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Original Article

Comparison of Ultrasonography Guided Fascia Iliaca Compartment Block and Intravenous Fentanyl for Positioning During Spinal Anesthesia in Fracture Femur Surgeries - A Randomized Controlled Study

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Abstract

Introduction: Anesthesia for femur surgeries is usually provided by subarachnoid block. Proper positioning during subarachnoid block is essential for a successful procedure. Alleviating pain increases patient comfort and also provides better patient positioning for subarachnoid block.

Aim: To compare the efficacy of fascia iliaca compartment block (FICB) under ultrasound guidance and intravenous (IV) fentanyl (FENT) for positioning during spinal anesthesia in fracture femur surgeries.

Materials and Methods: A total of 60 patients were randomly allocated into two groups, Group FICB and Group FENT. Group FICB patients were administered 30 ml of 0.25% bupivacaine in the fascia iliaca compartment using ultrasound. Group FENT patients received titrated doses of injection FENT 0.5 mcg/kg IV repeated to 3 doses (1.5 mcg totally) with an interval of 5 min between doses.

Results: There was a statistically significant difference in relation to visual analog scale score during positioning between FICB group and FENT group. There was a statistically significant difference in relation to patient satisfaction status between FICB group and FENT group. There was a statistically significant difference in relation to time to perform subarachnoid block between FICB group and FENT group.

Conclusion: It is concluded that FICB is more efficacious than IV FENT for positioning during spinal anesthesia in surgery for fracture femur. FICB provides superior analgesia, better quality of patient positioning, greater patient satisfaction thereby reducing the time taken to perform spinal anesthesia in sitting position compared to IV FENT in fracture femur surgery.

Key words: Fascia iliaca block, Femur surgery, Fentanyl, Spinal anesthesia, Ultrasound

INTRODUCTION

Fracture femur is a common orthopedic injury which causes severe pain and distress to the patient. Anesthesia for femur surgeries is usually provided by subarachnoid block. Proper positioning during subarachnoid block is essential for a successful procedure.[1] However, overriding of bone ends during movement worsens pain, delays positioning which in turn increases pain further. Alleviating pain increases patient comfort and also provides better patient positioning for subarachnoid block.[2] Various drugs such as nonsteroidal anti-inflammatory drugs, opioids, midazolam, ketamine, and propofol have been in use to reduce the pain preoperatively and improve positioning in these patients.[3] Nerve blocks have come up as an effective and a safe alternative to provide pain relief. Ultrasound

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is gaining importance in recent years and has provided anesthesiologists, ineffective alternative tool for the identification and safe blockade of nerve fibres.[4,5] In this study, we compared fascia iliaca compartment block (FICB) under ultrasound guidance and intravenous (IV) fentanyl (FENT) for positioning during spinal anesthesia in femur fractures. Primary objective of this study is to compare the analgesia obtained for positioning during spinal anesthesia and the ease of positioning and the time taken for giving spinal anesthesia.

Aim

To compare the efficacy of FICB under ultrasound guidance and IV FENT for positioning during spinal anesthesia in fracture femur surgeries.

MATERIALS AND METHODS

A total of 60 patients posted for femur surgeries were included in the study after obtaining written informed consent (n = 30 in FICB arm and n = 30 in FENT arm) and approval from the Institution Ethics Committee. Patients belonging to ASA Grade I and II, of either sex, between the age group 18-55 years, with fracture femur, posted for surgery under subarachnoid block, who gave a valid informed consent, were included in the study. Patients not satisfying inclusion criteria belonging to ASA Grade III or IV, with hemorrhagic diathesis, neurological disorders, psychiatric disorders, previous femoral bypass surgery, allergy to local anesthetics or opioids and with polytrauma, infection over the injection site were excluded from the study. After obtaining informed consent, patients who were willing to be included in the study were enrolled. They were preoperatively evaluated, clinically examined and assessed. A total of 60 patients were included in the study. They were randomly allocated into two groups. Group FICB were administered ultrasound guided FICB preoperatively. Group FENT were administered IV FENTs preoperatively. All patients were kept nil per oral for at least 6 h before the procedure. Patients were shifted inside the operation theater ½ h before the scheduled procedure. Baseline vitals such as pulse rate, noninvasive blood pressure, saturation in room air, respiratory rate, and ECG pattern were recorded. IV access was obtained with 18G IV cannula and IV fluid started. Local anesthetic test dose was given using 0.1 ml of injection lignocaine 2%. All patients were premedicated with injection ondansetron 0.1 mg/kg intravenously. Oxygen was given through Hudson's mask at 4 L/min. Group FICB patients were placed in supine position. The local anesthetic solution was prepared with 15 mL of 0.5% bupivacaine and of distilled water and hence 30 ml of 0.25% bupivacaine. The ultrasound machine was powered on and the linear array probe was covered with sterile dressing after applying ultrasound gel. The probe was placed in a horizontal direction over the anterior part of thigh just below the inguinal ligament. The ultrasound setting used to visualize was at a frequency of 10 MHz and a depth of 3-4 cm. The gain and focus were adjusted according to the image scanned. Femoral artery was identified first. Then, the iliacus muscle covered by fascia iliaca was identified lateral to the artery. An 18G needle was then inserted in plane to the ultrasound beam. The needle was advanced until the tip of the needle was placed beneath the fascia iliaca (appreciating the give as the fascia is perforated) and after negative aspiration, the local anesthetic was injected and its spread visualized on the ultrasound screen. The FICB was done 15 min before the subarachnoid block. Group FENT patients received titrated doses of injection FENT 0.5 mcg/kg IV repeated to 3 doses (1.5 mcg totally) with an interval of 5 min between doses. Hemodynamic variables such as heart rate, noninvasive blood pressure, saturation of oxygen, and respiratory rate were recorded after the block/IV FENT and at 5 min intervals till positioning. The analgesia provided by either of the modes was assessed using visual analog scale (VAS) scores 15 min (i.e., during positioning) after the block/IV FENT. Subarachnoid block was performed in the sitting posture under strict aseptic precautions in the L3-L4 space using 25G Quincke needle with 3 ml of 0.5% bupivacaine (hyperbaric and dextrose 80 mg/ml) + 0.5 ml (50 mcg) of FENT. The quality of patient positioning for administering spinal anesthesia was recorded by another anesthesiologist blinded to the mode of analgesia with scores of 0-3.0 - Not satisfactory, 1 - Satisfactory, 2 - Good, and 3 - Optimal. Time to perform spinal anesthesia will be recorded (time from beginning of positioning to end of spinal). Patient satisfaction was also recorded; 1 - Satisfactory and 2 - Not satisfactory.

Post-operative analgesia was standardized in all patients of both groups with injection tramadol 50 mg IV. 8th hourly; first dose was given whenever patient complained of pain. The collected data were recorded for further statistical analysis. Descriptive statistics were done for all data and were reported in terms of mean values and percentages. Suitable statistical tests of comparison were done. Continuous variables were analyzed with the unpaired t-test. Categorical variables were analyzed with the Chi-square test and Fisher exact test. Statistical significance was taken as $P < 0.05$. The data were analyzed using SPSS version 16.

RESULTS

Both the groups were comparable with respect to age, gender, weight, and duration since fracture.

Among the patients undergoing spinal anesthesia in fracture femur surgery, there was a statistically significant difference in relation to VAS score during positioning between FICB group (mean = 1.13, standard deviation [SD] = 1.25) and FENT group (mean = 2.27, SD = 1.55). The mean VAS score during positioning was significantly lesser in FICB group compared to FENT group by a mean difference of 1.13 scoring points (50% lesser). This difference is significant with a $P = 0.0029$ as per unpaired *t*-test. There was a statistically significant difference in relation to quality of patient positioning between FICB group (mean = 2.43, SD = 0.63) and FENT group (mean = 1.87, SD = 0.78). The mean quality of patient positioning score was significantly higher in FICB group compared to FENT group by a mean difference of 0.57 scoring points (23% higher). This difference is significant with a $P = 0.0024$ as per unpaired *t*-test. There was a statistically significant difference in relation to patient satisfaction status between FICB group (yes = 96.67%, no = 3.33%) and FENT group (yes = 76.67%, no = 23.33%). The positive patient satisfaction status was significantly higher in FICB group compared to FENT group by a percentage difference of 20.00 (21% higher). This difference is significant with a $P = 0.0284$ as per Fisher's exact test. There was a statistically significant difference in relation to time to perform subarachnoid block between FICB group (mean = 4.90, SD = 0.55) and FENT group (mean = 5.86, SD = 0.83). The mean time to perform subarachnoid block was significantly shorter in FICB group compared to FENT group by a mean difference of 58 s (16% shorter). This difference is significant with a $P < 0.0001$ as per unpaired *t*-test. There was a statistically significant difference in relation to heart rate at 10-15 min between FICB group (mean = 86.52, SD = 8.39) and FENT group (mean = 81.02, SD = 7.10). The mean heart rate was significantly lower in FENT group compared to FICB group by a mean difference of 6 breaths per minute (bpm) (6% lower). This difference is significant with a lowest $P = 0.0022$ as per unpaired *t*-test. There was a statistically significant difference in relation to time of first post-operative analgesic need between FICB group (mean = 5.90, SD = 0.80) and FENT group (mean = 1.65, SD = 0.60). The mean time of first post-operative analgesic need was significantly delayed in FICB group compared to FENT group by a mean difference of 4 h and 15 min (72% more delayed). This difference is significant with a $P < 0.0001$ as per unpaired *t*-test. There was a statistically significant difference in relation to respiratory rate at (10-15 min) between FICB group (mean = 16.93, SD = 0.93) and FENT group (mean = 15.07, SD = 1.27). The mean respiratory rate was significantly lower in FENT group compared to FICB group by a mean difference of 2 bpm (11% lower). This difference is significant with a lowest $P < 0.0001$ as per unpaired *t*-test. Both the groups were comparable with respect to SpO_2 and mean arterial pressure (MAP). There was no statistical difference between the groups with respect to SpO_2 and MAP. There were no complications of block such as infection, block failure, vascular puncture, nerve damage, or systemic toxicity of bupivacaine.

DISCUSSION

FICB, first described by Dalens *et al.*[6] is a simple, low skill, and safe technique that can be used during prehospital care, emergency department and in the pre-operative settings. It blocks the femoral, lateral femoral cutaneous nerve and sometimes the obturator nerve. Furthermore, since the injection is done away from the artery and nerve, there are minimal chances of neurovascular injury. The usage of ultrasound guidance to visualize the fascia iliaca and to deposit the drug beneath it lateral to the femoral nerve increases the success rate of block and further reduces the risk of neurovascular injury. The VAS score during positioning was 1.13 ± 1.25 in FICB group and 2.27 ± 1.55 in FENT group and was statistically significant with a $P = 0.0029$. It shows that FICB provides better analgesia for patient positioning in fracture femur surgeries (Figure 1).

A study conducted by Jadon *et al.*[7] compared the femoral nerve block (FNB) and IV FENT for analgesia obtained in surgery for femur fractures. 60 patients were divided into two groups. In one group, FNB was performed using a peripheral nerve stimulator with 20 ml of 1.5% lignocaine with adrenaline. In the other group, 1 mcg/kg of FENT IV was given. Both these interventions were done 5 min before positioning and then both the groups received subarachnoid block. In FNB group, during positioning, the VAS score was significantly lower ($P = 0.002$). The quality of positioning ($P = 0.027$) and the patient acceptance ($P = 0.031$) was significantly better when compared to IV FENT. The time required to perform subarachnoid block was also less in FNB ($P = 0.049$). The results showed that FNB when compared to IV FENT provided better

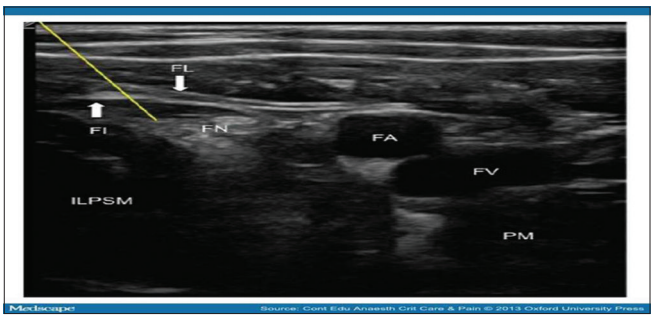

Figure 1: Sonographic appearance of fascia iliaca block (fentanyl)

analgesia for patient positioning during subarachnoid block in surgery for femur fractures.

Yun *et al.*[8] compared the analgesia obtained while positioning between FICB and IV alfentanil in the elderly who were posted for surgery for neck of femur fracture. In one group, IV alfentanil 10 mcg/kg loading dose was given, and then an infusion of 0.25 mcg/kg/min was started 2 min before subarachnoid block. In the second group, FICB was done with 30 ml of ropivacaine 20 min before subarachnoid block. The VAS score was lower ($P = 0.001$) and the acceptance of the patient was better in the block group compared to IV alfentanil. Furthermore, the mean time taken to perform subarachnoid block was also significantly lower ($P = 0.009$) in the fascia iliaca compartment group. The study showed that FICB is more efficient compared to IV alfentanil for positioning in the elderly who underwent subarachnoid block for neck of femur fractures. In our study, the quality of patient positioning was higher in FICB group with a mean of 2.43 ± 0.63 when compared to FENT group which had a mean of 1.87 ± 0.78. It was statistically significant with a $P = 0.002$. It means that FICB provides better quality of patient positioning for spinal anesthesia compared to IV FENT. Patient satisfaction was also significantly better in FICB group ($P = 0.028$). The time taken to perform subarachnoid block (time from beginning of positioning to end of spinal) was shorter in FICB group 4.90 ± 0.55 compared to FENT group 5.86 ± 0.83. It was statistically significant with a $P < 0.0001$. It indicates that FICB reduces the time taken for providing subarachnoid block.

Lamaroon *et al.*[9] compared FNB and IV FENT for analgesia to facilitate positioning in patients with fracture femur who underwent surgery under subarachnoid block. 64 patients were included. Among them, 32 were given FNB 15 min before spinal block with 20 ml of 0.5% bupivacaine and 10 ml of normal saline. The other 32 patients were given IV FENT 0.5 mcg/kg initially followed by another 0.5 mcg/kg 5 min later. Additional FENT 0.5 mcg/kg was given in increments if the pain scores were above 4. Subarachnoid block was then performed in both the groups. The results obtained showed that the requirement of additional FENT, the satisfaction of positioning and the time taken to achieve spinal block ($P = 0.74$) did not vary significantly between the two groups.

FNB and IV FENT were compared by Sia *et al.*[10] for analgesia during positioning in fracture shaft of femur surgeries done under spinal block. Patients with fracture shaft of femur posted for surgery under spinal block were randomized into two groups. One group was given FNB with 15 ml of 1.5% lidocaine under the guidance of a peripheral nerve stimulator while the other group was given 3 mcg/kg of IV FENT. Spinal block was done after 5 min in the sitting position in both the groups. The VAS scores ($P < 0.001$), quality of patient positioning ($P < 0.005$) and the acceptance of the patient ($P < 0.005$) were comparatively better in the FNB group. Furthermore, the time for performing spinal anesthesia was lesser ($P < 0.05$) in the FNB group compared to IV FENT. The results showed that FNB is more efficacious during positioning compared to IV FENT in fracture shaft of femur surgeries done under spinal block.

Durrani *et al.*[11] did a study in patients with femur fractures posted for surgery under spinal block. 84 patients were divided into two groups. 15 min before positioning for spinal block, the FNB group received FNB with 15 ml of lignocaine with adrenaline and 5ml distilled water, and the IVN group received 6 mg IV nalbuphine. VAS during positioning was significantly less in FNB group (1.40 ± 0.66) versus IVN group (3.02 ± 1.39), $P = 0.000$. AQ4
Time taken to perform spinal block was significantly shorter in FNB group (2.15 ± 0.78 min) versus IVN (3.50 ± 1.46 min), $P = 0.001$. Quality of patient positioning during spinal was significantly better in FNB group (2.45 ± 0.55) than IVN group (1.88 ± 0.80), $P = 0.000$. Acceptance of patient was very significantly higher among FNB group (40/42 = 95.24%) than IVN (28/42 = 66.67%) group, $P = 0.001$.

In our study, the heart rate was significantly lower in FENT group at 10 and 15 min ($P < 0.05$) while there was no significant difference in MAP and oxygen saturation between the two groups. The respiratory rate was significantly less in FENT group at 10 and 15 min ($P < 0.0001$) though none of the patients had a respiratory rate of <12/min or a saturation of <95%. FICB had the advantage of significant post-operative analgesia as the requirement of first rescue analgesic was after 5.90 ± 0.80 h compared to 1.65 ± 0.60 h in FENT group ($P < 0.0001$). There were no complications of block such as infection, block failure, vascular puncture, nerve damage, or systemic toxicity of bupivacaine.

CONCLUSION

Ultrasound guided FICB is more efficacious than IV FENT for positioning during spinal anesthesia in surgery for fracture femur. FICB provides safety, superior analgesia, better quality of patient positioning, greater patient satisfaction thereby reducing the time taken to perform spinal anesthesia in sitting position compared to IV FENT in fracture femur surgery.

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