Comparison of Preemptive and Post Operative Fascia Iliaca Compartment Block for Alleviating Pain and Post Operative Delirium in Elderly Patients with Proximal Femur Fracture Surgery

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Conflict of interest: No! Conflict of interest is found elsewhere considering this work.
Source of Funding: There was no financial support concerning this work

KEYWORDS

fascia Iliaca Compartment Block, Post-Operative delirium, Proximal Femur, Spinal Anesthesia

ABSTRACT

Background and Aim: Pain management is a challenging issue in elderly patients with hip fracture. Adequate pain relief before administrating spinal blockade will increase patient's cooperation. This study was done to assess analgesic effect of fascia iliaca compartment block (FICB) for positioning for spinal anesthesia. Present Study was done with an aim to evaluate and compare the analgesic effect of Pre-emptive Fascia Iliaca Compartment block (FICB) and Post-operative Fascia Iliaca Compartment Block on the incidence of post-operative delirium in geriatric patients undergoing proximal femur fracture surgeries under spinal anaesthesia.

Material and Methods: A Prospective, Randomised, single blind, comparative study recruiting 110 patients posted for proximal femur fracture surgery. The two groups were assigned randomly. Landmark guided FICB will be given 30 mins Prior to surgery with 23G 1 ½ Inch block needle with Inj. Ropivacaine (0.25%) 30ml. Spinal Anaesthesia would be performed with Inj.Bupivacine (0.5%) heavy. GROUP B (POST FICB Group): When effect of central neuroaxial block (S/A) reach up to level L1 and after shifting Patient in recovery room Landmark guided FICB is given with Inj. Ropivacaine (0.25%) 30 ml. Vitals were monitored before and after block, at the time of positioning for spinal anesthesia, intraoperative and postoperative periods.

Results: At Completion of surgery, after regression of SAB to L1, after 30 minutes, 1 Hour, 6 Hour and 24 Hour of postoperative period there was a significant difference between VAS of Group A and Group B. The mean total duration of analgesia in Group A was 6.13 hr min after spinal anesthesia, whereas in Group B, mean total duration of analgesia was 5.38 hr. There was statistically significant difference in the total duration of analgesia in postoperative period between Group A and Group B.

Conclusion: FICB effectively provides analgesia for positioning for spinal anesthesia to patients in hip and proximal femur surgeries. It also provides analgesia in postoperative period without having significant alteration in the hemodynamic profile of patients.

Introduction

Fracture of hip and femur are severely painful bone injuries because the periosteum has the lowest pain threshold. Pain and delirium often occur together especially in older population. Interaction between pain and delirium is complex and multidirectional. Pain may be risk factor for delirium in older population.[1]

Post-Operative delirium (POD) can occur from anywhere between 10 minutes after anaesthesia uptil discharge from the hospital and is commonly recognized as sudden, fluctuating and usually reversible disturbances of mental status with a degree of inattention. There is evidence from carefully controlled studies that pain can impact on cognition and thus might precipitate Delirium. A large prospective study suggested that severe pain was associated with a nine-fold risk of developing delirium. So, when pain is managed in femoral fracture patients, the delirium is reduced.[2,3]

Delirium is one of the most common complications in proximal femur fracture patients, with incidence ranging from 38% to 62%, and it increases with age, comorbidities and cognitive status. severe postoperative pain is a critical predisposing factor for delirium, and severe pain accelerates the activation and release of pro-inflammatory cytokines, which consequently promote development of delirium. Cytokines such as interleukins (IL), tumor necrosis factor alpha (TNF-α), and interferons (IFN) play an intricate role in the inflammatory process. Likewise, increase levels of cytokines seem to have a Connection in causing delirium. Interleukin-1 (IL-1), IL-2 (a T-cell activator), IL-6 (pro-pyrogenic molecules), and TNF-α, have all been suspected of causing delirium.[4-6]

Iliac Fascia space is potential space between the iliac fascia and iliopsoas muscles. It houses the femoral nerve, obturator nerve and lateral femoral cutaneous nerve which run behind the iliac fascia. Fascia Iliaca Compartment block proposed by Dalens in 1989, is effective in blocking the above nerves with fewer side effects.

Positioning for successful regional anaesthesia in patients with hip and proximal femur fracture for corrective surgeries is a major challenge and FICB effectively provides analgesia for positioning for spinal anaesthesia with good postoperative analgesia.and reduces the stress response of perioperative patients. FICB is the injection of anaesthetic drugs into the fascia iliaca compartment with the effect of blocking the lumbar plexus via an anterior approach. FICB is clinically safe and coefficient providing consistent analgesic effects. The pre-emptive analgesic effect of FICB can reduce the release of pro-inflammatory cytokines, thereby preventing the occurrence of perioperative delirium. In addition, reducing opioid usage can also reduce release of pro-inflammatory cytokines.[7-9]

Currently most widely used analgesics are nonsteroidal anti-inflammatory drugs and opioids or peripheral nerve blocking. However, opioids cause side effect like vomiting, constipation, Respiratory distress, pruritus, tolerance, physical dependence, reward behaviour as well as contribute to serious and potentially permanent nerve damage. Elderly patients are known to be vulnerable to the side effects of opioids, with reduction in renal and hepatic blood flow. Patients who experience delirium have longer hospital stay.by reducing incidence of delirium we can shorten duration of hospital stay. Ropivacaine 0.25% 30 ml can be used for peripheral nerve block. Ropivacaine is a long-acting regional anaesthetic that is structurally related to Bupivacaine. Ropivacine developed to reduce potential toxicity and improving relative sensory and motor block profiles. Ropivacaine has reduced central nervous system and cardiovascular toxicity.It produces less motor blockade and more sensory blockade as it has lower lipid solubility above all of this we are using less concentration of Ropivacaine as our study is focused on Elderly patients.[10]

Pre-emptive FICB helps with Positioning of patients to perform a spinal blockade. As we know in patients with proximal femur fracture adequate pain relief before administrating spinal blockade will increase patient's co-operation. Post-operative analgesia by FICB improve overall quality and efficacy of care, provide adequate pain relief with decreased supplementary analgesics promoting decreased risk of delirium.

Present Study was done to evaluate and compare the analgesic effect of Pre-emptive Fascia Iliaca Compartment block (FICB) and Post-operative Fascia Iliaca Compartment Block on the incidence of post-operative delirium in geriatric patients undergoing proximal femur fracture surgeries under spinal anaesthesia.

Material and Methods

After obtaining the approval from the Institutional Ethics Committee and written informed consent, a prospective, randomised, single-blind, comparative study recruited 110 patients posted for proximal femur fracture surgery (REF/2024/02/079206). The cases were allocated alternatively after confirmation of inclusion criteria and patient's informed and written consent in two groups: Group A and Group B.

Inclusion Criteria

1. Age>=65 years of either sex
2. ASA grading II to IV
3. X-Ray Diagnosis of U/L Proximal Femur Fracture
   - Neck of femur fracture
   - Intertrochanteric fracture
   - Subtrochanteric fracture

Exclusion Criteria

1. Previous Psychiatric illness or cognitive impairement (dementia, Alzheimer's disease)
2. Patients having history of substance abuse
3. Multiple fracture and previous surgery/Palliative surgery of affected limb
4. Drug Allergies/hypersensitivity
5. Any C/I for SA or Regional Blocks
6. Failed Spinal anaesthesia and any need of GA

To estimate the sample size for this study, we took estimated prevalence of post operative delirium as 21% as per study conducted by Chrispal A *et al*.[1] We further took α as 0.05 to have 95% confidence level with 10% absolute precision. 110 patients undergoing proximal femur fracture repair with fascia iliaca compartment block was selected as final sample size for this study.

An online randomization program was used to generate a random number list (1:1 Ratio). Patient randomized numbers were sealed in opaque envelopes that were opened by the study investigator. All members of the study group were blinded to randomization.

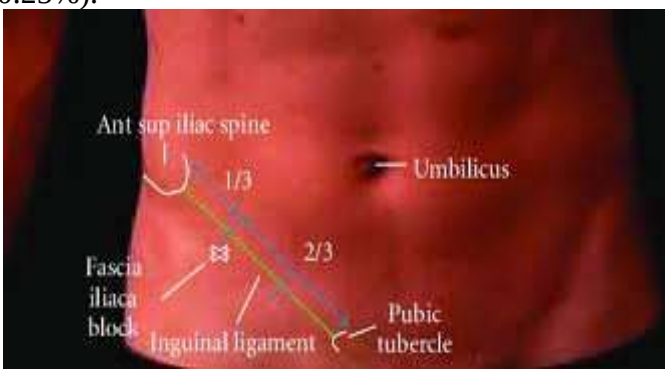
GROUP A (PRE FICB-Group): Landmark-guided FICB was given 30 minutes prior to surgery with a 23G 1 ½ inch block needle and Inj. Ropivacaine (0.25%) 30ml. Spinal anaesthesia was performed with Inj. Bupivacaine (0.5%) heavy.

GROUP B (POST FICB Group): When the effect of central neuroaxial block (S/A) reached up to level L1 and after shifting the patient to the recovery room, landmark-guided FICB was given with Inj. Ropivacaine (0.25%) 30ml.

DRUGS USED: Inj. Ropivacaine (0.25%), Inj. Bupivacaine (0.5%) heavy, 23G 1 ½ inch block needle, 23G/25G spinal needle. All patients underwent a pre-anaesthetic checkup before surgery, and all routine investigations and special investigations were documented. The patients were nil per os for 6 hours prior to surgery. Before surgery, the patient was explained about the procedure, and informed consent was taken. An IV line was secured with an 18G/20G IV cannula, standard monitors (NIBP, SpO2, and ECG) were connected, and vitals were recorded. The interventions used in the study were SA and FICB. Patients allocated to Group A were administered FICB 30 minutes prior to spinal anaesthesia. Briefly, a typical patient was placed in the supine position. A line was drawn from the pubic tubercle to the anterior superior iliac spine and divided into three sections. The puncture site was marked 1 cm caudal to the point dividing the lateral third and medial two-thirds of this line. After sterilizing the skin, a 23G 1 ½ inch block needle was blunted and inserted perpendicular to the skin until two "pops" became evident, indicating puncturing of the fascia lata and fascia iliaca. Upon confirmation of the needle perforation of the iliac fascia, followed by negative aspiration, a total of 30 mL of 0.25% ropivacaine hydrochloride was gradually injected deep to the iliac fascia. All proximal femur fracture surgeries were performed by trauma doctors. The internal fixation surgeries for intertrochanteric and subtrochanteric fractures were performed on traction tables, with the patient lying supine, in contrast to neck of femur fracture surgeries, which were

performed with the patient lying in a lateral decubitus position. During surgery, no additional local anaesthetics or opioids were administered. Sensory block was assessed after 15 minutes using a pin prick over the sensory distribution of the femoral nerve (anterior aspect of the thigh), lateral femoral cutaneous nerve (lateral aspect of the thigh), and obturator nerve (medial and posterior aspect of the knee). Sensory block was graded as follows: Grade 0 - sharp pain, Grade 1 - touch sensation only, Grade 2 - no sensation.

After the sensory block was achieved from FICB, spinal anaesthesia was administered in a sitting/lateral position with a 23G/25G spinal needle using Inj. Bupivacaine under all aseptic and antiseptic precautions. In Group B, FICB was given after the completion of surgery when the sensory level of the subarachnoid block regressed to level L1 (in the operating room or post-operative recovery room). The FICB procedure was the same as mentioned, using 30 ml of Inj. Ropivacaine (0.25%).



Land Mark Guided FICB:

The CAM can be used to determine both a CAM-S Long Form and CAM-S Short Form delirium severity score.

Feature	**Severity Score**		
Scoring the CAM-S: Rate each symptom of delirium listed in the CAM as absent (0), mild (1), marked (2). Acute onset or fluctuation is rated as absent (0) or present (1). Add these scores into a composite. Higher scores indicate more severe delirium.			
	Not Present	**Present (mild)**	**Present (marked)**
1. ACUTE ONSET & FLUCTUATING COURSE	0	1	2
2. INATTENTION	0	1	2
3. DISORGANIZED THINKING	0	1	2
4. ALTERED LEVEL OFCONSCIOUSNESS	0	*vigilant/lethargic:* 1	*stupor or coma:* 2
Short Form SEVERITY SCORE:	Add the scores in rows 1-4. Range is 0-7. ☐		

Results

Table 1: Demographic Parameters

Cofactors	**Group A (Pre-emptive FICB)**	**Group B (Post operative FICB)**
Age		
65-80 yrs	49 (89.09%)	53 (96.36%)
>80 yrs	6 (10.90)	2 (3.63%)
Sex		
Male	30 (54.54%)	33 (60%)
Female	25 (45.45%)	22 (40%)
ASA Grading		
II	0	0
III	30 (54.54%)	51 (92.72)
IV	25 (45.45%)	4 (7.27)
Type of Surgery		
Intertrochanteric fracture	35 (63.63)	36
Sub trochanteric Fracture	3 (5.45)	2 (3.63%)
Neck of Femur Fracture	17 (30.90)	17 (30.90)
Time to surgery (Mean±SD)(days)	2.03±0.97	1.70±0.45
Duration of surgery (hrs) (Mean±SD)	2.31±0.58	2.30±0.34

Table 2: Comparison of mean VAS SCORE at different time interval in both the groups

TIME	GROUP A (Mean±SD)	GROUP B (Mean±SD)	P value
0 min (baseline)	6.9±1.51	7.30±1.51	0.09
After 30 minutes of FICB (In group A)	3.47±1.52	4.37±1.76	0.06
At time of positioning for S/A	2.82±1.25	3.70±1.45	0.05*
VAS at Completion of surgery	2.70±1.11	3.13±0.62	0.01*
After regression of SAB to L1 (In group B)	3.05±1.14	5.07±0.97	0.001*
After 30 minutes	3.16±1.06	4.96±0.90	0.001*
1 hr	3.83±1.35	5.32±0.94	0.001*
6 hr	5.00±1.84	5.70±0.93	0.006*
12 hr	6.4±1.46	6.3±1.07	0.32
24 hr	7.4±1.23	7.05±0.77	0.01*

*** Indicate statistically significance at p≤0.05**

Table 3: Duration of Analgesia Among Patients in both the groups (Time to First Rescue Analgesia)

Duration of Analgesia	Mean±SD (Hours)	P value
Group A	6.13±0.82	0.002*
Group B	5.38±0.72	

*** Indicate statistically significance at p≤0.05**

Table 4: Total number of Rescue Analgesics Required Among Both Groups in 24 hours

Doses(numbers) of Rescue Analgesics	Group A	Group B
0	2 (3.63%)	7 (12.72%)
1	10 (18.18%)	7 (12.72%)
2	13 (23.63%)	37 (67.27%)
3	12 (21.81)	1 (1.81)
4	13 (23.63%)	3 (5.45%)
5	3 (5.45%)	0
6	2 (3.63%)	0

Table 5: Comparison of Incidence of Post-Operative Delirium in Both Groups

DELIRIUM	GROUP A	GROUP B
YES	21 (38.18%)	5 (9.09%)
NO	34 (61.81%)	50 (90.90%)

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GROUP B (POST FICB Group): When effect of central neuroxial block (S/A) reach up to level L1 and after shifting Patient in recovery room Landmark guided FICB is given with Inj. Ropivacaine (0.25%) 30ml.

In the present study, the demographic characteristics in terms of age, gender, ASA Grading, Type of Surgery, Time to surgery and Duration of Surgery. of all the patients were comparable in both the groups (Table 1).

At At time of positioning for S/A, Completion of surgery, after regression of SAB to L1, after 30 minutes, 1 hour, 6 hour and 24 hour of postoperative period there was a significant difference between VAS of Group A and Group B ($P \leq 0.05$). (Table 2)

The mean total duration of analgesia in Group A was 6.13 hr min after spinal anesthesia, whereas in Group B, mean total duration of analgesia was 5.38 hr. Hence, there was statistically significant difference in the total duration of analgesia in postoperative period between Group A and Group B. ($P<0.05$) (Table 3)

According to Table 4, highest number of patients required dose were 2 and 4 (23.63%) and in Group B highest number of patients (67.27%) required was 2.

Incidence of postoperative delirium was higher in Group A (38.18) in comparison to Group B (9.09%). (Table 5)

Discussion

Patients with hip fracture often suffer from severe pain, particularly during posture alterations that accompanies examination and treatment. Pain management is critical in the pre-and post-operative period of elderly hip fracture patients. Hence, good pain management can vastly improve patient outcomes. Traditional surgical anesthesia

methods for hip fracture mostly involve epidural anesthesia. Although this meets the needs of surgical treatment, analgesia after surgery provides good analgesia, but it has fallen out of favor as anticoagulants and early ambulation are often considered necessary. Early postoperative analgesia is important for the rapid recovery of hip function.[11] With the popularization and application of ultrasound visualization technology, precise nerve block has made great progress. In addition to FICB, there are other modalities for analgesia such as femoral nerve block, pericapsular nerve group block and lumbar plexus nerve block. The FICB technique is associated with minimal risk because the puncture is made at a safe distance from the femoral artery and femoral nerve. It was demonstrated that even a low dose can significantly relieve pain within a few hours.[12]

The use of FICB has been shown to be effective in controlling pain in both hip arthroplasty and hip fracture. Multiple studies support this finding stating that FICBs following hip fractures are effective and easily learned.[13-15] FIBs with continuous catheters have the potential to greatly reduce the morbidity in hip fracture patients when evaluating the influence and prevalence of side effects from opiate medications. A large study, including the postoperative time period, would help validate the clinical and cost-effectiveness of this low-risk and highly effective compartment block. There are specific concerns regarding the elderly in the peri-operative period regarding side effects from medication. One such concern is acute delirium associated with opioid medication. Delirium has been identified as a variable that delays ambulation and necessitates placement for rehabilitation.[16] Other concerns include urinary retention and sedation.

We observed that there was significant reduction in VAS of patients in Group A than patients of Group B at various intervals. ($P<0.05$) Yun et al. concluded that an FICB with ropivacaine is more efficacious than IV alfentanil in terms of facilitating the lateral position for spinal anesthesia in elderly patients undergoing surgery for femoral neck fractures.[17] Elkhodair et al. observed that there is reduction in pain by three points on the pain scale following a FICB by emergency department physicians using the two-pop technique.[18]

The mean total duration of analgesia in Group A was 6.13 hr min after spinal anesthesia, whereas in Group B, mean total duration of analgesia was 5.38 hr. Hence, there was statistically significant difference in the total duration of analgesia in postoperative period between Group A and Group B. ($P<0.05$) Highest number of patients required dose were 2 and 4 (23.63%) and in Group B highest number of patients (67.27%) required was 2. ($P\leq0.05$)

Stevens et al. concluded that a modified FICB has a significant morphine-sparing effect in unilateral total hip arthroplasty.[19] Anaraki and Mirzaei also concluded that in FICB group, the time required for the 1st need of analgesic was significantly longer and total analgesic consumption was significantly lower than that of gabapentin group. The median level of patients' satisfaction in postoperative period in FICB group was significantly higher than that of gabapentin group.[20] A Korean study found that the first analgesic request happened after 8.6 hours (516 minutes) in the FICNB group, whereas after 4.5 hours (270 minutes) in the control group.[18]

FICB is considered as safe and effective procedure for providing analgesia with very few complications. In our study, we observed that there were few incidences of post operative delirium in Group B compared to Group A. Since postoperative pain is one of the major causes of postoperative delirium in geriatric patient undergoing proximal femur surger, hence regional nerve block like FICB helps in allievating pain in such patients and they reduce the incidence of postoperative delirium. Paria et al. also observed that overall FICB is a very low-profile risky procedure to block, and the risk of intravascular injection, toxicity of local anesthetic, and

mechanical nerve damage is extremely low. The chance of infection is rare with good aseptic preparation of the site.[7]

Few limitations of our study were that sample size is small and also pre and post FICB with spinal anaesthesia might have confounded the results related to pain. We considered only pain as the major risk factor of postoperative delirium for geriatric patients and we could not analyse the other risk factors and predictors causing postoperative delirium. Also we used traditional land-marked guided FICB in both the groups without the use of ultrasound.

Conclusion

FICB effectively provides analgesia for positioning for spinal anesthesia to Geriatric patients in hip and proximal femur surgeries. It also provides analgesia in postoperative period without having significant alteration in the hemodynamic profile of patients. FICB reduces the total number of doses of analgesic agent required by patients in the 1st 24 h of postoperative period. FICB is a safe procedure for providing analgesia with remarkable safety profile. Also incidence of postoperative delirium was lower in post-FICB group as it provides more effective analgesia in the postoperative period considering.

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