

# A Comparative Study of Popliteal Nerve Block Approaches and Guidance Modalities

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## Statement of Purpose

The popliteal (sciatic) nerve block has become a mainstay in regional anesthesia for foot and ankle surgery, providing dense sensory and motor blockade below the knee while preserving proximal hamstring function.<sup>1,2</sup> Peripheral nerve blockade of the tibial and popliteal nerve has been shown to decrease acute and chronic postoperative pain and minimize the usage of postoperative narcotics. Two principal approaches to the popliteal block are currently described in the anesthesiology literature: the traditional posterior approach and the lateral approach, which allows block placement in the supine position. This study compares posterior and lateral popliteal block techniques performed with ultrasound and PNS guidance in 100 consecutive cases over a one-year period (2023–2024).

## Level of Evidence

Level of Evidence: II; Prospective Comparative Study

## Introduction

The popliteal nerve block is a cornerstone of regional anesthesia for foot and ankle surgery, providing reliable sensory and motor blockade below the knee while reducing postoperative pain and opioid use. Successful block placement requires a detailed understanding of popliteal fossa anatomy, a diamond-shaped space posterior to the knee containing a superficial-to-deep arrangement of nerve, vein, and artery. The sciatic nerve typically bifurcates proximal to the popliteal crease, though high bifurcation occurs in up to 25% of patients and may affect block reliability. Ultrasound improves identification of neural and vascular anatomy, including shared paraneural sheaths and anatomic variants that increase procedural risk.

Two primary techniques are described: posterior and lateral approaches, with the lateral approach allowing block placement in the supine position. With advances in ultrasound and adjunctive nerve stimulation, technique selection remains an important determinant of block success and patient comfort. This study compares posterior and lateral popliteal block techniques performed with combined ultrasound and peripheral nerve stimulator guidance in 100 consecutive cases over one year (2023–2024).

## Methods and Technique

One hundred adult patients undergoing popliteal nerve blockade were included. Fifty patients received a prone, nerve stimulator-guided posterior approach, and fifty received a supine, ultrasound-guided lateral approach. All procedures were performed with the attending anesthesiologist present. Exclusion criteria included peripheral neuropathy, lumbar spine pathology or infection, and ipsilateral below-knee amputation. Case types utilizing popliteal blockade are listed in Table 1.

### Group A: Prone, Nerve Stimulator-Guided

Patients were positioned prone with the knee flexed. The sciatic nerve was localized using surface landmarks and nerve stimulation via a 100-mm insulated needle proximal to the popliteal crease. After obtaining a tibial motor response, 30 mL of 0.5% ropivacaine was injected incrementally.

### Group B: Supine, Ultrasound-Guided

Patients were positioned supine with the knee flexed and externally rotated. High-frequency ultrasound identified the sciatic nerve proximal to the popliteal crease. An in-plane injection of 20–25 mL of 0.5% ropivacaine was administered under direct visualization to achieve circumferential spread.

### Saphenous Nerve Block

All patients received a saphenous nerve block for complete sensory coverage. Four milliliters of 0.5% ropivacaine was injected subcutaneously adjacent to the great saphenous vein at the medial tibial condyle or proximal medial malleolus.

Table 1: Listing various procedures performed under the popliteal block

Procedure Type	Number of Cases (n)
Bunionectomy and forefoot osteotomies	23
Metatarsal ORIF	10
Lisfranc ORIF	6
Talar fracture ORIF	1
Calcaneal ORIF	5
Ankle fracture fixation	16
Achilles tendon rupture or repair	10
Triple arthrodesis	4
Subtalar joint arthrodesis	5
Lateral ankle stabilization	10
Flatfoot reconstruction	4
Peroneal tendon repair	6

## Results

In this prospective series of 100 consecutive popliteal nerve blocks, the ultrasound guided supine technique demonstrated significantly greater efficiency, patient comfort, and safety compared with the prone electrical stimulator guided approach. Ultrasound guidance resulted in shorter block performance time and faster onset of anesthesia, which was attributed to direct visualization of the sciatic nerve bifurcation and local anesthetic spread, while stimulator guided blocks often required repeated needle redirection.

Block duration was comparable between groups at approximately 13 hours, although ultrasound guidance produced more consistent sensory and motor blockade. Patient satisfaction scores were higher in the ultrasound group, and no vascular punctures or paresthesias occurred, whereas transient paresthesias were observed in the stimulator group. In patients with BMI greater than 30, ultrasound guidance significantly reduced the need for needle redirection, highlighting its advantage in patients with poorly defined landmarks. Overall, ultrasound guided popliteal nerve blocks provided superior workflow, safety, and patient satisfaction with equivalent anesthetic duration, while all patients received an adjunctive saphenous nerve block for complete medial coverage.

Table 2: Results of PNS and Ultrasound Guided Injections

Parameter	Group A (Prone/Stimulator)	Group B (Supine/US Guided)	p-Value
Average block time (min)	8.4 ± 2.1	6.1 ± 1.6	<0.01
Onset of anesthesia (min)	9.5 ± 3.2	6.8 ± 2.1	<0.01
Duration (hours)	13.4 ± 2.8	12.8 ± 2.5	NS
Complications	3 (transient paresthesia)	0	<0.05
Patient satisfaction (VAS)	8.2	9.5	<0.05
Need for repositioning	20 repositioned	0	<0.05

## Conclusion

Popliteal nerve blocks remain a cornerstone of regional anesthesia for foot and ankle surgery, providing reliable anesthesia and prolonged postoperative analgesia with minimal systemic effects. In this study, both posterior nerve stimulator-guided and lateral ultrasound-guided approaches achieved effective anesthesia with comparable onset, duration, and safety profiles. The posterior approach offers a direct trajectory to the sciatic bifurcation but is limited by prone positioning and airway access, whereas the lateral ultrasound-guided approach allows for supine positioning, improved ergonomics, and greater patient comfort, supporting its growing role in outpatient surgery. Ultrasound guidance has become the standard for precision and safety, enabling reduced anesthetic volumes, faster onset, and fewer complications compared with nerve stimulation alone, while continued adherence to anatomic principles and meticulous technique remains essential for optimal outcomes. As technology continues to evolve, including advancements in imaging and injection systems, successful outcomes remain grounded in sound anatomic knowledge, meticulous technique, and vigilant patient monitoring.

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