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**Original Research Article**

# Ultrasound-guided popliteal block for foot and ankle surgery: a prospective observational study of clinical outcomes and patient satisfaction

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## ABSTRACT

**Background:** Regional anaesthesia has become an integral component of modern perioperative care owing to its ability to provide superior postoperative analgesia while reducing opioid consumption and avoiding the physiological perturbations associated with general anaesthesia. Ultrasound-guided popliteal block has emerged as an effective technique for surgeries involving the foot and ankle, offering precise localisation of neural structures and improved procedural success. However, clinical data evaluating its effectiveness in the Indian population remain limited. Aim was to evaluate the clinical efficacy, safety, block characteristics, postoperative analgesia, and patient satisfaction associated with ultrasound-guided popliteal block as the primary anaesthetic technique for foot and ankle surgery.
**Methods:** A prospective observational study was conducted in 60 adult patients (ASA physical status I to III) undergoing elective or emergency foot and ankle surgery. Ultrasound-guided popliteal sciatic nerve block was performed using a mixture of 10 ml of 1.5% lignocaine and 5 ml of 0.5% bupivacaine. Procedural time, onset and duration of sensory and motor blockade, duration of postoperative analgesia, haemodynamic variables, block success, complications, and patient satisfaction were recorded and analysed.
**Results:** The mean procedure time was 4.1±1.3 minutes. Sensory blockade occurred after 3.1±1.0 minutes, while motor blockade developed after 7.0±1.3 minutes. Mean duration of sensory blockade was 183±14.8 minutes and motor blockade lasted 144.3±13.3 minutes. The first postoperative complaint of pain occurred after 239.0±21.6 minutes. Haemodynamic parameters remained stable throughout the perioperative period. Only one block required conversion to general anaesthesia, resulting in an overall success rate of 96.7%. No procedure-related complications were observed, and all remaining patients reported high satisfaction with the anaesthetic technique.
**Conclusions:** Ultrasound-guided popliteal sciatic nerve block is a safe, reliable, and effective primary anaesthetic technique for foot and ankle surgery. It provides rapid onset, prolonged postoperative analgesia, excellent patient satisfaction, and minimal complications. Wider adoption of this technique may contribute to enhanced recovery protocols and reduced perioperative opioid requirements.

**Keywords:** Ultrasound guidance, Popliteal block, Sciatic nerve, Foot and ankle surgery, Regional anaesthesia, Patient satisfaction

## INTRODUCTION

Regional anesthesia for foot and ankle surgery has been used extensively by podiatric surgeons for over thirty years.[1] Regional anesthesia is ideal for ambulatory-type surgery, especially when combined with sub-hypnotic doses of sedatives to allay patient anxiety.[1-4]

Popliteal blocks can potentially be utilized as the sole source of anesthesia for foot and ankle surgery. This can

be beneficial in medically compromised patients. Profound analgesia during both the operative and post-operative time periods and the avoidance of systemic complications such as nausea and vomiting are also potential benefits of the popliteal nerve block.[2,5,6]

Ultrasound guidance shortens the block performance time, reduces the number of needle passes, and shortens the block onset time. Ultrasound also allows dose reduction of the local anaesthetic.[7]

Ultrasound guidance allows the anaesthetist to detect the point of sciatic nerve division and modify the procedure such that both branches are effectively blocked. Ultrasound guidance can also be used to block the posterior femoral cutaneous nerve, a branch of the sacral plexus innervating posterolateral thigh segments that cannot be blocked by conventional means because it is separated from the sciatic nerve at the level of the proximal thigh.[8] We therefore chose to perform and study ultrasound-guided popliteal fossa blocks in patients undergoing foot and ankle surgeries.[8,9]

The popliteal nerve block is a form of regional anesthesia utilized for a variety of foot and ankle conditions. This form of anesthesia has become a popular technique to decrease postoperative pain, decrease narcotic use, and increase patient satisfaction.[9]

Compared to general anesthesia, popliteal blocks carry fewer inherent risks, especially for the compromised or chronically ill patient. Many patients who require surgical intervention are diabetic, hypertensive, and have cardiac disease. A significant number of these patients are not good candidates for general anesthesia.[11,13]

Ultrasound has improved the success of nerve blockade by allowing more accurate injection around nerves, a lower dose of anesthetic drugs, and less nerve damage. In comparison to spinal anesthesia, this procedure carries no risk of postdural puncture headache.[12,14]

A popliteal block can provide prolonged post-operative analgesia and can be performed in patients being treated with anticoagulant therapy.[14,15]

## METHODS

This prospective observational study was conducted in the Department of Anaesthesiology at VS General Hospital and Smt. NHL Municipal Medical College, Ahmedabad, between July 2014 and July 2016 after obtaining approval from the institutional ethics committee. The study included 60 patients who underwent elective and emergency foot and ankle surgeries, all belonging to ASA grades I, II, and III.

All patients underwent a thorough preanaesthetic checkup, which included history taking, general and physical examination, and laboratory and radiological investigations. The local part was examined and the anaesthetic plan was discussed with the patient and the operating surgeon on the night before surgery in the case of elective procedures, and just prior to the procedure in the case of emergency operations. Informed written consent was taken from the patient and a close relative. All patients were advised nil by mouth as per fasting guidelines.

### *Inclusion and exclusion criteria*

Patients aged 19 years or older, belonging to ASA physical status I, II, or III, who were willing to participate in the study and were undergoing elective or emergency surgery confined to the foot or ankle, were included. Patients were excluded if they did not provide consent, had a known bleeding disorder, had an ASA grade greater than III, were pregnant, had septicaemia, or had a local site infection at the site of the planned block.

### *Preparation*

After institution of pulse oximetric monitoring, an intravenous line was secured with an intravenous cannula. Non-invasive blood pressure monitoring and electrocardiographic monitoring were started, and pre-procedure and intraoperative vitals were noted.

### *Equipment*

A portable sterile tray was prepared containing 10 mL disposable syringes, a disposable 23G spinal needle, bowls containing povidone-iodine, spirit, and normal saline solutions, sponge-holding forceps, a sterile towel and towel clip, and the study drugs (injection lignocaine 2% 10 mL and injection bupivacaine 0.5% 5 mL). Emergency resuscitation equipment, comprising an anaesthesia workstation (Boyle or Drager), an oxygen source with a Bain's circuit and appropriately sized masks, laryngoscopic blades of appropriate sizes, endotracheal and tracheostomy tubes, a working suction apparatus, and intravenous crystalloid and colloid infusion fluids, was kept ready. The ultrasound machine and probe were cleaned and aseptically prepared before the procedure.

### *Position and landmarks*

The patient was positioned prone, with the head turned to the opposite side and the hands kept by the side. Anatomical landmarks, including the course of the semitendinosus tendon and the biceps femoris tendon, were identified and marked with a skin marker. The mid-popliteal crease was identified and marked (Figure 1).

### *Procedure*

After preparing the site with iodine, spirit, and normal saline solutions, proper draping was carried out and a high-frequency (5 to 12 Hz) ultrasound probe was placed transversely at the mid-popliteal crease. After localising

the popliteal artery, the probe was moved proximally to locate the sciatic nerve at or prior to its bifurcation into the tibial and peroneal branches (Figure 2). A 23G spinal needle was inserted using an out-of-plane approach, and the needle tip was advanced until it reached very close to the nerve, visualised as a bright dot. Once placement was confirmed by questioning the patient verbally regarding the presence of paraesthesia in the foot and ankle region, injection lignocaine 1.5% 10 mL and injection bupivacaine 0.5% 5 mL were injected, and correct deposition of the local anaesthetic around the nerve was confirmed by ultrasound visualisation (Figure 3).

Sensory block was assessed by the pinprick method and motor block was assessed by the ability to plantar flex the ankle. All data were entered into a spreadsheet program. The time taken for sensory and motor blockade to recede completely was noted, as was the time to the onset of pain postoperatively.

***Parameters recorded***

The following parameters were recorded for each patient: time taken for the procedure, number of attempts needed to localise the sciatic nerve, onset and duration of sensory blockade, onset and duration of motor blockade, supplementary anaesthesia needed, patient satisfaction, time to onset of pain after the procedure, and the incidence of complications.

***Definitions of parameters***

Time taken for the procedure was defined as the interval between preparation of the local part and administration of the full dose of the local anaesthetic. Onset of sensory blockade was defined as the interval between injection of the full dose of local anaesthetic and complete loss of pinprick sensation over the ankle and foot. Onset of motor blockade was defined as the interval between injection of the full dose of local anaesthetic and complete inability to plantar flex the ankle.

Duration of sensory blockade was defined as the interval between onset of sensory block and the first-time pinprick sensation is felt again by the patient on periodic checking. Duration of motor block was defined as the interval between onset of motor block and the time the patient is able to plantar flex the ankle again. Onset of pain was defined as the interval between onset of sensory block and the first time the patient complains of pain.

Number of attempts was defined as the number of times the skin had to be punctured with the spinal needle to localise the sciatic nerve and inject the full dose of the local anaesthetic. Failure of block was defined as inadequate analgesia, sensory blockade, or motor blockade even after 30 minutes of injection of the local anaesthetic solution; this was managed with anxiolytics such as injection midazolam 1 mg in anxious patients, or by supplementation with general anaesthesia. Supplementation, if needed was defined as the anaesthetic drug or technique administered in addition to the local anaesthetic agents used.

***Grading of block and patient satisfaction***

Sensory block was graded as follows: Grade 1, normal sensation to pinprick; Grade 2, pinprick perceived as touch with a blunt object; Grade 3, complete loss of pinprick sensation. Motor block was graded as follows: Grade 1, normal function; Grade 2, weakness in performing the movement; Grade 3, inability to perform the specified movement. Patient satisfaction was assessed using a questionnaire that classified each patient's response into one of three categories: not satisfied, satisfied, or very satisfied.

All data were entered into a spreadsheet program and statistical analysis was performed using Microsoft excel software.

## RESULTS

Our study consisted of 60 patients undergoing elective and emergency foot and ankle surgery. Patient ages ranged from 19 to 78 years (mean 53.2±15.5 years) and weight ranged from 41 to 90 kg (mean 63.4±10.9 kg). The study comprised 43 male and 17 female patients, distributed across ASA grades I, II, and III as detailed in Table 1.

Haemodynamic parameters remained stable throughout the perioperative period. Apart from a modest rise in pulse rate, systolic blood pressure, and diastolic blood pressure at 5 minutes, likely attributable to the anxiety response associated with the needle prick, all parameters remained close to baseline values throughout the procedure and postoperatively (Table 2).

The mean time taken to conduct the block was 4.1±1.3 minutes (range 2 to 7 minutes). Mean sensory onset time was 3.1±1.0 minutes (range 2 to 6 minutes), while mean motor onset time was 7.0±1.3 minutes (range 4 to 10 minutes). The mean time taken for completion of surgery was 39.3±5.3 minutes (range 30 to 50 minutes). Complete motor regression occurred at a mean of 144.3±13.3 minutes (range 110 to 180 minutes), and complete sensory regression occurred at a mean of 183±14.8 minutes (range 160 to 220 minutes). The first postoperative complaint of pain was registered at a mean of 239±21.6 minutes (range 200 to 300 minutes), as summarized in Table 3.

One case was considered a failure because general anaesthesia had to be supplemented, giving an overall block success rate of 96.7%. No procedure-related complications or adverse reactions were observed in any patient. All patients in whom the block was successful graded their experience as very satisfied with the anaesthetic technique (Figure 1-3).

**Table 1: Demographic and clinical characteristics of study patients, (n=60).**

| Parameters | Category | Number of patients |
|---|---|---|
| **Age (in years)** | 19-28 | 6 (10%) |
| | 29-38 | 2 (3%) |
| | 39-48 | 11 (18%) |
| | 49-58 | 20 (33%) |
| | 59-68 | 7 (12%) |
| | 69-78 | 14 (23%) |
| | Mean±SD | 53.2±15.5 |
| **Weight (kg)** | 41-50 | 9 (15%) |
| | 51-60 | 17 (28%) |
| | 61-70 | 17 (28%) |
| | 71-80 | 14 (23%) |
| | 81-90 | 3 (5%) |
| | Mean±SD | 63.4±10.9 |
| **ASA grade and sex distribution** | | |
| ASA grade | Male/female | Total (%) |
| ASA I | 19/4 | 23 (38%) |
| ASA II | 17/12 | 29 (48%) |
| ASA III | 7/1 | 8 (13%) |
| Total | 43/17 | 60 (100%) |

**Table 2: Perioperative haemodynamic parameters (mean±SD).**

| Time points | Pulse (mean) | Pulse (SD) | SBP (mean) | SBP (SD) | DBP (mean) | DBP (SD) |
|---|---|---|---|---|---|---|
| **Preop** | 96.8 | 17.5 | 122.5 | 22.0 | 77.8 | 15.3 |
| **5 min** | 101.7 | 18.4 | 125.2 | 23.2 | 79.7 | 16.4 |
| **10 min** | 97.8 | 17.5 | 123.7 | 22.4 | 78.7 | 15.7 |
| **15 min** | 97.8 | 17.6 | 123.5 | 22.0 | 78.5 | 15.6 |
| **30 min** | 96.8 | 17.5 | 122.5 | 22.0 | 77.8 | 15.3 |
| **45 min** | 96.9 | 17.7 | 122.9 | 22.4 | 77.8 | 15.3 |
| **Postop** | 96.9 | 17.7 | 122.9 | 22.4 | 77.8 | 15.3 |

**Table 3: Block characteristics and time intervals (mean±SD, range).**

| Parameter (minutes) | Mean±SD | Range |
|---|---|---|
| **Time taken for procedure** | 4.1±1.3 | 2-7 |
| **Sensory onset** | 3.1±1.0 | 2-6 |
| **Motor onset** | 7.0±1.3 | 4-10 |
| **Operating time** | 39.3±5.3 | 30-50 |
| **Complete motor regression** | 144.3±13.3 | 110-180 |
| **Complete sensory regression** | 183.0±14.8 | 160-220 |
| **Onset of postoperative pain** | 239.0±21.6 | 200-300 |

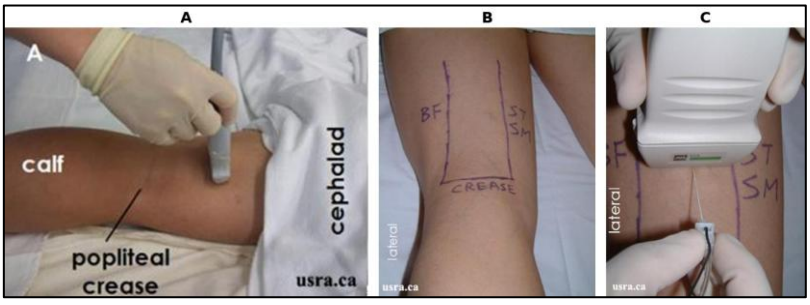


**Figure 1 (A-C): Reference diagrams illustrating ultrasound probe position and surface anatomy for the popliteal block. (A) Transducer position at the mid-popliteal crease. (B) Anatomical landmarks: biceps femoris (BF); semitendinosus and semimembranosus (ST, SM). (C) Out-of-plane needle insertion technique.**

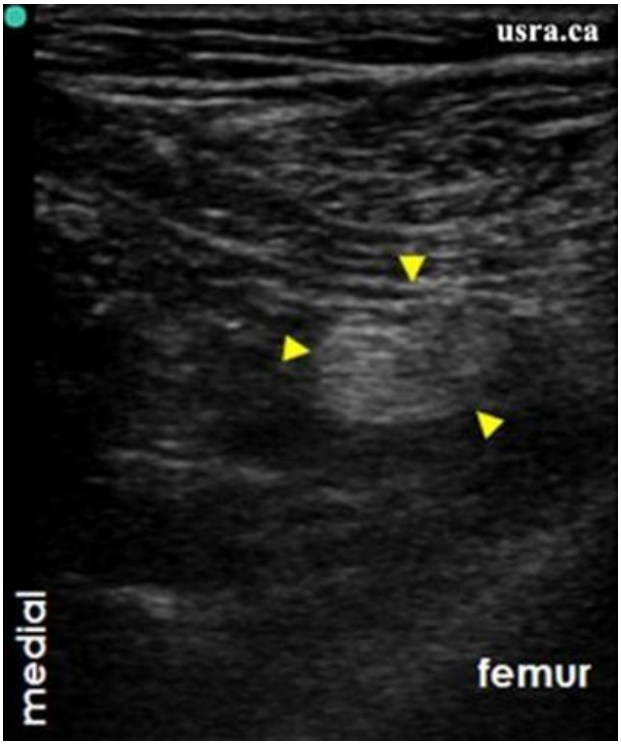


**Figure 2: Ultrasonogram showing the sciatic nerve (arrowheads) in the popliteal fossa before its bifurcation.**

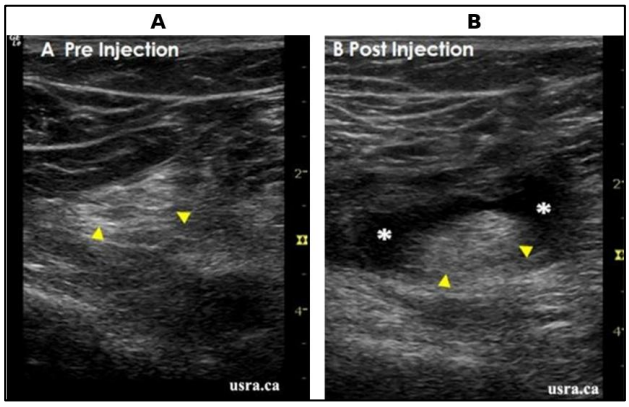


**Figure 3 (A and B): Ultrasonogram showing deposition of local anaesthetic (stars) around the sciatic nerve. (A and B) show local anaesthetic spread around the nerve at two levels.**

## DISCUSSION

We studied 60 randomly selected patients undergoing ankle and foot surgeries who received an ultrasound-guided popliteal fossa block. Patients were monitored closely and the data obtained were analysed.

### *Time taken*

The mean time taken to administer the block in our study was 4.1±1.3 minutes, mean sensory onset time was 3.1±1.0 minutes, and mean motor onset time was 7.0±1.3 minutes, which was comparable to the study by Hadzic et al and Zetlaoui et al, who reported an average time to perform a popliteal fossa block of 4.10 minutes, with motor blockade complete in all patients within thirty minutes.[16,17] The shorter procedure time and the fact that all blocks were successfully administered on the first attempt in our study can be attributed to a fair degree of expertise and readiness with the equipment and drugs as and when needed. Mean duration of sensory blockade was 183±14.8 minutes and motor blockade lasted 144.3±13.3 minutes.

### *Volume of local anaesthetic solution used*

We used a total volume of 15 ml of local anaesthetic, which is less than that suggested by Southerland et al who recommended 20 to 30 ml of local anaesthetic (a combination of injection bupivacaine 0.5% and injection lignocaine 1.5%).[18]

In our study, mean time for motor regression was 144.3±13.3 minutes, while mean time for sensory regression was 183±14.8 minutes. Patients' first complaint of pain occurred at 239.0±21.6 minutes. These times were longer than those reported in some existing studies. This could be attributable to a higher tolerance to pain among Indian patients compared with western populations.[19]

### *Complications and haemodynamic stability*

In our study of 60 cases of foot and ankle surgery performed under ultrasound-guided popliteal fossa block alone, all patients showed stable haemodynamic parameters and no complications were noted. There was one failure in our study, in which general anaesthesia had to be supplemented to complete the surgery. Possible contributing factors could have included improper isolation of the nerve, faulty injection technique, migration of the needle during drug injection, or incorrect identification of the nerve itself.

### *Patient satisfaction*

In our study, all patients in whom the block was successful reported that they were very satisfied with the anaesthesia provided, which is comparable to the findings reported by Phillips et al and Rodríguez et al.[19,20]

## CONCLUSION

The popliteal fossa is a readily accessible site ultrasonographically, and the structures found there can be easily distinguished from one another via the posterior approach. Blockade of the sciatic nerve in the popliteal fossa can serve as adequate standalone anaesthesia and analgesia for foot and ankle surgeries, avoiding the complications associated with other regional and general anaesthetic techniques for the same operations. It additionally provides excellent haemodynamic stability and patient satisfaction. Although further studies are needed to compare various approaches to sciatic nerve

block in the popliteal fossa, we consider ultrasound-guided popliteal fossa block to be a valuable technique for the future of anaesthesia in foot and ankle surgery.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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