European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 09, Issue 04, 2022

Original research article

Comparison of Ultrasound-Guided Fascia Iliaca Compartment Block with 0.25% Ropivacaine to Intravenous Fentanyl for Positioning Under Hip Surgeries

Dr. Aditya Raj Yadav[1], Dr. Pankaj Kumar[2], Dr. Raj Lakshmi Bhandari[3]

[1]Resident, Department of Anaesthesiology, VPIMS, Lucknow

[2]Senior Resident, Department of Anaesthesiology, IGIMS Patna

[3]Prof. & Head, Department of Anaesthesiology, VPIMS, Lucknow

Corresponding Author: Dr. Pankaj Kumar

Abstract

Background: Fractures of the femur commonly affect femoral neck, intertrochanteric or sub-trochanteric area of femur, These fractures are almost always associated with significant soft-tissue injury, causing severe pain to patients. These patients require analgesia for positioning for spinal block.

Material and Methods: A total of 62 patients were included in the study. They were randomly allocated into two groups. Randomization was done using computerized random number tables.

1.Group FICB were administered ultrasound guided FICB preoperatively.

2.Group FENT were administered IV fentanyl preoperatively in incremental dosage

Results: Both the groups were comparable in terms of age and BMI distribution ,VAS score comparison at 0 minutes didn't revealed any significant differences at 95% confidence interval (*P*= 0.85263). VAS score at 15 minutes post procedure interestingly showed a strong statistical significant differences between the groups, with lower mean values in FICB groups (*P*< 0.0001). The patient position satisfaction status was significantly higher in FICB group compared to FENT group by a percentage difference of 16.00 (16% higher). The mean time to perform subarachnoid block was significantly shorter in FICB group compared to FENT group by a mean difference of 58s (16% shorter) (*P* < 0.0001). The mean heart rate was significantly lower in FENT group compared to FICB group by a mean difference of 6 beats per minute.There was no statistical difference between the groups with respect to SpO2 and MAP.T he first postoperative analgesic need between FICB group (mean=5.75, SD=0.75) and FENT group (mean=1.45, SD=0.60) with a p value of <0.05 as per unpaired t test.

Conclusion: Ultrasound guided FICB is more efficacious than i.v. fentanyl for positioning during spinal anaesthesia.

Keywords: BMI, VAS Score, Ropivacaine, Fentanyl.

Introduction

Initial concept of pain was formulated in early 1800 worldwide.[1] An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage".[2,3] fractures of the femur commonly affect femoral neck, intertrochanteric or sub-trochanteric area of femur, These fractures are almost always associated with significant soft-tissue injury, causing severe pain to patients.[4] Patient positioning to perform a spinal blockade causes severe pain. Overriding of bone ends during movement worsens pain, delays positioning. These patients require analgesia for positioning for spinal block.[5] Analgesia can be provided in the form of systemic analgesic such as NSAIDS (diclofenac, parecoxib) and opioids, local anaesthesia, or femoral nerve blocks (FNBs). Femoral and 3- in-1 nerve block has been used to provide analgesia in patients with hip fractures in prehospital setting and emergency department[6,7]Different techniques have been used to identify and block nerve fibres eg. landmark techniques, Nerve stimulators, both these methods can cause neurovascular injuries leading to permanent nerve damage. Ultrasound is gaining importance in recent years and has provided anaesthesiologists, an effective alternative tool for the identification and safe blockade of nerve fibres.

FICB (fascia iliaca compartment block) was first reported by Dalens et al. in 1989 as an alternative to the 3-in-1 nerve block.[8] Iliacus and iliopsoas muscles are covered in a dense fascia known as fascia iliaca. Femoral nerve originates from the L_2 to L_4 nerve roots and travels under the iliacus fascia along with the lateral femoral cutaneous nerve and the obturator nerve. There is evidence to suggest that the fascia iliaca compartment block is easy to perform, and can be accessed via a minimal risk approach. Wide range of local anaesthetic agents are available for FICB such as lidocaine, mepivacaine, prilocaine, bupivacaine, and ropivacaine.[9] Ropivacaine is a newer local anaesthetic agent with greater selectivity for sensory blockade. In comparison to bupivacaine, it is less lipophilic in nature and therefore possess lesser degree of penetration to larger myelinated motor fibers and potentially lowers down the toxicity to cardiac and central nervous system.[10] Aged patients possess a high incidence of cardiovascular comorbid disease and poorly tolerated hemodynamic fluctuations in comparison to young adults. Ropivacaine is an effective long-acting local anaesthetic drug to have been evaluated definitively, at an early stage in its development. There are fewer studies available indicating the usefulness of ropivacaine in FICB.[11,12]

Aims:

The present study aimed to compare the efficacy of ultrasound-guided fascia iliaca compartment block with 0.25% ropivacaine to intravenous fentanyl for positioning during spinal anaesthesia in hip and proximal femur surgeries.

Objectives:

Primary Objectives:

1. Compare the analgesia obtained for positioning during spinal anaesthesia using VAS score.
2. To compare the quality of patient positioning.
3. To compare the time taken for giving spinal anaesthesia.

Secondary Objectives:

1. To compare the patient satisfaction between the two groups.
2. To compare vital parameters; heart rate (HR), mean arterial pressure (MAP) by noninvasive blood pressure (NIBP) and oxygen saturation (SpO 2) between the two groups.

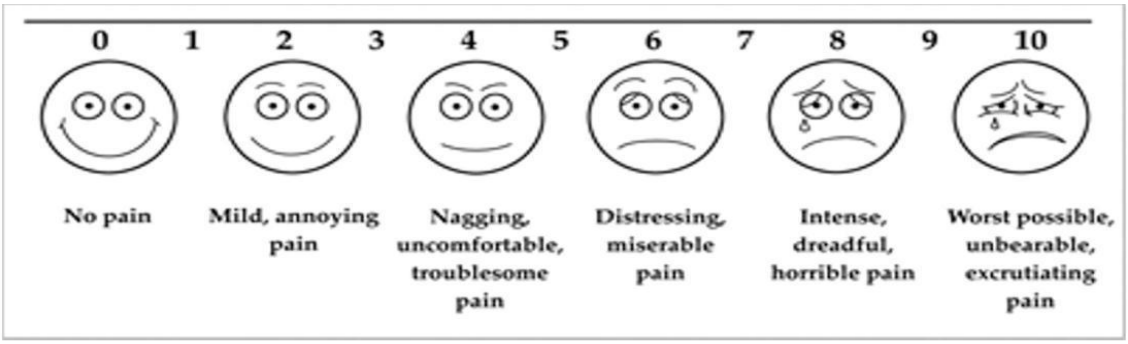
Methods:

After obtaining approval from the institutional ethical committee, Patients were examined in ward one day before surgery and complete physical as well as systemic examination was done. Routine investigations such as hemoglobin, PT/INR, chest X ray, ECG were done for all patients (as required). The purpose and protocol of the study was explained to patients and informed written consent was obtained. Method of Linear Visual Analogue Scale (VAS) scoring on 0-10cm was explained to all patients for the assessment of pain where 0 denotes no pain and 10 denotes worst pain imaginable. All patients were kept nil per oral for at least 6 h before the procedure. Patients were shifted inside the operation theater ½ hour before the scheduled procedure.

A total of 62 patients were included in the study. They were randomly allocated into two groups. Randomization was done using computerized random number tables.
1.Group FICB were administered ultrasound guided FICB preoperatively.
2.Group FENT were administered IV fentanyl preoperatively in incremental dosage.

After shifting patient in OT, Baseline vitals such as pulse rate, noninvasive blood pressure, saturation in room air, respiratory rate, VAS score were recorded. IV access was obtained with 18G IV cannula and IV fluid was started. Local anaesthetic 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 5 L/min. Group FICB patients were placed in supine position. The local anaesthetic solution was prepared with 15 mL of 0.5% ropivacaine and 15 ml of distilled water and hence 30 ml of 0.25% ropivacaine. Ultrasound machine was powered on and the linear array probe was covered with sterile dressing after applying ultrasound gel. The ultrasound probe was placed in transverse orientation on the thigh just inferior to inguinal ligament at one-third of the distance from Anterior Superior Iliac Spine (ASIS) to pubic tubercle. The ultrasound was set at frequency of 10 MHz and a depth of 3-4 cm was used. 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. The two fascial planes, the fascia lata and the fascia iliaca were visualized as two hyperechoic lines. After local skin disinfection using topical 10% povidone iodine, a short bevelled 23G Quincke's lumbar puncture needle was introduced through the skin in a lateral to medial orientation and directed in plane to ultrasound probe to allow visualization of the full length of the needle throughout the procedure. The needle tip was visualized penetrating the fascia lata and then the fascia iliaca (appreciating the give way as the fascia is perforated). After puncturing the fascia iliaca, and negative aspiration, 30 mL of 0.25% ropivacaine was injected over a 2-3 minutes period interrupted by intermittent aspirations. An expanding anechoic collection just below the fascia iliaca was considered as visual confirmation of correct placement of anaesthetic. The FICB was done 15 min before the subarachnoid block. Group FENT patients received titrated doses of injection fentanyl 0.5 mcg/kg IV repeated to 3 doses (1.5 mcg/kg totally) with an interval of 5 min between doses. Hemodynamic variables such as heart rate, noninvasive blood pressure and oxygen saturation were recorded after the block/IV fentanyl and at 5 min intervals till positioning.

The analgesia provided by either of the modes was assessed using visual analog scale (VAS) scores 0 and 15 min (i.e., during positioning) after the block/IV fentanyl.



Results:

The groups had no statistically significant differences among them in demographic details such as age,sex,weight,B.M.I and ASA grade.All data have been reported as mean value+-2 SD.The collected data (both descriptive and quantitative) was analyzed using SPSS software 16.0 version for Windows (Chicago: SPSS Inc). Descriptive statistics were represented as mean values and percentages. Continuous and Categorical variables were analyzed using unpaired t-test and Chi-square test or Fisher exact test respectively. In all the cases, Statistical significance was taken as $P < 0.05$.

Table 1: Tabular representation of the statistical summary of the VAS score in FENT and FICB group at 0 minutes.

	VAS-0m-FENT	VAS-0m-FICB
N	31	31
Min	5.5	5.5
Max	8.2	8.5
Mean	6.96129	7
Std. error	0.1426838	0.1506259
Stand. dev	0.7944295	0.8386497
Median	7.1	7
P value	0.85263	

Table 2: Tabular representation of the statistical summary of the quality of patient positioning in FENT and FICB group at 15 minutes.

	FENT	FICB
Not satisfactory (score 0)	4	0
Satisfactory (score 1)	12	6
Good (score 2)	13	10
Optimal (score 3)	2	15
Mean	1.419	2.29
Standard deviation	0.807	0.78
P value	<0.001	

Table 3: Tabular representation of the statistical summary of the time (minutes)required for spinal anaesthesia in FENT and FICB group patient

	FENT	FICB
N	31	31
Min(minutes)	3	3
Max(minutes)	6.2	5.4
Mean	4.858065	4.151613
Std. error	0.1575194	0.1351121
Stand. dev	0.8770307	0.7522725
Median	5.2	4.2
P value	0.0012	

Table 4: Tabular representation of the statistical summary of the heart rate(beats/minute) at different interval in FENT and FICB group.

Heart Rate					
Time		**Before Block**	**5 mins**	**10 mins**	**15 mins (Before positioning)**
FENT Group	**Mean**	76.0	74.6	70.9	70.2
	SD	9.3	8.9	9.5	9.2
FICB Group	**Mean**	75.7	75.7	74.4	74.0
	SD	8.7	7.8	8.8	8.4
p-values		0.9	0.6	0.1	0.1

Table 5: Tabular representation of the statistical summary of the SPO2(%) at different interval in FENT and FICB group

SPO2					
Time		**Before Block**	**5 mins**	**10 mins**	**15 mins (Before positioning)**
FENT Group	**Mean**	97.3	99.6	99.8	99.9
	SD	1.6	0.6	0.4	0.2
FICB Group	**Mean**	97.0	99.7	99.8	99.9
	SD	1.8	0.6	0.4	0.2
p-values		0.6	0.8	1.0	1.0

Table 6: Tabular representation of the statistical summary of MAP(mm Hg) at different interval in FENT and FICB group.

Mean Arterial Pressure (MAP)					
Time		**Before Block**	**5 mins**	**10 mins**	**15 mins (Before positioning)**
FENT Group	**Mean**	91.0	91.9	91.6	91.4
	SD	11.3	11.5	10.0	10.1
FICB Group	**Mean**	95.6	95.8	96.0	95.5
	SD	9.6	10.7	10.6	10.6
p-values		0.1	0.2	0.1	0.1

Table 7: Tabular representation of the statistical summary of First rescue analgesic requirement postoperatively in FENT and FICB group.

First Rescue Analgesic Postoperative	**FICB Group**	**FENT Group**
N	31	31
Mean	5.75	1.45
SD	0.75	0.60
P value Unpaired t Test	<0.0001	

Discussion:

Fractures of the hip and femur bones are common orthopedic problems following trauma in old age patients. At our institution we practice regional anaesthesia for surgical repair of fracture femur. However, the immediate problem faced is the excruciating pain when trying to position the patient for conduct of spinal anaesthesia. study was carried out with an aim to compare ultrasound-guided fascia iliaca compartment block with 0.25% ropivacaine to intravenous fentanyl for positioning during spinal anaesthesia in hip and proximal femur surgeries. For the same, a total of 62 patients satisfying the inclusion criteria were chosen and allocated into two groups of 31 each.

In our study, the mean age of the patients in FICB and FENT group was 52.29 ± 18.26 and 53.19 ± 16.50 years (mean ± SD) respectively. The mean BMI of the patients in FICB and FENT group was 23.9 ± 4.14 kg/m2 and 25.2 ± 4.5 kg/m2 (mean ± SD), respectively. Both the groups were comparable in terms of age and BMI distribution as the P value was not significant (P>0.05).

We next compared the VAS score in both the groups at two distinct time-points (0 and 15 minutes). VAS score comparison at 0 minutes didn't revealed any significant differences at 95% confidence interval (*P*= 0.85263). VAS score at 15 minutes post procedure interestingly showed a strong statistical significant differences between the groups, with lower mean values

in FICB groups ($P< 0.0001$). The mean VAS scores at 15 mins in FICB and FENT were 1.5 ± 0.7 and 2.6 ± 0.8 (mean ± SD) respectively. Sendilmurukan *et al*[13] in their study observed the VAS score during positioning was 1.13 ± 1.25 in FICB group (0.25% bupivacaine) and 2.27 ± 1.55 in FENT group and was statistically significant ($P= 0.0029$), similar to our findings

When considering the quality of patient positioning during spinal anaesthesia there was a statistically significant difference in relation to quality of patient positioning between FICB group (mean=2.29, SD=0.78) and FENT group (mean=1.41, SD=0.80) with a p value of <0.001 as per unpaired t test. Our results clearly indicate an overall improvement in the patient positioning in both the groups, albeit the improvement was higher in FICB group patients Similarly, we observed increase in patient satisfaction level in FICB group patients in contrast to FENT group patients ($P = 0.0317$). The positive patient satisfaction status was significantly higher in FICB group compared to FENT group by a percentage difference of 16.00 (16% higher). Sendilmurukan *et al*[13] observed that there was a statistically significant difference in relation to time to perform subarachnoid block between FICB (4.90 ± 0.55) and FENT group (5.86 ± 0.83). The mean time to perform subarachnoid block was significantly shorter in FICB group compared to FENT group by a mean difference of 58s (16% shorter) ($P < 0.0001$).

We also compared the time required for the spinal anaesthesia in FICB and FENT group patients. The mean time required in FICB group (4.15 ± 0.13) is comparatively lesser than that of FENT group (4.85 ± 0.15) with a significant P value = 0.0012027. Sendilmurukan *et al*[13] observed that there was a statistically significant difference in relation to time to perform subarachnoid block between FICB (4.90 ± 0.55) and FENT group (5.86 ± 0.83). The mean time to perform subarachnoid block was significantly shorter in FICB group compared to FENT group by a mean difference of 58s (16% shorter) ($P < 0.0001$). In our study, we estimated and compared hemodynamic parameters between FENT and FICB groups. Statistical analysis of these parameters revealed that there is no significant (95% confidence interval) differences between the groups ($P> 0.05$). However, the mean values of heart rate and MAP were comparatively lower in FENT group. The mean Heart rate at 15 mins in FICB and FENT were 74.0 ± 8.4 and 70.2 ± 9.2 respectively. Sendilmurukan *et al*[13]however, observed a statistically significant difference (P=0.0022) in relation to heart rate at 10-15 min between FICB group (86.52 ± 8.39) and FENT group (81.02 ± 7.10). The mean heart rate was significantly lower in FENT group compared to FICB group by a mean difference of 6 beats per minute. There was no statistical difference between the groups with respect to SpO2 and MAP. Among the patients undergoing spinal anaesthesia in fracture femur surgery, there was a statistically significant difference in relation to time of first postoperative analgesic need between FICB group (mean=5.75, SD=0.75) and FENT group (mean=1.45, SD=0.60) with a p value of <0.05 as per unpaired t test. Sendilmurukan *et al*[13] also documented similar results that FICB had the advantage of significant postoperative analgesia as the requirement of first rescue analgesic was after 5.90±0.80 hrs compared to 1.65±0.60 hrs in FENT group($P< 0.0001$).

Conclusion:

Our results clearly indicate that ultrasound guided FICB is more efficacious than i.v. fentanyl for positioning during spinal anaesthesia. FICB provides safety, superior analgesia, better quality of patient positioning, greater patient satisfaction thereby reducing the time taken to perform spinal anaesthesia in sitting position compared to i.v. fentanyl in hip and proximal femur surgeries. It also provides better and long-lasting analgesia in postoperative period. FICB is a safe procedure for providing analgesia with remarkable safety profile.

References

1. Chen J. History of pain theories. Neurosci Bull. 2011 Oct;27(5):343–50.

2. Cervero F, Laird JM. One pain or many pains? A new look at pain mechanisms. NIPS 1991;6:268-73.
3. Elzack R, Wall PD. On the nature of cutaneous sensory mechanisms.Brain 1962;85:331-56.
4. Kacha NJ, Jadeja CA, Patel PJ, Chaudhari HB, Jivani JR, Pithadia VS. Comparative study for evaluating efficacy of fascia iliaca compartment block for alleviating pain of positioning for spinal anaesthesia in patients with hip and proximal femur fractures. Indian J Orthop 2018; 52: 147-53.
5. Kim HY, Lee MJ, Kim M-N, Kim J-S, Lee WS, Lee KC. Effect of position changes after spinal anaesthesia with low-dose bupivacaine in elderly patients: sensory block characteristics and hemodynamic changes. Korean J Anesthesiol. 2013 Mar;64(3):234–9.
6. Tam CW, Rainer TH. Femoral nerve block for pain management of femoral fractures in the emergency department: Evidence based topic review. Hong Kong J Emerg Med. 2005;12(3):178-81
7. McGlone R, Sadhra K, Hamer DW, Pritty PE. Femoral nerve block in the initial management of femoral shaft fractures. Arch Emerg Med 1987;4:163-8
8. Dalens B, Vanneuville G, Tanguy A. Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. Anesth Analg. 1989 Dec;69(6):705–13
9. Becker DE, Reed KL. Essentials of Local Anesthetic Pharmacology. Anesth Prog. 2006;53(3):98–109.
10. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and
1. clinical use. Indian J Anaesth. 2011;55(2):104–10.
11. Helayel PE, Lobo G, Vergara R, Conceição DB, Oliveira Filho GR. Effective volume of local anaesthetics for fascia iliac compartment block: A double-blind, comparative study between 0.5% ropivacaine and 0.5% bupivacaine. Rev Bras Anestesiol2006;56:454-60
12. Paria R, Surroy S, Majumder M, Paria B, Sengupta S, Das G, et al. Combination of fascia iliaca compartment block on the surgical side with sacral spinal anaesthesia for hip to knee surgery. IOSR J Dent Med Sci 2014;13:46-9
13. Sendilmurukan M, Nanthaprabu M, Deepa K, Anandan H. Comparison of Ultrasonography Guided Fascia Iliaca Compartment Block and Intravenous Fentanyl for Positioning During Spinal Anesthesia in Fracture Femur Surgeries - A Randomized Controlled Study. 2017;5(6)