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Original Research Article

Prospective, Randomized Comparative Assessment of IV Fentanyl Vs Femoral Nerve Block to Facilitate Administration of Subarachnoid Block for Femur Fracture Surgeries

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to compare the analgesic efficacy of femoral nerve block and IV Fentanyl in femur shaft fracture patients for positioning them for neuraxial block.

Methods: A prospective, randomized study was conducted on 50 patients of ASA I and II between the age group of 18-65 years undergoing surgical correction of fracture shaft femur under subarachnoid anesthesia at Banaras Hindu University (BHU), Varanasi, Uttar Pradesh, India for nine months.

Results: There were 10 and 8 cases IN ASA I in group A and B respectively. The mean of demographic data were not significant. Difference in mean heart rate in both the groups after 10 min interval is statistically significant. Difference in mean SBP in both the groups after 10 min interval was statistically significant. Difference in mean DBP in both the groups after 10 min interval was statistically significant. Difference in mean MAP in both the groups after 10 min interval is statistically significant. Mean VAS at rest in group A & group B at 10 min (8.33 & 6.8), 15 min (5.33 & 7.30), 20 min (3.73 & 7.23), 25 min (1.53 & 6.47) 30 min (2.40 & 6.33) which were statistically significant. Difference in mean VAS at movement in both the groups after 10 min interval was statistically significant.

Conclusion: Femoral nerve block has better analgesic efficacy compared to IV Fentanyl. Hemodynamic parameters are more stable when femoral nerve block was used for analgesia.

Keywords: Femoral nerve block, Efficacy, Fentanyl, Analgesia, Intervention.

Introduction

Patients with a fracture of the femoral shaft present special problems to the anesthesiologist. The femoral shaft is subjected to major muscle forces that, especially in young patients, can deform the thigh and angulate the bone fragments, thus complicating the intraoperative reduction of the fracture. [1] Therefore, complete paralysis of all the muscles acting on the femur is mandatory. Spinal

anesthesia is routinely used at our institution in these patients. However, any overriding of the fracture ends is extremely painful, and the procedure of patient positioning to perform a spinal block always requires the administration of a large amount of IV analgesics. Femoral nerve block has been shown to be an effective method of analgesia for fractured femoral shaft when it is performed either during prehospital management or in the emergency department [2,3] and also can provide excellent postoperative analgesia. [4]

Hip fractures are commonest fractures encountered in orthopaedic department. Surgical repair most commonly involves either internal fixation of the fracture or replacement of the femoral head with arthroplasty. Recently spinal anesthesia (SA) is usually preferred to general anesthesia for hip surgeries owing to less chances of mortality as in this procedure intubation is avoided and also the fact that there is reduced blood loss, and superior postoperative analgesia. As there is an unavoidable movement of fracture ends of the femur, extreme pain creates difficulty in patients positioning and creates a challenge for SA administration. [5,6] It has been found that periosteum has least pain threshold than deep somatic structures, fractures of femur causes considerable pain. Studies showed that around one-third patients with hip fractures have mild pain at rest, remaining two thirds have moderate to severe pain. However more than 75% of these patients exhibit moderate to severe pain on movement. There are reports of risks of cardiovascular events postoperatively in cases where effective pain control prior to the surgery was not carried. Analgesics generally used were opiods and non-steroidal anti-inflammatory drugs. But these drugs were having side effects and complications. Hence in cases of femoral fractures, proper pain management is considered as vital. [7,8]

One such alternative to these oral drugs is femoral nerve block (FNB). It is considered as a safe method which is injected directly or with ultrasound guidance. Parker et al found that FNB effectively reduced pain on movement within 30 minutes than an intravenous analgesic (IVA). Opiates and non-steroidal anti-inflammatory drugs are the common used drugs, but they can bring some complications, which are more severe in aged individuals. [9,10] Providing adequate pain relief not only increases comfort in these patients, but has also been shown to improve positioning for neuraxial block. Analgesics or femoral nerve block (FNB) are often used to help the patient tolerate position. Femoral nerve block has been shown to be an effective method of analgesia for fractured femoral shaft either during pre-hospital management or in the emergency department [2,3] and also provide excellent postoperative analgesia. [4]

The aim of the present study was to compare the analgesic efficacy of femoral nerve block and IV Fentanyl in femur shaft fracture patients for positioning them for neuraxial block.

Materials and Methods

A prospective, randomized study was conducted on 50 patients of ASA I and II between the age group of 18-65 yrs undergoing surgical correction of fracture shaft femur under subarachnoid anesthesia at Banaras Hindu University (BHU), Varanasi, Uttar Pradesh, India for nine months. Patients were randomly allocated into two groups with the help of computerized randomization into

Group A: In this group of patients, femoral nerve block was administered 30 minutes before planned subarachnoid blockade.

Group B: In this group of patients, IV Fentanyl 3ug/kg was administered 30 minutes before planned subarachnoid blockade.

Inclusion criteria:

1. All patients undergoing elective surgeries for femur shaft fractures.
2. Age >18 years and <65 years
3. ASA I & II

Exclusion criteria:

1. Patients with poor GCS
2. Age <18 years and >65 years
3. Patients with liver and renal diseases
4. Patients with known local anesthetic allergy.
5. Patients with bleeding tendencies and coagulopathy.
6. Patients with known neuropathy.
7. Patients with skin lesion at block site.

Study procedure: After obtaining Scientific & ethical committee approval and written informed consent, we recruited 60 patients with fractured shaft of femur. On arrival in the anesthesia induction room, a visual analogue pain scale (VAS) (0 - no pain to 10 - maximal pain) was clearly explained to the patients. An IV access was secured and ringers lactate solution was started. All patients were monitored with electrocardiography, pulse oximeter, and non-invasive blood pressure measurement. All patients were given oxygen (6 L/min) via a face mask. Skeletal traction was maintained during the procedure

Patients in the FNB group received FNB guided by a peripheral nerve stimulator (Stimuplex; B Braun, Melsungen, AG). An insulated 50 mm 22 G needle was introduced 1 cm lateral to the femoral artery and just below the inguinal ligament. When a current 0.2–0.4 mA elicited a quadriceps contraction, 30 ml of Bupivacaine 0.3% (a mixture of 20 ml of Bupivacaine 0.5% and 10 ml of normal saline 0.9%) was injected incrementally after a negative aspiration test.

Patients in the Fentanyl group received IV Fentanyl 3 μg/kg. In both groups, the time when the treatment drug (FNB or Fentanyl) was administered was considered as the starting time and patient was given sitting position for spinal anesthesia 30 min after starting time. If the patient's pain is greater than 4 according to VAS, rescue analgesic in the form of IV Paracetamol 15 mg/kg was used.

Parameters observed

1. Heart rate
2. Systolic blood pressure
3. Diastolic blood pressure
4. Mean arterial pressure
5. VAS score at rest
6. VAS score at movement of fractured limb
7. Rescue analgesic requirement

Parameters noted on arrival of patient and every 5 min after intervention (FNB or IV Fentanyl) till 30 min.

Statistical analysis: By using ANOVA test (Windostat Version 8.6 from indostat services).

Results

Table 1: Demographic Data of the Study Subjects

Variables	Group A	Group B	P Value
Age in years: Mean ±SD	62.75± 14.30	65.09±13.92	0.632
Height in cm: Mean ±SD	168.40±12.46	169.62±11.75	0.876
Weight in Kg: Mean ±SD	68.72±7.41	69.38±7.98	0.625
ASA I/II	10/20	8/22	0.830
Fracture Site			
Neck	9	8	-
Intertrochenteric	14	16	-
Shaft	7	6	-

There were 10 and 8 cases IN ASA I in group A and B respectively. The mean of demographic data was not significant.

Table 2: Summary of heart rate (HR) /minute in treatment group

Variables	Group A Mean±SD	Group B Mean±SD	P Value
Pre-intervention	87.60±7.96	89.13±8.43	0.450
5 minutes	87.50±7.38	86.37±6.74	0.520
10 minutes	84.77±5.29	89.30±7.10	0.007
15 minutes	80.83±6.24	88.70±5.81	0.000
20 minutes	78.30±5.27	88.37±5.77	0.000
25 minutes	75.90±4.88	86.53±5.45	0.000
30 minutes	75.67±5.44	87.30±5.86	0.000

In Group A, there was decrease in mean heart rate compared to pre-intervention period till 25 min period and stable thereafter. In group B there is decrease in mean heart rate at 5 min interval compared to pre-intervention period which again increased after 10 min. Difference in mean heart rate in both the groups after 10 min interval is statistically significant.

Table 3: Summary of systolic blood pressure (SBP) in mmHg

Variables	Group A Mean±SD	Group B Mean±SD	P Value
Pre-intervention	132.47±9.32	133.07±9.19	0.800
5 minutes	132.53±7.93	133.47±7.31	0.620
10 minutes	129.97±7.97	134.77±4.86	0.007
15 minutes	128.63±7.74	135.63±4.38	0.000
20 minutes	127.50±7.98	134.80±4.21	0.000
25 minutes	126.90±7.75	134.53±4.34	0.000
30 minutes	126.00±7.79	135.27±3.69	0.000

Mean SBP in group A decreased gradually after 5min interval while mean SBP in group B increased after 5 min interval. Difference in mean SBP in both the groups after 10 min interval was statistically significant.

Table 4: Summary of diastolic blood pressure (DBP) in mmHg

Variables	Group A Mean±SD	Group B Mean±SD	P Value
Pre-intervention	79.23±4.36	79.23±4.92	1.000
5 minutes	79.67±4.10	79.60±3.87	0.930
10 minutes	79.57±4.25	81.20±2.01	0.064
15 minutes	78.60±3.71	80.87±1.70	0.003
20 minutes	78.77±4.51	80.87±2.83	0.036
25 minutes	79.10±3.93	80.97±2.03	0.024
30 minutes	78.87±4.19	80.77±1.76	0.026

Mean DBP in group A increased till 10 min interval and thereafter decreased while in group B mean DBP increased after 5min and remained same thereafter. Difference in mean DBP in both the groups after 10 min interval was statistically significant.

Table 5: Summary of mean arterial blood pressure (MAP) in mmHg

Variables	Group A Mean±SD	Group B Mean±SD	P Value
Pre-intervention	97.00±4.90	97.20±5.00	0.850
5 minutes	97.30±4.10	97.60±3.80	0.796
10 minutes	96.40±5.00	99.10±2.00	0.010
15 minutes	95.30±4.50	99.10±2.10	0.000
20 minutes	95.00±5.10	98.80±2.70	0.000
25 minutes	95.00±4.80	98.80±2.00	0.000
30 minutes	94.60±4.90	98.90±1.70	0.000

It was seen that MAP mean in group A decreased after 10 min while in group B MAP mean increased after 10 min and remained same thereafter. Difference in mean MAP in both the groups after 10 min interval is statistically significant.

Table 6: Summary of pain score: VAS Rest

Variables	Group A Mean±SD	Group B Mean±SD	P Value
Pre-intervention	9.00±0.00	9.00±0.00	1.000
5 minutes	9.00±0.00	9.00±0.00	1.000
10 minutes	8.33±0.84	6.80±0.80	0.000
15 minutes	5.33±1.35	7.30±0.80	0.000
20 minutes	3.73±1.44	7.23±0.73	0.000
25 minutes	1.53±1.55	6.47±0.86	0.000
30 minutes	2.40±1.65	6.33±0.84	0.000

Mean VAS at rest in group A decreased after 10 min interval while mean VAS at rest in group B also decreased but remained same thereafter. Mean VAS at rest in group A & group B at 10min(8.33 & 6.8), 15 min (5.33 & 7.30), 20min(3.73 & 7.23), 25min(1.53 & 6.47) 30 min(2.40 & 6.33) which were statistically significant. That means FNB has better analgesic profile compared to iv fentanyl.

Table 7: VAS Movement

Variables	Group A Mean±SD	Group B Mean±SD	P Value
Pre-intervention	10.00±0.00	10.00±0.00	1.000
5 minutes	10.00±0.00	10.00±0.00	1.000
10 minutes	9.33±0.84	8.10±0.80	0.000
15 minutes	6.43±1.10	8.20±0.70	0.000
20 minutes	4.83±1.39	8.23±0.73	0.000
25 minutes	2.50±1.63	7.47±0.86	0.000
30 minutes	3.37±1.65	7.37±0.85	0.000

Mean VAS at movement in group A decreased after 10 min interval while mean VAS movement in group B also decreased after 10 min but remained same thereafter. Mean VAS at movement of fractured limb in group A & group B at 10min, 15min, 20min, 25min and 30min were(9.33 & 8.1), (6.43 & 8.20), (4.83 & 8.23), (2.50 & 7.47) and (3.37 & 7.37) respectively which were statistically significant(p-value 0.000). Difference in mean VAS at movement in both the groups after 10 min interval was statistically significant. That means FNB

Discussion

Fracture of the femur is a common orthopaedic problem following trauma in patients of all ages and central neuraxial block such as spinal anaesthesia is the preferred technique for providing anaesthesia. [11] As the periosteum has the lowest pain threshold of the deep somatic structures, fracture of femur is very painful bone injury. [12] Repair of femur fracture most commonly involve either internal fixation of the fracture or intra medullary nailing. [6,13] The choice of the anesthesia management in patients with a fracture of the femoral shaft is greatly affected by the surgical needs. A fractured femoral shaft is subjected to major muscle forces that, especially in young patients, can deform the thigh and angulate the bone fragments. Therefore, a technique that allows the complete paralysis of all the muscles acting on the femur is mandatory to facilitate the intraoperative realignment of a femoral shaft fracture, especially if

surgery has been delayed for more than 3 days. [1]

The fracture of femur shaft is operated by closed intra-medullary nailing in anterograde fashion. The patients are placed in the supine position on the fracture table. The surgical incision is made proximal to the greater trochanter to develop the entry hole for the nail. The non-affected limb is often abducted to facilitate the use of the image intensifier. We routinely practice spinal anesthesia (with or without the placement of an epidural catheter). The positioning of these patients to perform neuraxial blockade is often problematic because even a minimal overriding of the fracture ends while positioning is extremely painful. To reduce the pain and avoid further soft tissue trauma, we prefer to maintain femoral traction and perform spinal anesthesia in the sitting position. Despite this practice, administration of a substantial amount of IV analgesics is mandatory during placement of the neuraxial block. Sandby-Thomas et al [11] reported that the most frequently used agents were midazolam, ketamine, and propofol. Alternative agents were Fentanyl, remifentanil, morphine, nitrous oxide, and sevoflurane, whereas nerve blocks were used infrequently.

The femoral nerve block has been used successfully in adults for femoral shaft fracture. [2,3] Capdevilla et al4 reported effective and safe analgesia provided by using continuous femoral blocks for bilateral femoral shaft surgery. However, few studies have investigated FNB to facilitate positioning during conduct of regional anesthesia. Gosavi et al [14] assessed pain during change of position from supine to sitting after FNB with lidocaine; VAS scores were 2.7±1.1.13. In our study mean VAS at movement after 30 min of intervention was 3.37 in FNB group and 7.37 in iv fentanyl group. Arissara Iamaroon et al [15] were unable to show benefit of femoral nerve block over IV fentanyl for positioning fracture femur patient for neuraxial block. Salvatore Sia, Francesco Pelusio, et al [16] concluded that femoral nerve block is better than IV Fentanyl for giving position for spinal block in femoral shaft fracture surgeries. In their study VAS at positioning for spinal anaesthesia was 0.5±0.5 and 3.3±1.4 in femoral nerve block group and iv fentanyl group respectively with p-value <0.001 which is statistically significant.

The VAS score (0 – 10) was chosen to evaluate pain in the present study. A VAS score of 0 is no pain and 10 worst imaginable pain. The analgesic effect of femoral nerve block was significantly better than IV Fentanyl. Mean VAS at rest and movement of fractured limb in femoral nerve group at 10, 15, 20, 25 and 30 min were (8.33 & 9.33), (5.33 & 6.43), (3.73 & 4.83), (1.53 & 2.50) and (2.40 & 3.37) while in fentanyl group (6.8 & 8.10), (7.3 & 8.20), (7.23 & 8.23), (6.47& 7.47) and (6.33 & 7.37) respectively. P- value at all interval was 0.000 which is statistically significant implying that femoral nerve block was more effective in terms of analgesia than iv fentanyl.

The hemodynamic parameter variations (H.R., SBP, DBP, MAP) in Fentanyl and FNB groups are statistically significant after 10 min interval, which implies hemodynamic parameters in FNB group are stable compared to IV Fentanyl group. In our study, we compared all groups for 30 min. and at the end of 30 min; if VAS score is more than 4, rescue analgesia (IV Paracetamol 15mg/kg) was given. It is found that in femoral nerve block group no rescue analgesia was required and in IV Fentanyl group 100% rescue analgesia was required. [17]

No adverse systemic toxicity of Bupivacaine, such as seizure, arrhythmia, or cardiovascular collapse was noted in the femoral nerve block group. Neither vascular puncture nor paresthesia occurred. No complications, such as hematoma, infection, or persistent

paresthesia were observed within 24 hours after the operation. Similarly, no adverse effect like nausea, vomiting, and respiratory depression were found in IV fentanyl group.

Conclusion

Fracture shaft femur is painful. Femoral nerve block and IV Fentanyl both are useful in reducing pain to facilitate administration of subarachnoid block in sitting position. Femoral nerve block has better analgesic efficacy compared to IV Fentanyl. IV Fentanyl is inadequate as a sole analgesic agent in fracture femur patient and requires supplementation of other analgesics (i.e. rescue analgesia).

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