

## Comparison of Posterior Versus Lateral Approaches To Block Sciatic Nerve In The Popliteal Fossa

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**Background:** Popliteal block is used to block the sciatic nerve at the popliteal fossa to anesthetize the region supplied by it, distal to the site of local anesthetic administration. Various approaches to sciatic nerve block have been described in the literature. The study aimed to compare posterior versus lateral approaches to block the sciatic nerve in the popliteal fossa.

**Methodology:** After approval and permission from the institutional ethics committee no.MC/190/2007/Pt-11/July-2021/TH-22) 60 patients of either sex, ASA I and II, between the ages of 18-60, posted for lower limb surgeries under popliteal sciatic nerve block were selected for the study. The patients were divided into groups A (n=30) and B (n=30) by a computer-generated random selection to receive the popliteal block using either the lateral or posterior approach. In both groups, a peripheral nerve stimulator was employed to perform the nerve block procedure. Local anesthesia used in both groups was 30 ml of 0.5% ropivacaine.

**Results:** The block performance time in group A was  $9.27 \pm 2.95$  minutes and in the group, B was  $5.77 \pm 2.84$  minutes. Both techniques resulted in a successful blockade. A number of attempts for the nerve blockade were found to be more with the lateral approach than the posterior approach ( $p < 0.0001$ ). There was no significant difference in the onset of sensory and motor block in group A and group B. The duration of analgesia observed in our study in group A was  $586.67 \pm 69.979$  minutes and in the group, B was  $576.33 \pm 70.868$  minutes.

**Conclusion:** Posterior approach required less time to perform the block compared to the lateral approach. Both posterior and lateral approaches are comparable in terms of onset of sensory block, motor block, duration of motor block, duration of analgesia, and duration of postoperative analgesia.

**Keywords:** popliteal nerve block, nerve stimulator, block performance time, sciatic nerve block, lateral approach, posterior approach.

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### I. Introduction

The popliteal nerve block is becoming popular in adults for the management of pain in surgery involving the foot, ankle, and knee.<sup>(1,2)</sup> Popliteal block is used to block the sciatic nerve at the popliteal fossa so that the region supplied by it, distal to the site is anesthetized. Sciatic nerve block is a well-recognized technique for providing anesthesia and post-operative analgesia for foot and ankle surgeries.<sup>(3,4)</sup> Various approaches to popliteal nerve block have been described in the literature.<sup>(5-7)</sup> The posterior approach was first described by Duane Keith Rorie, and the lateral approach was first described by Jerry Vloka. Both approaches provide equivalent anesthesia and are suitable for catheter placement. However, not many studies have been conducted to compare the two approaches. In our study, we compared the lateral and posterior approaches to block the sciatic nerve in the popliteal fossa.

## II. Methods And Material

### Patient selection

A total of 60 patients between the age of 18-60 years, ASA I and II, posted for elective orthopedic ankle and foot surgeries under popliteal sciatic nerve block, were selected for the study. Patients problems with positioning, known hypersensitivity to local anesthetic agents, infection at the site of block, known coagulopathy, patients with diabetes mellitus, pregnant or, lactating mothers, patients with peripheral vascular disease, and chronic analgesic therapy were excluded from the study.

**Sample size calculation:** Based on a previous study<sup>8</sup> considering a mean block performance time of 180.86+/-75.31 sec, to detect a difference of 60sec in the mean block performance time with 80% power and 5% level of significance, 25 Patients were needed in each group. Considering a dropout rate of 20%, 30 patients were studied in each group with a total sample size of 60 patients.

This prospective, randomized, patient-blinded, single-hospital study was carried out after obtaining informed and written consent from the participants of the study. Patients meeting the inclusion criteria were divided into groups A or B, by a computer-generated random selection using **block randomization** with blocks of variable sizes.

- Group A (n=30): patients received nerve stimulator-guided popliteal block by lateral approach with 30 ml 0.5% ropivacaine.
- Group B(n=30): patients received nerve stimulator-guided popliteal block by posterior approach with 30 ml 0.5% ropivacaine.

On arrival at the preoperative area, standard monitoring in the form of baseline non-invasive blood pressure, heart rate, ECG, and peripheral oxygen saturation was noted. Prior to the application of the proposed popliteal block, an intravenous line was secured with an 18G cannula. All patients received a 10-30 µg/kg injection of midazolam and a 1-2 µg/kg injection of fentanyl intravenously in the preoperative period.

### Technique of Anaesthesia

#### Lateral approach

The patient was positioned supine and with their leg extended at the knee joint on the operation table. The foot on the side to be blocked was positioned so that even the slightest movements of the foot or toes can be easily observed. This was best achieved by placing the foot on a footrest. This positioning allowed easy visualization of any foot movement during nerve stimulation. Under all aseptic and antiseptic precautions, a 100-mm 21-gauge insulated stimulation short bevel needle (Stimuplex B-Braun Medical) connected to a nerve stimulator was inserted in the horizontal plane 7 cm cephalad to the most prominent point of the lateral epicondyle, in the groove between the vastus lateralis and biceps femoris muscle until the shaft of the femur was intentionally contacted. Keeping the fingers of the palpating hands firmly pressed and immobile in the groove. If the femur was not contacted within the depth of approximately 50 mm, the needle was inserted again 5-10 mm anterior to the first insertion. After the femur was contacted, the needle was withdrawn to the skin and redirected posteriorly at a 30 angle to the horizontal plane. If the first attempt did not result in nerve localization, the same technique was repeated through a new skin puncture in 5 mm increments posterior to the initial insertion plane.

#### Posterior approach

The patient was positioned prone with their leg fully extended. The foot on the side to be blocked was positioned and feet protruded off the table in order to detect even the slightest movements of the foot or toes can be easily observed. Under all aseptic and antiseptic precautions, the needle (Stimuplex B-Braun Medical) connected to a nerve stimulator was inserted perpendicular at the midpoint between the tendons of the biceps femoris and semitendinosus muscles, 7 cm above the popliteal fossa crease. If there was a failure to stimulate the sciatic nerve, removal of the needle and repetition of the same maneuvers through a new puncture site 5 mm lateral to the initial insertion site was done. This technique was repeated through subsequent attempts in 5-mm incremental lateral insertions until the desired response was obtained.

The ultimate goal of nerve stimulation in both the above technique is to obtain visible or palpable twitches of the foot or toes at a current of 0.5 mA. Stimulation of the sciatic nerve gives two common twitches. Tibial nerve stimulation gives the planter flexion and inversion of the foot. Stimulation of the common peroneal nerve gives dorsiflexion and eversion of the foot. Isolated twitches of the calf muscles should not be accepted because they may be the result of stimulation of the sciatic nerve branches to the calf muscles that may be outside the sciatic nerve sheath. After obtaining initially visible twitches of the sciatic nerve, the stimulating

current is gradually decreased until twitches are still seen or felt at 0.5 mA. At this point, the needle is stabilized, and after negative aspiration 30 ml of 0.5% ropivacaine was injected slowly

The primary aim studied was the block performance time in both approaches. After the blocks were performed with 30 ml of 0.5% ropivacaine, Sensory block onset time, Motor block onset time, postoperative analgesia, duration of analgesia, duration of motor block, side effects, and complications were noted. Block performance time was defined as the time interval between the needle insertion and complete local anesthetic administration close to the nerve.

The grading of the sensory block was assessed by a pinprick test was conducted according to scores: 0-normal sensation, 1-blunted sensation (analgesia), 2-absence of sensation. The onset of sensory block was defined from the end of total local anesthetic injection to the complete loss of sensation to pinprick and the duration of sensory the block was considered from the onset of sensory block to the reappearance of pinprick sensation in the sciatic nerve distribution.<sup>9</sup> Motor block was evaluated by Modified Bromage Scale (MBS): was used every 5 minutes after completion of injection until the inability of the patient to move the ankle and toes of the operating limb (score 3) to assess motor power in the postoperative period every 2 hours until complete recovery.<sup>(9,10)</sup>

0 – No movement in the relevant muscle group.

1 – Flicker of movement in the relevant muscle group.

2 – Ability to move relevant muscle group against gravity, inability to move against resistance.

3 – Reduce power but ability to move muscle group against resistance.

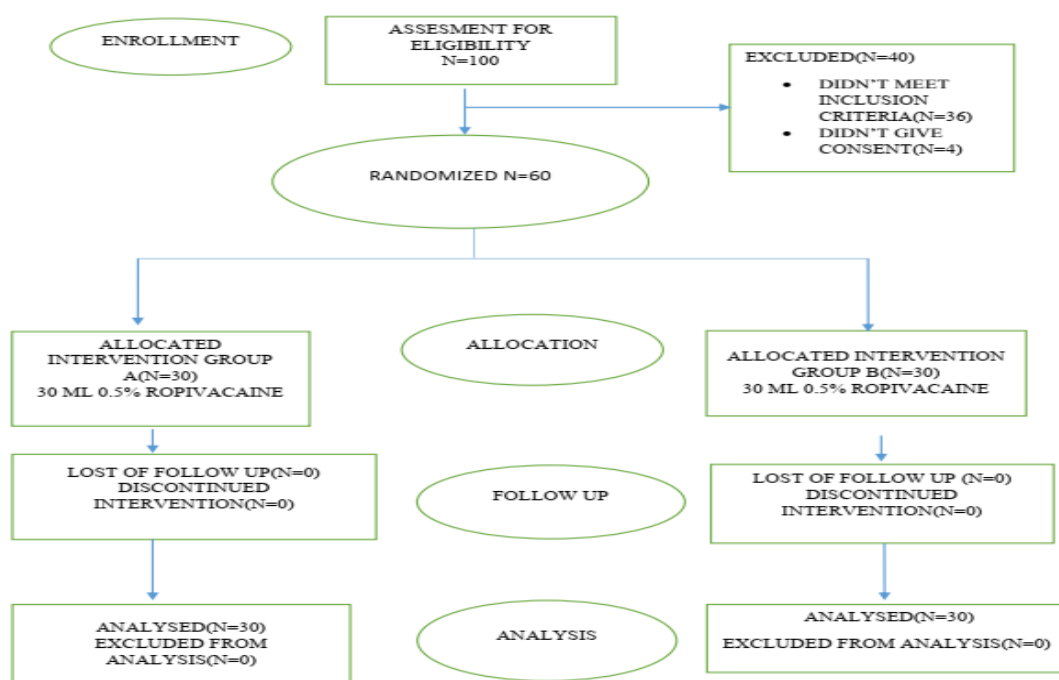
4 – Full power in the relevant muscle group.

Duration of motor block was defined as the time interval between onset of motor block to the recovery of ankle and toe motion of the operating limb (MBS score 0).<sup>9</sup>

Intraoperatively, sedation with 1 mg intravenous midazolam was provided to all patients.

### III. Results And Observations

For this study, 100 patients were screened for inclusion criteria.



**Figure 1:** Consort flow diagram

The demographic characteristics of the patients in the study groups in terms of age, sex, ASA category, height, weight, laterality of surgery and the duration of surgery were comparable and statistical tools did not show any significant difference.

**Block characteristics**

a. **Block performance time**

**Table 1:** Comparison of block performance time in each groups

Group	Mean block performance time(min)	SD	p value
Group A	9.27	2.95	<0.001
Group B	5.77	2.84	

Theanesthetic procedureduration was 9 (7 -12) minutes in group A and 4 (3 -8) minutes in group B. Time toperform sciatic nerve block in the popliteal fossa significantly differed between the twogroups.

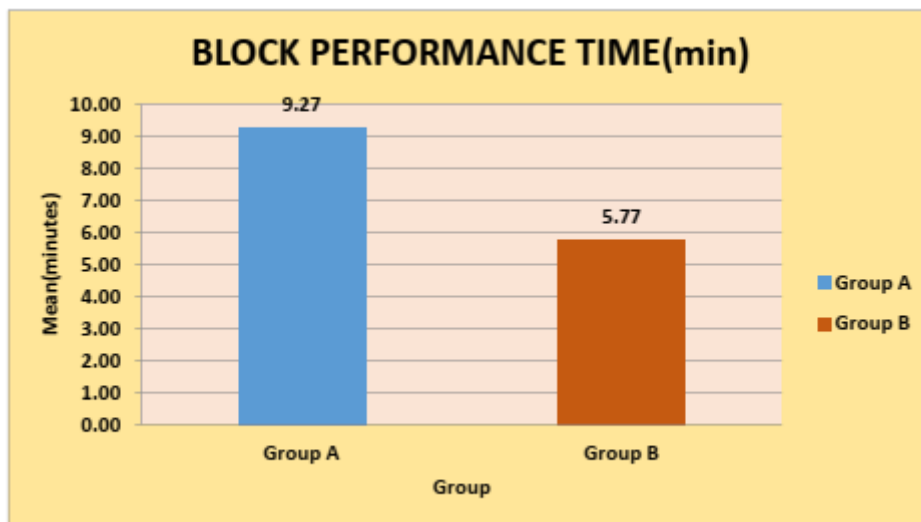


Figure 2: Distribution of block performance time in each groups

b. **Number of attempts**

**Table 2:** Ease of the nerve location in the study groups.

Number of Attempts	Group A	Group B	Total	p-value
1	4(13.3%)	17(56.7%)	21(35%)	P<0.0001
2	4(13.3%)	10(33.3%)	14(23.3%)	
3	20(66.7%)	3(10%)	23(38.3%)	
4	2(6.7%)	0(0%)	2(3.3%)	
Total	30(100%)	30(100%)	60(100%)	

In 56.7% of thepatients, the posterior approach was successful in one attempt, whereas the success ratewas only 13.3% in the lateral approach group. In 33.3% of patients, the posterior approach was successful in the second attempt whereas it was 13.3% in the lateralapproach. In 66.7% of patients, the lateral approach was successful in the thirdattempt whereas it was 10% in the posterior approach. Thus, there was a highlysignificant statistical difference was found between the study groups, with respectto the number of attempts.

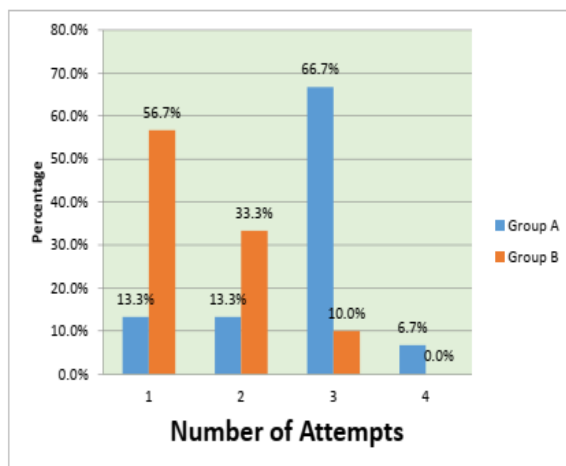


Figure 3: Distribution of the number of attempts in each study group

c. **Onset of motor block**

Table 3: Motorblock onset time in both groups

Group	Mean onset of motor block (min)	SD	p value
Group A	33.33	2.11	0.807
Group B	33.47	2.11	

d. **Onset of sensory block**

Table 4: Sensory block onset time in both groups

Group	Mean onset of sensory block (min)	SD	p value
Group A	22.93	1.53	0.582
Group B	22.70	1.49	

Statistically, there were nosignificant differences between the two groups with respect to the onset of sensoryblock and the onset of motor block.

**Post-operative analgesia**

The mean duration of analgesia in group A was  $586.67 \pm 69.979$  minutes and ingroup B was  $576.33 \pm 70.868$  minutes respectively and no statistically significantdifference was found between the two groups. The postoperative analgesia was studied using the NRS score.

Table 5: Comparison of NRS score between two groups

	Group A	Group B	p-value
	Median (IQR)	Median (IQR)	
NRS_0 HR	0 (0-0)	0 (0-0)	0.557
NRS_0.5 HR	0 (0-0)	0 (0-0)	0.464
NRS_1 HR	1 (1-2)	1 (1-2)	1.000
NRS_6 HR	2 (1-3)	2 (1-3)	0.741
NRS_12 HR	5 (4-6)	5 (4-6)	0.869
NRS_18 HR	4 (3-4)	4 (3-4)	0.901
NRS_24 HR	6 (5-6)	6 (5-6)	0.730

Thus, we can conclude that up to the 24th postoperative hour, there was nosignificant statistical difference in NRS score between groups A and B.

**IV. Discussion:**

The study was conducted with the objectiveof comparing the block performance time between the lateral and posteriorapproach of the popliteal block. The secondary objectives of our study were to comparethe onset of sensory and motor block, duration of motor block, duration of analgesia,postoperative analgesia, postoperative pain assessment, and any other relevantobservation between the two groups up to the 24th postoperative hour.

The block performance time observed in our study, in group A (popliteal block by lateral approach) was  $9.27 \pm 2.95$  minutes, and in group B (popliteal block by posterior approach) was  $5.77 \pm 2.84$  minutes. The

difference between the two groups was highly significant ( $p$ -value $<0.001$ ). This finding of our study is consistent with the findings as was noted by Hadzic A *et al.*<sup>5</sup> who also compared posterior and lateral approaches of the popliteal block using a nerve locator and demonstrated that the lateral approach was technically difficult and took longer to accomplish. Our study findings also correlate with the study done by Dr. Palaniappan *et al.*<sup>6</sup>, Vloka *et al.*<sup>11</sup>, Radhakrishnan A<sup>7</sup> and Radhakrishnan A *et al.*<sup>12</sup> which shows that the lateral approach is slightly more difficult technically and took longer to be performed. In our study, both techniques resulted in a successful blockade in all surgeries but the number of attempts for the nerve blockade was found to be more with the lateral approach (group A) than the posterior approach (group B). This finding of our study is consistent with the findings as noted by Hadzic A *et al.*<sup>5</sup>, Dr. Palaniappan *et al.*<sup>6</sup>, Radhakrishnan A<sup>7</sup> and Radhakrishnan A *et al.*<sup>12</sup>

In our study, there was no significant difference in the onset of sensory and motor block in group A and group B ( $p$  value= 0.582 & 0.807) & our findings are concurrent with the study by Hadzic A *et al.*<sup>5</sup> and Radhakrishnan A.<sup>7</sup> In contrast, Domingo Triado V *et al.*<sup>13</sup> found a significant difference in the onset of the sensory and motor block between the lateral and posterior approach of the popliteal block. The time to onset of the block was significantly shorter with the lateral approach (10 minutes, range 5-25 minutes) than with the posterior approach (17 minutes, range 4-45 minutes). This difference in findings was probably due to the fact that they had more experience, hands-on practice & procedural efficacy with the lateral approach, as commented by the authors themselves.

The duration of analgesia observed in our study in group A (lateral approach) was  $586.67 \pm 69.979$  minutes and in group B (posterior approach) it was  $576.33 \pm 70.868$  minutes. Thus there was no significant difference found between the two groups ( $p$  value= 0.683). In contrast to our findings, a longer duration of analgesia was noted by Taboada M *et al.*<sup>14</sup> in which sciatic nerve was blocked by lateral approach with 0.75 % ropivacaine. They found postoperative analgesia  $1140 \pm 204$  minutes in lateral approach. The difference in the duration of analgesia can be attributed to a higher concentration of drug used for the block in their study approach, while we used 0.5 % ropivacaine.

The hemodynamic parameters were also compared in our study and no significant difference was found between the two groups. The heart rate and mean arterial pressure of the two groups were comparable during the immediate postoperative period and at 15-minute intervals recorded in the intraoperative period. No significant difference in the hemodynamic parameters between the two groups. The incidence of adverse effects in both groups of our study was low.

#### **The limitations of our study are:**

1. It is a single-center study, but for the purpose of evaluation of parameters that we have used in our study, a multi-center study is considered to be better.
2. The study limited assessment of postoperative analgesia to the first 24 hours only.
3. Comfort and ease of patient positioning were not assessed.
4. Although, ultrasound has better visualization, in our study we used nerve stimulator due to the unavailability of the ultrasound machine in our institute during my study period.

#### **V. Conclusion:**

From this prospective randomized study, we can conclude that the Posterior approach required less time to perform the block compared to the lateral approach. Both posterior and lateral approaches are comparable in terms of onset of sensory block, motor block, duration of motor block, duration of analgesia, and duration of postoperative analgesia.

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