Comparative Evaluation of Femoral Nerve Block and Intravenous Fentanyl for Positioning During Spinal Anaesthesia in Surgeries of Femur Fracture

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ABSTRACT

Introduction: Spinal anaesthesia is preferred to fix femur fracture. Extreme pain does not allow ideal positioning for this procedure. We conducted this study to compare analgesic effect provided by femoral nerve block and intravenous fentanyl prior to positioning for spinal anaesthesia in patients undergoing surgeries of femur fracture.

Material and Methods: In this observational study 100 patients scheduled for fracture femur surgery under subarachnoidblock at M.Y Hospital, Indore for 1 year were included. Patient consent and ethics committee permission obtained. Patients observed as 2 groups-FNB and FENT.5 min prior to positioning, FNB group patients received Femoral nerve block 20 ml lignocaine+adr (1.5%) via nerve stimulator and FENT group received fentanyl 1 µg/ kg IV.If either group reported pain scores ≥4 during positioning, IV fentanyl 0.5 µg/kg was given every 5 min until the pain score decreased to <4(maximum dose 3 µg/kg).Spinal block was performed, visualanalogscores before and during positioning were observed.Statistical analysis done with SPSS 20 computer software. Z -test applied to compare the means and $P < 0.05$ taken as significant.

Results: VAS during positioning: FNB: 1.72± 0.783 versus FENT 2.14 ± 0.92 (P = 0.000). Time to perform spinal:FNB: 2.30 ± 0.61 min versus FENT 3.29 ± 0.95 min (P = 0.000). Quality of patient positioning was better in FNB group. Patient satisfaction same in both group. No major side-effect.

Conclusion: Femoral nerve block provides better analgesia, satisfactory positioning during spinal anaesthesia in patients of fracture femur

Keywords: Anaesthesia, femoral nerve block, femur fracture, fentanyl, spinal block, positioning during spinal block

INTRODUCTION

Fracture femur is one of the common orthopaedic problem following trauma in all age groups. Fracture femur is a common injury which causes severe pain and distress. The shaft of femur is subjected to shear muscle forces which leads to deformation of thigh and angulation of bone fragments, thereby complicating the intraoperative reduction of these fractures.[1] Thus, the muscles acting on the femur should be completely relaxed. However, any overriding of the fracture ends is extremely painful and any movement of the patient leads to severe pain.

Central neuraxial block such as subarachnoid block is the preferred technique for providing anaesthesia and muscle paralysis.[2] During central neuraxial block, proper positioning is the most important factor. However, immobility of the limb and extreme pain hamper the proper positioning during this procedure.

Previously modalities like intravenous fentanyl, femoral nerve block or fascia iliaca block using local anaesthetic have been used for allaying the pain preoperatively and thereby improving the position of these patients.[3,4] Although the present studies fail to demonstrate superiority of femoral nerve block over intravenous fentanyl, previous studies have shown the superiority of the femoral nerve block over intravenous fentanyl.[5,6] Thus, we conducted the following study to compare the analgesic efficacy of Femoral Nerve Block and Intravenous Fentanyl just before positioning for central neuraxial block in patients undergoing femur fracture surgeries.

MATERIAL AND METHODS

Institutional approval and written informed consent was taken from the patients before the study. Patients of both sexes within 18–70 years age group having weight more than 45 kgs and American Society of Anesthesiologist’s physical status I to II, scheduled for fracture femur operation under central neuraxial (spinal) block, but unable to sit due to pain were included in the study. Patients with ASA III and IV, those who could sit comfortably, refused for participation in the study or having any contraindication to spinal anaesthesia, FNB or use of local anaesthetic, history of cardiac or respiratory compromise were excluded. Patients were observed as two groups; FNB and IV FENT. We calculated our sample size based on earlier studies.[7] Their pilot study showed that FNB group was more effective in reducing pain, and the mean score was 2 in FNB group. Based on $\alpha = 0.05$, $\beta = 0.20$ and considering a significant difference at mean difference of 2.2 in pain score, with standard deviation (SD) of 3.0, a sample size of 30 per group was required for one-tailed testing. We took 50 per group as sample size for our observational study._IV line was secured and fluid started, monitors attached and baseline parameters were recorded. FNB group patients received FNB guided by a peripheral nerve stimulator, 5 min prior to positioning. Point of needle entry was infiltrated with 1 ml 1% lignocaine first and then an insulated 50 mm 22 gauge needle was introduced identifying following landmark lying 1 cm lateral to femoral artery and 1.5 cm below inguinal ligament.20 mL drug in a concentration of 1.5% lignocaine with adrenaline (1:200, 000) aspirated and carefully injected (15 mL 2% lignocaine diluted with 5 ml distilled

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water) at the site after eliciting a quadriceps contraction at the stimulating current intensity of 0.3-0.5 mA. Whereas, patients of the FENT group were given injection fentanyl 1 µg/kg IV 5 min before positioning. After 5 min, if it was found that any patient in either of the groups had pain scores ≥4 during positioning, IV fentanyl 0.5 µg/kg was given further every 5 min till the pain scores reduced to <4 or maximum dose of 3 µg/kg was achieved (whichever first); still if pain score ≤ 4 remained, patients were excluded. Thereafter, subarachnoid block was given via midline/paramedian approach at the L2/ L3/L4 level, according to the anesthesiologist's preference. Pain scores before and during positioning using visual analog scale were noted (where 0 = no pain, 10 = maximal pain).Other parameters were additional fentanyl required during positioning, time taken to achieve position to perform block, satisfaction of the anaesthesiologist with respect to position maintained for performing spinal block (0 = not satisfactory, 1 = satisfactory, 2 = good, 3 = optimal) and whether the patient was satisfied or not with pain relief. Basic hemodynamic parameters of the patients such as heart rate (HR), mean arterial pressure (MAP) (non-invasive) and oxygen saturation (SpO_2) was monitored strictly at specified time intervals.

STATISTICAL ANALYSIS

Statistical analysis was performed with SPSS version-20 computer software. Parametric variables were described as mean ± SD; qualitative variables were described as number (percentage) and as median and range. Paired t-test, Unpaired t-test or Mann Whitney test were used as appropriate to compare the two groups. $P < 0.05$ was considered as statistically significant.

RESULT

50 patients were observed in each group for various parameters. Demographic data and base line values for HR, MAP, SpO_2 and type of surgery were comparable in both the groups (Tables-1 and 2). There was no significant change noticed in HR between two groups (P = 0.622); however, MAP was significantly lower in FENT group 5 min after the intervention (P = 0.0081). Visual analog scale during positioning (median ± SD) was lesser in group FNB: 1.72±0.783 versus FENT 2.14± 0.92 (P = 0.022) (Figure-1). Time required to perform spinal (mean ± SD) was shorter in group FNB: 2.30 ± 0.61 min versus 3.29 ± 0.95 min (P = 0.000).Quality of patient positioning for spinal anaesthesia as per anaesthesiologist (mean rank) was higher in group FNB 59.62 versus FENT 41.38 (P = 0.000). Patient satisfaction was same in both groups. No patient required additional dose of fentanyl. Excessive sedation was seen in 2 patients in FENT group. Although no patient in both the groups had SpO_2 < 95 % during the procedure (Tables-2 and 3).

DISCUSSION

Spinal anaesthesia is universally accepted and preferred technique of anaesthesia for surgeries of fracture femur.[8] It has gained popularity over general anaesthesia in femur surgeries because of early ambulation with spinal anaesthesia, reducing

	FNB Group (N=50)	FENT Group (N = 50)
AGE (years)		
18-30 years	9	12
31-50 years	15	15
51-70 years	26	23
SEX (male/ female)	37/13	36/14
Fracture site		
Neck of Femur	14	11
Intertrochanteric	21	24
Subtrochanteric	2	1
Shaft (Upper Third)	5	5
Shaft (Middle Third)	5	3
Shaft (Lower Third)	2	5
Suprachondylar	1	1

FNB – Femoral nerve block; FENT – Fentanyl

Table-1: Demographic Data

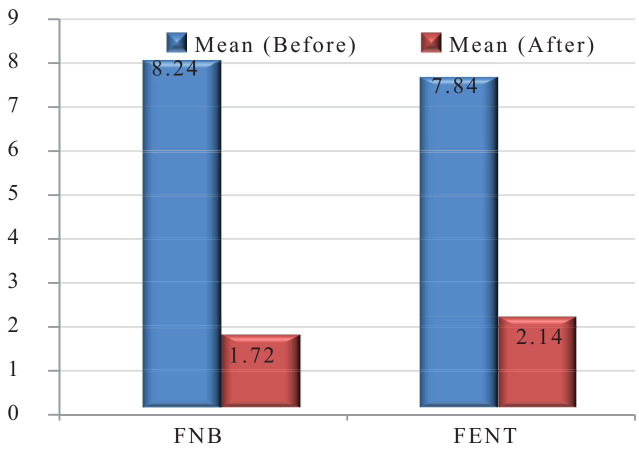

Figure-1: Mean of Visual Analogue Score before and after Intervention in Both Groups

	FNB (N=50)	FENT (N=50)	P Value
MAP at T0	96.68 ± 7.28	96.62 ± 10.92	0.974
MAP during positioning	97.64 ± 6.80	97.38 ± 8.16	0.863
MAP 5 min after intervention	89.4 ±7.42	85.82 ± 7.60	0.041
HR at T0	86.56 ± 12.85	87.74 ± 11.87	0.544
HR during positioning	89.29 ± 11.63	88.14 ± 10.40	0.622
HR 5 min after intervention	88.66 ±10.51	81.30 ±10.14	0.659
SpO_2 at T0	98.925 ± 0.764	98.750 ± 0.63	0.267
SpO_2 during positioning	98.625 ± 0.774	98.725 ± 0.679	0.541
SpO_2 5 min after intervention	99.050 ± 0.677	98.975 ±0.862	0.666

T0 – Baseline value; MAP – Mean arterial pressure; HR – Heart rate; FNB – Femoral nerve block; SpO_2 – Oxygen saturation; FENT – Fentanyl

Table-2: Vital clinical parameter before analgesia and during positioning

	FNB (N = 50)	FENT (N = 50)	P- Value
VAS score at T0	8.24 ± 1.299	7.84 ± 1.23	0.111
VAS score during positioning	1.72 ± 0.751	2.14 ± 0.92	0.022
Time taken to achieve position (min)	2.31 ± 0.61	3.29 ± 0.95	0.00
Anaesthesiologist's satisfaction (0-3) Mean rank	59.62	41.38	0.00
Patient satisfaction (%)	100	100	-
Additional fentanyl required during positioning (mcg)	0	0	-
Complication: Excessive Sedation	0	2	-
T0 – Baseline value; FNB – Femoral nerve block; FENT – Fentanyl; VAS – Visual analog scale			

Table-3: VAS scores, Time for spinal, Quality of position as per anaesthesiologist and Patient

chances of deep vein thrombosis, thereby reduction in morbidity and mortality.[9,10]

Sandby-Thomas et al. found that the most frequent agents used were midazolam, ketamine, and propofol which aided in positioning patients for the subarachnoid block. Other less preferred agents were fentanyl, remifentanil, morphine, nitrous oxide, and sevoflurane, whereas nerve block techniques were seldomly used worldwide.[11] Use of Femoral nerve block to relieve pain from a fracture of the femur at various other situations[12,13] is well known and now, is being used for positioning during spinal anaesthesia.[14-17]

In our study, the patients were comparable in relation to the age and sex distribution and types of femur fractures had similar representation in both groups i.e both the groups had majority patients of femur fracture of proximal site (fracture neck of femur, intertrochanteric fracture and shaft (upper third) rather than distal site femur fractures) as is evident from Table-1. The visual analogue scale values in FNB were significantly lower than fentanyl (Table-3). Many other studies also reported significantly low pain scores with FNB compared to IV fentanyl. A study by Iamaroon et al. did not find any significant difference between FNB and fentanyl. Possibly because they used 0.3% bupivacaine for FNB and positioned the patients 15 min after block instead of lidocaine whose effect comes in 5 min however; onset of analgesic effect of bupivacaine is variable and may take 25–30 min for full effect.

One of the important finding in our study was the superiority of femoral nerve blockade in terms of analgesia as compared to IV fentanyl in fracture femur along with greater anaesthesiologist satisfaction for positioning during spinal anaesthesia. **Iamaroon et al.** used 0.5 µg/kg fentanyl as the initial dose and average additional dose of fentanyl in FENT group was 17.1 ± 18.4. The total additional doses required by IV fentanyl group in our study is found to be zero. In our study, doses of FENT 1.0 µg/kg was given incrementally in 5 min interval because titrated doses of fentanyl reduce any serious side-effects, such as hypoventilation or apnea especially in older age group without affecting the analgesic effect[18] however, interval more than five minutes could have prolonged the anaesthetic procedure. We had used lidocaine for femoral nerve block because of its shorter time onset over long-acting local anaesthetic. Long-acting local agents have advantage of more effective and longer postoperative pain relief.

Pulse variation was statistically insignificant in both groups. Although bradycardia is known with fentanyl but because of premedication with anticholinergic (glycopyyrolate) causing opposing vagal mediated bradycardia, no significant change was observed. Mean arterial pressure was reduced significantly in both groups after 5 minutes of intervention (P = 0.081) MAP fell more in FENT group. This effect was seen because of pain relief to both groups (reduced sympathetic stimulation) as well as fall in arterial pressures due to added factors associated with fentanyl like myocardial depression, venodilation, bradycardia. Only two patients in FENT group had drowsiness as side-effect due to excessive sedation which required more persons for holding the patient during positioning. Excessive drowsiness was seen in elderly age group patients only. Our findings correlated with the study of Jadon et al[19] with respect to visual analogue score, additional fentanyl required, time taken to achieve position, quality of positioning and patient satisfaction.

CONCLUSION

Both femoral nerve block and intravenous fentanyl are effective in relieving pain during patient positioning for spinal anaesthesia in surgeries of femur fracture but femoral nerve block provides better analgesia, more optimal positioning for central neuraxial blockade in less time and with no major hemodynamic instabilities and complications

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