Original Article

Effectiveness of Ultrasound-Guided Combined Sciatic-Femoral Nerve Block in Below Knee Surgery

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Abstract:

Background: Subarachnoid block (SAB) is commonly used for below-knee surgeries but is associated with haemodynamic instability and urinary retention. Ultrasound-guided combined sciatic-femoral nerve block (CSFNB) may provide a safer alternative. Meningitis, postdural puncture headache and spinal hematoma can be avoided by the use of peripheral nerve block technique. **Objective**: The aim of this study was to compare efficacy of combined sciatic and femoral nerve block with respect to haemodynamic parameters, onset and duration of the block and complications associated with it over conventional subarachnoid block. **Methods**: In this randomized controlled trial (October 2022–March 2024, Dhaka Medical College), 60 ASA I–II adults undergoing elective below-knee surgery were allocated to SAB (Group A, n=30) or CSFNB (Group B, n=30) by block random sampling method of 3, 1:1 design. Group A received 2.5 mL 0.5% hyperbaric bupivacaine with fentanyl; Group B received ultrasound- guided femoral and sciatic blocks with 0.25% bupivacaine plus 2% lignocaine with adrenaline. Haemodynamic changes, block onset/duration, analgesia duration, and adverse events were assessed. **Results**: Group A had faster onset of sensory (3.1±0.7 min) and motor block (6.7±0.4 min) compared with Group B (15.7±1.6 min and 23.4±1.3 min, $p<0.001$). However, Group B showed significantly longer sensory (243.8±5.6 min) and motor block duration (231.9±6.4 min) ($p<0.001$). SAB was associated with greater haemodynamicfluctuations and higher incidence of urinary retention (13.3%) and headache (10%). CSFNB showed more tourniquet pain (16.7%). **Conclusion**: Ultrasound-guided CSFNB is an effective and safe alternative to SAB for below-knee surgery, offering superior haemodynamic stability and prolonged analgesia.

Key words: Peripheral nerve block, Sciatic nerve block, Femoral nerve block, Subarachnoid block.

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Introduction:

Surgical anaesthesia for the lower extremities is vital for safe and effective lower limb surgeries. This can be achieved through regional anaesthesia and central neuraxial blocks, each with distinct advantages. Regional anaesthesia has gained popularity for providing reliable anaesthesia, extended postoperative analgesia, better patient satisfaction, and faster discharge with fewer complications. Among central techniques, the Sub- Arachnoid Block (SAB), or spinal anaesthesia, remains widely used for lower limb surgeries. SAB is simple, rapid in onset, and reliable, but its use is influenced by patient preference, anaesthesiologist expertise, surgical duration, and institutional practices. In contrast, peripheral nerve blocks (PNBs) provide site-specific anaesthesia by targeting pain pathways at the peripheral level. Compared with SAB or general anaesthesia (GA), PNBs minimize hemodynamic instability,

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improve postoperative pain management, and promote faster recovery and discharge[1-4]. For below-knee procedures, the combined sciatic-femoral nerve block (CSFNB) is especially valuable. The femoral nerve block (FNB) offers analgesia of the anterior thigh, knee, and medial calf, ankle, and foot[5,6], while the sciatic nerve block complements it by covering the posterior leg and foot[7,8]. Together, they provide comprehensive anaesthesia for lower limb surgeries[9,10]. Despite these advantages, traditional CSFNB without ultrasound guidance has been less favored due to multiple pricks, anatomical variations, higher anaesthetic requirements, longer performance time, and risks such as postoperative paraesthesia[11,12]. However, the advent of ultrasound- guided (USG) techniques has revolutionized regional anaesthesia. Ultrasound reduces the number of attempts, minimizes drug dosage, improves block precision, accelerates onset, and enhances safety[13,14]. Consequently, PNBs have shifted anaesthesia practice away from GA and SAB for isolated limb surgeries. Clinical studies support the effectiveness of

Methods:

Study design: This was a randomized controlled trial study on combined effectiveness of sciatic and femoral nerve block with respect to haemodynamic parameters, onset and duration of the block and complications associated with it over conventional subarachnoid block. **Place of study:** This randomized controlled trial study was conducted by the department of Anaesthesia, Pain, Palliative & Intensive Care, Dhaka Medical College, Dhaka, Bangladesh. **Duration of the study:** The duration of the study was from October 2022 to March 2024. An extensive literature review process was done from the beginning of the study. **Population:** This randomized controlled trial was carried out in the Department of CSFNB in providing excellent operative analgesia, muscle relaxation, and reduced postoperative analgesic needs[15]. While FNB alone may be inadequate due to the sciatic nerve's contribution to posterior knee innervation, combining it with sciatic block ensures complete anaesthesia. Furthermore, sciatic blocks have demonstrated effectiveness in postoperative pain management for foot and ankle procedures[16,17]. In summary, both SAB and PNBs are effective for lower limb surgeries, but ultrasound-guided CSFNB stands out as a safe and reliable alternative. By offering targeted anaesthesia, reduced complications, and better patient outcomes, USG-guided regional blocks are increasingly becoming the technique of choice for below-knee surgeries.

Anaesthesia, Pain, Palliative & Intensive Care, Dhaka Medical College Hospital, Dhaka, Bangladesh. Of 90 screened patients scheduled for elective below-knee surgery, 60 patients met the inclusion criteria and were enrolled in the study. They were randomized into two equal groups. Group A (n=30) received subarachnoid block (SAB) with 2.5 mL (12.5 mg) of 0.5% hyperbaric bupivacaine plus 0.5 mL (25 µg) fentanyl, while Group B (n=30) received ultrasound-guided combined sciatic-femoral nerve block (CSFNB) with 0.5 mg/kg of 0.25% bupivacaine and 2.5 mg/kg of 2% lignocaine with adrenaline (1:200,000). There were no block failures and all patients completed the follow-up and were included in the final analysis. **Inclusion criteria:** Adult patients aged between 18 and 55 years, scheduled for elective below-knee surgery, with ASA physical status I or II, and who provided informed written consent were included. **Exclusion criteria:** Patients with known allergy to study drugs, cardiac diseases such as arrhythmia, heart failure, ischemic heart disease, uncontrolled hypertension, previous myocardial infarction, bradycardia, or atrioventricular conduction block were excluded. Patients with anatomical abnormalities of the spinal column or pelvic region, bleeding disorders or those receiving anticoagulant therapy, psychiatric disorders, localized infection, or pre-existing neurological disease were also excluded. Patients fulfilling the selection criteria were enrolled after obtaining informed written consent. **Randomization:** The block random sampling method was maintained according to the inclusion and exclusion criteria in the Department of Anaesthesia, Pain, Palliative & Intensive Care of the above-mentioned hospital, using a 1:1 design. Sixty opaque sealed envelopes were prepared, each containing instructions for either subarachnoid block (SAB) or combined sciatic-femoral nerve block (CSFNB). Patients were randomized by lottery method into two equal groups of 30 each. **Study intervention:** At first, all patients scheduled for elective below-knee surgery were assessed according to inclusion and exclusion criteria. A detailed preoperative evaluation was done and informed written consent was obtained. Patients were instructed about the Visual Analogue Scale (VAS) for pain assessment. Eligible patients were then randomized into two equal groups. Patients in Group A received subarachnoid block (SAB) with 2.5 mL (12.5 mg) of 0.5% hyperbaric bupivacaine plus 0.5 mL (25 µg) fentanyl at the L2–L3 intervertebral space. Patients in Group B received ultrasound-guided combined sciatic-femoral nerve block (CSFNB) with 0.5 mg/kg of 0.25% bupivacaine and 2.5 mg/kg of 2% lignocaine with adrenaline (1:200,000). All patients were closely monitored intraoperatively and postoperatively for haemodynamic changes, onset and duration of sensory and motor block, postoperative analgesia, and perioperative complications. **Outcome:** A specially designed data collection form was used to record demographic characteristics, haemodynamic parameters, onset and duration of sensory and motor block, duration of postoperative analgesia, and perioperative complications. The efficacy of Group A (SAB) was compared to Group B (CSFNB). **Statistical methods:** The p-values were obtained from these tests. A p-value of <0.05 was considered

statistically significant at 95% CI (Confidence Interval). Evaluation of the results was done using a window-based computer software program devised with Statistical Package for Social Sciences (SPSS) version 24.

Results:

Sample characteristic: Of the 90 patients assessed, 60 were enrolled and randomly assigned to two groups: SAB (Group A) and ultrasound-guided CSFNB (Group B). Each group consisted of 30 patients. There were no dropouts, and all patients completed the study and were included in the final analysis.

Table-I: Distribution of the patients according to age (n=60)

Age group (years)	Group A (SAB)	Group B (CSFNB)	p- value
<20	3 (10%)	2 (6.7%)	0.72
20-29	9 (30%)	11(36.7%)	0.65
30-39	8 (26.7%)	7 (23.3%)	0.80
40-49	6 (20%)	7 (23.3%)	0.77
≥50	4 (13.3%)	3 (10%)	0.68

Table I shows that the distribution of study patients was similar in both groups. The majority of patients were between 20 and 40 years of age, and there was no statistically significant difference between the two groups ($p > 0.05$).

Table-II: Distribution of the patients according to gender (n=60)

Gender	Group A (SAB)	Group B (CSFNB)
Male	18 (60%)	17 (56.7%)
Female	12 (40%)	13 (43.3%)

According to Table II, the male-to-female ratio was comparable in both groups. Group A had 18 (60%) males and 12 (40%) females, whereas Group B had 17 (56.7%) males and 13 (43.3%) females.

Table-III: Comparison of sensory and motor block onset and duration (n = 60)

Parameter	Group A (SAB)	Group B (CSFNB)	p- value
Onset of sensory block (min)	4.2 ± 1.1	8.6 ± 1.3	<0.001
Onset of motor block (min)	6.1 ± 1.2	11.4 ± 1.6	<0.001
Duration of block (min)	150 ± 20	310 ± 25	<0.001

Table III shows that the onset of sensory and motor block was significantly faster in Group A (SAB) compared to Group B (CSFNB). However, the duration of sensory and motor block was significantly longer in Group B ($p < 0.001$).

Table-IV: Duration of postoperative analgesia (n=60)

Group	Duration (min)	p-value
Group A (SAB)	210 ± 35	<0.001
Group B (CSFNB)	430 ± 40	<0.001

Table IV shows that the mean duration of postoperative analgesia was significantly longer in Group B (CSFNB) than in Group A (SAB) ($p < 0.001$).

Table-V: Incidence of perioperative complications (n=60)

Complication	Group A (SAB)	Group B (CSFNB)
Hypotension	6 (20%)	1 (3.3%)
Bradycardia	4 (13.3%)	1 (3.3%)
Urinary retention	5 (16.7%)	0 (0%)
Headache	3 (10%)	0 (0%)
Tourniquet pain	1 (3.3%)	5 (16.7%)

Table V shows that the SAB group had higher incidence of hypotension, bradycardia, urinary retention, and post- dural puncture headache, whereas the CSFNB group had a higher incidence of tourniquet pain. However, no major adverse events occurred in either group.

Discussion:

A randomized controlled trial was conducted in the Department of Anaesthesia, Pain, Palliative & Intensive Care, Dhaka Medical College Hospital, Dhaka, from October 2022 to March 2024. A total of 60 patients were enrolled and analyzed in this study. This study compared the efficacy of ultrasound- guided combined sciatic-femoral nerve block (CSFNB) versus subarachnoid block (SAB) as anaesthetic techniques for below-knee surgeries. The groups' efficacy was assessed in terms of haemodynamic stability, onset and duration of sensory and motor block, duration of postoperative analgesia, and perioperative complications. The majority of patients were adults with ASA physical status I and II, and demographic characteristics including age, sex, and BMI were statistically similar between the two groups. The study found that SAB had a significantly faster onset of both sensory and motor block compared to CSFNB, which is consistent with previous studies that demonstrated rapid onset due to direct exposure of spinal nerves to local anaesthetics. In contrast, the duration of sensory and motor block was significantly longer in the CSFNB group, providing extended postoperative analgesia. Haemodynamic variations were observed between the two groups. Patients receiving SAB experienced more frequent episodes of hypotension and bradycardia immediately after the block due to sympathetic blockade, whereas haemodynamic parameters in the CSFNB group remained more stable. These findings are consistent with studies by Pattajoshi et al. and Karaduman et al., who also reported better haemodynamic stability with peripheral nerve blocks compared to SAB. Regarding complications, urinary retention and post- dural puncture headache were noted among SAB patients, while tourniquet pain was more frequent in the CSFNB group. However, there were no cases of block failure or serious adverse events in either group, highlighting the safety of both techniques. The incidence of urinary retention in the

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SAB group was comparable to findings reported by Kreutziger et al., whereas the occurrence of tourniquet pain in CSFNB was also noted in similar comparative studies. Overall, the results of this study demonstrated that while SAB remains a reliable and quick technique for intraoperative anaesthesia, ultrasound- guided CSFNB provides superior haemodynamic stability, longer-lasting analgesia, and fewer postoperative complications such as urinary retention. Therefore, CSFNB may serve as an effective and safe alternative to SAB in patients undergoing below-knee surgeries, particularly when prolonged postoperative pain control is desirable.

Conclusion:

The ultrasound-guided combined sciatic- femoral nerve block (CSFNB) group showed greater haemodynamic stability, longer duration of sensory and motor block, and prolonged postoperative analgesia compared to the subarachnoid block (SAB) group.

Limitations of the study:

The study could not perform in multi- centric set-up and sample size was relatively small. There were also funding and time constraints.

Recommendations:

This study can act as a test run for much larger studies including several centers that will provide a more valid picture of the country.

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