

Original Research Article

Opioid-Sparing Effect of Preoperative Versus Postoperative Fascia Iliaca Compartment Block for Femoral and Hip Fracture Surgery: A Randomised Controlled Trial

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Abstract: Femoral and hip fracture surgery is associated with substantial perioperative pain and frequent opioid requirements. This study compared the opioid-sparing effects of anatomical fascia iliaca compartment block (FICB) performed before surgical incision with those of the same block performed at wound closure in adults undergoing femoral or hip fracture repair under general anaesthesia. In this prospective, single-centre, randomised comparative study, 68 adults classified as American Society of Anesthesiologists physical status I–III were allocated equally to preoperative FICB or postoperative FICB. Each participant received 40 mL of 0.25% plain bupivacaine by the anatomical landmark technique, together with a standardised general anaesthetic and multimodal analgesic regimen. Postoperative pain was assessed using the numerical rating scale, and the time to first request for additional analgesia and cumulative morphine consumption during the first 24 and 48 postoperative hours were recorded. Preoperative FICB significantly prolonged the mean time to first analgesic request compared with postoperative FICB (264.44 ± 37.37 versus 116.47 ± 36.00 minutes; $p < 0.001$). Median morphine consumption was also lower after preoperative FICB at 24 hours (54.9 [33.6 – 84.6] versus 80.4 [57.6 – 96.0] mg; $p < 0.001$) and 48 hours (53.32 [40.8 – 64.8] versus 81.6 [63.0 – 91.2] mg; $p < 0.001$). Scheduled ketorolac and paracetamol consumption did not differ significantly between groups. In this study population, preoperative anatomical FICB was associated with delayed rescue-analgesic requirement and reduced early postoperative morphine consumption compared with postoperative FICB. Preoperative FICB may therefore be a useful component of multimodal analgesia for selected adults undergoing femoral or hip fracture surgery.

Keywords: Fascia Iliaca Compartment Block, Femoral Fracture, Hip Fracture, Opioid-Sparing Analgesia, Postoperative Analgesia, Morphine Consumption, Rescue Analgesia, Regional Anaesthesia, Randomised Controlled Trial.

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INTRODUCTION

Femoral and hip fractures are important causes of acute pain, functional limitation, and hospital admission. They commonly result from road traffic injuries and falls, while hip and femoral fractures are also frequent in older adults with osteoporosis, many of whom have multiple comorbidities and require several medications [1–3]. The combination of severe injury-related pain, advanced age, and medical comorbidity creates a difficult perioperative analgesic problem. Inadequate analgesia may impair mobilisation and rehabilitation, increase postoperative morbidity, and

prolong hospitalization [3–5]. Analgesic strategies that provide sustained pain relief while reducing systemic opioid exposure are therefore important in the perioperative care of these patients.

Opioids remain central to the treatment of severe postoperative pain, but their use may be associated with sedation, nausea and vomiting, respiratory depression, and impaired mobilization [6, 7]. These effects are particularly undesirable after femoral or hip fracture surgery, when early mobilisation and rehabilitation contribute to recovery. Patients with advanced age or coexisting disease may be more

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vulnerable to opioid-related effects and may consequently require additional monitoring. Non-steroidal anti-inflammatory drugs may provide an alternative or adjunct to opioid analgesia, although their use may be limited by gastrointestinal adverse effects and acute kidney injury in susceptible patients [8, 9]. The continuing need for rescue analgesia in this population therefore represents a clinically relevant outcome, and opioid-sparing interventions may reduce total analgesic requirements without compromising early postoperative pain control.

Regional analgesic techniques provide an opportunity to reduce systemic analgesic consumption by interrupting nociceptive transmission closer to the site of injury. Peripheral nerve blocks can be directed towards the nerves supplying the injured region and may be particularly useful where advanced analgesic equipment, nerve stimulators, or ultrasound machines are not readily available [10, 11]. In patients with femoral or hip fractures, injury and surgical manipulation may involve the femoral, lateral femoral cutaneous, and obturator nerves, which transmit nociceptive impulses from the hip and thigh [10]. Blocking these nerves may reduce postoperative pain intensity and, consequently, the amount of opioid analgesia required.

The fascia iliaca compartment block (FICB) is a regional analgesic technique in which local anaesthetic is deposited in the potential space between the fascia iliaca and iliacus muscle. The intended spread may block the femoral, lateral femoral cutaneous, and obturator nerves [12-14]. FICB is considered a simple, relatively low-skilled, and inexpensive technique for patients with painful hip or femoral conditions. It can be performed using anatomical landmarks, making it relevant in resource-constrained environments where ultrasound guidance may not be readily available [10-12]. By providing regional analgesia, FICB may decrease supplemental systemic opioid requirements and reduce cumulative morphine exposure during the early postoperative period.

The timing of FICB may influence its opioid-sparing effect. When administered before surgery, the block may reduce nociceptive input before incision and limit the development or amplification of postoperative pain. It may also establish analgesia before the period of greatest perioperative stimulation and continue into the early postoperative period. Previous reports have suggested that preoperative FICB may provide analgesia for eight hours or more, increase the time before additional analgesia is requested, and reduce the need for postoperative analgesic supplements.^{16, 17, 19, 20} These findings provide a pharmacological rationale for assessing preoperative FICB through postoperative opioid consumption and rescue-analgesic requirements.

Postoperative FICB may also reduce pain after fracture repair, when analgesic requirements are already

established; however, evidence regarding its effectiveness has not been consistent. Bang *et al.*, [21], reported no difference in pain scores after postoperative FICB in patients undergoing hip hemiarthroplasty, whereas Gola *et al.*, [22], and Atwa²³ reported significant analgesic benefits after postoperative FICB in patients with hip fractures. Although these studies support the possible use of postoperative FICB, they do not establish whether administering the block before surgery provides a greater opioid-sparing effect than administering it after surgery. Previous investigations have also not consistently isolated the effect of block timing on cumulative opioid requirements during both the first 24 and 48 postoperative hours.

The comparative opioid-sparing effectiveness of preoperative and postoperative anatomical FICB therefore remains insufficiently elucidated in adults undergoing femoral or hip fracture repair under standardised general anaesthesia. A direct comparison of these timings is clinically relevant because a reduction in total morphine consumption may indicate more effective regional analgesia and may reduce exposure to opioid-related adverse effects during early recovery. The present study compared postoperative opioid requirements following preoperative versus postoperative anatomical FICB. The principal outcomes were morphine consumption during the first 24 and 48 postoperative hours, total rescue-morphine use, time to first request for additional analgesia, and rescue-analgesic requirement. Patient satisfaction and block-related safety outcomes were outside the scope of this focused analysis.

MATERIALS AND METHODS

Study Design and Setting

This prospective, single-centre, randomised comparative study was conducted in the Department of Anaesthesia, Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria, from October 2021 to December 2022. Irrua Specialist Teaching Hospital is a tertiary healthcare institution and the teaching hospital of Ambrose Alli University College of Medicine. It provides specialist healthcare services to patients from Edo State and neighbouring states, including Delta and Kogi States.

Participants

The study population comprised adults of either sex, classified as American Society of Anesthesiologists physical status I–III, who were scheduled for elective repair of a femoral or hip fracture. Patients aged 18–65 years were eligible. Patients were excluded if they declined participation; had uncontrolled cardiovascular or renal disease; were receiving anticoagulant therapy; had undergone previous femoral bypass surgery; had infection at the proposed block site; had a known allergy to bupivacaine or another local anaesthetic; or had fractures involving other body regions in addition to the femoral or hip fracture.

Sample-Size Estimation

The sample size for the parent randomised comparative study was calculated using the formula for comparing two independent proportions. A previously reported postoperative analgesic effectiveness of 80% with preoperative FICB was used as the reference estimate [18]. A 40% relative reduction in analgesic effectiveness was assumed for the postoperative FICB group, corresponding to an expected effectiveness of 48% in that group. Using a two-sided significance level of 5%, 80% power, and standard normal values of 1.96 and 0.84, the calculated sample size was 31 participants per group. Allowing for a 10% loss or protocol violation resulted in a target sample of 68 participants, with 34 participants allocated to each group. The present analysis was restricted to opioid-consumption and rescue-analgesic outcomes collected within this randomised study.

Ethical Considerations and Informed Consent

Ethical approval was obtained from the Ambrose Alli University Ethics and Research Committee, Ekpoma, Edo State. The National Health Research Ethics Committee registration number was NHREC/12/06/2013. The study protocol, including the anaesthetic and analgesic procedures, was explained to eligible participants, and written informed consent was obtained before enrolment. Morphine sulphate used for intraoperative and rescue analgesia was documented as 0.3 mg/kg intravenously, supplied/manufactured by Fidson Healthcare Plc, with the reported batch or product identifier NDC 76045-005-01. Manufacturer, supplier, product-name, and batch details for the other study drugs should be verified from the institutional study or pharmacy records before submission.

Randomisation and Blinding

A senior resident who was not involved in the other study procedures prepared 68 folded paper slips, comprising 34 slips labelled P and 34 slips labelled Q. Each participant selected one slip from a container, and the slips were reshuffled before the next selection. Participants were blinded to the meaning of the selected label. Group P received FICB before surgical incision, whereas group Q received the same block at wound closure, before reversal of neuromuscular blockade and tracheal extubation. The principal investigator administered the general anaesthetic and all FICBs and could not be blinded because the timing of the block differed between groups. Blinding of surgeons, postoperative nurses who recorded pain assessments, and the data analyst was not documented in the source protocol.

Preoperative Assessment and Preparation

All participants were assessed on the ward at least one day before surgery. The history of the injury, intercurrent illnesses, medication and allergy histories, and findings from a comprehensive physical examination were documented, with particular attention to organ

function and additional fractures. Investigations included full blood count, serum electrolytes, urea and creatinine, and blood grouping and cross-matching in preparation for possible intraoperative transfusion. Chest radiography, electrocardiography, and echocardiography were performed when clinically indicated, particularly in older participants.

Participants were fasted according to standard anaesthetic recommendations: 8 hours for fatty meals, 6 hours for light meals, and up to 2 hours for clear fluids. Diazepam 10 mg was administered orally at night, followed by a further 10 mg dose as premedication on the morning of surgery. Before surgery, the principal investigator explained the study procedures and instructed participants in the use of the 11-point numerical rating scale (NRS), in which 0 represented no pain and 10 represented the worst pain imaginable [24].

Standardised Anaesthetic Technique

Before each participant arrived in the operating theatre, the anaesthetic machine, multiparameter monitor, suction equipment, and other necessary equipment were checked for availability and function. Resuscitation drugs and 20% intravenous lipid emulsion were available in the theatre. Standard monitoring was applied on arrival, including electrocardiography, non-invasive blood pressure, pulse oximetry, respiratory rate, temperature, and mean arterial pressure. Baseline measurements were recorded, and two 16-gauge intravenous cannulae were inserted before induction.

All participants received general anaesthesia with endotracheal intubation. The lungs were preoxygenated with 100% oxygen for 5 minutes, after which anaesthesia was induced with propofol 2–3 mg/kg intravenously. Tracheal intubation was facilitated with suxamethonium 2 mg/kg. Anaesthesia was maintained with isoflurane 1–2% in 60% oxygen in air, and neuromuscular blockade was maintained with atracurium 0.3 mg/kg. Standardised intraoperative analgesia consisted of morphine sulphate 0.3 mg/kg intravenously (Fidson Healthcare Plc; reported batch or product identifier NDC 76045-005-01), paracetamol 15 mg/kg, and ketorolac 0.5 mg/kg. No additional intraoperative analgesic was administered after this regimen. The same general anaesthetic and intraoperative analgesic regimen was used in both groups to minimise variation in subsequent postoperative opioid requirements.

Heart rate, blood pressure, mean arterial pressure, respiratory rate, peripheral oxygen saturation, end-tidal carbon dioxide, and electrocardiographic variables were recorded at 5-minute intervals throughout surgery. Intravenous fluid maintenance was provided with normal saline at 10 mL/kg during the first hour and 5 mL/kg/h thereafter. Clinically significant blood loss was assessed and replaced with crystalloid or blood when indicated.

Anatomical Fascia Iliaca Compartment Block

FICB was performed using the anatomical landmark technique with the participant in the supine position. The anterior superior iliac spine and pubic tubercle on the side of the fracture were identified, and an imaginary line joining these landmarks was divided into three equal parts. The needle insertion point was located 1 cm caudal to the junction of the lateral and middle thirds [25]. The skin was prepared with 0.5% chlorhexidine and infiltrated with 2 mL of 2% lidocaine. A short-bevel or blunt needle was inserted perpendicular to the skin and advanced through the fascia lata and fascia iliaca, identified by two distinct fascial pops. The needle was advanced a further 1–2 mm to facilitate placement in the fascia iliaca compartment.

After negative aspiration for blood, 40 mL of 0.25% plain bupivacaine was injected incrementally. Approximately 20 mL was administered initially, followed by the remaining 20 mL. Aspiration was performed after each 5-mL aliquot to reduce the risk of intravascular injection. The needle was withdrawn, gentle pressure was applied to the injection site for approximately 2 minutes to encourage cephalad spread of the local anaesthetic, and a sterile dressing was applied. The volume and concentration of local anaesthetic were selected according to the study protocol and the volume described for anatomical FICB [26].

Participants in group P received FICB before the commencement of surgery, and the surgeons waited 15 minutes after completion of the block before making the incision. Participants in group Q received the same block, using the same anatomical landmarks, local anaesthetic, volume, and injection technique, at wound closure before reversal of neuromuscular blockade and tracheal extubation.

At the end of surgery, the oropharynx was suctioned and residual neuromuscular blockade was antagonised with neostigmine and glycopyrrolate. Isoflurane was discontinued, and the trachea was extubated when the relevant clinical criteria had been met. Supplemental oxygen was administered by face mask. Participants were monitored for 15 minutes before transfer to the post-anaesthesia care unit and were transferred to the ward after achieving an Aldrete score of at least [9].

Postoperative Analgesia and Assessment of Rescue Analgesia

Postoperative analgesia consisted of paracetamol 15 mg/kg every 6 hours and ketorolac 0.5 mg/kg every 6 hours according to the institutional protocol. Morphine sulphate 0.3 mg/kg intravenously (Fidson Healthcare Plc; reported batch or product identifier NDC 76045-005-01) was administered as rescue analgesia when additional analgesia was required. The indication for rescue morphine was an NRS score greater than 3 or a participant's request for analgesia. The

same postoperative analgesic regimen and rescue-morphine dose were used in both groups.

The NRS was recorded hourly during the first 6 postoperative hours, 2-hourly until 12 hours, and 12-hourly thereafter until 48 hours. Pain assessments were performed at rest and during sitting or movement where applicable. For this opioid-sparing analysis, pain assessments were used to identify the need for rescue analgesia, whereas the principal outcomes were administration and cumulative dose of postoperative morphine.

Time to first rescue-analgesic request was measured from completion of the FICB injection to the first complaint of pain requiring additional analgesia or the first participant request for analgesia. This timing reference was applied to both groups; therefore, the interval includes the remaining operative period in the preoperative group but begins at wound closure in the postoperative group. Rescue-analgesic requirement was recorded as whether a participant received at least one postoperative morphine dose and, for participants who received morphine, the cumulative dose administered during the first 24 and 48 postoperative hours.

Outcome Measures

The primary outcomes for this focused analysis were cumulative postoperative morphine consumption during the first 24 and 48 hours after surgery. Morphine consumption was calculated for each participant by summing all rescue-morphine doses administered during the relevant observation period. Total morphine use was reported in milligrams for each participant and compared between the preoperative and postoperative FICB groups.

Secondary analgesic outcomes were time from completion of FICB to the first request for additional analgesia, the proportion of participants requiring at least one rescue-morphine dose, and cumulative rescue-morphine dose during the first 24 and 48 postoperative hours. Patient satisfaction and block- or drug-related complications were not included in this focused paper because it addresses analgesic consumption and opioid-sparing effectiveness only.

Data Collection and Statistical Analysis

Sociodemographic, clinical, anaesthetic, analgesic, and postoperative data were recorded on a structured data-collection form. A junior anaesthetist instructed in use of the NRS recorded perioperative data, while ward nurses recorded scheduled postoperative pain scores and analgesic administration. Data were entered into a Microsoft Excel spreadsheet, cleaned, and imported into IBM Statistical Package for the Social Sciences, version 25, for analysis.

Continuous variables were assessed for distribution. Approximately normally distributed

variables were summarised as mean and standard deviation, whereas non-normally distributed variables were summarised as median and interquartile range. Categorical variables were presented as frequencies and percentages. Between-group comparisons of 24-hour and 48-hour cumulative morphine consumption, total rescue-morphine dose, and time to first request for additional analgesia used the independent-samples Student's *t* test for normally distributed variables and the Mann–Whitney *U* test for non-normally distributed variables. The proportion of participants receiving at least one rescue-morphine dose was compared using Fisher's exact test. All tests were two-sided, and $p < 0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

Sixty-eight participants were recruited and randomised equally to receive anatomical FICB either before skin incision (preoperative FICB, group P; $n=34$) or at wound closure (postoperative FICB, group Q; $n=34$). All randomised participants completed follow-up through the postoperative assessment period. The two groups were comparable with respect to the reported demographic and clinical characteristics. Mean age was 37.50 ± 2.41 years in the preoperative group and 40.73 ± 2.57 years in the postoperative group ($p=0.358$), while mean body mass index was 24.69 ± 3.00 kg/m² and 25.30 ± 3.02 kg/m², respectively ($p=0.398$). No reported between-group differences were observed in sex, fracture diagnosis, or American Society of Anesthesiologists physical status. These findings support the comparability of the groups for assessing postoperative opioid-related outcomes.

Baseline pain severity was also similar. Before block administration, mild pain was reported by 3 participants (8.82%) in the preoperative group and 4 participants (11.76%) in the postoperative group. Moderate pain was reported by 16 participants (47.06%) and 18 participants (52.94%), respectively, while severe pain was reported by 15 participants (44.12%) in the preoperative group and 12 participants (35.29%) in the postoperative group ($p=0.743$). Mean duration of surgery was 90.44 ± 26.81 minutes in group P and 95.59 ± 25.04 minutes in group Q ($p=0.420$). Thus, the observed differences in rescue-analgesic timing and morphine consumption were not accompanied by a statistically significant baseline imbalance in pain severity or operative duration.

Time to First Rescue-Analgesic Request

The interval from completion of FICB to the first request for additional analgesia was significantly longer in participants who received the block preoperatively. Mean time to first analgesic request was 264.44 ± 37.37 minutes in group P compared with 116.47 ± 36.00 minutes in group Q ($p < 0.001$), representing an approximately 148-minute difference. Kaplan–Meier analgesic-estimate curves demonstrated the same pattern, with significantly prolonged time to

first additional analgesic requirement in the preoperative group compared with the postoperative group ($p < 0.001$). Approximately 25%, 50%, and 75% of participants in the preoperative group requested additional analgesia by 245, 260, and 280 minutes, respectively, compared with approximately 120 minutes for each corresponding landmark in the postoperative group.

Postoperative Morphine Consumption

At 24 hours, median morphine consumption was 54.9 mg (IQR, 33.6–84.6 mg) in the preoperative FICB group compared with 80.4 mg (IQR, 57.6–96.0 mg) in the postoperative FICB group ($p < 0.001$). At 48 hours, the corresponding reported median morphine values were 53.32 mg (IQR, 40.8–64.8 mg) and 81.6 mg (IQR, 63.0–91.2 mg), respectively ($p < 0.001$). Thus, the direction of effect was consistent at both assessment points, with lower reported morphine consumption in the preoperative group.

The supplied results also reported non-opioid analgesic consumption. At 24 hours, ketorolac consumption was 131 mg (IQR, 115–150 mg) in group P and 139 mg (IQR, 130–150 mg) in group Q ($p=0.210$), while paracetamol consumption was 4010 mg (IQR, 3480–4560 mg) and 4200 mg (IQR, 3900–4560 mg), respectively ($p=0.293$). At 48 hours, ketorolac consumption was 145.45 mg (IQR, 130–175 mg) in group P and 165 mg (IQR, 138–187.5 mg) in group Q ($p=0.299$), while paracetamol consumption was 5100 mg (IQR, 4500–5700 mg) and 5250 mg (IQR, 4875–5850 mg), respectively ($p=0.442$). The statistically significant between-group difference was therefore observed for morphine, rather than scheduled ketorolac or paracetamol consumption.

NRS-Defined Rescue-Analgesic Requirement

The postoperative NRS findings were consistent with earlier analgesic failure or rescue requirement in the postoperative FICB group during the early observation period. At 60 minutes after FICB, 7 participants (20.59%) in group Q had an NRS score greater than 3 and required additional analgesia, compared with no participant in group P ($p=0.004$). At 120 minutes, 22 participants (64.71%) in group Q had NRS scores greater than 3 compared with no participant in group P ($p < 0.001$). At 180 minutes, the corresponding proportions were 5 participants (14.71%) and 1 participant (2.94%), respectively ($p=0.089$).

At later recorded time points, the table showed 3 participants (8.82%) with NRS scores greater than 3 in group P and none in group Q at 210 minutes ($p=0.078$), followed by 14 participants (41.18%) versus none at 240 minutes ($p=0.001$), 12 participants (35.29%) versus none at 270 minutes ($p=0.001$), and 4 participants (11.76%) versus none at 300 minutes ($p=0.039$). At 360 minutes, no participants were recorded in either group. These later values should be interpreted in relation to the manner in which rescue analgesia was recorded. Participants in the

postoperative group had already requested or received additional analgesia earlier, particularly by 120 minutes; consequently, a value of zero at a later time point does not necessarily indicate absence of pain or superior

analgesia at that time. The more direct opioid outcomes remain time to first request and reported morphine consumption at the specified assessment points.

Table 1: Baseline demographic, clinical, and analgesic characteristics

Variable	Preoperative FICB (n=34)	Postoperative FICB (n=34)	p-value
Age (years), mean±SD	37.50±2.41	40.73±2.57	0.358
Male/female, n	16/18	14/20	0.331
BMI (kg/m ²), mean±SD	24.69±3.00	25.30±3.02	0.398
Femoral shaft fracture, n (%)	26 (76.47%)	25 (73.53%)	0.779
Hip fracture, n (%)	8 (23.53%)	9 (26.47%)	—
ASA I, n (%)	16 (47.06%)	12 (35.29%)	—
ASA II, n (%)	14 (41.18%)	17 (50.00%)	0.615
ASA III, n (%)	4 (11.76%)	5 (14.71%)	—
Mild NRS 0–3, n (%)	3 (8.82%)	4 (11.76%)	—
Moderate NRS 4–6, n (%)	16 (47.06%)	18 (52.94%)	0.743
Severe NRS 7–10, n (%)	15 (44.12%)	12 (35.29%)	—
Duration of surgery (min), mean±SD	90.44±26.81	95.59±25.04	0.420

Percentages in Table 1 are calculated within each randomised group, using 34 as the denominator. The fracture-diagnosis rows sum to 34 participants in each group (26+8 and 25+9). The ASA rows also sum to

34 participants in each group (16+14+4 and 12+17+5). The p-values shown are the values reported with the supplied results; recalculation of the omnibus tests would require the original participant-level dataset.

Table 2: Proportion of participants with NRS score >3 after FICB

Time after FICB (min)	Preoperative FICB, n (%)	Postoperative FICB, n (%)	p-value
60	0 (0.00%)	7 (20.59%)	0.004
120	0 (0.00%)	22 (64.71%)	<0.001
180	1 (2.94%)	5 (14.71%)	0.089
210	3 (8.82%)	0 (0.00%)	0.078
240	14 (41.18%)	0 (0.00%)	0.001
270	12 (35.29%)	0 (0.00%)	0.001
300	4 (11.76%)	0 (0.00%)	0.039
360	0 (0.00%)	0 (0.00%)	1.000

At 360 minutes, the comparison is 0/34 versus 0/34. The previously reported value of 0.000 is incorrect; an exact comparison of two identical zero proportions

gives p=1.000. Because neither group had an event at this time point, the row does not provide evidence of a between-group analgesic difference.

Table 3: Rescue-analgesic timing and reported postoperative analgesic consumption

Outcome	Preoperative FICB	Postoperative FICB	p-value
Time to first analgesic request (min), mean±SD	264.44±37.37	116.47±36.00	<0.001
24-hour morphine (mg), median (IQR)	54.9 (33.6–84.6)	80.4 (57.6–96.0)	<0.001
24-hour ketorolac (mg), median (IQR)	131 (115–150)	139 (130–150)	0.210
24-hour paracetamol (mg), median (IQR)	4010 (3480–4560)	4200 (3900–4560)	0.293
48-hour morphine (mg), median (IQR)	53.32 (40.8–64.8)	81.6 (63.0–91.2)	<0.001
48-hour ketorolac (mg), median (IQR)	145.45 (130–175)	165 (138–187.5)	0.299
48-hour paracetamol (mg), median (IQR)	5100 (4500–5700)	5250 (4875–5850)	0.442
25% requesting first analgesic	245	120	—
50% requesting first analgesic	260	120	—
75% requesting first analgesic	280	120	—

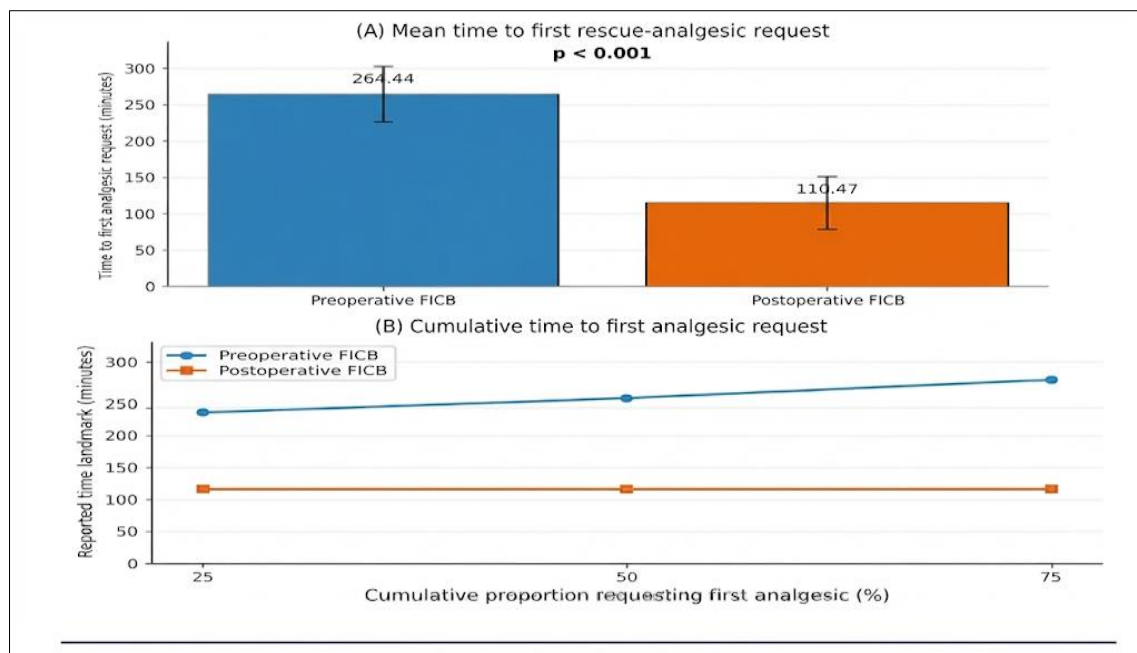


Figure 1: Timing of first rescue-analgesic request and reported analgesic-request landmarks.

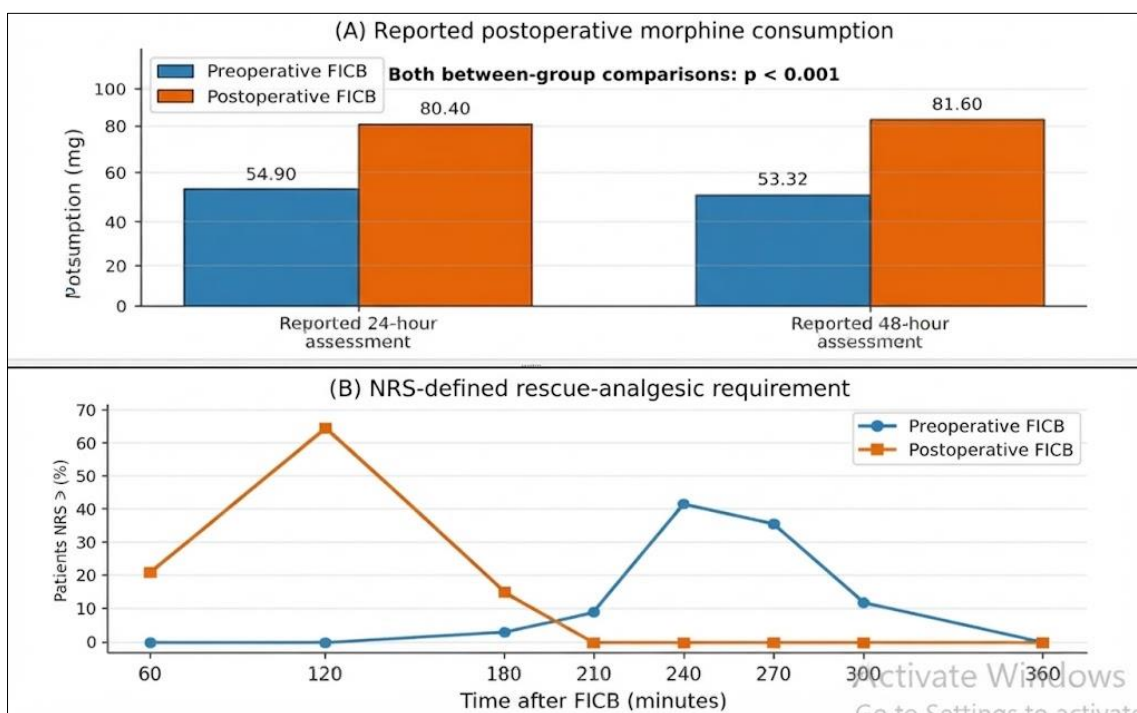


Figure 2: Participants requiring intervention for NRS >3.

This focused analysis indicates that the timing of anatomical FICB was associated with postoperative opioid use after femoral or hip fracture surgery. Participants who received the block before incision had a significantly longer time to first rescue-analgesic request and lower reported morphine consumption at both 24 and 48 hours than participants who received the block at wound closure. Because the same anatomical block and background analgesic regimen were used in both groups, the findings support an opioid-sparing association for preoperative FICB under the conditions of this study.

The difference in rescue-analgesic timing was clinically substantial. The first request occurred, on average, at 264.44 minutes after preoperative FICB compared with 116.47 minutes after postoperative FICB. The Kaplan–Meier curves reinforced this result, showing that requests accumulated much earlier in the postoperative group. A block performed before incision may interrupt peripheral nociceptive transmission before the principal surgical stimulus and reduce the intensity of subsequent postoperative pain. This provides a plausible pre-emptive analgesic explanation for the longer interval before rescue analgesia in group P and is consistent with

previous reports describing prolonged analgesia and reduced supplemental analgesic requirements after preoperative regional analgesia [19, 20].

The morphine findings provide the principal pharmacological evidence for the opioid-sparing effect. Median morphine consumption was lower in the preoperative group by 25.5 mg at 24 hours and by 28.28 mg at 48 hours when the reported group medians were compared. Both differences were statistically significant ($p < 0.001$). In contrast, differences in scheduled ketorolac and paracetamol consumption were not statistically significant. This distinction suggests that the principal measurable separation between the two timing strategies was in rescue-opioid exposure rather than scheduled non-opioid analgesic administration. Because morphine was administered when additional analgesia was required, the lower morphine requirement reflects a reduced need for rescue opioid treatment within the multimodal regimen.

The opioid-sparing finding is clinically relevant because opioids remain useful for severe fracture and postoperative pain but may cause sedation, nausea, vomiting, respiratory depression, pruritus, urinary retention, and delayed mobilization [6, 7]. A regional technique that delays the first rescue request and reduces morphine exposure may support recovery while limiting systemic opioid burden. Nevertheless, the present findings do not indicate that preoperative FICB eliminates the need for postoperative analgesia. Participants in both groups continued to receive postoperative analgesic treatment, and rescue medication remained available when pain exceeded the prespecified threshold or when a participant requested additional analgesia.

The timing of the block is particularly important when interpreting the first-request outcome. Participants in group Q underwent the surgical stimulus before the block was administered, whereas participants in group P had the block established before incision. Consequently, the postoperative group may have experienced substantial pain before the block could take effect. The earlier request in group Q may therefore reflect both the absence of pre-incisional nociceptive blockade and the period of established pain before wound closure. For this reason, time from block completion should not be regarded as identical to time from surgical incision or completion of surgery. The comparison nevertheless remains clinically informative because the same anatomical block strategy was evaluated at two different perioperative time points.

The findings are broadly compatible with previous studies, although direct comparison should be cautious. Bang *et al.*, [21], reported a postoperative analgesic experience after postoperative FICB that did not produce the same benefit observed in some other investigations, whereas Gola *et al.*, [22], and Atwa [23],

reported postoperative analgesic benefits in patients with hip fracture. Differences in local anaesthetic, concentration, block technique, surgical procedure, background analgesia, and patient characteristics may account for variability between studies. Other studies have reported reduced postoperative opioid consumption after preoperative FICB or related regional analgesic approaches, including investigations using ropivacaine, higher local-anaesthetic concentrations, or adjuvants [29, 30]. These differences emphasise that the present result concerns the timing of FICB under the conditions of this study and should not be treated as a universal estimate of opioid reduction for every FICB technique.

The NRS data support the early opioid findings but require careful interpretation. The absence of participants with NRS scores greater than 3 in group P at 60 and 120 minutes, compared with 20.59% and 64.71% in group Q, respectively, is consistent with more effective early analgesia after preoperative block placement. However, the later table entries show more recorded NRS-defined interventions in group P at 240–300 minutes and none in group Q. Because participants in the postoperative group had already received additional analgesia earlier, those later zero values cannot be interpreted as evidence that postoperative FICB became superior. This pattern illustrates why time-to-event methods and cumulative morphine consumption are more appropriate primary measures for an opioid-sparing analysis than isolated cross-sectional counts of participants exceeding an NRS threshold at successive time points.

The study has several strengths. It used equal allocation, included 34 participants in each group, reported comparable baseline pain severity and operative duration, and followed participants through the postoperative assessment period. It directly compared the timing of the same anatomical FICB strategy rather than comparing different regional techniques. The use of morphine consumption as an outcome also provides a direct measure of rescue-opioid exposure, while time-to-first-request analysis and Kaplan–Meier curves provide complementary information about the duration of clinically useful analgesia.

Important limitations should also be considered. The sample was small and derived from a single centre, which limits precision and generalisability. Participants were aged 18–65 years and classified as ASA I–III; therefore, the findings may not apply directly to frail older adults with hip fractures, who may have different pain responses, comorbidity profiles, medication requirements, and opioid-related risks. The principal investigator could not be blinded to block timing, and complete blinding of postoperative caregivers or outcome assessors was not documented. In addition, the study did not provide separate group-level counts of participants who received rescue morphine, the number of rescue doses, or the dose administered at each request.

The opioid-sparing conclusion is consequently based on reported time to first analgesic request and group-level morphine summaries rather than a complete dose-by-dose rescue-opioid dataset.

The clinical implication is that preoperative anatomical FICB may delay the first request for rescue analgesia and reduce early postoperative morphine requirements in selected adults undergoing femoral or hip fracture repair. The technique may be particularly useful as part of a multimodal analgesic protocol in settings where a simple anatomical block is used. It should not replace regular postoperative pain assessment or the availability of rescue analgesia, because the duration of a single-shot block may vary between patients and may not cover the entire postoperative period.

Future research should be multicentre and adequately powered for opioid-consumption outcomes. Primary endpoints should be defined prospectively as cumulative morphine consumption over clearly specified intervals, such as 0–24 and 0–48 hours, with separate reporting of the 24–48-hour interval. Studies should report the proportion of participants receiving rescue opioid, the number and timing of rescue doses, total morphine-equivalent exposure, and the exact timing of each analgesic administration. Time should be referenced separately to block completion, surgical incision, and surgical completion to distinguish duration of block analgesia from the effect of perioperative timing. Future trials should also include older and frail patients, document allocation concealment and outcome-assessor blinding, and compare anatomical with ultrasound-guided FICB.

CONCLUSION

In adults undergoing femoral or hip fracture surgery under standardised general anaesthesia, preoperative anatomical FICB was associated with a longer interval to the first request for additional analgesia and lower cumulative morphine consumption during the first 24 and 48 postoperative hours than postoperative FICB performed at wound closure. The reduction in opioid consumption occurred without a statistically significant difference in scheduled ketorolac or paracetamol use, suggesting that the principal between-group difference was in rescue-opioid requirement. These findings support preoperative anatomical FICB as a potentially useful component of multimodal analgesia for selected patients in settings where a simple landmark-based technique is appropriate. However, the conclusion should be interpreted cautiously because of the small, single-centre sample, incomplete documentation of assessor blinding, and limited dose-by-dose rescue-opioid data. Preoperative FICB should therefore complement, rather than replace, regular postoperative pain assessment and access to rescue analgesia.

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Declarations: Ethics Approval and Consent to Participate.

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