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Original Research Article

Pericapsular nerve group (PENG) block vs femoral nerve block for pain control during spinal anaesthesia in hip surgeries- A randomized prospective trial

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Abstract

Background and Aims: Hip fractures have a high incidence in the elderly population, often requiring surgical intervention under spinal anaesthesia. Achieving optimal patient positioning for this procedure is challenging due to severe pain, and effective analgesia is crucial for its success. This study aimed to compare the efficacy of the Pericapsular Nerve Group (PENG) block versus the Femoral Nerve Block (FNB) in providing analgesia for patient positioning during spinal anaesthesia for hip surgeries.

Materials and Methods: In this prospective, double-blind, randomized controlled trial, 80 patients scheduled for hip surgery were allocated using a computer-generated sequence to receive either a PENG block or an FNB (n=40 per group). Both groups received 20 mL of 0.25% bupivacaine 30 minutes before spinal anaesthesia. The primary outcome was the Visual Analog Scale (VAS) score during positioning. Secondary outcomes included the number of assistants required, time to perform the spinal block, duration of analgesia, time to mobilisation, patient satisfaction, and complications**.**

Results: The VAS score during positioning was significantly lower in the PENG group (1.93 ± 0.73) compared to the FNB group (3.35 ± 0.58) (p=0.001). Significantly fewer assistants were required for positioning in the PENG group. Furthermore, the PENG group demonstrated a shorter time to perform spinal anaesthesia, a longer duration of analgesia, earlier mobilization, and higher patient satisfaction, with no reported complications**.**

Conclusion: The PENG block provides superior analgesia to the FNB for patient positioning during spinal anaesthesia in hip surgery. This results in a significantly reduced requirement for assistance and lower patient pain scores. The PENG block also facilitates a better recovery profile, including prolonged analgesia and earlier mobilisation.

Keywords: Pericapsular nerve group (PENG) Block; Femoral nerve block; Spinal anaesthesia; Hip fracture; Analgesia.

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1. Introduction

Hip fractures are a significant public health concern, associated with high one-year mortality rates (over 40%) and substantial patient morbidity, thereby imposing a considerable burden on healthcare systems.[1] Spinal anaesthesia is a common technique for hip surgeries, such as total hip replacements and fracture repairs, offering benefits like reduced mortality and faster recovery compared to general anaesthesia.[2] However, its application is challenged by difficulties in patient positioning and effective perioperative pain management. Inadequate pain control, due to individual variability in anatomy and anaesthetic efficacy, can lead to patient discomfort, the need for supplemental analgesics, and potentially prolonged hospital stays.[2-4]

Preoperative analgesia is, therefore, critical to optimize the surgical experience. Effective analgesia facilitates optimal patient positioning for the neuraxial block, minimizes intraoperative pain and anxiety, and can improve overall recovery outcomes.[5] In this context, regional nerve blocks have emerged as a valuable strategy. Techniques such as the fascia iliaca compartment block and the femoral nerve block (FNB) target specific nerves to provide analgesia while reducing opioid consumption.[6,7] More recently, the

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pericapsular nerve group (PENG) block has been introduced as a novel approach that potentially offers superior coverage of the anterior hip capsule.[8]

Positioning for spinal anaesthesia in hip fracture patients remains a specific and significant challenge. While previous studies, such as the one by Chaudary et al., have compared the PENG block and FNB, their primary objectives focused on postoperative pain reduction and ease of positioning scores.[9] This study aimed to provide a more rigorous, direct comparison of the PENG block versus the FNB, specifically for facilitating patient positioning during spinal anaesthesia. The present study employed a double-blinded design with a standardized drug protocol and quantitatively assesses outcomes using Visual Analog Scale (VAS) scores at defined intervals and the number of assistants required for positioning, thereby addressing gaps in the existing literature.

2. Materials and Methods

A prospective, double-blinded, randomized controlled trial was conducted from November 2023 to December 2024 following approval from the institutional ethical committee (IHEC No. AV/IHEC/2023/032) and was registered with the Clinical Trials Registry - India (CTRI/2023/11/059548). Eighty patients scheduled for hip surgery were randomly allocated into two groups using a computer-generated sequence, with allocation concealed in sealed opaque envelopes. Participants included adults aged 18-80 years with ASA physical status I-III. Exclusion criteria were patient refusal, local anaesthetic allergy, hemodynamic instability, and bleeding disorders.

The sample size of 80 (40 per group) was calculated based on a mean difference in pain scores of 2.5 with a standard deviation of 3 from a similar study Lin et al.,[11] requiring 40 patients per group to achieve 90% power with an alpha error of 0.05. Randomization was performed using computer generated randomization to assign patients to either the PENG block or FNB group (50% each) and sealed opaque envelopes were used for concealment in patient allocation. Blinding was achieved by ensuring the anaesthesiologists who collected the data were unaware of the type of nerve block procedure. Patients were also blinded to the nerve block technique which they received. While the performing anaesthesiologist was not blinded due to the nature of the intervention, the patients and the anaesthesiologists responsible for all outcome assessments were blinded to group assignment. After informed consent, patients received standard pre-anaesthetic preparation. On the day of surgery, under ultrasound guidance, one group received a pericapsular nerve group block and the other received a femoral nerve block, both with 20 mL of 0.25% bupivacaine, by experienced anaesthesiologist in pain blocks.

Pain was assessed using a Visual Analog Scale at baseline, 15 minutes, 30 minutes post-block, and during positioning for spinal anaesthesia. The primary outcome were the VAS pain scores during positioning for spinal anaesthesia and the number of assistants required for positioning. Secondary outcomes included the time to perform spinal anaesthesia, duration of analgesia, 24-hour analgesic requirement (rescue analgesia- IV Tramadol 1mg/kg), time to mobilisation, patient satisfaction assessed via a Likert scale, and complications. (**Figure 1*)***

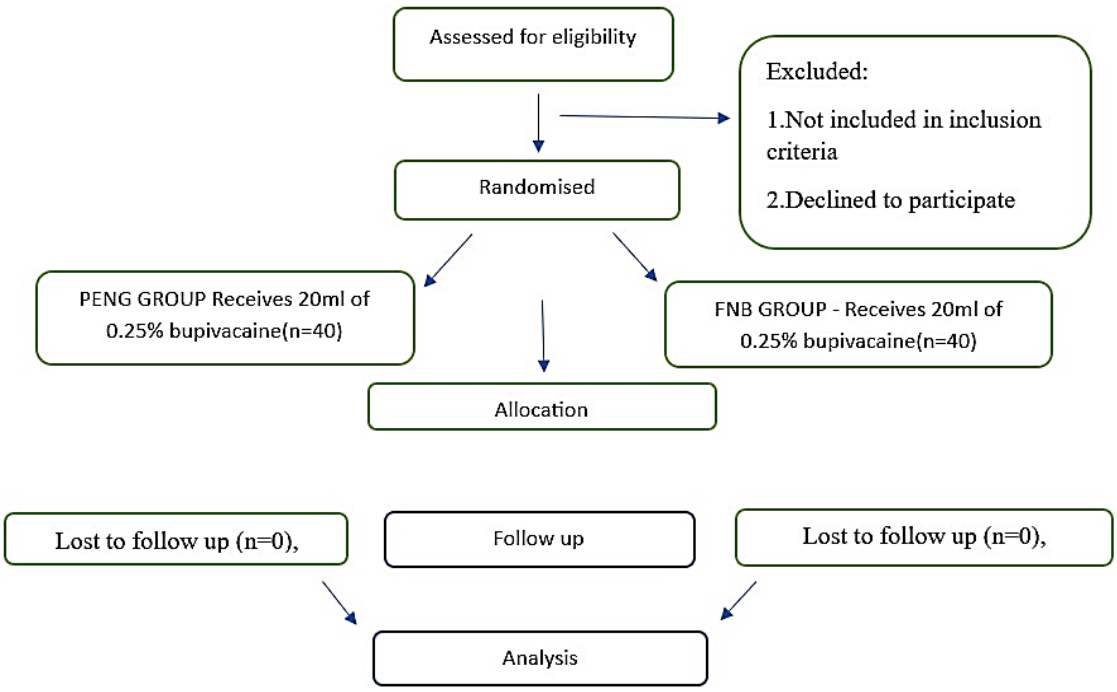

Figure 1: Consort for study

Statistical analysis was performed using SPSS software, version 29.0. Continuous variables are presented as mean with standard deviation, while categorical variables are summarized as frequencies and percentages. The normality of the distribution for Visual Analog Scale scores was formally assessed using the Kolmogorov-Smirnov test. As this test indicated a significant deviation from normality, the non-parametric Mann-Whitney U test was employed for the comparison of VAS scores between the two groups. For the comparison of categorical variables, such as American Society of Anaesthesiologists physical status grades, the Chi-square test was utilized. A p-value of less than 0.05 was considered to indicate statistical significance for all tests.

3. Results

The baseline demographic and clinical characteristics were comparable between the two study groups, confirming successful randomization (**Table 1** and **Table 2**). The mean operative duration was 114.29 minutes (SD 5.32) and did not differ significantly between the groups, indicating that the type of nerve block did not influence surgical time.

Analysis of pain scores revealed that while both groups had similar Visual Analog Scale scores at baseline, the PENG block group demonstrated statistically significant reductions in pain at 15 minutes, 30 minutes, and during the critical period of positioning for spinal anaesthesia (**Figure 2**). This superior analgesia had a direct clinical impact, resulting in a significantly lower number of assistants required for patient positioning in the PENG block group compared to the FNB group (p = 0.01) (**Figure 3**).The benefits of the PENG block extended to procedural efficiency and postoperative recovery The time taken to perform spinal anaesthesia was significantly shorter in the PENG group (2.03 ± 0.16 minutes) than in the FNB group (2.45 ± 0.5 minutes; p = 0.001).

Patients received PENG block showed increased duration of analgesia than FNB (9.65 ± 0.7hrs vs 7.25 ± 0.81, (p = 0.001), with the average analgesic effect lasting 8.4 ±1.42) hours across both groups. Moreover, during the initial 24-hour postoperative period, the total consumption of analgesics was less in PENG group, a difference that reached statistical significance. Functional recovery was also enhanced, with the PENG block group mobilising at an average of 12.54 hours post-intervention, notably earlier than the FNB group's average of 15 hours. Also, patient satisfaction scores were significantly higher in the PENG block group, and no procedural or block-related complications were recorded in either cohort (**Table 3**).

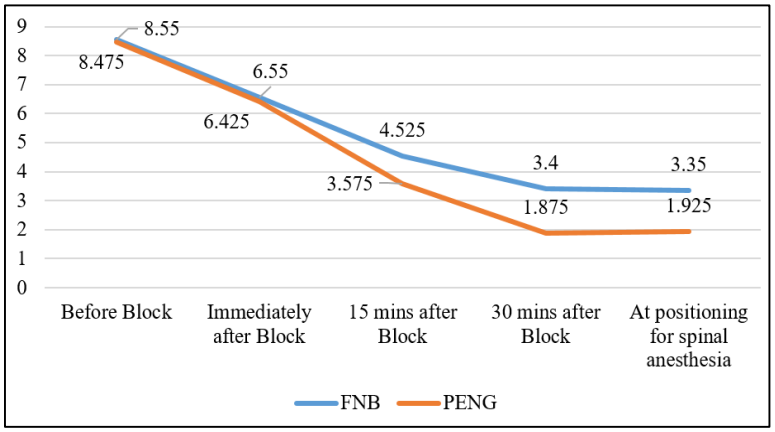

Figure 2: Comparison of VAS score - PENG and FNB group

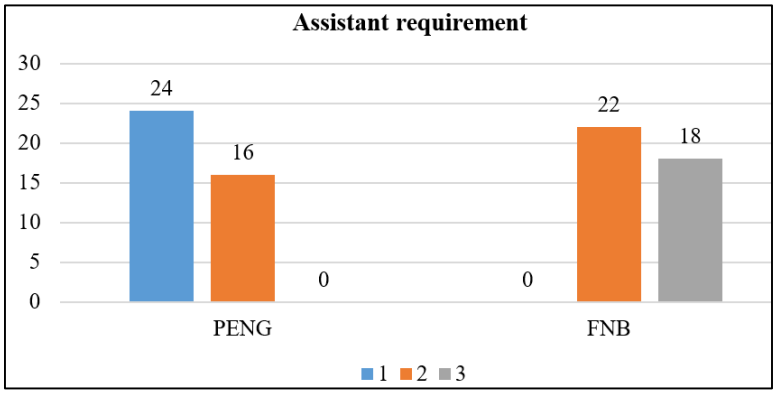

Figure 3: Comparison of number of assistants required in PENG block and FNB group

Table 1: Demographic characteristics of the study population

Parameters	PENG block group	Femoral Block Group	p-value
Age (years)	65.025 ± 10.65	62.175 ± 13.73	0.527[#]
Gender (M: F)	15: 25	22: 18	0.117[$]
Weight (kg)	59.5 ± 6.95	58.95 ± 6.48	0.681[#]
Height (cm)	162.58 ± 6.72	162.15 ± 7.298	0.787*
ASA Physical status (1:2:3)	9:26:5	13:23:4	**0.599**

Table 2: Baseline haemodynamic parameters between the PENG block and FNB group

Variables	PENG		FNB		Overall		p-value
	Mean	SD	Mean	SD	Mean	SD	
Pulse rate	100.650	19.129	98.750	8.938	99.7	14.87	0.907[#]
SpO_2	98.500	0.506	98.475	0.506	98.49	0.5	0.828[#]
Systolic BP	130.20	13.875	133.45	10.318	131.82	12.26	0.104[#]
Diastolic BP	72.70	9.163	77.300	13.88	75	11.92	0.187[#]
[#] Mann- Whitney U Test							

Table 3: Perioperative outcomes following spinal anaesthesia with FNB and PENG techniques

	Overall		PENG		FNB		p-value
Variables	Mean	SD	Mean	SD	Mean	SD	
Time to perform spinal anaesthesia block (in Mins)	2.24	0.43	2.025	0.158	2.450	0.504	< .00001
Post operative analgesia time (in hrs)	8.45	1.42	9.650	0.700	7.250	0.809	< .00001
Total Number of analgesia required in 1st 24 hrs	3.39	1.29	2.250	0.670	4.525	0.506	< .00001
Early mobilization time (in hrs)	12.54	2.69	10.075	1.141	15.000	0.934	< .00001
Patient Satisfaction Score	3.42	1.08	4.350	0.580	2.500	0.506	< .00001

4. Discussion

The findings of this study demonstrate that while both the Pericapsular Nerve Group (PENG) block and the Femoral Nerve Block (FNB) provide effective analgesia, the PENG block offers a clinically superior profile for facilitating spinal anaesthesia in hip surgery patients. The comparable baseline pain scores ($p = 0.508$) and immediate post-block relief ($p = 0.805$) between groups validate an unbiased comparison, with the significant advantages of the PENG block emerging from 15 minutes post-procedure and persisting through the critical period of positioning for spinal anaesthesia ($p < 0.01$). This enhanced analgesia during positioning is a key clinical benefit, as it directly impacts patient comfort and the ease of performing the neuraxial block.

The findings of the current study are consistent with a growing body of literature supporting the efficacy of the PENG block. Chaudhary et al. directly compared the two techniques and reported a statistically greater median pain reduction at 30 minutes post-block in the PENG group (6 [IQR 5–7]) compared to the FNB group (5 [IQR 5–6]), with a p-value of 0.004.[9] While both groups in their study showed similar ease-of-sitting-position scores and a high proportion of patients able to sit with no or mild pain (96.6% PENG vs. 93.3% FNB), the PENG block demonstrated a more favourable postoperative profile, including less quadriceps muscle weakness and a statistically significant extension of analgesic duration.[9] This aligns with the results of Ela Erten et al., who also documented lower VAS scores in the PENG group, specifically noting less pain during repositioning into the lateral decubitus position and during hip flexion.[10]

Further corroborating these results, the work of Lin et al. confirms the superior analgesic profile of the PENG block, showing that patients experienced less discomfort during the first 24 hours post-surgery compared to those who received an FNB.[11] Critically, their research also objectively demonstrated the motor-sparing advantage of the PENG block, using Oxford muscle strength grading to confirm significantly better preservation of quadriceps muscle strength both in the recovery ward and on the first post-operative day. [11] This collective evidence strongly positions the PENG block as a technique that provides not only superior analgesia but also a functional advantage that may facilitate earlier recovery.

In our study, analgesia lasted an average of 8.45 hours (SD = 1.42). Whereas the mean duration of analgesia was substantially longer in the PENG group had a significantly

longer duration than in the FNB group ($p < 0.001$). These results are in line with those of Jeevindran et al.,[12] who found that the PENG block for subarachnoid blockade increased anaesthesiologists' satisfaction. In our study, the PENG patients (63%) experienced much less pain in sitting posture while attempting the regional spinal technique than the FNB patients (26%). Moreover, the FNB group required rescue analgesia (IV Tramadol) more frequently (25.7%) during post-surgical period.

The prolonged analgesic effect of the PENG block was further evidenced by the reduced need for supplemental pain medication. During the first postoperative day (POD), patients who received a Femoral Nerve Block (FNB) required rescue analgesia four to five times more frequently than those in the PENG block group, highlighting the more effective and sustained pain control provided by the PENG technique. This comparative efficacy is consistent with studies that have evaluated the PENG block against the Fascia Iliaca Compartment Block (FICB). While both regional techniques effectively reduce Numeric Rating Scale (NRS) pain scores, the PENG block has been shown to provide superior and more immediate pain relief at rest, reflected in significantly lower post-procedure Visual Analog Scale (VAS) scores (13-16). Both blocks led to significant pain reduction at rest and during mobility, with the PENG block associated with a notably higher ease of patient positioning for spinal anaesthesia. Although one study noted a lower NRS score at rest at the 12-hour mark for the PENG group, it found little difference in the time to first analgesic request or the total 24-hour pain reduction, suggesting that the primary advantage of the PENG block may be its speed of onset and quality of initial analgesia, providing better and faster pain relief compared to FICB.[13-16]

Patient satisfaction with pain management was formally assessed, revealing a significantly higher mean satisfaction score in the PENG block group (4.35) compared to the FNB group (2.5). This substantial disparity indicates that the PENG block leads to more favourable patient perceptions of their perioperative experience, a finding corroborated by the meta-analysis of Huda et al.[17] and supported by other clinical studies.[11,18,19]

The credibility of these findings is strengthened by the rigorous methodology employed. This study was conducted as a prospective, double-blinded, randomized clinical trial. The double-blind design, in which neither the patients nor the evaluating anaesthesiologist was aware of the assigned nerve block, was implemented to minimize assessment bias. Moreover, the use of standardized outcome measures, including Visual Analog Scale scores, the number of assistants required for positioning, and the time taken to perform spinal anaesthesia, alongside predefined protocols, enhanced the objectivity, consistency, and reproducibility of the results.

Notwithstanding these strengths, several limitations must be acknowledged. The single-centre design may limit the generalizability of the findings to other clinical settings. While an effort was made to blind participants and outcome assessors, the anaesthesiologist performing the nerve block was not blinded to the group assignment, which introduces a potential source of performance bias. The study's focus was on immediate perioperative outcomes; therefore, long-term effects and functional recovery were not evaluated. Finally, the efficacy of the blocks could be influenced by unmeasured confounding factors, such as individual anatomical variations and the subjective nature of pain perception.

5. Conclusion

The PENG block demonstrates superior analgesic efficacy compared to the femoral nerve block for hip fracture surgery. It provides significantly better pain control during patient positioning for spinal anaesthesia, reduces the need for assistant staff, and prolongs postoperative analgesia. These benefits result in lower opioid consumption, facilitated early mobilisation, and higher patient satisfaction. Future studies should evaluate the long-term functional outcomes and cost-effectiveness of the PENG block in multi-centre settings.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Rath S, Yadav L, Tewari A, Chantler T, Woodward M, Kotwal P, et al. Management of older adults with hip fractures in India: a mixed methods study of current practice, barriers and facilitators, with recommendations to improve care pathways. *Arch Osteoporos*. 2017;12(1):55. https://doi.org/10.1007/s11657-017-0344-1.
2. Neuman MD, Feng R, Carson JL, Gaskins LJ, Dillane D, Sessler DI, et al. Spinal anesthesia or general anesthesia for hip surgery in older adults. *N Engl J Med*. 2021;385(22):2025–35. https://doi.org/10.1056/NEJMoa2113514.
3. Costa F, Del Buono R, Agrò FE, Tambone V, Vitali AM, Ricci G. thoracic unilateral spinal cord injury after spinal anaesthesia for total hip replacement: Fate or mistake? *Turk J Anaesthesiol Reanim*. 2017;45(2):116–8. https://doi.org/10.5152/TJAR.2016.32967.
4. Slaven SE, Dedeogullari ES, Parks NL, Sershon RA, Fricka KB, Hamilton WG. Spinal anesthesia for primary hip and knee arthroplasty: comparative rates of transient neurological symptoms and urinary retention using lidocaine, mepivacaine, and bupivacaine. *J Arthroplasty*. 2023;38(6S):S42–S46. https://doi.org/10.1016/j.arth.2023.03.036.
5. Min B-W, Kim Y, Cho H-M, Park K-S, Yoon PW, Nho J-H, et al. Perioperative pain management in total hip arthroplasty: korean hip society guidelines. *Hip Pelvis*. 2016;28(1):15–23. https://doi.org/10.5371/hp.2016.28.1.15.
6. Ramadanov N, Marinova-Kichikova P, Hable R, Dimitrov D. Minimally invasive versus conventional approaches in total hip arthroplasty: A systematic review and meta-analysis of 47 randomized controlled trials. *Prosthesis*. 2023;5(3):962–91. https://doi.org/10.3390/prosthesis5030067
7. Anger M, Valovska T, Beloeil H, Lirk P, Joshi GP, Van de Velde M, et al. PROSPECT guideline for total hip arthroplasty: a systematic

review and procedure-specific postoperative pain management recommendations. *Anaesthesia.* 2021;76(8):1082–97. https://doi.org/10.1111/anae.15498.

8. Niyonkuru E, Iqbal MA, Zeng R, Zhang X, Ma P. Nerve blocks for post-surgical pain management: A narrative review of current research. *J Pain Res.* 2024;17:3217–39. https://doi.org/10.2147/JPR.S476563.
9. Chaudhary K, Bose N, Tanna D, Chandnani A. Ultrasound-guided pericapsular nerve group (PENG) block versus femoral nerve block for positioning during spinal anaesthesia in proximal femur fractures: A randomised comparative study. *Indian J Anaesth.* 2023;67(10):913-19. https://doi.org/10.4103/ija.ija_553_23.
10. Erten E, Kara U, Şimşek F, Eşkin MB, Bilekli AB, Öcal N, et al. Comparison of pericapsular nerve group block and femoral nerve block in spinal anesthesia position analgesia for proximal femoral fractures in geriatric patients: a randomized clinical trial. *Ulus Travma Acil Cerrahi Derg*. 2023;29(12):1368–75. https://doi.org/10.14744/tjtes.2023.33389.
11. Lin DY, Morrison C, Brown B, Saies AA, Pawar R, Vermeulen M, et al. Pericapsular nerve group (PENG) block provides improved short-term analgesia compared with the femoral nerve block in hip fracture surgery: a single-center double-blinded randomized comparative trial. *Reg Anesth Pain Med.* 2021;46(5):398–403. https://doi.org/10.1136/rapm-2020-102315.
12. Jeevendiran A, Suganya S, Sujatha C, Rajaraman J, Surya R, Asokan A, et al. Comparative evaluation of analgesic efficacy of ultrasound-guided pericapsular nerve group block and femoral nerve block during positioning of patients with hip fractures for spinal anesthesia: A prospective, double-blind, randomized controlled study. *Cureus.* 2024;16(3):e56278. https://doi.org/10.7759/cureus.56270.
13. Farag A, Hendi NI, Diab RA. Does pericapsular nerve group block have limited analgesia at the initial post-operative period? Systematic review and meta-analysis. *J Anesth.* 2023;37(1):138–53. https://doi.org/10.1007/s00540-022-03129-5.
14. 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):572–78. https://doi.org/10.4103/ija.ija_417_21.
15. 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. https://doi.org/10.11604/pamj.2023.46.93.41117.
16. Baheti S, Yerramshetty M, Baheti DS. Ultrasound-guided fascia iliaca block versus pericapsular nerve group block before positioning for spinal anesthesia in patients undergoing surgery for neck of femur fracture: A comparative study. *Cureus.* 2024;16(8):e64337. https://doi.org/10.7759/cureus.68173.
17. Huda AU, Ghafoor H. The use of pericapsular nerve group (PENG) block in hip surgeries is associated with a reduction in opioid consumption, less motor block, and better patient satisfaction: a meta-analysis. *Cureus.* 2022;14(9):e28887. https://doi.org/10.7759/cureus.28872.
18. Scanaliato JP, Christensen D, Polmear MM, Salfiti C, Gaspar PS, Wolff AB. Prospective single-blinded randomized controlled trial comparing pericapsular injection versus lumbar plexus peripheral nerve block for hip arthroscopy. *Am J Sports Med.* 2020;48(11):2740–6. https://doi.org/10.1177/0363546520943580.
19. Zheng J, Pan D, Zheng B, Ruan X. Preoperative pericapsular nerve group (PENG) block for total hip arthroplasty: a randomized controlled trial. *Reg Anesth Pain Med*. 2022;47(3):155–60. https://doi.org/10.1136/rapm-2021-103228.

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