Archives of Anesthesiology and Critical Care (In Press); x(x): xx-xx.

Available online at http://aacc.tums.ac.ir

Research Article

Infrainguinal vs. Suprainguinal Approach of Ultrasound-Guided Fascia Iliaca Block for Analgesia after Intertrochanteric Femur Surgery: A Randomized Controlled Trial

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ARTICLE INFO

Article history:
Received 06 September 2025
Revised 27 September 2025
Accepted 11 October 2025

Keywords:
Ultrasound-guided;
Fascia iliaca block;
Analgesia;
Supra-inguinal approach;
Infra-inguinal approach

ABSTRACT

Background: Intertrochanteric femur fractures are prevalent orthopedic injury among the the geriatric population and demand adequate pain relief after surgery to improve recovery. While opioids are commonly used for analgesia, concerns about their side effects have led to increased interest in regional anesthesia techniques. The supra-inguinal (S-FICB) and infra-inguinal (I-FICB) fascia iliaca compartment blocks are two such approaches, but comparative studies on intertrochanteric fracture surgery are few. The present study was conducted to compare the efficacy and safety of the S-FICB approach with the I-FICB approach for postoperative pain management.

Methods: This single-center, prospective, randomized, double-blind clinical trial included 80 patients aged 55–75 years who underwent intertrochanteric femur fracture surgery. The participants were randomly divided to receive either S-FICB or I-FICB under real-time ultrasound guidance after spinal anesthesia. The main outcome measure was the pain index at rest and movement, based on the Numeric Rating Scale (NRS) score, which was compared at multiple intervals up to 24 hours. Secondary outcome measures included total morphine consumption over the 24-hour postoperative period, time to first request for morphine, and the occurrence of adverse effects.

Results: At 1, 4, 8, and 16 hours after surgery, patients in the S-FICB group experienced significantly lower pain scores, both at rest and during movement relative to the I-FICB group ($P < 0.05$), but not at 24 hours. Although the mean consumption of morphine was slightly lower in the S-FICB group (4.5 ± 1.2 mg) compared to the I-FICB group (5.2 ± 1.3 mg), the difference was not significant (P value > 0.05). Although the S-FICB group demonstrated a prolonged interval to initial morphine administration compared to the I-FICB group, this difference was not statistically significant (P value > 0.05). Patient satisfaction scores were significantly superior in the S-FICB group (P value < 0.05), while adverse events were similar between the groups.

The authors declare no conflicts of interest.
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Conclusion: In the early postoperative period, the S-FICB approach had better postoperative pain relief and greater patient satisfaction than I-FICB. However, there were no significant differences between groups in opioid use or the incidence of adverse effects.

Introduction

Hip fractures, particularly those involving the intertrochanteric region, are a significant source of morbidity and mortality among the elderly population, with annual incidence rising globally in parallel with increased life expectancy and an aging demographic [1–3]. Early surgery with proximal femoral nails or dynamic hip screws, is the standard care to optimize recovery and reduce perioperative morbidity; However, achieving adequate postoperative analgesia is still challenging and can affect both short- and long-term outcomes [4–6]. Suboptimal pain relief following hip fracture surgery can increase patient discomfort and lead to delirium, delayed mobilization, and longer hospital stays [7].

Opioids have long been the cornerstone of pain control after intertrochanteric fracture surgery. However, they can cause adverse effects such as respiratory depression, constipation, and suboptimal control of dynamic pain [8]. Because systemic analgesics are frequently limited by side effects and inadequate pain relief, generating growing interest in regional anesthesia techniques [9]. In recent years, a range of regional anesthesia techniques, including lumbar epidural blocks, fascia iliaca compartment blocks (FICB), and femoral nerve blocks, have been used as alternatives for management of postoperative pain [8-10].

Among the available regional anesthesia techniques, the fascia iliaca compartment block (FICB) has become popular owing to its demonstrated efficacy, simplicity, and desirable safety profile. FICB is a useful modality for perioperative pain control in hip surgery, offering targeted blockade of the femoral nerve, lateral femoral cutaneous nerve, and potentially the obturator nerve [10-11]. The introduction of ultrasound guidance has enhanced the success rate of FICB to more than 80%, establishing it as one of the most commonly used analgesic technique in hip and knee surgical procedures [8,10,12]. Studies have shown that FICB can attenuate postoperative pain and decrease the need for additional morphine by blocking both the femoral and lateral femoral cutaneous nerves simultaneously [13-15].

FICB can be performed via two distinct approaches: infrainguinal (I-FICB) and suprainguinal fascia iliaca (S-FICB). In the I-FICB technique local anesthetic is injected below the inguinal ligament, while in the S-FICB technique it is injected above the inguinal ligament [10,16]. Multiple clinical studies have reported that S-FICB provides better pain relief, longer duration of analgesia, and lower opioid use compared to I-FICB in hip fracture and arthroplasty patients [17-19]. However, most studies focused on hip fractures, and there is limited evidence specifically for patients undergoing surgery for intertrochanteric fractures. Although the suprainguinal approach appears promising, questions still remain about its effectiveness, ideal technique, and influence on functional recovery after intertrochanteric femur fracture surgery.

The present study aimed to compare the efficacy of supra-inguinal versus infra-inguinal fascia iliaca compartment blocks in patients undergoing for hip fracture surgery. The investigation will primarily focus on postoperative analgesia, opioid consumption, incidence of adverse events, and patient-reported satisfaction.

Methods

Study Design

A single-center, randomized, double-blind clinical trial was performed in patients scheduled to undergo surgical intervention for intertrochanteric femur fracture at a university-affiliated hospital.

The main aim of the present study was to compare the effectiveness of supra-inguinal fascia iliaca block (S-FICB) and infra-inguinal fascia iliaca block (I-FICB), in postoperative pain attenuation in patients undergoing intertrochanteric femur fracture surgery.

Ethics Approval

The study protocol was approved by the Ethics Committee of Iran University of Medical Sciences (Ethics Code: IR.IUMS.FMD.REC.1399.571). All participants were fully informed about the study prior to their enrollment, and written informed consent was obtained from each participant. The trial was also registered at the Iran-Clinical Trial Registry (Registry Code: IRCT20120814010599N27).

Study Participants and Inclusion Criteria

The study population comprised elective cases of intertrochanteric fracture in individuals aged 55-75 years with an American Society of Anesthesiologists (ASA) physical status of I-III. Exclusion criteria included patients requiring emergency surgery, those with a body mass index greater than 40 kg/m^2, known allergy to ropivacaine, a history of opioid dependency or tolerance, hepatic or renal impairment, or coagulopathy.

Randomization and Concealment

After surgery, participants were randomly assigned to either the S-FICB or I-FICB group using a computer-generated randomization sequence with an equal 1:1 allocation ratio. Each patient was assigned a number ranging from 1 to 80 and received an 8-character alphanumeric code. The codes were written on paper and placed in sealed envelopes and were provided to the research group. For each enrolled patient, the code was announced, and the corresponding envelope was opened, repeating this process until all participants were assigned. Throughout the patient enrollment period, the research group remained unaware of the assigned codes to ensure allocation concealment.

Methods

All patients were monitored according to ASA standard monitoring guidelines. Spinal anesthesia was administered in the lateral position using 2.5 mg bupivacaine 0.5% and 10 µg fentanyl. The level of sensory block was assessed, and after reaching the T10 level, the surgery was started. Intraoperative hypotension, defined as a systolic blood pressure ≤80 mmHg or a reduction greater than 20% from baseline, was documented and treated with intravenous administration of 10 mg ephedrine. Bradycardia, defined as a heart rate less than 50 beats per minute, was managed with atropine at doses ranging from 0.3 to 0.6 mg.

At the post-anesthesia care unit (PACU), all patients received standardized monitoring. Patients were placed in the supine position prior to administration of the FICB, according to their designated group allocation.

In the S-FICB group, in the supine position, a high-frequency linear ultrasound probe (5-13 MHz; Sonosite S-Nerve, Bothell, WA, USA) was placed transversely over the inguinal ligament, 1 cm superior to the junction of the lateral and middle thirds of the line joining the pubic tubercle and anterior superior iliac spine (ASIS), aligned parallel to this line. Under real-time ultrasound guidance, a 22-guage, 90 mm disposable spinal needle was inserted using an in-plane approach, in a lateral-to-medial direction, and 40 mL of 0.2% ropivacaine was injected between the fascia iliaca and iliac muscle, in accordance with the technique described by Stevens [17].

In the I-FICB group, with patients positioned supine, a high-frequency linear ultrasound probe was placed transversely at the level of the inguinal crease to identify the femoral artery. Following the identification of the iliopsoas muscle, fascia iliaca, and femoral nerve, with an in-plane technique, a 22-gauge spinal needle was inserted 1 cm inferior to the junction of the middle and lateral thirds of the line connecting the pubic tubercle and ASIS using an in-plane technique, according to the method described by Dalens [12]. After confirming a negative aspiration test, 40 mL 0.2% ropivacaine was injected into the targeted fascial plane. Additionally, upon arrival in PACU, the intravenous analgesia infusion pump containing ketorolac at a concentration of 0.6 mg/mL with continuous infusion of 6 ml/h was started. Patients and clinicians in the recovery room were blinded to both the type of nerve block and the contents of the analgesia pump.

Outcome Assessment

Postoperative pain severity, both at rest and during movement was evaluated using the Numeric Rating Scale (NRS) as the primary outcome measure. Assessments were measured upon arrival to the PACU (time 0) and subsequently at 1, 4, 8, 18, and 24 hours after performing the block. For any patient reporting a NRS score greater than 3, 3 mg of intravenous morphine was administered as rescue analgesic therapy. Patient satisfaction with the pain control was evaluated at each time point using a 5-point satisfaction score (0= poor; 1= moderate; 2= good; 3= very good; 4= excellent) as an exploratory endpoint. Total opioid consumption within 24 hours was recorded as a secondary outcome. The time to first request for supplementary morphine was also recorded and compared between the groups. Demographic data encompassing age, sex, body mass index (BMI), and duration of surgery, were recorded as possible confounding variables. All data were collected by trained nursing personnel and a group of researchers who were blinded to the type of block and group allocation.

Sample Size

A total of 80 patients were included in the study, with 40 individuals assigned to each intervention group (S-FICB and I-FICB). The sample size calculation was based on the mean difference in pain reduction observed between S-FICB and I-FICB in a prior investigation conducted by Kumar et al. [18]. The sample size was calculated using the following formula, in which σ^2 represented the variance in analgesic effects between S-FICB and I-FICB, set at 1:

$$n = (Z_{\alpha/2} + Z_{\beta})^2 * \sigma^2 / \delta^2$$

With a significance level (α) of 0.05 and a statistical power (1 - β) of 80%, the estimated sample size was calculated to be 25 participants per group. To compensate for a potential 10% dropout rate, the final sample size was increased to 40 patients in each group. This ensured sufficient power to detect a meaningful difference in postoperative pain reduction between the two intervention groups.

Statistical analysis

Continuous variables were expressed as mean +/- standard deviation (SD), whereas categorical variables were reported as frequencies and percentages. Comparisons of NRS between two groups were performed using an independent t-test. Within-group

variability was analyzed using repeated measures analysis of variance (ANOVA). Between-group morphine consumption was also assessed by independent t-tests. The incidence of side effects was compared using the chi-square. All statistical analyses were performed using Stata software (Ver 17.0, College Station, TX, USA). A P value less than 0.05 was considered statistically significant.

Results

A total of 87 patients were screened for eligibility, and 80 met the inclusion criteria and were enrolled in the study. The study is presented in a Consolidated Standards of Reporting Trials (CONSORT) flow diagram (Figure 1). The mean age of patients was 75.1 ± 5.2 years in the supra-inguinal and 74.3 ± 5.0 years in the infra-inguinal group, with no significant difference observed between the groups (p = 0.500). Baseline characteristics-including gender, BMI, duration of surgery, baseline pain scores, and ASA physical status classification- were comparable between the supra-inguinal and infra-inguinal groups, with no significant differences observed (p > 0.05) (Table 1).

Analysis of static pain scores showed that the supra-inguinal group demonstrated a significantly lower mean pain score relative to the infra-inguinal group at time 1 (p = 0.001). Throughout times 4, 8, and 16, the supra-inguinal group consistently had significantly lower average static pain scores compared to the infra-inguinal group (P value < 0.001). However, at time 24, no statistically significant difference was observed in mean static pain scores between the two groups (p = 0.203) (Table 2).

For dynamic pain scores, the supra-inguinal group had a significantly lower mean pain score at time 1 compared to the infra-inguinal group (p < 0.001). The pain score in the supra-inguinal group remained unchanged at time point 4, whereas it increased to 3.8 in the infra-inguinal group, leading to a statistically significant difference between the two groups (p < 0.001). At 8 and 16 hours, the supra-inguinal group continued to demonstrate significantly lower pain scores in comparison to the infra-inguinal group (p < 0.05). However, at 24 hours, the mean dynamic pain scores did not differ significantly between the two groups (p = 0.181) (Table 2). The comparison of total analgesic consumption during the first 24 hours revealed no statistically significant difference between the supra-inguinal and infra-inguinal groups. The mean cumulative morphine consumption was 4.5 ± 1.2 mg in the supra-inguinal group and 5.2 ± 1.3 mg in the infra-inguinal group (p = 0.624). The time to first analgesic request was comparable between the two groups, with no statistically significant difference observed, occurring at approximately 9.1 hours and 8.9 ± 0.8 hours after surgery in the supra-inguinal and infra-inguinal groups, respectively (p=0.392). No statistically significant difference in the rate of adverse events was observed between the supra-inguinal and infra-inguinal block groups (p = 0.723) (Table 3).

However, a statistically significant difference in patient satisfaction levels was observed between the supra-inguinal and infra-inguinal groups. At 1-hour post-surgery, over 70% of patients in the supra-inguinal group reported excellent satisfaction, whereas fewer than 40% of patients in the infra-inguinal group reported similarly high satisfaction levels. This disparity in satisfaction levels between the two groups persisted at 4 and 8 hours postoperatively, with the supra-inguinal group consistently reporting superior satisfaction scores compared to the infra-inguinal group. The difference in patient satisfaction between the two groups remained statistically significant across all time points (p<0.05) (Figure 2).

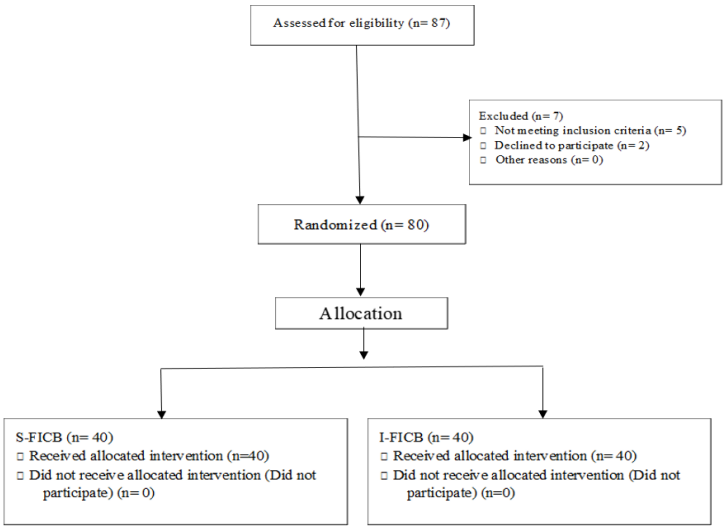

Figure 1- Consolidated Standards of Reporting Trials (CONSORT) flow diagram

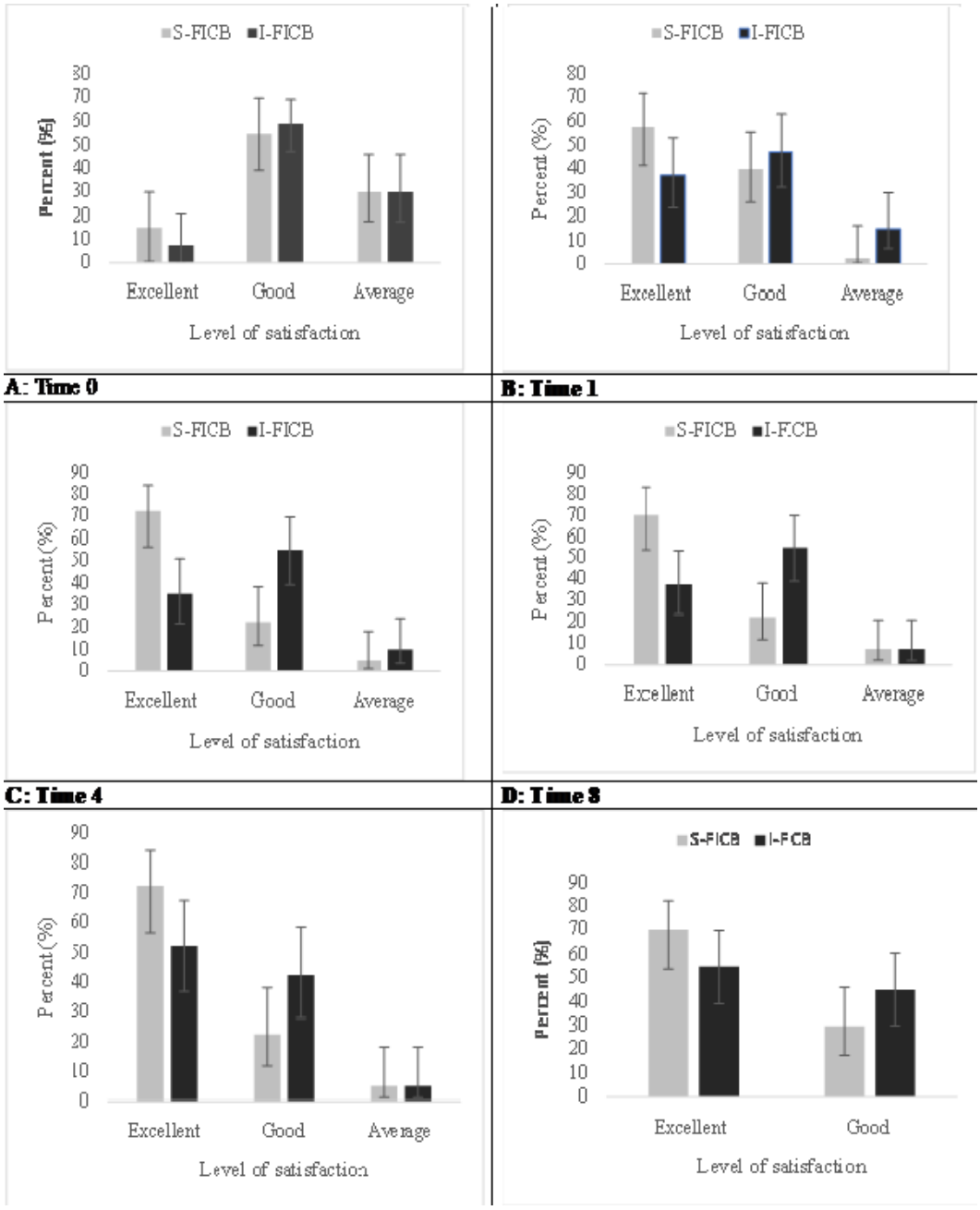

Figure 2- Comparison the patients' satisfaction scores between S-FICB and I-FICB groups in different times

Table 1- Comparison of the baseline characteristics between S-FICB and I-FICB

Characteristics	S-FICB	I-FICB	P value
Age, years	75.1 (5.2)	74.3 (5.0)	0.500
Female gender, n (%)	23 (57.5%)	21 (52.5%)	0.653
BMI, Kg/m^2	20.8 (1.3)	20.7 (1.2)	0.598
Surgery duration, min	104.8 (15.3)	102.1 (15.9)	0.433
Baseline NRS score	4.5 (0.6)	4.5 (0.6)	0.977
ASA, n (%)			
II	13 (32.5%)	20 (50.0%)	
III	27 (67.5%)	20 (50.0%)	0.112

*Age, BMI, surgery duration, and NRS are presented as mean and standard deviation

Table 2- Comparison of static and dynamic NRS scores between S-FICB and I-FICB

Parameter	Time (hour)	Group S Mean (SD)	Group I Mean (SD)	P value
Static NRS	Baseline	4.6 (0.5)	4.5 (0.5)	0.265
	1	1.9 (0.6)	2.9 (0.6)	0.001
	4	1.6 (0.6)	2.8 (0.6)	0.001
	8	1.7 (0.7)	2.7 (0.5)	0.001
	16	2.0 (0.5)	2.5 (0.6)	0.001
	24	1.9 (0.6)	2.1 (0.5)	0.203
Dynamic NRS	Baseline	4.6 (0.5)	4.5 (0.5)	0.288
	1	2.7 (0.8)	3.7 (0.8)	0.001
	4	2.7 (0.6)	3.8 (0.7)	0.001
	8	2.7 (0.6)	3.6 (0.6)	0.001
	16	2.9 (0.6)	3.3 (0.5)	0.001
	24	2.7 (0.6)	2.9 (0.5)	0.181

*NRS scores are presented as mean and standard deviation

Table 3- First opium request, overall Analgesic requirements, and adverse effects in S-FICB and I-FICB groups

Parameters	Group S	Group I	P value
24h morphine consumption, mg	4.5 (1.2)	5.2 (1.3)	0.624
First opium request, hour	9.1 (0.8)	8.9 (0.8)	0.392
Vomiting, n (%)	4 (10.0%)	5 (12.5%)	0.723

*Morphine consumption, and first opium use are presented as mean and standard deviation

Discussion

The present randomized controlled trial evaluated the analgesic efficacy of ultrasound-guided supra-inguinal versus infra-inguinal fascia iliaca compartment blocks (FICB) in patients undergoing surgical management of intertrochanteric femoral fractures. The main findings showed that the supra-inguinal approach achieved significantly superior static and dynamic pain control during the first 16 hours postoperatively compared to the infra-inguinal approach. Despite these differences in pain scores, there was no significant difference in 24-hour opioid consumption or time to first analgesic request between groups. Notably, patient satisfaction was significantly higher in the supra-inguinal group during the early postoperative period. The incidence of adverse event rates was similar in both groups.

Our results align with previous studies supporting the efficacy of the supra-inguinal approach in pain management. Similarly, Ridderikhof et al. documented more reliable distribution of local anesthetic to the lumbar plexus with the supra-inguinal technique, which may explain its better clinical effectiveness [8]. Our results are consistent with those of Bansal et al., who reported superior pain relief and patient satisfaction with supra-inguinal FICB in orthopedic surgical procedures. In contrast to some studies showing substantial opioid-sparing effects with supra-inguinal approach, we did not find a statistically significant reduction in morphine use, which may be related to sample size or use of standardized multimodal analgesia protocols [10]. Kumar et al. similarly reported improved analgesia and reduced morphine consumption with supra-inguinal FICB compared to infra-inguinal blocks in total hip arthroplasty [18]. Chen et al. documented superior dynamic pain control with S-FICB compared to alternative approaches in patients undergoing femoral fracture surgery [19]. Additionally, Vermeylen et al showed that the supra-inguinal block provides much better obturator nerve blockade, with extensive anesthesia achieved in 80% of cases versus only 10% with I-FICB [20]. Zheng et al. reported that I-FICB was ineffective in adequately blocking the femoral nerve, obturator nerve, and lateral femoral cutaneous nerve, further highlighting the advantages of the supra-inguinal approach [21]. Similar findings have been reported in other studies as well [22-23]. Cadaveric studies by Hebbard et al. also demonstrated a more cephalad spread of local anesthetic with S-FICB, resulting in better analgesic effects and more efficient lumbar plexus blockade in comparison to I-FICB [24].

The improved analgesia seen with the supra-inguinal approach is thought to be due to a higher injection site and more proximal spread of local anesthetic above the inguinal ligament. This allows better blockade of the femoral, lateral femoral cutaneous, and obturator nerves, leading to more complete pain relief, particularly for movement-related (dynamic) pain, which is consistent with our findings [25-26].

In our study, the superior analgesic effect of S-FICB was evident only up to 16 hours postoperatively, with no significant difference at the 24-hours. These findings are concordant with those reported by Kumar et al., who likewise reported no difference between S-FICB and I-FICB in pain reduction at 12 and 24 hours after femoral fracture surgery [18]. Bali et al. similarly established that S-FICB was superior to I-FICB during the early postoperative period, supporting our results [27]. Other

reports suggest that the analgesic effects of single-shot FICB may last only 6 hours [28]. The lack of difference at 24 hours may be explained by the wearing off of the single-shot block and increasing influence of systemic analgesics.

Although total 24-hour morphine consumption was relatively lower in the S-FICB group, this difference was not statistically significant, contrasting with previous studies demonstrating lower morphine consumption with S-FICB. Kumar et al. reported reduced morphine consumption after femoral fracture surgery with S-FICB compared to I-FICB [18]. Stevens et al. documented a 40% reduction in morphine consumption in the S-FICB group compared to I-FICB [17]. Vermeylen et al. reported no reduction in opioid consumption with I-FICB, suggesting its failure to provide effective analgesia in the anatomical location of the obturator nerve [20]. The absence of a statistically significant difference in opioid use and time to first analgesic request in our study, despite lower pain scores in S-FICB group, may be explained by multiple factors influencing opioid requirements beyond pain severity, such as individual variability, institutional analgesic protocols, and thresholds for rescue analgesia administration. Furthermore, the relatively low cumulative morphine doses observed in both groups suggest effective overall pain management, which may have diminished the sensitivity of the study to detect between-group differences in opioid utilization. The small sample size in our study may also have contributed to these findings.

Vomiting was the sole side effect reported, occurring in fewer than 10% of participants in both the S-FICB and I-FICB groups, indicating that both techniques were safe and well-tolerated. These findings align with previous studies reporting low adverse event rates for both S-FICB and I-FICB [29-31]. In contrast, Kumar et al. reported more side effects with I-FICB, possibly due to the superior lumbar plexus blockade achieved with suprainguinal approach [18]. Yamada et al. suggested that S-FICB may achieve effective nerve block with lower doses of local anesthetic, thereby reducing the risk of systemic toxicity [32]. The similar doses used in both groups and the absence of significant differences in morphine consumption may explain the lack of statistical difference in side effects.

This study has several limitations. Although the sample size was sufficient to detect differences in pain scores, it may not have been large enough to detect differences in opioid consumption and adverse event rates. The single-center design may limit the generalizability of the findings. Furthermore, the study employed a single-shot block without catheter placement, which may limit the duration of analgesia; continuous infusion techniques could yield different results. There were limitations to our study that should be considered when interpreting the findings. The use of spinal anesthesia prevented the assessment of motor blockade and its effect on motor sparing. Patient satisfaction, while significantly higher in the supra-inguinal group, is subjective and may be influenced by factors beyond analgesia alone.

Future investigations should focus on evaluating the comparative efficacy of continuous supra-inguinal versus infra-inguinal fascia iliaca compartment block catheters with respect to sustained analgesia, opioid consumption, and postoperative functional recovery. Conducting larger, multicenter randomized controlled trials would improve the external validity of findings and increase the statistical power to detect differences in secondary endpoints. Furthermore, research aimed at determining the optimal volumes and concentrations of local anesthetics for supra-inguinal block administration is warranted.

Conclusion

In conclusion, our study supports the notion that S-FICB provides better analgesic effects in intertrochanteric femoral fracture surgery, without increasing adverse events. S-FICB was more effective in managing both dynamic and rest-time pain and can be the preferred regional anesthesia modality in this patient population. Integrating this approach into multimodal analgesia protocols may contribute to enhanced recovery pathways and better clinical outcomes.

Acknowledgment

We would like to thank all staff at the Rasoul Akram Hospital who helped us in the data collection process.

Author contribution

NN: Data collection, statistical analysis, drafted the first manuscript; SHRF: Study design and conceptualization; MA, SRE and NN: Supervised data collection, review and edit; PR: Critical revision. All authors read and approved the final version of manuscript.

Data sharing

Data could be shared based on the request from corresponding authors.

References

[1] Attum B, Pilson H. Intertrochanteric Femur Fracture. StatPearls [Internet]. StatPearls Publishing. 2025.
[2] Sharma A, Sethi A, Sharma S. Treatment of stable intertrochanteric fractures of the femur with proximal femoral nail versus dynamic hip screw: a

comparative study. Rev Bras Ortop. 2017; 53(4):477-81.
[3] Karakus O, Ozdemir G, Karaca S, Cetin M, Saygi B. The relationship between the type of unstable intertrochanteric femur fracture and mobility in the elderly. J Orthop Surg Res. 2018; 13(1):207.
[4] Rahimzadeh P, Imani F, Faiz SH, Nikoubakht N, Sayarifard A. Effect of intravenous methylprednisolone on pain after intertrochanteric femoral fracture surgery. J Clin Diagn Res. 2014; 8(4):GC01-4.
[5] Rudolph JL, Marcantonio ER. Review articles: postoperative delirium: acute change with long-term implications. Anesth Analg. 2011; 112(5):1202-11.
[6] Joshi GP, Ogunnaike BO. Consequences of inadequate postoperative pain relief and chronic persistent postoperative pain. Anesthesiol Clin North Am. 2005; 23(1):21-36.
[7] Rahimzadeh P, Imani F, Sayarifard A, Sayarifard S, Faiz SH. Ultrasound-guided fascia iliaca compartment block in orthopedic fractures: Bupivacaine 0.2% or 0.3%? Med J Islam Repub Iran. 2016; 30:433.
[8] Ridderikhof ML, De Kruif E, Stevens MF, Baumann HM, Lirk PB, Goslings JC, et al. Ultrasound guided supra-inguinal Fascia Iliaca Compartment Blocks in hip fracture patients: An alternative technique. Am J Emerg Med. 2020; 38(2):231-6.
[9] Imani F, Rahimzadeh P. Interventional pain management according to evidence-based medicine. Anesth Pain Med. 2012; 1(4):235-6.
[10] Bansal K, Sharma N, Singh MR, Sharma A, Roy R, Sethi S. Comparison of suprainguinal approach with infrainguinal approach of fascia iliaca compartment block for postoperative analgesia. Indian J Anaesth. 2022; 66 Suppl 6:S294-S299.
[11] Cho TH, Jun B, Yang HM, Kim SH. Comparison of Dye Spread Pattern and Nerve Involvement between Suprainguinal and Infrainguinal Fascia Iliaca Blocks with Different Injectate Volumes: A Cadaveric Evaluation. Medicina (Kaunas). 2024; 60(9):1391.
[12] Dalens B, Vanneuville G, Tanguy A. Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. Anesth Analg. 1989; 69(6):705-13.
[13] Bang S, Chung J, Jeong J, Bak H, Kim D. Efficacy of ultrasound-guided fascia iliaca compartment block after hip hemiarthroplasty: A prospective, randomized trial. Medicine (Baltimore). 2016; 95(39):e5018.
[14] Dalens B, Tanguy A, Vanneuville G. Lumbar plexus blocks and lumbar plexus nerve blocks. Anesth Analg. 1989; 69(6):852-4.
[15] Jones MR, Novitch MB, Hall OM, Bourgeois AP, Jeha GM, Kaye RJ, et al. Fascia iliaca block, history, technique, and efficacy in clinical practice. Best Pract Res Clin Anaesthesiol. 2019; 33(4):407-13.
[16] Smith JH, Kraeutler MJ, Keeling LE, Scillia AJ, McCarty EC, Mei-Dan O. Fascia Iliaca Block for Postoperative Pain Control After Hip Arthroscopy: A Systematic Review of Randomized Controlled Trials. Am J Sports Med. 2021; 49(14):4042-9.
[17] Stevens M, Harrison G, McGrail M. A modified fascia iliaca compartment block has significant morphine-sparing effect after total hip arthroplasty. Anaesth Intensive Care. 2007; 35(6):949-52.
[18] Kumar K, Pandey RK, Bhalla AP, Kashyap L, Garg R, Darlong V, et al. Comparison of conventional infrainguinal versus modified proximal suprainguinal approach of Fascia Iliaca Compartment Block for postoperative analgesia in Total Hip Arthroplasty. A prospective randomized study. Acta Anaesthesiol Belg. 2015; 66(3):95-100.
[19] Chen L, Shen Y, Liu S, Cao Y, Zhu Z. Ultrasound-guided supra-inguinal fascia Iliaca compartment block for older adults admitted to the emergency department with hip fracture: a randomized controlled, double-blind clinical trial. BMC Geriatr. 2021; 21(1):669. Erratum in: BMC Geriatr. 2022; 22(1):5.
[20] Vermeylen K, Desmet M, Leunen I, Soetens F, Neyrinck A, Carens D, et al. Supra-inguinal injection for fascia iliaca compartment block results in more consistent spread towards the lumbar plexus than an infra-inguinal injection: a volunteer study. Reg Anesth Pain Med. 2019.
[21] Zheng T, Hu B, Zheng CY, Huang FY, Gao F, Zheng XC. Improvement of analgesic efficacy for total hip arthroplasty by a modified ultrasound-guided supra-inguinal fascia iliaca compartment block. BMC Anesthesiol. 2021; 21(1):75. Erratum in: BMC Anesthesiol. 2021; 21(1):99.
[22] Qian Y, Guo Z, Huang J, Zhang Q, An X, Hu H, et al. Electromyographic Comparison of the Efficacy of Ultrasound-guided Suprainguinal and Infrainguinal Fascia Iliaca Compartment Block for Blockade of the Obturator Nerve in Total Knee Arthroplasty: A Prospective Randomized Controlled Trial. Clin J Pain. 2020; 36(4):260-6.
[23] Shariat AN, Hadzic A, Xu D, Shastri U, Kwofie K, Gandhi K, et al. Fascia lliaca block for analgesia after hip arthroplasty: a randomized double-blind, placebo-controlled trial. Reg Anesth Pain Med. 2013; 38(3):201-5.
[24] Hebbard P, Ivanusic J, Sha S. Ultrasound-guided supra-inguinal fascia iliaca block: a cadaveric evaluation of a novel approach. Anaesthesia. 2011; 66(4):300-5.
[25] Steenberg J, Møller AM. Systematic review of the effects of fascia iliaca compartment block on hip fracture patients before operation. Br J Anaesth. 2018; 120(6):1368-80.
[26] O'Reilly N, Desmet M, Kearns R. Fascia iliaca compartment block. BJA Educ. 2019; 19(6):191-7.
[27] Bali C, Ozmete O. Supra-inguinal fascia iliaca block in older-old patients for hip fractures: a retrospective study. Braz J Anesthesiol. 2023; 73(6):711-7.
[28] Biboulet P, Morau D, Aubas P, Bringuier-

Branchereau S, Capdevila X. Postoperative analgesia after total-hip arthroplasty: Comparison of intravenous patient-controlled analgesia with morphine and single injection of femoral nerve or psoas compartment block. a prospective, randomized, double-blind study. Reg Anesth Pain Med. 2004; 29(2):102-9.

[29] Azizoğlu M, Orekeci Temel G, Rumeli Atıcı Ş. Comparison of the Effectiveness of Suprainguinal Fascia Iliaca Compartment Block and Patient-Controlled Analgesia for Major Hip Surgeries in Elderly Patients. Turk J Anaesthesiol Reanim. 2020; 48(6):460-6.

[30] Vermeylen K. Interventional Analgesia After Major Hip Surgery: Evaluation of the Utility of the Fascia Iliaca Compartment Block. KU Leuven. 2018.

[31] Desmet M, Vermeylen K, Van Herreweghe I, Carlier L, Soetens F, Lambrecht S, et al. A Longitudinal Supra-Inguinal Fascia Iliaca Compartment Block Reduces Morphine Consumption After Total Hip Arthroplasty. Reg Anesth Pain Med. 2017; 42(3):327-33.

[32] Yamada K, Inomata S, Saito S. Minimum effective volume of ropivacaine for ultrasound-guided supra-inguinal fascia iliaca compartment block. Sci Rep. 2020; 10(1):21859.