

Original Research Article

A DOUBLE BLINDED PROSPECTIVE STUDY COMPARING ULTRASOUND GUIDED PERICAPSULAR NERVE BLOCK (PENG) AND FEMORAL NERVE BLOCK FOR MINIMIZING POSITIONAL PAIN IN HIP FRACTURES PATIENTS POSTED FOR SURGERY

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ABSTRACT

Background: Regional anesthesia is widely preferred method for hip surgeries over general anesthesia. Patients with hip fractures suffer from severe pain, which makes it challenging to achieve optimal positioning for spinal anesthesia. Alleviating positional pain is necessary as it increases patient comfort and provides optimal positioning for administering Spinal anesthesia (SA). Now a days various USG guided blocks like femoral nerve block, FICB block, PENG block etc are being used to alleviate positional pain. There are few studies to compare between femoral n block and PENG block So we are interested to compare between these studies.

Materials and Methods: USG guided PENG block and femoral nerve block was given, drugs used in both the group are same i.e (inj 0.25 % Bupivacaine total volume of 20 ml) for positioning before spinal anesthesia.

Results: After 30 minutes of block during rest (supine position) NRS score was measured in both the group, which was nearly same in both the groups i.e for PENG block (3.46 ± 0.68) and for femoral nerve block (3.83 ± 0.8) with p value of 0.058. During spinal positioning for sitting position the NRS score was measured in both the group, with mean and standard deviation of (4.16 ± 1) for PENG block, (4.56 ± 0.75) for femoral nerve block with a p value of 0.08 which is insignificant.

Conclusion: In our study PENG block and femoral nerve block provide the same analgesia after 30min of block during supine position and ease of spinal positioning for sitting position. The postoperative duration of analgesia was longer in pericapsular nerve block compared to femoral nerve block.

Key words: Spinal Anaesthesia (SA), Femoral Nerve Block (FNB), PENG Block, Ease of Spinal Anaesthesia Poisoning.

INTRODUCTION

Hip fracture surgery is a common orthopedic procedure, especially in elderly patients.^[1] Untreated/poorly managed perioperative pain is directly linked to delirium, bad prognosis, and secondary chronic pain in hip fracture patients.^[2] So perioperative pain should be one of the anesthetist's highest priorities, regardless of the anesthetic

modality used. Regional anesthesia is widely preferred method for hip surgeries over general anesthesia due to distinctive advantages, such as reduced length of hospital stay and lesser incidence of blood loss, thromboembolism, pneumonia, morbidity, and mortality.^[3] Patients with hip fractures suffer from severe pain, which makes it challenging to achieve optimal positioning for spinal anesthesia (SA).^[4] Alleviating positional pain is

necessary as it increases patient comfort and provides optimal positioning for administering SA.^[5] Systemic analgesics and sedatives that are commonly used to treat acute and positional pain in hip fractures include opioids, non-steroidal anti-inflammatory drugs (NSAIDs), ketamine, Dexmedetomidine but due to these drugs respiratory depression, urinary retention, sedation, cognitive impairment, delirium, acute kidney injury, emergence reactions, and bradycardia are the common side effects.^[6] The anterior part of hip capsule, which is the source of pain in the hip joint, is mainly innervated by the articular branch of the femoral nerve and the obturator nerve. Ultrasound-guided peripheral nerve blocks have become the standard of care in treating acute pain, procedural pain, and as a part of anesthetic management for hip fractures, as they provide superior analgesia with minimal adverse effects.^[7] Various peripheral nerve blocks, such as femoral nerve block (FNB), fascia iliaca block (FIB), and lumbar plexus block, have been described in the literature as analgesic options for hip fractures but each has its limitations.^[8] Girón-Arango et al. described the novel pericapsular nerve group (PENG) block, which targets the articular branches supplying the anterior capsule of the hip joint as they cross the anterior inferior iliac spine and iliopubic eminence, providing effective analgesia without affecting motor function.^[9] FNB is one of the existing standard practices for pain management in hip fractures and there are very few research studies comparing the efficacy of the two blocks for positional pain. This study aimed to compare the analgesic efficacy of ultrasound-guided PENG block and FNB for positional pain in hip fracture patients before administering SA. We hypothesized that the PENG block would offer better analgesia over FNB.

MATERIALS AND METHODS

This prospective, randomized, double blinded study was conducted after approval from institutional ethical committee (IEC/IMS.SH/SOA/2022/466) and the clinical trial registry India (CTRI/2024/01/061467 www.ctri.nic.in). Informed consent was taken from all study participants before the study. The study was conducted over a period of one year six months from March 2022 to September 2023. All of the 60 patients of age between 18-70 years from both the sexes who are posted for hip surgery and having severe positional pain and they are belonged to ASA Grade I and Grade II was randomized into two groups (30 patients in each group) that is USG guided PENG block and Femoral block using random numbers generated by the computer. Patient refusal, inability to cooperate, and severe allergy to local anesthetic agents, current infection at the site of local injection, patients on anticoagulation and antithrombotic medications, and patients with bleeding disorders are excluded from the study. The drug combination is to be prepared by one anesthesiologist/pharmacist not involved in the

study. Spinal anesthesia, patient data collection and analysis to be done by anesthesiologists who are blinded to the study drug and the group. Based on a priori two-tailed hypothesis, using parameters of 0.05 alpha, 95% confidence level, 0.75 moderate Effect size and 80% power with allocation ratio of 1:1 sample size was calculated by using G* Power. The sample size calculated was 56, which was inflated to 60, each arm consisting of 30 participants. Standard hospital protocols like medical optimization, intravenous line placement and antibiotics prophylaxis was followed. In preoperative room Pain during rest and pain on 15-degree passive limb elevation was assessed by numeric rating score (NRS), {0- no pain, 10-severe pain}. Then in preoperative room in one group of patients we will give pericapsular nerve group block and in another group we will give femoral nerve block using ultrasound guided needle. Drugs used in both the group are same i.e (inj 0.25 % Bupivacaine total volume of 20 ml). The time of first request of rescue analgesia was recorded. Patients reporting an LVAS score of ≥ 4 were treated with inj Tramadol 100mg IV, as rescue analgesic and Inj Paracetamol 1gm IV TDS was administered irrespective of LVAS.

PENG BLOCK: Pericapsular nerve block was developed in 2018 by Giron argon et al. This block is a diffusion block on the anterior surface of the hip joint capsule, target nerve branch of this block are the articular branches of femoral nerve, the obturator nerve and the accessory obturator nerve, leading to no quadriceps motor block. For the Pericapsular nerve block, a low-frequency curvilinear probe was placed over the anterior inferior iliac spine and moved inferiorly to see the pubic ramus. Then, iliopectineal eminence was seen, and the femoral artery and iliopsoas muscle was identified. The area between the iliopectineal eminence and pubic ramus was our target. Maintaining this view, a 23 G spinal needle was inserted using an in-plane technique, taking care to avoid injury to the femoral nerve. After visualisation of the needle tip at the target point, 20 mL to 0.25% bupivacaine and were injected after negative aspiration. The local spread of the drug between the psoas muscle and pubic ramus was confirmed on the ultrasound screen.

FEMORAL NERVE BLOCK: The femoral nerve block anaesthetizes the femoral nerve distribution. For FNB, a high-frequency linear ultrasound probe was placed over the inguinal crease. In cross-section, femoral vessels and femoral nerve were identified. Just lateral to the artery and deep to fascia iliaca, the femoral nerve was located as a spindle-shaped structure with a honeycomb appearance. The 23 G 70 mm block needle (B-Braun Melsung, Germany) was inserted using an in-plane technique. After advancing the needle through fascia iliaca, 20 mL of 0.25% bupivacaine were injected after careful aspiration at the target point.

After the block in operation theatre NRS score was recorded after 30 minutes during rest and during spinal positioning (EOSP). In the operation room

monitors for non-invasive blood pressure, electrocardiogram, and pulse oximeter were attached. Spinal anaesthesia will be performed by using Quincke's 25 gauge spinal needle in sitting position by giving 0.5 % bupivacaine heavy total volume of 3.6 ml. After the operation, the patient will be shifted to the post op recovery room. In postoperative period, PR, NIBP, and saturation will be recorded at regular intervals, and postoperative pain relief will be assessed by numbered rating score(NRS) immediately after surgery, then at (2,4,6,8,10,12 hrs), and then the demand for 1st dose of analgesia was recorded and complication if any like pruritus, paresthesia, local anesthesia systemic toxicity. The time of first request of rescue analgesia was recorded. Patients reporting an NRS score of ≥ 4 were treated with inj TRAMADOL 100mg IV, as rescue analgesic and Inj PARACETAMOL 1gm IV TDS was administered irrespective of NRS score. The data collected were entered in Microsoft Excel spreadsheet and imported to SPSS software. The data were analyzed by the help of Expert from Department of Community Medicine, IMS & SUM Hospital, Bhubaneswar, Odisha IBM SPSS Statistics software version 26 was used for data analysis. Descriptive statistics were expressed as frequencies (percentages), means, median, standard deviations. Independent t test and Chi-square test were done where applicable. P value of 0.05 or less was considered statistically significant.

CONSORT DIAGRAM

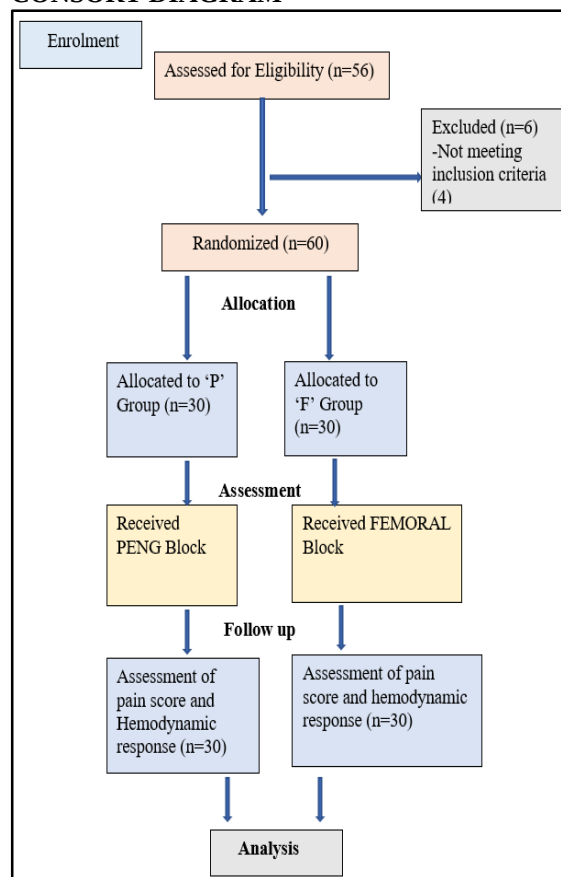


Table 1: Descriptive analysis of all the continuous parameter among all patients (n=60)

	Minimum	Maximum	Mean $\pm$ SD
Age	50	61	54.40 $\pm$ 2.38
Weight	45	92	68.52 $\pm$ 14.9

Table 2: Comparison of NRS score at different time in both the groups

	PENG Group Mean $\pm$ SD	Femoral nerve Group Mean $\pm$ SD	P-value
Before block NRS at Rest	5.97 $\pm$ 0.61	5.57 $\pm$ 0.72	0.08
NRS at passive movement	7.17 $\pm$ 0.69	7.03 $\pm$ 1.09	0.07
After block NRS at Rest	3.46 $\pm$ 0.68	3.83 $\pm$ 0.8	0.058
After block during spinal positioning	4.16 $\pm$ 1	4.56 $\pm$ 0.75	0.08
NRS at 2 hours	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.001
NRS at 4 hours	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.002
NRS at 6 hours	3.10 $\pm$ 0.305	3.30 $\pm$ 0.65	0.13
NRS at 8 hours	3.97 $\pm$ 0.18	4.33 $\pm$ 0.80	0.019
NRS at 12 hours	4.26 $\pm$ 0.52	4.40 $\pm$ 0.75	0.38

RESULTS

The study was performed in the department of Anaesthesia at the institute of medical science & sum hospital, Kalinga Nagar, Bhubhaneswar. Total 60 patient [30 patients in each group] were included in the study. The data was analysed and results are presented in table 1 & 2.

Table 1: Descriptive analysis of continuous parameters among all patients

Table 1 presents the descriptive analysis of age and weight among the 60 patients included in the study. The age of the participants ranged from 50 to 61 years, with a mean age of 54.40 $\pm$ 2.38 years,

indicating that the study population predominantly consisted of middle-aged to older adults with relatively limited variation in age. The body weight of the participants ranged from 45 to 92 kg, with a mean weight of 68.52 $\pm$ 14.9 kg. Compared with age, greater variability was observed in body weight, as reflected by the relatively larger standard deviation.

Table 2: Comparison of NRS scores between the PENG and femoral nerve groups

Table 2 compares the Numerical Rating Scale (NRS) pain scores between the PENG group and the femoral nerve group at different assessment time points. Before administration of the block, the mean NRS score at rest was 5.97 $\pm$ 0.61 in the PENG group and

5.57 ± 0.72 in the femoral nerve group. The difference between the two groups was not statistically significant (p=0.08), indicating that the baseline pain intensity at rest was comparable between the groups. Similarly, the mean NRS score during passive movement before the block was 7.17 ± 0.69 in the PENG group and 7.03 ± 1.09 in the femoral nerve group. This difference was also statistically non-significant (p=0.07), suggesting comparable baseline pain during movement in both groups. Following administration of the block, a reduction in pain scores was observed in both groups. The mean NRS score at rest after the block decreased to 3.46 ± 0.68 in the PENG group and 3.83 ± 0.8 in the femoral nerve group. Although the mean pain score was numerically lower in the PENG group, the difference did not reach statistical significance (p=0.058). During spinal positioning after the block, the mean NRS score was 4.16 ± 1 in the PENG group compared with 4.56 ± 0.75 in the femoral nerve group. Again, the PENG group demonstrated a numerically lower pain score, but the difference between the groups was not statistically significant (p=0.08).

At 2 hours after the block, the mean NRS score was 0.00 ± 0.00 in both the PENG and femoral nerve groups, while the reported p-value was 0.001. Similarly, at 4 hours, both groups had a mean NRS score of 0.00 ± 0.00, with a reported p-value of 0.002. Thus, according to the reported values, complete pain relief was observed in both groups at 2 and 4 hours after the block. However, because the means and standard deviations are identical in both groups at these time points, the reported statistically significant p-values should be rechecked against the original statistical output, as an ordinary between-group comparison would generally not produce a significant difference when both groups have identical values.

At 6 hours, pain scores gradually increased in both groups, with a mean NRS score of 3.10 ± 0.305 in the PENG group and 3.30 ± 0.65 in the femoral nerve group. The difference was not statistically significant (p=0.13), although the PENG group continued to show a slightly lower mean pain score. At 8 hours, the mean NRS score was 3.97 ± 0.18 in the PENG group and 4.33 ± 0.80 in the femoral nerve group. The difference was statistically significant (p=0.019), indicating significantly lower pain intensity in the PENG group at this time point.

At 12 hours, the mean NRS score increased to 4.26 ± 0.52 in the PENG group and 4.40 ± 0.75 in the femoral nerve group. Although the mean score remained slightly lower in the PENG group, the difference was not statistically significant (p=0.38). Overall, both groups demonstrated substantial reduction in pain following the block, particularly during the early post-block period. The PENG group generally showed numerically lower NRS scores than the femoral nerve group after the block, with a statistically significant difference observed at 8 hours (p=0.019).

DISCUSSION

Hip fracture is usually seen after trauma in young and a trivial fall in elderly. The incidence of hip fracture worldwide are being estimated to be 1.26 million in the 1990s and are predicted to increase to 2.6 million by 2025 and increase to 4.5 million by 2050. Spinal anesthesia is a routine technique used in the reduction of hip fracture but the most challenging task in the process is positioning patients for spinal anesthesia. Usually, patient positioning is needed to be performed before spinal block and always requires the administration of a large amount of IV analgesics. Various conventional forms of analgesics such as opioids and nonsteroidal antiinflammatory drugs (NSAIDs) are used. Fentanyl a lipophilic opioid which is stronger than morphine and is 50-100 times more potent. It can provide cardiovascular stability even in ill patients, but there is a direct concentration-effect relation between the fentanyl and respiratory depression.

Here in this study, we compare pericapsular nerve block and femoral nerve block for ease of spinal positioning and for post operative analgesia. The anterior hip capsule is innervated by articular branches of the femoral nerve, accessory obturator nerve and obturator nerve, whereas the sciatic nerve. Innervates the posterior capsule. The mechanoreceptor (nociceptive), responsible for pain, is mainly present in the anterior capsule. The articular branches collectively do not get blocked in the femoral nerve block, which have been practiced for procedural pain relief; thus, there is inadequate analgesia. PENG block is an interfascial block providing adequate analgesia by blocking articular branches of the femoral nerve, accessory obturator nerve and obturator nerve. Articular branches of these nerves are between the psoas muscle and the pubic ramus. Therefore, PENG block has the propensity to provide more complete and better analgesia. In patients with hip fracture, pain is the major problem as it effects the positioning for central neuraxial block as well as postoperative rehabilitation. Here in our study, we have compared the effects of pericapsular nerve block and femoral nerve block for Ease of spinal positioning and for post operative analgesia.

In preoperative area Before giving PENG and Femoral block NRS (Numeric rating score) of both the the group was Measured at rest and at 15 degrees of passive movement. During rest NRS score of peng group is (5.97±0.67), femoral nerve group is (5.57±0.72) with p value of 0.08, which is insignificant. USG directed pericapsular nerve block and femoral nerve block was given in group P and group F patients. Drugs used in both cases were 20 ml of 0.5% Bupivacaine. After 30 minutes of block during rest NRS score was measured in both the group, which was nearly same in both the groups i.e for PENG block (3.46±0.68) and for femoral nerve block (3.83±0.8) with p value of 0.058. During spinal positioning for sitting position the NRS score was

measured in both the group, with mean and standard deviation of (4.16±1) for PENG block, (4.56±0.75) for femoral nerve block with a p value of 0.08 which is insignificant. Both block provides same analgesia for ease of spinal positioning. Ela Erten et al., in a randomized clinical trial found that preoperative PENG block is more effective in reducing the pain associated with spinal anesthesia positioning (lateral positioning) than femoral nerve block in geriatric hip fracture. But both blocks had a similar effect on posture quality and the number of spinal interventions.^[10] Similar study by Chaudhary K et al found The PENG block provides better analgesia for sitting than FNB before spinal anaesthesia in proximal femur fractures but patient's comfort while sitting was comparable with both blocks and no difference in the EOSP scores between both groups.^[11]

In our study we found non-significant result between USG guided PENG block and femoral block that means both group of patients' similar comfort during positioning of spinal anaesthesia. Allard et al. did a cohort study to compare the analgesic effect of PENG block vs. Femoral block and 48 h morphine consumption. They did not find a difference in morphine consumption till 48 h postoperatively.^[12] In this study the effect of blocks on postoperative pain relief was also observed at various time intervals up to 12 h between group P and group F We found pain scores at rest, during passive mobilization, at 2 hours, 4 hours, 6 hours were comparable in both groups but at 8 hours P value was 0.019 which was significant means Peri capsular block provides long duration of post of analgesia than femoral nerve block. D-Yin Lin compared PENG and FNB for short-term analgesia. They observed pain score at 4 h was significantly lower with the PENG block group than with FNB.^[13] Chaudhary k et al and D-Yin Lin both found in their studies PENG block provides long duration analgesia in post operative period. In our study we also observed the requirements of number of rescue analgesic Doses and better muscle strength for 12 hours which were more in femoral nerve group patients. Malati K et al mentioned USG-guided PENG block is more effective than a USG-guided Femoral nerve block in reducing pain associated with positioning (sitting) of a subarachnoid block in patients with a fractured femur.^[14] Jeevendran A et al found that PENG block offers better analgesia for positioning before SA than FNB without any significant side effects, and improves patient and anesthesiologist satisfaction, thus proving to be an effective analgesic alternative for painful hip fractures.^[15]

CONCLUSION

In our study, both the PENG block and femoral nerve block provided comparable analgesia 30 minutes after the block in the supine position and facilitated spinal positioning in the sitting position. The postoperative duration of analgesia was longer with

the pericapsular nerve group (PENG) block compared with the femoral nerve block. This ultrasound-guided pericapsular approach may offer advantages over the femoral nerve block by providing more complete analgesia to the hip joint while preserving motor function of the involved extremity. In our study, patient comfort during sitting for spinal positioning was comparable between the PENG block and femoral nerve block groups.

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