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Original Article

Anaesthesia Section

Evaluation of Ultrasound-guided Pre-emptive Fascia Iliaca Compartment Block for Postoperative Analgesia in Femur and Hip Fracture Surgeries: A Randomised Controlled Trial

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ABSTRACT

Introduction: Spinal anaesthesia is the preferred anaesthetic technique for fractures of the hip and femur. Ultrasound-guided Fascia Iliaca Compartment Block (FICB) provides more intense analgesia which can prolong the duration of postoperative analgesia and also mitigate the pain encountered while positioning for spinal anaesthesia.

Aim: To evaluate the efficacy of ultrasound-guided pre-emptive FICB in hip and femur fracture surgeries.

Materials and Methods: This randomised, double-blinded, control study was conducted between May 2019 to December 2019, at SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India. Total 66 patients scheduled for hip and femur fracture surgeries under spinal anaesthesia were randomly divided into two groups i.e, group A received Ultrasound-Guided (UG) FICB preoperatively and group B received no block. All the patients received fentanyl 1 mcg/kg intravenous (i.v.) 15 min before spinal anaesthesia. The Anaesthesiologist performing spinal anaesthesia graded the score of positioning as 0 as not satisfactory, 1 as satisfactory, 2 as good, 3 as optimal. The time for the first request for analgesia, consumption of analgesics and Visual Analog Scale (VAS) scores for 24 hours postoperatively and any adverse effects were compared between the two groups. Student's t-test was used to compare continuous data and unpaired t-test for categorical data.

Results: The time for the first request for analgesia was 671.52±66.73 min in group A and 480.3±57.65 min in group B and was statistically significant (p-value <0.0001). In group A, the quality of positioning for spinal anaesthesia was optimal in 13 patients and good in 14 patients. In group B, it was unsatisfactory in 12 patients and just satisfactory in four patients (p-value=0.0009). Majority of the patients (24) in group A required three doses of paracetamol, while 26 patients required two doses for group B. The total number of doses for tramadol was 4 in group A, and 13 in group B. The VAS scores were reduced at the 8th and 10th hours following surgery in group A. No adverse effects were encountered in the study.

Conclusion: The FICB prolongs the time to first request for analgesia postoperatively, improves patient positioning for spinal anaesthesia, reduces the consumption of analgesics, and improves VAS scores postoperatively without any adverse effects.

Keywords: Analgesia, Patient positioning, Spinal anaesthesia, Ultrasonography, Visual analog scale

INTRODUCTION

Fractures of the hip and femur are severely painful bone injuries because the periosteum has the lowest pain threshold [1]. The inadequate treatment of pain can lead to neurohumoral response leading to adverse cardiac events. Hip fractures are common among the elderly population where increased heart rate and blood pressure are undesirable. This can even lead to fatal cardiac events [2]. Hence, adequate pain control is essential in these patients. Also, positioning the patients with hip and femur fractures in a lateral decubitus position or supine for the central neuraxial blockade is extremely onerous and excruciating [3]. Adequate analgesia rendered before spinal or epidural anaesthesia can achieve optimal positioning of the patient. This not only escalates the success rate but also bestows comfort to both patients and anaesthesiologists [4].

The pain alleviation ensuing surgeries are usually treated with opioids or Non Steroidal Anti-inflammatory Drugs (NSAIDs). This can lead to renal damage or respiratory depression, nausea, vomiting, and pruritus respectively especially in elderly patients. The peripheral nerve blocks like Femoral Nerve Block (FNB) and Fascia Iliaca Compartment Block (FICB) can provide adequate analgesia preoperatively. This nerve blockade succours in positioning the patient for spinal anaesthesia, extends the duration of analgesia, and diminishes the consumption of opioids postoperatively [5].

In developing countries, most hip and femur fracture surgeries are performed under spinal anaesthesia. But, positioning the patients for spinal anaesthesia is an onus. Singh AP et al., proved that femoral nerve block was superior to intravenous (i.v.) fentanyl in reducing the time for spinal anaesthesia and better Visual Analog Scale (VAS) scores postoperatively in fracture femur surgeries [1]. They showed that Ultrasound-Guided (UG) FICB was more effective than femoral nerve block in relieving patient pain during positioning of spinal anaesthesia [3]. A meta-analysis demonstrated that FICB was more effective than i.v. analgesics in providing better quality during positioning of spinal anaesthesia [5].

There are only fewer studies assessing the efficacy of UG FICB administered pre-emptively, duration of postoperative analgesia and quality of positioning for spinal anaesthesia. Hence, this study was planned to evaluate the effectiveness of pre-emptive ultrasound-guided FICB in hip and femur fracture surgeries. The primary objective was to assess the time for the first request for analgesia. The secondary objectives were to compare positioning scores

for spinal anaesthesia, consumption of analgesics for 24 hours postoperatively, VAS scores and adverse effects, if any.

MATERIALS AND METHODS

This randomised, double-blinded control study was conducted between May 2019 to December 2019, at SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India. This study was initiated after Institutional Ethical Committee (1378/IEC/2018) assent and registration with Clinical Trial Registry- India (CTRI/2019/04/018488). The study was done in accordance with the Ethical Guidelines of Helsinki Declaration.

Sample size calculation: A pilot study was conducted with 10 patients to determine the sample size, with the time for the first request for analgesia as the primary endpoint. The result was 780.45±96.72 min in group A, and 366.19±54.83 min in group B. Taking the power at 0.9 and the alpha error at 0.05, a sample size of atleast 20 patients for each group was computed. A total of 33 patients were included in each group to improve statistical analysis and offset potential dropouts. Data from the pilot project were not included in the final analysis.

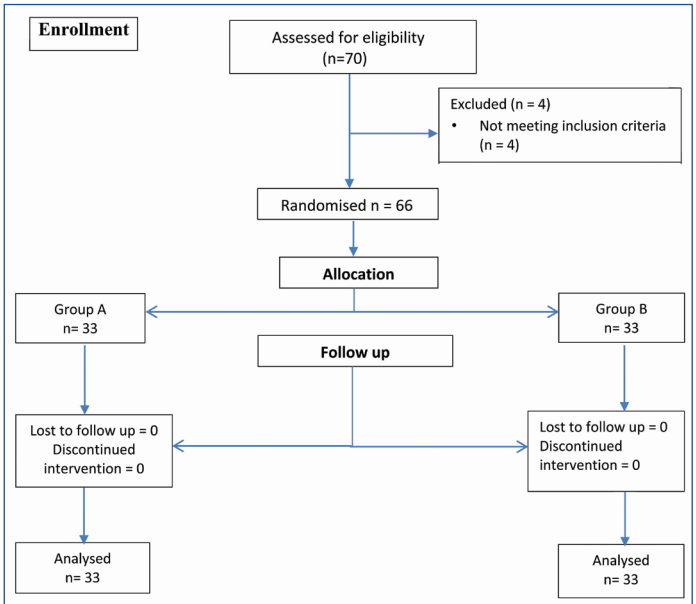
Inclusion criteria: All patients with American Society of Anesthesiologists (ASA) physical status I or II patients, aged between 18 to 75 years, with Body Mass Index (BMI) between 18 to 25 kg/m^2, and scheduled for hip and femur fracture surgeries under spinal anaesthesia were included in the study.

Exclusion criteria: Patients with cardiac, liver, or renal disorders, pregnancy, coagulation disorders, and those with contraindications for spinal anaesthesia were excluded from the study.

Total 66 consecutive patients eligible for the study were randomly split into two groups by using computer-generated random numbers and stored in a sealed, opaque enclosure. The envelope was opened at the start of a case and allocated to that particular group.

- Group A patients received UG FICB before spinal anaesthesia
- Group B patients no intervention was performed

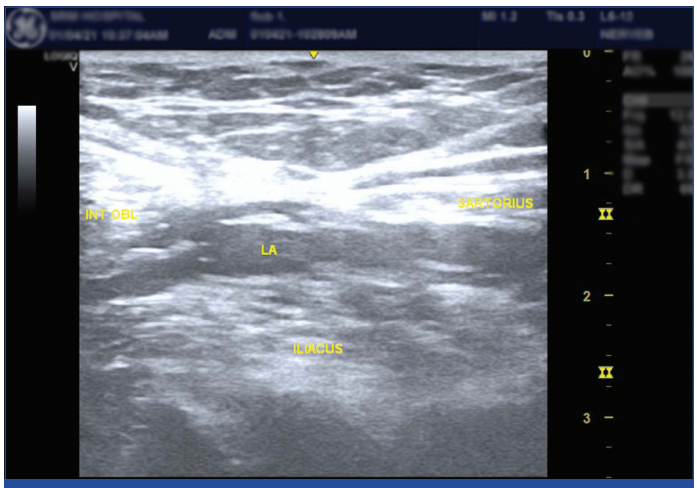
A total of 70 patients were screened, and four patients were excluded for not meeting the inclusion requisites. Total 33 patients were analysed in each group and none of them were lost to follow-up. The CONsolidated Standards of Reporting Trials (CONSORT) flowchart depicting the passage of patients in the study is given in [Table/Fig-1].



[Table/Fig-1]: CONsolidated Standards of Reporting Trials (CONSORT) flowchart.

Procedure

The anaesthesia was standardised in both groups. An Ultrasonogram machine (Logiq V2, GE Medical Systems, China), with a 5-13 MHz linear probe was utilised for the FICB. Under strict aseptic precautions, the patient was placed in the recumbent position, the ultrasonogram was placed medial to the anterior superior iliac spine to visualise internal oblique and sartorius muscle in a bow-tie fashion. The fascia iliaca and iliacus muscles were identified and 30 mL of 0.5% ropivacaine was injected just below the fascia iliaca. The correct position of the needle {100 mm, 20 G Stimuplex (B Braun) needle} was confirmed by the peeling of the iliacus muscle from the fascia iliaca [Table/Fig-2]. The blocks were performed by a single, experienced Anaesthesiologist. Patients in both groups received fentanyl 1 mcg/kg intravenously for 15 minutes before positioning for spinal anaesthesia. The patients were changed to sitting position 30 minutes after administration of the block in group A. No block was given to patients in group B.



[Table/Fig-2]: Ultrasound-guided fascia iliaca compartment block.
Int obl: Internal oblique; LA: Local anaesthetic

Positioning scores for spinal anaesthesia: The scoring was done by the anaesthesiologist performing spinal anaesthesia according to the positioning of the patient in the sitting position [6]:

- 0: not satisfactory,
- 1: satisfactory,
- 2: good,
- 3: optimal

The spinal anaesthesia was administered in both the groups with 0.5% heavy bupivacaine and fentanyl 25 mcg. Patients were monitored using a pulse oximeter, electrocardiogram, and non invasive blood pressure continuously. All the surgeries were done by a single trauma surgeon.

At the end of the surgery, the patient was transferred to the Postanaesthetic Care Unit (PACU). The patient was monitored by a separate Anaesthesiologist, who was not aware of the group involved.

Visual Analogue Scale (VAS): The pain was evaluated by VAS score [7]:

- 0 as mild pain,
- 2 as hurts little bit,
- 4 as hurts little more,
- 6 as hurts even more,
- 8 as hurts whole lot and
- 10 as the worst possible pain.

Consumption of analgesics for 24 hours postoperatively: The patients were administered paracetamol 1 gm intravenously (i.v.) when VAS score was ≥3 with the maximum of four doses for 24 hour. If the pain relief was inadequate at any stage (VAS score was ≥6), tramadol 100 mg i.v. was administered along with ondansetron 4 mg i.v. If adequate pain relief (VAS score was ≥6) was not achieved after 30 min of paracetamol and tramadol, fentanyl 1 mcg/kg i.v. was administered. The time for the first request for analgesia was taken as the time taken from the performance of spinal anaesthetic to the first use of paracetamol (VAS score ≥3). The total consumption

of paracetamol and tramadol for 24 hours was recorded. The VAS scores were monitored every two hours during a 24 hours postoperative period.

Adverse effects: The patients have been monitored for any adverse effects like hypotension, bradycardia, nausea, vomiting, pruritus, respiratory depression, haematoma formation, and infection at the block site.

STATISTICAL ANALYSIS

All statistical analysis was accomplished using Statistical Package for Social Science (SPSS) version 17.0 for Microsoft windows. Data were distributed uniformly and categorical data were presented as numbers and percentages of patients. A Chi-square test was used in the comparison of two variables. The continuous data were expressed as mean±Standard Deviation (SD). Independent sample student's t-test/Mann Whitney tests were used to compare continuous variables between the two groups. A two-tailed p-value <0.05 was considered statistically significant.

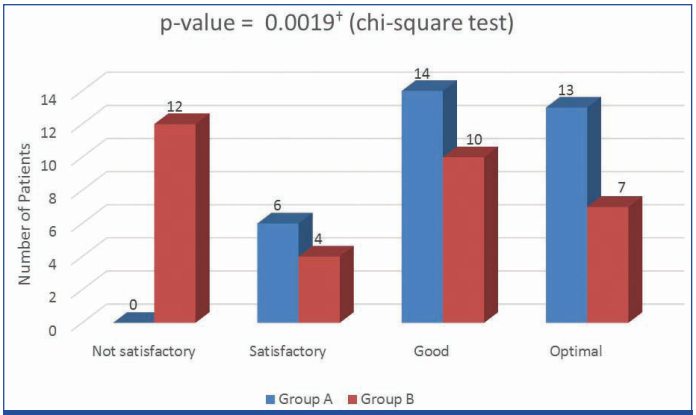
RESULTS

Total 33 patients were analysed in each group and none of them were lost to follow-up. There was no statistically significant difference in age, body mass index, sex, American Society of Anesthesiologists (ASA) physical status, and duration of surgery. The results were tabulated in [Table/Fig-3].

Variables	Group A	Group B	p-value
Gender (Male/ Female)	15/18	16/17	0.805*
Age (years)	52.64±14.26	51.61±14.74	0.7713
Body mass index (Kg/m^2)	22.07±3.74	23.88±4.14	0.067#
American Society of Anesthesiologists (ASA) physical status I/II	7/26	12/21	0.277#
Duration of surgery (min)	82.94±10.62	80.48±11.89	0.378#

[Table/Fig-3]: Demographic characteristics of the study subjects.
Values are in Mean±Standard deviation (SD) or number of patients; *Chi-square test; #Unpaired t-test

The time for the first request for analgesia was 671.52±66.73 min in group A and 480.3±57.65 min in group B, with a p-value of <0.0001 and the result was statistically significant. The quality of positioning for spinal anaesthesia was good to optimal in about 27 (81.8%) of patients in group A. In group B, it was non satisfactory in 36.3% of patients, and optimal in 21.2% of patients. It was statistically noteworthy with a p-value of 0.0009 and represented in [Table/Fig-4].



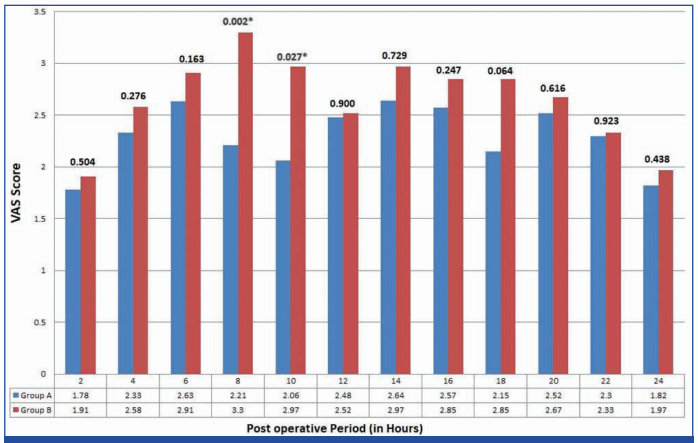
[Table/Fig-4]: Quality of positioning for spinal anaesthesia.
Values are number of patients

The total consumption of paracetamol was more in group A than the use of tramadol. The total consumption of tramadol was more in group B. This is attributed to the lower VAS scores in group A, which determined the type of analgesics administered. The difference in paracetamol consumption was statistically significant with a p-value of <0.0001. The tramadol usage was also statistically significant with a p-value of 0.002. The results were summarised in [Table/Fig-5].

Parameters	Group A	Group B	p-value
Time for first request for analgesia (minutes) (Mean±SD)	671.52±66.73	480.30±57.65	<0.0001#
Number of doses of paracetamol (1/2/3)	0/9/24	2/26/5	<0.0001*
Number of doses of tramadol (0/1/2)	29/4/0	20/9/4	0.002*

[Table/Fig-5]: Postoperative analgesia and analgesic requirements.
Values are in Mean±SD or number of patients; *Chi-square test; #Unpaired t-test; p-value <0.05 was considered significant

There was a statistically significant difference in VAS scores at the eighth and tenth hours ensuing surgery with pain scores less in group A than group B. There was no significance till six hours and after ten hours in VAS scores postoperatively and mentioned in [Table/Fig-6]. No adverse effects were encountered.



[Table/Fig-6]: Visual Analogue Scale (VAS) score.
Values are in mean with p-value (unpaired t-test) at the top; p-value <0.05 was considered significant

DISCUSSION

The positioning of the patient for spinal anaesthesia in sitting or lateral decubitus position is challenging as pain is excruciating due to over-riding fracture ends during movements. FICB performed under ultrasound guidance is easy to learn, has a high success rate and provides intense analgesia when administered pre-emptively in femur fracture patients. The primary aim of the study was to assess the duration of postoperative analgesia. The present randomised control study showed that the administration of UG FICB preoperatively not only alleviates the pain of positioning, but also improves patient satisfaction and prolongs the duration of postoperative analgesia.

The FICB prolonged the duration of analgesia postoperatively for more than 11 hours in hip and femur fracture surgeries. The pain relief lasted for nine hours without FICB. Kacha NJ et al., performed blind FICB with 30 mL of 0.25% ropivacaine before spinal anaesthesia. They reported the duration of postoperative analgesia to be 428.3 min and were prolonged in the FICB group than the control group. This duration of postoperative analgesia was less than this study and it may be due to not utilising ultrasound [8]. Anaraki AN and Mirzaei K, also proved that FICB delayed the time to first request for rescue analgesia in femur surgery [9].

The quality of positioning for spinal anaesthesia and the anaesthetist satisfaction score was better when FICB was performed. Singh AP et al., demonstrated that a higher number of patients could be positioned optimally in the FICB group than femoral nerve block. They also stated that UG FICB was more effective in relieving pain for positioning of spinal anaesthesia [3]. Kacha NJ et al., proved that FICB provided effective pain relief for positioning patients for spinal anaesthesia [8]. Hsu YP et al., performed a meta-analysis comparing FICB with intravenous analgesics for positioning before spinal anaesthesia. They studied four randomised controlled trials comprising 141 participants and concluded that FICB can significantly

lower the pain scores which facilitate better positioning for spinal anaesthesia [5].

There was a reduction in the consumption of paracetamol and tramadol in the postoperative period. Hsu YP et al., in their meta-analysis, reported that FICB was superior in reducing opioid consumption than intravenous analgesics [5]. Bang S et al., observed that UG FICB reduces postoperative fentanyl consumption after hemiarthroplasty [10]. Williams H et al., compared standard preoperative analgesia with paracetamol, codeine, and morphine preoperatively with FICB for the neck of femur fractures. They concluded that FICB significantly reduced the consumption of opioids and thereby its adverse effects [11]. There was a reduction in VAS scores when FICB was performed preoperatively.

Zhou Y et al., proved that VAS scores were reduced in the acute postoperative period when FICB and femoral obturator nerve block was performed for elderly patients with hip fractures [12]. Kacha NJ et al., also proved that there was a reduction in VAS scores after FICB [8]. Madabushi R et al., demonstrated a reduction in VAS scores (24.72±15.70 mm) in the FICB group than the intravenous fentanyl group (61.22±18.18 mm). This drop-in VAS score was statistically significant [13]. The FICB is a relatively safer block and complications were not encountered in any of the studies. Hao J et al., even demonstrated that pre-emptive continuous FICB even reduces the incidence of postoperative delirium in elderly patients [14].

Limitation(s)

All the blocks were performed by an experienced Anaesthesiologist and hence failure in blocks was not encountered. The block failure may be encountered in inexperienced hands. Secondly, the obturator nerve may be spared in FICB and a separate block for it may be needed [10,15,16]. However, adequate pain relief was achieved in most of the patients.

CONCLUSION(S)

It can be concluded that ultrasound-guided fascia iliaca compartment block administered pre-emptively is effective in femur fractures. It prolongs time to first request for analgesia postoperatively, improves patient positioning for spinal anaesthesia, reduces consumption of analgesics, and improves VAS scores postoperatively, without any adverse effects. The ultrasound-guided FICB should be administered routinely before spinal anaesthesia in femur fracture surgeries.

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