

# Usefulness of ultrasonography guided femoral and lateral femoral cutaneous nerve blocks in providing analgesia before giving spinal anaesthesia in patients undergoing surgery for intertrochanteric fracture of femur: A randomized clinical trial

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## Abstract

**Background and Aims:** It is challenging to give the patient position for subarachnoid block (SAB) as intertrochanteric (IT) fracture of the femur produces intolerable pain. In this study, we have analyzed the usefulness of combined ultrasonography (USG)-guided femoral nerve block (FNB) and lateral femoral cutaneous nerve block (LFCNB) to reduce the fracture pain before performing SAB.

**Material and Methods:** A prospective, randomized, comparative study was conducted on 60 American society of anesthesiologists (ASA) grade I and II patients (18–80 years) scheduled for elective IT fracture surgery. Group A ( $n = 30$ ) patients received USG-guided FNB and LFCNB using 0.75% ropivacaine before SAB. Group B patients ( $n = 30$ ) received SAB only. All the patients received SAB (3 mL of 0.5% bupivacaine) by an anesthesiologist blinded to the patient groups. The patients were observed for quality of patient positioning for SAB, perioperative visual analog scale (VAS) scores, time to administration of SAB, and duration of analgesia and motor blockade. Statistical analysis was done by Student's *t*-test and Chi-square test.

**Results:** Baseline VAS score (T1) was similar in both the groups. Mean T2 (VAS score just before SAB) in group-A ( $3.2 \pm 0.98$ ) was lower compared to group-B ( $8.23 \pm 0.7$ ) with  $P < 0.0001$ . The quality of patient positioning in group-A was good to optimal but in group-B, it was satisfactory to not satisfactory. Group-A had longer mean duration of analgesia  $804 \pm 114.28$  minutes with  $P$  value  $< 0.0001$  than group-B in which it was  $200 \pm 28.77$  min. Backache was significant in group-B with  $P$  value of 0.038 compared to group-A.

**Conclusion:** USG-guided FNB and LFCNB can be used as an effective supplementation to SAB in patients undergoing surgery for IT fracture of the femur as it reduces fracture site pain, provides good patient positioning during SAB, and prolongs postoperative analgesia.

**Keywords:** Femoral nerve block, lateral femoral cutaneous nerve block, ropivacaine, subarachnoid block, ultrasound-guided nerve block

## Introduction

Intertrochanteric (IT) fractures of the femur subject the patients to lot of pain, morbidity, and mortality

perioperatively.<sup>[1]</sup> Subarachnoid block (SAB) is commonly used for surgery of IT fracture of the femur. However, over-riding of the fracture ends produce intense pain during patient positioning for SAB. Various approaches have been

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used to reduce the fracture pain before positioning for SAB. A national survey by Sand-by-Thomas *et al.* reported that the most frequently used agent for analgesia and sedation was midazolam followed by ketamine and propofol.<sup>[2]</sup> Sia S *et al.* established the superiority of femoral nerve block (FNB) over IV fentanyl.<sup>[3]</sup> Amisha V *et al.* also established the superiority of FNB over IV fentanyl.<sup>[4]</sup> Beaudoin FL *et al.* determined that USG-guided 3-in-1 block produced good analgesia and reduced the requirement of IV morphine in patients presenting to emergency department (ED).<sup>[5]</sup> On the contrary, Imaroon A *et al.* have not shown any superiority of FNB over IV fentanyl.<sup>[6]</sup> But they suggested the possibility of adverse effects (hypoventilation or apnea) of IV fentanyl; hence, its analgesic dosage must be carefully titrated based on pain score. Many studies have assessed the usefulness of peripheral nerve blocks of the lower limbs such as FNB, lateral femoral cutaneous nerve block (LFCNB), 3-in-1 block, fascia iliaca compartment block (FICB), lumbar plexus block (LPB), and subcostal nerve block (SNB). In Cochrane database, Guay J *et al.* did not demonstrate that any one was superior to another.<sup>[7]</sup> But Neena Jain *et al.* demonstrated that FNB is more effective than FICB.<sup>[8]</sup>

Based on review of literatures, we thought of combining FNB and LFCNB before SAB. Ultrasonography (USG) guidance for nerve blocks improves visualization of anatomical structures, success rate, quality of sensory block, and onset time,<sup>[9]</sup> and ropivacaine 0.75% has emerged as a safer local anesthetic drug.<sup>[10,11]</sup> We conducted a prospective randomized comparative trial to study the effects of supplementation of USG-guided nerve blocks (FNB and LFCNB) using 0.75% ropivacaine to SAB given prior to SAB, compared with SAB alone, in reducing the fracture pain, facilitating patient positioning for SAB, and postoperative analgesia in patients coming for IT fracture femur surgery. We avoided systemic opioids as they have various adverse effects, especially in elderly patients who might have multiple comorbidities.

## Material and Methods

After obtaining institutional ethical committee clearance and written informed consent, we selected 60 patients of either gender, aged between 18 and 80 years, belonging to ASA I and II grades scheduled for elective IT fracture femur surgery. Patients previously on opioid therapy or with poly trauma were excluded from the study. The patients were randomized into two groups by computer-generated random number table. Group-A ( $n = 30$ ) patients received USG-guided FNB and LFCNB 10 min before SAB using 10mL of 0.75% ropivacaine for each nerve. Group-B patients ( $n = 30$ )

received SAB only. In both the groups, SAB was performed using 3 mL of 0.5% bupivacaine. After shifting patients to the operation theatre (OT), baseline vital signs were noted using noninvasive blood pressure monitoring (NIBP), pulse oximeter, and electrocardiogram (ECG). All patients were assessed for pain using visual analogue scale (VAS) score as soon as the patients enter OT (T1) and again just before SAB (T2).

Group-A patients received nerve blocks by an experienced anesthesiologist who was not involved in further monitoring of the patients. The patients were positioned supine with the operative lower limb extended and slightly externally rotated. With aseptic precautions, under the guidance of ultrasound (LOGIQ C5 Premium/GE) a 7.5 to 10 MHz linear probe was positioned transversely in the inguinal crease, and femoral nerve was identified at a depth of 2 to 4 cm from skin. Then, with local infiltration of the skin 1 cm lateral to the probe a 22-G 50mm insulated needle (Stimuplex<sup>R</sup> B/BRAUN/JAPAN) was advanced in-plane lateral to medial. Once the needle was adjacent to the nerve, after careful aspiration 10mL of 0.75% ropivacaine was injected. Subsequently, the LFCN was visualized by the probe, placed 2cm medial and inferior to the anterior superior iliac spine (ASIS) parallel to inguinal ligament at a depth of 0.5–1.0 cm from skin. Again after the local infiltration of the skin, the needle was advanced in-plane lateral to medial to place it between the tensor fasciae latae muscle (TFLM) and the sartorius muscle (SaM). After careful aspiration, 10 mL of 0.75% ropivacaine was injected.

Then, the patients of both the groups were made to sit and under aseptic precautions, SAB was performed using a 23-G Quincke-Babcock spinal needle with 3 mL of 0.5% bupivacaine heavy at L3-L4 interspinous level by anesthesiologist, who was blinded to the mode of analgesia. The quality of patient positioning for administering SAB was recorded with scores of 0–3 (0-Not satisfactory, 1-Satisfactory, 2-Good, 3-Optimal).<sup>[4]</sup> Time to perform SAB was recorded (time from beginning of positioning to end of SAB procedure). The patients were monitored for heart rate (HR), noninvasive blood pressure (NIBP), saturation of oxygen (SpO<sub>2</sub>), respiratory rate (RR) before the block and at 5 min intervals throughout the procedure. Intraoperative analgesia was assessed by using VAS scores every 2 min after SAB up to 15 min, every one hour up to 6h, and thereafter every 2h up to 24h. Injection diclofenac 75mg IV used as rescue analgesia at VAS score 4. Postoperatively, analgesic requests in the first 24 h were also assessed. Sensory blockage was assessed by loss of pain to pin prick with a blunt hypodermic needle. Motor blockage was assessed with modified Bromage scale. [Score 0-None (full flexion of knee and feet), 1-Partial (just able to move knees

and feet), 2-Almost complete (just able to move feet only), 3-Complete (unable to move feet or knees)].

### Statistics

The sample size was calculated based on the pilot study. Even though there were similar studies in the past, we wanted to observe the technical considerations in using ultrasonography for nerve blocks in our setup. In pilot study we included 10 patients in each group. We found reductions in mean VAS score from  $8.31 \pm 0.6$  to  $3.14 \pm 0.7$  in patients receiving nerve blocks before receiving spinal anesthesia compared to patients receiving only spinal anesthesia in whom it remained same. Therefore we hypothesized to detect improvement in mean VAS score in study group compared to control group. The sample size was calculated to be 24 patients in each group to provide 80% power to detect at least 25% difference in VAS score at positioning of the patients for SAB with two-tailed significance level of  $\alpha < 0.05$ . To account for study error and attrition, sample size finalized to be 30 patients in each group. The statistical software namely IBM statistical package for social sciences (SPSS) version 16 was used for the analysis of the data. Microsoft word and Excel have been used to generate the graphs, tables, and charts. Descriptive statistics including proportions, measures of central tendency, and measures of dispersions were used to describe the data. Chi-square test has been used to test the significance of homogeneity of gender distribution. Furthermore, student's *t*-test have been used to find the significance of mean difference of analgesia (VAS scores), total consumption of analgesia, duration of postoperative analgesia, and motor blockade and also to test the homogeneity of samples on age, height, and weight. *P* value of  $< 0.05$  was considered to be statistically significant.

### Results

A total of 60 patients were included in this study out of which 30 patients of group-A were administered FNB and LFCNB before SAB, and remaining 30 patients of group-B were administered SAB only. All patients completed the study, and there were no dropouts. Table 1 shows the demographic profile of the patients in both the groups. The mean age of the patients in group-A and group-B were  $56.97 \pm 13.82$  years and  $53.40 \pm 15.97$  years, respectively, with *P* value 0.3581 showing no statistically significant difference. There were 16 males and 14 females in group-A, and 13 males and 18 females in group-B, showing no statistically significant difference in gender distribution with *P* value 0.372. The mean weight of group-A was  $65.33 \pm 10.34$  kg and group-B was  $58.73 \pm 10.45$  kg, with *P* value 0.756 showing no statistically significant difference. The mean height of group-A

was  $163 \pm 9.972$  cm and group-B was  $162.2 \pm 8.755$  cm, with *P* value 0.742 showing no statistically significant difference.

Mean prespinal values of VAS scores were compared [Table 2]. Mean T1 (Baseline VAS score) was  $8.3 \pm 0.65$  in group-A and  $8.23 \pm 0.7$  in group-B, with *P* value 0.71 showing no statically significant difference. Mean T2 (VAS score just before SAB) was  $3.2 \pm 0.98$  in group-A and  $8.23 \pm 0.7$  in group-B, with *P* value  $< 0.0001$  showing statistically significant difference. Table 3 shows that the quality of patient positioning was good (score2) to optimal (score3) in group-A compared to group-B who had low scores (0 = not satisfactory, 1 = satisfactory).

Table 4 shows the various parameters of the study and how they differ between two groups. The mean time to perform SAB was shorter in group-A with value  $3.03 \pm 0.72$  min which is statistically highly significant having *P* value  $< 0.0001$  when compared to group-B with value  $7.73 \pm 1.44$  min. Based on the VAS score  $> 4$  [Figure 1], time to first rescue analgesic was  $801.87 \pm 128.7$  min in group-A and was  $206.57 \pm 29.18$  min in group-B which was statistically significant with *P* value  $< 0.0001$ . The mean duration of analgesia in group-A was  $804 \pm 114.28$  min, which is statistically highly significant with *P* value  $< 0.0001$  than group-B in which it was  $200 \pm 28.77$  min. Total consumption of analgesia in 24h was  $2.83 \pm 0.38$  doses in group-A and was  $3.93 \pm 0.37$  doses in group-B, which was statistically significant with *P* value  $< 0.0001$ . The mean duration of motor block in group-A was  $444 \pm 29.9$  min with *P* value

**Table 1: Demographic profile**

	Group-A (n=30)	Group-B (n=30)	P
Age (years)	56.97±13.82	53.40±15.97	0.3581
Sex (male/female)	16/14	13/18	0.372
Weight (kg)	61.03±10.34	61.73±10.45	0.756
Height (cm)	163±9.972	162.2±8.755	0.742

**Table 2: Comparison of pre-spinal VAS scores**

	Group-A (n=30)	Group-B (n=30)	P
T1 (Baseline)	8.3±0.65	8.23±0.7	0.71
T2 (Just before SAB)	3.2±0.98	8.23±0.7	<0.0001

**Table 3: Comparison of quality of patient positioning**

Score	Group-A Percentage (n=30)	Group-B Percentage (n=30)
3 (Optimal)	19 (63%)	0 (0%)
2 (Good)	11 (37%)	0 (0%)
1 (Satisfactory)	0 (0%)	14 (47%)
0 (Not satisfactory)	0 (0%)	16 (54%)

**Table 4: Comparison of various parameters**

	Group-A (n=30)	Group-B (n=30)	P
Time to perform SAB* (min)	3.03±0.72	7.73±1.44	<0.0001
Total duration of analgesia (min)	804±114.28	200±28.77	<0.0001
Total duration of motor block (min)	444±29.9	114.27±12.27	<0.0001
Time to first rescue analgesia (min)	801.87±128.7	206.57±29.18	<0.0001
Total consumption of analgesia in 24 h (doses)	2.83±0.38	3.93±0.37	<0.0001

\*SAB - Subarachnoid block

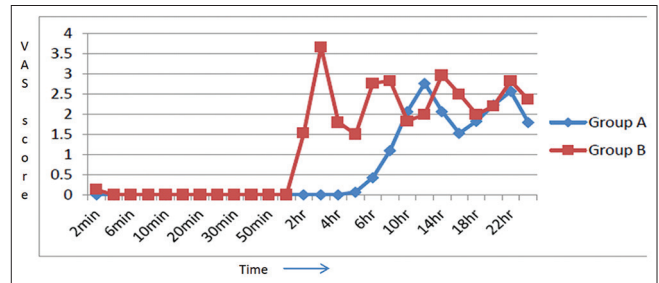
**Table 5: Comparison of side effects**

Side effect	Group-A (n=30)	Group-B (n=30)	P
Head ache	2	0	0.1503
Nausea	5	7	0.5186
Back ache	0	4	0.0384
None	23	19	0.2597

of < 0.0001 which is statistically highly significant when compared to group-B in which it was 114.27 ± 12.27 min. Differences in other parameters such as HR, NIBP, RR, and SpO<sub>2</sub> were statistically not significant throughout the study period. Side effects such as nausea and headache were present in both groups which were statistically not significant. In Group A, none of the patients had backache when compared to Group B which had four cases, which is statistically significant with a P value of 0.038 [Table 5].

## Discussion

The IT fracture femur surgery includes proximal femur nailing (PFN) with incision in the lateral part of the thigh. SAB is commonly used anesthesia for the surgery, but it needs to be supplemented with some analgesic method before patient positioning for SAB. We conducted a prospective randomized control trial designed to study the effect of supplementation of USG- guided FNB and LFCNB using 0.75% ropivacaine to SAB (Group-A), compared with SAB alone (Group-B) in patients coming for IT fracture femur surgery. Block of femoral nerve and lateral femoral cutaneous nerve (LFCN) provide anesthesia and analgesia to anteromedial and anterolateral parts of the thigh, respectively. Therefore, femoral and LFCN blocks reduce the fracture site pain of IT femur fracture and are indicated in corresponding surgery such as PFN where incision is taken in lateral part of the thigh.<sup>[12]</sup> The anatomical course of the LFCN and its branches is highly variable; hence, the sensory area covered by the block is also highly variable. It can be overcome by use of USG-guided LFCNB as USG improves the accuracy of needle placement within the vicinity of nerve. Although FICB covers both femoral nerve and LFCN, the distribution of anesthesia and analgesia depends on the extent of local anesthetic spread as it is a volume dependent block.<sup>[12]</sup>



**Figure 1:** Line graph showing post-spinal VAS score

In our study, all patients had significant fracture pain indicated by comparable baseline VAS scores. Whereas just before SAB, VAS scores were lower in group-A patients indicating significant reduction of fracture pain which can be attributed to the effect of USG-guided blocks of femoral and LFCN. But in group-B patients who did not receive nerve blocks, VAS scores just before SAB were same as baseline values. The quality of patient positioning was good to optimal in group-A, but satisfactory to not satisfactory in group-B, and the time to perform SAB was quicker in group-A. This can be attributed to the effect of USG-guided blocks of femoral and LFCN which provided effective analgesia and facilitated patient positioning, so that SAB can be performed easily and quickly. Our findings were supported by Guay J *et al.* who published their systematic review of usefulness of various nerve blocks for hip fractures.<sup>[7]</sup>

The VAS score was similar between the two groups till the time spinal wore off. Later, VAS score remained low in group-A as nerve blocks provided prolonged analgesia up to 13h compared to group-B patients who experienced pain soon after spinal wore off that is after 3h. When spinal wore off, analgesia in group-A was provided by nerve blocks resulting in a low VAS score. Our findings of low VAS scores with nerve blocks were supported by Neena Jain *et al.* who compared FNB versus FICB in fracture femur surgery and found that reduction in VAS score by FNB is more effective than FICB.<sup>[8]</sup>

The time to first rescue analgesic was delayed in group-A compared to group-B and similarly total doses of rescue analgesics required during 24h postoperative period were less in group-A compared to group-B. This decreased

requirement of rescue analgesic in group-A is due to analgesia provided by nerve blocks. Similarly, the duration of analgesia and motor blockade were prolonged in group-A compared to group-B, which are attributed to nerve blocks. Prolonged motor blockade is supported by Kasper *et al.* who in their study have commented on the possible motor component with nerve blocks.<sup>[13]</sup> Therefore, nerve blocks help in improving pain-free period and in turn prevention of postoperative morbidity.<sup>[11]</sup>

In both the groups, differences in hemodynamics (HR, NIBP) and other parameters such as RR and SpO<sub>2</sub> were statistically not significant throughout the study period. This signifies that nerve blocks will not affect the hemodynamics independent of the SAB, and they can be useful in patients with cardiovascular impairment.

Side effects such as nausea and headache were present in both groups which is statistically not significant. Incidentally, we found that backache was more in group-B compared to group-A (statistically significant), which can be assumed because of increased difficulty in performing the SAB in group-B patients and probably soft tissue damage that might have occurred while performing spinal anesthesia, secondary to improper patient positioning due to persistent fracture site pain. Our finding is supported by Benzon HT *et al.* and Md K Rafique *et al.* who state that back pain after neuraxial blockade can occur when patient positioning for spinal anesthesia is not proper and soft tissue damage is a possibility.<sup>[14,15]</sup>

Major limitations of our study included assessment of VAS score which is subjective and varies with the level of understanding between the patient and anesthesiologist.

## Conclusion

USG-guided femoral and lateral femoral cutaneous nerve blocks effectively reduce the fracture site pain in patients with intertrochanteric fracture of the femur. Thereby, they help in proper positioning of patients for subarachnoid block (SAB) and shorten the time required to give SAB. They also prolong the postoperative analgesia and motor block. They are safe without any additional complications. Therefore, we recommend using them routinely in combination with SAB to improve the patient comfort and postoperative recovery.

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## Conflicts of interest

There are no conflicts of interest.

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