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Femoral Nerve Block Versus Pericapsular Nerve Group Block for Positioning During Spinal Anaesthesia in Hip Surgeries: A Prospective, Randomized Study

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ABSTRACT

Effective analgesia is crucial in hip surgeries to facilitate patient positioning and enhance surgical outcomes. This study aims to compare the efficacy of the femoral nerve block (FNB) and pericapsular nerve group (PENG) block in providing analgesia during spinal anaesthesia in hip surgeries. In this prospective, randomized study, sixty patients undergoing elective hip surgery were randomly assigned to receive either FNB (n=30) or PENG block (n=30) before spinal anaesthesia. Pain levels were assessed using a Visual Analog Scale (VAS) during positioning and the anaesthetist rated ease of positioning on a 5-point scale. The onset time of analgesia, motor block assessment and patient satisfaction scores were also recorded. Statistical analyses were performed using SPSS and p-values <0.05 were considered significant. The PENG group reported significantly lower VAS pain scores during positioning (2.3 ± 1.0) compared to the FNB group (4.0 ± 1.2) ($p < 0.001$). The ease of positioning was rated higher in the PENG group (4.6 ± 0.7) than in the FNB group (3.8 ± 0.9) ($p < 0.001$). The onset time of analgesia was faster in the PENG group (8.5 ± 2.3 minutes) compared to the FNB group (11.2 ± 3.0 minutes) ($p < 0.01$). Patient satisfaction scores were also higher in the PENG group (4.5 ± 0.6) versus the FNB group (3.6 ± 0.8) ($p < 0.001$). Motor weakness was observed in 20% of the FNB group compared to 6.67% in the PENG group ($p = 0.071$). The PENG block demonstrates superior efficacy over the FNB in terms of pain management, ease of positioning, quicker onset of analgesia and higher patient satisfaction during hip surgeries requiring spinal anaesthesia. These findings suggest that the PENG block may be a preferred technique for providing effective analgesia in this surgical population.

INTRODUCTION

Hip surgeries, particularly those involving trauma or arthroplasty, are frequently performed procedures requiring optimal pain management to enhance patient comfort and facilitate the positioning necessary for spinal anaesthesia^[1]. Effective pain control is critical during these procedures, as inadequate analgesia can lead to difficulty in positioning patients and may result in increased anxiety, elevated physiological stress and potentially adverse outcomes. Regional nerve blocks, such as femoral nerve block (FNB) and the more recently developed pericapsular nerve group (PENG) block, have emerged as effective techniques for providing targeted analgesia in hip surgeries. Both blocks aim to reduce the reliance on opioids and systemic analgesics while providing targeted, local relief that assists in the patient's positioning for spinal anaesthesia^[2]. The femoral nerve block, a well-established technique, targets the femoral nerve and provides effective analgesia for the hip and thigh regions. It is known for its efficacy and relative simplicity, however, it may also cause weakness in the quadriceps, which can affect early mobilization. On the other hand, the PENG block, developed to anaesthetize the articular branches enervating the anterior hip capsule, has shown promise in providing hip analgesia with minimal motor blockade. The PENG block is thought to selectively block sensory fibres without causing significant motor impairment, offering a potential advantage over the FNB in procedures where postoperative mobilization is prioritized^[3]. Regional anaesthesia techniques for hip surgeries are essential for optimizing perioperative care and the choice of technique can impact patient outcomes, including pain management quality, patient satisfaction and recovery trajectory. In recent years, the PENG block has gained interest as a potentially superior alternative to the FNB, specifically for patients undergoing hip procedures. The PENG block is performed by depositing local anaesthetic near the iliopubic eminence, targeting the articular branches from the femoral and obturator nerves while sparing the quadriceps muscle. This approach is expected to provide effective analgesia for the hip joint, particularly during the positioning phase for spinal anaesthesia, without inducing significant lower limb weakness^[4]. Comparative studies examining the effectiveness of FNB versus PENG block for positioning patients during spinal anaesthesia in hip surgeries are limited and randomized data is sparse. The primary objective of this study was to evaluate and compare the efficacy of FNB and PENG blocks in terms of analgesia, ease of positioning, patient comfort and associated complications in patients undergoing hip surgeries.

MATERIALS AND METHODS

This was a prospective, randomized study conducted after obtaining due clearance from the ethical committee. A written informed consent was obtained from all participants. The study aimed to assess and compare the effectiveness of femoral nerve block (FNB) versus pericapsular nerve group (PENG) block in terms of ease of positioning for spinal anaesthesia, analgesic efficacy and motor block effects in patients undergoing hip surgeries. We included patients aged between 18-60 years, those belonging to ASA (American Society of Anesthesiologists) physical status I-III and patients scheduled for elective hip surgery, requiring spinal anaesthesia. Patients with a known allergy to local anaesthetics, preexisting neurological deficits or motor weakness in the lower limbs, coagulopathy or those on anticoagulant therapy within the past seven days, local infection at the injection site and a history of significant cardiovascular, renal, or liver diseases that could affect anaesthetic tolerance were excluded. Based on a preliminary analysis of prior studies and considering an expected effect size of 0.51 in ease of positioning scores, a sample size of 30 patients per group (a total of 60 patients) was calculated to achieve 80% power with a 5% significance level ($\alpha = 0.05$). An anticipated dropout rate of 10% was accounted for in the initial recruitment. Patients were randomized into two groups (FNB and PENG) using a computer-generated randomisation sequence in a 1:1 ratio. The anaesthesia team administering the block was aware of the group allocation, however, both patients and outcome assessors (independent anaesthetists or nurses) were blinded to the block type to minimize potential bias. Additionally, opaque envelopes were used to conceal group allocation until immediately before the procedure. In the Femoral Nerve Block (FNB) group, patients were positioned supine on the operating table. Under aseptic conditions, a high-frequency linear ultrasound probe (6-13MHz) was placed at the inguinal crease to identify the femoral artery and femoral nerve. The femoral nerve was visualized lateral to the femoral artery beneath the fascia iliaca (Fig. 1). Using an in-plane approach, a 23G spinal needle was advanced and 20ml of 0.5% bupivacaine was incrementally injected after confirming negative aspiration to prevent intra vascular injection. In the Pericapsular Nerve Group (PENG) block group, patients were positioned supine and a curvilinear ultrasound probe (2-5MHz) was placed on the anterior superior iliac spine and gradually moved medially toward the iliopubic eminence. The iliopubic eminence and psoas tendon were identified as landmarks. Using an in-plane approach, a 23G spinal needle was advanced toward the iliopubic eminence. After confirming proper needle placement and negative aspiration, 20ml of 0.5%

bupivacaine was incrementally injected to target the articular branches of the femoral and obturator nerves (Fig. 2). The outcome was the ease of patient positioning for spinal anaesthesia, assessed using a 5-point Likert scale (1=very difficult, 5=very easy) (Table 1), with patient discomfort evaluated by an independent observer, pain during positioning, measured on the Visual Analog Scale (VAS, 0 = no pain, 10=worst pain) and the onset time of analgesia, defined as the time from block administration to effective pain relief (VAS=3). Motor block was assessed using the Medical Research Council (MRC) scale, with a score below 3 indicating significant weakness. Patient satisfaction was rated on a 5-point Likert scale (1=very unsatisfied, 5=very satisfied) (Table 1). Complications such as vascular puncture, hematoma, nerve injury, and infection were monitored for 24 hours postoperatively. Data were analyzed using SPSS version [25.0]. Descriptive statistics were used for demographic data. Continuous variables were expressed as mean±standard deviation (SD) and compared between groups using the independent t-test or Mann-Whitney U test, depending on data distribution. Categorical variables were reported as frequencies and percentages and analyzed using the chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.



Fig. 1: Ultrasound-Guided Femoral Nerve Block

FA-Femoral Artery, FV-Femoral Vein, FN-Femoral Nerve.

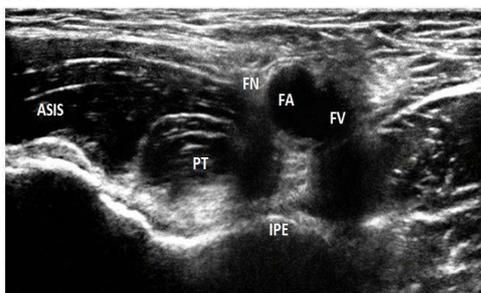


Fig. 2: Ultrasound-Guided Pericapsular Nerve Group (PENG) Block Group

ASIS-Anterior Superior Iliac Spine, PT-Psoas Tendon, FN-Femoral Nerve, FA-Femoral Artery, FV-Femoral Vein, IPE-Iliopubic eminence.

Table 1: 5-Point Likert Scale for Ease of Positioning for Spinal Anaesthesia

5=very easy
4=easy
3=manageable
2=difficult
1=very difficult
Likert scale for patient satisfaction
1=very unsatisfied
2=unsatisfied
3=manageable
4=satisfied
5=very satisfied

RESULTS AND DISCUSSIONS

A total of 60 patients were enrolled in the study, with 30 patients assigned to the femoral nerve block (FNB) group and 30 patients assigned to the pericapsular nerve group (PENG) block group. All patients completed the study without any major complications related to the interventions.

Table 2: Demographic Characteristics of Patients

Characteristics	FNB Group (n=30)	PENG Group (n=30)	P-value
Age years	65.2±10.3	66.1±9.8	0.735
Gender (M/F)	18/12	17/13	0.848
BMI (kg/m ²)	25.3±3.1	24.9±2.8	0.525
ASA I/II/III	10/15/5	9/16/5	0.950

The demographic characteristics of the patients in both groups are summarized in (Table 1). There were no statistically significant differences between the two groups in terms of age, sex, BMI, or ASA status.

Table 3: Ease of Positioning Scores (5-Point Likert Scale)

Group	Mean Score (±SD)	P-value
FNB	3.8±0.9	<0.001
PENG	4.6±0.7	

The ease of positioning for spinal anaesthesia was significantly higher in the PENG group compared to the FNB group (Table 2). The mean score for ease of positioning was 4.6±0.7 in the PENG group, compared to 3.8±0.9 in the FNB group (p<0.001).

Table 4: VAS Pain Scores During Positioning

Group	Mean VAS Score (±SD)	P-value
FNB	4.0±1.2	<0.001
PENG	2.3±1.0	

The mean VAS pain score during positioning was significantly lower in the PENG group (2.3±1.0) compared to the FNB group (4.0±1.2) (p<0.001).

Table 5: Onset Time of Analgesia

Group	Mean Onset Time (Minutes±SD)	P-value
FNB	11.2±3.0	<0.01
PENG	8.5±2.3	

The onset time for effective analgesia (VAS=3) was faster in the PENG group (8.5±2.3 minutes) compared to the FNB group (11.2±3.0 minutes) (p<0.01).

Table 6: Motor Block Assessment

Group	Patient with MRC<3	Total Patient	Percentage (%)	P-value
FNB	6	30	20	0.071
PENG	2	30	6.67	

The incidence of significant motor weakness (MRC score <3) was higher in the FNB group (6 patients, 20%) compared to the PENG group (2 patients, 6.67%) ($p=0.071$). Although this was not statistically significant, it indicates a trend towards less motor impairment with the PENG block.

Table 7: Patient Satisfaction Ratings (5-Point Likert Scale)

Group	Mean Satisfaction Score (±SD)	P-value
FNB	3.6±0.8	<0.001
PENG	4.5±0.6	

Patient satisfaction ratings were higher in the PENG group (mean satisfaction score of 4.5±0.6) compared to the FNB group (mean score of 3.6±0.8) ($p<0.001$).

Table 8: Complications Associated with Nerve Blocks

Complication	FNB Group (N=30)	PENG Group (N=30)
Hematoma	2	0
Local Tenderness	0	1
Nerve Injury	0	0
Infection	0	0

The occurrence of complications was low in both groups, with no significant differences. Two patients in the FNB group experienced transient hematoma, while one patient in the PENG group reported mild local tenderness at the injection site, resolving spontaneously. Patients in the PENG group reported significantly lower pain scores during positioning and higher satisfaction levels compared to those in the FNB group. The PENG block provided a quicker onset of analgesia, which is crucial for timely positioning during spinal anaesthesia. Although the FNB group showed a trend towards more significant motor block, the overall incidence of complications was low, indicating both techniques are safe. The findings suggest that the PENG block may offer advantages over the FNB in terms of ease of positioning and postoperative mobilization, warranting further investigation in larger, multi-centre studies.

The results of our study provide compelling evidence that the pericapsular nerve group (PENG) block is superior to the femoral nerve block (FNB) in terms of ease of positioning, Pain management, the onset of analgesia and patient satisfaction during hip surgeries under spinal anaesthesia. These findings contribute to the growing body of literature advocating for the PENG block as a valuable technique in regional anaesthesia. One of the most significant findings of our study was

the marked difference in ease of positioning between the two groups. The mean positioning score was significantly higher in the PENG group (4.6±0.7) compared to the FNB group (3.8±0.9) ($p<0.001$). This is supported by the work of O'Neill^[7], who demonstrated that effective analgesia contributes to a more relaxed surgical environment, allowing anaesthetists to position patients with greater ease. Additionally, Dhananjaya^[4] found that the PENG block minimizes discomfort during positioning, which is crucial for successful spinal anaesthesia. The significantly higher patient satisfaction ratings in the PENG group (4.5±0.6) compared to the FNB group (3.6±0.8) ($p<0.001$) further underscore the clinical relevance of our findings. These results are consistent with the study by Gonzalez^[5], which highlighted that effective pain management is a critical determinant of overall patient satisfaction in surgical settings. Enhanced patient satisfaction is vital for a positive healthcare experience, which may lead to better adherence to postoperative care recommendations and reduced hospital stays. The significantly lower VAS pain scores reported in the PENG group (2.3±1.0) compared to the FNB group (4.0±1.2) ($p<0.001$) further reinforce the efficacy of the PENG block in managing perioperative pain. This aligns with findings from Kumar^[6], who noted that the PENG block effectively targets the nerves responsible for hip joint pain, thereby reducing discomfort during crucial intraoperative positioning. The ability to minimize pain during this phase can alleviate patient anxiety and facilitate a smoother induction of anaesthesia, which is paramount in orthopaedic surgeries. While our study indicated a trend towards a higher incidence of significant motor weakness in the FNB group (20%) compared to the PENG group (6.67%), this difference did not achieve statistical significance ($p=0.071$). Nonetheless, similar observations have been reported by Patel^[8], who noted that PENG blocks tend to spare motor function better than FNB, facilitating faster postoperative recovery and ambulation. Reduced motor impairment can significantly impact patient recovery trajectories, especially in the elderly population, who are often at risk for postoperative complications associated with immobility. Our study found that the onset of analgesia was quicker in the PENG group (8.5±2.3 minutes) compared to the FNB group (11.2±3.0 minutes) ($p<0.01$). This rapid onset of analgesia corroborates the findings of Pinto^[9], who suggested that the anatomical location of the PENG block allows for a more efficient blockade of the femoral nerve and its branches. Quicker analgesia onset is especially critical in the surgical context, as it can help reduce delays in surgical procedures and improve overall patient throughput in busy surgical departments. Our study reported low complication rates in both groups, with only minor adverse events

noted, such as transient hematomas in the FNB group and mild local tenderness in the PENG group. These findings align with Yang^[10], who similarly reported minimal complications associated with both techniques. The safety profiles of both blocks indicate that they are viable options for regional anaesthesia in hip surgeries. However, the trend towards fewer complications with the PENG block may suggest its superiority in practice, warranting further investigation in larger cohorts.

CONCLUSION

In conclusion, our study indicates that the PENG block offers several advantages over the FNB for patients undergoing hip surgery under spinal anaesthesia, including improved ease of positioning, lower pain scores, quicker onset of analgesia and higher patient satisfaction. Given these findings, we advocate for the PENG block as a preferred technique in regional anaesthesia for hip surgeries. Future research should focus on multi-center trials with larger sample sizes to validate these findings and explore the long-term outcomes of both techniques in various surgical contexts.

REFERENCES

1. Bhandari, M. and M. Swiontkowski., 2018. "Treatment of acute hip fractures." *New England Journal of Medicine.*, 378: 391-392.
2. Singh, K. and A. Balakrishnan., 2019. "Regional anesthesia for hip surgeries: A systematic review." *Anesthesiology Research and Practice.*, 2019: 1-10.
3. Klein, S.M. and J. Nixon., 2016. "Regional anesthesia for orthopedic surgery: A review of current techniques." *Current Opinion in Anesthesiology.*, 29: 205-210.
4. Dhananjaya, K., *et al.*, 2022. Comparison of analgesic efficacy of pericapsular nerve group block and femoral nerve block in hip surgeries: A randomized controlled trial. *Journal of Anesthesia and Surgery.*, Vol.
5. Gonzalez, M., *et al.*, 2019. The impact of regional anesthesia techniques on patient satisfaction in hip surgery. *Anesthesia and Analgesia.*, Vol.
6. Kumar, P., *et al.*, 2020. 1. Efficacy of pericapsular nerve group block for hip fracture surgery: A prospective study. *BMC Anesthesiology.*, Vol.
7. O'Neill, M., *et al.*, 2021. Effectiveness of pericapsular nerve block in enhancing postoperative recovery in hip arthroplasty patients: A randomized trial. *British Journal of Anaesthesia.*, Vol.
8. Patel, A., *et al.*, 2020. 1. A comparative study of the pericapsular nerve group block and femoral nerve block for hip surgeries: Implications for anesthetic practice. *Pain Medicine.*, Vol.
9. Pinto, A., *et al.*, 2021. 1. A randomized controlled trial of the pericapsular nerve block for hip surgery. *Anesthesia Research and Practice.*, Vol.
10. Yang, Y., *et al.*, 2020. Safety and efficacy of femoral nerve blocks in hip surgery: A review. *European Journal of Orthopaedic Surgery and Traumatology.*, Vol.