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# A Prospective Randomised Controlled Study Comparing Efficacy of Ultrasonography Guided Fascia Iliaca Compartment Block and Femoral Nerve Block in Hip Surgeries for Positioning the Patient before Spinal Anaesthesia

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**Background:** Regional nerve blocks may alleviate pain and reduce the need for intravenous opiates in patients with hip and femoral neck fractures. The current prospective randomized study compares the onset times and pain management of Ultrasonography (USG) guided Femoral nerve block (FNB) and Fascia iliaca compartment block (FICB).

**Materials and methods:** A total of 40 patients of ASA status I, II and III were randomized into two groups of 20 each: Group Fascia iliaca compartment block (FICB) received 20 ml of 0.75% Ropivacaine + 10 ml 2% LOX with adrenaline and Group Femoral nerve block (FNB) received 20 ml of 0.75% Ropivacaine + 10 ml 2% LOX with adrenaline. Patients were given the block under the guidance of ultrasound in the induction area by an anaesthesiologist and outcomes were analysed.

**Results:** The study finds no significant difference concerning age, sex, or weight distribution in both groups. At the time of the block, the FNB group's mean VAS score was 6.25 ± 2.02, while the FICB group was 6.80 ±1.15 which is comparable. In terms of analgesia efficacy, the FICB group performed better than the FNB group, as shown by the mean VAS score at SAB of 1.50 ±0.94, compared to 2.05 ±0.69 in the FNB group. Analgesia sets in faster in the FICB group than in the FNB group, with the former taking an average of 122.45 ±13.76 seconds to complete the SAB post block, while the latter took an average of 113.85 ± 9.83 seconds. In comparison to the FNB group, FICB demonstrated a higher degree of patient acceptance and better quality of position attainment to perform spinal anaesthesia.

**Conclusion:** FICB is superior to the FNB in terms of pain relief and the initiation of analgesic effects is earlier in the FICB.

**Keywords:** Fascia iliaca compartment block, Femoral nerve block, Spinal anaesthesia, Visual Analogue Scale

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# Introduction

The frequency of femoral neck fractures in the general population has increased along with the average life expectancy, and these patients typically need surgical hip repair. While spinal anaesthesia is commonly employed for the repair of femoral neck fractures, patients may encounter significant pain due to the minor displacement of fracture ends during the positioning of the spinal anaesthesia.[1]

This can result in severe patient distress and sympathetic activation, which can manifest as tachycardia, hypertension, and increased cardiac work. To mitigate pain and enhance positioning before anaesthesia, non-steroidal anti-inflammatory medications (NSAIDs), intravenous opioids, or peripheral nerve blockades (PNBs) are administered. On the other hand, NSAIDs have a limited ability to relieve pain and may also inhibit platelets and cause gastrointestinal bleeding. Furthermore, opioids do not adequately relieve pain in the dynamic state; instead, they are better at controlling static pain than dynamic pain.[2] Above all, elderly patients have delicate physical conditions, which makes them more vulnerable to the negative effects of opioids, including sedation, nausea, vomiting, and respiratory depression.[3]

A systematic review found that regional nerve blocks may help patients with hip and femoral neck fractures feel better and require fewer intravenous opiates.[4] In individuals with femur fractures, the recommendation for the use of lower extremity peripheral nerve blocks for the management of pain has been on the rise.[5] This is primarily due to a reduction in the duration of hospital stays, the alleviation of pain, and delirium, the necessity for systemic analgesics, and the time required for the administration of the first rescue analgesic.[6] The femoral nerve block (FNB) and fascia iliaca compartment block (FICB) are straightforward procedures with few absolute contraindications, such as hypersensitivity to local anaesthetics or the existence of neurological or vascular issues in the limb.[7] Nevertheless, the management of pain relief in femur fractures is underutilization of these basic techniques. When compared to nerve stimulator or landmark techniques, ultrasound guidance yields better visualization of anatomical structures, success rate, quality of sensory block and onset time with a reduction in dosage of local anaesthetics and associated complications.[8]

In recent years, there has been a significant enhancement in acceptance of utilizing ultrasonic guidance for nerve blocks. The basis of ultrasound imaging is grounded in principle of producing sound waves that are beyond audible range of human ear (20 kHz).[9] To allow sound to reach depth of interest and return before next pulse is sent, ultrasonic pulses must be spaced sufficiently apart.[10] Ultrasound imaging has several advantages which mainly help to direct visualization of neural structures, tendons and blood vessels.[11]

Guidance of the needle under real-time visualization, and monitoring the spread of local anaesthetic allows repositioning of the needle after an initial injection to allow better delivery of local anaesthetic to areas that may not be completely blocked with a single dose. It can be used in patients with poor twitch response to nerve stimulation and mainly to avoid complications like intravascular and intraneuronal injection.[12]

This prospective randomized study aims to evaluate the efficacy of ultrasonography (USG) guided femoral nerve block (FNB) and fascia iliaca compartment block (FICB) in terms of pain management and the onset time of positioning patients for spinal anaesthesia before femoral neck fracture repair.

# Materials and methods

**Study Design:** A prospective, randomized, controlled study.

**Study Sample:** This prospective study included 40 American Society of Anaesthesiologists (ASA) Grade I, II and III patients, regardless of sex, between the ages 21 to 70 years old who underwent hip fracture surgeries under spinal anaesthesia. The computerized random table was used to randomly assign 20 patients of any sex to the Groups Femoral nerve block (FNB) and Fascia iliaca compartment block (FICB).

**Inclusion criteria:** This study includes patients between 21 years to 70 years of age, and American Society of Anesthesiologists (ASA) Grade I, II and III patients with a BMI of 18-35kg/m2 of either sex. Patients scheduled for hip fracture surgeries (dynamic hip screw (DHS), inter-trochanteric fractures or proximal femoral nail (PFN implantation) under spinal anaesthesia were also included.

**Exclusion criteria:** This study excludes patients refusing spinal anaesthesia, pregnant patients, those unable to provide informed consent, or those who are unable to communicate or cooperate, on a chronic regimen of strong opioids such as morphine or oxycodone, patients with allergies to local anaesthetics, with pre-existing neurological deficits of the lower limb, with pre-existing lung disease (COPD, uncontrolled asthma), uncontrolled anxiety. With infection at the injection site, previous femoral vascular surgery, with underlying comorbidities/disorders like diabetes mellitus, schizophrenia or bipolar disorder, peripheral neuropathy, and renal impairment. Patients with liver impairment, BMI > 35, coagulopathy, significant cardiovascular disease. Patients with a history of chronic pain condition or daily intake of analgesics and steroids, with daily use of gabapentin, pregabalin, tricyclins, antidepressants, Serotonin- nor epinephrine, tramadol, patients who are addicted to alcohol and drugs, with any pain management in 12 hr before the surgery.

**Study site:** The current study is a single-centre, hospital-based investigation conducted from February 2022 to September 2022 in the Department of Anaesthesia, Yashoda Hospital, Secunderabad, which accredited by NABH & NABL.

A total of 40 patients with written informed consent who were having Hip fracture surgeries under general anaesthesia were included in the study and after receiving approval from the ethics committee the study was initiated. A computer-generated random number list was used to randomize patients into 2 groups (20 in each group) groups were allocated by using envelopes which are sealed and opened by anaesthesiologists not involved in intra-op care of patients.

The patients were randomly divided into 2 groups namely group FICB and group FNB. Group FICB: A total of 20 patients were administered a combination of 20 ml of 0.75% Ropivacaine, 10 ml of 2% LOX and an additional 10 ml of adrenaline. Group FNB: Similarly, 20 patients received the same dosage regimen, comprising 20 ml of 0.75% Ropivacaine, 10 ml of 2% LOX and an additional 10 ml of adrenaline. Depending on the allotted group, patients were given the block under the guidance of ultrasound in the induction room by an experienced anaesthesiologist and the outcomes of each patient were noted and analysed.

All patients underwent a thorough pre-anaesthetic evaluation the day before their surgery. All systems were examined including the surface anatomy where the block would be given and the procedure to be carried out was explained to the patients. They were informed about the development of paraesthesia. Patients were reassured to alleviate their anxieties. By the fasting guidelines, all patients were kept at zero oral. Blood investigations, urine investigations, Electrocardiogram (ECG) and chest X-ray procedures were conducted based on the patient's age and any associated comorbidities. Additional investigations were performed solely to meet the anaesthetic requirements. Preliminaries like written informed consent and intravenous access – starting an intravenous line with an 18G intravenous cannula on the upper limb under aseptic techniques were done. Pulse oximetry, Non-invasive blood pressure monitor on the opposite upper limb, Respiratory rate, and Electrocardiography were monitored.

FEMORAL NERVE BLOCK (FNB) was performed under the guidance of high-frequency linear ultrasonography. Inferior to the inguinal ligament, situated on the upper thigh, the ultrasound probe was carefully positioned transversely. The femoral nerve is situated beneath the fascia iliaca, adjacent to the femoral artery, and exhibits a high-reflectivity characteristic. After disinfection of the skin in the inguinal region and upper thigh, a 22-G, 50-mm, short-bevel Stimuplex D needle was inserted at the lateral side of the thigh and 1 cm outside the edge of the probe. The needle was inserted using the in-plane technique, moving from the outside to the inside and toward the femoral nerve. Once the needle tip was close to the nerve, it was inserted multiple times around the femoral nerve using a multiple-injection technique and negative aspiration until 20 ml of 0.75% Ropivacaine + 10 ml of 2% LOX with adrenaline was given.

FASCIA ILIACA COMPARTMENT BLOCK (FICB) In our study we opted for Supra inguinal FICB. In this technique, the patient has positioned supine and a high-frequency linear probe (6–14 MHz) was placed sagittal to obtain an image of the ilium and iliacus muscle. By positioning the probe inferiorly and medially along the inguinal ligament, the femoral artery was found. After that, the probe was advanced superior and laterally along the inguinal ligament in the direction of the anterior superior iliac spine (ASIS), lying laterally to the FN.

The needle was positioned between 2 to 4 centimetres caudad to the inguinal ligament, to place it beneath the fascia ilia cephalad to the inguinal ligament. Local anaesthetic (LA) extended into the iliac fossa, visible as the space between the fascia iliaca and the iliacus muscle. After puncturing the fascia iliaca and negative aspiration, 20 ml of 0.75% Ropivacaine + 10 ml 2% LOX with adrenaline was injected. An expansion of the anechoic space observed between the fascia iliaca and iliopsoas muscle served as visual confirmation of the precise placement of the local anaesthetic.

The patient's pain level was assessed utilizing a Visual Analog Scale (VAS) before and throughout the nerve block and spinal anaesthesia positioning procedures. In both groups, the nerve block completion times were compared, measured, and recorded. The time to perform spinal anaesthesia/ duration of spinal analgesia was noted.

The level of quality in maintaining the patient position during the placement of spinal anaesthesia blocks was documented (0-not satisfactory, 1-satisfactory, 2-good, 3-optimal). Upon the conclusion of surgery, each patient was inquired, "Are you comfortable with the pain management having been administered before your positioning? "Yes'' or "No". The other outcomes like any complications related to block such as hematomas, hypersensitivity reactions, paraesthesia's, hemodynamic compromise etc., were noted.

**Statistical Analysis:** The statistical analysis of the variables resulted in their expression as Mean ± standard deviation. The analysis of categorical data was conducted through the utilization of the Chi-square test. The unpaired Student's t-test was utilized to analyse quantitative parametric data, and the Mann-Whitney test was employed to analyse non-parametric data. When the variables are quantitative, the correlation coefficient was computed to find the correlation. A *p*-value of less than 0.05 was deemed significant for statistical significance.

# Results

Table 1 shows that the current study group's mean age distribution was 57.43 ± 9.04 years and 56.85 ± 9.25 years for FNB, and FICB respectively and there was no significant difference between the study groups ($p$=0.87).

The study also shows, that the weight distribution in the FNB group was 3% greater than the FICB group and there was no significant difference between the study groups ($p$ = 0.46). Baseline visual analogue scale (VAS) scores at the time of block were 9% less in the FNB group than in the FICB group, with no significant difference between groups ($p$ = 0.33).

VAS score at positioning for subarachnoid block (SAB) was significantly lower (27%) in the FICB group than in the FNB group and there was a significant difference between the two study groups ($p$ = 0.04). Performance time for spinal anaesthesia in the FICB group was significantly lower (7%) than in the FNB group with a significant difference between the two study groups ($p$ = 0.02).

Table 2 explains that females outnumber the males in both femoral nerve block (FNB) and fascia iliaca compartment block (FICB) groups and there was no significant difference between the two groups (p = 0.74).

In performer-rated quality of positioning, among the 20 patients of the group, FICB 90% reported as good and 10% reported unsatisfactory, whereas, among 20 patients of Group FNB, 55% participants reported as good and 45% reported unsatisfactory and there a significant difference among the groups ($p$ = 0.01); Inpatient acceptance 55% stated "yes" and 45% patients stated "no" in FNB group whereas in group FICB 90% stated as "yes" and "10%" patients stated as "no" and there is a significant difference between two groups($p$ = 0.01).

**Table 1:** Comparison of baseline demographic profile among study groups.

| Characteristics | Group(N=40) | | P |
|---|---|---|---|
| | FNB (Mean ±SD) | FICB (Mean ±SD) | |
| Age | 57.43 ± 9.04 | 56.85 ± 9.25 | 0.87 |
| Weight | 56.05 ± 7.61 | 54.20 ± 8.31 | 0.46 |
| VAS score at Block | 6.25 ± 2.02 | 6.80 ± 1.51 | 0.33 |
| VAS at positioning for SAB | 2.05 ± 0.94 | 1.50 ± 0.69 | 0.04 |
| Time to perform Spinal anesthesia | 122.45 ± 13.76 | 113.85 ± 9.83 | 0.02 |

# Discussion

Hip fracture represents a prevalent and grave injury among the elderly population, particularly those with osteoporosis. This condition not only imposes a significant financial burden but also has a substantial social impact.

Patients suffering from hip fractures frequently experience severe pain leading to delirium, hypoglycemia, dehydration, hypertension and arrhythmias. Parenteral opioids have consistently been the primary method for managing pain associated with hip fractures or following hip arthroplasty for an extended period. Opioids often lead to drowsiness, respiratory depression nausea and vomiting.[13] All these adverse effects can be avoided by

**Table 2:** Comparison of Gender, Quality, and Patient satisfaction among study groups

| Characteristics | Group | | Total | Chi square | P |
|---|---|---|---|---|---|
| | FNB | FICB | | | |
| Gender | | | | | |
| Male | 9 | 8 | 40 | 0.1023 | 0.74 |
| Female | 11 | 12 | | | |
| Quality | | | | | |
| Good / Optimum | 11 | 18 | 40 | 6.1442 | 0.01 |
| Satisfactory / Not Satisfactory | 9 | 2 | | | |
| Patient Satisfaction | | | | | |
| Yes | 11 | 18 | 40 | 6.1442 | 0.01 |
| No | 9 | 2 | | | |

Employing peripheral nerve blocks Intravenous Fentanyl has been extensively studied for its role in positioning spinal anaesthesia in hip fractures, yielding varied results. The femoral nerve block (FNB) and fascia iliaca compartment block (FICB) are two frequently employed peripheral nerve block (PNB) techniques in patients with femoral neck fractures.[14]

Lignocaine has a faster onset of action as compared to ropivacaine. On the other hand, ropivacaine has a longer duration of effect. In the OT, where an extensive caseload is involved, it is preferable to have a quicker onset.[15] Therefore, we used the mixture, hoping to combine both the benefits of faster onset and achieving a minimum volume sufficient to block the target nerves. This may explain the disparity in results observed in the study conducted by Jain N et al comparing FICB and FNB in positioning when only plain ropivacaine was used. [16] The obturator and lateral cutaneous nerve of the thigh are not affected by the FNB, explaining less reduction in pain in the group.[17] FICB and FNB had desirable effects in alleviating pain caused by preoperative postural changes in patients with femoral neck fractures, but those who underwent FICB had faster analgesic onset and better analgesic effects.

We provided USG-guided blocks to enhance accuracy and reduce complications in both groups. Comparing the Visual analogue scale during positioning of spinal anaesthesia, both techniques provided a reduction in VAS during positioning but reduction in VAS by FICB was higher than FNB in the present study with higher significance.

Ghimire et al. demonstrated that FICB when given, 1.5% lignocaine with adrenaline up to a total volume of 30 ml, was more effective in reducing the VAS score than the FNB with 15 ml of the same drug and concentration.[18]

In our case, the same volume was administered to the patients of the FICB group which significantly reduced the VAS score. The supra inguinal FICB generates a more extensive sensory blockade across the medial, anterior, and lateral regions of the thigh, compared with an infrainguinal FICB.[19]

Moreover, in our study, we opted for a supra inguinal FICB over an infrainguinal FICB which demonstrates, that a supra inguinal FICB more reliably spreads LA to the anatomical location of the three target nerves of the lumbar plexus than an infrainguinal FICB. A superior inguinal FICB also results in a more uniform distribution across the cranial plane beneath the fascia iliaca and circumferentially around the psoas muscle.[20]

Improved pain relief and better alignment with the FICB are seen in the amount of time required to perform the subarachnoid block (SAB) procedure and the onset of analgesia is quicker in the FICB than in the FNB which is significantly different.[21]

The less time difference between FNB and FICB in our study can be attributed to the recent advancement in the accuracy of USG-guided blocks as in our study where we could deliver a better block using ultrasound.

The present study has found that both FICB and FNB facilitate positioning for SAB in patients undergoing surgeries for proximal femoral fractures. However, the FICB demonstrates a markedly enhanced degree of effectiveness when compared to the FNB. The quality with which the position was attained to perform spinal anaesthesia was better in the FICB group when compared to the FNB group. The SAB performer's evaluation of the positioning quality and the patient's acceptance of the technique both corroborate this assertion.[22]

When performing an FNB or FICB, different conclusions may be drawn depending on the local anaesthetic used, concentrations and volumes, and different levels of ultrasound-guided nerve blockade.[23] Thus, in our study, we found FICB to have significant advantages over the FNB. Though FICB is a relatively difficult block, it gives a definite approach for nerves supplying the hip. The distribution of analgesia was significantly better with this block. The key factors like sufficient volume, supra inguinal FICB, and ultrasound guidance were possibilities that have edged fascia iliaca compartment block (FICB over femoral nerve block (FNB) as a better block for positioning of hip fracture patients for SAB in our study.

# Conclusion

Based on the study results, the fascia iliaca compartment block (FICB) demonstrates a higher efficacy in relieving pain compared to the femoral nerve block (FNB). The onset of the analgesic effect was earlier in FICB compared to FNB. The anesthesiologist is more satisfied with the quality of patient positioning when working with FICB. Thus, FICB can serve as a standard method for managing pain in patients with hip fractures, particularly for positioning them for spinal anaesthesia.

# Declarations

**Source(s) of support:** Nil

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**Registration number of clinical trials:** Reg. No. (DHR).EC/NEW/INST/2020/1148] vide DNBT-04/2022 The study was approved by the Institutional Ethics Committee (IEC), Yashoda Academy of Medical Education and Research, Yashoda Hospital, Secunderabad- 500003 [EC Reg. No. (DHR).EC/NEW/INST/2020/1148] vide DNBT-04/2022 on 18-02-2022. Written informed consent was obtained for participation in study and use of patient data for research and educational purposes. The procedures follow guidelines laid down in Declaration of Helsinki 1964 and as revised later.

**Conflict of interest:** None declared

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