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ORIGINAL ARTICLE

Comparison of Ultrasound Guided Femoral Nerve Block and Fascia Iliaca Compartment Block for Pain Relief During Positioning and Postoperative Analgesia in Proximal Femur Fracture

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Abstract
Introduction: Proximal femur fractures are usually associated with pain, which poses a challenge for patient positioning for subarachnoid block (SAB). The femoral nerve block (FNB) which is a regional anaesthetic technique such as and fascia iliaca compartment block (FICB) are widely utilised to alleviate this pain. While both the techniques are efficient, there is limited comparative data regarding their efficacy under ultrasound guidance. **Materials and Methods:** This observational comparative study included 44 adult patients who undergo elective surgery for isolated proximal femur fractures under spinal anaesthesia. The study participants were divided into two groups: Group 1 (n = 22) who received ultrasound-guided FNB with 20 mL of 0.25% Ropivacaine, and Group 2 (n = 22) who received ultrasound-guided FICB with 30 mL of 0.25% Ropivacaine. Pain was assessed using a 10 cm Visual Analog Scale (VAS) before the block and at 5-minute intervals up to 40 minutes post-block. Patients were positioned for SAB when VAS < 3. **Results:** VAS scores were comparable between the groups up to 10 minutes after block administration. From 15 to 35 minutes, the FNB group showed significantly lower VAS scores compared to the FICB group ($p < 0.05$), indicating a faster onset of analgesia. The mean time for VAS to regress to 3 was significantly shorter in the FNB group (29.32 ± 3.87 minutes) compared to the FICB group (35.00 ± 3.45 minutes; $p < 0.001$). **Conclusion:** Both ultrasound-guided FNB and FICB are effective in managing preoperative pain during positioning for SAB in patients with proximal femur fractures. FNB offers a faster onset of analgesia, making it preferable for early positioning, while FICB provides longer-lasting postoperative pain relief. The choice of block can be tailored to meet specific perioperative analgesic goals.

Keywords: Femoral nerve block, Fascia iliaca block, Proximal femur fracture, Ultrasound guidance, Postoperative analgesia

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Graphical Abstract

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Introduction
Proximal femur fractures are usually associated with pain, which poses a challenge for patient positioning for subarachnoid block (SAB). The femoral nerve block (FNB) which is a regional anaesthetic technique such as and fascia iliaca compartment block (FICB) are widely utilised to alleviate this pain. While both the techniques are efficient, there is limited comparative data regarding their efficacy under ultrasound guidance

Methods
This observational comparative study included 44 adult patients who undergo elective surgery for isolated proximal femur fractures under spinal anaesthesia. The study participants were divided into two groups: Group 1 (n = 22) who received ultrasound-guided FNB with 20 mL of 0.25% Ropivacaine, and Group 2 (n = 22) who received ultrasound-guided FICB with 30 mL of 0.25% Ropivacaine. Pain was assessed using a 10 cm Visual Analog Scale (VAS) before the block and at 5-minute intervals up to 40 minutes post-block. Patients were positioned for SAB when VAS < 3.

Socio demographic characteristics of the study population

Parameter	Sub classification	FICB (n = 22)	FNB (n = 22)	CSV	P Value
Age	51 – 60	0 (0.0%)	4 (18.2%)	2.572	0.46
	61 – 70	9 (40.9%)	6 (27.3%)		
	71 – 80	9 (40.9%)	9 (40.9%)		
	> 80	4 (18.2%)	3 (13.6%)		
Gender	Male	5(22.7%)	7(31.8%)	0.458	0.49
	Female	17(77.3%)	15(68.2%)		
Side of Fracture	Right	6 (27.3%)	9 (40.9%)	0.91	0.34
	Left	16 (72.7%)	13 (59.1%)		
Type of Surgery	CRIF	14 (63.6%)	16 (72.7%)	0.419	0.52
	Hemiarthroplasty	8 (36.4%)	6 (27.3%)		
ASA Class	ASA II	10 (45.5%)	14 (63.6%)	1.467	0.23
	ASA III	12 (54.5%)	8 (36.4%)		

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Conclusions Both ultrasound-guided FNB and FICB are effective in managing preoperative pain during positioning for SAB in patients with proximal femur fractures

Introduction

Fractures of the proximal femur, including the neck of femur and intertrochanteric fractures, are among the most common orthopaedic emergencies encountered in the elderly population. These injuries are associated with severe pain and significant functional limitations, often necessitating early surgical intervention under regional anaesthesia, particularly spinal anaesthesia, to minimize perioperative complications and enhance recovery [1-3]. However, the intense pain experienced by these patients frequently makes positioning for subarachnoid block (SAB) extremely challenging, potentially reducing the success rate of the regional technique and increasing the risk of haemodynamic fluctuations due to catecholamine surges [1,4,5]. A pain free, calm and quiet patient improves the ease of doing block and gives the chance for an earlier successful SAB.

To address this issue, various analgesic strategies have been employed to facilitate patient positioning. This comprises of systemic analgesics like intravenous opioids as well as peripheral nerve blocks. Among the latter, the femoral nerve block (FNB) and the fascia iliaca compartment block (FICB) are widely practiced and have shown promise in providing effective preoperative analgesia for femur fracture surgeries [1]. Both techniques aim to nerves supplying proximal part of femur, thereby reducing pain during positioning for spinal anaesthesia.

Although several studies have evaluated the analgesic effects of FNB and FICB individually, only a limited number of comparative studies have been conducted under ultrasound guidance. Ghirmire et al. [6] found that FICB resulted in greater VAS score reduction compared to FNB using lignocaine with adrenaline. In contrast, Jain et al. [7] reported that ultrasound-guided FNB with Ropivacaine provided more effective pain relief than FICB in femur fracture patients. Meeta Gupta et al. [1]

observed that FICB resulted in significantly lower VAS scores at various intervals after the block and offered longer postoperative analgesia than FNB. Liang et al. [5] also proved that FNB had a faster onset compared to FICB, although both techniques were ultimately effective.

With the arrived mixed results and the lack of consensus, especially in the South Indian patient population, further research on these types of comparative studies are warranted. The current research aims to compare the analgesic efficacy of ultrasound-guided FICB and FNB in patients with proximal femur fractures undergoing surgery under spinal anaesthesia, specifically assessing their role in facilitating positioning and providing postoperative analgesia.

Materials and Methods

This comparative observational study was done at MES Medical College, Perinthalmanna, after getting IHEC clearance. The present study aimed to compare the efficacy of analgesia between ultrasound (USG)-guided femoral nerve block (FNB) and fascia iliaca compartment block (FICB) in patients with proximal femur fractures planned for corrective surgery under spinal anaesthesia. A total of 44 participants, aged above 18 years, of both the gender, belonging to the American Society of Anaesthesiologists (ASA) physical status from I to III, were included for the study.

The exclusion criteria includes patient with coagulopathies, infection at the injection site, polytrauma or multiple fractures, a history of lower limb nerve block within the preceding 48 hours, suspected compartment syndrome, were anxious or agitated or, were unwilling to participate in the study.

All the patients were provided with a detailed explanation of the study objectives, procedures, risks, and benefits in their native language before including them in the study. The consent process was conducted in a quiet and private setting, ensuring that each participant had adequate time to ask questions and clarify any doubts. Patients were informed about their right to withdraw at any stage without affecting their treatment. A written informed consent form, approved by the Ethics Committee and available in the local language, was signed by each participant. In cases where patients had difficulty writing, a thumb impression was obtained in the presence of a witness, as per institutional norms.

Patients were allocated into two groups by non-probability sampling. Group 1 (n = 22) received an ultrasound-guided femoral nerve block with 20 mL of 0.25% Ropivacaine, while Group 2 (n = 22) received an USG-guided fascia iliaca compartment block with 30 mL of 0.25% Ropivacaine. This volume difference follows a similar pattern of several previous similar studies, which used higher volume for fascial plane blocks [7-10]. The procedures were performed in a supine position under strict aseptic precautions by the principal investigator, with the assistance of an experienced anaesthesiologist. In the FNB group, the femoral artery was identified under USG guidance using a high-frequency linear probe, and the needle was introduced in-plane to deposit the local anaesthetic adjacent to the femoral nerve. In the FICB group, under ultrasound guidance femoral artery and femoral Nerve are identified in an “in plane technique”. Psoas muscle lies lateral to the femoral nerve and is covered by the iliacus fascia, which lies beneath the fascia lata. The needle was advanced through the fascia lata and fascia iliaca until two characteristic "pops" were felt, and the local anaesthetic was deposited beneath the fascia iliaca after confirming negative aspiration.

Pain intensity was assessed using a 10 cm Visual Analog Scale (VAS), where 0 indicated no pain and 10 represented the worst possible pain. VAS scores were recorded before the block, immediately after the block, and at 5-minute intervals up to 40 minutes. Patients were considered ready for spinal anaesthesia when the VAS score dropped below 3. After the surgical procedure, postoperative pain scores were recorded at 0, 2, 4, 6, 8, 10 and 12 hours. Rescue analgesia was administered when the VAS score was 4 or more, and the time to the first analgesic request was noted.

The data collected was entered into Microsoft Excel, coded and analysed using SPSS software. Continuous variables such as age and VAS was expressed as mean ± standard deviation (M±SD), and categorical variables like gender, ASA classification, and type of fracture were presented as frequencies and percentages. Independent t-test was performed for normally distributed continuous data and Mann-Whitney U test for non-parametric data, and the chi-square test for association between categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1 shows the sociodemographic characteristics of the study population, including age distribution, gender, side and site of fracture, type of surgery, and ASA classification. The mean age was comparable between groups (72.6 ± 6.93 years in FICB and 70.7 ± 11.3 years in FNB), with no statistically significant difference across age strata (p = 0.46). The gender distribution was also similar, with females forming the majority in both groups (77.3% in FICB vs. 68.2% in FNB; p = 0.49). The side of fracture (right or left), type of surgery (CRIF or hemiarthroplasty), and ASA class distribution between FICB and FNB groups were not significantly different (p > 0.05 for all), suggesting that both groups were well-matched demographically and clinically at baseline (Table 1).

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Type of Surgery	Hemiarthroplasty	8 (36.4%)	6 (27.3%)		
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	ASA III	12 (54.5%)	8 (36.4%)		

The comparison of pain scores using the Visual Analog Scale (VAS) before and after administration of the block is presented in Table 2. Before the block and up to 10 minutes afterward, VAS scores were not significantly different between FICB and FNB groups ($p > 0.05$). However, starting from 15 minutes post-block, the FNB group demonstrated significantly lower VAS scores, with the difference persisting up to 35 minutes ($p < 0.05$). At 40 minutes post-block, VAS scores in both groups converged to 3.0, showing no statistical difference ($p = 1.000$). This indicates that while both blocks are eventually effective, FNB achieves pain relief faster, making it more suitable for early positioning before spinal anaesthesia (Table 2).

Table 2. Comparison of Pre-op and During Procedure VAS between FICB and FNB

Pre-op VAS	FICB	FNB	p-value
Before Procedure	7.09 ± 0.81	6.86 ± 0.71	0.327
After Block			
5 Minutes	7.09 ± 0.81	6.86 ± 0.71	0.327
10 Minutes	6.91 ± 0.75	6.86 ± 0.71	0.849
15 Minutes	6.36 ± 0.79	5.73 ± 0.77	0.014
20 Minutes	5.64 ± 0.73	4.86 ± 1.04	0.009
25 Minutes	4.82 ± 0.85	3.86 ± 0.77	0.001
30 Minutes	4.05 ± 0.79	3.14 ± 0.35	0.000
35 Minutes	3.23 ± 0.43	3.00 ± 0.00	0.019
40 Minutes	3.00 ± 0.00	3.00 ± 0.00	1.000
Post-op VAS			
0 Hours	0.00 ± 0.00	0.00 ± 0.00	1.000
2 Hours	0.36 ± 0.58	1.68 ± 0.65	0.000
4 Hours	1.36 ± 0.79	2.64 ± 0.73	0.000
6 Hours	2.19 ± 0.68	3.65 ± 0.59	0.000
8 Hours	2.65 ± 0.67	3.83 ± 0.41	0.002
10 Hours	3.33 ± 0.69	4.00 ± 0.00	0.313
12 Hours	3.65 ± 0.75	4.13 ± 0.32	0.321

Mann-Whitney test was performed.

Postoperative VAS scores recorded from 0 to 14 hours show that immediately after surgery, pain scores were identical in both groups (VAS 0.00 ± 0.00). However, beginning at 2 hours postoperatively, patients in the FICB group experienced significantly lower VAS scores compared to the FNB group up to 8 hours ($p < 0.05$). By 10 hours, the difference was not statistically significant. VAS scores beyond 12 hours were not recorded, as the majority of patients in both groups had required rescue analgesia by then (Table 2).

The comparison of the time to regression of VAS score to 3 and the duration of postoperative analgesia is presented in Table 3. Patients in the FNB group reached a VAS score of 3 significantly earlier (29.32 ± 3.87 minutes) than those in the FICB group (35.00 ± 3.45 minutes), suggesting a faster onset of action with FNB. In contrast, the time to first postoperative analgesic request was significantly longer in the FICB group (10.45 ± 2.39 hours) compared to the FNB group (6.46 ± 1.37 hours), highlighting that FICB provided a longer duration of pain relief after surgery (Table 3).

Table 3. Comparison of Time to Pain Regression and Duration of Postoperative Analgesia between FICB and FNB

Parameter Measured	FICB		FNB		P Value
	M	SD	M	SD	
Time Taken for Regression of VAS Score to 3 (min)	35	3.45	29.32	3.872	<0.001
Time Taken for First Analgesia post op(hrs)	10.45	2.385	6.455	1.371	<0.001

Discussion

Patients presenting with proximal femoral fractures often endure severe pain that complicates positioning for subarachnoid block (SAB). In order to effectively manage the positioning pain, different analgesic modalities have been suggested, including intravenous opioids and regional nerve blocks. Out of these, femoral nerve block (FNB) and fascia iliaca compartment block (FICB) are two frequently employed regional techniques for providing preoperative analgesia.

In the current research, both FNB and FICB were evaluated for their efficacy in pain relief during positioning for SAB and their subsequent postoperative analgesic effects. The findings emphasized that while both techniques provided effective analgesia, FNB resulted in a quick onset of pain relief. This was made evident from significantly lower Visual Analog Scale (VAS) scores observed from 15 to 35 minutes after the block in the FNB group, when compared to the FICB group. But the VAS scores became similar in both groups by the 40-minute mark, suggesting that the overall analgesic effectiveness equilibrated after a certain period.

These findings are in similar with the results reported by Liang et al. [5], who showed that FNB provided significantly lower VAS scores at 3 and 5 minutes after the block compared to FICB. But, at 8 and 10 minutes, the analgesic effect of both blocks was found to be same, indicating that FNB has a quicker onset but comparable efficacy in the longer term. Similarly, Jain et al. [9] also proved that the lower VAS scores during positioning for SAB in patients receiving ultrasound-guided FNB compared to those who received FICB, showing the evidence of faster onset with FNB.

In contrast, postoperative analgesia duration was shown to be significantly longer in the FICB group in the present study. This was shown by a longer time for the VAS score to reach 3 and a significantly delayed request for the first rescue analgesic in the FICB group compared to the FNB group. The above findings align with those of Meeta Gupta et al. [1], who showed that FICB resulted in prolonged postoperative analgesia with delayed rescue analgesia requirements. Thus, the superior duration of analgesia with FICB could be attributed to its anatomical distribution, which may encompass the femoral nerve, lateral cutaneous nerve of thigh (LCNT), and obturator nerve (ON), thus providing a broader and longer-lasting pain control in these cases [8,9].

Ghirmire et al. [6] in contrast, reported that FICB provided more effective VAS score reduction than FNB at 20 minutes after the block when utilising the lignocaine with adrenaline. The variation in these findings may be attributed to differences in the volume and concentration of local anaesthetic used, the use of ultrasound guidance, and patient-specific anatomical factors. In our study, both blocks were administered under ultrasound guidance using 0.25% Ropivacaine, enhancing the accuracy and consistency of nerve localization and drug delivery [10,11].

The present findings further proved the relevance of choosing the appropriate block based on clinical objectives. For faster patient positioning before spinal anaesthesia, FNB may be the preferred technique due to its quicker onset. However, when prolonged postoperative analgesia is desired, FICB appears to be more advantageous. As both blocks were performed using ultrasound guidance, the risk of complications was minimized, and precision was improved, potentially enhancing the efficacy of both techniques [10,13].

Overall, while both blocks serve their intended purposes well, tailoring the choice based on patient needs, urgency of SAB, and expected postoperative pain requirements would lead to better outcomes. Given the limited comparative data in South Indian populations, this study adds valuable evidence to the existing literature and supports the integration of ultrasound-guided regional techniques in the perioperative management of femoral fractures.

Conclusion

Both ultrasound-guided femoral nerve block (FNB) and fascia iliaca compartment block (FICB) are effective techniques for providing analgesia during positioning in patients with proximal femur fractures undergoing spinal anaesthesia. FNB was associated with a faster onset of pain relief, facilitating quicker and more comfortable patient positioning for subarachnoid block. On the other hand, FICB offered significantly prolonged postoperative analgesia, as evidenced by delayed onset of pain and a longer duration before the first request for rescue analgesia. These findings suggest that the choice between FNB and FICB can be guided by the specific clinical goals—FNB being more suitable for rapid procedural preparation, and FICB being more advantageous for extended postoperative pain control. Both blocks, when administered under ultrasound guidance, offer a safe, reliable, and patient-friendly alternative to systemic analgesics. Further large-scale, multicentre studies are warranted to validate these findings and refine regional anaesthesia protocols for optimal perioperative pain management in femoral fracture patients.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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