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Original Research Article

Effect of ultrasound guided sciatic nerve block by anterior approach on quality of recovery in patients undergoing below knee orthopaedic surgery: A randomised controlled trial

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Abstract

Background: Postoperative pain following below-knee orthopaedic procedures is commonly managed with neuraxial blocks, which may delay early ambulation. The conventional posterior approach to sciatic nerve block can be challenging in patients with fractures due to positioning difficulties. The anterior approach offers a viable alternative that allows better positioning for nerve block. The Quality of Recovery-15 (QoR-15) questionnaire is a validated tool to assess postoperative recovery. This study aimed to evaluate the effect of ultrasound-guided sciatic nerve block via the anterior approach on the quality of recovery in patients undergoing below-knee orthopaedic surgery.

Materials and Methods: This was a double-blinded randomised controlled trial. Patients in Group A received an ultrasound-guided sciatic nerve block via the anterior approach along with subarachnoid block, while Group B received only subarachnoid block. The QoR-15 questionnaire was administered postoperatively, and scores were recorded. Additional outcomes included time to first analgesic demand, total fentanyl consumption via PCA pump in the first 24 hours, and any post-procedural complications related to the nerve block or fentanyl administration.

Results: The QoR-15 scores were significantly higher in Group A (128.63 ± 2.36; 95% CI: 127.75–129.51) compared to Group B (108.40 ± 2.86; 95% CI: 107.33–109.46), with $p < 0.0001$. The time to first analgesic demand was significantly longer in Group A (11.13 ± 1.41 hours; 95% CI: 10.60–11.65) than in Group B (5.93 ± 0.94 hours; 95% CI: 5.58–6.28), also with $p < 0.0001$. Fentanyl consumption in the first 24 hours was significantly lower in Group A (351.67 ± 34.07 µg) compared to Group B (452.50 ± 23.99 µg), with $p < 0.0001$. No post-procedural complications were reported in either group.

Conclusion: Preoperative administration of ultrasound-guided sciatic nerve block via the anterior approach significantly improves the quality of recovery in patients undergoing below-knee orthopaedic surgery. It also prolongs the duration of postoperative analgesia and reduces opioid consumption in the early postoperative period.

Keywords: Early ambulation, Postoperative pain, Orthopaedic procedures, Sciatic nerve, Nerve block.

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1. Introduction

Sciatic nerve block is frequently employed to ensure postoperative analgesia after lower limb surgeries. Sciatic nerve can be blocked by posterior, anterior or parasacral approaches.[1] The ultrasound guided, anterior approach to sciatic nerve is performed when patients cannot be positioned due to pain or external fixators. The advent of ultrasound (US) guidance lowers the rate of vascular puncture and other complications of nerve blocks as well. Usage of Ultrasound also helps to deposit a lesser volume of local anaesthetic close to the nerve.[2,3]

The measurement of the quality of recovery requires assessment of multiple patient centered outcomes.[4] There are many recovery tools of which QoR-15 (Quality of recovery-15) is a validated score. The QoR-15 score is a standardized, patient-centric approach to assess overall well-being of patient after peripheral nerve block and not just pain relief. It includes fifteen questions to assess five different domains of patient health namely pain, physical comfort,

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physical independence, psychological support and emotional state. The 11-point scoring system has a minimum score of 0 (very poor recovery) and maximum score of 150 (excellent recovery).[5,6] The QoR-15 score encompass multidimensional approach to assess holistic impact of nerve block on postoperative recovery. Its use in day care surgery is under further research.[7]

The posterior approach is used conventionally to block sciatic nerve but positioning for block may challenging in view of the deep location of sciatic nerve and proximity to vascular structures.[8] Hence this study was designed to study the effect of ultrasound guided sciatic nerve block by anterior approach on quality of recovery in patients undergoing below knee orthopaedic surgeries.

This study was aimed to find the effect of ultrasound guided sciatic nerve block by anterior approach on quality of recovery in patients undergoing below knee orthopaedic surgeries. The primary objective was to find the effect of ultrasound guided sciatic nerve block by anterior approach on quality of recovery. The secondary objectives were to the note duration of analgesia as measured by time to demand first analgesia, total amount of fentanyl consumed in first 24 hours via PCA pump, complications of nerve block like pain, infection in punctured area, transient sensory deficit, and accidental vascular punctures.

2. Materials and Methods

This prospective, double-blinded (patient and anaesthetist) randomized controlled trial was conducted at a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee and registration with the Clinical Trials Registry–India (CTRI/2024/01/061192). The study adhered to the Declaration of Helsinki and Good Clinical Practice guidelines.[9]

Sixty patients aged 18–60 years, classified as American Society of Anaesthesiologists Physical Status (ASA-PS) I or II, scheduled for below-knee orthopaedic procedures, were enrolled after obtaining written informed consent in the local language. Exclusion criteria included patients with coagulopathies, peripheral neuropathies, uncompensated systemic disorders, known allergies to local anaesthetics, or infection at the intended injection site (**Figure 1**).

During the pre-anaesthetic assessment, patients were educated about the Quality of Recovery-15 (QoR-15) questionnaire (**Figure 2**) and the use of patient-controlled analgesia (PCA) pumps. Participants were randomly assigned to either Group A or Group B using a computer-generated random number sequence concealed in sealed opaque envelopes.

Group A patients received an ultrasound-guided sciatic nerve block via the anterior approach using 25 mL of 0.25% bupivacaine, followed by subarachnoid block with 12.5 mg of 0.5% hyperbaric bupivacaine. Group B patients received only subarachnoid block with the same dose of 0.5% hyperbaric bupivacaine.

For the sciatic nerve block in Group A, patients were positioned supine with the limb slightly flexed and externally rotated at the hip and knee. After applying standard monitors and maintaining strict aseptic precautions, a low-frequency curvilinear ultrasound probe (GE Venue Fit™) was placed approximately 8 cm distal to the inguinal crease. Upon tilting the probe, the sciatic nerve appeared as a hyperechoic structure located posterior and medial to the lesser trochanter of the femur, within the fascial plane between the adductor group and gluteus maximus muscle. After skin infiltration with 3 mL of 2% lignocaine, a 21-gauge, 15-cm needle was introduced in-plane from the medial side of the probe in a posterolateral direction. The needle tip was visualised near the sciatic nerve, and 25 mL of 0.25% bupivacaine was administered under direct vision, with confirmation of appropriate drug spread (**Figure 3**).

All patients were monitored intraoperatively, and necessary equipment and medications were prepared in advance for conversion to general anaesthesia in the event of spinal anaesthesia failure, patchy block, or prolonged surgical duration.

Postoperative analgesia was given with intravenous fentanyl via PCA pump CADD-Legacy™ 1 (Model 6400) with a bolus of 25 µg with a lockout interval of 20 minutes. PCA was switched on and attached as soon as shifting the patient to postoperative ward or intensive care unit from the recovery room. It was not initiated as continuous infusion as our plan was to find if the block is really effective and whether it could reduce the amount of analgesia postoperatively. The quality of recovery QoR-15 questionnaire was given to the patients at 24 hours after the procedure and the scores were noted. Time to demand first analgesia and total dosage of intravenous fentanyl administered via PCA pump were noted from the postoperative period.

2.1. Sample size

Sample size of 30 patients each group was calculated from the parent article M.N Varun et al. using the following formula.[10]

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 (\sigma_1^2 + \sigma_2^2)^2}{(\mu_1 + \mu_2)^2}$$

Where $z_{1-\frac{\alpha}{2}}$ = level of significance and

$z_{1-\beta}$ = power of study

µ1 = Mean 24 hour tramadol consumption in patients who received sciatic nerve block

µ2 = Mean 24 hour tramadol consumption in patients who received IV fentanyl

δ1 = Standard deviation of 24 hour tramadol consumption in patients who received sciatic nerve block

δ2 = Standard deviation of 24 hour tramadol consumption in patients who received IV fentanyl.

2.2. Statistical analysis

Data was entered in Microsoft excel sheet and results were reported as mean, standard deviation, frequency, percentage as applicable. Continuable variables were compared by the use of independent sample t-test while categorical variables were compared by Pearson chi-square test. Significance was defined by p values less than 0.05 using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Science Inc., Chicago, IL).

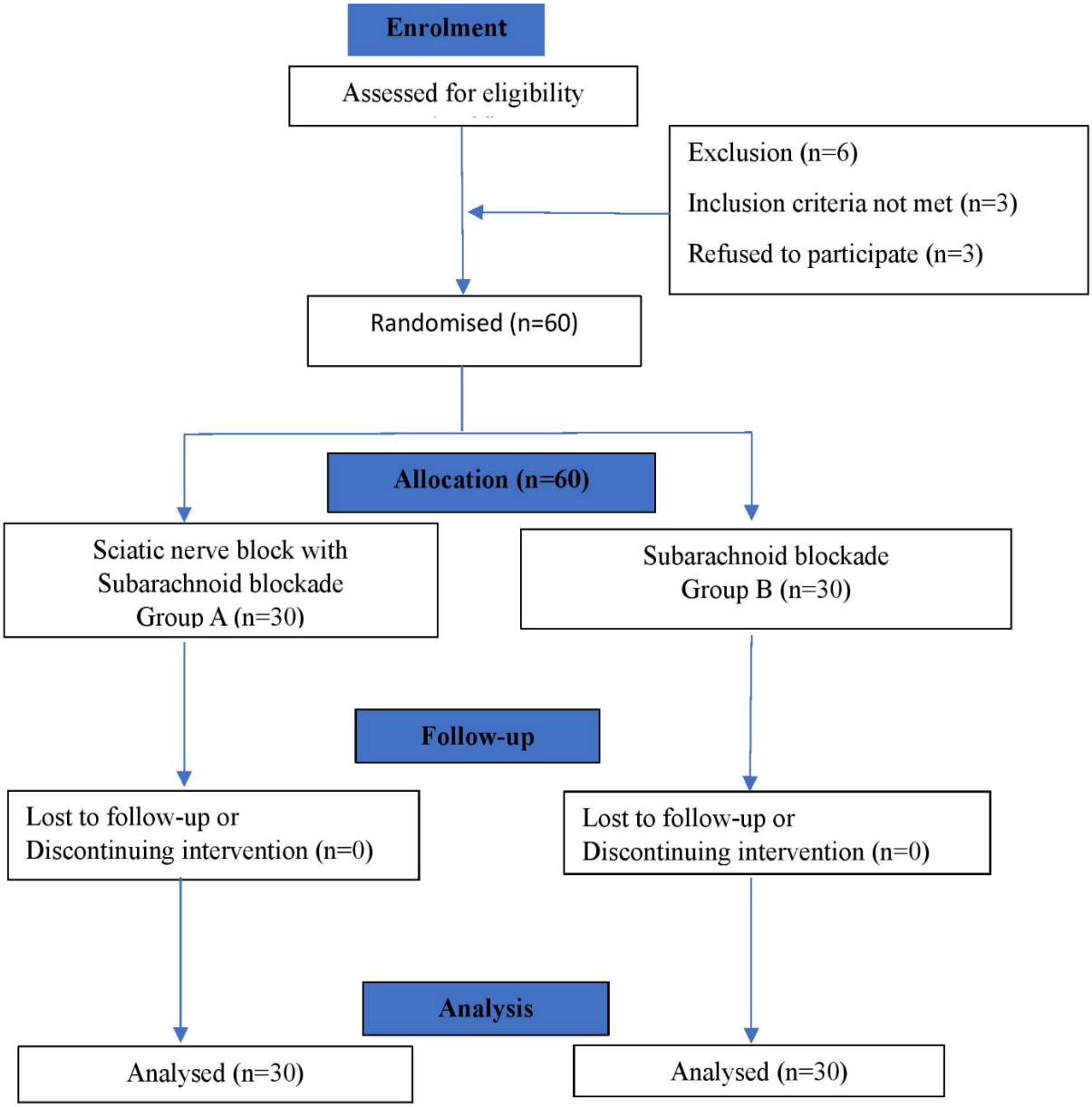


Figure 1: Consolidated standards of reporting trials (Consort) diagram

QoR-15 Patient Survey

Date: _ _ / _ _ / _ _ Study #: _____

Preoperative ☐ Postoperative ☐

PART A

How have you been feeling in the last 24 hours?

(0 to 10, where: 0 = none of the time [poor] and 10 = all of the time [excellent])

1. Able to breathe easily	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
2. Been able to enjoy food	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
3. Feeling rested	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
4. Have had a good sleep	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
5. Able to look after personal toilet and hygiene unaided	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
6. Able to communicate with family or friends	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
7. Getting support from hospital doctors and nurses	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
8. Able to return to work or usual home activities	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
9. Feeling comfortable and in control	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time
10. Having a feeling of general well-being	None of the time	0	1	2	3	4	5	6	7	8	9	10 All of the time

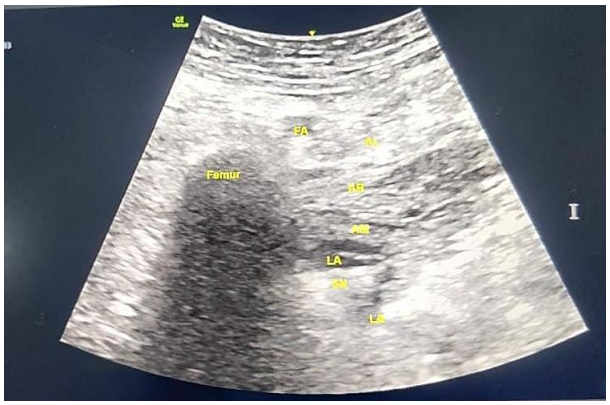
PART B

Have you had any of the following in the last 24 hours?

(10 to 0, where: 10 = none of the time [excellent] and 0 = all of the time [poor])

11. Moderate pain	None of the time	10	9	8	7	6	5	4	3	2	1	0 All of the time
12. Severe pain	None of the time	10	9	8	7	6	5	4	3	2	1	0 All of the time
13. Nausea or vomiting	None of the time	10	9	8	7	6	5	4	3	2	1	0 All of the time
14. Feeling worried or anxious	None of the time	10	9	8	7	6	5	4	3	2	1	0 All of the time
15. Feeling sad or depressed	None of the time	10	9	8	7	6	5	4	3	2	1	0 All of the time

Figure 2: The quality of recovery (QoR-15) questionnaire



FA: Femoral artery; AL – Adductor longus; AB – Adductor brevis; AM: Adductor magnus; SN: Sciatic nerve; LA: Local anaesthetic

Figure 3: Ultrasound view after local anesthetic infiltration around sciatic nerve

3. Results

The demographic and surgical parameters, including age, height, weight, BMI, and duration of surgery, were comparable between Group A and Group B, with no statistically significant differences. The distribution of surgical types was also similar across both groups, ensuring baseline uniformity (

Table 1).

The quality of recovery (QoR-15) scores were significantly higher in patients who received subarachnoid blockade combined with ultrasound-guided sciatic nerve block via the anterior approach (Group A: 128.63 ± 2.36; 95% CI: 127.75–129.51) compared to those who received only subarachnoid blockade (Group B: 108.40 ± 2.86; 95% CI: 107.33–109.46), with the difference being statistically significant ($p < 0.0001$) (**Table 2**, **Figure 4**, **Figure 5**).

The time to first analgesic demand was significantly prolonged in Group A (11.13 ± 1.41 hours; 95% CI: 10.60–11.65) compared to Group B (5.93 ± 0.94 hours; 95% CI: 5.58–6.28), indicating a longer duration of postoperative analgesia in the intervention group ($p < 0.0001$) (**Table 3**).

Postoperative fentanyl consumption over 24 hours was significantly lower in Group A (351.67 ± 34.07 µg) than in Group B (452.50 ± 23.99 µg), reflecting better analgesic efficacy in the combined block group ($p < 0.0001$) (**Table 4**).

No post-procedural complications were observed in either group.

Table 1: Demographic parameters, duration and type of surgery

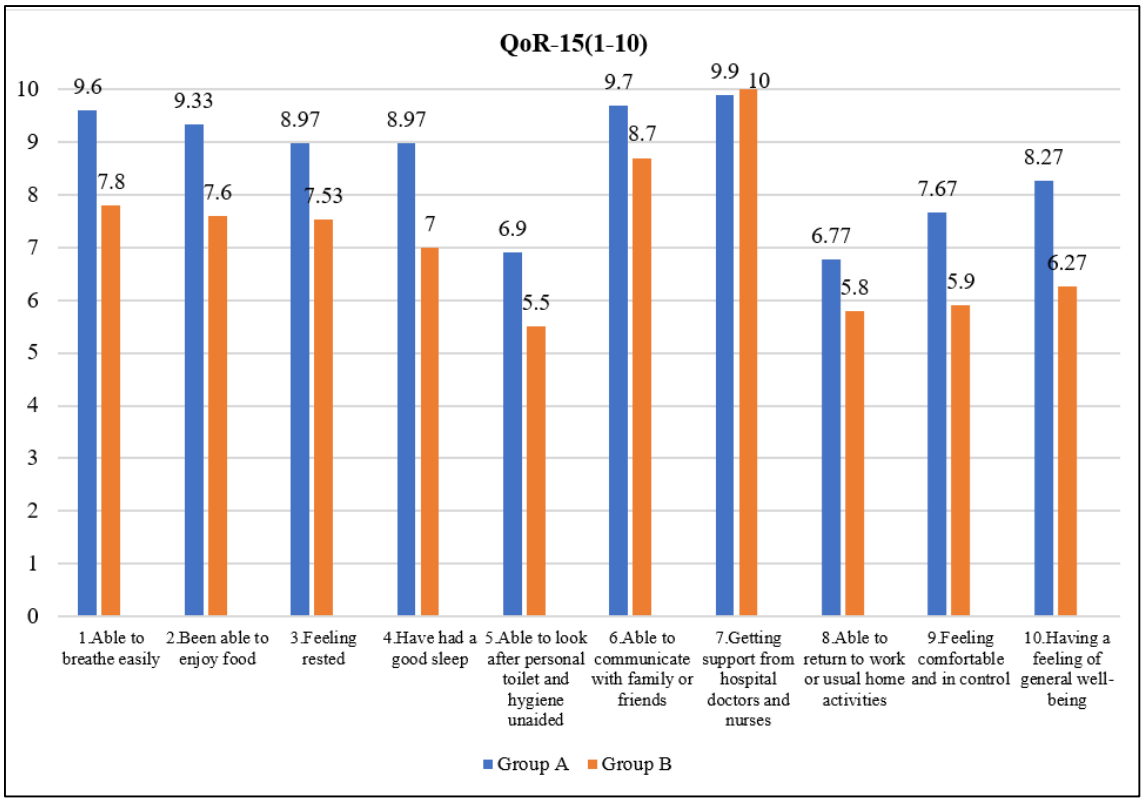
Parameter	Group A (Intervention)	Group B (Control)	P value
Age in years [Mean ± SD]	39.33±14.47	43.80±12.76	0.210
Gender (M:F)	23:7	20:10	
Height in cm [Mean ± SD]	152.77±4.20	151.47±4.53	0.254
Weight in kilogram [Mean ± SD]	69.23±10.06	67.77±6.97	0.514
Body mass index [Mean ± SD]	29.62±4.18	29.54±3.36	0.938
Duration of surgery(min) [Mean ± SD]	92.00±19.59	93.50±21.46	0.778
Type of surgery			
ORIF with plating/nailing for tibia fracture	10	16	
Foot and ankle surgeries	9	9	
Implant exit of tibia fractures	8	4	
Patella surgeries	2	1	
ORIF with plating for fibula fractures	1	0	
External fixators for tibia fractures	0	2	

Table 2: Quality of recovery score

Group	Group A (Intervention)	Group B (Control)	P value
QoR score [Mean ± SD] (95%CI)	128.63±2.36 (127.75–129.51)	108.40±2.86 (107.33–109.46)	<0.0001

Table 3: Time to demand first analgesia

Group	Group A (Mean+/-SD)	Group B (Mean+/-SD)	P value
Time in Hours [Mean ± SD]	11.13±1.41	5.93±0.94	<0.0001



X-axis = QoR-15 questionnaire from 1st to 10th
Y-axis = score out of 10 for each questionnaire where 0 represents none of the time and 10 represents all of the time

Figure 4: Quality of recovery score 1 – 10 parameters

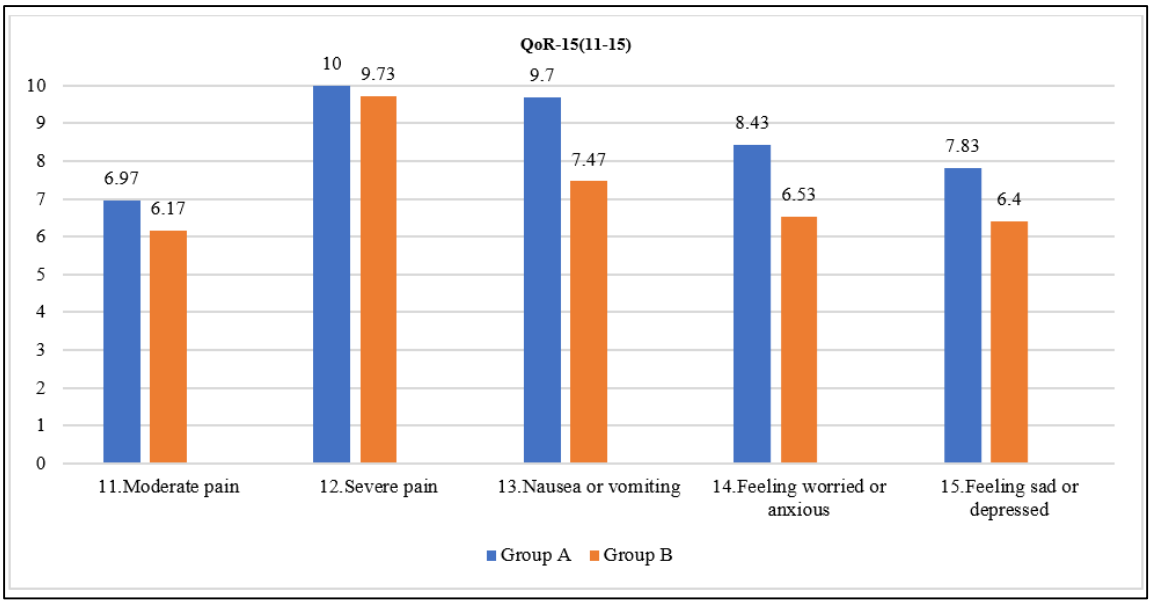


Figure 5: Quality of recovery score 11 – 15 parameters

Table 4: Dosage of fentanyl consumed

Group	Group A (Mean+/-SD)	Group B (Mean+/-SD)	P value
Fentanyl consumed in µg [Mean ± SD]	351.97±34.07	452.50±23.99	<0.0001

4. Discussion

Surgeries for lower limb fractures have traditionally been performed under neuraxial block. When these patients are associated with co-morbid cardio-respiratory problems then it becomes challenging for anesthesiologist to maintain homeostasis with good surgical anesthesia.[11] Moreover, delayed ambulation due to motor block, urinary retention, and side effects of intrathecal opioids often prolong recovery and hospital stay compared to peripheral nerve blocks. Pain complicates the administration of a sciatic nerve block via the posterior approach, as positioning the patient in the prone or lateral position can be difficult due to the discomfort caused by fractures. This makes it challenging to perform the procedure effectively. For emergency lower limb surgery, where central neuraxial block is such block is a good option with intraoperative anaesthesia as well as analgesia and good postoperative analgesia.[12] Ultrasound guidance facilitates identification and blockade of the sciatic nerve via the anterior approach without changing the patient's position, thus improving patient comfort during positioning for neuraxial block.

An ideal peripheral nerve block (PNB) technique should offer prolonged postoperative analgesia, minimal risk of infection, neurologic complications, bleeding, and systemic toxicity, while being simple to perform, convenient for patients, and easy to manage in the postoperative period.[13,14] Postoperative recovery assessment focuses not only on pain control but also on evaluating physical, psychological, and functional well-being. Tools such as the Quality of Recovery (QoR) score and other patient-reported outcome measures (PROMs) are increasingly used to assess recovery. Regular evaluation of recovery scores allows timely intervention, enhances patient satisfaction, and contributes to shorter hospital stays and improved long-term outcomes.[15]

In our study, patients undergoing below-knee orthopaedic surgery under spinal anaesthesia combined with ultrasound-guided sciatic nerve block by anterior approach reported a significantly higher QoR-15 score (128.63). This finding is consistent with results from Erica Wessels et al., who noted lower QoR-15 scores (mean 113.1) in patients where peripheral nerve blocks were not utilized for lower limb surgeries.[16]

Our study also demonstrated prolonged postoperative analgesia (mean 11.13 hours) and reduced opioid requirement (mean fentanyl consumption: 351 µg) in the group receiving sciatic nerve block. Similarly, Varun MN et al. reported that sciatic nerve block with 0.5% ropivacaine resulted in less pain during positioning, prolonged analgesia (around 5 hours), and reduced analgesic consumption.[17] However, their study focused only on postoperative analgesia, one dimension of the QoR score, whereas we assessed the multidimensional QoR-15. Differences in block duration may be attributed to variations in local anaesthetic type and volume (bupivacaine vs. ropivacaine; 25 mL vs. 10 mL).

Alsatli A et al. compared anterior and transgluteal approaches for sciatic nerve block and found no significant differences in onset time, ultrasound visibility, narcotic use, or patient satisfaction.[18] However, the anterior approach was quicker and more comfortable for patients. In contrast to Alsatli et al., who used IV fentanyl as an adjunct, we avoided adjuvants to assess the block's true efficacy.

The lateral positioning required for the parasacral approach can be particularly painful in fracture patients. By using the anterior approach, which can be performed in the supine position, we achieved effective analgesia (approximately 11 hours) with better patient comfort. Attri J et al. found that combining parasacral sciatic nerve block with femoral nerve block and fentanyl provided 12–13 hours of analgesia, improved satisfaction, and fewer complications.[19] However, opioids can cause adverse effects such as pruritus, nausea, vomiting, and urinary retention. Our study achieved comparable analgesia without the use of adjuvants, thereby minimizing these risks.

We chose the anterior approach over the classical posterior (Labat) approach and found it technically easier with fewer complications. Sinha SA et al. reported that the posterior approach provided up to 18 hours of postoperative analgesia using bupivacaine, but they used diclofenac sodium for pain management, while we used fentanyl via a PCA pump.[20] Further studies evaluating the Quality of Recovery (QoR) scores following the posterior approach to sciatic nerve block are warranted and should be compared with those obtained using the anterior approach to determine the optimal technique.

Our findings indicate that the ultrasound-guided anterior approach to sciatic nerve block enhances the quality of recovery, prolongs postoperative analgesia, and reduces the need for rescue analgesics in patients undergoing below-knee orthopaedic surgery.

Limitations of our study include the short follow-up period of 24 hours, which did not allow evaluation of long-term outcomes. Additionally, the study included only patients with ASA physical status I and II, limiting the applicability of results to higher-risk populations.

5. Conclusion

Preoperative administration of ultrasound guided sciatic nerve block by anterior approach in patients undergoing below knee orthopaedic surgery significantly enhances the quality of recovery. It also provides a longer duration of postoperative analgesia and reduces the need for analgesics during the initial postoperative period.

6. Source of Funding

None.

7. Conflict of Interest

None.

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