e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2025; 16(9); 283-288

Original Research Article

Comparing Analgesic Effectiveness of Ultrasound Guided Femoral Nerve Block versus Fascia Iliaca Block for Positioning During Spinal Anaesthesia in Adult Patients Undergoing Femoral Fracture Surgery

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Received: 06-07-2025 / Revised: 11-08-2025 / Accepted: 23-09-2025

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Conflict of interest: Nil

Abstract:

Background: Femoral fractures are highly painful and commonly require surgical fixation, typically performed under SAB (Subarachnoid Block). However, severe pain can hinder proper positioning for SAB. PNB (Peripheral Nerve Blocks), such as FNB (Femoral Nerve Block) and FICB (Fascia Iliaca Compartment Block) offer effective analgesia in these cases.

Methods: This prospective observational study included 70 patients undergoing femur fracture surgery, divided into two groups: Group 1 (n=35) received ultrasound-guided FNB (15 ml of 0.25% bupivacaine), and Group 2 (n=35) received FICB before SAB. Parameters assessed included VAS during positioning, ease of interspinous space palpation, number of dural puncture attempts, patient satisfaction, and haemodynamic/respiratory changes.

Results: Both blocks effectively reduced pain during positioning, but Group 2 (FICB) showed significantly lower VAS scores ($p < 0.05$), indicating superior analgesia. Both techniques had a similar onset of analgesia, achieving pain relief within 15 minutes ($p < 0.05$). Patient satisfaction was higher in the FICB group ($p < 0.05$). Quality of positioning, assessed by fewer spinal attempts, was also better in the FICB group ($p < 0.05$). No significant differences were observed between groups regarding interspinous palpation, haemodynamic, or respiratory changes.

Conclusion: Preoperative FICB provides superior analgesia compared to FNB for SAB positioning in femur fracture surgeries, evidenced by lower VAS scores, better positioning, and higher patient satisfaction. Both techniques were safe with no significant impact on haemodynamics or respiration during positioning.

Keywords: Femoral Nerve Block, Fascia Iliaca Compartment Block, Spinal Anaesthesia, Bupivacaine, Visual Analogue Scale, Patient Satisfaction.

Introduction

Femur fractures are the most common fractures globally, with approximately 2.9 million cases annually. The highest incidence occurs between ages 15 and 44, followed by 5–14 years and those over 60, accounting for 29% and 21% of cases, respectively.[1]

The periosteum, one of the body's most pain-sensitive tissues, contributes to the severe pain in femoral shaft fractures. It receives innervation from surrounding nerves, while the deeper periosteum is supplied by motor branches of muscles attached to the bone. In the femoral shaft, the femoral nerve, which innervates the quadriceps femoris muscle, is the primary source of periosteal innervation.

SAB (Subarachnoid Block) is the most widely used anaesthetic technique for femur fracture fixation, typically performed in sitting or lateral positions. However, positioning patients with femur fractures for SAB is challenging due to severe pain caused by fracture movement, often requiring high doses of opioids.[2] This poses risks, especially in elderly patients with comorbidities, such as respiratory depression.

Effective pre-procedure analgesia can greatly ease patient positioning and reduce opioid needs. FICB (Fascia Iliaca Compartment Block) and FNB (Femoral Nerve Block) are simple, safe, and effective regional blocks with few contraindications.[3] FICB is especially useful in prehospital care due to its safety, ease, and high success rate.[4]

Ultrasound guidance improves the accuracy, reduces local anaesthetic dosage, enhances sensory block quality, and lowers complication rates compared to landmark or nerve stimulator techniques.[5] Ultrasound-guided FNB offers rapid, long-lasting, opioid-sparing analgesia, especially beneficial in elderly patients with hip fractures.[6]

Pain assessment using the VAS (Visual Analogue Scale) involves marking a 100-mm line from "no pain" to "worst pain possible," providing a simple yet effective pain quantification method.[7]

Aims and Objectives

The study aimed to compare the analgesic efficacy of ultrasound-guided FNB and FICB in patients with femur fractures to facilitate optimal positioning for spinal anaesthesia. The study evaluates the effectiveness and quality of analgesia using the VAS 20 minutes post-block, the ease of patient positioning assessed by the number of spinal attempts, and monitors for any intervention-related complications.

Materials and Methods

Study Design: This prospective observational study was conducted in the Department of Anaesthesiology at Government Medical College, Thrissur, Kerala, India, after obtaining approval from the Institutional Research and Ethics Committees. The study included patients aged between 18 and 80 years who were scheduled for surgical management of femur fractures.

Inclusion and Exclusion Criteria: The study included patients aged 18 to 80 years with ASA physical status I or II who were scheduled for proximal femur fracture surgeries. Patients were excluded if they had any of the following: refusal to participate, cardiovascular or cerebrovascular disease, raised intracranial pressure, psychiatric illness, agitation or anxiety, vertebral column deformity, bleeding disorders, local infection or malignancy at the injection site, sepsis, history of seizures, or known allergy to local anaesthetics or study drugs.

Sample Size Calculation: As per the study conducted by Jain N, Mathur PR, Patodi V, and Singh S.A comparative study of ultrasound-guided femoral nerve block versus fascia iliaca compartment block in patients with fractured femurs for reducing pain associated with positioning for subarachnoid block. Indian J Pain 2018; 32:150-4.[6]

The mean VAS score in 20 minutes in group A-femoral nerve block (μ1) = 1.88 The mean VAS score in 20 minutes in group B-fascia iliaca block (μ2) = 2.40 d = mean difference.

SD1 (standard deviation in group A) = 0.83 Sd2 (standard deviation in group B) = 0.52 $Z\alpha$ at 0.05 significance = 1.96

$Z\beta$at 80% power = 0.84

Sample size (N) can be calculated by substituting values in the formula.

$$\frac{(Z_\alpha + Z_\beta^2) \, x \, (S_1^2 + S_2^2)}{d^2}$$

Final sample size (N) = 70 (35 in each group)

Data Collection Procedures

Seventy patients with proximal femur fractures who met the inclusion criteria were enrolled and divided into two groups of 35 each: Group 1 received ultrasound-guided FNB, and Group 2 received FICB, both with 20 ml of 0.25% bupivacaine, 20 minutes prior to spinal anaesthesia. All patients received standard premedication, fasting instructions, IV access, and baseline monitoring, along with oxygen supplementation and pre-procedure sedation using IV midazolam (0.01–0.05 mg/kg) and fentanyl (1 mcg/kg). Under ultrasound guidance, nerve blocks were administered in the supine position using a high-frequency linear probe. Spinal anaesthesia was performed in the lateral position with the fractured side down using a 25G spinal needle at the L3–L4 interspace under aseptic precautions. Pain during positioning was assessed using the VAS, and other parameters recorded included ease of palpating interspinous space (graded 1–5), number of dural puncture attempts, MAP, respiratory rate, heart rate, and patient satisfaction (satisfied/not satisfied).

Statistical Analysis: Data were entered in Microsoft Excel and analyzed using SPSS version 20, with graphs generated using Excel or SPSS. Continuous variables were expressed as mean ± standard deviation based on their distribution, while categorical variables were presented as frequencies and percentages. Baseline demographic and clinical parameters were compared using the chi-square test or Fisher's exact test, as appropriate. Outcome variables between the two groups were analyzed using an unpaired t-test for normally distributed continuous data. A p-value of <0.05 was considered statistically significant.

Results

Table 1: Distribution of Cases in Each Group

Group	Number of Cases
Femoral Block	35
Fascia Iliaca Block	35

Table 1 observes the equal distribution of patients across both study groups (35 each).

Table 2: Demographic and Anthropometric Characteristics of Study Groups

Variable	Group	N	Mean ± SD	P-Value
Age (in years)	Femoral	35	59.11 ± 15.55	0.396
	FICB	35	55.54 ± 19.20	
Weight (kg)	Femoral	35	60.09 ± 7.95	0.903
	FICB	35	59.86 ± 7.67	
Height (cm)	Femoral	35	159.97 ± 6.59	0.708
	FICB	35	159.42 ± 5.42	
BMI (kg/m²)	Femoral	35	23.43 ± 2.55	0.915
	FICB	35	23.50 ± 2.67	

Table 2 shows comparable baseline age, weight, height, and BMI between the two groups (p>0.05).

Table 3: Sex and ASA Grade Distribution

Variable	Femoral	FICB	Total	P-Value
Sex				
Male	21	19	40 (57.1%)	
Female	14	16	30 (42.9%)	
ASA Grade				
ASA I	13	18	31	0.229
ASA II	22	17	39	

Table 3 illustrates the distribution of sex and ASA grades, showing no significant differences between groups.

Table 4: Ease of Palpating Spine

Ease of Palpation	Femoral	FICB	Total	P-Value
Easily palpable	26	26	52	0.819
Palpable	8	7	15	
Difficult	1	2	3	

Table 4 observes that ease of palpation was similar between groups, with most spines being easily palpable.

Table 5: VAS Score Distribution Over Time

Time Interval	Femoral (Mean ± SD)	FICB (Mean ± SD)	P-Value
Before block	7.82 ± 0.75	7.91 ± 0.95	0.676
5 min	6.86 ± 0.81	6.74 ± 0.82	0.559
10 min	5.80 ± 0.87	5.31 ± 0.86	0.022*
15 min	4.20 ± 1.11	3.63 ± 1.00	0.027*
20 min	2.94 ± 0.64	2.34 ± 0.68	0.000*
During positioning	1.65 ± 0.64	1.23 ± 0.73	0.011*
* Significant (p<0.05)			

Table 5 shows that VAS scores reduced significantly faster in the FICB group after 10 minutes.

Table 6: Hemodynamic and Respiratory Parameters during Study

Parameter	Time	Femoral (Mean ± SD)	FICB (Mean ± SD)	P-Value
Heart Rate	Before block	86.31 ± 9.22	81.86 ± 7.30	0.028*
HR during positioning	79.05 ± 5.93	78.60 ± 5.87	0.747	
MAP before block	89.77 ± 8.72	92.71 ± 10.59	0.209	
MAP during positioning	86.31 ± 6.30	88.54 ± 10.52	0.286	
RR before block	15.23 ± 1.66	15.26 ± 1.40	0.938	
RR during positioning	12.94 ± 1.23	13.09 ± 0.98	0.594	
* Significant (p<0.05)				

Table 6 demonstrates that hemodynamic and respiratory parameters were mostly similar, except for a slightly lower baseline heart rate in the FICB group.

Table 7: Clinical Outcomes – Spinal Attempts and Patient Satisfaction

Outcome	Femoral	FICB	P-Value
No. of spinal attempts (Mean ± SD)	1.8 ± 0.86	1.3 ± 0.53	0.01*
Patient satisfaction (Satisfied/Not Satisfied)	27 / 7	34 / 1	0.02*

Table 7 shows significantly better outcomes with FICB, including fewer spinal attempts and higher patient satisfaction.

Discussion

Pain during positioning for SAB is a significant concern in patients with femur fractures, even in those with a normal spine. Inadequate analgesia leads to multiple attempts, prolonged painful positioning, and sometimes failure to accomplish SAB. Therefore, ensuring proper pain relief before surgical preparation or immobilization is crucial both for patient comfort and for the anaesthesiologist to achieve an effective block. [8-11]

Traditionally, opioids have been administered for positioning analgesia. However, opioids carry adverse effects such as nausea, vomiting, respiratory depression, cognitive impairment, and urinary retention, particularly in elderly patients. [12,13] PNBs have thus emerged as safer alternatives. Among them, FNB, three-in-one block, and FICB are commonly employed. Studies suggest that compared with FNB, both three-in-one block and FICB provide superior analgesia. [11,14] Hence, this study compared FICB and FNB in patients undergoing femur fracture surgery.

FNB and FICB are well-recognized for acute pain relief in lower extremity trauma. [15,16] While FICB blocks the femoral, obturator, and lateral femoral cutaneous nerves, providing broad sensory coverage of the hip joint, FNB mainly covers the anterior thigh and knee. Literature indicates that ultrasound-guided PNBs significantly reduce pain scores, opioid use, and opioid-related complications, while improving patient satisfaction. [17,18] Reported complications are rare but may include nerve injury, hematoma, or local anaesthetic toxicity.

The comparative efficacy of FNB versus FICB remains debated. Some studies found no difference; others favored FNB for early analgesia, while FICB was found better for preoperative positioning.[19,20] The consensus is that FICB is simpler, quicker to perform, and particularly useful in improving patient positioning for SAB.[21] Our study aligns with these observations, as FICB provided significantly lower VAS scores at 10, 15, and 20 minutes and during positioning compared to FNB ($p<0.05$).

Choice of local anaesthetic is also important. Although lignocaine has a rapid onset, its short duration is a drawback. Bupivacaine, as used in our study, provides longer-lasting analgesia compared to ropivacaine. [22,23] Use of ultrasound further enhances block accuracy, reduces anaesthetic dose, and improves block quality compared to blind or nerve stimulator techniques. [24,25]

Patient positioning during SAB can be lateral or sitting. Lateral positioning is often more comfortable and associated with fewer post-dural puncture headaches compared to sitting. [26-28] In our study, lateral positioning was adopted, and analgesia with FICB facilitated better comfort.

Previous studies comparing FNB and FICB have shown mixed results. Jadon et al. found FNB superior to intravenous fentanyl for positioning during SAB. [29] Jain et al. reported lower VAS scores with FNB compared to FICB. In contrast, our findings demonstrated superior analgesia with FICB, consistent with its broader nerve coverage. Similarly, Newman et al. reported FNB superiority in their trial,[30] while our results favoured FICB. Ghimire et al. found comparable positioning quality with both blocks using landmark technique,[31] but in our study, FICB required significantly fewer spinal attempts and had higher patient satisfaction.

Importantly, no block-related complications were reported in our study, consistent with findings from Ghimire et al. and Bantie et al. Even hemodynamic and respiratory parameters were comparable between groups, supporting prior results by Meeta et al. [32] This suggests that both FNB and FICB are safe techniques, but FICB provides better patient comfort and facilitates smoother SAB.

In summary, although both blocks provided effective analgesia, the fascia iliaca block was associated with superior pain control, fewer spinal attempts, and higher patient satisfaction. It can thus be recommended as the preferred option for positioning femur fracture patients for subarachnoid block.

Limitations

This study has several limitations, including a small sample size, subjective pain assessment via the Visual Analogue Scale, and variability in anaesthesiologist technique. Additionally, lack of postoperative follow-up and non-standardized timing between trauma and surgery may have influenced pain perception and block effectiveness.

Conclusion

Based on the findings of this study, it can be concluded that while both FNB and FICB are effective in providing preoperative analgesia for patients undergoing femur fracture surgery, FICB offers superior analgesic quality for facilitating spinal anaesthesia. This is evidenced by significantly lower VAS scores during positioning, fewer attempts required for successful dural puncture, and higher patient satisfaction in the FICB group. Additionally, the administration of FICB did not result in any significant hemodynamic or respiratory changes during positioning for spinal anaesthesia, confirming its safety and efficacy as a pre-procedural analgesic technique.

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