Indian Journal of Clinical Anaesthesia 2024;11(4):530–537

Content available at: https://www.ipinnovative.com/open-access-journals

Indian Journal of Clinical Anaesthesia

Journal homepage: www.ijca.in

Original Research Article

Ultrasound-guided pericapsular nerve group block for postoperative analgesia following hip arthroplast

Khagol Bhatnagar[1], **Rohan Bhatia**[1]*, **Rajiv Bhandari**[2], **Faiz Akbar Siddiqui**[1]

[1] *Dept. of Anesthesiology, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India*
[2] *Kailash Deepak Hospital, Delhi, India*

ARTICLE INFO

Article history:
Received 09-07-2024
Accepted 12-08-2024
Available online 07-11-2024

Keywords:
Pericapsular nerve group block (PENG)
Hip arthroplasty
Numerical rating scale (NRS)
Patient- controlled analgesia (PCA)

ABSTRACT

Background: Our objective was to evaluate postoperative analgesia after ultrasound-guided Pericapsular nerve group block (PENG) in patients undergoing hip arthroplasty surgeries.
Aims and Objective: To compare total post operative analgesic consumption between the two groups and to evaluate patient satisfaction using Likert Scale and Compare adverse effects and complications if any.
Materials and Methods: In this study, two groups of fifty-six hip arthroplasty patients, each with 28 patients, were created. Subarachnoid Block (SAB) was administered to each group using 3 milliliters of 0.5% hyperbaric bupivacaine. PENG block was administered to Group A patients following SAB. Group B did not receive any blocks. Tramadol was given to both groups in the PACU (Postanesthesia Care Unit) as part of a PCA (Patient Controlled Analgesia). The Numerical Rating Scale (NRS) was used to measure pain. Postoperative data also included the total amount of tramadol taken within the first 24hrs, as well as the timing of the first need for an analgesic.
Results: There was no appreciable difference observed between the two groups concerning demographic information, surgical type, or length of surgery. In the first 24 hours, the PENG Block group had significantly low NRS pain scores ($P < 0.001$). The control group consumed significantly more tramadol (348.93 ± 39.00) than the PENG group (237.14 ± 39.89) mg. Similarly, the control group's first analgesic requirement in the PACU occurred significantly earlier (56.79 ± 31.038 min) than the block group's (87.62 ± 42.08 min).
Conclusions: The combination of PENG block + PCA Pump with Tramadol demonstrated advantage over PCA Pump with Tramadol alone regarding the management of pain, reduced analgesic consumption, & higher patient satisfaction suggesting its potential utility in improved postoperative pain management.

1. Introduction

Hip surgeries are primarily performed on patients in their late sixties or older due to an increase in life expectancy. A sizeable portion of these patients have moderate to severe pain following surgery.[1,2] Because hip surgery patients must be able to walk early—ideally the day of the procedure—in order to prevent complications, it is challenging to provide them with appropriate postoperative pain relief.[3] Post-operative pain after hip surgery can range from mild, to moderate to severe. Due to excessive post-operative pain, there may be a delay in recovery, which increases the stay in the hospital and can lead to mental and emotional impairment. Peripheral nerve blocks have demonstrated effectiveness in reducing opioid consumption after major surgeries involving other joints.[4–6] However, performing regional anesthesia for the hip is complex due

* *Corresponding author.*
E-mail address: rohanbhatia789@gmail.com (R. Bhatia).

https://doi.org/10.18231/j.ijca.2024.096

to the existence of multiple mixed sensory-motor nerves originating from the lumbosacral plexus.[6]

PENG block is the latest technique used for hip surgeries which is gaining massive popularity due to its involvement of, the obturator nerve and motor-sparing capability. Giron-Arango first described "the Pericapsular Nerve Group (PENG) block under ultrasound guidance. It reduces motor impairment and speeds up mobilization by blocking the obturator, femoral, and accessory branches of the obturator nerve, which innervate the hip joint's anterior capsule.[7,8] The musculo-fascial plane, which is bordered by the pubic ramus posteriorly and the psoas tendon anteriorly, is the target site of the block. While the patient is in a supine position, the ultrasonography probe is first positioned across the anterior superior iliac spine in the transverse plane. After that, it is turned 45 degrees counterclockwise. Before the needle is inserted, the psoas tendon, iliopubic eminence, pectinous muscle, and femoral artery are visible. The drug is injected between the psoas tendon and the pubic ramus in the musculo-facial plane.[8,9] Thanks to developments in ultrasound guidance, there is now a modality called the Pericapsular Nerve Group (PENG) Block" that can provide a sensory block to all three nerves at a single injection site.[10]

Our goal in this study was to evaluate the analgesia following hip arthroplasty using ultrasound-guided PENG block.

2. Materials and Methods

This was an active-controlled trial that was randomized and parallel group. The study was authorized by the institute's ethical committee (SRHU/HIMS/ETHICS/2023/113) and carried out in a tertiary care facility in 2023–2024. Clinical Trial Registry India (CTRI acknowledgment number CTRI/2023/10/058678 [Registered on: 16/10/2023]) has the study registered. Every patient on the waiting list for an elective hip arthroplasty gave their written, informed consent.

In the study, 56 patients of both sexes, ages 20 to 70, and "American Society of Anaesthesiology" (ASA) Grades 1 and 2 were enrolled. The sample size was calculated based on the primary outcome the Numeric Rating Scale (NRS) score at 24 hours post operative. Based on the previous studies done by Julián Aliste et al. and Lin DY,[11,12] the average NRS in no block group (control group) at post operative 24 hours was 6 with standard deviation of 2 units. Anticipated a reduction of 25% in NRS score at post operative 24 hours with PENG block taking 80% power and 5% level of significance with 1:1 ratio and 2-sided, we required a sample 28 subjects per arm, so a total of 56 subjects were needed for this study.

The research excluded individuals with severe liver and kidney disease, allergies to local anesthetics, bleeding disorders, local site infections, patients taking anticoagulants, patients unable to give informed consent, individuals refusing regional anesthesia, individuals incapable of operating a PCA system, and individuals suffering from psychiatric disorders. (Diagram 1)

Prior to surgery, "eligible patients were kept on a 6-hrs fast for solid food and a 2-hrs fast for clear fluid. Prior to surgery, patients were prescribed 150 mg of ranitidine and 25 mg of alprazolam tablets at bedtime and two hours prior to the procedure. Every patient received an explanation of the anesthetic process & the meaning of the NRS in the preoperative room. Standard monitoring, including noninvasive BP, ECG, and SpO2 (oxygen saturation), was recorded in the operating room following the establishment of intravenous access. The patients were split into two groups: Group B, which served as the control group, did not receive any block, and Group A received a PENG block. For each group, twenty-eight patients were assigned. Following enrollment, blinding was established using a computer-generated number sequence housed in an opaque envelope with sequential numbers. The nurse who collected the data and the patients" who took part in the study were both kept in the dark about the intervention. (Diagram 1) displays a CONSORT flow diagram for this investigation.

A 29-G spinal needle placed intrathecally at the L3–4 or L4-5 intervertebral level in the median approach was used to administer spinal anesthesia to each patient. Also injected were three milliliters of hyperbaric 0.5% bupivacaine. After that, the patient was immediately put to sleep. An ultrasound-guided PENG block was performed by a certified anesthesiologist with over a year of experience using ultrasound imaging for nerve blocks after the patient had reached a sufficient level of anesthesia. The ultrasonic device used was the M TURBO. FUJIFILM Sonosite, Inc., 21919 Bothell, WA 98021 USA. Using a Curvilinear 2-5 MH US probe, the block surgical procedure was initiated.

The curvilinear probe ultrasound was kept on the femoral crease and pushed superiomedially towards the pubic ramus. The femoral artery, pectinius muscle, "iliopsoas muscle and tendon, and iliopubic eminence were visible prior to the needle's insertion. An in-plane approach was used to puncture the wound lateromedially using a 10cm SonoPlex STIM 22 gauge needle. In the area between the iliopsoas muscle and the pubic ramus, 20ml of Ropivacaine 0.5% local anesthetic was injected after a negative aspiration test." On the ultrasound, we observed the local anesthetic lifting up the iliopsoas muscle. No block was given in the control group.

After surgery, patients were transfered to the Post Anesthesia Care Unit (PACU) where standard variables such as SpO2, heart rate, and blood pressure (systolic, diastolic, and mean) were recorded and monitored. Pain levels were evaluated using the Numeric Rating Scale (NRS) 20 minutes after the block, with further assessments at 30 minutes, 2, 4, 6, 12, 18, and 24 hours postoperatively. To enhance analgesia, a tramadol Patient-Controlled

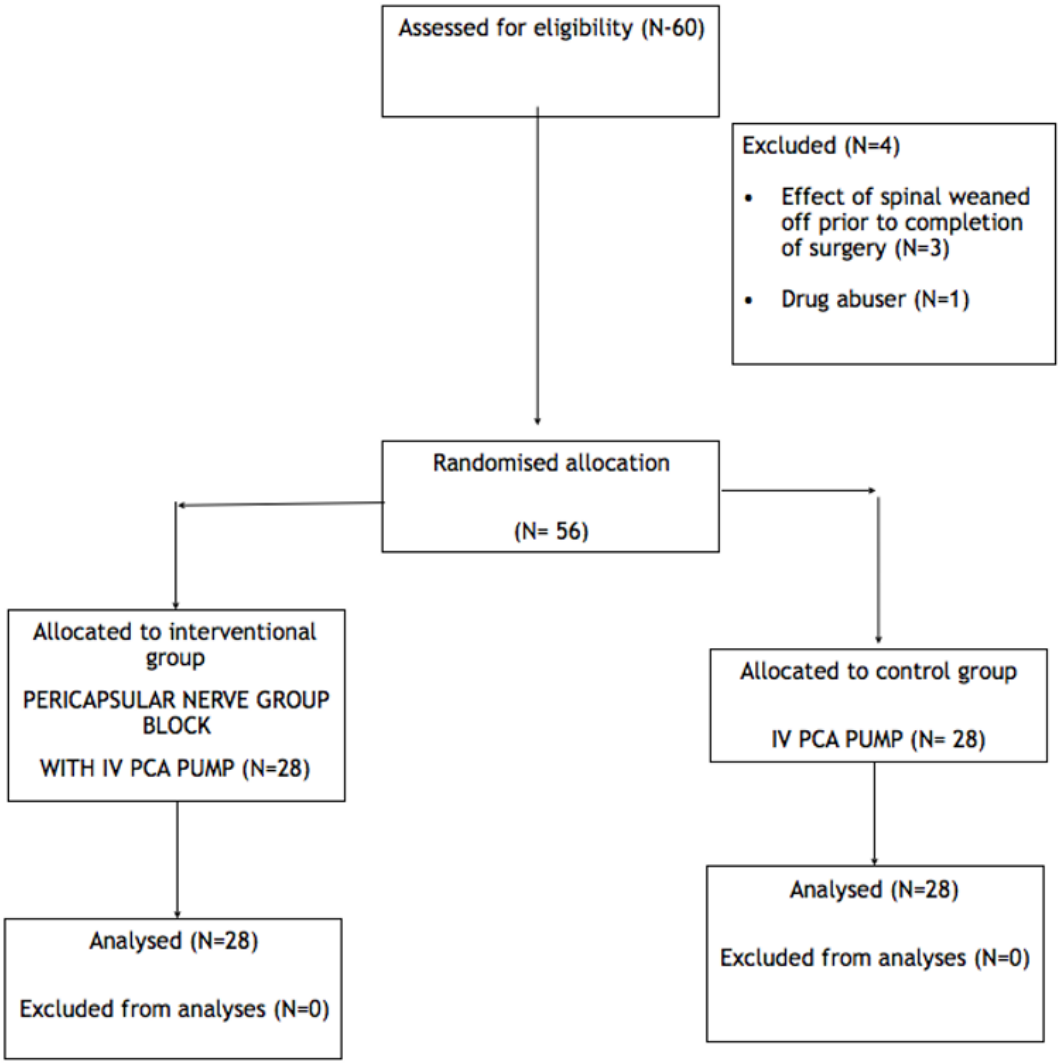

Diagram 1: Flow diagram for study

Analgesia (PCA) pump was used, allowing patients to self-administer tramadol as needed. The PCA pump delivered 20 mg of tramadol on demand with a 20-minute lockout period. If pain persisted after tramadol administration, an intravenous dose of 1 g of paracetamol was provided as a rescue analgesic. The first analgesic demand and the total amount of tramadol consumed over the first 24 hours post-surgery were recorded.

The primary outcome of the statistical analysis was the NRS score, which ranges from 0 (no pain) to 10 (worst pain imaginable), with higher scores indicating worse pain. The secondary outcome variables included total opioids consumed in a 24-hour period, the time to the first analgesic request within 24 hours (interval between the block administration and the patient's first request for analgesia), adverse effects related to opioids within the first 24 hours, and patient satisfaction on the first postoperative day, measured using a Likert-scale questionnaire.

2.1. Statistical analysis

Data analysis was conducted using SPSS version 25. Continuous variables are presented as mean (standard deviation) or median (interquartile range), depending on the distribution of the data. Categorical variables are reported as frequencies and percentages. For the primary outcome, the NRS score at 24 hours, comparisons between the PENG block and non-PENG block groups were performed using the unpaired Student's t-test if the data were normally distributed. If the data were not normally distributed, the Mann-Whitney U test was applied.

Secondary outcomes, including the total amount of tramadol administered and the time to the first analgesic request, were compared between the two groups using an

independent Student's t-test. The Fisher's exact test was used to analyze differences in the occurrence of side effects between the groups. Statistical significance was defined as a p-value of less than 0.05.

3. Results

A total of 60 patients who met the eligibility criteria were enrolled in the study, with 56 completing the full protocol. Three patients were excluded due to the effects of spinal anesthesia dissipating before the study's conclusion. Additionally, one patient was removed due to excessive Tramadol use, which could have compromised the integrity of the pain score data. (Table 1) Outlines the comparable demographics, ASA classifications, types of surgeries, durations of the subarachnoid block, and total surgical times across the study groups. Pain assessments were performed at multiple time points over a 24-hour period using the NRS score for both groups.

The NRS scores for pain intensity at various time points (30 minutes, 2 hours, 4 hours, 6 hours, 12 hours, 18 hours, and 24 hours) are detailed in (Table 2), along with the corresponding p-values for group comparisons. At the 30-minute mark, there was no significant difference in the mean NRS scores between Group A and Group B (0.71 ± 1.18 vs. 0.68 ± 1.31, p = 0.77). However, at 2 hours, Group A's mean NRS score was 1.93 ± 1.15, whereas Group B's mean NRS score was 3.07 ± 1.92, showing a significant difference (p = 0.015). Throughout the subsequent time points (4 hours, 6 hours, 12 hours, 18 hours, and 24 hours), Group B consistently reported higher NRS scores compared to Group A ($p < 0.001$ for all time points), indicating greater pain severity in Group B. This increased pain was associated with elevated heart rates in Group B from 2 hours to 18 hours postoperatively, as shown in (Figure 3). Additionally, Group B exhibited significantly higher mean blood pressure values from 12 hours to 18 hours, as detailed in (Table 5).

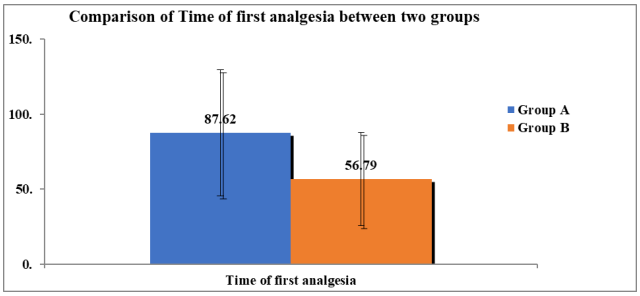

Figure 1: Comparison of time of first analgesia between two groups

The comparison of mean total tramadol consumption between Group A and Group B is presented in (Table 3). Group B had a higher average consumption of tramadol, with a mean of 348.93 ± 39.00 mg, compared to Group A, which had a mean consumption of 237.14 ± 39.89 mg. The difference in tramadol consumption between the two groups was statistically significant, with a p-value of less than 0.001.

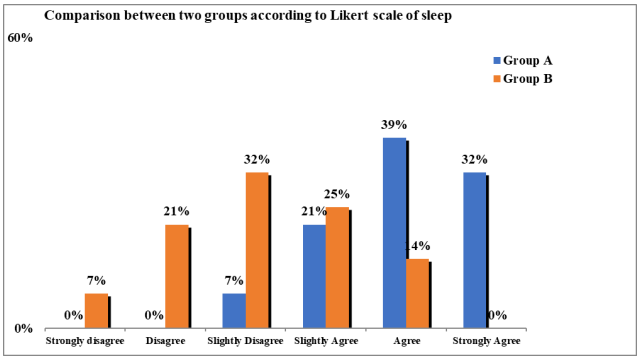

Figure 2: Comparison between two groups according to Likert scale of sleep

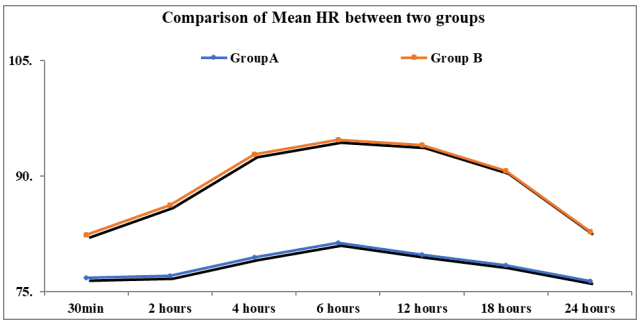

Figure 3: Comparison of Mean HR between two groups

Group A had an average time to first analgesia of 87.62 ± 42.08 minutes, with a median of 75 minutes (IQR 60 - 120 minutes) and a range from 30 to 250 minutes (Figure 1). In contrast, Group B's time to first analgesia ranged from 5 to 120 minutes, with a median of 60 minutes (IQR 30 - 86.25 minutes) and a mean of 56.79 ± 31.04 minutes. The difference in time to first analgesia between the two groups was statistically significant, with a p-value of less than 0.001. (Figure 4) shows that Group B attempted button press to administer tramadol significantly more times for analgesia compared to Group A during the postoperative period.

Twenty-four hours after the study initiation, patient satisfaction was assessed using the Likert scale (Table 4). The PENG group demonstrated significantly better overall pain management compared to the control group, with a p-value of less than 0.001. Additionally, patients were queried about their sleep quality from the previous night (POD 0) (Figure 2). Both block groups reported superior sleep quality compared to the control group.

Table 1: Demographic data, ASA grading, duration of subarachnoid block, and duration of surgery

	Group A	Group B	P values
Age (years)	50.79 ± 16.22	48.32 ± 13.96	0.545
Males (%)	16 (57.1%)	21 (75.0%)	0.158
Females (%)	12 (42.9%)	7 (25.0%)	
ASA 1 (%)	12 (42.9%)	7 (25.0%)	0.158
ASA 2 (%)	16 (57.1%)	21 (75.0%)	
Duration of SAB (min)	3.512 ± 0.368	3.524 ± 0.430	0.912
Duration of surgery (min)	2.759 ± 0.469	2.744 ± 0.457	0.904

Table 2: Comparing NRS scores between two groups

NRS Score	Group A			Group B			p-value
	Mean ± SD	Min – Max	Median (IQR)	Mean ± SD	Min – Max	Median (IQR)	
30min	0.71 ± 1.18	0 – 4	0 (0 – 1.75)	0.68 ± 1.31	0 – 5	0 (0 – 1)	0.77
2 hours	1.93 ± 1.15	0 – 5	2 (1 – 2.75)	3.07 ± 1.92	0 – 7	3 (2 – 4)	0.015*
4 hours	2.57 ± 1.32	0 – 5	2 (2 – 3)	4.89 ± 1.57	2 – 9	5 (4 – 6)	<0.001**
6 hours	2.79 ± 1.29	1 – 5	3 (2 – 4)	5.50 ± 1.62	2 – 8	5 (4.25 – 7)	<0.001**
12 hours	2.57 ± 1.14	1 – 5	2.5 (2 – 3)	5.61 ± 1.91	2 – 9	6 (4 – 7)	<0.001**
18 hours	2.00 ± 1.25	0 – 6	2 (2 – 3)	4.43 ± 1.60	2 – 8	4 (3 – 5.75)	<0.001**
24 hours	1.25 ± 1.00	0 – 3	1 (0 – 2)	2.68 ± 1.06	1 – 4	3 (2 – 3.75)	<0.001**

* "signifies significant p value<0.05
**signifies highly significant p value<0.001
The test used: Mann Whitney U" test

Table 3: Comparison of total Tramadol consumption between two groups

	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Total Tramadol consumption (mg)	237.14 ± 39.89	348.93 ± 39.00	<0.001**

**signifies highly significant p value<0.001
The test used: Stuent's t-test

Table 4: Comparison according to the Likert scale of pain management

Overall pain management was good	Group A n(%)	Group B n (%)	p-value
Strongly disagree	0 (0.0%)	4 (14.3%)	0.111
Disagree	0 (0.0%)	4 (14.3%)	0.111
Slightly Disagree	2 (7.1%)	13 (46.4%)	0.002*
Slightly Agree	12 (42.9%)	6 (21.4%)	0.086
Agree	12 (42.9%)	1 (3.6%)	<0.001**
Strongly Agree	2 (7.1%)	0 (0.0%)	0.491

**signifies highly significant p value<0.001
The test used: Chi-square test

Table 5: Comparison of mean blood pressure between two groups

Mean BP	Group A (Mean ± SD)	Group B (Mean ± SD)	p value
30 mins	88.71 ± 10.05	93.61 ± 11.33	0.930
2 hours	90.86 ± 9.57	96.11 ± 12.60	0.850
4 hours	94.36 ± 11.36	99.68 ± 13.73	0.120
6 hours	95.86 ± 12.48	100.18 ± 13.92	0.227
12 hours	95.25 ± 12.71	103.64 ± 12.45	0.016*
18 hours	92.14 ± 10.22	99.79 ± 13.18	0.019*
24 hours	90.25 ± 9.50	95.79 ± 11.81	0.058

*signifies significant p value<0.05
Test used: Student's t test

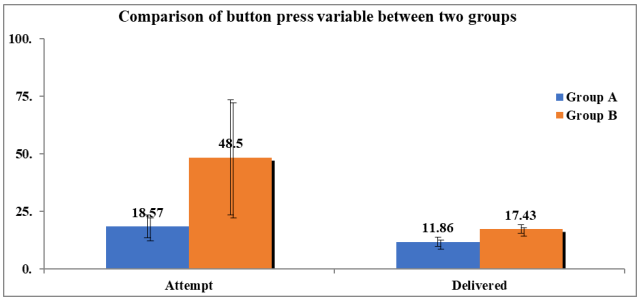

Figure 4: Comparison of button press variable between two groups

4. Discussion

In our study, we found that an ultrasound-guided PENG block produced a statistically significant reduction of pain following surgery. After the initial 24h of surgery, block groups had significantly lower levels of both opioid consumption and NRS pain scores. A portion of the sacral plexus (L4-S1) and the lumbar plexus (L2-L4) supply the hip joint's nerve supply. The "lateral cutaneous branch of iliohypogastric nerve" (T12 & L1), the "subcostal nerve" (T12), and the "lateral femoral cutaneous nerve" (L2-L3) provide skin innervation in hip arthroplasty (posterolateral approach).[13,14]

Traditionally, epidural analgesia is the analgesic choice modality in hip arthroplasty.[15] In the recent past, a number of truncal blocks such as "Quadratus lumborum block" (QLB), "Transverse abdominis plane block" (TAP), "lumbar plexus block", "paravertebral block", "fascia iliaca block" & "erector spinae plane block" (ESPB) been successfully utilized in hip surgeries.[16]

The comprehensive analysis conducted noted the absence of statistically significant differences in demographic characteristics between the defined study cohorts, namely Group A (PENG + PCA Pump with Tramadol) and Group B (PCA Pump with Tramadol). Equally noteworthy is the comparison of completion times for spinal anesthesia. This reaffirms the homogeneity of the groups in terms of this critical procedural variable. Moreover, the duration of surgery, another paramount parameter, was found to be akin between the groups. Our results agree with studies that have been published by Sahoo RK et al. and Sharma et al.which showed similar results in demographic data and surgical duration.[17]

Between Groups A and B, there are no appreciable variations in preoperative parameters. Between GroupA & GroupB, no significant variation was seen in the mean levels of serum creatinine, platelet counts, or hemoglobin. These findings collectively indicate that, at the preoperative stage, the two groups demonstrated a comparable baseline regarding key parameters.

The evidence indicates that the ultrasound-guided PENG block significantly outperforms the control group, which only received a PCA pump with tramadol for postoperative pain management. Analysis of pain scores at various postoperative intervals reveals substantial differences between the two groups. These findings strongly support the incorporation of the PENG block alongside the PCA pump and tramadol for enhanced pain control. This study's results align with those of Julián Aliste et al. who compared ultrasound-guided pericapsular nerve group block with suprainguinal fascia iliaca block in patients undergoing primary total hip arthroplasty.[11] Their study demonstrated that the suprainguinal fascia iliaca block resulted in a lower incidence of quadriceps motor block and comparable pain scores.

Evaluation of mean blood pressure at various postoperative time points reveals the hemodynamic effects associated with these interventions. Group A exhibited less hemodynamic variation during the recovery phase, indicating more stable blood pressure compared to the control group. In contrast to the findings of Perry et al. which did not emphasize the hemodynamic benefits of specific analgesic strategies, the present study highlights the potential advantages of incorporating a PENG block with a PCA pump and tramadol.[18] This combination appears to offer improved blood pressure stability and pain management in the early postoperative period, particularly in the context of hip arthroplasty.

The mean time to the first attempt at analgesic therapy was significantly shorter in Group B (no-block group) compared to Group A (block group). A notable difference was also observed in total tramadol consumption, with Group A (the block group) demonstrating substantially lower mean tramadol use than Group B. This suggests that incorporating the ultrasound-guided PENG block, along with a PCA pump, may reduce the requirement for intravenous analgesics, underscoring its potential effectiveness in postoperative pain management following hip arthroplasty. These findings are consistent with those reported by Fusco et al. highlighting the broader applicability of the ultrasound-guided PENG block across various clinical settings.[19]

The NRS Pain Score trajectories postoperatively within two distinctive groups show statistically significant differences. Group A consistently exhibits superior pain control and maintains a lower proportion of patients in severe pain in comparison to Group B, highlighting the sustained efficacy of PENG block in postoperative analgesia. Notably, the findings of this study are consistent with those reported by Choi YS et al. who discovered a correlation between lower NRS scores and suprainguinal fascia iliaca compartment block. This implies that contextual factors influencing the results of various studies in this domain need to be further explored and taken into account.[20]

Group A experienced significantly fewer cases of nausea and vomiting compared to Group B, suggesting that opioids, such as tramadol, may contribute to postoperative nausea and vomiting (PONV). These findings enhance our understanding of opioid-related side effects and provide valuable insights for managing postoperative analgesia. The p-values for PONV indicate a trend towards significance, underscoring the need for further research and careful consideration of these factors in clinical practice. These results are consistent with the study by Guay et al. which reported similar occurrences of PONV in patients managed solely with opioids in the postoperative period.[21]

Our study highlights the complex interplay between pain management effectiveness and its impact on sleep satisfaction in patients undergoing hip arthroplasty. In Group A, where patients received the ultrasound-guided PENG block in addition to a PCA pump with tramadol, there was a clear trend towards greater satisfaction with pain management. Most patients in Group A either agreed or strongly agreed that their pain management was satisfactory. In contrast, only 25% of patients in Group B, who relied solely on the PCA pump with tramadol, reported a similar level of satisfaction.

Beyond pain management, the study also examined sleep satisfaction. Group A patients reported significantly better sleep quality, with a high proportion agreeing or strongly agreeing that their sleep was satisfactory. In Group B, however, fewer patients expressed similar levels of sleep satisfaction. These findings underscore the additional benefits of incorporating the ultrasound-guided PENG block into postoperative care, as it not only improves pain management but also positively affects related factors such as sleep quality.

The results align with those of Lin DY, who emphasized the importance of the chosen analgesic method in shaping patient perceptions and satisfaction with pain and sleep management.[12] Additionally, these findings are consistent with the study by Allard et al. reinforcing the significance of considering how analgesic interventions influence patient outcomes in hip arthroplasty.[22] The statistical significance of these differences supports the argument for integrating comprehensive pain management strategies to enhance overall patient care and satisfaction.

While there are numerous approaches to pain management, ultrasound guided PENG block is a potentially useful and an easier technique that targets the articular branches innervating the hip joint capsule which may lead to targeted and long-lasting pain relief after hip replacement, improving patient satisfaction and postoperative recovery. The PENG block has the potential to take the place of Epidurals for proving analgesia for hip surgeries in day to day practice.

5. Limitations

Our study has several limitations. First, dynamic pain levels were not assessed due to the hip joint being immobilized by the surgeon on the first postoperative day. Additionally, patients whose spinal anesthesia had worn off before the completion of surgery were excluded from the study. The evaluation of motor power in the lower limb muscles was also not conducted. Finally, while our study utilized 20 ml of ropivacaine at a 0.5% concentration, there may be potential for enhanced analgesic effects with higher concentrations

6. Conclusion

The ultrasound-guided PENG block demonstrates superior postoperative pain control compared to intravenous tramadol in patients undergoing hip arthroplasty. This technique not only enhances pain management but also significantly improves patient satisfaction and sleep quality. Our findings suggest that incorporating the PENG block into postoperative care can lead to more effective analgesia and a better overall recovery experience, making it a valuable alternative to traditional opioid-based approaches.

7. Source of Funding

None.

8. Conflict of Interest

None.

Acknowledgments

Swami Rama Himalayan University, Dehradun, Uttarakhand for their encouragement and support for conducting this study.

References

1. Gundtoft PH, Varnum C, Pedersen AB, Overgaard S. The Danish hip arthroplasty register. *Clin Epidemiol*. 2016;8:509–14.
2. Nikolajsen L, Brandsborg B, Lucht U, Jensen TS, Kehlet H. Chronic pain following total hip arthroplasty: a nationwide questionnaire study. *Acta Anaesthesiol Scand*. 2006;50(4):495–500.
3. Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. *Ann Surg*. 2008;248(2):189–98.
4. Runge C, Børglum J, Jensen JM, Kobborg T, Pedersen A, Sandberg J, et al. The analgesic effect of obturator nerve block added to a femoral triangle block after total knee arthroplasty: a randomized controlled trial. *Reg Anesth Pain Med*. 2016;41(4):445–51.
5. Bjørnholdt KT, Jensen JM, Bendtsen TF, Søballe K, Nikolajsen L. Local infiltration analgesia versus continuous interscalene brachial plexus block for shoulder replacement pain: a randomized clinical trial. *Eur J Orthop Surg Traumatol*. 2015;25(8):1245–52.
6. Lin E, Choi J, Hadzic A. Peripheral nerve blocks for outpatient surgery: evidence-based indications. *Curr Opin Anaesthesiol*. 2013;26(4):467–74.
7. 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):859–63.
8. Buono RD, Padua R, Pascarella G, Costa F, Tognù A, Terranova G, et al. Pericapsular nerve group block: an overview. *Minerva Anestesiol*. 2021;87(4):458–66.

9. Black ND, Chin KJ. Pericapsular nerve group (PENG) block: Comments and practical considerations. *J Clin Anesth*. 2019;56:143–4.
10. Kaur G, Saikia P, Dey S, Kashyap N. Pericapsular nervegroup (PENG) block-a scoping review. *Ain-Shams Journal of Anesthesiology*. 2022;14(1).
11. Aliste J, Layera S, Bravo D, Jara A, Muñoz G, Barrientos C, et al. Randomized comparison between pericapsular nerve group (PENG) block and suprainguinal fascia iliaca block for total hip arthroplasty. *Reg Anesth Pain Med*. 2021;46(10):874–8.
12. 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.
13. Mccrum CL, Ben-David B, Shin JJ, Wright VJ. Quadratus lumborum block provides improved immediate postoperative analgesia and decreased opioid use compared with a multimodal pain regimen following hip arthroscopy. *J Hip Preserv Surg*. 2018;5(3):233–9.
14. Ke X, Li J, Liu Y, Wu X, Mei W. Surgical anesthesia with a combination of T12 paravertebral block and lumbar plexus, sacral plexus block for hip replacement in ankylosing spondylitis: CARE-compliant 4 case reports. *BMC Anesthesiol*. 2017;17(1):86.
15. Kose HC, Kose SG, Thomas DT. Lumbar versus thoracic erector spinae plane block: Similar nomenclature, different mechanism of action. *J Clin Anesth*. 2018;48:1.
16. Chin KJ, Mcdonnell JG, Carvalho B, Sharkey A, Pawa A, Gadsden J. Essentials of Our Current Understanding: Abdominal Wall Blocks. *Reg Anesth Pain Med*. 2017;42(2):133–83.
17. Sahoo RK, Jadon A, Sharma SK, Peng PW. Peri-capsular nerve group block provides excellent analgesia in hip fractures and positioning for spinal anaesthesia: A prospective cohort study. *Indian J Anaesth*. 2020;64(10):898–900.
18. Perry F, Parker RK, White PF, Clifford PA. Role of psychological factors in postoperative pain control and recovery with patient-controlled analgesia. *Clin J Pain*. 1994;10(1):57–63.
19. Fusco P, Sanctis FD, Paolis VD, Carlo SD, Martino ED, Volpe D, et al. Could US-guided PENG block pass the ICU door? First reported case in a multiple-fracture ICU patient. *Minerva Anestesiol*. 2020;86(8):884–5.
20. Choi YS, Park KK, Lee B, Nam WS, Kim DH. Pericapsular Nerve Group (PENG) Block versus Supra-Inguinal Fascia Iliaca Compartment Block for Total Hip Arthroplasty: A Randomized Clinical Trial. *J Pers Med*. 2022;12(3):408.
21. Guay J, Johnson RL, Kopp S. Nerve blocks or no nerve blocks for pain control after elective hip replacement (arthroplasty) surgery in adults. *Cochrane Database Syst Rev*. 2017;10(10):CD011608.
22. Allard C, Pardo E, Jonquière CDL, Wyniecki A, Soulier A, Faddoul A, et al. Comparison between femoral block and PENG block in femoral neck fractures: A cohort study. *PLoS One*. 2021;16(6):e0252716.

Author's biography

Khagol Bhatnagar, PG Resident https://orcid.org/0009-0007-0910-7700

Rohan Bhatia, Professor https://orcid.org/0000-0002-1270-6241

Rajiv Bhandari, Associate Consultant https://orcid.org/0000-0003-4175-1655

Faiz Akbar Siddiqui, Assistant Professor

Cite this article: Bhatnagar K, Bhatia R, Bhandari R, Siddiqui FA. Ultrasound-guided pericapsular nerve group block for postoperative analgesia following hip arthroplast. *Indian J Clin Anaesth* 2024;11(4):530-537.