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Original Research Article

A Randomized Control Study to Compare Ultrasound Guided Femoral Nerve Block versus Intravenous Fentanyl to Provide Analgesia for Positioning Patients with Femur Fracture before Spinal Anaesthesia at Tertiary Care Centre, Ahmedabad

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Abstract

Background and Aim: Nerve fibres have been located and blocked using a variety of methods. In recent years, ultrasound has grown in significance and given anesthesiologists a useful alternate tool for locating and safely blocking nerve fibres. This study compares intravenous fentanyl for positioning during spinal anaesthesia in femur fractures to femoral nerve block under ultrasound guidance.

Material and Methods: Present Prospective, Randomized, single-blind, Controlled study was conducted in 60 Patients admitted to the Department of Orthopedics, GMERS Medical College and Civil Hospital, Sola, Ahmedabad. The trial was random, single-blind, and controlled. Patients were divided into two groups of 30 each at random. Preoperative ultrasonography guidance was used to provide a femoral nerve block to group FNB. Fentanyl was preoperatively given intravenously to Group FENT. After the block/IV fentanyl, hemodynamic measurements including heart rate, noninvasive blood pressure, oxygen saturation, and respiratory rate were taken at intervals of five minutes until positioning. Visual analogue scale scores obtained 15 minutes after the block and intravenous fentanyl were used to evaluate the analgesia offered by either of the techniques. Moreover, patient satisfaction was noted.

Results: There was a statistically significant difference between the FNB group (mean=2.43, SD=0.63) and the FENT group in terms of the effectiveness of patient positioning among the patients undergoing spinal anaesthesia in fracture femur surgery. In terms of VAS score during positioning, there was a statistically significant difference between the FNB group (mean=1.13, SD=1.25) and the FENT group (mean=2.27, SD=1.55). Femoral Nerve Block took shorter time to

complete subarachnoid block than I.V. fentanyl. Compared to intravenous fentanyl, femoral nerve block produced greater postoperative analgesia.

Conclusion: In the case of femur fracture surgery, femoral nerve block is more effective than intravenous fentanyl for placement during spinal anaesthesia. When compared to IV fentanyl in femur fracture surgery, femoral nerve block offers higher analgesia, better patient posture, and greater patient satisfaction, all of which shorten the time required for spinal anaesthesia in the sitting position.

Keywords: Femoral Nerve Block, Intravenous Fentanyl, Noninvasive Blood Pressure, Subarachnoid Block.

Introduction

The most used anaesthetic method for orthopaedic treatments on the lower limbs is regional anaesthesia.[1] Regional anaesthesia has several benefits over general anaesthesia, including better perioperative pain relief, fewer prescriptions for polypharmacy medications, less need for systemic analgesics, less need for airway manipulation, earlier ambulation, and a lower risk of deep vein thrombosis.[2] The periosteum has the lowest pain threshold of the deep somatic structures, making it a common orthopaedic injury that leaves patients in great pain and misery.[3]

Subarachnoid blocks are frequently used to administer anaesthesia for femur operations. A successful subarachnoid block surgery depends on the patient being positioned correctly. Unfortunately, overriding of the bone ends during movement makes the discomfort worse and delays placement, which makes the agony worse still. By reducing discomfort, patients are more comfortable and can be positioned more optimally for subarachnoid blocks.[4]

Several medications, including non-steroidal anti-inflammatory medicines, opioids, midazolam, ketamine, and propofol, have been used to lessen the discomfort in these patients prior to surgery and enhance posture.[5] In order to relieve pain, nerve blocks have emerged as an efficient and secure alternative. For these patients, various techniques have been used to lessen pain prior to surgery and enhance positioning. In order to relieve pain, nerve blocks have emerged as an efficient and secure alternative. [6]

Nerve fibres have been located and blocked using a variety of methods. Peripheral nerve blockade has advanced significantly over time, from early blind methods that caused paresthesia to recent uses of peripheral nerve stimulators and ultrasonography. In the past, nerve blocks were carried out by inducing paresthesia and using landmark techniques. They damaged the nerves and encircling structures and were linked to significant failure rates.[7]

Nerve stimulators were invented for higher success rates and to decrease the complications. It ensured a better blockade than conventional paresthesia technique. But both these methods can cause neurovascular injuries leading to permanent nerve damage.[8,9] Ultrasound is gaining importance in recent years and has provided Anesthesiologists, an effective alternative tool for the identification and safe blockade of nerve fibers.[10] This study is designed to compare Femoral Nerve Block under ultrasound guidance and intravenous Fentanyl for positioning during spinal Anaesthesia in femur fractures.

Material and Methods

Study Area: Patients admitted to the Department of Orthopedics, GMERS Medical College and Civil Hospital, Sola, Ahmedabad was enrolled in the study.

Study Population: Patients of ASA grade I and II posted for Femur fracture surgeries in the Departments of orthopedics of GMERS Medical College & Hospital, Sola, Ahmedabad.

Study Design: Prospective, Randomized, single-blind, Controlled study.

Sample Size Calculation: Sample size was determined based on study by Jadon, *et al[11]* in 2014 the mean time to perform spinal Anaesthesia in group FNB: 15.33 ± 1.64 min versus FENT 19.56 ± 3.09 min (P = 0.000049) with a standard deviation of 3.09.

The minimum sample size needed for the study was calculated to be 58 using an assumption that the study's power is 80 percent. As a result, each group has a sample size of 30 patients.

Inclusion Criteria: 1) Patients belonging to ASA grade I and II. 2) Patients of either sex, between the age group 18 to 70 years. 3) Patients with body mass index (BMI) 18-40 kg/m2 . 4) Patients with fracture femur, posted for surgery under sub-arachnoid block. 5) Patients who give a valid written informed consent.

Exclusion Criteria: 1) Patients not satisfying inclusion criteria. 2) Patients belonging to ASA grade III or IV. 3) Patients with hemorrhagic diathesis, neurological disorders, psychiatric disorders. 4) Patients with allergy to local anesthetics or opioids. 5) Patients with polytrauma , infection over the injection site. 6) Patients who did not give consent

We divided the 60 patients, who ranged in age from 18 to 70 and had BMIs of 18 to 40 kg/m2, into two groups at random using a simple randomization technique and a computer-generated randomization table. The study's objective and nature were explicitly disclosed to all patients who met the inclusion criteria, and they were counselled about its risks and advantages in a language they could comprehend. Patients who agreed to participate in the study were enrolled after providing written, informed consent.

Allocation of Groups: The study comprised of 60 patients in total. They were divided into two groups of 30 each at random.

Group FNB: were administered ultrasound guided Femoral Nerve Block preoperatively.

Group FENT: were administered intravenous fentanyls preoperatively.

After documenting the medical history, each case underwent a standard pre-anesthetic examination. a comprehensive systemic analysis performed to identify the presence of any systemic disorders. Investigations, both routine and unique, are conducted accordingly. To rule out any indication of sepsis, prior injury, or prior deformity, a local examination of the block site was performed. Prior to the surgery, all patients were kept off all oral intake for at least 6 hours. The block technique was described, the patients were reassured, and signed, informed consent was acquired from them.

Before the scheduled procedure, patients were moved inside the operating room. Baseline vitals were recorded, including heart rate, noninvasive blood pressure, oxygen saturation in the air, respiration rate, and ECG rhythm. A 18G IV cannula was used to provide intravenous access, and IV fluid ringer lactate was started. A test dose of local anaesthetic was administered using 0.1 ml of injectable lidocaine 2%. All patients received an intravenous injection of ondansetron at a dosage of 0.1 mg/kg. Hudson's mask delivered oxygen at a rate of 4 lit/min. Patients in the Group FNB were

positioned supine. 20ml of 1.5% lidocaine with adrenaline were created from 15ml of 2% lidocaine with adrenaline and 5ml of distilled water for the local anaesthetic solution.

After applying ultrasound gel and covering the linear array probe with a sterile dressing, the ultrasound machine was turned on. Just below the inguinal ligament, the probe was positioned horizontally over the anterior part of the thigh. The visual setting for the ultrasound was at a depth of 3–4 cm and a frequency of 10 MHz. The gain and focus were modified 42 based on the scanned image. The femoral artery was located initially, followed by the nerve, which is typically visible in cross section as an oval- or triangular-shaped hyperechoic speckled structure just lateral to the artery. An 18G needle was then inserted in the plane of the ultrasound beam. When the needle's tip is seen adjacent to the nerve, an aspirate is taken to look for intravascular puncture. After negative aspiration, the local anaesthetic was administered, and its spread was shown on the ultrasound screen. The needle tip was preferable placed inferiorly to the nerve so that the local anaesthetics may elevate the nerve and separate it from the artery rather than push it away.

The sub arachnoid block was performed 15 minutes after the femoral nerve block. Patients in the Group FENT received titrated doses of Inj. Fentanyl 0.5mcg/kg I.V. repeated to 3 doses (total: 1.5 mcg) with a 5-minute gap between doses. After the block and intravenous fentanyl administration, and at five minutes later, hemodynamic measurements including heart rate, noninvasive blood pressure, oxygen saturation, and respiration rate were taken. Visual analogue scale scores were used to evaluate the analgesia offered by either of the modalities 15 minutes (during positioning) after the block/I.V. Fentanyl. The L3-L4 space was treated with a sub arachnoid block using a 25G Quincke needle and 3.5 ml of 0.5% Bupivacaine (hyperbaric, dextrose 80mg/ml)+ 0.5 ml (25mcg) of fentanyl while the patient was seated and under strict aseptic conditions. • Another anesthesiologist who was blind to the type of analgesia used a scale from 0 to 3 to rate the effectiveness of patient placement before spinal anaesthesia was administered.

0-Not satisfactory0

1-satisfactory

2-good

3-optimal

Patient satisfaction was also measured, along with the length of time it took to administer spinal anaesthesia (measured from the start of positioning to the end of spinal). 1- gratifying 2 – insufficient. All patients in both groups received the same amount of Inj.Tramadol 50 mg I.V. every eight hours; the first dosage was administered whenever the patient complained of pain.

Data Analysis: All data were subjected to descriptive statistics, which were presented as mean values and percentages. Appropriate statistical comparison tests were conducted. Unpaired t test was used to evaluate continuous variables. Both the Chi-Square Test and the Fisher Exact Test were used to analyse categorical variables. The cutoff for statistical significance was P 0.05. The SPSS version was used to examine the data.

Results

Both groups of patients ranged in age from 18 to 50 years old. Age, weight, and gender distribution were similar between the two groups. Demographic statistics comparing the two groups did not show any discernible difference.

There was no statistically significant difference in the ASA Grade distribution between the FNB group (2.070.305) and the FENT group (2.100.254) among the patients

undergoing spinal anaesthesia, according to the unpaired t test, with a p value of >0.05. As a result, we cannot prove that there is no difference in the distribution of ASA grades between the intervention groups, which is the null hypothesis.

According to an unpaired t test, there was a statistically significant difference between the FNB group (mean=1.13, SD=1.25) and the FENT group (mean=2.27, SD=1.55) among patients undergoing spinal anaesthesia for fracture femur surgery regarding VAS score during placement. As a result, we reject the null hypothesis that there was no variation in VAS scores across the intervention groups during placement. As comparison to the FENT group, the mean VAS score during positioning was much lower in the FNB group, with a mean difference of 1.13 scoring points (50 percent less). According to an unpaired t-test, this difference has a p-value of 0.0029, making it significant.

There was a statistically significant difference in the quality of patient positioning between the FNB group (mean=2.43, SD=0.63) and the FENT group (mean=1.87, SD=0.78) among the patients undergoing spinal anaesthesia in fracture femur surgery, with a p value of 0.05 according to an unpaired t test. As a result, we disprove the null hypothesis that there is no variation in patient placement quality between the intervention groups.

When compared to the FENT group, the FNB group's mean quality of patient placement score was 23% higher on average, or a mean difference of 0.57 scoring points. According to an unpaired t-test, this difference has a p-value of 0.0024, making it significant.

There was a statistically significant difference in the patient satisfaction status between the FNB group (yes=96.67%, no=3.33%) and the FENT group (yes=76.67%, no=23.33%) among the patients having spinal anaesthesia in fracture femur surgery, with a p value of 0.05 as per the unpaired t test. As there is no difference in patient satisfaction levels between the intervention groups, the null hypothesis is rejected. The positive patient satisfaction status was significantly higher in FNB group compared to FENT group by a percentage difference of 20.00 (21% higher). According to Fisher's exact test, this difference is significant with a p-value of 0.0284.

There was a statistically significant difference between the FNB group (mean=5.90, SD=0.80) and the FENT group (mean=1.65, SD=0.60) among the patients undergoing spinal anaesthesia during fracture femur surgery, with a p value of 0.05 as per the unpaired t test. As a result, we reject the null hypothesis that there is no difference between the intervention groups in the timing of the first postoperative analgesic requirement.

When compared to the FENT group, the FNB group's mean time of first postoperative analgesic need was significantly delayed by a mean difference of 4 hours and 15 minutes (72% more delayed). According to an unpaired t-test, this difference has a p-value of 0.0001 meaning it is significant.

Table 1: Satisfaction of patients

Patient Satisfaction	FNB Group	FENT Group
Yes	29	23
No	1	7
Total	30	30

Discussion

The most popular anaesthetic approach in orthopaedics for lower limb fractures is spinal anaesthesia. While placing the patient for neuraxial blocking has been demonstrated to be more painful for patients with femur fractures, regional anaesthesia has been shown to be more useful than general anaesthesia. For these patients, a variety of systemic analgesics are being administered to reduce pain while they are being positioned. [12]

Opioids are among the most commonly used systemic analgesics, but they are also known to have side effects such cognitive decline, nausea, urine retention, and respiratory depression, especially in the elderly. The 3 in 1 block, femoral nerve block, and fascia iliaca compartment block are just a few of the nerve blocks that have been proposed as an alternative method to reduce pain and improve positioning in these patients.[13,14]

In this prospective, randomised trial, the effectiveness of intravenous fentanyl versus lidocaine adrenaline for placement during spinal anaesthesia in femur fractures was examined. The 60 patients who met the criteria for inclusion were split into two groups of thirty each. While group FENT received titrated doses of Inj. Fentanyl 0.5mcg/kg I.V. repeated to 3 doses (1.5 mcg total) with an interval of 5 minutes between doses, the first dosage was given 15 minutes before positioning, group FNB received 20ml of 15% lidocaine adrenaline under ultrasound supervision.

Since the periosteum has the lowest pain threshold of the deep somatic structures, a femur fracture causes the patient great pain and distress. The discomfort gets worse while in the sub arachnoid block position. The pain can be relieved by blocking the femoral nerve, which supplies the articular branches of the hip joint and the anterior, medial, and lateral thighs. IV Fentanyl's effect is generalized ,not localized to femoral region. Hence, for placement, FNB has a better analgesic effect than IV fentanyl.

In our study, the positioning score on the Visual Analogue Scale was 1.13 1.25 in the FNB group and 2.27 1.55 in the FENT group. This score was statistically significant with a P value of 0.0029. It demonstrates that during fracture femur procedures, femoral nerve block offers greater analgesia for patient positioning.

Similarly, Jadon *et al* [7] found that VAS during positioning were lower in group FNB (0.57±0.31) compared to group FENT (2.53±1.61) and that this difference was statistically significant with a p value of 0.0020, which is comparable to Amarjeet Kumar *et al* study [9] that discovered lower VAS during positioning in group FNB 1.57 compared to group FENT 2.93, which was statistically significant with a p value of 0.0001. VAS during positioning were found to be lower in group FNB 1.72 0.783 compared group FENT 2.14 0.92, according to Amisha Vats *et al*. This finding was statistically significant with a p value of 0.022, which is not statistically significant.

In our study, patient satisfaction was higher in the FNB group (96.6%) than the FENT group (76.67%), with P value 0.005 being statistically significant. This finding is comparable to those of Amita Vats *et al*. [15] and Amarjeet Kumar *et al*. [16], who found that the FNB group had higher patient satisfaction (p value 0.001).

With the use of 1.5% 20 ml lignocaine adrenaline in the femoral nerve block, which relieves the pain associated with positioning and improves patient positioning, the time required to perform sub arachnoid block (SAB) was shorter in the FNB group.

In our study, the FNB group's subarachnoid block procedure took less time—4.900.55

minutes versus 5.860.83 minutes—from the start of positioning to the end of the spinal—than the FENT group. With a P value of 0.0001, it was statistically significant. It suggests that FNB shortens the time needed to administer a subarachnoid block.

In a study by Ashok Jadon *et al*., similar outcomes were found (FNB group15.33 1.64, FENT group19.56 3.09, p value 0.000049). While the need for the first rescue analgesic occurred after 5.900.80 hrs as opposed to 1.650.60 hrs in the FENT group, FNB had the advantage of having extensive post-operative analgesia. (P<0.0001). No block-related problems, such as infection, block failure, vascular puncture, nerve injury, or systemic lidocaine adrenaline toxicity, occurred.

In this study, it was discovered that femoral nerve blocks were superior to intravenous fentanyl for facilitating patient placement in femur fractures. Also, patients with spinal anomalies or those undergoing operations like epidural placement where the patients may need to sit for an extended period of time may benefit more from femoral nerve block. The length of post-operative analgesia would also be prolonged by inserting a catheter near the femoral nerve and adding additives.

Conclusion

We arrived at the following conclusions after viewing our study's observations and findings: In the case of femur fracture surgery, femoral nerve block is more effective than intravenous fentanyl for placement during spinal anaesthesia. When compared to IV fentanyl in femur fracture surgery, femoral nerve block offers higher analgesia, better patient posture, and greater patient satisfaction, all of which shorten the time required for spinal anaesthesia in the sitting position.

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