



PROSPECTIVE COMPARATIVE STUDY ON EFFICACY OF IV FENTANYL VERSUS FEMORAL NERVE BLOCK FOR POSITIONING PRIOR TO SUBARACHNOID BLOCK IN PATIENTS UNDERGOING FRACTURE FEMUR SURGERIES.

Anaesthesiology

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ABSTRACT

Fracture femur is a common orthopaedic problem following trauma in patients of all ages. Fracture femur is particularly painful bone injury because the periosteum has the lowest pain threshold of the deep somatic structures. These patients generally being elderly with multiple comorbidities are likely to have many undesirable effects of opioids including respiratory depression and confusion.

KEYWORDS

Femoral nerve block Ropivacaine Fracture femur Ultrasound guided

1. INTRODUCTION

Fracture of the femur is a common orthopaedic problem following trauma in patients of all ages. The fracture shaft is subjected to major muscle forces that, especially in young patients, can deform hip and/or thigh and angular the bone fragments, thus complicating the intra operative reduction of fracture, therefore complete paralysis of all the muscles mandatory. Correct positioning during central neuraxial blockade is prerequisite for successful procedure. Previous studies suggest femoral nerve block is a safe and effective method and can be carried out in the preoperative setting. Femoral nerve block is one of the easiest peripheral nerve blocks to perform because the landmarks are easy to identify and nerve is usually superficial¹.

Fracture femur is a particularly painful bone injury because the periosteum has the lowest pain threshold of the deep somatic structures². These patients generally being elderly with multiple comorbidities are likely to have many undesirable effects of opioids including respiratory depression and confusion³.

Indication of femoral nerve block include analgesia for femoral shaft fracture, as a part of multimodal regimen⁴.

The use of peripheral nerve blocks has grown in popularity because it decreases pain as assessed by VAS scores postoperatively⁵.

2. MATERIALS AND METHODS

The study was conducted on patients at hospitals attached to Bangalore Medical College and Research Institute, Bangalore, between November 2018 to May 2020. After obtaining approval by the Hospital ethical committee and written informed consent and routine pre-anesthetic evaluation surgeon's consent, patients were divided into 2 groups.

Group A – received 1 mcg/kg IV fentanyl

Group B- underwent femoral nerve block with 0.2% ropivacaine 15ml volume

Patients Fulfilling The Following Criteria Were Included

1. Adult patients (18 – 65yrs) of both genders will be included after receiving informed written consent (annexure 1)
2. Patients belonging to American Society of Anesthesiologist class 1 & 2 (annexure 2)
3. Patients with painful femoral fractures planned for open reduction and internal fixation.

Following Patients Were Excluded

1. Patient does not have pain
2. Patient refusing to participate in study
3. Patient with allergy to local anaesthetics
4. Patient with peripheral neuropathy, bleeding diathesis, previous femoral bypass surgery, inguinal hernia, inflammation or infection over injection site, morbid obesity, spine abnormality.
5. Patient with psychiatric disorders and poly trauma / communicated fractures.
6. Use of analgesics for premedication

All patients were subjected to pre-anaesthetic evaluation including medical history, physical examination and laboratory tests. The patients were premeditated with tablet alprazolam 0.5mg the night before surgery. In the preoperative waiting room, patients were put on standard monitoring like non invasive blood pressure, pulse oximetry, electrocardiogram and baseline readings noted. Baseline visual analog scale score was noted.

2.1 Anesthetic Procedure

Patients were randomised in a 1:1 allocations ratio by simple randomization using randomization.com, a web based tool, into 2 groups of 35 each, i.e group A and group B. Patients who are in group A will receive 1 mcg/kg fentanyl IV 20 minutes prior to surgery and patient was shifted into operating room, vitals were monitored and before administering subarachnoid block, additional 0.5mg/kg dose was added if pain is more and all vital parameters were recorded and VAS score for pain was noted.

Patients who are in group B underwent ultrasound guided FNB 20min prior to shifting into operating room. Under aseptic precautions, sonosite ultrasound guided machine with linear probe was placed transversely, inferior to the inguinal ligament to identify the femoral vessels and nerves in cross section. The nerve was located and 23 G quinke's spinal needle was introduced through the skin at 45-degree angle in plane to the ultrasound probe and 15ml 0.2% ropivacaine was injected along the nerve sheath through this needle. The needle was directly visualised by the probe throughout the procedure to ensure that vascular puncture is avoided and that the spread of the study drug will be in correct fascial plane. Immediately after injection, manual pressure was held for 5 min, 1cm below injection site. 20min after the block, patient was shifted into the operating room, vitals were monitored and before administering subarachnoid block, all vital parameters were recorded and VAS score for pain was noted.

Ramsay sedation scores were also noted after giving IV fentanyl and FNB with 0.2% ropivacaine 15ml.

Subarachnoid block was administered using injection bupivacaine 0.5% (H) 3ml. Data collected was recorded in a study proforma.

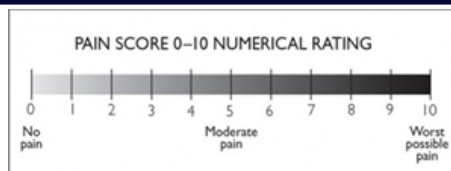
After giving Subarachnoid block patient was assessed for onset of sensory block, onset of motor block, also highest level of block was recorded.

Post operative assessment was done in post operative ward for following parameters and were recorded in a study proforma.

1. Duration of sensory block
2. Duration of motor block
3. Time for requirement of first rescue analgesia
4. VAS score assessed at 0hr, 4hr, 8hr, 12hr, 24hr.

Ramsay Sedation Assessment Scale

Awake	Patient anxious or agitated or both	1
Levels:	Patient cooperative, oriented and tranquil	2
	Patient responds to commands only	3
Asleep	A brisk response to a light glabellar tap	4
Levels:	A sluggish response to a light glabellar tap	5
	No response	6



2.2 Sample Size

Based on previous study by A. Lamaroon et al, pain score during positioning in femoral nerve block(FNB) group was 6.1 $\pm$ 2.6 and in fentanyl group 5.9 $\pm$ 3.4. Minimum expected difference between two groups will be 2 VAS scores. The sample size calculation is, n=35 in each group.

2.3 Statistical Analysis.

- Results obtained were analysed using descriptive statistics. Parametric variables were analysed using paired "t" test, unpaired "t" test and ANOVA.
- P value less than 0.005 was considered statistically significant.
- Data was entered into Microsoft excel sheet and was analysed using SPSS 22 version software.

3. RESULTS

70 patients completed the study and were included in data analysis. Demographic statistics in both the groups did not show any statistically significant difference(p value > 0.05)

3.1 Comparing The Outcome Of The 2 Groups

Hemodynamic parameters(pulse rate, blood pressure, respiratory rate) in group A i.e fentanyl group before and 20 minutes after administration of fentanyl to study participants showed statistically significant difference(p value < 0.05). Also reduction in VAS scores from 7.5 $\pm$ 0.6 to 2.6 $\pm$ 1.2 was noted , which was statistically significant (p value 0.001)

Hemodynamic parameters (pulse rate, systolic blood pressure, respiratory rate) in group B i.e FNB group before and 20 minutes after FNB to study participants showed statistically significant difference(p value < 0.05). Also reduction in VAS scores from 7.4 $\pm$ 0.7 to 1.2 $\pm$ 1.3 was noted, which was statistically significant(p value 0.001)

Time required for first rescue analgesia (in hours) was significantly more in case of group B i.e FNB {8.5 $\pm$ 2hrs} compared to group A i.e fentanyl group {3.8 $\pm$ 1.4hrs} , thus reducing the post operative requirement of analgesics.

4. DISCUSSION

This prospective, comparative study shows that IV fentanyl 1mcg given 20min prior to SAB and FNB using 0.2% ropivacaine 15ml (USG guided) can provide pain relief prior to positioning patients with fractured femur for spinal block, but reduction in VAS scores were more in group B i.e FNB compared to group A i.e fentanyl group. In this study, the time required for first rescue analgesia was more in patients who received FNB with 0.2% ropivacaine compared to those who received IV fentanyl(1mcg/kg). Also patients were monitored for serious side effects of fentanyl such as hypoventilation, apnoea; but no side effects were noted with either fentanyl or femoral nerve block.

In addition patients in fentanyl group had higher mean Ramsay sedation score (2.8), were drowsy , requiring more number of persons for positioning of patient for spinal block.

Table-1: Age and BMI distribution of study participants

Sl.No.	Features	Group-1 (Fentanyl) (N=35) Mean (SD)	Group-2 (FNB) (N=35) Mean (SD)	p value#
1	Age in years	41.6 (11.2)	43.9 (12.6)	0.41
2	Height in cm	168 (6.1)	164.8 (9.8)	0.11
3	Weight in kg	65.2 (9.6)	64.3 (7.9)	0.24
4	BMI	24.6 (3.5)	23.9 (3.5)	0.45
5	Duration of surgery	2.3 (0.4)	2.3 (0.5)	0.98

Note: p value based on independent sample t test, SD-Standard deviation

Table-2: Gender and ASA status of study participants

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Sl.No.	Features	Group-1 (Fentanyl) (N=35) n (%)	Group-2 (FNB) (N=35) n (%)	p value#
1	Gender			
	Male	27 (77.1)	27 (77.1)	0.99
	Female	8 (22.9)	8 (22.9)	
2	ASA group			
	I	17 (48.6)	15 (42.9)	0.63
	II	18 (51.4)	20 (57.1)	

Note: p value based on Chi-square test

Table-3: Hemodynamic parameters before and 20 minutes after fentanyl to study participants (N=35).

Sl.No	Features	Before Mean	Before SD	20 minutes after Mean	20 minutes after SD	p value#
1	Pulse rate	79.3	7.2	74.6	5.9	0.001*
2	Systolic BP	123.2	10.9	119.7	9.4	0.02*
3	Diastolic BP	76.8	7.3	73.7	5.7	0.04*
4	SPO2	98.3	1.3	98.4	1.2	0.48
5	Respiratory rate	19.3	2	17.4	1.8	0.001*
6	VAS score	7.5	0.6	2.6	1.2	0.001*

Note: p value based on paired t test, SD-Standard deviation, * statistically significant (p<0.05).

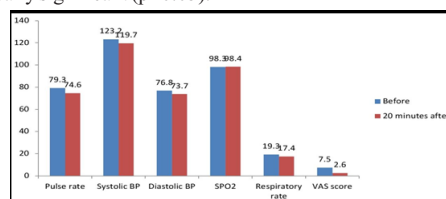


Table-4: Hemodynamic parameters before and 20 minutes after FNB to study participants (N=35)

Sl.No	Features	Before Mean	Before SD	20 minutes after Mean	20 minutes after SD	p value#
1	Pulse rate	82.1	14.1	74.2	10.6	0.001*
2	Systolic BP	126.7	15.4	120.8	12.8	0.001*
3	Diastolic BP	77.2	10.3	76.3	7.1	0.64
4	SPO2	97.9	1.7	98	1.6	0.68
5	Respiratory rate	18.8	3.8	17.1	2.8	0.001*
6	VAS score	7.4	0.7	1.2	1.3	0.001*

Note: p value based on paired t test, SD-Standard deviation, * statistically significant (p<0.05).

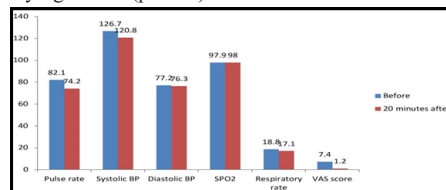
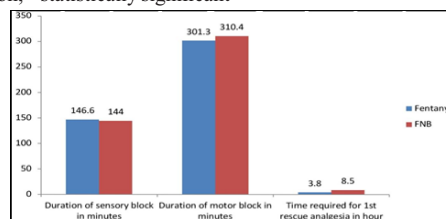


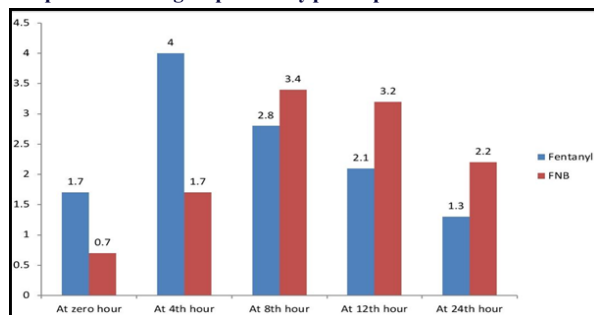
Table-5: Duration of block between groups of study participants.

Sl. No.	Features	Group-1 (Fentanyl) (N=35) Mean	Group-1 (Fentanyl) (N=35) SD	Group-2 (FNB) (N=35) Mean	Group-2 (FNB) (N=35) SD	p value#
1	Duration of sensory block in minutes	146.6	9.5	144	10.2	0.28
2	Duration of motor block in minutes	301.3	12	310.4	18.8	0.02*
3	Time required for 1 st rescue analgesia in hour	3.8	1.4	8.5	2	0.001*

Note: p value based on independent sample t test, SD-Standard deviation, * statistically significant



• Comparison of post-operative VAS score at different time point between groups of study participants.



Comparing our study results with some studies conducted previously. A. Lamaroon² et al concluded that no difference was demonstrated between FNB using nerve stimulator with 20ml 0.5% bupivacaine and 10ml normal saline (group 1) and fentanyl 0.5mcg/kg 2 doses given at 5 min interval (group 2). Sia⁶ et al concluded that FNB was more advantageous than IV fentanyl to facilitate positioning.

Casati⁷ et al concluded that ultrasound guidance provided a 42% reduction in minimum effective anesthetic volume of ropivacaine 0.5% required to block the femoral nerve as compared with the nerve stimulation guidance. The use of ultrasound can be useful in patients in whom it is difficult to palpate a femoral pulse, because of weight, anatomic variability, or changes to the needle insertion site (before radiation or surgery). The femoral nerve can be identified lateral to the artery as a triangular shaped structure⁸.

Arvinder Pal Singh⁹ et al concluded that FNB using 0.2% ropivacaine is a safe and effective method to alleviate pain as preemptive analgesic than IV fentanyl. The concept of preemptive analgesia, which means use of analgesia before surgery in order to prevent post operative pain by preventing the central nociceptive sensitization, is gaining popularity in recent times. Post operative pain is not purely nociceptive in nature and may consist of inflammatory, neurogenic, and visceral components. Therefore, multimodal approach for treating post operative pain by using a number of drugs acting via different mechanisms is used.

Ashok Jadon¹⁰ et al concluded that FNB provides better analgesia, patient satisfaction and satisfactory positioning than IV fentanyl for position during spinal anesthesia in patients with fracture femur.

Fentanyl is about 100 times more potent than morphine. Like all opioids the analgesic response to IV fentanyl is highly variable. Fentanyl's lipophilic structure means it rapidly crosses the BBB and is evident from a characteristic delta wave appearing on the EEG. Fentanyl's analgesic effect is 10-20 minutes. Fentanyl dosing should be repeated at regular intervals in order to maintain a comfortable analgesic state¹¹. Opioids have multiple central and peripheral mechanisms of analgesic actions. Spinal administration of opioids provides analgesia primarily by attenuating C-fibre nociception and is independent of supraspinal mechanisms. Co administration of opioids with central neuraxial local anesthetics results in synergic analgesia¹².

5. CONCLUSION

- In our study, both ultrasound guided FNB with ropivacaine and IV fentanyl provided reduction in VAS score during positioning for spinal block, however reduction in VAS scores were more in FNB group compared to IV fentanyl group, thus had superior analgesia.
- Time required for first rescue analgesia was significantly more in case of FNB compared to IV fentanyl, thus reducing post operative requirement of analgesics.
- There were no adverse effects noted with FNB in post operative period, and some patients who received fentanyl had drowsiness.

6. Source Of Funding

None

7. Conflict Of Interest

None

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