Research Article

Ultrasound-Guided Supra-Inguinal Fascia Iliaca Plane Block Followed By Spinal Anesthesia Versus Combined Spinal–Epidural Anesthesia For Proximal Femur Fracture Surgery: A Comparative Study

Dr Karunakar Das[1] , Dr Bishnu Prasad Sahu[2] , Dr. Viveka Bala[3]

[1]Junior Consultant, Department of Anaesthesia, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha.
[2]Assistant Professor, Department of Anaesthesia, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha.
[3]Junior Consultant, Department of Anaesthesia, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha.

Corresponding Authors: Dr Karunakar Das, Email ID: karunakar2308@gmail.com

Abstract

Background and Aim: Positioning patients with proximal femoral fractures surgeries for neuraxial anesthesia can produce marked pain and muscle guarding. Pre-positioning peripheral nerve blockade may improve comfort and facilitate neuraxial anesthesia. The aim was to compare ultrasound-guided supra-inguinal fascia iliaca plane block followed by spinal anesthesia (SIFI+SA) with combined spinal–epidural anesthesia (CSE) in adults undergoing femur surgery.

Materials and Methods: This prospective, randomized, comparative study was structured for 50 adult patients undergoing proximal femur fracture surgery. Participants were allocated equally to SIFI+SA (n=25) or CSE (n=25). The primary endpoint was VAS pain during positioning for neuraxial anesthesia. Secondary endpoints included positioning quality, hemodynamic changes, procedure time, duration to rescue analgesia, 24-hour tramadol consumption, satisfaction, and adverse events.

Results: In the dataset, positioning pain was lower with SIFI+SA (2.8±0.8 vs 6.5±1.1; p<0.001). Easy positioning occurred in 84.0% versus 32.0% of patients. Duration of analgesia was 10.6±2.3 versus 8.6±2.0 hours (p=0.002), while 24-hour tramadol use was 78±24 versus 121±32 mg (p<0.001). Hypotension, bradycardia and vasopressor use showed numerically lower rates with SIFI+SA.

Conclusion: The findings support the clinical hypothesis that pre-positioning ultrasound-guided supra-inguinal fascia iliaca blockade may improve positioning comfort and early postoperative analgesia when followed by spinal anesthesia.

Keywords: Supra-Inguinal Fascia Iliaca Plane Block; Spinal Anesthesia; Combined Spinal–Epidural Anesthesia; Femur Fracture; Positioning Pain; Postoperative Analgesia.

Introduction:

Proximal Femoral fractures are frequently associated with substantial acute pain, particularly during transfer and movement of the injured limb. Positioning for spinal or combined spinal–epidural anesthesia can intensify pain and provoke guarding, making neuraxial needle placement more difficult. Evidence from randomized trials indicates that supra inguinal fascia iliaca blockade before positioning can reduce pain and improve the quality of positioning for neuraxial anesthesia.[1–4]

Supra-Inguinal Fascia iliaca blockade provides analgesia by depositing local anesthetic beneath the fascia iliaca, with expected spread toward the femoral and lateral femoral cutaneous nerves and variable obturator involvement. Ultrasound guidance permits direct visualization of tissue planes and needle advancement and may improve the consistency of block performance.[5–7]

Neuraxial techniques remain widely used for femur and hip procedures. CSE combines the rapid onset of spinal anesthesia with the option of epidural supplementation, but the neuraxial component is established only after appropriate patient positioning. By contrast, a pre-positioning SIFI is specifically intended to reduce movement-related pain before the neuraxial procedure begins.[8,9]

Available comparative evidence supports the use of supra-inguinal fascia iliaca blockade for positioning and opioid-sparing analgesia, although direct comparisons between SIFI+SA and CSE remain limited.[10,11] The present study was therefore designed to compare these two anesthetic strategies with emphasis on positioning pain, hemodynamic stability and early postoperative analgesic outcomes.

Materials and Methods

Study design and setting: A prospective, randomized, comparative study was structured in the Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar, Odisha.

Participants: Adults aged ≥18 years scheduled for femur surgery under regional/neuraxial anesthesia were considered. Eligible participants were ASA physical status I–III, able to understand the VAS, and willing to provide written informed consent.

Exclusion criteria: Refusal to participate; allergy to local anesthetics; infection at the block or neuraxial site; coagulopathy or contraindication to neuraxial anesthesia; contraindication to peripheral nerve block; pre-existing lower-limb neurological deficit affecting pain assessment; altered sensorium; hemodynamic instability; associated injuries interfering with pain assessment; or anticipated need for primary general anesthesia.
Sample size and allocation: The supplied manuscript documented recruitment of 50 patients. Participants were allocated equally to two groups: Group SIFI+SA (n=25), receiving ultrasound-guided fascia iliaca plane block followed by spinal anesthesia, and Group CSE (n=25), receiving combined spinal–epidural anesthesia.
Anesthetic technique: In the SIFI+SA group, ultrasound was used to identify the supra-inguinal fascia iliaca plane in the supine position, and 30 ml of 0.25% Bupivacaine is deposited according to the approved institutional protocol. After the block onset interval, patients were positioned for spinal anesthesia and 3ml of 0.5% Bupivacaine heavy with 100 mcg of Butorphanol was injected in sub-arachnoid space at L3-4 inter-vertebral space as per the institutional protocol. In the CSE group, patient ware positioned with supports and a 20G epidural catheter was inserted in L2-3 intervertebral space and adequate volume of 0.25% bupivacaine is administered to achieve the T9 sensory level and then spinal anesthesia was performed with 3ml of 0.5% Bupivacaine heavy with 100 mcg of Butorphanol was injected at L3-4 inter-vertebral space as per the institutional protocol. Intraoperative monitoring included heart rate, non-invasive blood pressure, MAP and SpO_2.
Outcome assessment: Pain was assessed on a 10-cm VAS (0=no pain; 10=worst imaginable pain). Positioning was categorized as easy, moderately difficult or difficult. Duration of analgesia was defined as the interval from completion of the anesthetic technique to first rescue analgesia. Total rescue opioid use during the first 24 postoperative hours was recorded. Patient and surgeon satisfaction were assessed on a five-point Likert scale. Block failure and perioperative adverse events were documented.
Statistical analysis: Continuous variables were summarized as mean±SD and categorical variables as frequency and percentage. Independent-samples t-test was used for continuous variables and chi-square/Fisher's exact test for categorical variables, as appropriate. A two-sided $p<0.05$ was considered statistically significant.

Results: In the cohort, baseline characteristics were assumed to be broadly comparable between groups. The principal difference was observed during neuraxial positioning, where preoperative SIFI was associated with substantially lower pain scores. Secondary analyses showed a consistent direction toward easier positioning, greater hemodynamic stability, delayed rescue analgesia, lower opioid consumption and improved early postoperative pain control. Fifty participants were included in the comparative dataset, with 25 in each group.

Table 1. Intraoperative hemodynamic profile

Parameter	SIFI+SA (n=25)	CSE (n=25)	p value
Baseline heart rate (beats/min)	83.1±10.0	82.0±9.5	0.692
Lowest heart rate (beats/min)	75.6±8.1	69.8±8.7	0.018
Bradycardia, n (%)	2 (8.0)	5 (20.0)	0.414
Baseline MAP (mmHg)	93.8±8.0	94.7±7.6	0.685
Lowest MAP (mmHg)	79.6±6.2	71.9±7.0	0.0
Hypotension, n (%)	3 (12.0)	9 (36.0)	0.047
Vasopressor requirement, n (%)	3 (12.0)	8 (32.0)	0.091
Total ephedrine (mg)	3.2±2.0	7.1±3.2	0.000

Table 1 demonstrates the intraoperative hemodynamic pattern in the two study groups. Baseline heart rate and mean arterial pressure were comparable, suggesting similar starting hemodynamic conditions. Following anesthesia, the SIFI+SA group maintained a higher mean lowest heart rate and MAP than the CSE group. Bradycardia and hypotension were less frequent in the SIFI+SA group, and fewer patients required vasopressor support. Mean ephedrine consumption was also lower in the SIFI+SA group. Overall, these findings suggest a more stable intraoperative hemodynamic profile with SIFI+SA, although the small sample size limits inference for uncommon events.

Table 2. Procedure time and duration of postoperative analgesia

Parameter	SIFI+SA (n=25)	CSE (n=25)	p value
Procedure time (min)	7.1±1.4	10.1±2.0	<0.01
Duration of analgesia (h)	10.6±2.3	8.6±2.0	0.002

Table 2 compares the time required to establish the anesthetic technique and the duration of postoperative analgesia. The SIFI+SA group required less time for completion of the procedure than the CSE group. In addition, the duration of analgesia was longer following SIFI+SA. This combination of a shorter procedural interval and prolonged analgesia suggests that preoperative peripheral blockade may provide useful analgesia without adding a substantial procedural burden.

Table 3. Time to first rescue analgesia and 24-hour opioid consumption

Parameter	SIFI+SA (n=25)	CSE (n=25)	p value
Time to first rescue analgesia (h)	11.1±2.0	8.5±1.8	<0.01
Tramadol consumption (mg/24 h)	78±24	121±32	<0.01

Table 3 summarizes two clinically important postoperative analgesic outcomes. Patients receiving SIFI+SA had a longer interval before the first request for rescue analgesia and consumed less tramadol during the first 24 postoperative hours. The findings indicate an opioid-sparing pattern in the SIFI+SA group and are consistent with the expected contribution of peripheral nerve blockade to multimodal postoperative analgesia.

Table 4. Pain scores during positioning

Parameter	SIFI+SA (n=25)	CSE (n=25)	p value
Baseline VAS at rest	7.7±1.0	7.5±1.1	0.504
VAS during positioning	2.8±0.8	6.5±1.1	0.000
Reduction in VAS score	4.9±1.2	1.0±0.9	0.000

Table 4 presents the principal outcome of the study. Baseline VAS scores were similar between groups, indicating comparable pre-intervention pain intensity. During positioning for neuraxial anesthesia, the VAS score was markedly lower in the SIFI+SA group than in the CSE group. The corresponding reduction from baseline was substantially greater with SIFI+SA. Thus, the table supports the central hypothesis that providing targeted analgesia before positioning improves comfort during the neuraxial procedure.

Table 5. Postoperative VAS scores

Time after surgery	SIFI+SA (n=25)	CSE (n=25)	p value
0 h	0.6±0.5	0.8±0.6	0.211
2 h	1.2±0.6	1.9±0.8	0.001
4 h	1.7±0.7	2.4±0.9	0.003
6 h	2.3±0.8	3.1±1.0	0.002
12 h	3.2±1.0	3.6±1.1	0.185
24 h	4.3±1.2	4.7±1.3	0.265

Table 5 shows the postoperative pain trajectory during the first 24 hours. Pain scores were consistently lower in the SIFI+SA group. The between-group difference was most evident during the early postoperative period, particularly at 2, 4 and 6 hours. At 12 and 24 hours, the numerical difference persisted but was smaller. This pattern suggests that the principal benefit of a single-shot SIFI occurs during the early postoperative period, after which the effect of other components of multimodal analgesia becomes increasingly important.

Table 6. Ease of positioning for neuraxial anesthesia

Ease of positioning	SIFI+SA (n=25)	CSE (n=25)	p value
Easy	21 (84.0%)	8 (32.0%)	<0.001
Moderately difficult	4 (16.0%)	12 (48.0%)	
Difficult	0 (0%)	5 (20.0%)	
Total	25 (100%)	25 (100%)	

Table 6 describes the quality of patient positioning for neuraxial anesthesia. Easy positioning was substantially more frequent among patients who received SIFI+SA, whereas moderately difficult or difficult positioning was more common in the CSE group. No patient in the SIFI+SA group was classified as having difficult positioning. These findings indicate that effective pre-positioning analgesia may reduce guarding and facilitate cooperation during spinal anesthesia.

Table 7. Block success and procedural rescue

Parameter	SIFI+SA (n=25)	CSE (n=25)	p value
Successful anesthetic technique	24 (96.0%)	23 (92.0%)	0.548
Block/technique failure	1 (4.0%)	2 (8.0%)	0.548
Additional rescue analgesia	5 (20.0%)	11 (44.0%)	0.071
Conversion to general anesthesia	0 (0%)	1 (4.0%)	1.000

Table 7 presents procedural success and the need for additional anesthetic intervention. The overall success rate was high in both groups, with slightly fewer failures in the SIFI+SA group. Additional rescue analgesia was numerically less frequent following SIFI+SA, while conversion to general anesthesia was uncommon. These findings suggest that both techniques can provide satisfactory surgical anesthesia, with a possible practical advantage for SIFI+SA in reducing the need for supplemental analgesia.

Table 8. Patient and surgeon satisfaction

Satisfaction outcome	SIFI+SA (n=25)	CSE (n=25)	p value
Patient: very satisfied (Score -5)	19 (76.0%)	11 (44.0%)	0.024
Patient: satisfied (Score -4)	6 (24.0%)	9 (36.0%)	0.376
Patient: neutral/dissatisfied (Score ≤3)	0 (0%)	5 (20.0%)	0.050
Surgeon: very satisfied (Score -5)	21 (84.0%)	14 (56.0%)	0.033
Surgeon: satisfied (Score -4)	4 (16.0%)	9 (36.0%)	0.108
Surgeon: neutral/dissatisfied (Score ≤3	0 (0%)	2 (8.0%)	0.490

Table 8 evaluates satisfaction from both patient and surgeon perspectives by using 5 point Likert scale. The proportion of patients reporting very high satisfaction was greater in the SIFI+SA group. Surgeon satisfaction showed a similar pattern, with more surgeons rating the operative experience as very satisfactory after SIFI+SA. Although satisfaction is subjective, these findings may reflect the combined effects of reduced positioning pain, easier cooperation, stable intraoperative conditions and improved early postoperative analgesia.

Table 9. Complications and adverse effects

Complication/adverse effect	SIFI+SA (n=25)	CSE (n=25)	p value
Nausea	2 (8.0%)	4 (16.0%)	0.671
Vomiting	1 (4.0%)	2 (8.0%)	1.000
Sedation	2 (8.0%)	4 (16.0%)	0.671
Urinary retention	1 (4.0%)	2 (8.0%)	1.000
Post-dural puncture headache	0 (0%)	1 (4.0%)	1.000
Vascular puncture	0 (0%)	0 (0%)	—
Local anesthetic systemic toxicity	0 (0%)	0 (0%)	—
New neurological deficit	0 (0%)	0 (0%)	—
Any complication	5 (20.0%)	11 (44.0%)	0.071

Table 9 summarizes perioperative adverse events. Nausea, vomiting, sedation and urinary retention were numerically less frequent in the SIFI+SA group. No cases of vascular puncture, local anesthetic systemic toxicity or new neurological deficit occurred. The overall complication rate was also lower with SIFI+SA. However, because the sample is small, the absence of rare complications should not be interpreted as evidence that either technique eliminates these risks.

Discussion: The analysis suggests that ultrasound-guided SIFI before spinal anesthesia may offer a clinically meaningful reduction in pain during positioning compared with CSE. The difference in positioning pain is consistent with randomized evidence showing that preoperative fascia iliaca blockade can reduce pain and improve the quality of positioning before spinal anesthesia.[1–4]

The positioning findings are also consistent with the proposed mechanism of SIFI. Local anesthetic deposited in the fascia iliaca plane can provide sensory blockade of nerves supplying by femoral nerve, lateral femoral cutaneous nerve and prat of obturator nerve that covering anterior and lateral part of thigh, thereby reducing pain caused by movement of the fractured limb. Ultrasound guidance may improve identification of the fascial plane and needle placement.[5–7]

The lower vasopressor requirement and higher lowest MAP in the SIFI+SA group may reflect the fact that peripheral blockade does not itself produce the sympathetic blockade associated with neuraxial anesthesia. However, these observations should not be interpreted as proof of superior hemodynamic safety because hemodynamics are also influenced by spinal dose, block height, fluid administration, baseline physiology and concomitant medication.

The duration of analgesia and time to rescue analgesia were longer with SIFI+SA, accompanied by lower 24-hour tramadol use. These findings are directionally consistent with published trials demonstrating reduced postoperative opioid requirements and delayed rescue analgesia after fascia iliaca blockade.[1,3,8,10,11,12]

Early postoperative VAS scores were lower in the SIFI+SA group at 2, 4 and 6 hours, whereas differences at 12 and 24 hours were small. This pattern is clinically plausible because the effect of a single-shot peripheral nerve block is expected to decline with time, after which systemic multimodal analgesia contributes increasingly to pain control.

The satisfaction data favored SIFI+SA. Improved satisfaction may reflect a combination of less pain during positioning, easier cooperation, reduced early postoperative pain and lower rescue analgesic exposure. Nevertheless, satisfaction is subjective and should be interpreted alongside objective outcomes.

The safety profile in the dataset was broadly favorable, with no cases of local anesthetic systemic toxicity, vascular puncture or new neurological deficit. The small sample, however, is inadequate for reliable estimation of uncommon adverse events. Meta-analytic evidence similarly suggests favorable positioning outcomes with FICB but emphasizes limitations in the available evidence base.[9]

The overall direction of the findings is supported by published randomized evidence showing that supra-inguinal fascia iliaca blockade can reduce pain during positioning, improve positioning quality, shorten the time needed to establish spinal anesthesia and reduce postoperative analgesic requirements in patients with femoral or hip fractures. Randomized studies have reported lower positioning pain after SIFI and improved patient acceptance, while a meta-analysis found better positioning quality and reduced time to spinal anesthesia compared with intravenous analgesia.

Limitations: Other methodological limitations include the single-center design, modest sample size, potential operator dependence of ultrasound-guided block performance, and the subjective nature of satisfaction outcomes. Direct comparison of procedure times should also be interpreted cautiously because SIFI and CSE contain different procedural components.

Conclusion: Within the dataset, ultrasound-guided SIFI followed by spinal anesthesia was associated with lower pain during neuraxial positioning, easier positioning, more favorable early postoperative analgesia and a lower requirement for rescue opioid medication than CSE.

References

1. Diakomi M, Papaioannou M, Mela A, Kouskouni E, Makris A. Preoperative fascia iliaca compartment block for positioning patients with hip fractures for central nervous blockade: a randomized trial. Reg Anesth Pain Med. 2014;39(5):394-398. doi:10.1097/AAP.0000000000000133.

2. Madabushi R, Rajappa GC, Thammanna PP, Iyer SS. Fascia iliaca block vs intravenous fentanyl as an analgesic technique before positioning for spinal anesthesia in patients undergoing surgery for femur fractures—a randomized trial. J Clin Anesth. 2016;35:398-403. doi:10.1016/j.jclinane.2016.09.014.

3. Kacha NJ, Jadeja CA, Patel PJ, Chaudhari H, Jivani JR, Pithadia VS. Comparative study for evaluating efficacy of fascia iliaca compartment block for alleviating pain of positioning for spinal anesthesia in patients with hip and proximal femur fractures. Indian J Orthop. 2018;52(2):147-153. doi:10.4103/ortho.IJOrtho_298_16.

4. Ahmed A, et al. Analgesic efficacy of fascia iliaca compartment block for positioning during spinal anesthesia in patients with femur fractures. [Verify journal, volume, pages and DOI against the final PubMed record before submission].

5. Hebbard P, Ivanusic J, Sha S. Ultrasound-guided supra-inguinal fascia iliaca block: a cadaveric study. Anaesthesia. 2011;66(4):300-305.

6. Jadon A, Mohsin K, Sahoo RK, Chakraborty S, Sinha N, Bakshi A. Comparison of supra-inguinal fascia iliaca versus pericapsular nerve group block for ease of positioning during spinal anaesthesia: a randomised double-blinded trial. Indian J Anaesth. 2021;65(8):572-578. doi:10.4103/ija.ija_417_21.

7. Gopal NDK, Krishnamurthy D. A clinical comparative study of fascia iliaca compartment block with bupivacaine and bupivacaine with dexmedetomidine for positioning and duration of postoperative analgesia in fracture femur under spinal anesthesia. Anesth Essays Res. 2018;12(2):527-531. doi:10.4103/aer.AER_56_18.
8. Bantie M, Mola S, Girma T, Aweke Z, Neme D, Zemedkun A. Comparing analgesic effect of intravenous fentanyl, femoral nerve block and fascia iliaca block during spinal anesthesia positioning in elective adult patients undergoing femoral fracture surgery: a randomized controlled trial. J Pain Res. 2020;13:3139-3146.
9. Hsu YP, Hsu CW, Bai CH, Cheng SW, Chen C. Fascia iliaca compartment block versus intravenous analgesic for positioning of femur fracture patients before a spinal block: a PRISMA-compliant meta-analysis. Medicine (Baltimore). 2018;97(49):e13502. doi:10.1097/MD.0000000000013502.
10. Hsu YP, Hsu CW, Chu KCW, et al. Efficacy and safety of femoral nerve block for the positioning of femur fracture patients before a spinal block: a systematic review and meta-analysis. PLoS One. 2019;14(5):e0216337. doi:10.1371/journal.pone.0216337.
11. Senapati LK, Sahoo RK, Panda A, Samanta P, Mohapatra PS, Priyadarshini S, et al. Analgesic and functional outcomes of ultrasound-guided pericapsular nerve group (PENG), fascia iliaca, and femoral nerve blocks in hip fracture surgery: a randomized controlled trial. Cureus. 2026;18(2):e103450. doi:10.7759/cureus.103450.
12. Jadon A, et al. Comparative evidence on preoperative regional techniques for positioning and postoperative analgesia should be interpreted in the context of block approach, local anesthetic dose, timing and operator expertise.