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Original research article

Ultrasound guided suprainguinal fascia iliaca block in acetabular fracture surgery: A randomized controlled pilot study

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Abstract

Ultrasound-guided suprainguinal fascia iliaca block has been used with good result, particularly in hip surgeries, as this block also covers the area of incision usually provided by femoral nerve and LFCN. A sample size of 20 was taken, taking into consideration the low incidence of acetabular fractures and that it was a pilot study. The study was single blinded. The anesthetist performing neuraxial block was blinded to obtain unbiased quality of positioning score. The mean Comfort VAS scores of Group F and Group B was 5.3±2.4 and 7.1±1.2 respectively. Group F had lower mean comfort score (-1.8) in comparison to Group B, but the difference was not statistically significant (t=-2.08, df=18, $p>0.05$). Positioning for neuraxial was successful in all patients in group B. Positioning failed in 1 patient in group F inspite of 2 boluses of rescue analgesia.

Keywords: Ultrasound guided suprainguinal fascia iliaca block, acetabular fracture surgery, VAS scores

Introduction

Intravenous opioids are the most commonly used analgesic modality for pain management following trauma or fractures. However, inadequate analgesia and side effects like nausea, vomiting, urinary retention, pruritus, ileus, and respiratory depression have prompted the quest for better analgesic modalities. Regional anesthesia has proven to be a better alternative that provides superior analgesia with fewer serious side effects. Although studies on analgesic modalities and regional techniques in acetabular fractures are scarce, several techniques such as femoral nerve block, lumbar plexus block, fascia iliaca block, and 3 in 1 block have been used in clinical practice to provide regional blocks to the lower limb and hip with varying rates of success [1].

The acetabulum and the hip joint has rich sensory innervation from the femoral nerve, obturator nerve, and sciatic nerve. Fractures of the acetabulum are therefore highly painful and good analgesia requires blockade of multiple nerves arising from the lumbar and sacral plexus.

The Fascia iliaca block is a fascial plane block where local anesthetic is deposited below the fascia iliaca. As the nerves of the lumbar plexus are also located under the fascia iliaca- primarily the femoral nerve, the lateral femoral cutaneous nerve and the obturator nerve, a sufficiently large volume of local anesthetic can theoretically block these nerves. This technique is therefore considered to be an anterior approach to lumbar plexus block and thus widely used in hip surgeries. Fascia iliaca block using landmark guided technique has long been used in hip surgeries. However, the success rate by this technique is often low (35 - 47%). The use of ultrasound has been shown to further improve its success

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to 82 – 87%. The original fascia iliaca block was an infrainguinal approach. However with this approach, there is unreliable block of the obturator nerve, with block occurring in only 44% of patients, even with the use of an ultrasound guided approach. Thereafter in 2011, a suprainguinal approach was described, wherein local anesthetic solution was deposited cranial to the inguinal ligament and thus would have better spread under the fascia iliaca and would produce a more reliable block of the lateral femoral cutaneous nerve (LFCN) and the obturator nerve. This is because theses nerves lie close to the femoral nerve above the inguinal ligament but below the ligament, they have an inconsistent course and shows variable branching and therefore may not be blocked by the conventional infrainguinal fascia iliaca block. A suprainguinal approach using up to 40 ml of local anesthetic has been shown to produce reliable blockade of femoral nerve, obturator nerve and LFCN [2, 3].

Ultrasound-guided suprainguinal fascia iliaca block has been used with good result, particularly in hip surgeries, as this block also covers the area of incision usually provide by femoral nerve and LFCN.

Unlike hip surgeries, there is a paucity of studies on pain management in acetabular fracture surgeries. These surgeries may be carried out under general anesthesia, regional anesthesia or combined techniques. When possible, we use a neuraxial technique like a combined spinal and epidural, thereby avoiding risks of general anesthesia and providing excellent analgesia in the intraoperative and postoperative period. Studies have shown that regional anesthesia is associated with reduced early mortality and incidence of deep venous thrombosis as compared to general anesthesia in hip surgeries. Regional anesthesia techniques have also been shown to decrease intraoperative blood loss [4].

Fractures of the acetabulum are highly painful. Thus, although neuraxial blocks are often preferred in these patients, pain makes it difficult to position these patients for the same. This is a common problem encountered in hip and femur fractures as well. Traditionally, intravenous opioids have been used in such patients to provide analgesia during positioning for neuraxial anesthesia. However, the analgesia provided by opioids is often inadequate and associated with numerous side effects. Hence, there is a need for better analgesic techniques in these patients. Regional anesthesia techniques like fascia iliaca block and femoral nerve blocks have been used successfully to facilitate positioning for neuraxial blocks in patients with hip and femur fractures. We hypothesized that a regional anesthetic technique like suprainguinal fascia iliaca block will provide good analgesia and enable positioning of patients with acetabular fractures for neuraxial blockade [5, 6].

As these fractures are not very common, and previous similar studies in acetabular fracture were not found, we conducted a pilot study to compare the analgesic efficacy of preoperative ultrasound guided suprainguinal fascia iliaca block to intravenous fentanyl in positioning acetabular fracture patients for neuraxial blockade.

Methodology

Study Design

Randomized Controlled Pilot Study

Sample size

A sample size of 20 was taken, taking into consideration the low incidence of acetabular fractures and that it was a pilot study.

Inclusion Criteria

Patients above the age of 18, posted for elective surgical repair of the following acetabular fractures:

a. Anterior column fractures
b. Anterior column - posterior hemi-transverse fractures
c. Associated both column fractures

Above patients undergoing surgery by following approaches of acetabular fracture repair:

a. Iliofemoral approach
b. Ilioinguinal approach
c. Stoppas approach

Exclusion Criteria

1. Patient refusal
2. Any contraindication to neuraxial block like coagulopathy, local infection, increase ICP etc.
3. Known allergy to local anaesthetic drugs.
4. Peripheral neuropathy
5. Hemodynamically unstable polytrauma patients.
6. Patients who were ASA 4 and above.

Assignment of intervention

The patients were assigned to the two groups using computer generated randomization.

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Blinding

The study was single blinded. The anesthetist performing neuraxial block was blinded to obtain unbiased quality of positioning score

Results

Efficacy of positioning using Suprainguinal fascia iliaca block (Group B) and intravenous fentanyl (Group F) was compared using Sitting angle (SA) achieved following intervention, change of VAS scores and positioning score.

Sitting Angle

The baseline mean SA of Group F and Group B was 60.5±22.5 degrees and 54.7±18.1 degrees respectively. The mean SA of Group F and Group B postintervention was 75.8±18.7 degrees and 87.1±4.0 degrees respectively.

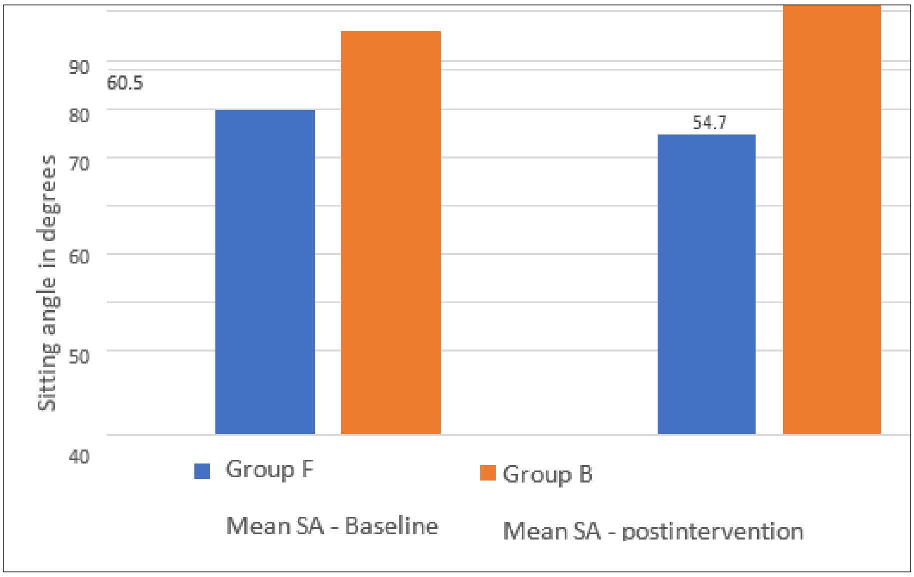

Fig 1: Sitting Angles (SA) at Baseline and Post Intervention

Baseline: There was no statistically significant difference in the baseline sitting angle between the groups (t=0.63, df=18, *p*>0.05).

Post-intervention: Group F had lower mean SA (-11.3) in comparison to Group B, however the difference was not statistically significant (t=-1.86, df=18, *p*>0.05).

Improvement in SA: Measured as difference in SA achieved post-intervention and baseline. The median improvement in SA in group B was 27.5 (20.75-36.5), while that in group F was 10 (5-18.75). Thus, Group B had better improvement in SA in comparison to group F (+17.5) and the difference was statistically significant (Mann- Whitney U=85, d p=0.006)

Table 1: Baseline and Postintervention Sitting Angle (mean):

Sitting Angle (degrees)	Group F (n=10)	Group B (n=10)	P value
Baseline	60.5±22.5	54.7±18.1	0.53
Postintervention	75.8±18.7	87.1±4.0	0.07

Table 2: Improvement in Sitting Angle after intervention:

Group	Median (IQR) SA improvement (post-intervention SA - baseline SA) (degrees)	P value
Group B (n=10)	27.5 (20.75-36.5)	0.006*
Group F (n=10)	10 (5-18.75)	

* denotes statistical significance

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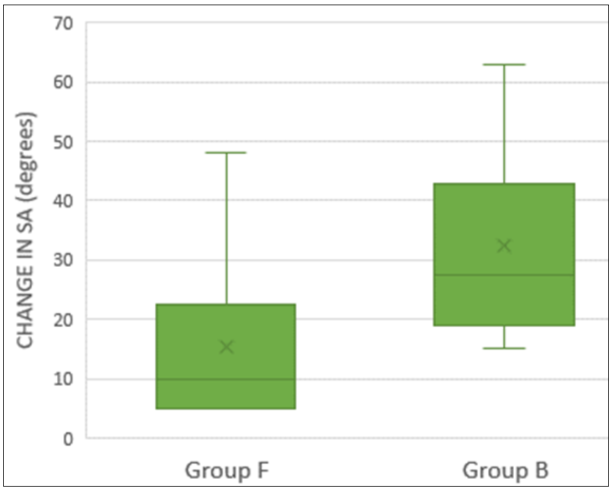

Fig 2: Comparison of Improvement in SA in the two groups

VAS Scores

Baseline VAS scores and VAS scores after intervention (5 minutes after intravenous fentanyl in group F and 30 mins after block in group B) were measured both in the supine and sitting position.

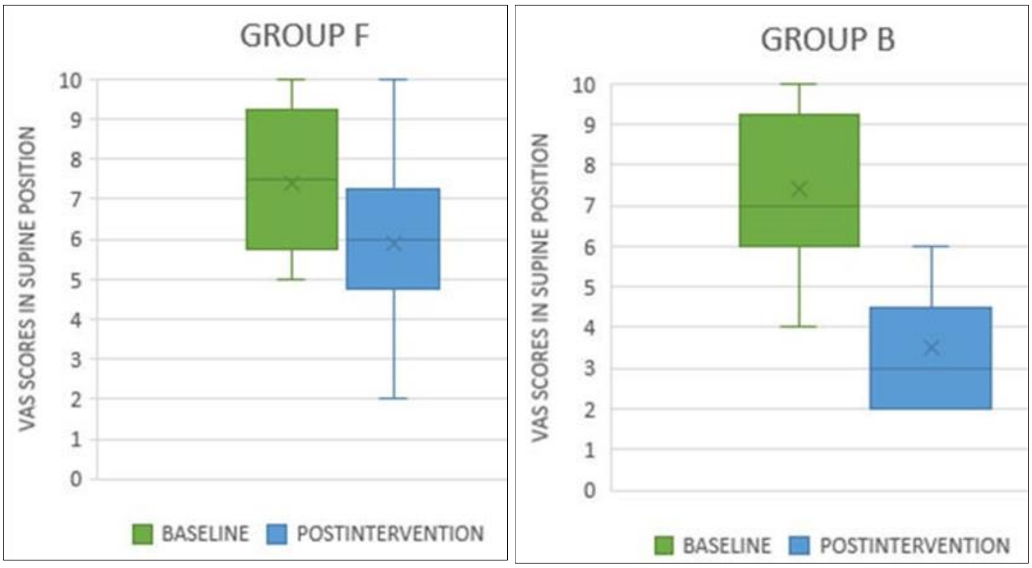

Fig 3: Comparison of VAS Scores in Supine Position before and after Intervention

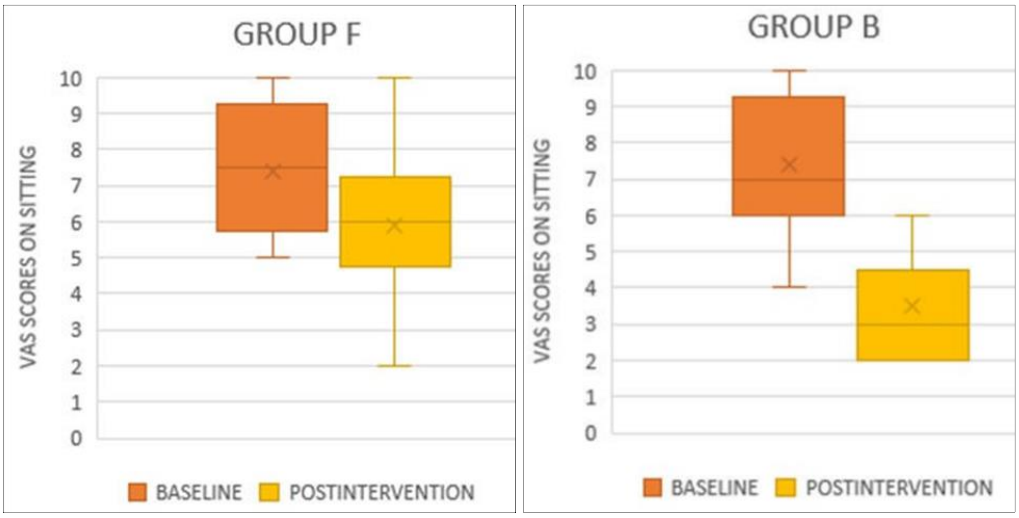

Fig 4: Comparison of VAS Scores in Sitting Position before and after Intervention

Baseline supine: The baseline mean VAS scores of Group F and Group B in supine position was 4.6±2.8

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and 4.1±2.6 respectively. Group F had higher mean VAS scores (0.5) in comparison to Group B in supine position but the difference was not statistically significant (t=0.405, df=18, *p*>0.05).

Baseline sitting: The baseline mean VAS scores of Group F and Group B in sitting position was 7.4±1.8 and 7.4±2.1 respectively. There was no statistically significant difference between the groups in sitting position (t=0.00, df=18, *p*>0.05).

Postintervention supine: The median (IQR) VAS scores of Group F and Group B in supine position after the Intervention was 2.5(0.75-5.25) and 1.5(1.5-2.25) respectively. Group F had higher median VAS scores (+1.0) in comparison to Group B in supine position, however the difference was not statistically significant (Mann- Whitney U=34.5, df=18, *p*>0.05).

Postintervention sitting: The mean VAS scores of Group F and Group B in sitting position after the intervention was 5.9±2.1 and 3.5±1.5 respectively. Group F had higher mean VAS scores (2.4) in comparison to Group B in sitting position and the difference was statistically significant (t=2.85, df=18, *p*<0.05).

Table 3: Baseline and Postintervention VAS scores in supine and sitting position:

VAS Score		GROUP F (n=10)	GROUP B (n=10)	P value
Baseline	Supine^	4.6±2.8	4.1±2.6	0.69
	Sitting^	7.4±1.8	7.4±2.1	1.0
Post intervention	Supine#	2.5 (0.75-5.25)	1.5 (1.5-2.25)	0.24
	Sitting^	5.9±2.1	3.5±1.5	0.01*

^ Mean±SD, # Median (Interquartile range), *denotes statistical significance

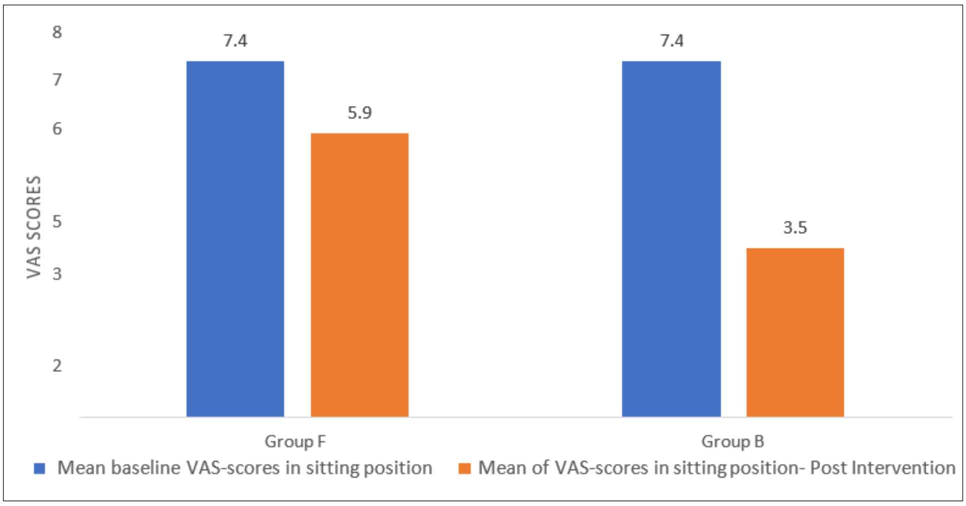

Fig 5: Study participants profile on VAS scores in sitting position at baseline and post intervention

Patient Positioning

Quality of positioning was assessed using positioning score obtained from the anesthesiologist performing the neuraxial procedure. There was statistically significant difference in positioning scores between the two groups, with 70% patients in group B achieving optimal position in group B compared to 10% in group

F. 20% had unsatisfactory positioning (P score- 0) in group F (p=0.02)

Table 4: Study of association between positioning of the study participants and the type of groups:

Group	Positioning score (P Score)				P value^
	0 (not satisfactory)	1 (satisfactory)	2 (good)	3 (optimal)	
Group F	2(20%)	5(50%)	2(20%)	1(10%)	0.02*
Group B	0	1(10%)	2(20%)	7(70%)	

^Fisher exact test, *denotes statistical significance

Success Rate

Positioning for neuraxial was successful in all patients in group B. Positioning failed in 1 patient in group F inspite of 2 boluses of rescue analgesia.

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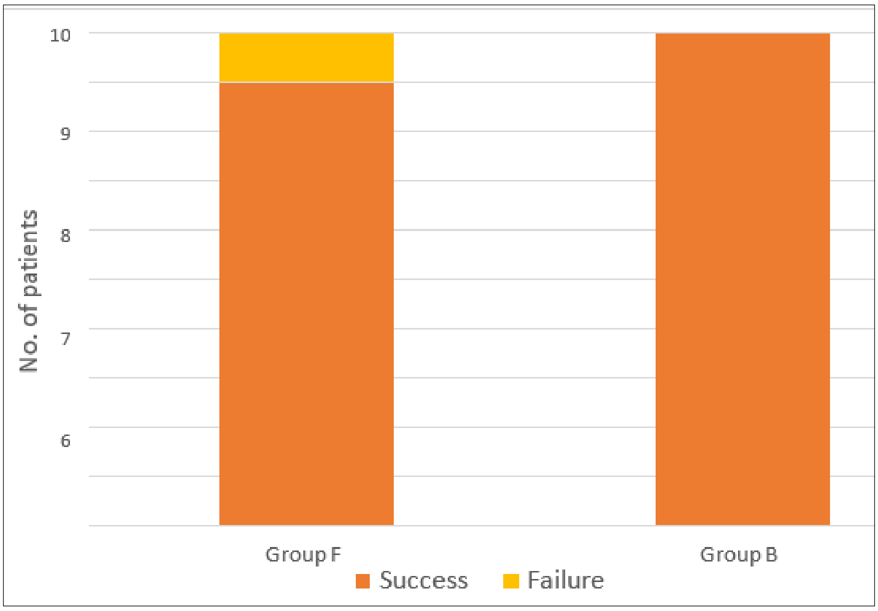

Fig 6: Comparison of Success Rate of Positioning in The Study Groups

Comfort VAS Scores

The mean Comfort VAS scores of Group F and Group B was 5.3±2.4 and 7.1±1.2 respectively. Group F had lower mean comfort score (-1.8) in comparison to Group B, but the difference was not statistically significant (t=-2.08, df=18, *p*>0.05).

Table 5: Comparison of Comfort VAS scores of the study groups

Group	Mean Comfort VAS scores	P value
Group F (n=10)	5.3±2.4	0.051
Group B (n=10)	7.1±1.2	

Discussion

Previous studies assessing efficacy of analgesic modalities for facilitating positioning of patients for neuraxial anesthesia have shown that nerve blocks like fascia iliaca block and femoral nerve block are superior to intravenous opioids. The opioid of choice in most studies including ours was fentanyl in view of its potency, fast onset and shorter duration of action [7].

The baseline VAS scores measured before intervention in supine and sitting positions were comparable in the two groups. The post intervention VAS scores in the supine position was lower in group B compared to group F, with a median difference of 1, but this was not statistically significant. On the other hand, postintervention VAS scores in the sitting position were significantly reduced in group B as compared to group F, with a mean difference in VAS of 2.4 between the two groups [p= 0.01]. Thus, while fentanyl could provide adequate analgesia at rest (supine median VAS score- 2.5), analgesia on movement was poor (mean sitting VAS score- 5.9). This is in contrast to patients who received suprainguinal fascia iliaca block who had significantly lower VAS scores, particularly on movement (sitting). It is known that pain associated with fractures is often excruciating. This is further worsened by movement as the fractured ends of the bone rub against each other. Often, pain also causes localized muscle spasms and restricts mobility. We surmise that the suprainguinal fascia iliaca block, by blocking three of the major sensory nerves to the acetabulum provided superior analgesia than fentanyl, particularly during movement as reflected by the VAS scores on sitting [8].

Many studies have used good VAS scores, better quality of positioning and patient satisfaction scores as indicators of better positioning. In our study, in addition to measuring these parameters, we also measured sitting angles to get a more direct and objective measure of how much each intervention would enable positioning. Rajashree *et al* in their study comparing FICB versus intravenous fentanyl for positioning in femur fractures had similarly compared sitting angles. They found that the group which had received FICB had better improvement in sitting angles [56.17±16.54 versus 21.38±23.90 in fentanyl group (p= 0.01)] [9]. Our study showed a similar, statistically significant improvement in sitting angles in patients in group B as compared to group F. In addition, the mean sitting angle post intervention was better in group B, 87.1±4 degrees versus 75.8±18.7 degrees in group F, but this was not statistically significant. We presume that the significantly better analgesia provided by the suprainguinal fascia iliaca block is reason for the better improvement in sitting angles obtained in patients of group B.

In terms of quality of patient, we found a statistically significant difference in between the two groups, with 70% of patients in group B attaining optimal position (score=3) as compared to only 10% in in group F. Further, 20% patients had unsatisfactory positioning (score=0) in group F as compared to none in group B [p= 0.02]. This score was influenced by factors such as ease and swiftness of positioning, help needed from OT staff to obtain and maintain a good sitting position, interruption or movement during neuraxial blockade, need for rescue analgesia to maintain sitting position- all of which could serve as indirect indicators of adequacy of analgesia. Thus, a better quality of patient positioning in group B is suggestive of the superior analgesia obtained in these patients. In line with these findings, requirement of rescue analgesia was also lesser in group B with only one patient requiring rescue analgesia in the form of i.v fentanyl 0.5ug/kg once, as compared to 4 patients in group F, two of whom required rescue boluses twice. However, this was not found to be statistically significant. It is also important to note that while all patients in group B were successfully positioned for neuraxial block, positioning failed in one patient in group F inspite of receiving two doses of rescue analgesia.

The results of our study are comparable to previous studies using FICB for positioning patients with hip or femur fractures for neuraxial block. Rajashree *et al* and Yun *et al* used FICB and compared its efficacy to intravenous fentanyl and alfentanil respectively in femur fractures. Like our study, both these studies showed lower VAS scores, better sitting angles and better quality of positioning in the FICB group. In these studies, time required to perform spinal anesthesia was also recorded and found to be significantly lower in the FICB group. We did not record time to performance of neuraxial block in our study.

In our study, we assessed postoperative patient comfort scores as inverted VAS scores with a score of 0 representing ‘no comfort’ and a score of 10 representing ‘most comfort’. Patients in group B reported higher comfort scores than group F (7.1±1.2 versus 5.3±2.4), although this was not found to be statistically significant (p value= 0.051).This score served not only as an indicator of adequacy of analgesia but also the discomfort faced during the procedure and how satisfied the patient was with the procedure. Diakomi *et al* used patient satisfaction rates recorded on the second postoperative day as whether or not they would choose the same anesthetic handling again. They reported that 75% of patients who received i.v fentanyl would not prefer the same anesthetic handling, whereas all patients in group FICB patients stated that they would (p<0.001) [10]. Similarly, Yun *et al* also recorded better patient acceptance in the group which received FICB as compared to those who received alfentanil for positioning.

Conclusion

Thus, we conclude that an ultrasound guided suprainguinal fascia iliaca block is a safe and effective analgesic modality in patients with acetabular fractures. It is also a better analgesic modality than intravenous fentanyl in enabling patient positioning for neuraxial blockade.

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