Section: Anesthesia

Original Research Article

A RANDOMIZED CONTROLLED STUDY ON THE ANALGESIC EFFECTIVENESS OF PERICAPSULAR NERVE BLOCK COMPARED TO INTRAVENOUS FENTANYL FOR PATIENT POSITIONING DURING SPINAL ANESTHESIA IN PROXIMAL HIP FRACTURE SURGERIES

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ABSTRACT

Background: Positioning for spinal anesthesia in proximal hip fracture surgeries is often hindered by severe pain.The pericapsular nerve group (PENG) block, a newer regional technique, may offer better analgesia than intravenous fentanyl. This study compares the effectiveness of the PENG block versus IV fentanyl for facilitating spinal anesthesia positioning.

Materials and Methods: In this randomized, double-blinded study, 60 patients undergoing proximal hip fracture surgery under spinal anesthesia were divided into two groups: Group 1 received an ultrasound-guided PENG block with 20 mL of 0.25% bupivacaine; Group 2 received intravenous fentanyl 1 mcg/kg. Pain scores during positioning, quality of positioning, patient satisfaction, and need for rescue analgesia were recorded.

Results: VAS scores during positioning were significantly lower in the PENG group (2.53 ± 0.25) than the fentanyl group (4.27 ± 0.45) ($p<0.0001$). All patients in Group 1 achieved optimal positioning; 16 in Group 2 required additional fentanyl. Patient satisfaction was significantly better in the PENG group ($p=0.001$).

Conclusion: The PENG block offers superior analgesia, facilitates optimal positioning, and enhances patient satisfaction compared to intravenous fentanyl, supporting its role in opioid-sparing anesthetic practices for hip fracture surgeries.

Keywords: Proximal femur fracture, PENG block, Intravenous fentanyl, Spinal anesthesia, Positioning pain.

INTRODUCTION

Proximal hip fractures often require surgical fixation under spinal anesthesia, but severe pain can hinder proper positioning. IV fentanyl is commonly used to facilitate positioning but has limitations including short duration, sedation, and respiratory depression—especially concerning in elderly patients.[1]

Regional techniques such as the femoral nerve block (FNB) and the pericapsular nerve group (PENG) block offer safer, longer-lasting alternatives.[2] The FNB primarily targets the femoral nerve and may result in incomplete analgesia due to inadequate coverage of the hip joint's articular branches.[3] In contrast, the PENG block anesthetizes the articular branches of the femoral, obturator, and accessory obturator nerves, providing more complete pain relief while preserving motor function.[4]

This study compares the analgesic efficacy of the PENG block versus IV fentanyl for spinal anesthesia positioning in proximal hip fracture surgeries, aiming to evaluate the PENG block as a potential opioid-free alternative.[5]

Objectives of The Study

Compare analgesic efficacy of PENG block vs. IV fentanyl for spinal anesthesia positioning in proximal hip fractures.

To assess patient acceptance, quality of positioning, hemodynamic responses, and adverse effects associated with each analgesic technique.

MATERIALS AND METHODS

This prospective, randomized, double-blinded controlled trial was conducted at Madha Medical College Hospital and Research Institute by the Department of Anesthesiology.,from January 2024 to December 2024, after institution ethics approval.

Inclusion Criteria

ASA I–III, age 20–75 years, proximal femur fractures (neck, intertrochanteric, subtrochanteric), undergoing hemiarthroplasty or femur nailing, surgery duration <150 minutes.

Exclusion Criteria

Fractures >7 days old, pathological fractures, polytrauma, coagulopathy, local infection, or cognitive/communication impairments.

Sample size

Based on the inclusion and exclusion criteria, 60 patients were recruited during the study period. All underwent standard pre-anesthetic evaluation and fasting protocols. The night before surgery, patients were counselled on the procedure and the Visual Analogue Scale (VAS: 0–10). Informed written consent was obtained. Participants were then randomly assigned into two groups (30 each) using a computer-generated randomization table:

- **Group 1 (PENG Block):** Received 20 mL of 0.25% bupivacaine via ultrasound-guided PENG block, 20 minutes before spinal anesthesia.
- **Group 2 (IV Fentanyl):** Received 1 mcg/kg IV fentanyl, 10 minutes before positioning.

Procedure

Standard monitoring (NIBP, ECG, SpO_2) was applied. All patients received spinal anesthesia with 15 mg of 0.5% heavy bupivacaine in the sitting position. The anesthetist performing the spinal block and the patient was blinded to group allocation.

Outcome Measures

- **Pain during positioning** was assessed using the Numerical Pain Rating Scale (NPRS) before and after analgesia.
  - Mild: 1–3, Moderate: 4–6, Severe: 7–10
- **Ease of spinal positioning (EOSP Score):** 0 = Not satisfactory, 1 = Satisfactory, 2 = Good, 3 = Optimal
- **Additional analgesia:** IV fentanyl 0.5 mcg/kg if VAS ≥4
- **Patient acceptance score:** Good (1), Bad (2)
- **Demographic and clinical data:** Age, ASA grade, fracture type, surgery type, and vital signs

Statistical Analysis

Data were entered in MS Excel and analyzed using SPSS version 23. Continuous variables were presented as mean ± SD, and categorical variables as numbers (%).

- **Chi-square test** was used for categorical variables.
- **Student's t-test or ANOVA** was applied for continuous data.
- A **p-value < 0.05** was considered statistically significant.

RESULTS

Table 1: Baseline Characteristics

Parameter	Group 1	Group 2	P value
Age (years)	70.10 ± 3.387	58.67 ± 6.110	<0.001*
Weight (kg)	50.90 ± 5.294	68 ± 6.638	<0.001*
ASA I/II/III	5 / 15 / 10	19 / 11 / 0	<0.001*

Table 2: Baseline Vitals

Baseline	Group 1	Group 2	P value
Heart rate	96.87 ± 1.676	94.53 ± 2.389	<0.0001*
Systolic BP	159.90 ± 7.25	137.10 ± 8.62	<0.0001*
Diastolic BP	91.67 ± 7.383	76.53 ± 5.73	<0.0001*
Mean BP	64.20 ± 5.24	55.73 ± 4.152	<0.0001*

Demographic and Clinical Parameters

Group 1 participants were significantly older (mean age 70.1 vs. 58.67 years) and had lower body weight (50.9 kg vs. 68 kg) compared to Group 2 ($p < 0.001$). Vital parameters including systolic BP, diastolic BP, and mean arterial pressure were significantly higher in Group 1 ($p < 0.0001$). The mean heart rate was also slightly higher in Group 1 (96.87 bpm vs. 94.53 bpm), showing a statistically significant difference.

Table 3: Study Variables

Variable	Group 1	Group 2	P value
Pain score before block	6.83 ± 1.053	7 ± 0.802	0.48
Pain score after positioning	2.53 ± 0.25	4.27 ± 0.450	<0.0001*
Additional fentanyl required	0	16	<0.0001*

Ease of spinal positioning (Score 1)	30	0	0.52
Ease of spinal positioning (Score 3)	0	14	
Ease of spinal positioning (Score 4)	0	16	
Patient acceptance score (Good/Bad)	30 / 0	0 / 30	0.001*

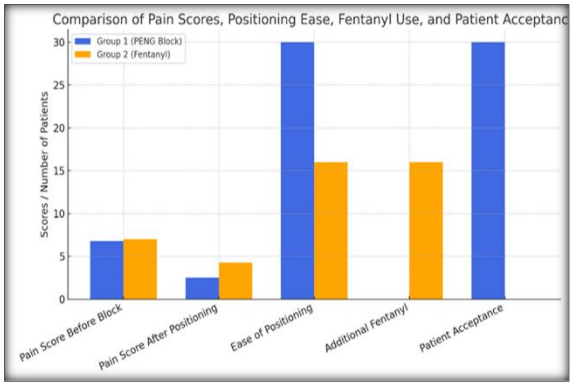

Figure 1: Comparison of Outcomes

Pain scores after the block were significantly lower in Group 1 and statistically significant. All patients in Group 1 achieved optimal positioning, while scores varied in Group 2. Additional fentanyl was required in 16 patients from Group 2, with none in Group 1 ($p < 0.05$). Patient acceptance was "good" in all Group 1 and "bad" in all Group 2. These findings confirm that the PENG block offers superior analgesia, better positioning, and higher patient satisfaction compared to IV fentanyl.

DISCUSSION

Proximal hip fractures often require spinal anesthesia, but severe pain can hinder positioning, especially in elderly patients. IV fentanyl is commonly used but has limitations. The femoral nerve block provides incomplete analgesia, as it misses key articular branches. The PENG block, introduced in 2018, targets these branches while preserving motor function.[4] Therefore, instead of comparing the PENG block with FNB, we chose to evaluate it against IV fentanyl, the most commonly used systemic analgesic for positioning.[5,6] This study compares the efficacy of the PENG block and IV fentanyl in facilitating positioning and evaluates the PENG block as an opioid-sparing alternative.

Our study demonstrated that the pericapsular nerve group (PENG) block offers significantly better pain relief, ease of positioning, and patient satisfaction compared to intravenous fentanyl during spinal anesthesia for proximal hip fracture surgeries.

Pain scores before intervention were comparable between groups but were significantly lower in the PENG group after positioning ($p < 0.0001$). All patients in the PENG group achieved optimal positioning, while 16 in the fentanyl group required additional analgesia. Patient acceptance was unanimously positive in the PENG group, contrasting with uniformly negative feedback in the fentanyl group ($p = 0.001$).

Our results align with previous studies by Girón et al,[4] Guay et al,[7] and Acharya and Lamsal,[8] all of whom demonstrated improved analgesia and positioning with PENG blocks. Alrefaey et al. also noted enhanced procedural conditions and experience.[9] Lin et al. reported superior postoperative pain control with the PENG block compared to femoral nerve blocks, supporting its broader clinical utility.[10]

Although our study population had a higher mean age and lower mean weight than in some prior studies (e.g., AbdElhalim et al.), the PENG block remained consistently effective across demographics. No complications were observed, confirming the safety of the single-injection technique used.

Overall, the PENG block proved to be a safe, effective, and opioid-sparing alternative to IV fentanyl, improving positioning and patient experience in spinal anesthesia for femur fracture surgeries. These findings support its routine use in clinical practice.

CONCLUSION

In conclusion, the PENG block provides superior pain relief, facilitates optimal patient positioning, enhances patient satisfaction, and prolongs postoperative analgesia compared to intravenous fentanyl. This study reinforces the growing role of regional anesthesia techniques in optimizing perioperative pain management for femur fracture patients.

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Competing Interest

There is no competing interest

Authors Contribution

All authors in our study contributed to the data collection of the patients

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