Comparison of suprainguinal approach with infrainguinal approach of fascia iliaca compartment block for postoperative analgesia

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ABSTRACT

Background and Aims: Fascia iliaca compartment block (FICB) is increasingly being used for anaesthesia and analgesia of the hip, knee and thigh. It can be administered via two ultrasound-guided approaches, suprainguinal and infrainguinal. This study aimed to compare the analgesic efficacy of the suprainguinal approach of FICB with infrainguinal approach of FICB in patients undergoing above knee orthopaedic surgeries. Methods: In this single-centre, double-blinded randomised trial, 32 patients undergoing above knee lower limb orthopaedic surgery under spinal anaesthesia were randomised into group I (infrainguinal FICB) and S (suprainguinal FICB). They were given ultrasound-guided FICB with 30 mL 0.2% ropivacaine for postoperative analgesia using the respective approaches. Injection tramadol was administered as a rescue analgesic when Numeric Rating Scale (NRS) ≥ 4. A blinded observer recorded pain score (NRS) from the initiation of the block every 2 h for 24 h. Time to first rescue analgesia, total duration of analgesia and analgesic consumption, and patient satisfaction score were noted. Results: The mean pain scores were comparable between the two groups at all time intervals till 24 h except at 12 h and 20 h, when pain intensity was significantly less in group S than in group I. Total tramadol consumption was also significantly less in group S. There was no significant difference in time to first rescue analgesia and total duration of analgesia between the two groups. At 24 h, the patient satisfaction score was significantly better in group S. Conclusion: Suprainguinal FICB has superior analgesic efficacy over infrainguinal FICB in terms of reduced pain intensity, reduced 24-h tramadol consumption and better patient satisfaction.

Key words: Analgesia, orthopaedic procedures, pain, ropivacaine, ultrasound

INTRODUCTION

Femur fractures and arthroplasty surgeries of the hip and knee have been associated with severe postoperative pain requiring substantial narcotic administration for analgesia, leading to longer hospital stays and prolonged immobilisation. Varying intensity of pain necessitates the use of either parenteral or central neuraxial techniques like continuous epidural analgesia for postoperative pain relief for orthopaedic lower limb surgeries. Both these modalities are fraught with adverse side effects like drowsiness or motor block which may adversely affect dynamic pain relief and rehabilitation. Therefore, the need for effective postoperative pain control after lower limb surgeries has led to the use of various regional analgesic techniques.

Fascia iliaca compartment block (FICB) is one such regional block that has been widely used for perioperative analgesia in patients undergoing lower
limb fracture fixation and arthroplasty.\cite{1-3} FICB places the local anaesthetic in the plane containing the femoral nerve and lateral femoral cutaneous nerve between the fascia iliaca and the underlying iliacus muscle.

There are two techniques of FICB administration that have been described in the literature, a conventional infrainguinal approach by Dalens and a modified suprainguinal approach by Stevens.\cite{4,5}

We hypothesised that suprainguinal FICB provides better postoperative analgesia than infrainguinal FICB for lower limb orthopaedic surgeries including hip arthroplasty, femur nail and femur plating. Hence, we compared the efficacy of ultrasound-guided suprainguinal approach of FICB with that of infrainguinal approach of FICB for postoperative analgesia in patients undergoing these surgeries. The primary objective of the study was to calculate the 24-h tramadol consumption. Secondary objectives were assessment of pain (VAS) scores, duration of analgesia, patient satisfaction scores and the incidence of nausea or vomiting.

**METHODS**

After approval by the institutional ethics committee, this study was registered in the Clinical Trial Registry of India (CTRI). It was a prospective randomised double-blind controlled study that was conducted in accordance with the Helsinki II Declaration and reported as per Consolidated Standards of Reporting Trials (CONSORT) 2010 guidelines. The study was conducted in a tertiary care hospital from July 2021 to August 2021 on a total of 32 adult patients of American Society of Anesthesiologists (ASA) physical status I, II and III, undergoing knee lower limb orthopaedic surgeries under subarachnoid block.

The orthopaedic surgeries included were hip arthroplasty, femur nail and femur plating. Exclusion criteria included patient refusal, coagulopathy, allergy to local anaesthetic drugs, patients receiving combined spinal-epidural for lower limb surgeries, inability to comprehend visual analogue scale (VAS) score, diabetic neuropathy and other neurological deficits in the lower limb. All patients were randomised into group S or group I using computer-generated random numbers. Group S comprised 16 patients who received local anaesthetic solution of 30 mL of 0.2% ropivacaine using ultrasound-guided suprainguinal approach and Group I comprised 16 patients who received local anaesthetic solution of 30 mL of 0.2% ropivacaine using ultrasound-guided infrainguinal approach. The group allocation envelope was opened by an anaesthesiologist who was not involved with the direct clinical care of the patient. A blinded observer assessed the postoperative pain scores and 24-hour opioid consumption. These codes were decoded at the end of the study period.

A routine thorough pre-anesthetic checkup was conducted and it included taking a detailed history, looking for comorbidities, allergy to any drug being used and doing a general physical and systemic examination. The patients were explained about the study being conducted, and written informed consent was taken. The patients were also educated on the use of Numeric Rating Scale (NRS).

All the patients in both groups received primary anaesthesia technique of subarachnoid block with 2.5 mL hyperbaric 0.5% bupivacaine with 0.5 mL of 25 µg fentanyl in the sitting position under all aseptic conditions. The adequacy of the spinal block was checked by sensory and motor (modified Bromage score) examination. Then, the patients of both groups were placed in the supine position and were given ultrasound-guided FICB block by different approaches according to their allocated groups. Group S patients received FICB using ultrasound-guided suprainguinal approach with a high frequency (6–14 Mhz) linear probe in the supine position. Initially, the anterior superior iliac spine (ASIS) was palpated. The transducer was placed in the inguinal crease to identify the femoral artery in the short axis. From the femoral artery, the transducer was translated laterally to identify the sartorius muscle. The sartorius was traced cephalad to its insertion on the ASIS. Using this technique, the hypoechoic shadow of the ASIS was easily identifiable just cephalad to the insertion of the sartorius. The iliacus muscle lay medial to the shadow of the ASIS. With the ASIS and iliacus identified, the medial end of the transducer was rotated to the point at the umbilicus, which was the final transducer position. With the transducer in the final position, sonographic anatomy was identified, from superficial to deep, consisting of subcutaneous fat, the internal oblique muscle, the transversus abdominus muscle, the fascia iliaca overlying the iliacus muscle, and the iliacus muscle itself. A 21-gauge, 100-mm block needle (Stimuplex; B. Braun, Bethlehem, PA) was advanced in an in-plane fashion to puncture the fascia iliaca. With the needle tip just below the fascia iliaca, 2 mL of a local anaesthetic was injected to confirm the
tip location. Once the proper position was confirmed, 30 mL of 0.2% ropivacaine was incrementally injected superficial to the iliacus muscle and deep to the fascia iliaca. After completion of the injection, the transducer was translated medially toward the femoral nerve, where caudomedial spreading of the local anaesthetic was easily identified.

For infrainguinal approach, in the supine position as before, a high frequency (6–14 Mhz) linear probe was placed transversely to identify the femoral artery at the inguinal crease. The iliopsoas muscle with the overlying fascia iliaca was identified, and the hyperechoic femoral nerve was typically seen lying between the iliopsoas and fascia iliaca at a depth of 2–4 cm, lateral to the femoral artery. The probe was tilted cranially and caudally until optimal images of the femoral nerve and fascia iliaca were obtained. The triangular-shaped sartorius muscle and the ASIS were identified on moving the probe laterally. After skin disinfection and local anaesthetic infiltration, a 100 mm blunt-ended needle was inserted using an in-plane technique with the aim of placing the needle tip beneath the fascia iliaca around the lateral third of a line between the ASIS and pubic tubercle. Once the proper position was confirmed, 30 mL of 0.2% ropivacaine was incrementally injected. Correct needle placement was confirmed by separation of the fascia iliaca from the iliopsoas muscle with local anaesthetic spreading towards the femoral nerve medially and iliac crest laterally.

All patients received 1 gm paracetamol intravenously 8 hourly postoperatively. Intravenous tramadol 50 mg was used as for rescue analgesia when NRS score ≥4 to a maximum of 150 mg within 24 h. Both the patient and the observer in the post-anaesthesia care unit were blinded to the nature of the FICB approach being used. Primary outcomes were defined in terms of total 24-hour tramadol consumption (mg). Secondary outcomes were, i. Pain scores assessed using the NRS, postoperatively every 2 hours till 24 hours (time zero: time of administration of block), ii. Duration of analgesia, defined as the time from administration of block to the time of the first requirement of rescue analgesic (NRS ≥4), iii. Incidence of post-operative nausea and vomiting; iv: Patient satisfaction score, measured by asking the patient to rate their satisfaction on a 5-point Likert scale 24 h after surgery in the post anaesthesia care unit (PACU).

The sample size estimation was based on the overall 24-hour tramadol consumption in a previous study[21] and assuming a 30% reduction of tramadol use to be of significance, the necessary sample size for 95% confidence level and 80% power was calculated to be 16 in each group.

Data were described in terms of range, mean ± standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was done using the Student t-test and Mann–Whitney U test for independent samples for parametric and non-parametric data, respectively. For comparing categorical data, Chi-square ($\chi^2$) test was performed, and Fisher's exact test was used when the expected frequency was less than 5. A probability value ($P$ value) less than 0.05 was considered statistically significant.

**RESULTS**

Thirty-two patients were enroled in the study, all of whom met the inclusion criteria and were included for study data analysis. All patients had successful subarachnoid block and ultrasound-guided FICB [Figure 1].
The demographic profile of patients in both the groups was comparable with regards to age and gender and also ASA status [Table 1].

Pain intensity was measured by NRS score every 2 h for up to 24 hours postoperatively and was found to be significantly less at 12 h (1.13 ± 0.9 versus 2.13 ± 1.1) and 20 h (0.94 ± 0.93 versus 2.31 ± 2.47) post block in group S as compared to group I (P = 0.010; 0.046) [Table 2]. At other time intervals up to 24 hours, pain intensity was less, and NRS scores were comparable in the two groups (P > 0.05) [Table 2 and Figure 2].

The total amount of rescue analgesia required in the postoperative period was significantly lower in group S as compared to group I (34.38 mg versus 68.75 mg, P < 0.028) [Table 3]. Time to first analgesic demand was comparable in both groups (P > 0.05). Also, the total duration of analgesia was comparable in the two groups (P > 0.05) [Table 3]. Patient satisfaction scores were significantly better in group S when compared to group I (P = 0.026) [Table 4].

Postoperative nausea and vomiting (PONV) was also comparable in both groups with no significant difference (P > 0.05) [Table 3]. Haemodynamic parameters were stable and comparable in the two groups.

**DISCUSSION**

FICB is increasingly being used for postoperative analgesia in orthopaedic surgeries such as hip arthroplasty and even for anterolateral thigh surgeries in children. We observed a significant reduction in the amount of total tramadol consumption over 24 hours in group S as compared to group I (P = 0.028). Also, the reduction in tramadol consumption was by 77.1% (+34.16) in Group S as compared to 54.2% (+20.0) in group I, which was statistically significant (P = 0.028). This is substantiated by the findings of Kumar et al. who also found a significant reduction in overall morphine consumption.

![Figure 2: Trend in postoperative pain scores in groups I and S. (NRS: Numerical Rating scale)](image-url)

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**Table 1: Demographic profile**

| GROUP | Chi-square value | P |
|-------|-----------------|---|
| Age (years) | 56±22.6 | 55.63±21.9 | 0.048 | 0.962 |
| Gender | | | | |
| F | 44% | 38% | 0.130 | 0.719 |
| M | 56% | 63% | | |
| ASA Grade | | | | |
| I | 13% | 13% | 0.164 | 0.921 |
| II | 31% | 25% | | |
| III | 56% | 63% | | |

F: Female; M: Male; ASA: American Society of Anesthesiologists

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**Table 2: Postoperative pain score in Group I and Group S**

| Time of NRS evaluation (hour; h) | NRS | P |
|---------------------------------|-----|---|
| | Mean | SD | Mean | SD |
| 2 | 0.13 | 0.50 | 0.38 | 0.81 | 0.300 |
| 4 | 1.13 | 1.20 | 0.94 | 1.29 | 0.674 |
| 6 | 2.31 | 1.74 | 1.88 | 1.54 | 0.458 |
| 8 | 2.56 | 2.16 | 1.88 | 0.96 | 0.253 |
| 10 | 1.69 | 1.92 | 2.19 | 2.17 | 0.495 |
| 12 | 2.13 | 1.09 | 1.13 | 0.96 | 0.010 |
| 14 | 1.13 | 1.09 | 1.81 | 0.91 | 0.062 |
| 16 | 1.56 | 1.71 | 1.06 | 0.85 | 0.304 |
| 18 | 1.63 | 1.36 | 1.00 | 0.89 | 0.135 |
| 20 | 2.31 | 2.47 | 0.94 | 0.93 | 0.046 |
| 22 | 1.44 | 1.03 | 0.88 | 0.96 | 0.120 |
| 24 | 1.50 | 1.15 | 0.88 | 0.89 | 0.096 |

NRS: Numerical Rating Scale; SD: Standard Deviation

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**Table 3: Analgesic requirement and incidence of post-operative nausea and vomiting (PONV)**

| Parameters | Group I (n=16) | Group S (n=16) | P |
|-----------|--------------|--------------|---|
| Time of first rescue analgesia (in h) | 5.63±3.9 | 4.63±4.0 | 0.484 |
| Total amount of rescue analgesia (mg) | 68.75±51.2 | 34.38±30.1 | 0.028 |
| Total duration of analgesia (hours) | 17.06±20.7 | 13.63±8.4 | 0.545 |
| PONV | | | |
| 0 | 75% | 75% | 1.000 |
| 1 | 25% | 25% | | |

Continuous data described as Median±SD. Values are expressed Mean±SD. SD: Standard deviation

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**Table 4: Patient satisfaction scores in Group I and Group S**

| Patient satisfaction score | Group | Chi-square value | P |
|---------------------------|-------|-----------------|---|
| I | S | | | |
| Very dissatisfied | 0 | 0% | 0% | |
| Dissatisfied | 0 | 0% | 1% | 9.273 | 0.026 |
| Neither satisfied nor dissatisfied | 38% | 0% | 0% | |
| Satisfied | 7 | 44% | 7 | 48% | |
| Very Satisfied | 3 | 19% | 8 | 50% | |

Indian Journal of Anaesthesia | Volume 66 | Supplement 6 | October 2022
with suprainguinal approach compared to the infringual. Also, they observed that there is 34% more morphine sparing effect of modified FICB over conventional infringual FICB, whereas Stevens et al.\[^4\] concluded that suprainguinal FICB had 40% lower morphine consumption compared to sham block. A higher reduction in analgesic consumption in our study could be because of the use of ultrasound for administering the block which has a higher success rate and allows precise deposition of local anaesthetic in the correct fascial planes leading to better analgesic block.

On evaluation, the total duration of analgesia was comparable in group I (17.06 + 20.7 hours) and group S (13.63 + 8.4 hours) (\(P > 0.05\)). We did not find any study comparing the total duration of analgesia of the two approaches. Time to need for first rescue analgesia was also comparable in both the groups in our research (\(P > 0.05\)), whereas we found no studies evaluating the same.

In our study, pain intensity as measured by NRS scores was significantly lower in suprainguinal FICB at 12 and 20 hours post-operatively as compared to infringual FICB, whereas NRS scores at other time points up to 24 hours were comparable in both the groups. Our findings corroborate with that of Kumar et al.\[^3\] who in a similar study using landmark technique, found significantly reduced pain at 6 hours postoperatively in the suprainguinal group as compared to infringual (VAS scores assessed at 3, 6, 12 and 24 hours). Early significant reduction in pain score in their study can be attributed to the larger volume of local anaesthetic used (40 mL) as compared to that in our study (30 mL). The efficacy of the conventional (infringual) FICB has been controversial in few previous studies as well.\[^7,8\] In a study done by Shariat et al.\[^6\] comparing infringual FICB with sham block, medial to lateral spread of local anaesthetics was ascertained instead of cephalad spread with infringual approach. Also, the study concluded that infringual FICB conferred no significant benefit over sham block.

Our findings corroborate with Stevens\[^4\] hypothesis according to which in suprainguinal FICB, cephalic spread of the local anaesthetic is more. Hence, there is better blockage of the lumbar plexus as compared to that with infringual FICB, aiding in a better analgesic effect. Hebbard et al.\[^9\] in his cadaveric study and Vermeyln\[^10\] in his volunteer study also demonstrated higher cephalad and more consistent spread of local anaesthetics by depositing the same volume above the inguinal ligament.

On a five-point Likert scale, the patient satisfaction scores were seen to be significantly better with suprainguinal FICB, with 50% of the patients being very satisfied in group S (c.f. 19% in group I). There are no studies in the literature commenting on the comparative patient satisfaction scores with the two approaches of FICB. Postoperative nausea and vomiting was either absent or of mild grade in both groups, which can be attributed to the opioid-sparing effect of FICB.

We found limited studies evaluating the comparative analgesic efficacy of two techniques of FICB. Our study was a prospective study that used real-time ultrasound guidance for greater accuracy of block administration.

The present study is limited by the fact that the anaesthesiologist performing the block could not be blinded. This flaw was overcome by blinding the assessor who was recording the NRS scores and tramadol consumption in the postoperative care unit. Another limitation is that our observation time was till 24 hours (since pain intensity is maximum in the first 24 hours after surgery); better analgesic efficacy of the block would have been validated if the study period could have been extended to 48–72 hours. Also, the sample size in our study was relatively small, so our findings cannot be extrapolated to a larger population.

**CONCLUSION**

We conclude that suprainguinal FICB has superior analgesic efficacy compared to infringual FICB for postoperative analgesia in patients undergoing hip arthroplasty, femur nailing or plating in terms of significantly less tramadol consumption in the first 24 hours postoperatively, reduction in NRS scores up to 20 hours and better patient satisfaction scores. However, further studies with more sample sizes are needed to validate this point.

**Financial support and sponsorship**
Nil.

**Conflicts of interest**
There are no conflicts of interest.
REFERENCES

1. Jadon A, Mohsin K, Sahoo RK, Chakraborty S, Sinha N, Bakshi A. Comparison of supra-inguinal fascia iliaca versus pericapsular nerve block for ease of positioning during spinal anaesthesia: A randomised double-blinded trial. Indian J Anaesth 2021;65:572-8.

2. Seunguk B, Jihyun C, Jaejung J, Hahyeon B, Dongju K. Efficacy of ultrasound-guided fascia iliaca compartment block after hip hemiarthroplasty. Medicine 2016;95:e5018.

3. Kumar K, Pandey RK, Bhalla AP, Kashyap L, Garg R, Darlong V, et al. Comparison of conventional infrainguinal versus modified proximal suprainguinal approach of Fascia Iliaca Compartment Block for postoperative analgesia in Total Hip Arthroplasty. A prospective randomized study. Acta Anaesthesiol Belg 2015;66:95-100.

4. Stevens M, Harrison G, McGrail M. A modified fascia iliaca compartment block has significant morphine-sparing effects. Anaesth Intensive Care 2007;35:949-52.

5. Desmet M, Balocco AL, Van Belleghem V. Fascia iliaca compartment blocks: Different techniques and review of the literature. Best Pract Res Clin Anaesthesiol 2019;33:57-66.

6. Ponde VC, Gursale AA, Chavan DN, Jothari AN, Osazuwa MO, Nagdev T. Fascia iliaca compartment block: How far does the local anaesthetic spread and is it a real time continuous technique feasible in children? Indian J Anaesth 2019;63:932-7.

7. Goitia Arrola L, Telletxea S, Martínez Bourio R, Arizaga Maguregui A, Aguirre Larracochea U. Fascia iliaca compartment block for analgesia following total hip replacement surgery. Rev Esp Anestesiol Reanim 2009;56:343-8.

8. Shariat AN, Hadzic A, Xu D, Shastri U, Kwofie K, Gandhi K, et al. Fascia iliaca block for analgesia after hip arthroplasty: A randomized double-blind, placebo-controlled trial. Reg Anesth Pain Med 2013;38:201-5.

9. Hebbard P, Ivanusic J, Sha S. Ultrasound-guided supra-inguinal fascia iliaca block: A cadaveric evaluation of a novel approach. Anaesthesia 2011;66:300-5.

10. Vermeylen K, Desmet M, Leunen I, Soetens F, Neyrinck A, Carens D, et al. Supra-inguinal injection for fascia iliaca compartment block results in more consistent spread towards the lumbar plexus than an infra-inguinal injection: a volunteer study. Reg Anesth Pain Med 2019;44:483-491.