

Comparison of Ultrasound Guided Peng (Pericapsular Nerve Group) Block and Landmark Guided Fib (Fascia Iliaca Block) for Facilitating Position during Spinal Anaesthesia and Postoperative Analgesia for Hip Surgeries

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Abstract: *Background and aims:* This observational cross-sectional study was designed to compare the effect of PENG (Pericapsular nerve group) and FIB (Fascia Iliaca block) to facilitate positioning for spinal anaesthesia with acetabular and proximal femur fracture and to compare the duration of postoperative analgesia in patients fracture around hip joint. *Method:* 70 patients of ASA grade 1, 2, 3 of either sex in the age group of 18 - 80 years formed 2 groups: Group P (n=30): - patients who received Pericapsular Nerve Group Block to alleviate pain of positioning before spinal anaesthesia. Group F (n=39): - patients who received FIB to alleviate pain of positioning before spinal anaesthesia. In Pre-operative room patient's baseline pulse rate, Blood pressure and spo2 were recorded and IV cannula was secured. Injection midazolam 0.02 – 0.03 mg/kg iv was given as a pre-medication. All patients were given systemic analgesic or regional analgesia with either of a block according to the consultant anaesthesiologist's choice in preoperative room. Patient's vitals were monitored continuously. Pain was assessed using VAS at an interval of every 5 mins after giving the block and at 30 minutes and also at the time of positioning for spinal anaesthesia. Total duration of analgesia, postoperative analgesia trend in VAS score, VAS score at various time points and patient satisfaction score were noted. *Results:* Patients in group P had less VAS at 15, 20 and 30 minutes ($p < 0.05$). Group P has a longer mean duration of postoperative analgesia (344.6 ± 25.6 minutes) compared to the group F, which has a mean duration of (310.8 ± 55.01 minutes). Patient's satisfaction was better in Group P as compared to Group F. *Conclusion:* FIB and PENG; both are equally efficacious to provide analgesia during positioning for spinal anaesthesia, but FIB is more feasible than PENG in routine practice as it is easy to perform and is safe, doesn't require specialized equipment and is equally efficacious as PENG block.

Keywords: FIB, PENG, VAS, Postoperative Analgesia, Patient satisfaction score

1. Introduction

Proximal femur fracture (including neck of femur fracture) simply referred to as hip fractures, are a common, painful condition of patients presenting to the ED who are typically elderly and frail (1). After 55 years of age, incidence rate of fractures is significantly higher due to osteoporotic changes.

These fractures are associated with significant soft tissue trauma and are extremely painful and it is difficult to position the patient for anaesthesia procedures. Even slight overriding of fracture bone ends, during movement or at the time of shifting causes excruciating pain to the patient.

This Pain causes anxiety and distress to the patient. Pain can further lead to tachycardia and rise in blood pressure due to the sympathetic stimulation, which in turn increases cardiac workload. Geriatric patients are more likely to have associated co-morbidities, thus hemodynamic changes can have detrimental effect, causing significant morbidity and mortality. The definite treatment of these fractures is fracture reduction and fixation surgery.

Early surgical fixation is the best analgesic for associated

pain. Spinal anaesthesia has been favoured by many anaesthesiologists due to simplicity of the technique, the better analgesic profile and the lower incidence of complications like delirium and thromboembolic events. (2). However, severe pain encountered during positioning for spinal anaesthesia, can complicate the technique and worsen the patient experience (2). Effective perioperative analgesia that minimises the need for opioids and related adverse effects (respiratory depression, nausea, vomiting, and delirium mainly), and improves health quality of life, is essential in this population of patients (3). Inadequate postoperative analgesia can restrict the limb mobility thereby causing delay in recovery.

Adequate pain relief during positioning increases patient's cooperation and improves positioning before spinal block and thus alter the overall success rate of procedure. Various systemic analgesics like opioids, NSAIDs are commonly used to provide analgesia at this stage. Various nerve blocks are the other modality that is used for analgesia in perioperative period. Systemic analgesics are associated with various adverse effects. The analgesic effect of NSAIDs is limited and may cause nausea, vomiting, gastrointestinal bleeding, renal dysfunction and platelet

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inhibition. Patients with proximal femur fracture are usually geriatric patients with a delicate physical balance and thus they are susceptible to the side effects of opioids such as nausea, vomiting, sedation, and respiratory depression.

Peripheral nerve blocks are the better alternative to systemic analgesics. Many studies have been done to compare systemic analgesic with peripheral nerve blocks. These studies have proved that regional/nerve blocks are superior to systemic analgesics. Lumbar plexus block, femoral nerve block, 3 in 1 block, Fascia iliaca block (FIB) and PENG (pericapsular nerve group block) block are used to alleviate pain associated with proximal femur fracture. In our institute, usually all lower limb surgeries are generally managed under spinal anaesthesia; FIB and PENG block are routinely practiced to alleviate pain during positioning in patients with proximal femur and acetabular fracture.

A wide range of local anaesthetic agents are available for nerve blocks such as lidocaine, levobupivacaine, bupivacaine, and ropivacaine. Ropivacaine and levobupivacaine are newer and safer local anaesthetic with greater selectivity for sensory blockade. Old - aged patients have high incidence of cardiovascular comorbidities and they poorly tolerate hemodynamic fluctuations. Ropivacaine, a long acting amide local anaesthetic structurally related to bupivacaine, is less lipophilic that results in less cardiovascular and neurological toxicity and provides good hemodynamic stability, so it seems to be an attractive option so whenever available we use ropivacaine for regional blocks.

We decided to conduct an observational, comparative study using ropivacaine as a local anaesthetic and dexamethasone as an adjuvant in FIB or PENG block to observe its efficacy to provide analgesia before performing a spinal anaesthesia in the sitting position in patients with fractures around hip joint.

2. Material and Method

- After approval from the ethical committee, an observational study was conducted for comparison of Fascia iliaca compartment block and Pericapsular nerve group block for alleviating pain of positioning for spinal anaesthesia in 70 patients underwent surgery around hip joint during period of May 2019 - May 2023
- This study was conducted on patient's having closed ipsilateral proximal femur fracture like subtrochanteric, intertrochanteric and acetabular fracture of ASA class I, II, and III between age group 18 - 80 years scheduled for surgery.
- The sample size was calculated with convenient sampling technique on the basis of previous year data.

In Pre - operative room patient's baseline pulse rate, Blood pressure and spo2 were recorded and IV cannula was secured. Injection midazolam 0.02 - 0.03 mg/kg iv was given as a pre - medication.

All patients were given systemic analgesic or regional analgesia with either of a block according to the consultant anaesthesiologist's choice in preoperative room. Patient's

vitals were monitored continuously.

The patients who received fascia iliaca block or Pericapsular nerve group block were explained about the study and their data were collected after taking written informed consent.

For patients who received either FIB or PENG block from the period of May 2019 - October 2021, data collected retrospectively from department record.

Patients who received a Fascia iliaca block formed group F (Fascia iliaca compartment block group) and those who received Pericapsular nerve group block formed group P.

Fascia iliaca block:

This block was performed in supine position with all aseptic precaution by loss of resistance technique.

A line connecting anterior superior iliac spine and pubic tubercle was drawn and trisected. The puncture site was marked 1 cm caudal to the point of junction of lateral $\frac{1}{3}$ and medial $\frac{2}{3}$.

After infiltrating 2% lignocaine 2 cc at the puncture point, the block needle 18 - gauge Tuohy needle was inserted and advanced slightly cephalad. FICB was performed with landmark guided loss of resistance technique. After feeling 2 pop ups, 1st pop up of fascia lata and 2nd pop up of fascia iliaca, ropivacaine 0.375% 30 ml + injection dexamethasone 8mg (2ml) was injected.

Firm pressure was applied just distal to the puncture site, to facilitate the cephalic spread of block.

Pericapsular nerve group block

After all aseptic precautions and sterile measures, a low frequency curvilinear ultrasound probe was placed parallel to inguinal crease, at the level of anterior superior iliac spine (ASIS). The scanning was done with gradual caudad movement of the probe. After inferior iliac spine (AIIS) is visible, the probe is turned slightly medial until the hyperechoic shadow of superior pubic ramus visible. The psoas muscle with prominent tendon was identified just above the pubic ramus. The target was the plane between these two structures. Aligning the pubic ramus in the centre of the image and targeting the pubic ramus just medial to AIIS, 23 G spinal needle was introduced and anaesthetic solution is administered using ultrasound guided out - of - plane technique with repeated aspiration to avoid intravascular injection. The correct needle position was confirmed by drug spread below the psoas tendon.

Spinal anaesthesia was performed with 0.5% bupivacaine heavy 0.3 - 0.4 mg/kg under strict aseptic precaution in sitting position.

Method of assessment: (parameter assessed)

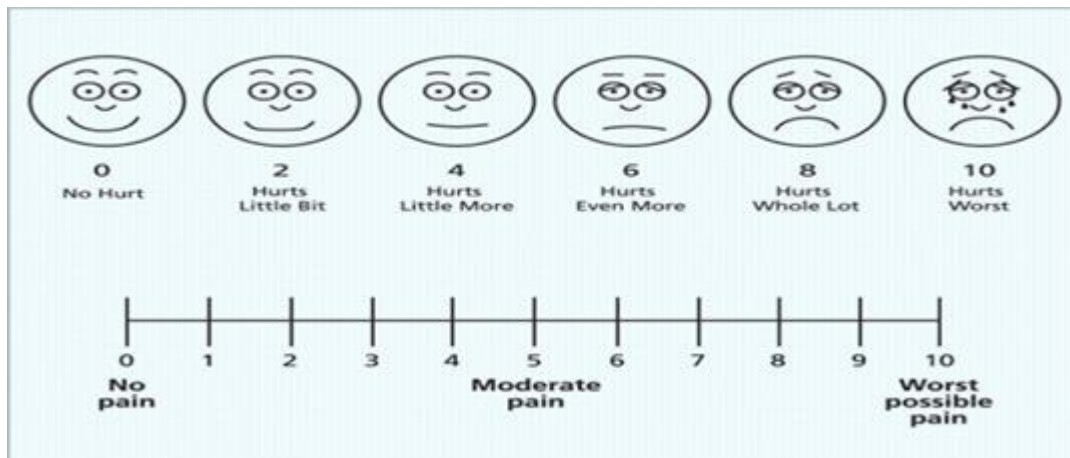
Intensity of pain was assessed by Visual analogue scale (VAS) at following intervals; before block, and at 5, 10, 15, 20, 25, 30 minutes after block and at the time of spinal anaesthesia positioning.

1) Visual Analogue Scale

0: No pain

10: Worst pain

[0 --- 1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9 --- 10]



If the VAS > 6 at the time of positioning, it was considered as a failed block and that patient was given IV analgesic like fentanyl or tramadol and excluded from assessment of postoperative analgesia.

- 2) Time taken to perform a block was noted. (Time from infiltrating of local anaesthetic to the time when block drug ropivacaine + dexamethasone was given)
- 3) Success rate
- 4) Any adverse events
- 5) Duration of post - operative analgesia by VAS - (from the onset of analgesic effect of block till the requirement of 1st dose of analgesia.)
- 6) Overall Patient satisfaction score was noted as follows in the evening at postoperative round.

Patient satisfaction score:

- Fair
- Good
- Very good

3. Observation and Results

The efficacy of the two blocks from VAS at various time intervals, till spinal anesthesia was given and also during postoperative period was compared.

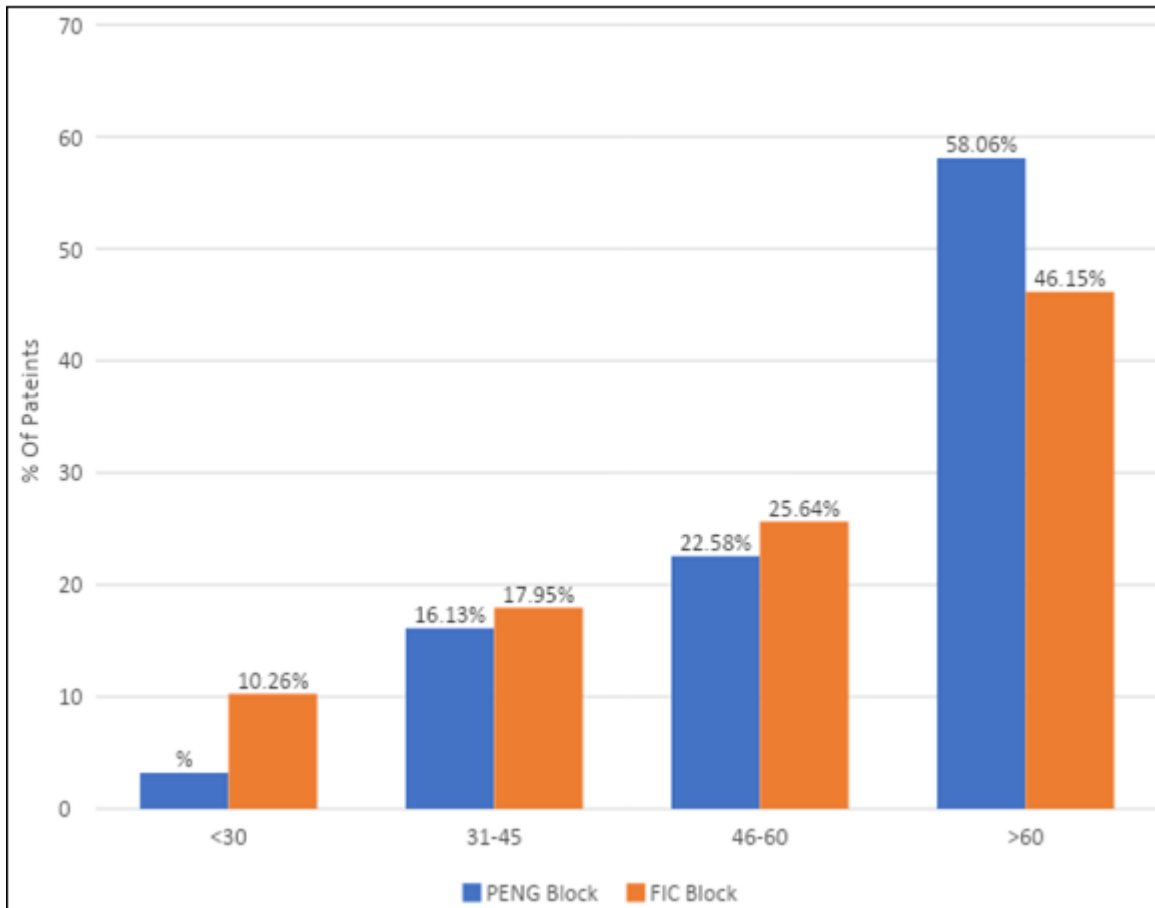
The data collected was entered into a database Microsoft excel sheet. The statistical analysis was done using STATA version 17 using student's t - test and chi - square test. The difference was considered to be statistically significant when $P < 0.05$.

Table 1: Demographic data

Age

Table 1: Distribution of Age (n=70)

Age (Years)	Group		
	Group P (n=31)	Block F (n=39)	Total
			70
Mean (SD)	62.7 (15.25)	55.9 (16.55)	58.8 (14.33)
<30	1	4	5
	3.23%	10.26%	7.14%
31 - 45	5	7	12
	16.13%	17.95%	17.14%
46 - 60	7	10	17
	22.58%	25.64%	24.29%
>60	18	18	36
	58.06%	46.15%	51.43%



Gender

Table 2: Gender distribution of the participants (n=70)

Gender	Group P (n=31)	Group F (n=39)	Total
Male	18 (58.06%)	30 (76.92%)	48 (68.57%)
Female	13 (41.94%)	9 (23.08%)	22 (31.43%)
Pearson Chi - square = 2.09; P - value = 0.148 (p > 0.05)			

The gender - wise distribution of the participants in the two study groups was comparable. (p=0.148).

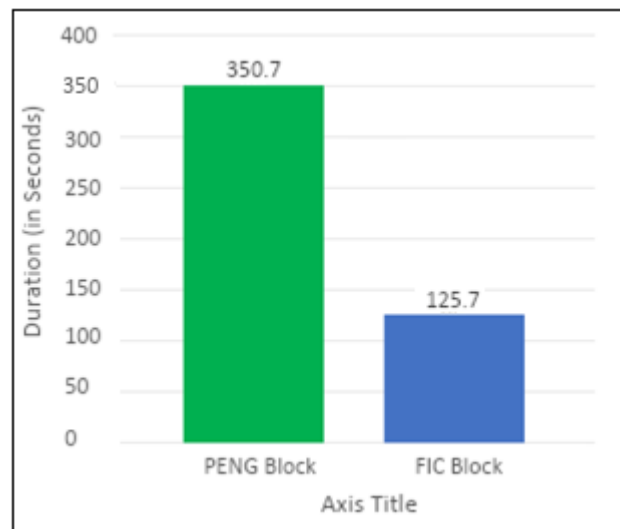
Procedural Time

Procedural time for FIB is defined as time required from drawing of landmarks till injecting ropivacaine and for PENG block is defined as time required from placement of ultrasound probe till injecting ropivacaine.

Table 3: Procedural time (n=70)

Time (in Second)	Group P n=31	Group F n=39
Mean (±SD)	350 (±72.6)	125.7 (±25.5)
*Student's Unpaired T - Test = 11.81 P - value < 0.0001 (p < 0.05)		

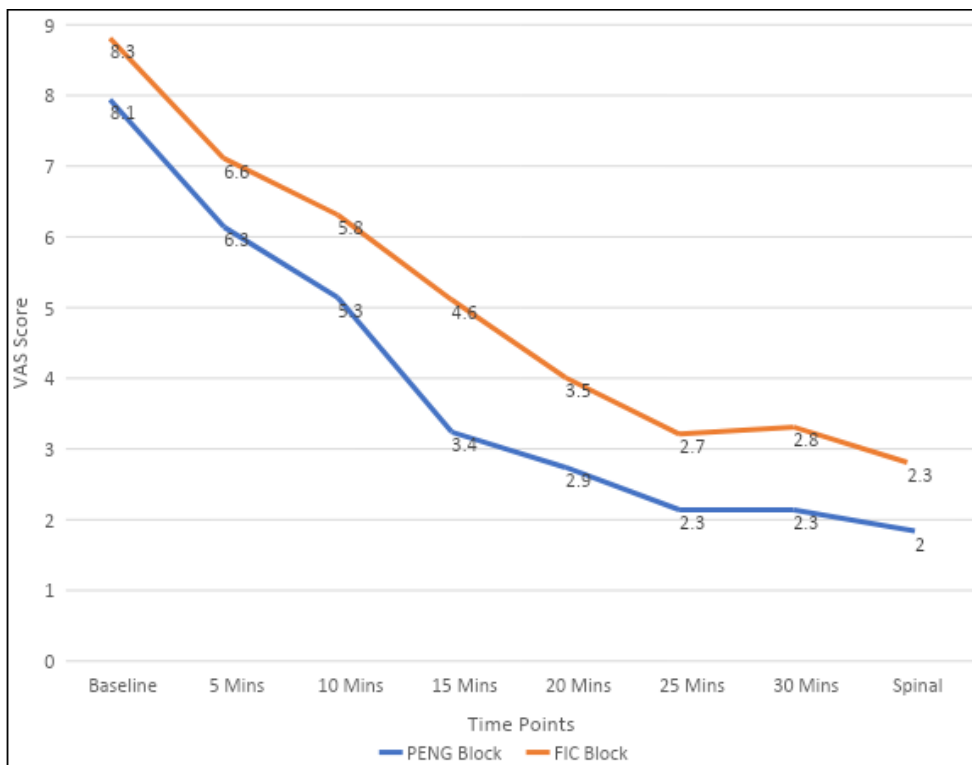
The P - value is less than 0.0001, which indicates a significant difference. Thus, time taken to perform PENG block is significantly longer than time taken to perform FIB block.



Trend in VAS score

Table 5: Trend in VAS score during the study (n=70)

Time points	Group P n=39	Group F n=31	P - value*
	Mean	Mean	
Baseline	8.1	8.3	0.93 (P > 0.05)
5 Mins	6.3	6.6	0.227 (P > 0.05)
10 Mins	5.3	5.8	0.492 (P > 0.05)
15 Mins	3.4	4.6	0.0002 (P < 0.05)
20 Mins	2.9	3.5	0.046 (P < 0.05)
25 Mins	2.3	2.7	0.58 (P > 0.05)
30 Mins	2.3	2.8	0.038 (P < 0.05)
During Spinal	2.0	2.3	0.064 (P > 0.05)
*Student's Unpaired T - Test			



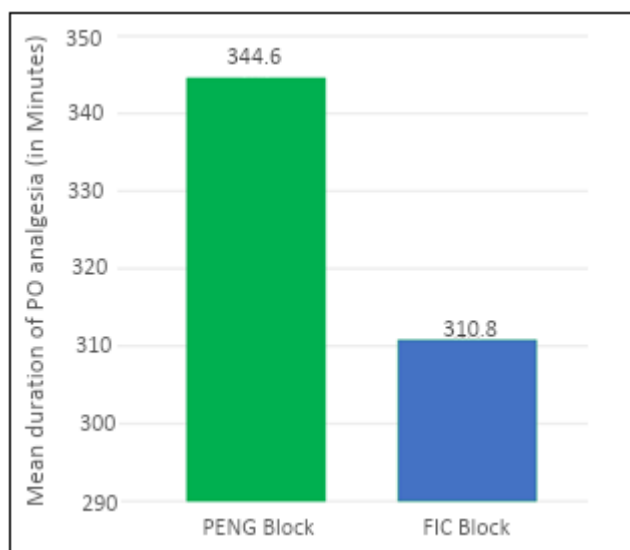
Out of 70 patients, 2 patients had failed block and in 1 patient general anaesthesia was supplemented. So, these 3 patients were excluded from analysis of postoperative analgesia.

Postoperative Analgesia

Table 9: Duration of Postoperative Analgesia (n=67)

Duration (in Minutes)	Group P n=30	Group F n=37	P - value*
Mean (±SD)	344.6 (±25.61)	310.8 (±55.01)	<0.05
Student's Unpaired T - Test = 7.98 P - value = 0.0011 (p < 0.05)			

Group P has a longer mean duration of postoperative analgesia (344.6± 25.6 minutes) compared to the group F, which has a mean duration of (310.8 ± 55.01 minutes). The P - value of 0.0011 indicates that the observed difference in postoperative analgesia duration between the two groups is highly unlikely to be due to chance.



4. Discussion

In our study, data shows no significant difference between both groups in **haemodynamic parameters** in term of Pulse rate, Systolic BP and Diastolic BP. K Shankar et al, 2020, [4] found out that baseline parameters heart rate and pulse rate were compared in both groups with p - value >0.05.

In our study pain was assessed using Linear **Visual Analogue Scale (VAS)**. The VAS score decreased gradually in both the groups and reached to <3 in 25 minutes. VAS was comparable in both the groups at different time interval except at 15, 20 and 30 minutes, where statistical difference was found in the two groups (p<0.05). At these intervals, Group P consistently reports lower VAS scores (indicating less pain or discomfort) as compared to group F. (p<0.05)

However, there was no significant difference between VAS score in both the groups at the time of positioning for spinal anaesthesia at 30 minutes. (p>0.05). Ashok Jardon et al, 2019, [5] observed that both S - FICB and PENG block provided a significant reduction in NRS pain scores.

In our study, **success rate**, out of 31 patients who received PENG block, in one case effect of block was not satisfactory, VAS score remained >6 at 30 minutes after block and also at the time of positioning for spinal anaesthesia, thus it was considered failed block (3.2% of total). Out of 39 patients who received FIB, in one patient VAS score did not decrease at the time of positioning for spinal anaesthesia, hence it was considered as failed block (2.56% of total).

Utsav Acharya et al, 2020, [6] found that none of the patient had failed block in their case series of ultrasound guided PENG block.

In our study we found that **mean duration of analgesia** was longer in group P 507.5 ± 35.12 minutes as compared to group F where it was 480.7 ± 49.43 minutes which was statistically significant ($p < 0.05$). This prolongation of effect is maybe due to accurate USG guidance in case of PENG block. Ashok Jadon et al, 2019, [5] observed that NRS 12 hours post block was less in PENG group as compared to S - FICB group.

We assessed **patient satisfaction score** and graded it as fair, good and very good. In PENG group 3 (10%) patients reported fair, 16 (53.33%) reported good and 11 (36.67%) reported very good satisfaction score. In FIB 2 (5.26%) patients had fair satisfaction score, 31 (81.58%) patients had good and 5 (13.16%) patient had very good satisfaction score.

Percentage of patients with very good satisfaction score was more than double in PENG compared to FIB group. K Shankar et al, 2020, [4] They evaluated patient's acceptance in terms of Yes or No. In group P it was accepted by 27 patients and in group F it was accepted by 14 patients out of 30. Priyanka Bipin Kulkarni et al, 2021, [7] observed that in PENG group out of 30 patients, 26 patients had good acceptance of anaesthesia as compared to FICB group where out of 30 only 23 patients had good acceptance of anaesthesia.

Limitations of our study was that Dose of bupivacaine is not fixed for spinal anaesthesia and was ranging from 2.5 - 3.5 ml (0.5%). So, it may have affected the results of total duration of analgesia.

5. Conclusion

FIB and PENG; both are equally efficacious to provide analgesia during positioning for spinal anaesthesia, but FIB is more feasible than PENG in routine practice as it is easy to perform and is safe, doesn't require specialized equipment and is equally efficacious as PENG block.

Declaration

Article has not been submitted/ published in any other journal. · Order of Authorship as placed in Manuscript is final and accepted by all.

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