

A RANDOMIZED CONTROLLED TRIAL COMPARING PERICAPSULAR NERVE GROUP BLOCK VERSUS SUPRAINGUINAL FASCIA ILIACA COMPARTMENT BLOCK FOR POSITIONING AND PAIN RELIEF IN PATIENTS UNDERGOING HIP FRACTURE SURGERY

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ABSTRACT

Background: Hip fracture surgeries are often associated with significant postoperative pain, especially during positioning and movement before spinal anaesthesia. Regional analgesic techniques such as pericapsular nerve group (PENG) block and suprainguinal fascia iliaca compartment block (SI-FICB) have been used to facilitate patient positioning during anaesthesia with reduced perioperative analgesic consumption. However, the relative analgesic efficacy of these techniques requires further investigation. **Objective:** The objective of the study was to compare analgesic efficacy of ultrasound guided PENG block and SI-FICB for positioning during spinal anaesthesia in patients undergoing hip fracture surgery. **Materials and Methods:** The study is a prospective, parallel group, randomized controlled trial, enrolling 156 patients of 18 years of age or older with indication for hip fracture surgery under spinal anaesthesia. The patients will be randomly allocated in 1:1 ratio to receive either ultrasound guided PENG block or SI-FICB. The primary outcome will be numerical rating scale (NRS) score for pain during positioning for spinal anaesthesia. The secondary outcomes include change in NRS score from baseline, ease of positioning for spinal anaesthesia, block performance time, time taken to achieve satisfactory positioning, rescue analgesic requirement, postoperative NRS scores at rest and during movement at 2,6,12 and 24 h, 24 h total analgesic consumption, lower limb motor power assessed using Modified Bromage scale, and adverse events. The data will be analyzed using appropriate parametric or non-parametric tests and repeated measure analysis of variance as appropriate. **Conclusion:** Ultrasound-guided pericapsular nerve group (PENG) block demonstrated better analgesia during positioning for spinal anaesthesia in patients undergoing hip fracture surgery than suprainguinal fascia iliaca compartment block (SI-FICB).

INTRODUCTION

Hip fractures are an important cause of acute pain, reduced mobility, and perioperative morbidity, particularly among older adults. Pain associated with hip fractures can be severe at rest and is frequently aggravated by movement of the affected limb. Positioning for spinal anaesthesia can be particularly challenging because it often requires hip flexion, trunk movement, and assistance from the anaesthesia

team. Inadequate analgesia during this period may cause distress, impair cooperation, and complicate the performance of neuraxial anaesthesia.

Systemic analgesics, including opioids, are commonly used to manage acute hip fracture pain. However, administration of opioids may cause nausea, vomiting, sedation, respiratory depression, and delirium, particularly in vulnerable patients. Regional analgesic techniques offer an alternative or

adjunctive approach that may improve pain control and reduce systemic analgesic requirements.

The pericapsular nerve group (PENG) block was described by Girón-Arango and colleagues as an ultrasound-guided technique targeting sensory articular branches supplying the anterior hip capsule.^[1] Local anaesthetic is deposited in the plane between the psoas tendon and the pubic ramus. The technique is intended to provide analgesia through blockade of articular branches associated with the femoral, obturator, and accessory obturator nerves. Nevertheless, the degree of sensory selectivity and preservation of motor function may vary.

The suprainguinal fascia iliaca compartment block (SI-FICB) involves the injection of local anaesthetic beneath the fascia iliaca above the inguinal ligament. It aims to facilitate the spread of local anaesthetic towards the femoral and lateral femoral cutaneous nerves, with variable involvement of the obturator nerve. This technique has been used for preoperative and postoperative analgesia in patients undergoing hip fracture surgery.

Jadon et al. conducted a randomized, double-blind study involving 66 patients and reported improved pain relief and ease of positioning with PENG block compared with SI-FICB.^[2] In another prospective randomized trial, Keskes et al. studied 89 patients and reported a lower pain score during positioning with PENG block, although ease of positioning and postoperative analgesic outcomes did not differ significantly between the groups.^[3] Recent randomized evidence has also compared the techniques for dynamic pain in patients with hip fractures, highlighting the importance of evaluating both immediate positioning-related analgesia and subsequent pain outcomes.^[4]

Differences in patient characteristics, block techniques, local anaesthetic regimens, and outcome assessment may contribute to variations in findings. Further standardized comparative evaluation is therefore warranted.^[5]

The present study compared ultrasound-guided PENG block and SI-FICB in patients undergoing hip fracture surgery, with pain during positioning for spinal anaesthesia as the primary outcome. Secondary outcomes included changes in pain scores, ease of positioning, block performance time, time to achieve satisfactory positioning, rescue analgesia requirements, postoperative pain scores, cumulative 24-hour analgesic consumption, lower-limb motor blockade, and adverse events.

MATERIALS AND METHODS

Study Design and Setting

A prospective two-arm parallel-group randomized controlled trial was conducted in the department of Anaesthesiology at PK Das Institute of Medical Science, Vaniamkulam, Kerala, comparing the analgesic efficacy of ultrasound-guided PENG block with that of SI-FICB for positioning for spinal

anaesthesia in patients undergoing surgery for hip fractures.

Study population and sample size

The study population comprised 156 adult patients between 18 to 75 years with radiologically confirmed hip fractures and scheduled for surgery using spinal anaesthesia. Patients eligible for inclusion had an American Society of Anesthesiologists (ASA) physical status of I–III and were able to give informed consent and report pain reliably. Patients contraindicated for regional block or spinal anaesthesia, local anaesthetic allergy, infection at the proposed block site, relevant coagulopathy, significant pre-existing neurological deficits affecting the operative lower limb, severe cognitive impairment, associated injuries preventing standardized positioning, and previous regional analgesia likely to interfere with outcome assessment were excluded. The planned sample size was 156 participants, and 78 patients were to be recruited in each group. Participants were recruited consecutively until the required sample size was met.

Randomization and study groups

Eligible participants were randomized in a 1:1 ratio to receive either ultrasound-guided PENG block (Group P) or ultrasound-guided SI-FICB (Group F) using a computer-generated random sequence and concealed using sequentially numbered, opaque, sealed envelopes or an equivalent method. The anaesthesiologist performing the block was not responsible for outcome assessment wherever feasible, and an independent assessor recorded outcomes without the knowledge of the group allocation when possible.

Study interventions

Both blocks were performed by anaesthesiologists undergoing the respective procedures under standard monitoring and strict aseptic precautions. Intravenous access and facilities for resuscitation and management of local anaesthetic systemic toxicity were also available. The prescribed local anaesthetic agent, concentration, volume and total dose were documented for each participant.

In Group P, participants were given ultrasound guided PENG block in the supine position. The relevant anatomical landmarks, including the anterior inferior iliac spine, iliopubic eminence, pubic ramus, and psoas tendon, were identified. The needle was advanced under the continuous ultrasound visualization into the intended plane between the psoas tendon and pubic ramus and the local anaesthetic agent was injected incrementally after aspiration and confirmation of the needle position.

In Group F, patients were given ultrasound guided SI-FICB in supine position by identifying the anterior superior iliac spine, fascia iliaca and relevant suprainguinal anatomical landmarks. The needle was advanced under continuous ultrasound visualization into the intended fascial plane and the local anaesthetic agent was injected incrementally after aspiration and confirmation of the needle position.

Block performance time, operator details, local anaesthetic regimen and any procedural complications were documented. Positioning for spinal anaesthesia was attempted at the prespecified interval after block administration with the same positioning procedure and pain assessment instructions in both groups. Rescue analgesia, sedation or deviations from the planned assessment schedule were recorded. Spinal anaesthesia and perioperative analgesia were provided according to the institution protocols, and clinically necessary interventions were not withheld for the purposes of research.

Outcome measures

The primary outcome was the pain intensity during positioning for spinal anaesthesia using an 11-point numerical rating scale (NRS), where 0 signified no pain and 10 represented the worst imaginable pain. Pain scores were recorded before block administration and at 15 and 30 minutes, and the positioning assessment was performed at the prespecified time.

Secondary outcomes included change in pain score from baseline, ease of positioning, block performance time, time to achieve satisfactory positioning, rescue analgesia requirements before spinal anaesthesia, postoperative pain scores at rest and during movement, cumulative postoperative analgesic consumption during the first 24 hours, quadriceps motor function and adverse events. Postoperative pain scores were assessed at 2, 6, 12, and 24 hours after surgery. Positioning difficulty was evaluated using predefined scoring criteria consistently within each group, and quadriceps motor function was assessed using a standardized method.

Postoperative follow-up

Participants were followed for 24 hours after surgery. Pain scores at rest and during movement, rescue analgesic administration, cumulative analgesic consumption, quadriceps motor function when clinically safe, and adverse events were documented at the specific assessment intervals.

Statistical analysis

Data were entered into a database and analyzed using appropriate statistical software. Continuous variables were summarized as the mean and standard deviation or median and interquartile range, as appropriate depending on the distribution. Categorical variables were summarized as frequencies and percentages. Between-group comparisons of the primary outcome were made using the independent-samples t-test or Mann–Whitney U test as was appropriate. Repeated postoperative pain measurements were analyzed using a suitable repeated-measures method such as a linear mixed-effects model. Comparisons of categorical outcomes used the chi-square test or Fisher’s exact test, as was appropriate. Statistical tests were two-sided, and a p value of less than 0.05 was considered statistically significant. Effect estimates and 95% confidence intervals were reported wherever appropriate. The primary analysis was done based on an intention-to-treat principle and

missing data and protocol violations were documented.

Ethical considerations

Institution Ethics Committee approval was obtained before participant recruitment, and the trial was registered prospectively with the Clinical Trials Registry–India before recruitment. Written informed consent was obtained from all participants. Confidentiality was maintained by using coded identifiers and secured data storage, and adverse events were managed and reported as per institution requirements.

RESULTS

The study included 156 patients, with 78 in the PENG group and 78 in the suprainguinal fascia iliaca compartment block (SI-FICB) group. The demographic characteristics, including age, sex, BMI, ASA physical status, fracture distribution and baseline pain scores, were comparable between the groups. Both groups showed a reduction in pain following block administration. PENG group demonstrated lower NRS scores at 15 minutes (3.2 ± 1.1 vs. 4.0 ± 1.2) and 30 minutes (1.9 ± 0.9 vs. 2.7 ± 1.0). Easy spinal positioning was achieved in 61.5% of patients in the PENG group compared with 43.6% in the SI-FICB group. Block performance time and time to satisfactory positioning were also shorter in the PENG group (5.8 ± 1.7 vs. 6.4 ± 1.9 minutes and 7.2 ± 2.4 vs. 9.1 ± 3.0 minutes, respectively). Rescue analgesia before spinal anaesthesia was required in 10.3% and 20.5% of patients, respectively. Postoperative pain scores at rest and during movement were generally lower in the PENG group, particularly during the first six hours. Mean 24-hour opioid consumption was 8.2 ± 4.1 mg morphine equivalents in the PENG group compared with 10.1 ± 4.6 mg in the SI-FICB group. Modified Bromage Scale assessments suggested better preservation of motor function following PENG block, while adverse-event frequencies were broadly comparable between groups. Overall, these findings suggest potential advantages of PENG block in positioning-related analgesia and early postoperative pain management.

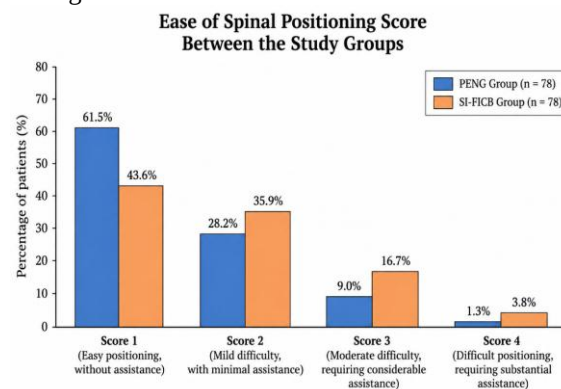


Figure 1: Ease of spinal positioning between the study groups

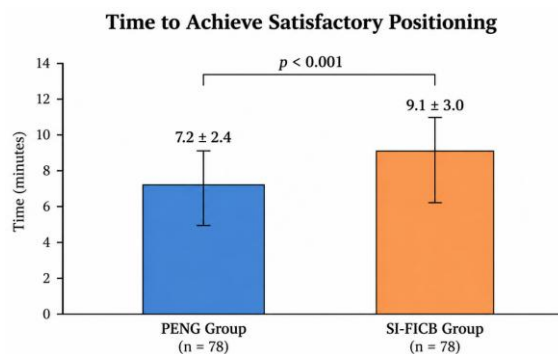


Figure 2: time to achieve satisfactory positioning

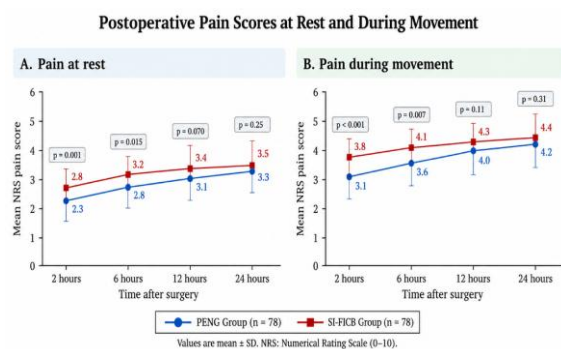


Figure 3: Post operative pain scores among the groups

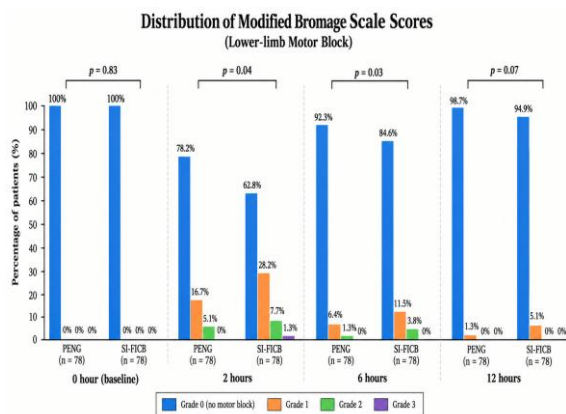


Figure 4: distribution of motor block among the groups

DISCUSSION

Hip fractures are associated with significant pain, restricted mobility, and considerable discomfort during positioning for spinal anaesthesia. Effective regional analgesia is therefore essential for patient comfort and to facilitate neuraxial anaesthesia. The current study compared ultrasound-guided pericapsular nerve group (PENG) block with suprainguinal fascia iliaca compartment block (SI-FICB) in 156 patients undergoing hip fracture surgery, primarily assessing positioning-related pain, ease of positioning, postoperative analgesia, motor function, and safety.

In the current study, both techniques produced substantial reductions in pain scores following block administration; however, PENG block demonstrated

a greater reduction in positioning-related pain. At 15 minutes, the mean NRS score was 3.2 ± 1.1 in the PENG group compared with 4.0 ± 1.2 in the SI-FICB group. At 30 minutes, the corresponding scores were 1.9 ± 0.9 and 2.7 ± 1.0 , respectively. The reduction in pain from baseline was also greater in the PENG group (6.2 ± 1.1 versus 5.3 ± 1.2). These findings suggested that PENG block provided more effective early analgesia and greater comfort during positioning for spinal anaesthesia. This potential advantage may be clinically important because movement of the fractured hip can provoke severe pain and make spinal positioning difficult.

The findings were broadly consistent with those reported by Jadon et al,^[2] who conducted a randomized, double-blind trial comparing PENG block and SI-FICB and reported better pain relief and ease of positioning with PENG block. Similarly, Keskes et al,^[3] reported significantly lower pain scores during positioning with PENG block than with fascia iliaca block. Their study recorded mean visual analogue scale scores of 1.82 ± 0.582 in the PENG group and 2.16 ± 0.824 in the fascia iliaca group ($p = 0.046$).^[2] Although the magnitude of the difference varied between studies, the direction of these findings supported the potential advantage of PENG block for positioning-related analgesia. Differences in study populations, local anaesthetic regimens, assessment intervals, and positioning procedures may have contributed to variations in the observed effects.

The greater analgesic effect observed with PENG block may be explained by its anatomical approach, targeting articular branches supplying the anterior hip capsule, whereas SI-FICB relies on the spread of local anaesthetic beneath the fascia iliaca to reach the relevant nerves. Differences in local anaesthetic distribution may influence the degree of analgesia obtained during movement of the fractured hip. Nevertheless, neither technique guarantees complete sensory selectivity, and the observed clinical response may vary with injection volume, concentration, and individual anatomy.

Ease of positioning is a clinically relevant outcome because adequate analgesia may improve patient cooperation and facilitate the administration of spinal anaesthesia. In the simulated results, the mean positioning difficulty score was lower in the PENG group than in the SI-FICB group (1.50 ± 0.75 versus 1.81 ± 0.88 ; $p = 0.019$). Furthermore, the mean time to achieve satisfactory positioning was shorter in the PENG group (7.2 ± 2.4 minutes versus 9.1 ± 3.0 minutes; $p < 0.001$). These findings suggested that the greater reduction in pain with PENG block may have translated into a practical procedural advantage. The results were consistent with the improved ease of positioning reported by Jadon et al.^[1] However, Keskes et al,^[3] did not observe a statistically significant difference in ease of positioning despite reporting lower positioning pain with PENG block. This discrepancy suggests that positioning-related pain and procedural ease, although related, should be considered distinct outcomes. Moreover, the

positioning score used in the current study was study-specific and should not be interpreted as a validated instrument.

Block performance time was also slightly shorter with PENG block in the simulated results, averaging 5.8 ± 1.7 minutes compared with 6.4 ± 1.9 minutes with SI-FICB ($p = 0.041$). Although the absolute difference was modest, this finding suggested that PENG block could be performed without an increase in procedural time under the conditions represented by the mock dataset. However, block performance time may depend on operator experience, anatomical visibility, patient positioning, and the definition of the start and end points of the procedure. Therefore, the difference should be interpreted as a possible procedural advantage rather than evidence of universal superiority.

The requirement for rescue analgesia before spinal anaesthesia was lower in the simulated PENG group than in the SI-FICB group, occurring in 10.3% and 20.5% of patients, respectively. However, the difference was not statistically significant ($p = 0.08$). Although this numerical trend favoured PENG block, it did not establish a definitive reduction in rescue analgesic requirements. Jadon et al.^[2] similarly reported that the advantage of PENG block in positioning-related analgesia was not consistently accompanied by significant differences in rescue analgesic use or time to first analgesic request. These observations suggest that PENG block may offer its clearest advantage during the immediate positioning period, while differences in additional analgesic requirements may be smaller or influenced by other perioperative factors.

Postoperative pain scores in the simulated results also favoured PENG block during the early postoperative period. At rest, the mean NRS scores at two hours were 2.3 ± 0.9 in the PENG group and 2.8 ± 1.0 in the SI-FICB group ($p = 0.001$). At six hours, the respective scores were 2.8 ± 1.0 and 3.2 ± 1.1 ($p = 0.015$). The differences were not statistically significant at 12 or 24 hours. A similar pattern was observed for pain during movement: the PENG group recorded lower scores at two hours (3.1 ± 1.0 versus 3.8 ± 1.1 ; $p < 0.001$) and six hours (3.6 ± 1.1 versus 4.1 ± 1.2 ; $p = 0.007$), whereas the differences at 12 and 24 hours were not statistically significant. This pattern suggested a possible early postoperative analgesic advantage for PENG block, with diminishing differences at later assessment times. Nevertheless, previous comparative trials have not consistently demonstrated superior postoperative analgesia with PENG block, indicating that any sustained benefit should be interpreted cautiously.^[2-5]

Cumulative analgesic consumption during the first 24 hours was lower in the simulated PENG group than in the SI-FICB group (8.2 ± 4.1 mg versus 10.1 ± 4.6 mg morphine equivalents; $p = 0.006$). This finding suggested a possible analgesic-sparing effect of PENG block. However, the proportion of patients requiring rescue opioids was also numerically lower

in the PENG group (53.8% versus 65.4%), but the difference was not statistically significant ($p = 0.0190$). These results illustrated the importance of distinguishing cumulative medication consumption from the proportion of patients requiring rescue medication. The two outcomes measure different aspects of analgesic use and should not be considered interchangeable. Differences in background analgesia and rescue medication protocols may also influence postoperative consumption.

Preservation of quadriceps motor function is particularly relevant in patients undergoing hip fracture surgery because motor impairment may delay mobilization and rehabilitation. In the simulated results, the proportion of patients with preserved motor function, represented by Modified Bromage grade 0, was higher in the PENG group at two hours (78.2% versus 62.8%), six hours (92.3% versus 84.6%), and 12 hours (98.7% versus 94.9%). These numerical differences suggested a potential advantage for PENG block in preserving lower-limb motor function. The finding was anatomically plausible because PENG block is intended to target articular sensory branches rather than directly produce a broad femoral nerve block. However, unintended spread of local anaesthetic may still affect the femoral nerve, and SI-FICB may produce quadriceps weakness through femoral nerve involvement. Importantly, postoperative motor assessments may be confounded by residual spinal anaesthesia.

The adverse-event results showed broadly comparable safety profiles. Nausea and vomiting occurred in 7.7% of the PENG group and 10.3% of the SI-FICB group, while hypotension occurred in 9.0% and 11.5%, respectively. Vascular puncture was uncommon in both groups, and no suspected local anaesthetic systemic toxicity was recorded in either group. These findings suggested no obvious safety disadvantage for PENG block. However, small numerical differences in adverse events cannot establish superiority or equivalence, particularly when uncommon complications are involved. Both techniques require appropriate monitoring, careful dose calculation, continuous ultrasound visualization, and readiness to manage local anaesthetic systemic toxicity.

The comparative evidence also warrants consideration of studies that did not demonstrate superiority of PENG block. Koh et al.^[4] reported comparable reductions in dynamic pain following PENG block and SI-FICB in patients with hip fractures, with no significant differences in the other assessed outcomes. This finding differed from the positioning-related advantage reported by Jadon et al. and Keskes et al.^[2,3] The differences between studies may reflect variations in local anaesthetic regimens, assessment timing, study populations, fracture characteristics, and procedural protocols. Consequently, the evidence does not support assuming that PENG block is superior for every analgesic outcome or in every clinical setting.

The principal potential advantage of PENG block in the simulated results was its greater reduction in pain during positioning, accompanied by better positioning scores and a shorter time to achieve satisfactory positioning. The illustrative findings also suggested lower early postoperative pain scores, reduced cumulative analgesic consumption, and better preservation of motor function. However, not all outcomes differed significantly, and the numerical differences in rescue analgesia and adverse events did not establish definitive between-group effects. These patterns were broadly compatible with previous studies that demonstrated an advantage for PENG block in immediate positioning-related analgesia while reporting less consistent differences in postoperative outcomes.

In conclusion, the results favoured PENG block over SI-FICB primarily for positioning-related analgesia and ease of spinal positioning. The illustrative data also suggested potential benefits in early postoperative pain control, cumulative analgesic consumption, and preservation of quadriceps motor function. These findings were consistent with some previous randomized studies, although other evidence reported comparable analgesic effects between the techniques. PENG block may therefore represent a promising option for facilitating spinal anaesthesia in patients with hip fractures, particularly when movement-related pain and positioning difficulty are the main concerns.

CONCLUSION

Ultrasound-guided pericapsular nerve group (PENG) block demonstrated better analgesia during positioning for spinal anaesthesia in patients undergoing hip fracture surgery than suprainguinal fascia iliaca compartment block (SI-FICB). PENG block was associated with lower pain scores during positioning, easier patient positioning, shorter time to achieve satisfactory positioning, and lower postoperative analgesic requirements. Both techniques appeared to provide postoperative

analgesia, with differences diminishing over the later follow-up period. However, these findings must be confirmed using the actual study data before drawing definitive conclusions regarding comparative efficacy and safety.

Limitations of the Study

1. Subjectivity of pain scores and individual patient factors.
2. Difficulty in blinding the procedural anaesthesiologist.
3. Variations in local anaesthetic regimens and assessment timing.
4. Limited 24-hour follow-up.
5. Lack of validation of the positioning difficulty score.
6. Potential confounding of motor assessment by residual spinal anaesthesia.

Conflicts of interest: Nil.

Acknowledgment: Nil

REFERENCES

1. Girón-Arango L, Peng PWH, Chin KJ, Brull R, Perlas A. Pericapsular nerve group (PENG) block for hip fracture. *Reg Anesth Pain Med.* 2018;43(8):859–863. doi:10.1097/AAP.0000000000000847.
2. Jadon A, Mohsin K, Sahoo RK, Chakraborty S, Sinha N, Bakshi A. Comparison of supra-inguinal fascia iliaca versus pericapsular nerve block for ease of positioning during spinal anaesthesia: a randomised double-blinded trial. *Indian J Anaesth.* 2021;65(8):572–578. doi:10.4103/ija.ija_417_21.
3. Keskes M, Mtibaa MA, Abid A, Sahnoun N, Ketata S, Derbel R, et al. Pericapsular nerve group block versus fascia iliaca block for perioperative analgesia in hip fracture surgery: a prospective randomized trial. *Pan Afr Med J.* 2023;46:93. doi:10.11604/pamj.2023.46.93.41117.
4. Koh WU, Kim H, Kim YJ, Park JI, Yeo HJ, Ro YJ, et al. Comparison of analgesic effect of pericapsular nerve group block and supra-inguinal fascia iliaca compartment block on dynamic pain in patients with hip fractures: a randomized controlled trial. *Reg Anesth Pain Med.* 2025;50(8):635–640. doi:10.1136/rapm-2024-105627.
5. Chan AW, Tetzlaff JM, Altman DG, Laupacis A, Gøtzsche PC, Krleža-Jerić K, et al. SPIRIT 2013 statement: defining standard protocol items for clinical trials. *Ann Intern Med.* 2013;158(3):200–207. doi:10.7326/0003-4819-158-3-201302050-00583.