

## Original Research Article

# USG guided femoral nerve block vs fascia iliaca compartment block as post-operative analgesia in hip fracture patients

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### ABSTRACT

**Background:** Adequate postoperative analgesia facilitates early mobilization which is important to reduce postoperative morbidity. Here, we intended to compare the efficacy of two different nerve blocks for postoperative pain relief in fractured neck of femur patients.

**Methods:** One hundred and five patients posted either for dynamic hip screw or proximal femoral nail implantation under spinal anaesthesia were randomly allocated to three groups. At the end of surgery, group 1 received femoral nerve block (FNB) and group 2 received fascia iliaca compartment block (FICB) for postoperative pain relief. These blocks were ultrasound guided. Group 3 received no block and acted as control. Patients' pain was evaluated by Visual Analogue Scale (VAS) both at rest and at passive elevation of leg. Rescue analgesia was given when VAS score exceeded 3. Heart rate, mean arterial blood pressure, respiratory rate and total analgesic consumption in first 24 hours were also recorded.

**Results:** Groups 1 and 2 had similar duration of analgesia of around 8 hours (P value = 0.727). Analgesic consumption in both these groups were similar (P value = 0.648). These groups had less pain, less analgesic requirement and more stable haemodynamics as compared to group 3. No adverse effect was seen due to application of block.

**Conclusions:** FICB can be an effective alternative to femoral nerve block, because of its relative simplicity in technique and less invasiveness. Hence FICB holds considerable promise as an effective postoperative analgesia.

**Keywords:** Femoral nerve block, Fascia iliaca compartment block, Post-operative analgesia, Visual analogue scale

### INTRODUCTION

Fractured neck of femur occurs most commonly in elderly individuals as a result of minimal trauma and fall from height.<sup>1</sup>

It is a common cause of admission to hospital in elderly patients and requires operative fixation. Trauma and pain induce a complex response to stress, characterized by inflammatory and hormonal changes that can lead to immunosuppression, which retards wound healing and

fracture repair and thereby hinder mobilization in individuals with already poor muscle function.<sup>2-4</sup>

Most commonly used non-opioid analgesics for the treatment of painful syndromes are non-steroidal anti-inflammatory drugs, which can cause damage to the gastrointestinal mucosa, renal tubules and platelet dysfunction, and can increase intra-operative bleeding.<sup>5</sup>

Peripheral nerve blocks are localized and site-specific. Nerves and neural plexus blocks are efficient and

depending upon the surgery, an alternative choice for postoperative analgesia.<sup>6</sup>

Femoral nerve block (FNB) is effective in providing analgesia for femur fractures.<sup>7</sup> A fascia iliaca compartment block (FICB) is a modification of the femoral nerve block. It is performed by application of local anaesthetic beneath the fascia iliaca and provides a block of femoral nerve and lateral femoral cutaneous nerve and rarely of obturator nerve.

In 1989, ultrasonography was first utilized to confirm the location of the needle and observe the spread of local anaesthetic while performing peripheral nerve blocks.<sup>8</sup> Subsequently, ultrasound-guided blocks have become increasingly popular with clinicians, owing to the precise action and faster onset of the block.<sup>9</sup>

## METHODS

This was a prospective randomized controlled observer blind study carried out after obtaining institutional ethics committee approval and written informed consent from all patients. All patients underwent thorough pre-anaesthetic check-up.

ASA I, II patients of either sex between the ages of 18-65 years, having a body mass index between 18-30kg/m<sup>2</sup> and posted for either dynamic hip screw (DHS) or proximal femoral nail (PFN) implantation were included in this study. Patients who had hypersensitivity or allergy to any of the study drugs, used opioids regularly, had malignancy, dementia, confusion, history of coagulopathies, infection over the injection site or whose duration of surgery was more than 2 hours were excluded from the study. Calculated sample size was 35 for each group.

The patients were randomly allocated to one of the three groups using sequentially numbered cards in sealed opaque envelopes-

- Group 1-Femoral nerve block was given with 40 ml of 0.25% Bupivacaine,
- Group 2-Fascia iliaca compartment block was given with 40 ml of 0.25% Bupivacaine,
- Group 3-No block was given.

At night and morning before surgery, all patients received Tab Ranitidine 150 mg and Tab Alprazolam 0.25mg. The vitals were checked in the pre-operative room. Before initiation, peripheral vascular access was obtained with a 18G intravenous cannula in all patients and 15ml/kg of Ringer Lactate was infused over 15-20 minutes. Blood pressure (mmHg), heart rate (beats/min), and peripheral oxygen saturation (SpO<sub>2</sub>) values were checked by non-invasive methods and monitored in all patients. The surgery was performed under spinal anaesthesia with 3 ml 0.5% bupivacaine in L3-L4 or L4-L5 intervertebral

space, using Quincke spinal needle of 25 G. Surgery was allowed once T12 level of sensory loss was achieved.

At the end of surgery, nerve blocks were given to the patients according to the allotted group. We used Sonosite Fujifilm ultrasound system with HFL38/13-6 MHz transducer to guide the blocks. Preparation of study drug and administration of block was done by another anaesthesiologist not involved in the study. The changes in haemodynamic variables as well as VAS (visual analogue scale) score was recorded by another anaesthesiologist who was blinded to the technique of the block. The description of VAS score was explained to the patient prior to administration of block.

Each participant randomized to group 1, received ultrasound (US)-guided femoral nerve block on affected side immediately after surgery. The procedure was performed in a supine Trendelenburg position. Under all aseptic precautions US probe was placed below the inguinal ligament on the side of the affected hip to identify the femoral vessels and nerve in cross-section. The nerve was located and 22 G Whitacre non-cutting spinal needle was introduced at a 45-degree angle in plane to the US probe, and 40 ml of 0.5% of bupivacaine was injected along the nerve sheath through this needle. The needle was directly visualized by US throughout the procedure to ensure that vascular puncture was avoided and that spread of study drug was in the correct fascial plane. Immediately after the injection, manual pressure was held for 5 minutes, 1cm below the injection site.

A single fascia iliaca compartment block was performed on affected side immediately after surgery in the patients randomized to group 2. This procedure was performed with the patient in supine Trendelenburg position. Under all aseptic precautions US probe was placed below the inguinal ligament on the side of the affected hip. The femoral artery and the iliacus muscle lateral to it, covered by the fascia iliaca, were identified. Needle was advanced until the tip was placed underneath the fascia iliaca (appreciating the give way as the fascia was perforated) and after confirming negative aspiration 40ml of 0.5% of bupivacaine was injected.

In group 3, no postoperative block was administered, and this group acted as control group. Patient was monitored throughout the surgery, and thereafter up to 24 hours after the surgery. Patient's pain was evaluated by Visual Analogue Scale (VAS)<sup>10</sup>, a scale of zero to ten, where 0 is no pain and 10 is very severe pain.

In groups 1 and 2, time to injection of either femoral nerve block or fascia iliaca block was considered as time zero, whereas in group 3, end of surgery was considered as time zero. VAS at time zero was baseline score and was recorded in all patients. Patient's pain was evaluated at the time zero and 5<sup>th</sup>, 15<sup>th</sup>, 30<sup>th</sup> minute and 1<sup>st</sup>, 2<sup>nd</sup>, 6<sup>th</sup> and 24<sup>th</sup> hour both at rest and at passive leg elevation. Hemodynamic variables viz, heart rate, mean arterial

pressure and respiratory rate were also recorded at the same time interval.

If the patient experienced pain (VAS>3) at any hour, intramuscular injection diclofenac (1.5mg/kg) was administered and if the patient was orally allowed 50mg oral tablet diclofenac was given. If this was not sufficient, analgesia with injection tramadol (1mg/kg) slow iv was given additionally.

First requirement of analgesic agent (taken as first postoperative analgesic agent administration time), dose of analgesic agent administered, total analgesic requirement in first 24 hours and complications after giving block (nausea, vomiting, hypotension, bradycardia and headache) were recorded.

All data was recorded, summarized, tabulated and statistically analysed using SPSS statistics program (Version 21). Demographic data was analysed by using non-parametric test, chi-square test. Hemodynamic variables and pain scores were analysed using analysis of variance (ANOVA) for three groups and independent t test for two groups' comparison. P value of <0.05 was considered as significant.

## RESULTS

One hundred and five patients were enrolled. Demographic profile of all the three groups was comparable (Table 1).

**Table 1: Demographic data.**

Characteristics	Group 1, (n=35)	Group 2, (n=35)	Group 3, (n=35)	P value
Age (years) (Mean ± SD)	46.37±13.386	45.46±13.032	46.31±14.381	0.952
BMI (kg/m <sup>2</sup> ) (Mean ± SD)	22.40±1.519	22.43±1.357	22.71±1.405	0.597
Duration of surgery (minutes) (Mean ± SD)	79.00±9.686	80.28±7.469	82.57±8.606	0.220
Male	22(62.9%)	28(80.0%)	24(68.6%)	0.278
Female	13(37.1%)	7(20.0%)	11(31.4%)	0.267
ASA I	20(57.1%)	24(68.6%)	21(60.0%)	0.592
ASA II	15(42.9%)	11(31.4%)	14(40.0%)	0.588

**Table 2: Changes in the visual analogue scoring after application of block.**

Time (Min)	Group 1 (n = 35) Mean ±SD	Group 2 (n = 35) Mean ±SD	Group 3 (n = 35) Mean ±SD	P value			
				Between group and 2	Between group and 3	Between group and 3	Between group 1, 2 and 3
0	0.0±0	0.0±0	0.0±0	-	-	-	-
5	0.0±0	0.0±0	0.0±0	-	-	-	-
15	0.0±0	0.0±0	0.0±0	-	-	-	-
30	0.0±0	0.0±0	0.23±0.731	-	0.073	0.069	0.036
60	0.0±0	0.0±0	2.26±1.482	-	0.000 <sup>□</sup>	0.000 <sup>□</sup>	0.000 <sup>□</sup>
360	0.26±0.561	0.31±0.758	2.74±0.741	0.721	0.000 <sup>□</sup>	0.000 <sup>□</sup>	0.000 <sup>□</sup>
720	1.51±1.011	1.69±0.796	2.09±0.702	0.433	0.008	0.029 <sup>□</sup>	0.018 <sup>□</sup>
1440	1.14±1.061	1.17±0.985	1.89±0.631	0.907	0.001 <sup>□</sup>	0.001 <sup>□</sup>	0.001 <sup>□</sup>

\*indicates p value is significant

**Table 3: Changes in VAS scores after passive elevation of leg.**

Time (Min)	Group 1 (n = 35) Mean ±SD	Group 2 (n = 35) Mean ±SD	Group 3 (n = 35) Mean ±SD	P value			
				Between group 1 and 2	Between group 1 and 3	Between group 2 and 3	Between group 1, 2 and 3
0	0.0±0	0.0±0	0.0±0	-	-	-	-
5	0.0±0	0.0±0	0.0±0	-	-	-	-
15	0.0±0	0.0±0	0.03±0.169	-	0.321	0.321	0.371
30	0.0±0	0.0±0	1.49±1.314	-	0.000 <sup>□</sup>	0.000 <sup>□</sup>	0.000 <sup>□</sup>
60	0.0±0	0.0±0	4.14±1.700	-	0.000 <sup>□</sup>	0.000 <sup>□</sup>	0.000 <sup>□</sup>
360	1.34±1.211	1.63±1.190	4.51±0.853	0.323	0.000 <sup>□</sup>	0.000 <sup>□</sup>	0.000 <sup>□</sup>
720	3.17±0.954	3.40±0.914	3.71±0.926	0.310	0.018 <sup>□</sup>	0.158	0.054
1440	2.77±0.877	2.89±0.867	3.40±1.035	0.585	0.008 <sup>□</sup>	0.028 <sup>□</sup>	0.013 <sup>□</sup>

**Table 4: The analgesic requirement comparison.**

	Group 1 (n = 35) Mean ±SD	Group 2 (n = 35) Mean ±SD	Group 3 (n = 35) Mean ±SD	P value			
				Between group 1 and 2	Between group 1 and 3	Between group 2 and 3	Between group 1, 2 and 3
Time (in hours) to 'First Requirement' of analgesic	8.24±1.880	8.09±1.869	1.42±0.820	0.727	0.000 <sup>□</sup>	0.000 <sup>□</sup>	0.000 <sup>□</sup>
Dose (in mg) of diclofenac used initially	50.00±0.0	50.00±0.0	75.00±0.0	-	-	-	-
Total diclofenac (in mg) consumed in first 24 hours	137.14±37.067	141.43±41.098	229.29±33.478	0.458	0.000 <sup>□</sup>	0.000 <sup>□</sup>	0.000 <sup>□</sup>

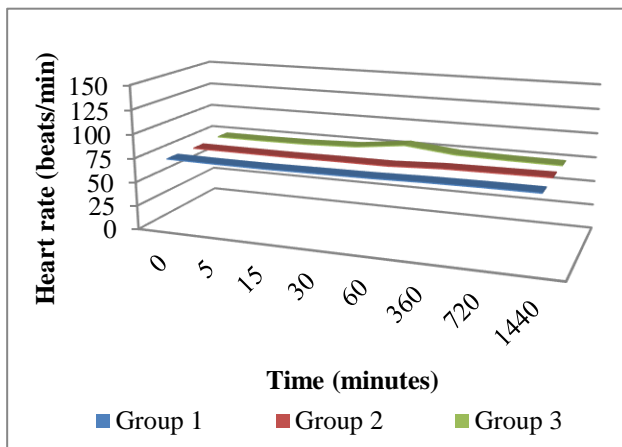
\*indicates p value is significant

At the time of application of block patient did not have any pain due to the persistent effect of subarachnoid block. On comparison of the groups 1 and 2, at no time interval any significant difference was reported (P value >0.05) (Table 2).

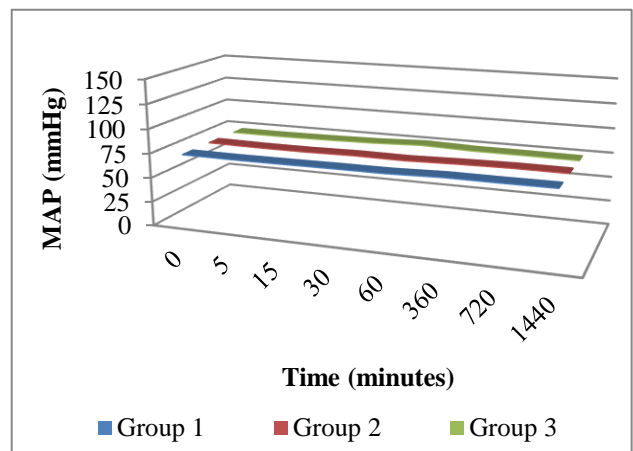
After passive elevation of leg VAS scores were nearly similar with non-significant P values between groups 1 and 2 (Table 3).

The first requirement of analgesic was significantly early in group 3 with a mean value of 1.42±0.820 hours (P value = 0.000). Total dose of analgesic used was significantly more in group 3 with a mean value of 229.29±33.478 mg as compared to other two groups with a mean value of 137.14±37.067 mg and 141.43±41.098 mg respectively (Table 4).

Heart rates in all the three groups were comparable at all times (Figure 1). There were no statistically significant differences among the three groups with respect to the mean MAP value at each time interval (Figure 2).

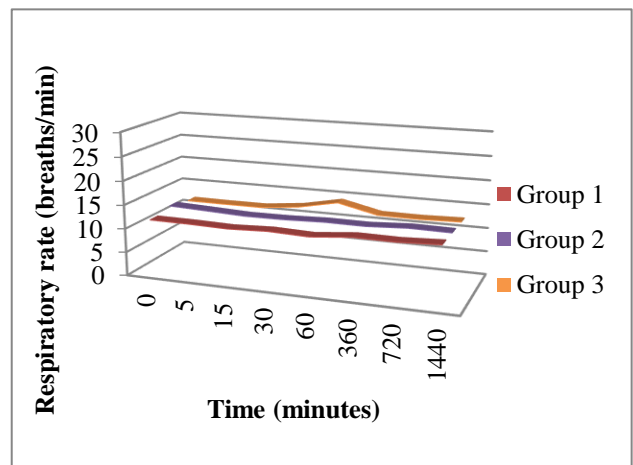


**Figure 1: Comparison of heart rates among the three groups.**



**Figure 2: Comparison of mean arterial pressure (MAP) among the groups**

In groups 1, 2, and 3 respiratory rates were also recorded at the same time intervals. There was no significant difference (Figure 3).



**Figure 3: Comparison of respiratory rates among the groups.**

## DISCUSSION

Peripheral nerve blocks not only provide excellent analgesia, they also reduce postoperative inflammatory response.<sup>11,12</sup> Various meta-analyses have been conducted on the role of different nerve blocks for postoperative analgesia in lower limb surgeries. However, most of them focussed on the femoral nerve block,<sup>13,14</sup> sciatic nerve block and continuous peripheral nerve block, and the surgical procedures studied were mainly limited to total knee arthroplasty.<sup>15,16</sup> Therefore, it is important to evaluate the effect of different peripheral nerve blocks on other surgeries like fractured femur neck surgery.

Theoretically, FICB should provide better postoperative analgesia than FNB, as it blocks lateral femoral cutaneous nerve along with femoral nerve, but several investigations have shown them to be equally effective.

Single injection technique for FICB and FNB were compared for postoperative analgesia in adolescents undergoing reconstructive knee surgery by Farid et al.<sup>10</sup> They found no significant difference in postoperative VAS scores. This is consistent with our study results, wherein we found no significant difference in pain intensity among these two blocks, but, there was a significant reduction in pain in both the groups as compared to the control group.

Continuous catheter techniques for FICB and FNB have also been compared. Möller et al, compared these two in hip replacement surgery and found them to be equally effective for postoperative analgesia.<sup>17</sup>

Yu et al, compared continuous FICB and continuous FNB for postoperative pain relief in elderly patients who underwent hip replacement under general anaesthesia.<sup>18</sup> Postoperative VAS scores were comparable in both the groups.

Thus, FICB when compared to FNB, either as a single injection technique or as a continuous catheter technique provides similar postoperative analgesia.

A Cochrane meta-analysis by Parker et al, in 2002 examined the effects of nerve blocks (inserted pre-operatively, intra-operatively or post-operatively) as part of the treatment for a hip fracture.<sup>19</sup> They concluded that nerve blocks resulted in a reduction of the quantity of parenteral or oral analgesia administered to control pain from the fracture or during surgery and a reduction in reported pain levels.

In this study, the total consumption of diclofenac was significantly lower in groups 1 (137.14±37.067mg) and 2 (141.43±41.098mg) as compared to group 3 (229.29±33.478mg). The difference was highly significant (P value = 0.000).

Foss et al, showed that FICB provided superior pain relief to 0.1mg/kg intramuscular morphine both at rest and at 15° leg lift in hip fracture patients.<sup>20</sup> In our study we also assessed the pain at passive leg elevation and reported lower VAS scores in groups 1 and 2. Pain on movement can delay early mobilization. Thus, nerve blocks in any form has definite advantage in decreasing morbidity and hospital stay as compared to systemic analgesics.

Taherzadeh et al, Marina Temelkovska-Stevanovska et al, Möller et al have shown decreased analgesic requirement in group where either FNB or FICB was used.<sup>21,22,17</sup>

Bergmann et al, studied the haemodynamic effects of peripheral nerve blocks and concluded that they provided more haemodynamic stability than general anaesthesia for ASA III patients. We too found similar results.<sup>23</sup>

In this study, the mean arterial pressures increased in the control group, but this difference was not significant. This could be because, as soon as pain increased (VAS>3), supplemental systemic analgesia was provided. As the first analgesic requirement was earlier in control group, parenteral analgesic was used only in group 3. In groups 1 and 2, first analgesic requirement came when patients were allowed orally, thus oral tablets of diclofenac were given. Additional requirement of tramadol was only in control group.

We gave USG guided blocks in order to increase accuracy and decrease complications. We have not measured the onset time of block as the patients were already under the effect of spinal anaesthesia. We could only record the duration of analgesia provided. The aim of our study was to compare the analgesic duration of these two blocks which appear to be same. Nevertheless, total requirement of oral or parenteral drug was found to be significantly decreased when compared to the control group.

Foss et al, Farid et al, Taherzadeh et al and Yu et al did not observe any side effects of the FICB or FNB technique.<sup>20,10,21,18</sup>

## CONCLUSION

From this study it can be concluded that the analgesia following the ultrasound guided FICB can be an effective alternative to femoral nerve block, because of its relative simplicity in technique and less invasiveness. Hence FICB holds considerable promise as an effective postoperative analgesia.

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