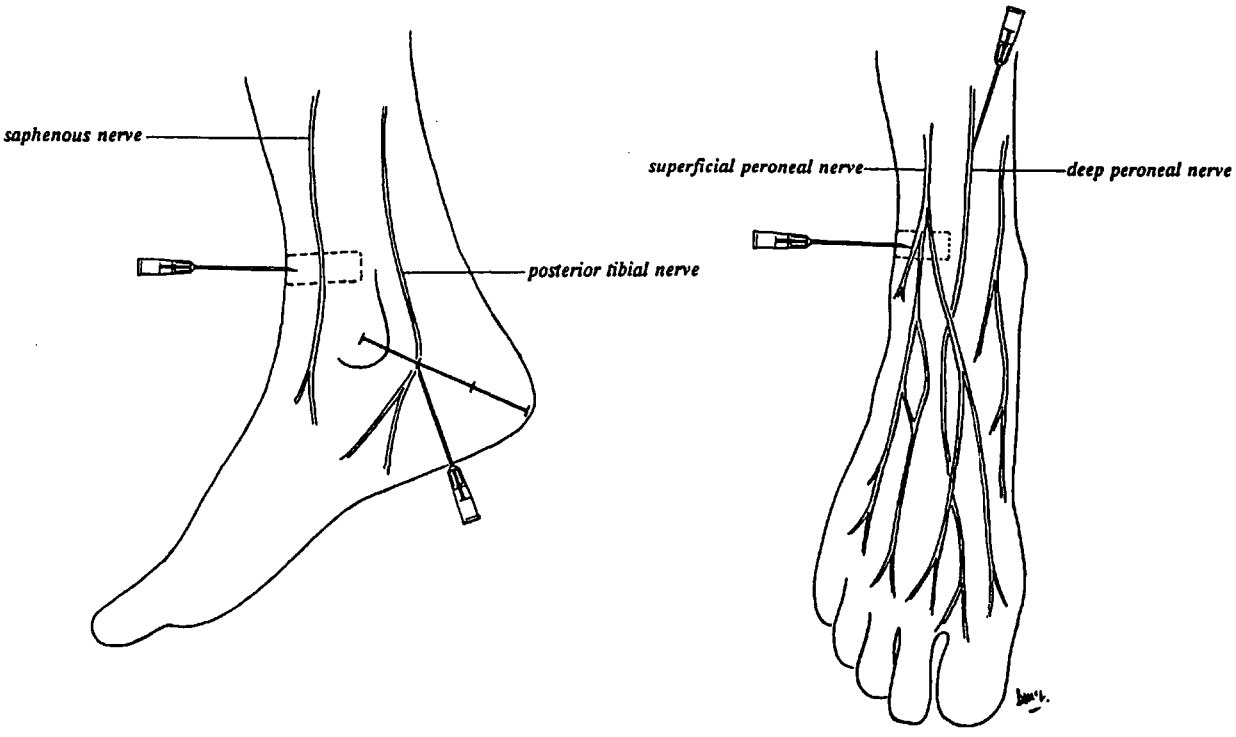

FIGURE 3 Needle placements for ankle block. Right foot.

anaesthetic recovery (PAR) nurses at zero, one hour and at discharge. Nurses were unaware of patients' group assignment. Patients completed a visual analogue scale (VAS) by shifting a pointer on a hand held horizontal 10 cm scale, on which 0 represented no pain, and 10 represented the worst pain imaginable. This technique was rehearsed with patients before surgery. The VAS scale was always presented to the patient with the pointer on the 0 position. A verbal rating scale (VRS) was also used whereby patient rated their discomfort as "none, mild, moderate, severe, or very severe." Postoperative analgesia consisted of morphine *iv* if required, followed by Tylenol #3®, one to two tablets four to six hourly (each Tylenol #3® tablets contains acetaminophen 300 mg, caffeine 15 mg, and codeine phosphate 30 mg). A telephone follow-up was done the evening following surgery by a blinded interviewer. Patients were asked to rate their pain at home, note at what time their foot began to hurt, describe any side effects, rate their satisfaction with postoperative relief and invited to make any comments (Table I).

Age and insertion time were analysed for between group differences with unpaired tests. Weight, anaesthetic

TABLE I Telephone questionnaire

1 How much pain have you had on the day of surgery? *Answer*: "none, mild, moderate, severe, very severe."
2 What time did your foot begin to feel uncomfortable?
3 Have you suffered any side effects since leaving the day surgical centre?
4 How would you rate your over-all satisfaction with pain relief? *Answer*: "completely satisfied, satisfied with reservations, dissatisfied."
5 Would you like to make any comments?

TABLE II Patient data

	Group PS (n = 21)	*Group AB (n = 19)*
Age (yr)	46 (±14)	46 (±15)
Weight (kg)	62 (47–119)	62 (52–109)
Operation		
- MTP arthrodesis/resection	11	10
- Chevron/cheilectomy	7	8
- Other	3	1
Duration of anaesthesia (min)	80 (35–115)	85 (40–120)

Values expressed as mean (±SD), median (range) or counts

and analgesic durations and VAS scores were analysed during Mann-Whitney tests. The rest of the variables were analysed with chi-square or Fisher's exact tests. $P < 0.05$ was considered significant except where Bonferroni's correction was applied to variables measured over time.

Results

The 21 patients in Group PS and 19 in Group AB were successfully followed up. There were no differences between the groups in age, weight, operation or duration of anaesthesia (Table II). The mean times taken for block insertion were not different between groups: PS = 3.4 min (±1.7), AB = 2.6 min (±1.4).

In the PS Group the mean needle depth was 4.8 cm (±1.0 cm) and twitch elicitation with the peripheral nerve stimulator was easy in 16 patients and difficult (more than three passes of needle) in five.

More patients in Group PS (43%) required morphine analgesia in the PAR than in Group AB (16%), ($P < 0.05$). There were no differences between the groups in PAR with respect to VAS or VRS at baseline, one hour at discharge (Tables III and IV), antiemetics received or side-effects encountered. The median duration of analgesia in Group PS was longer (1080 min, Range 435-1507) than in Group AB (690 min, Range 225-1160), ($P < 0.05$). There was no difference between the groups in patient satisfaction with postoperative analgesia; 95% of Group PS and 89.5% of Group AB were satisfied (Table V).

TABLE III VAS scores in PAR

	PS	*AB*	*P value*
Baseline	2.5 (0–8.5)	0 (0–5.0)	NS
One hr	1.5 (0–5.5)	0.5 (0–6.5)	NS
Discharge	1.0 (0–4.0)	0.8 (0–5.0)	NS

(Median values with ranges). (0–10 cm scale).

TABLE IV VRS in PAR

	PS	*AB*	*P value*
Baseline	48	21	NS
One hr	29	16	NS
Discharge	5	5	NS

(% with moderate and severe pain)

TABLE V Postoperative pain assessments

	PS	*AB*
Pain at home		
None, mild, moderate	18/21 (86%)	17/19 (89%)
Severe, very severe	3/21 (14%)	2/19 (11%)
Duration of analgesia (min)	1080 (435–1507)*	690 (255–1160)
Satisfaction with analgesia		
Satisfied	17/21 (81%)	15/19 (79%)
Satisfied with reservations	3/21 (14%)	2/19 (10.5%)
Dissatisfied	1/21 (5%)	2/19 (10.5%)

*$P < 0.05$.
Values expressed as counts and percentages. Duration of analgesia medians (ranges).

Discussion

This study indicates that whilst analgesia in the PAR was incomplete, particularly for the PS group, both the lateral popliteal sciatic block and the ankle block provided sufficient analgesia after discharge home to confer a high degree of patient satisfaction.

Sample size calculation showed that for a 50% difference in incidence of pain at home between the two groups we would need to study 24 patients in each group. Power analysis showed that the power we achieved with our sample size to find a 50% difference in incidence of pain at home was 0.72.

Concerning morphine use in the PAR, the ankle block appears to be a more reliable block. In Group PS 43% (9/21) of patients compared with 16% (3/19) in Group AB required morphine. In two of these patients, from Group PS, pain was a result of failed sciatic nerve block. These patients exhibited no signs of a functioning peripheral nerve block and experienced considerable postoperative pain. The remaining seven patients who required morphine postoperatively seemed to have a

functioning sciatic nerve block as they all described resolution of a nerve block with an accompanying increase in foot discomfort some time after discharge home. This same phenomenon had occurred in our initial study of the lateral popliteal sciatic nerve block.[1] We ascribed this pain to the surgery encroaching upon this territory of the saphenous nerve which was not blocked. It is possible that in this study the pain in the PAR was due to the same cause, from a failure of the saphenous nerve blocks. Van der Wal *et al.*,[5] showed recently that below-knee field block of the saphenous nerve, using the same approach as in this study, had a success rate of only 39%.

Plantar flexion as an indication of tibial nerve component stimulation was chosen as an endpoint. We were concerned that dorsi-flexion from stimulation of the common peroneal component may occur from a needle placed too laterally to block the tibial nerve adequately. We hoped that by localising the tibial nerve component, and by placing the needle 5 cm above the popliteal fossa skin crease, where the common peroneal should be in close proximity, and by using 20 ml local anaesthetic we could block both components of the sciatic nerve. However, we may have place some of our blocks too medially to block the common peroneal nerve, and this may have contributed to some of the pain seen in the PAR.

The approach we used to block the posterior tibial nerve at the ankle is one that has not been previously described. It has the advantage of blocking the nerve where it is superficial, easily accessible and can be performed whilst the patient is supine with the foot in the neutral position. It utilises easily identifiable landmarks, the medial malleolus and the posterior apex of the heel, with or without direct palpation of the nerve. This approach is similar to the midtarsal approach of Sharrock,[6] which used palpation of the posterior tibial artery below the medial malleolus, and the subcalcaneal approach of Wassef[7] which relies on palpation of the bony sustentaculum tali below the medial malleolus. Both these anatomical landmarks can be difficult to identify, hence our preference for using this previously undescribed approach.

We chose 8 ml to block the posterior tibial nerve as we assumed this to be the most important of the nerves to be blocked. Thus, by increasing the dose of bupivacaine for this nerve, we hoped to optimize the duration of neural blockade and postoperative analgesia. The sural nerve was not blocked as none of our patients had surgery involving the lateral aspect of the foot. Most of the surgical procedures were for correction of hallux valgus deformities.

Regarding the median analgesic time of 11.5 hr provided by the ankle block, it is likely that higher doses of bupivacaine would produce longer periods of postoperative analgesia. Using 30 ml bupivacaine 0.75% for bilateral midtarsal ankle blocks Mineo[8] produced a mean duration of analgesia of 17 hr. Sarrafian[3] using an average of 22 ml bupivacaine 0.5% produced analgesia ranging from 10 to 25 hr.

Twitch elicitation in identifying the sciatic nerve was difficult in five patients. The anaesthetist in each of these cases was less experienced in the new lateral approach to the popliteal sciatic nerve. With further exposure we would expect the incidence of difficult twitch elicitation to become less frequent. Using 20 ml bupivacaine 0.5% plain the median duration of analgesia for lateral popliteal sciatic nerve block was 18 hr compared with 11.5 hr for ankle block. In a similar study[1] we found that subcutaneous infiltration of the surgical wound produced a median duration of analgesia of 6.2 hr on analgesia for foot surgery. Despite the difference in the duration of analgesia between ankle block and lateral popliteal sciatic nerve block there was no difference in patient satisfaction between the groups; 95% of group PS and 98.5% of group AB were satisfied with their postoperative analgesia.

We conclude that, using 20 ml bupivacaine 0.5% plain, both ankle block and lateral popliteal sciatic nerve block provide effective analgesia and a high level of patient satisfaction after discharge home following foot surgery involving osteotomies.

Acknowledgments

The authors thank the staff of the Surgical Day Care Centre at the Vancouver Hospital and Health Sciences Centre for their cooperation during this study.

References

1 *McLeod DH, Wong DHW, Claridge RJ, Merrick PM.* Lateral popliteal sciatic nerve block compared with subcutaneous infiltration for analgesia following foot surgery. Can J Anaesth 1994; 41: 8: 673–6.

2 *Collum CR, Courtney PG.* Sciatic nerve blockade by a lateral approach to the popliteal fossa. Anaesth Intensive Care 1993; 21: A236–7.

3 *Sarrafian SK, Ibrahim IN, Breihan JH.* Ankle-foot peripheral nerve block for mid and forefoot surgery. Foot Ankle Int 1983; 4: 86–90.

4 *Scott BD.* Techniques of Regional Anaesthesia. Connecticut: Appleton & Lange - Mediglobe S.A. 1989: 132–3.

5 *van der Wal M, Lang SA, Yip RW.* Transsartorial approach for saphenous nerve block. Can J Anaesth 1993; 40: 542–6.

6 *Sharrock NE, Waller JF, Fierro LE.* Midtarsal block for surgery of the forefoot. Br J Anaesth 1986; 58: 37–40.

7 *Wassef MR.* Posterior tibial nerve block. Anaesthesia 1991; 46: 841–4.

8 *Mineo R, Sharrock NE.* Venous levels of lidocaine and bupivacaine after midtarsal ankle block. Reg Anesth 1992; 17: 47–9.