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Original Article

Comparison of Ultrasound-Guided Fascia Iliaca Compartment Block with Femoral Nerve Block for Positioning of Femur Fracture Patients before Spinal Anesthesia

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Abstract

Aims: To compare the ultrasound-guided fascia iliaca compartment block and femoral nerve block (FNB) for positioning of femur fracture patients before spinal anesthesia.

Objectives: Primary objectives were patient comfort during positioning for spinal anesthesia, anesthesiologist satisfaction during positioning for spinal anesthesia, and secondary objective was postoperative analgesia.

Methods: A prospective, randomized double-blinded controlled study was conducted with 60 patients admitted to Mahatma Gandhi Memorial Government Hospital, Trichirappalli, between the period of February 2020 and September 2021, after satisfying the inclusion and exclusion criteria, aged between 18 and 80 years undergoing elective surgery for fracture femur were included in the study.

Results: Significant improvement in Patient Numerical Rating Scale score, anesthesiologist satisfaction score, sensory blockade, and time to first analgesic requirement was observed.

Conclusion: Ultrasound-guided FNB was the best anesthetic technique in reducing pain associated with sitting position for subarachnoid block in patients with fracture femur compared to ultrasound-guided fascia iliaca block.

Key words: Fascia iliaca, Femoral nerve, Fracture femur, Pain, Spinal anesthesia, Ultrasound

INTRODUCTION

Fracture femur is a very painful condition perioperatively and this pain is further exaggerated by movements. Routine analgesics such as pracetamol, NSAIDs, and opioids have their side effects such as nausea, vomiting, constipation, urinary retention, respiratory depression, and nephrotoxicity and these are contraindicated due to their interactions with other drugs.[1-4]

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Peripheral nerve blocks in lower extremity are increasingly being recommended for the control of pain in patients with fracture femur as it reduces pain, time to first rescue analgesia, need for systemic analgesics, and incidence of delirium and shortens the duration of hospital stays. The femoral nerve block (FNB) and fascia iliaca compartment block (FICB) are the simple methods which require minimal instruments with few absolute contraindications, being hypersensitivity to local anesthetic agents or the presence of vascular or neurological problems in the affected limb. However, these simple techniques are underused in the management of pain relief in femur fracture.[5-7]

The hip joint is the largest weight-bearing ball and socket joint and is formed by joining thigh bone or femur and the pelvis and surrounded by muscles, ligaments, and tendons. The main nerves in the hip region include the femoral

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nerve in the front of the femur and the sciatic nerve at the back. The hip is also supplied by a smaller nerve known as the obturator nerve. Fascia iliaca is a thick connective tissue spanning from the lower thoracic vertebrae to the anterior part of the thigh. It lines the posterior part of the abdomen and pelvis, enclosing the psoas and iliacus muscles. Lower, it forms posterior wall of the femoral sheath. Further down, it is covered in the femoral triangle by the fascia lata, blending with it distally.

Contents of fascia iliaca compartment include femoral nerve, lateral femoral cutaneous nerve, obturator nerve, ilioinguinal nerve, and genitofemoral nerve.

Aims and Objectives

To compare the ultrasound-guided FICB and FNB for positioning of femur fracture patients before spinal anesthesia. The primary objectives include patient comfort, anesthesiologist satisfaction during positioning for spinal anesthesia and secondary objective includes post-operative analgesia.

MATERIALS AND METHODS

A prospective, randomized double-blinded controlled study conducted with 60 patients admitted to Mahatma Gandhi Memorial Government Hospital, Trichirappalli, between the period of February 2020 and September 2021, after satisfying the inclusion and exclusion criteria and aged between 18 and 80 years who are undergoing elective surgery for fracture femur were included in the study, after obtaining the institutional ethical committee clearance and after valid written and informed consent from the patient.

Patients were divided into two groups.

- Group A: 30 Patients receiving FNB
- Group B: 30 Patients receiving FICB.

Inclusion Criteria

ASA physical status 1 and 2, Patient posted for elective fracture femur surgery, Age between 18 and 80 years.

Exclusion Criteria

Patients with other bone fractures, psychiatric and neurological illness, inguinal hernia, coagulopathy, local skin infections, severe cardiovascular and respiratory disease, patients allergic to study drugs, and patient on analgesic within 8 h before performing nerve block were excluded from the study.

Methodology

On arrival of the patient in the operation theater, Numerical Rating Scale (NRS) pain score was assessed using a standard 10-cm NRS, with 0 corresponding to no pain and 10 designating the worst possible pain. The site to be blocked was painted with 5% povidone-iodine and was draped. A linear 7–13 MHz ultrasound probe was used with in-plane approach of 18G needle advancement. Probe was moved laterally or medially and rocked back and forth until a good-quality picture was obtained. Mark on the probe was always kept on the lateral side for image orientation. Optimal gain, depth, and focal point were

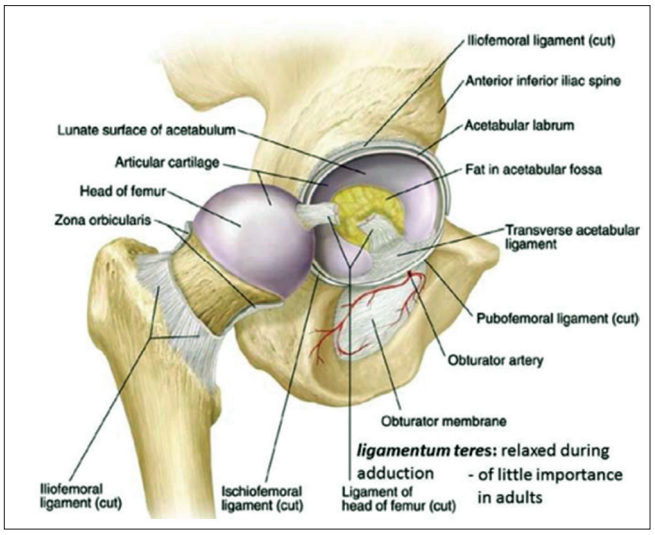

Figure 1: Hip joint anatomy

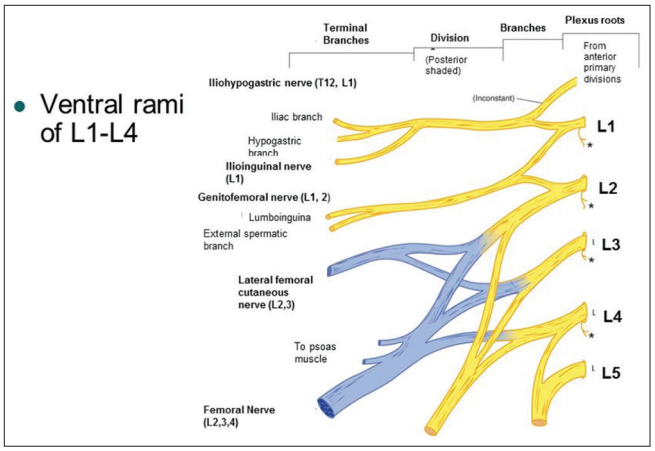

Figure 2: Lumbar plexuses

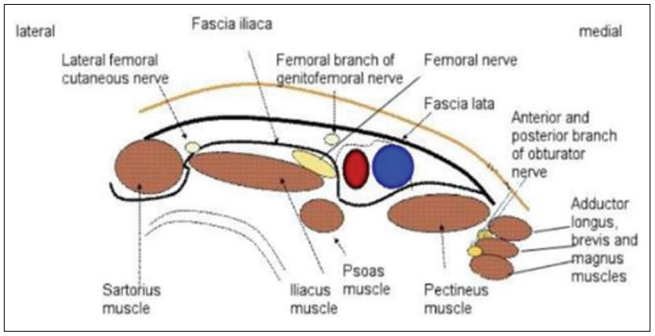

Figure 3: Contents of fascia iliaca compartment

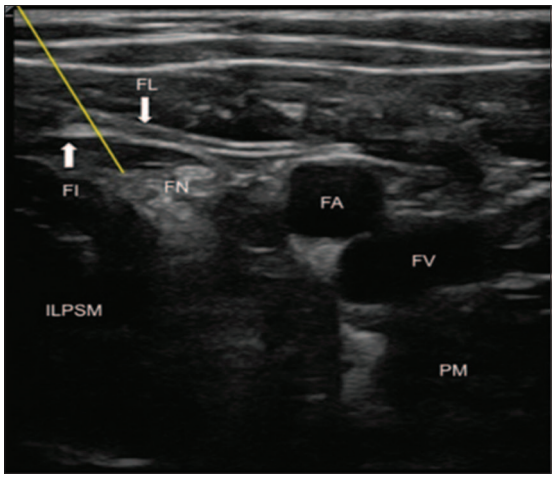

Figure 4: Femoral nerve block ultrasound anatomy and procedure

Figure 5: Femoral nerve block ultrasound anatomy and procedure

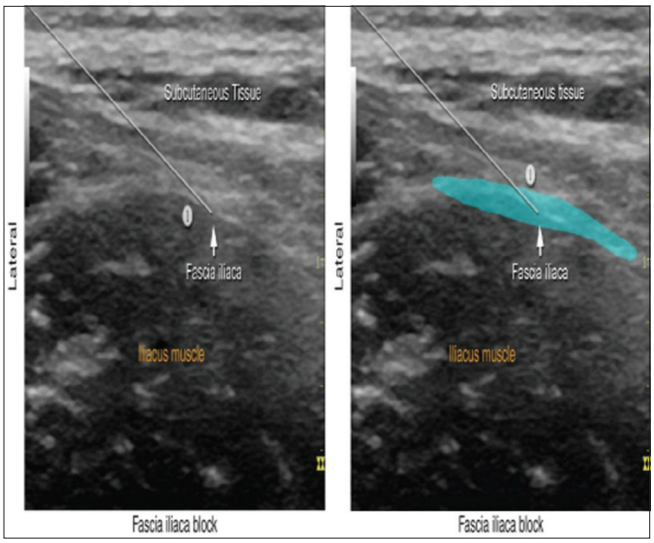

Figure 6: Fascia iliaca block

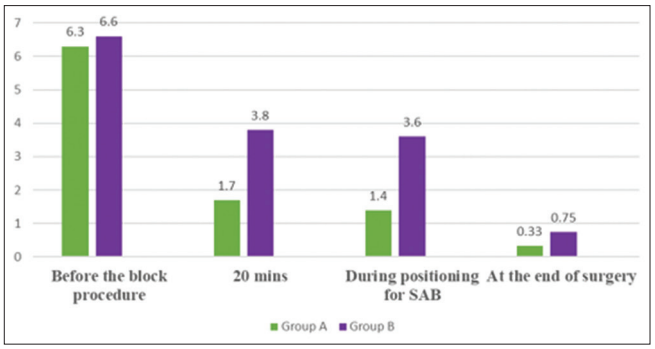

Figure 7: Patient satisfaction score

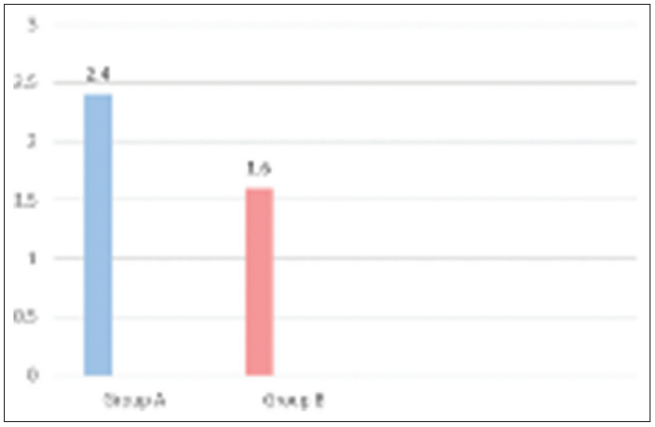

Figure 8: Anesthesiologist satisfaction score

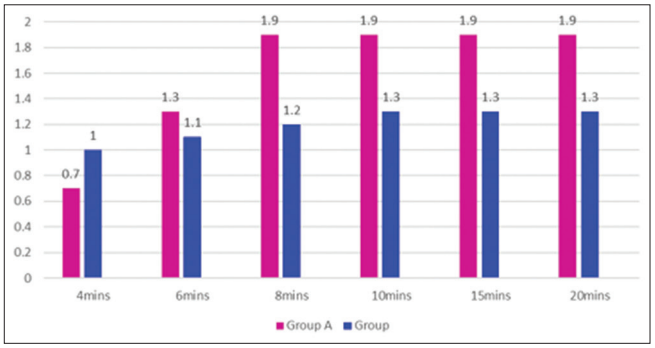

Figure 9: Pin-prick time

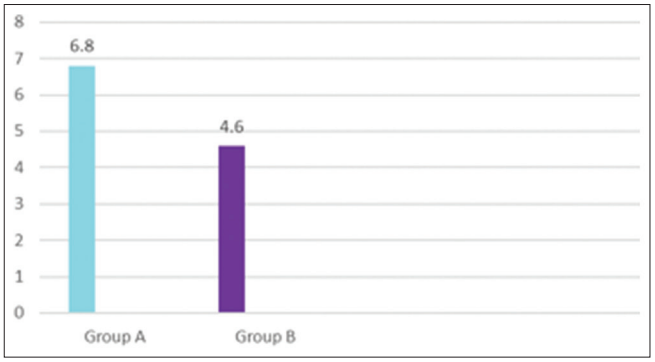

Figure 10: Time to first analgesic requirement

set to obtain the best possible view of the concerned anatomical structures.

Group A (n = 30) received ultrasonography (USG) FNB. Landmarks included the identification of femoral nerve lateral to femoral artery at the level of femoral crease followed by the injection of 0.5% ropivacaine 20 mL after careful aspiration adjacent to femoral nerve.

Group B (n = 30) received USG FICB. Landmarks included identification of femoral artery, iliopsoas muscle, fascia iliaca, and sartorius muscle followed by injection of 0.5% ropivacaine 20 mL after careful aspiration between fascia iliaca and iliopsoas muscle.

After the block procedure patient satisfaction before the block procedure, 20 min after the block procedure, during positioning for SAB, and at the end of surgery was assessed, anesthesiologist satisfaction during positioning for spinal anesthesia, pinprick (2 min, 4 min, 6 min, 8 min, 10 min, 15 min, and 20 min), total duration for surgery and time to first analgesics requirement were assessed. Variables were analyzed statistically and expressed as mean ± standard deviation. The categorical data were compared using the Chi-square test. Quantitative parametric data were analyzed using unpaired Student's *t*-test, whereas nonparametric data were analyzed using the Mann-Whitney test. $P = 0.05$ was considered statistically significant.

Injection bupivacaine 0.5% heavy 15 mg was given intrathecally using a 25G Quincke needle.

Duration of analgesia was defined as loss of pinprick sensation in the anterior part of thigh after the peripheral nerve block to NRS pain score was assessed every hour postoperatively or when the patient demanded for rescue analgesia. Perioperative patient comfort was assessed postoperatively using the standard NRS scale for comfort, with 0 corresponding to most comfortable and 10 designating the least comfortable state.

Complications such as nausea, vomiting, hypotension, bradycardia, hematoma, and local anesthetic toxicity were carefully monitored. No loss of pinprick sensation in the anterior part of thigh within 20 min of performing the peripheral nerve block was considered as

block failure. Such patients were excluded from the study.

RESULTS

The patient satisfaction score (NRS). Mean reduction in NRS score for pain before the block procedure, was also more in Group A FNB (6.3 ± 1.1) compared to Group B FICB (6.6 ± 1.3) (P = 0.3386). Mean reduction in NRS score for 20 min after the block procedure was also more in Group A (1.7 ± 1.2) as compared to Group B (3.8 ± 1.39) which is statistically significant (P = 0.0158). During positioning for spinal anesthesia, the mean reduction in patient satisfaction score was 1.4 ± 0.9 for Group A and 3.6 ± 1.8 for Group B which was statistically significant (0.0003). At the end of the surgery, the patient satisfactory score was 0.33 ± 0.7 for Group A and 0.75 ± 1.3 for Group B (P = 0.1247).

The anesthesiologist satisfaction score during the positioning for spinal anesthesia for the Group A (FNB) was 2.4 ± 0.7 and for the Group B (FICB) was 1.6 ± 0.8. There found to be significant changes P = 0.0001.

The pinprick in minutes for 4 min; the mean time in minutes was 0.7 ± 0.5 and 1 ± 0.6 for Group A and Group B and its statistically significant (0.0317). At 6 min, 1.3 ± 0.4 and 1.1 ± 0.5 for Group A and Group B. For 8 min, 10 min, 15 min, and 20 min, the pinprick mean minutes were 1.9 ± 0.3 for Group A and 1.3 ± 0.4 for Group B, respectively. It is statistically significant (0.001).

The mean time taken to first analgesics requirement for the Group A patients was 6.8 ± 1.3 and for the Group B patients 4.6 ± 1.2, which was statistically very significant (P = 0.0001).

The time duration taken for the procedure for the Group A (126 ± 15.4) was the mean time in min and for the Group B (141 ± 16.8) was the mean time in min and it was statistically significant (P = 0.0235).

The vitals at the time of block such as heart rate were 89.8 ± 10.9 and 93.3 ± 9.5 for the Group A and Group B, respectively, and systolic blood pressure was 115.2 ± 11.2 and 111.9 ± 11.4 and diastolic blood pressure was 65.9 ± 10.3 and 64.5 ± 9.4 for the Group A and Group B, For SPO_2 98.8 ± 0.8 and 98.6 ± 0.8 and for respiratory rate 14.9 ± 1.4 and 14.9 ± 1.6 for Group A and Group B, respectively. The vitals during position for spinal anesthesia, heart rate were 78.8 ± 5.1 and 76.8 ± 4.1 for the Group A and Group B, respectively, and the systolic blood pressure was 118.1 ± 8.9 and 114.1 ± 8.3 and diastolic blood pressure was 71.1 ± 7.8 and 70.3 ± 7.9 for the Group A and Group B for SPO_2 98.5 ± 1.04 and 98.5 ± 0.8 and for respiratory rate 15.1 ± 1.4 and 14.4 ± 1.1 for Group A and Group B, respectively [Figures 1-10].

DISCUSSION

Peripheral nerve block with spinal anesthesia is the most commonly used anesthetic technique for patients with

femur fracture. In fracture femur patients, positioning is a painful condition as evident from NRS pain scores assessed before performing the peripheral nerve block, in our study as well as previous studies. Patients presenting with fracture femur usually are the elderly and have multiple comorbidities, which precludes the use of systemic analgesics. Nerve blocks were used infrequently to aid with positioning. No sedation or analgesia was given for positioning in 15.1% of patients.[8-13]

A 2012 survey of three Toronto, Ontario-area hospitals found that regional nerve blocks for hip fractures were performed by only 33% of attending emergency physicians and only 6% performed them often or almost always. A 2009 survey in the United Kingdom found that 55% of emergency departments regularly use regional anesthesia techniques for hip and femur fractures. A 2002 Cochrane systemic review of nerve blocks for hip fractures undertaken shortly after admission to hospital concluded: "Nerve blocks resulted in statistically significant reductions in reported pain levels and in the quantity of parenteral or oral analgesia administered to control pain from the fracture or during surgery. National Institute for Health and Clinical Excellence guidelines says "Consider nerve block for additional analgesia or to limit opioid dosage." Thus, lower limb peripheral nerve blocks may prove to be a useful tool in an anesthetists' armamentarium for not only improving perioperative patient comfort and reducing pain exaggerated by movements but also increasing the ease, success rate and decreasing time for performing subarachnoid block.[14-16]

In our study FNB proves to be significantly more effective than FICB in reducing pain during sitting position for spinal anesthesia. Our study result consistent with the result of Kumar *et al*. had post-block pain Visual Analog Score (VAS) of 2.94 for FICB, with mean reduction in pain VAS score of 4.56 for ($P = 0.01$) using 0.5% ropivacaine and Newman *et al*., who had post block pain VAS score of 4.4 and 5.4 for FNB and FICB, respectively, using 0.5% levobupivacaine. Jain *et al*. finding reveals that FNB proves to be significantly more effective than FICB in reducing pain during positioning for subarachnoid block was also consistent with our study. Several randomized control trials have also proved the superiority of ultrasound over other techniques. Our study aims to compare FNB with FICB using USG technique as this remains unexplored. Ropivacaine, the S enantiomer of 1propyl 2', 6'pipecoloxylidide, one of the most commonly used long acting local anaesthetics in the peripheral nerve blockade was chosen because it has lower toxicity than the R enantiomer. Reduced central nervous system and cardiac toxicity, along with lower lipid solubility which leads to less propensity for motor blockade than bupivacaine. The FNB results in anesthesia of the skin and muscles of the anterior thigh and most of the femur and knee joint. The distribution of anesthesia and analgesia that is accomplished with the fascia iliaca block depends on the extent of the local anesthetic spread and the nerves blocked. The block should result in blockade of the femoral nerve in all instances (100%) and lateral cutaneous nerve of the thigh in 80–100% instances. The psoas muscle and pectineus muscle separate the obturator nerve from the femoral nerve along its course, and therefore, this nerve is not reliably blocked by FICB. These blocks are well suited for surgery on the anterior thigh and knee, quadriceps tendon repair, and postoperative pain management after femur and knee surgery. FNB and FICB were earlier performed using landmark or nerve stimulator technique, but the advent of ultrasound overcome their shortcomings and is now a preferred technique.

Deposition of ropivacaine within the vicinity of femoral nerve using ultrasound guidance that gives articular branches to hip joint increases the chances of the nerve getting block. This may be the reason why, in our study, the FNB proved to be more efficacious analgesic than FICB, which requires deposition of large volume of local anesthetic away from the femoral nerve. We observed that FNB and FICB provided longer duration of postoperative analgesia compared to intrathecal 0.5% heavy bupivacaine alone which has a duration of 60–240 min. It will decrease the use of systemic opiates and improves functional recovery and quality of life and decreases duration of hospital stay. Although our results were consistent with the previous studies, the use of USG for performing peripheral nerve blocks was the reasons for no failures and better peri-operative patient comfort in our study.

In resource-limited hospital settings, FICB, which is easy to learn and perform, can be used as it also provides satisfactory analgesia and patient comfort.

Major limitations of our study were assessment of NRS pain score which is subjective and varies with the level of understanding between patient and anesthesiologist.[17-20]

CONCLUSION

In our study, we concluded that ultrasound-guided FNB is the best anesthetic technique in reducing pain associated with positioning for spinal anesthesia in patients with fracture femur compared to ultrasound-guided FICB, nerve blocks performed with patient comfort and without complications and longer duration of post-operative analgesia in the patients undergoing surgery for fracture femur.

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