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Original Research Article

Effectiveness of Postoperative Analgesia by Ultrasound Guided Popliteal Sciatic Block and Adductor Canal Block in Patients Undergoing Below Knee Surgeries: A Prospective Study

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Conflict of interest: Nil

Abstract:

Background: Central neuraxial block and general anaesthesia in patients with significant comorbidities are associated with considerable peri-operative morbidity and mortality. This study aims to determine the efficacy of combined popliteal sciatic and adductor canal nerve block for postoperative pain relief in patients undergoing below-knee surgeries.

Objectives: Time for the first requirement of rescue analgesia. Total Dose of analgesia required in 24 hours after surgery, patient Satisfaction score.

Methods: Sixty-four patients with the American Society of Anesthesiologists' (ASA) physical status grades I and II, aged 18–60 years, scheduled for below-knee surgery from April 2024 to April 2025, were enrolled in this prospective study. All patients received an ultrasound-guided popliteal sciatic block with 20 mL of 0.25% bupivacaine and an adductor canal block with 10 mL of 0.25% bupivacaine. Postoperative analgesia was assessed using visual analogue scores at 2, 6, 12, and 24 hours. Rescue analgesia with inj. Tramadol 0.5- 1 mg/kg IV was given when the VAS score was more than 5. Patient's satisfaction was assessed using Likert's satisfaction scale (5-point scale) from dissatisfied to extremely satisfied. The first analgesic requirement time and total tramadol used in the first 24 hours were noted. Descriptive statistics for the study were calculated, and the data were analysed using the SPSS Statistics 21.0 program.

Results: VAS scores were significantly lower. The p-value for the VAS score was <0.0001. The mean duration of postoperative analgesia was significantly longer. Analgesic consumption was also very low and statistically significant. Patient satisfaction scores were also substantial and very much comfortable.

Conclusion: Ultrasound-guided combined popliteal sciatic and adductor canal block is an effective analgesic technique for patients undergoing below-knee surgeries.

Keywords: Postoperative Analgesia, Ultrasound Guided Nerve Block, Popliteal Sciatic Block, Adductor Canal Block, Below Knee Surgeries Pain, Management Efficacy of Nerve Blocks, Regional Anesthesia Techniques, Ultrasound in Anesthesiology, Visual Analog Scale Score, Patient Satisfaction with Nerve Block, Rescue Analgesia Requirement.

Introduction

The sciatic nerve is a nerve bundle consisting of two separate nerve trunks, the tibial and common peroneal nerves. Some common indications include corrective foot surgery, foot debridement, amputation of toes, and Achilles tendon repair.

Popliteal blockade results in anaesthesia[1] of the entire distal two-thirds of the lower extremity, except the medial aspect of the leg. The saphenous nerve, a superficial terminal extension of the femoral nerve, provides cutaneous innervation of the medial leg below the knee. Depending on the level of surgery, a saphenous nerve block may be required for surgery.[2]

The saphenous nerve originates from the L3-L4 nerve roots and is a terminal branch of the femoral nerve. This purely sensory nerve innervates the medial, anteromedial, and posteromedial aspects of the lower leg, ankle, and foot3. It travels laterally to the great saphenous vein, providing sensory innervation

to the medial aspect of the lower leg, ankle, and forefoot (4-7). We aim to determine the efficacy of combined popliteal and adductor canal nerve block for postoperative pain relief in patients undergoing below-knee surgeries.

Materials and Methods

After approval from the Institutional Ethics Committee, Ref, ECR/961/INST/AP/2017/RR-20/88-09/02-07-24 and written informed consent, patients with ASA physical status I and II, aged 18-60 years, scheduled for below-knee surgeries from April 2024 to April 2025, were enrolled in this prospective study. Patients allergic to Local Anaesthetics, on chronic opioid usage, ASA III and IV, neurological and haematological disorders, and anticoagulant usage were excluded from the study. Routine investigations, including a coagulation profile, were performed, and a Nil per oral order was placed 8 hours before surgery. The study was performed in accordance with the declaration of Helsinki (2013).

Sample Size

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^2 \, p(1-p)}{d^2}$$

$Z_{1-\alpha/2}$ = standard normal variate (at 5% type 1error ($P<0.05$) = 1.96

p = Expected proportion in population based on hospital census = 40%

d = Absolute error or precision = 12%

$SS = 1.96^2[0.40(1-0.40)/0.12^2$

SS = 3.84 (0.24)/0.014

SS = 0.9216/0.0144

Minimum sample size = 64

In the operating room, ASA standard monitors include ECG, NIBP, and pulse oximetry. Under strict aseptic precautions, 18-G Intravenous access was secured. All patients are pre-hydrated with 500 ml of Ringer's Lactate. Patients were given spinal anaesthesia for below-knee surgeries at L3-L4 interspace with a 25-G spinal needle. After surgery, when the patient achieves a modified Bromage scale of 2. We proceed with a combined popliteal sciatic block and adductor canal block for postoperative analgesia using ultrasound.

All sterile aseptic precautions were taken, and the ultrasound machine (Esoate) was placed on the opposite side of the limb to be blocked. For an adductor canal block, the patient lies supine with an extended leg in a neutral position or rotated slightly outward. A high-frequency linear ultrasound probe was placed on the anterior aspect of the patient's thigh at the mid-thigh level. The femur bone was identified, and the probe was moved medially until the boat-shaped sartorius muscle and superficial femoral vessels lying beneath it were visualised. The distal femoral triangle was determined, and a block was given distal to it in the adductor canal. A total volume of 30 mL of 0.25% bupivacaine was administered, with 10 mL used for the adductor canal block using a 100 mm echogenic USG needle. Then, for a popliteal sciatic nerve block, the patient was laid laterally on the non-operative limb. The limb to be blocked was partially flexed at the hip and knee joints. Using a high-frequency linear probe, a scan of the popliteal fossa was conducted to identify separate tibial and common peroneal nerves lying superficially and posterior to the popliteal artery. Movement of the probe proximally brings the tibial and common peroneal nerves together to form the sciatic nerve at a variable point, above the popliteal crease. At this level, via the in-plane technique, using a 100mm, 22G gauge echogenic needle, 20ml of 0.25% bupivacaine was deposited after negative aspiration. The real-time spread of local anaesthetic was visualised in the subparaneural space around the sciatic nerve. All patients will receive an injection. Paracetamol Intravenous 1gm 8th hourly.

The primary objective of this study is to analyse postoperative analgesia and patients' overall satisfaction. Postoperative analgesia was assessed using visual analogue scores at 2, 6, 12, and 24 hours. Rescue analgesia with inj. Tramadol 0.5- 1 mg/kg IV was given when the VAS score was more than 5. Patient's satisfaction was assessed using Likert's satisfaction scale (5-point scale) from dissatisfied to extremely satisfied.

The first analgesic requirement time and total tramadol used in the first 24 hours were noted. We also monitored for any adverse effects, such as bradycardia and hypotension, and treated them accordingly.

Statistical Analysis

Data were collected on MS Excel spreadsheets and double-checked for possible data entry errors. Data were expressed as mean ±SD and frequencies with percentages for continuous and categorical variables, respectively. Fischer's exact test and the ANOVA test were used to assess the statistical significance of categorical and continuous variables. P-value <0.05 was considered statistically significant.

Sixty-four patients were included in the study. Patients' characteristics, including age, gender, ASA physical status, type of surgery, VAS scores at various time points up to 24 hours, rescue analgesia required in the postoperative period, and patient satisfaction scores, were noted and tabulated as follows.

Results

Table 1: Patient characteristics

Variable	Mean±SD / n (%)
Age (years)	42.7±13.1 (Range: 18-60)
Gender:	
Male	35 (45.3%)
Female	29 (54.7%)
ASA PS score:	
I	36 (56.3%)
II	28 (43.8%
Type of Surgery:	
Ankle	15 (23.4%)
Tibia	22 (34.4%)
Foot	10 (15.6%)
Debridement	17 (26.6%)
Duration of Surgery (mins)	80.2±23.7
First analgesic required time (hrs)	19.3±1.6
Total Intraoperative Tramadol given (mg)	10.2±12.4
VAS Score:	
At 2 hrs	0.0±0.0
At 6 hrs	0.0±0.0
At 12 hrs	1.1±0.9
At 24 hrs	2.5±0.9
Nausea	0 (0%)
Vomiting	0 (0%)
Patient satisfaction score:	
4	22 (34.4%)
5	42 (65.6%)

The first rescue analgesia was 19.3 ± 1.6 hours, and the total Dose required was 10.2 ± 12.4mg. There were no complications, such as nausea and vomiting, in the postoperative period.

Table 2: Patient satisfaction score and P- value

Patient Satisfaction Score	No. of Patients	p-value
4	22 (34.4%)	**0.0004**
5	42 (65.6%)	
Fischer's exact test		

Above table showing five-point likerts patient satisfaction score. Most of the patients were satisfied and most satisfied and p- value was significant.

Vas Score

Table 3: Mean VAS score and P- value

Time	Mean VAS Score	p-value
2 hrs	0.0±0.0	<0.0001*
6 hrs	0.0±0.0	
12 hrs	1.1±0.9	
24 hrs	2.5±0.9	
ANOVA test. *Indicates significant p-value		

Postoperative VAS scores at different time intervals were measured and P- value was significant.

Discussion

We evaluated the efficacy of Adductor block and popliteal sciatic block in providing postoperative analgesia for patients undergoing below-knee surgeries and tramadol consumption during the postoperative period, in the study. The first rescue anaglesia was at 19.3 ±1.6 hours. The mean VAS scores at 12 hours and 24 hours were 1.1 ±0.9 and 2.5 ±0.9, respectively. Mean tramadol consumption was 10.2 ± 12.4 mg over 24 hours, and this was the lowest analgesic Dose required when compared to the analgesia needed in patients without nerve blocks. In our study, 34.4% of patients were graded as 4 and 42% of patients were graded as 5, which were satisfied and more satisfied, respectively, according to the five-point Likert patient satisfaction score. There were no postoperative complications like nausea and vomiting.

Ultrasound-guided peripheral nerve blocks remain a safe alternative for such patients. [8,9] There are few case reports based on lower limb surgeries performed under peripheral nerve blocks. Baddoo et al. published a case series of ten patients undergoing above-knee amputation surgery. The landmark technique of a three-in-one block and Labat's approach of sciatic block were administered, and a partial block was reported in three cases.[10] However, the use of ultrasound ensures adequate block. It facilitates rapid block onset and prolonged duration with a decrease in drug dosage and systemic complications. Shamim et al. studied combined femoral and sciatic nerve block under ultrasound guidance. They reported it as a safe and satisfactory anaesthetic technique for above- and below-knee amputation surgeries in high-risk patients.[11] But, the lateral cutaneous nerve of the thigh from the lumbar plexus and the posterior cutaneous nerve of the thigh from the sacral plexus should be blocked to achieve complete anaesthesia for above-knee surgeries.[12] Yun Suk Choi et al. reported below-knee surgery successfully performed in two patients with severe cardiac dysfunction under ultrasound-guided femoral and popliteal sciatic nerve block with stable intra-operative haemodynamic parameters.[13] But presently, there is no published literature on ultrasound-guided combined popliteal sciatic and adductor canal block for below-knee surgeries.

Since the block was performed under ultrasound guidance, the safety profile was high. There were no block-related adverse effects, as in various other studies by Goyal et al.,[14] Hanson et al.,[15] and Tan et al. [16] Jaeger et al. [17] observed that there was a statistically significant reduction in the incidence of nausea in the ACB group when we compared the incidence of nausea in the ACB group with one in the placebo group.

There are a few limitations to our study. Double blinding was not done because the control group received no placebo injection. Quadriceps muscle strength was not assessed and compared in our study. There is future scope for comparing the adductor canal block and popliteal sciatic block with other regional anaesthetic techniques in knee surgeries.

Conclusion

Ultrasound-guided combined popliteal sciatic and adductor canal block is an adequate postoperative analgesia for patients undergoing below-knee surgeries.

Declaration of Patient Consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given//their consent for//their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published, and every effort will be made to conceal their identity; however, anonymity cannot be guaranteed.

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