



**ORIGINAL RESEARCH PAPER**

**Anaesthesiology**

**COMPARISON OF FASCIA ILIACA COMPARTMENT BLOCK VERSUS 3-IN -1 BLOCK FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING LOWER LIMB ORTHOPAEDIC SURGERIES:A PROSPECTIVE RANDOMIZED CONTROL CLINICAL TRIAL.**

**KEY WORDS:** Fascia Iliaca Compartment Block, 3-in-1 Block

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**ABSTRACT**

**Background-** Fascia iliaca compartment block (FICB) and '3 in 1' block are effective for post operative analgesia in patients with lower limb fracture.

**Methodology-** Sixty patients of 18-65 years of age belonging to ASA Class I, II and III, of either sex posted for hip & femur shaft surgery were selected and randomly divided into two groups At the end of surgery (performed under subarachnoid block),patients of: Group '1' received Fascia iliaca compartment Block ,Group '2': received '3 in 1' Block .Both group received 35-40 ml of 0.25% bupivacaine. After wearing off spinal anaesthesia,both groups were assessed for motor and sensory blockade. Pain was assessed visual analogue scale at 30 min, 1, 2, 4, 6, 12 and 24 hours.The time to first rescue analgesic (duration of analgesia), total doses of analgesic requirement during 24 hours,patient satisfaction and any untoward side effects of block were noted.Statistical analysis was done by student's t-test and Mann-Whitney U test for Quantitative data & Chi-square test for Qualitative data.

**Conclusion:** Fascia iliaca compartment block may represent an attractive alternative to 3-in-1 block for postoperative analgesia after lower limb orthopaedic surgery.

**INTRODUCTION**

Major lower limb surgery is often painful and requires aggressive management.<sup>[2]</sup> Postoperative pain relief can be achieved by a variety of techniques including parenteral NSAIDs, neuraxial local analgesics and narcotics, epidural analgesia, peripheral nerve block, wound infiltration and patient controlled IV analgesia with opioids.<sup>[3,4]</sup> The use of lower extremity peripheral nerve blocks is a safe and effective approach to perioperative pain management.<sup>[5]</sup>

One of the most common peripheral nerve blocks to facilitate postoperative analgesia for lower limb surgery is the 3-in-1 nerve block, which uses a single injection to block the femoral, lateral femoral cutaneous and obturator nerves simultaneously.<sup>[6]</sup>

An alternative to 3-in-1 block is Fascia iliaca compartment block(FICB) captures these three major nerves with better anatomical safety profile and ease in placing the block.<sup>[6]</sup>

Our study is conducted to compare the efficacy of Fascia iliaca compartment block (FICB) and '3 in 1' block in relieving post operative pain and facilitating physiotherapy in a patient with lower limb fracture operated under spinal anaesthesia.

**METHODOLOGY**

This prospective randomized control clinical study was conducted on sixty patients of 18-65 years of age belonging to ASA Class I, II and III, of either sex posted for hip & femur shaft surgery, after approval from institutional ethical committee. They were randomly divided into two groups.

**EXCLUSION CRITERIA:**

- Patient giving negative consent
- Coagulation disorder
- Infection at the site of block,
- Past history of any drug reaction
- Neurological disease affecting lower limb,
- history of previous femoral bypass surgery
- Patient having psychiatric illness

Thorough preoperative evaluation was done and informed written consent was obtained.

In operative room ,all ASA standard monitors,ECG,NIBP,pulse oximeter attached. Intravenous line secured, preloading was done with Inj. Ringer Lactate 10 – 15 ml/kg. Spinal anaesthesia was given under all aseptic and antiseptic precaution using 25 gauge Quinke's spinal needle with 2.5-3.0 ml of Bupivacaine Heavy 0.5% at L2-L3 or L3-L4 intervertebral interspace.

**At the end of surgery patients of:**

Group '1' received Fascia iliaca compartment Block  
Group '2': received '3 in 1' Block

Patients of both group received 35-40 ml of 0.25% bupivacaine. The time at which, block performed was noted. In both groups,blocks were given by landmark technique.

Three hours after spinal anaesthesia, (after wearing off sensory and motor blockade of spinal anaesthesia).

After that sensory blockade of operated limb on the territories of femoral nerve (anterior aspect of thigh), obturator nerve (medial aspect of thigh), LFC nerve (lateral aspect of thigh) and genitofemoral nerve (skin over scarpa's triangle) was evaluated using pin prick test. Motor blockade was assessed using knee extension (femoral nerve) and thigh adduction (obturator nerve).

The results of these sensory and motor blockade were reported as either yes (complete motor and sensory blockade) or no (partial or absent motor and sensory blockade) of a given nerve territory.

The patients were also assessed for pain using 10 point visual analogue scale at 30 min, 1, 2, 4, 6, 12 and 24 hours after performing block. In the postoperative period, inj. diclofenac sodium 1.5 mg/kg IV was given as rescue analgesic when VAS $\geq$ 4.

The time to first analgesic (duration of analgesia), total doses of analgesic requirement during 24 hrs, satisfaction to postoperative analgesia (excellent, good, poor) and side effects like hematoma at injection site, intravascular injection, block failure, local anaesthetic toxicity were noted.

Statistically analysis was done by **student's t-test** and **Mann-Whitney U test** for Quantitative data & **Chi-square test** for Qualitative data.<sup>[7]</sup> with p Value < 0.05 – Significant.

**RESULTS-**

In our study demographic data and data regarding pre operative hemodynamics,type of surgery,duration of surgery was comparable.Preoperatively VAS score rest and during movement the difference between two groups was statistically not significant. (p>0.05)

Though the sensory blockade of both obturator nerve and LFC nerve was higher in patients of group 1 as compared to group 2.The blockade of obturator nerve was statistically not significant in both groups (p value>0.05 ), but blockade of LFC nerve was significantly higher in group 1 as compared to group 2. (p<0.001)

**TABLE 1: Sensory Blockade of Nerves:**

	Femoral	Obturator	LFC	Genito- femoral
<b>Group 1 (n=60)</b>	54/60 90%	50/60 83.33%	56/60 93.33%	33/60 55.0%
<b>Group 2 (n=60)</b>	56/60 93.33%	44/60 73.33%	38/60 63.33%	36/60 60.0%
<b>P-value</b>	>0.05	>0.05	<0.001	>0.05

**TABLE 2: Motor blockade of nerves:**

	Femoral	Obturator
<b>Group 1 (n=60)</b>	26/60 (43.33%)	18/60 (30.0%)
<b>Group 2 (n=60)</b>	36/60 (60.0%)	38/60 (63.33%)
<b>P-value</b>	0.795	0.584

Motor blockade of both femoral and obturator nerve was higher in patients of Group 2 in comparison to Group 1 but it was statistically not significant.(p>0.05).

**Postoperative Visual analogue scale for pain at rest and during movement:**

Postoperatively pain was assessed using visual analogue scale at 30 min, 1, 2, 4, 6, 12, 24 hours both at rest and during movement .

**TABLE 3: Mean Visual Analogue Scale (at different time interval):**

Time	At Rest		P value	During movement		P value
	Group 1	Group 2		Group 1	Group 2	
<b>30 min</b>	0	0	>0.99	0	0	>0.99
<b>1 hour</b>	0	0	>0.99	0	0	>0.99
<b>2 hour</b>	0	0	>0.99	0	0	>0.99
<b>4 hour</b>	0	0	>0.99	0	0	>0.99
<b>6 hour</b>	0	0	>0.99	0.33±0.88	0.67±0.02	0.105
<b>12 hour</b>	2±1.74	2.8±0.9	0.060	3.43±2.36	4.57±0.15	<b>0.036</b>
<b>24 hour</b>	4.47±0.50	4.57±0.15	0.531	6.67±0.66	6.57±0.22	0.518

Mean visual analogue scale 6 hours after surgery during movement was 0.33±0.88 in group 1 while in group 2 was 0.67±0.02.

Mean visual analogue scale 12 hours after surgery at rest was 2±1.71 in group 1 while 2.8±0.9 in patients of group 2 , which was statistically not significant.(p=0.06)

There was significant difference in visual analogue scale at 12 hours after surgery during movement with mean VAS of 3.43±2.36 in group 1 and mean VAS of 4.57±0.15 in group 2.(p=0.03).

There was no significant difference noted in both groups in terms of VAS at 24 hours postoperatively both at rest and during movement.(p value >0.05).

**Duration of Analgesia in Hours:**

Total duration of analgesia was 12.97±3.06 hours in fascia iliaca group compared to 11.93±3.02 hours in 3-in-1 group which was statistically not significant (p = 0.190).

**TABLE 4: Analgesic dose required in 24 hours :**

Total analgesic dose required in 24 hours	Group 1	Group 2
<b>1</b>	34 (56.7%)	28 (46.67%)
<b>2</b>	22 (36.66%)	24 (40%)
<b>3</b>	4 (6.66%)	8 (13.33%)
<b>Mean±SD</b>	1.50±0.63	1.67±0.71

In group 1, 34 (56.7%) patients and in group 2, 28 (46.67%) patients required single dose of inj. diclofenac sodium for supplemental analgesia within twenty four hours. In group 1, 22 (36.66%) patients whereas in group 2, 24 (40%) patients required two analgesic doses within twenty four hours while 4 (6.66%) patients in group 1 and 8 (13.33%) patients in group 2 required three doses of supplemental analgesics.

Mean requirement of supplemental analgesic was 1.50±0.63 in group 1 and 1.67±0.71 in group 2 which was statistically insignificant.(p=0.331)

**TABLE 15: Quality of postoperative analgesia :**

Patient's Acceptance	Group 1	Group 2
<b>excellent</b>	46 (76.67%)	28 (46.7%)
<b>good</b>	9 (15.0%)	24 (40.0%)
<b>poor</b>	5 (8.3%)	8 (13.3%)
<b>Total</b>	60 (100.0%)	60 (100.0%)

In group 1 quality of analgesia was rated as excellent by 76.67%, good by 15.0% and poor by 8.3% of the patients. In group 2 quality of analgesia was excellent in 46.7%, good in 40.0% patients and poor in 13.3%. Thus both the block provides effective analgesia postoperatively, the difference is highly significant (p<0.001)

**Side effects :**

No incidence of side effects like hematoma, accidental intra vascular injection, Block failure, local anaesthetic toxicity was seen during the study in any patients of both groups.

**DISCUSSION**

Major lower limb surgeries are associated with severe postoperative pain. Inadequate analgesia can produce unnecessary distress, suboptimal mobilization and medical complication due to immobility delaying the rehabilitation. Number of analgesic strategies has been adopted for the same<sup>36,37</sup>.

Regional anaesthetic techniques provide superior pain relief and better postoperative rehabilitation than systemic analgesia. Until relative recently, regional techniques have largely been confined to epidural or spinal approaches. However peripheral neural blockade has been shown to provide effective analgesia with potentially less morbidity than central neuraxial techniques<sup>37</sup>.

The most common approach of lumbar plexus blockade is the femoral perivascular or 3-in-1 block. However this approach does not achieve a reliable block of all three nerves of lumbar plexus (femoral nerve, obturator nerve and lateral femoral cutaneous nerve) sparing obturator nerve and LFC nerve. This sparing of LFC nerve may at least responsible for pain in incisional area after hip surgery<sup>6</sup>.

An alternative approach to 3-in-1 block is fascia iliaca compartment block. It is associated with blockade of all three nerves of lumbar plexus supplying the thigh in more than 90% of cases.

The purpose of our study was to determine which, the femoral nerve block or fascia iliaca compartment block, provides superior postoperative analgesia.

**A) Sensory and motor blockade of femoral nerve-** we observed that the sensory and motor blockade was higher in patients of Group 2, the difference between two groups was statistically not significant.

**Capdevila X. (1998)** observed sensory blockade of femoral nerve in 90% patients of Group 1 and in 88% patients of Group 2 in his study. The motor blockade of femoral nerve was present in 76% patients in Group 1 and 80% patients of Group 2.<sup>3</sup>

The sensory blockade of femoral nerve observed by them was similar to our study but they found a higher degree of motor blockade which seems to be due to use of high concentration of bupivacaine (0.5%) compared to our study as we used bupivacaine in 0.25% concentration.

**Wallace B. and their colleagues (2012)** found that sensory blockade of femoral nerve was not significantly different between groups but higher degree of motor blockade of femoral nerve was noted in 3-in-1 group (45%) compared to FICB group (22%).<sup>29</sup> similar to our study.

**B) Sensory and motor blockade of obturator nerve:**

We noted that sensory blockade of obturator nerve was present in 83.33% patients in Group 1 as compared to 73.33% patients in Group 2. Motor blockade of obturator nerve was found in 30% patients in Group 1 compared to 63.33% patients in Group 2. This difference was statistically not significant.

**Wallace B. And their colleagues (2012)** also found a comparative less consistent blockade of obturator nerve compared to femoral nerve similar to our study.<sup>29</sup>

**Ashraf and Samaa in 2012** compared the analgesic efficacy of continuous fascia iliaca block with continuous psoas compartment block after hip surgery. They noted sensory and motor blockade of obturator nerve in 89% patients in fascia iliaca group and in 88% patients, psoas compartment block.<sup>1</sup>

All of these authors found comparatively lower percentages of obturator nerve blockade than femoral nerve similar to our study, due to the fact that obturator nerve and genitofemoral nerve lies in a different muscle plane than femoral and LFC nerve and anaesthetic solution reaches these nerves with greater delay and less consistency.<sup>3</sup>

**C) Blockade of lateral femoral cutaneous nerve of thigh:**

We observed blockade of LFC nerve in 93.33% patients of group 1 as compared to 63.33% patients of group 2 with difference being highly significant. (p<0.005).

**Our result supports the finding of:**

**Dalens B et al.** In 1989 who observed blockade of LFC nerve in more than 90% patients who received fascia iliaca block compared to only in 15% patients who received 3-in-1 block with difference being statistically significant.<sup>4</sup>

**Capdevila X. (1998)<sup>3</sup> and Wallace B. and their colleagues (2012)** also noted that higher degree of LFC nerve blockade was achieved in FICB group compared to 3-in-1 group.<sup>29</sup>

**Ashraf and Samaa in 2012** noted 100% blockade of LFC nerve by using both psoas compartment block and fascia iliaca compartment block.<sup>1</sup>

**D) Blockade of genitofemoral nerve:**

We observed blockade of genitofemoral nerve in 53.33% patients of group 1 as compared to 60% patients of group 2, difference being statistically non significant.

**Capdevila X et al** also showed no significant difference in blockade of genitofemoral nerve in 3- in -1 block (group 1) and fascia iliaca compartment block (group 2).

**Postoperative VAS and Duration of analgesia and requirement of rescue analgesic:**

All patients had either no pain or mild pain up to six hours after performing block and there was no significant difference between two groups up to this time both at rest and during movement.

Adequate analgesia was present in patients of both groups up to 12 hr postoperatively at rest. Though mean VAS was more in group 2 patients the difference in VAS was statistically not significant. (p >0.05). There was significant difference in visual analogue scale 12 hours after surgery during movement with mean VAS of 3.43±2.36 in group 1 and mean VAS of 4.57±0.15 in group 2. (p <0.05). Thus fascia iliaca compartment block is more useful when early physiotherapy is started postoperatively as it improves analgesia during activity.

No significant difference in VAS was noted at 24 hours after surgery.

Total duration of analgesia was greater in fascia iliaca group than in 3 -in -1 group. However the difference between two groups was statistically not significant. (p value = 0.190).

Mean requirement of supplemental analgesic was 1.50±0.63 in group 1 and 1.67±0.71 in group 2 which was statistically not significant. (p>0.05)

More than 90% patients in both group graded their quality of postoperative analgesia as either excellent or good. No adverse effect was noted in patients of both groups.

**Capdevila X et al. 1998** found median duration of sensory blockade was 277(140-1140) min in 3-in-1 group and 322(150-1290) min in fascia iliaca group<sup>16</sup>. Thus duration of analgesia is in accordance to our study.

The shorter duration of analgesia noted by them may be because most surgical procedures performed in their patient populations were on the knee in which posterior innervations is assured by the sciatic nerve which is unaffected by anterior approach blocks.

The longer duration of analgesia in our study may be explained by the fact that we included only hip and femur shaft surgeries and used bupivacaine (0.25%) 35-40 ml for block as bupivacaine is longer acting than lignocaine.<sup>9</sup>

**B. Wallace and their colleagues (2012)** found that duration of analgesia was higher in FICB group(649±636 min) compared to 3-in-1 group (497±620 min). The total morphine equivalents required in 3-in-1 block was 20.6±16.4 mg compared with 19.9±11.3 mg in FICB group but difference was statistically not significant. Satisfaction score was similar between groups. Both groups reported a median score of 1 (complete satisfaction).<sup>29</sup> Thus the results obtained by authors regarding duration of postoperative analgesia, requirement of supplemental analgesics and patient satisfaction were similar to our study.

**Farid Is, Heiner EJ, Fleissner in 2010<sup>23</sup>** conducted a study which failed to show a difference between the femoral nerve block and the fascia iliaca nerve block in regard to VAS pain score and morphine consumption postoperatively. Thus the use of either the femoral nerve block or the fascia iliaca block, followed by patient-controlled analgesia with morphine, provides efficacious analgesia for adolescents undergoing ACL reconstruction. This is similar to our study in relation to postoperative Visual analogue scale and effectiveness of postoperative analgesia by both groups.

**Dalens B et al.** in 1989 found that in comparison to 3-in-1 block (group 1) the distribution of analgesia was significantly improved by fascia iliaca compartment block (group 2) technique, the duration of postoperative pain relief was significantly reduced ( by approximately 1 hr). The duration of postoperative analgesia was 6.2±1.4 hours in group 1 as compared to 5±1.3 hours in group 2<sup>16</sup>.

The result. was in contrast to our study as they found longer duration of analgesia in 3-in-1 block than fascia iliaca compartment block, explanation being the more extended spread of the local anaesthetic to the vicinity of highly vascularised tissues (specially the iliacus muscle) in fascia iliaca compartment blocks as compared 3-in-1 block with in the perifemoral nerve space, space with a relatively poor venous drainage. However, their sample was a paediatric population and this alone may account for dissimilarities<sup>16</sup>.

There was one limitation of our study as we were not able to compare the onset of sensory and motor blockade of nerves of lumbar plexus as blocks were given in the effect of spinal anaesthesia.

**CONCLUSION**

**From the study it was concluded that The fascia iliaca compartment block and the 3-in-1 block, both are effective methods of postoperative analgesia following hip and femur shaft surgery but Fascia iliaca compartment block provides more consistent sensory blockade of lateral femoral cutaneous nerve which innervates the skin of the incisional area of hip and femur moreover it is easy to perform, reliable and does not threaten any vital organ. As it improves analgesia during activity, it aids in early rehabilitation.**

**Thus, the fascia iliaca compartment block may represent an attractive alternative to 3-in-1 block for treatment of pain after lower limb orthopaedic surgery.**