

A Randomised, Controlled Clinical Study Comparing the Effectiveness of Pericapsular Nerve Group (PENG) Block Vs the Fascia Iliaca Compartment (FICB) for Pain Management After Hip Fracture

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Abstract

Introduction: Commonly used in hip fracture surgery, fascia iliaca compartment block (FICB) has lately been criticized for providing insufficient pain relief. The effectiveness of the innovative pericapsular nerve group block (PENG) technique for hip analgesia is still being debated. The goals of this research were to examine how effectively PENG blocks work at relieving hip fracture pain and how they stack up against FICB.

The aim of this study was to determine whether the PENG block is a viable alternative to the FICB for the treatment of hip fracture pain.

Methods: Following approval from Institutional Ethics Committee (IES-SSMC-0145), a prospective, randomized, comparative study was conducted at Shyam shah medical college Rewa between 2020 and 2023. Group A (n=25) underwent FICB, and Group B (n=25) received PENG block, of patients who had suffered a hip fracture.

Results: The two groups' VAS scores before the block procedure did not vary significantly from one another (p=0.23). The VAS score was considerably lower in the PENG block group compared to the FICB group after 15 minutes of blocks and after 12 hours post-surgery (p=0.035 and p=0.024, respectively). The PENG block had a substantially longer first-time analgesic consumption compared to the FCIB (p=0.006). The overall amount of morphine consumed over the course of 24 hours was considerably lower in the PENG block compared to the FICB group (p=0.007).

Conclusion: We conclude that the PENG block is superior to FICB for analgesia of hip fractures. However, further research with bigger sample numbers is needed to confirm the PENG blocks' effectiveness and superiority over standard methods.

Keywords: PENG; FICB; Femur fracture.

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Introduction

One of the most significant risks to public health is hip fracture [1]. When patients with hip fractures arrive at the emergency room, they are in excruciating pain. As a result, analgesia is essential for the pre-hospital, preoperative, and postoperative phases of hip fracture patients' care and is advised [2]. Opioids have historically been used to treat hip fractures and offer sufficient analgesia [3]. The use of alternative analgesic strategies that reduce the need for opioids and associated side effects is advised in the surgical treatment of hip fractures since opioids can cause nausea, constipation, delirium, respiratory depression, and vomiting [2]. The femoral nerve block and FICB are well-known techniques for managing hip fracture pain that lessen the adverse effects of opioids, such as delirium in older patients [3]. PENG block, a novel ultrasound-guided technique that effectively targets the articular branches of the hip, has recently been offered as a viable option for hip analgesia [4]. However, there are limited studies on PENG's usefulness in reducing hip fracture pain, and further research is required to demonstrate this technique's impact on analgesia and assess how it stacks up against earlier analgesic methods. In order to determine whether PENG block is useful for treating hip fracture pain and whether it could be a viable replacement for earlier painless methods like FICB, the current study is being conducted.

Methods

- After getting approval from Institutional Ethics Committee (IEC), and informed & written consent a randomized, prospective, double-blinded study was conducted on 80 patients with femur fractures at Shyam Shah Medical College, Rewa, Madhya Pradesh, India between January 2020 to December 2023. The data obtained during this period was collected,

tabulated, and analysed using MS Excel in the month of March 2023.

Inclusion criteria; Patients with hip fractures (stable intertrochanteric fractures, unstable intertrochanteric fractures, and femoral neck fractures) with ASA classes I and II.

Exclusion criteria: Other fractures requiring surgery, addiction, a history of mental illness, hemoglobin less than 9 mg/dl, if there was spinal anesthesia to general anesthesia conversion, blood transfusion, operation lasting more than three hours, change in surgical plan, or orthopaedic problem during surgery.

50 patients were split into two groups: Hip fracture patients in group A got fascia iliaca block procedures, and hip fracture patients in group B received PENG block procedures in the block room. For having a power of study more than 80%, the required sample size was calculated to be approximately 20 patients through a pilot study, assuming a 30% difference in the average fentanyl use between the two groups.

Study Procedure

FICB was carried out as follows: Following skin cleaning, cutaneous anesthesia was administered with a 2 mL injection of 1% lidocaine. The in-plane technique was used to inject 3 mL/kg (up to 40 mL) of ropivacaine 0.5% between the iliac fascia and the iliopsoas muscle under the guidance of a high-frequency linear transducer (10-25 MHz) ultrasound device (S-Nerve Sonosite) that was positioned horizontally in the inguinal area.

PENG was carried out as follows: Following skin cleaning, cutaneous anesthesia was administered with a 2 mL injection of 1% lidocaine. The anterior superior iliac spine was levelled using the low-frequency (2–5 MHz) curvilinear ultrasound probe. By turning the probe 45

degrees anticlockwise, the iliopubic bulge of the iliopsoas muscle, femoral artery, and pectineus muscle could be seen. The needle was inserted in the facial muscle between the anterior tendon and the superior pubic ramus using the in-plane technique. Ropivacaine 0.5% was infused at a rate of 3 mL/kg following a negative aspiration.

Before the block procedure (baseline), 15 minutes after the block procedure (before spinal anesthesia, when the patients were transferred from the block room to the operating room), in the sitting position for spinal anesthesia, at the recovery room, and at 6, and 12 hours after the procedure were all assessed using the VAS (visual analogue scale).

If the patient's VAS was below 3, they were put in the sitting position 20 to 30 minutes following the block. If the patient's VAS in the sitting position was greater than 3, 1 g/kg of intravenous fentanyl was administered, and this process was repeated as often as necessary every five minutes. Up to the right moment for spinal anesthesia, the entire amount of fentanyl administered was noted in this posture. All patients received an intravenous PCA pump (20 mg morphine in 100 cc normal saline) with a 15-minute lockout period that provided 1 mg of morphine with each button press from the patients for postoperative analgesia. Every time the patient's VAS fell below 4 during the following 24 hours, an additional 2 mg of morphine was administered. Additionally, the total amount of drugs used by the two groups over the course of 24 hours was noted. For stable intertrochanteric fractures, unstable intertrochanteric fractures, and femoral neck fractures, respectively, the dynamic hip screw (DHS), gamma nails, and screws were employed. Surgery-related adverse symptoms included shivering,

nausea, vomiting, hypotension, and a heart rate decrease (more than 20% of baseline).

Statistical analysis

The statistical significance level of $p < 0.05$ was accepted for the data, which are provided as mean SD. Statistical Package for Social Sciences (SPSS) version 16.0 (SPSS Inc., Chicago, IL) was used to analyze the data. The Kolmogorow-Smirnov test was used to determine whether all the data were normally distributed. The same variables between the two groups were analyzed using the independent student's t-test. The Chi-square test was used to analyze nominal data as well.

Results

Between May 2020 and May 2023, 80 hip fracture patients were admitted to the project. 30 patients were not included in the study for the following reasons: 18 refused to take part, 7 had mental illness and were using antipsychotic medications, and 5 had drug addictions of various kinds. The remaining 50 patients were split into 2 groups at random (Group A, $n = 25$, and Group B, $n = 25$). Age, sex, fracture, and surgical technique did not significantly differ between the two groups (Table-1). There was no discernible difference between the two groups' VAS scores prior to the block procedure. The VAS score significantly decreased in the PENG block group compared to the FICB group after 15 minutes of blocks (prior to spinal anesthesia) and after 12 hours post-surgery. In the PENG block compared to the FCIB group, the first-time analgesic use following surgery was much longer ($p = 0.006$), and the overall amount of morphine consumed over the course of 24 hours was significantly lower ($p = 0.007$). There was no appreciable difference in side effects between the two groups (Table-2).

Table 1: Demographic data

Variable	FICB (n=25)	PENG (n=25)	P value
Age (years)	51 ±12.22	54 ±11.23	P=0.345
Sex (M/F)	70.7/28.3	74.3/29.3	0.674
Fracture type (SI/UI/FN)	11/10/4	9/11/5	0.897
Surgery type (DHS/Gamma nail/screws)	11/10/4	9/11/5	0.467

SI: stable intertrochanteric; UI: unstable intertrochanteric; FN: femoral neck. FICB: fascia iliaca compartment block; PENG: pericapsular nerve group block

Table 2: The attributes of the block procedure.

Variable	FICB (n=25)	PENG (n=25)	P value
VAS score before blocks (baseline)	4.76± 1.23	4.43± 1.11	0.231
VAS score 15 minutes after blocks	3.65± 0.97	3.32± 0.76	0.035
VAS score when entering recovery	2.76±1.02	3.35±1.43	0.067
VAS score 6 h after post-surgery	3.43±1.24	3.42±1.15	0.87
VAS score 12 h after post-surgery	3.87±1.54	3.05±1.09	0.024
The total dose of fentanyl used during surgery	113.07±67.5	135.45±76.56	0.35
The first time of the analgesic drug consumption after surgery	2.87±2.1	4.6±3.2	0.006
The total dose of morphine consumed during 24 hours	76.23±14.54	56.36±24.33	0.007
Side effect after surgery (Yes/No) (%)	6.4/93.6	0/100	0.345

FICB: fascia iliaca compartment block; PENG: pericapsular nerve group block; VAS Visual Analogue Score

Discussion

For a patient with a hip fracture, pain management is crucial throughout the pre-hospital, pre-operative, and post-operative phases. Although they offer acceptable analgesia and are frequently used in hip fracture surgery, opioids can also result in delirium, nausea, and constipation [3]. Due to this, it is advised that alternate analgesic methods be used in the surgical treatment of hip fractures to reduce the requirement for opioids and their associated side effects. Patients with hip fractures frequently employ regional analgesia techniques like fascia iliaca block and femoral nerve block for pain management because they offer adequate analgesia with an opioid-sparing effect and are generally safe [4]. These blocks may not offer hip fracture patients enough analgesia, according to certain theories. Additionally, these methods have drawbacks such as motor adequacy [5]. PENG is a new technique for hip analgesia, although its effectiveness has not yet been thoroughly proven. The purpose of the

current study is to compare the efficacy of the PENG block to that of the FICB and to assess the impact of the PENG block in the management of hip fracture pain. According to our findings, the PENG block considerably lowers hip fracture patients' pain scores and is more effective at managing pain than the FICB.

Hip joint innervation is intricate, making it difficult to manage hip fracture patients' pain during pre-hospital, preoperative, and postoperative times. Histologically, the posterior capsule lacks sensory fibres and is mostly made up of mechanoreceptors, while the anterior capsule primarily contains nociceptive fibres [6]. The most densely innervated region of the joint, according to anatomical investigations, is the anterior hip capsule [7]. The anterior hip capsule is innervated by high branches of the femoral and obturator nerves, indicating that these nerves should be the primary targets for hip analgesia [4]. The FICB is a popular technique for treating hip fracture pain, and earlier research has

shown that it works quite well [8]. There is currently debate over the precise neuroanatomy that the FICB and its effective analgesia target [9]. Recent anatomical research on hip innervation raises doubts about the efficacy of FICB and implies that earlier findings may have been exaggerated [5]. Since the obturator nerve is not covered by the spread of local anesthetic after the FICB, this block may not result in effective analgesia, contrary to what is known about the importance of covering the hip joint articular nerve [5]. An interfascial plane block called the PENG is intended to block the articular branches supplied by the femoral, obturator, and auxiliary obturator nerves. When the dye was applied to the PENG block in cadaveric research, the anterior hip capsule regions connected to the articular branches of the femoral, obturator, and auxiliary obturator nerves became dyed [7]. PENG block appears to be a more effective analgesic than FICB because it covers more hip joint articular nerves. Our findings were supported by earlier research that showed the effectiveness of PENG block as a hip fracture analgesic technique and that it is superior to other widely used techniques in terms of analgesia. In this line, a short case series demonstrated that the PENG block is an effective analgesic treatment for hip fractures, resulting in a greater reduction in pain scores compared to other regional techniques [4].

Limitation:

The short sample size of this study is one of its limitations, and higher sample sizes in future randomized controlled trials are needed to confirm the effectiveness and superiority of PENG blocks over other approaches.

Conclusion

In conclusion, it appears that the PENG block is better suited for hip analgesia than the FICB.

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