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Original Research Article

COMPARISON OF EPIDURAL WITH ILIOPSOAS PLANE CATHETER INSERTION FOR PROVIDING POST-OPERATIVE ANALGESIA IN HIP SURGERIES

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Abstract

Background: Anaesthesiologists play an important role in post-operative pain management. For analgesia after lower abdominal surgery, epidural analgesia and iliopsoas plane block are suitable options. The study aims to compare the analgesic efficacy of both techniques. **Materials and Methods:** Sixty patients were divided into Group T (30 patients treated with Iliopsoas Plane Block) and Group I (30 patients treated with Epidural block). All patients had a detailed pre-aesthetic examination. Standard monitors, including NIBP, ECG, and Pulse Oximeter, were attached, and baseline vitals were recorded. Patients from both groups underwent hip surgery under spinal anaesthesia with 3.5 ml 0.5% Bupivacaine (heavy). **Result:** Male predominance was reported in group E, whereas female predominance was observed in Group I. The mean age, weight, height, and ASA grading were comparable in both Group E and I. The mean onset of sensory block was reported to be significantly lower in group I. In contrast, the duration of analgesia and the total number of top-ups were significantly higher in Group I. The mean VAS score was statistically significant between groups from 2 to 14 hours and 18 hours. The mean SBP was statistically significant at 0.5 and 1 hour and MDB at 0, 0.5, 8 and 10 hours. The MAP was statically significant at 0.5, 8 and 10 hours. At the all-time point, there was a statistical difference in Bromage score between groups E and I. **Conclusion:** The iliopsoas plane block holds considerable promise as an effective post-operative analgesia and motor sparing with fewer side effects than Epidural analgesia.

INTRODUCTION

The development of total hip and knee arthroplasty are among the most significant advances in orthopaedic surgery of the last century. Primary hip and knee arthroplasty are major surgical procedures associated with significant potential perioperative morbidity.[1] A significant subgroup of patients suffers moderate or severe pain following hip surgeries. Hip fractures cause moderate to severe pain, requiring effective analgesia preoperatively and postoperatively. Adequate post-operative pain relief can improve surgical outcomes.[2]

Multimodal analgesic regimens, which include non-steroidal anti-inflammatory drugs, opioids and various regional analgesic techniques, have been used in hip surgeries. NSAIDs at moderate dose has adverse effects, especially in the elderly population. Although opioids are potent analgesics, they are associated with severe adverse effects like drowsiness, nausea, respiratory depression, constipation etc., limiting their use.[3-4]

Regional analgesia can reduce post-operative pain and spare patients from opioids and their side effects. Regional analgesia of the hip is complicated since multiple nerves innervate the hip joint area.[5] The obturator and femoral nerves innervate the primary hip joint. Regional analgesia has contributed to post-operative compliance with physiotherapy. Regional anaesthesia has contributed to not only the outcome of hip surgeries but has also been the reason for reducing the length of hospital stay and thereby being economical.[6]

There have been many newer techniques for post-operative analgesia in hip surgeries. Epidural catheter placement has been widely accepted for

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providing post-operative analgesia, but it has been associated with many side effects and limitations.[7] Nerve blocks have also been accepted for post-operative analgesia, but it also has their challenges in techniques and the delay in recovery due to motor blockade. A femoral nerve block is known to reduce pain following hip surgeries but is unfortunately accompanied by an increased fall risk.[8] A novel nerve block—the iliopsoas plane block (IPB) and pericapsular nerve group (PENG)- can anaesthetize the hip articular sensory branches of the femoral nerve without causing motor blockade.[9]

Similar contributions to post-operative outcomes are the choice of local anaesthetics and the adjuvant. Hence patient with post-hip surgery requires adequate post-operative analgesia, which will also help in the overall outcome of the surgery.[10] Therefore, the present study was carried out to compare the Epidural with iliopsoas plane catheter insertion for post-operative analgesia in hip surgeries.

MATERIALS AND METHODS

This prospective, randomized, comparative study was conducted at the Department of Orthopaedic Surgery, Madurai Medical College, and Madurai. Sixty patients were divided into groups: Group T (30 patients treated with Iliopsoas Plane Block) and Group I (30 patients treated with Epidural block). Institutional ethical committee approval and written consent were taken before the start of the study.

Patients of either sex aged 18 years to 60 years of age with ASA grading 1 and 2 undergoing elective Hip surgeries were included.

Patients with ASA grading three or more and on antiplatelet and anticoagulant therapy, patients with pregnancy, neurological problems, local infections, allergy to Las and refusal to participate in the study were excluded.

The pre-anaesthetic assessment was done by recording a detailed history and performing a complete physical examination. Complete blood count, renal function test, blood grouping/typing, random blood sugar, electrocardiograph and chest x-ray were done. Patients not fulfilling the inclusion and exclusion criteria were excluded from the study.

All patients had a detailed pre-aesthetic examination. The patient was advised to fast overnight and to take a tablet of alprazolam 0.25 mg on the night before the surgery. On the morning of the surgery, patients were asked to take their routine medication for the coexisting condition. After confirming 8 hours of preoperative fasting status and a brief preoperative review examination, the anaesthetic management of all the patients was standardized. Standard monitors, including NIBP, ECG, and Pulse Oximeter, were attached, and baseline vitals were recorded. Venous cannulation was secured with an 18G cannula, and Patients were preloaded with 10–15 ml/kg body weight of Ringer's lactate solution before the procedure.

After ensuring all standard aseptic precautions, Patients from both groups underwent hip surgery under spinal anaesthesia with 3.5 ml 0.5% Bupivacaine (heavy). Group E patients received an epidural catheter during spinal anaesthesia preoperatively. Group I patients received an iliopsoas plane catheter at the end of the procedure.

Group-E Patients treatment

The patient was placed in a sitting position, and the back was prepared with povidone solution and sterile drapes applied. 2 ml of 2%. Lignocaine was used for local infiltration at space L3- L4 space. The approach used for the epidural technique was the midline approach. The technique chosen for identifying epidural space was the loss of resistance technique using air filled syringe using the Bromage grip. 18 G Tuohy needle was inserted at L3 –L4 interspace, and epidural space were identified at 3.5-5 cm from skin level by LOR Technique.

An Epidural catheter was threaded into the epidural space via the epidural needle. A catheter was fixed so that 5 cm of the catheter was in the epidural space. After a negative aspiration test dose was given with 3ml of 1.5% Lignocaine with 15mcg adrenaline. Then the patient was given spinal anaesthesia with 0.5% hyperbaric Bupivacaine 3.5ml at L4-L5 space using a 25G Quincke needle after local infiltration with 2% lignocaine. On experiencing pain at VAS > 4, patients will receive the first 10ml of bupivacaine 0.25% via the catheter.

The onset of analgesia is calculated from the time of drug administration till the VAS4. The patient was monitored for 24 hours and would receive a bolus of 10 ml 0.25% bupivacaine when their VAS score was>4. The total number of top-ups was noted for 24 hours.

Group-I Patients treatment

Group I patients were given spinal anaesthesia with 3.5 ml of injection 0.5% hyperbaric bupivacaine at L4-L5 interspace using a 25G Quinckes needle. At the end of the procedure, the patient received an ultrasound-guided iliopsoas plane block. The patient was placed in the supine position. After preparation of the skin with povidone solution, a sterile high-frequency USG probe (5-13 MHz) transducer (Sonosite M turbo USG machine) was oriented in the transverse plane just caudad to the anterior superior iliac spine. The transducer was then rotated 20-30 degrees counterclockwise on the right side and clockwise on the left side. Parallel shifted along the inguinal ligament until the hip joint was identified, where the head of the femur dived deep to the acetabular rim. Then the epidural needle is inserted lateral to the Sartorius muscle in an In-Plane approach after a skin wheel is made. The needle entry point was 3-4cm from the edge of the transducer. This allows for a decreased trajectory angle of the needle to the fascial plane, which optimizes the angle of incidence of the ultrasound beam relative to the needle. Then the needle is

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advanced until the tip of the needle is located in the iliopsoas plane between the iliopsoas muscle and the iliofemoral ligament just lateral to the iliopsoas tendon. Once the needle enters the iliopsoas plane, 10ml of 0.9% normal saline is injected to confirm the correct needle placement by hydro dissection. Optimal needle location is indicated by an anechoic fluid collection separating the iliopsoas muscle from the iliofemoral ligament. It visibly expands the plane, usually reached at an average depth of 6-8 cm from skin level. The epidural catheter is introduced 5cm beyond the needle tip into the compartment. Direct visualization may confirm the correct location of the catheter tip via USG or local anaesthetics accumulation in the iliopsoas plane.

On experiencing pain at VAS > 4, patients will receive the first 10ml of bupivacaine 0.25% via the catheter. The onset of analgesia is calculated from the time of drug administration till the VAS4. The patient was monitored for 24 hours and would receive a bolus of 10 ml 0.25% bupivacaine when their VAS score was>4. The total number of top-ups was noted for 24 hours.

Modified Bromage Score11

- Grade 0- Patient able to move at all the joints (Hip, Knee, and Ankle)
- Grade 1- Unable to move at the hip joint
- Grade 2- Unable to move at both hip and knee joint
- Grade 3- Unable to move at all three joints hip, knee and ankle

Complications like nausea, vomiting, hypotension, hypersensitive reaction, shivering, fever, drowsiness, pruritus, respiratory depression, urine retention, Motor blockade, PDPH, and any failure were also monitored.

Data were entered in an MS excel sheet and analysed using SPSS software version 16. Categorical variables like gender, study groups, etc., are represented in frequencies and percentages. An Independent t-test was used to compare numerical variables like pain scores and duration of analgesia among the study groups. For a test of significance, the chi-square test is used. P-values less than 0. 05 were considered statistically significant.

RESULTS

All 60 patients were further divided into two groups, Iliopsoas Plane Block (Group I) and Epidural block (Group E), each with 30 patients. Male predominance was reported in group E, and female predominance was observed in group I. In both groups, the maximum number of patients was reported at 41 to 50. The mean age, weight, height, and ASA grading were comparable in both Group E and I. The mean onset of sensory block was reported to be significantly lower in Group I. In contrast, the duration of analgesia and the total number of top-ups were significantly higher in Group I [Table 1].

Table 1: Demographic and other parameters of patients of both groups

Parameters	Observations Frequency (%)		p-value
	Group E	Group I	
Gender			
Male	18 (60%)	13(43.33%)	0.301
Female	12 (40%)	17 (56.66%)	
Age group			
< 30	7 (23.33%)	7 (23.33%)	0.549
31 – 40	6 (20%)	6 (20%)	
41 – 50	9 (30%)	14 (30%)	
> 50	8 (26.66%)	3 (26.66%)	
Mean age (Years ± SD)	42.1± 11.737	40.4±10.057	
Mean Weight (Kg ±SD)	70.3 ±8.322	68.6±7.824	0.418
Mean height (cm± SD)	163.6 ±6.473	160.7±6.686	0.093
ASA Grading			
I	16 (53.33%)	20 (66.66%)	0.429
II	14 (46.66%)	10 (33.33%)	
The onset of sensory block			
< 10	14 (46.66%)	24 (80%)	0.016
> 10	16 (53.33%)	6 (20%)	
Duration of analgesia (hrs)			
< 3	28 (93.33%)	6 (20%)	<0.001
> 3	2 (6.66%)	24 (80%)	
Total Top up			
T 3	10 (33.33%)	5 (16.66%)	<0.001
T4	19 (63.33%)	10 (33.33%)	
T 6	1 (3.33%)	15 (50%)	

The initial mean VAS score was 4.5±0.572 for group I and 4.733±0.74 for group E. Mean VAS score was found statistically significant ($p<0.05$) between groups at time points from 2 hours to 14 hours and at 18 hours. The mean heart rate was 86.5 ±3.998 and 84.433 ±8.709 for Group E and I. Mean heart rate was reported as statically significant ($p<0.05$) at 1, 2, 6 and 8 hours. The mean systolic and diastolic blood pressure was comparable among both groups. The mean SBP was reported statically significant ($p<0.05$) at a time point of

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0.5 and 1 hour, and MDB was observed statically significant ($p<0.05$) at a time point of 0, 0.5, 8 and 10 hours. The initial mean MAP was 93.989±2.638 for group E and 96.122± 5.962 for group I. The MAP was reported statically significant ($p<0.05$) at a time point of 0.5, 8 and 10 hours [Table 2].

Table 2: Observation of haemodynamic parameters of patients of both groups

Time point	Observations Frequency (%)														
	VAS Score			Heart rate			SBP			DBP			MAP		
	Group E	Group I	p-value	Group E	Group I	p-value	Group E	Group I	p-value	Group E	Group I	p-value	Group E	Group I	p-value
0	4.50	4.73	0.177	86.50	84.43	0.242	125.63	126.1	0.734	78.17	81.13	0.041	93.99	96.12	0.078
0.5	0 0	0 0	1	81.83	78.57	0.095	115.93	122.2	<0.001	69.03	78.07	<0.001	84.67	92.78	<0.001
1	0 0	0 0	1	77.93	72.33	0.002	119.27	120.77	0.257	73.80	75.37	0.262	88.96	90.50	0.179
2	0.07	0.77	0.005	77.93	71.73	0.001	119.60	120.13	0.735	72.87	73.17	0.825	88.44	88.82	0.733
4	0.37	3.77	<0.001	76.73	77.33	0.761	119.87	119.3	0.728	73.90	72.73	0.394	89.22	88.26	0.398
6	3.00	1.17	<0.001	77.20	81.97	0.02	116.23	118.8	0.262	73.23	73.53	0.857	87.57	88.62	0.437
8	1.93	0.23	0.002	76.67	81.50	0.006	119.47	120.07	0.678	68.97	75.77	<0.001	85.80	90.53	0.001
10	0.00	0.83	0.011	77.57	80.00	0.162	119.73	121.0	0.323	69.50	76.2	<0.001	86.24	91.13	<0.001
12	1.50	2.87	0.017	76.73	77.70	0.552	115.70	120.07	0.008	72.30	73.77	0.364	86.77	89.20	0.085
14	3.17	1.53	0.016	-	-	-	-	-	-	-	-	-	-	-	-
16	1.07	0.97	0.851	-	-	-	-	-	-	-	-	-	-	-	-
18	1.37	0.27	0.015	-	-	-	-	-	-	-	-	-	-	-	-
20	1.70	2.40	0.302	-	-	-	-	-	-	-	-	-	-	-	-
22	2.10	1.60	0.47	-	-	-	-	-	-	-	-	-	-	-	-
24	0.13	0.43	0.201	-	-	-	-	-	-	-	-	-	-	-	-

The Modified Bromage score for patients of both groups was evaluated, and it was found that Group I patients did not show any value for the Bromage score at any time. There was a statistical ($p<0.05$) difference in Bromage score between group E and I at an all-time point [Table 3, Figure 1].

Table 3: Observation of Modified Bromage Score patients in both groups

Time point	Modified Bromage Score (Mean ± SD)		t-value	p-value
	GROUP-E	GROUP-I		
0	0 ±0	0 ±0	15.232	< 0.001
0.5	1.333 ±0.479	0 ±0	27.028	< 0.001
1	2.3 ±0.466	0 ±0	8.93	< 0.001
2	2.2 ±1.349	0 ±0	7.616	< 0.001
4	0.667± 0.479	0 ±0	0	0
6	0 ±0	0 ±0		
8	1.4± 0.498	0 ±0	15.389	< 0.001
10	1.767± 1.382	0 ±0	7.003	< 0.001
12	0.4± 0.498	0 ±0	4.397	< 0.001

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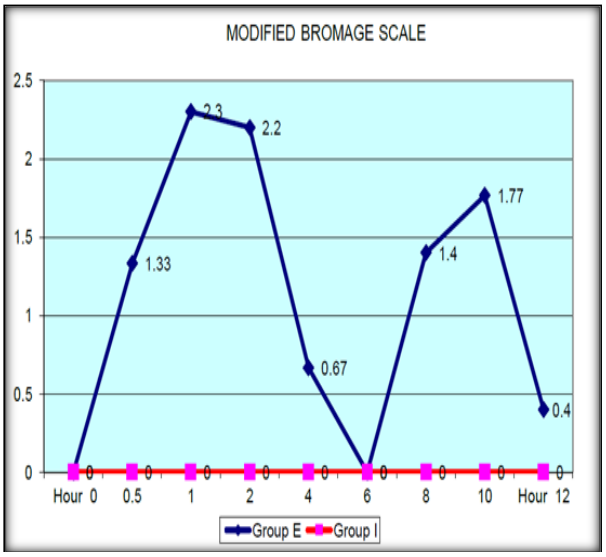

Figure 1: Observation of Modified Bromage score in both groups

DISCUSSION

Patients with HIP fractures require a continuum of pain management from the time of pre-hospital admission till final rehabilitation. Optimal perioperative analgesia is an issue to be addressed.[12] A good post-operative analgesic regimen is essential to reduce stress and improve post-operative outcomes, as inadequate pain control can lead to serious medical issues.[13] Pain following hip surgeries is more pronounced in the first two post-operative days and is aggravated during mobilization. Intravenous opioids provide static analgesia, but regional anaesthesia techniques provide dynamic analgesia.5 Epidural analgesia is superior to other pain relief forms but can cause hypotension, nausea, vomiting, urinary retention, and delayed ambulation.[14]

The epidural block group (group E) in this study had a mean duration of analgesia of 4 hours with 10 ml inj.0.25% bupivacaine. Burke et al., the study of using 0.25% S(-)-bupivacaine and 0.25% RS-bupivacaine for epidural analgesia in labour had reported approximately 2 hours of analgesia in the S(-)- bupivacaine and around 3 hours with the RS-bupivacaine group.[15] Another study by McMorland et al. compared the onset and the duration of analgesia after the elevation of pH by adding 0.1 ml 8.4% sodium bicarbonate to 20 ml 0.25% bupivacaine in the epidural space resulted in 96.5 min compared to 79.4 min in plane 20ml 0.25% bupivacaine.[16] Gruber et al., in their investigation, reported that 0.25% bupivacaine resulted in good ventilator outcomes as it had only sensory blockade and had improved the pulmonary volume parameters.[17] Hence our study had a longer duration of analgesia when compared with other studies. The reason could be added to the type of population the study was performed. Our study also had an incidence of a motor blockade in the epidural group due to the higher blockade with 10 ml 0.25% bupivacaine.

Peripheral nerve blocks can be an alternative to epidural analgesia, but the failure rate in anatomic landmark-based approaches was high in peripheral nerve blocks. With the advent of ultra-sonogram, peripheral nerve blocks gain popularity for lower limb surgeries like lumbar plexus block (posterior approach psoas compartment block and anterior approach femoral 3 in 1 block), fascia iliaca block, and sciatic block.[18]

The Iliopsoas plane block effectively blocks the femoral nerve, thus providing effective pre and post-operative analgesia in patients with hip fractures. Nielsen et al., in their study, showed that the injected dye localized at the iliopsoas plane, which can involve the articular branch of the femoral nerve.[19] This finding correlated with our study, where the Iliopsoas plane block would block only the articular branches of the hip joint. Another study demonstrated that the local injectate at the iliopsoas plane resulted in no motor blockade. Our study also showed that the patient's lower limb motor function was monitored with Modified Bromage Score and had no motor blockade.[20]

We conducted this randomized prospective double-blinded clinical study to compare the analgesic efficacy of USG-guided iliopsoas plane block with epidural analgesia for post-operative pain relief in patients undergoing hip fracture surgery under spinal anaesthesia. This study tested the hypothesis that USG-guided iliopsoas plane block would provide post-operative analgesia comparable to epidural analgesia. There was no incidence of bradycardia or respiratory depression in both group, which are common when opioids are used in a neuraxial blockade. Urinary retention was present in 4 patients of the epidural group. Based on a previous study by Baldini et al., spinal anaesthesia was associated with a higher incidence of urinary retention (22.2%) with an epidural 14.3%. [21]

Hypotension is the most common side effect seen with sympathetic denervation in a central neuraxial blockade. Risk factors associated with hypotension include hypovolemia, preoperative hypertension, high sensory block height, age older than 40, and obesity. The physiological effect of sympathetic blockade was a reason behind this hypotension in the epidural group. But there was no incidence of hypotension reported in the iliopsoas plane group and Epidural group.[22]

Regarding the hemodynamic parameters, there was a fall in systolic blood pressure, diastolic blood pressure, and mean arterial pressure at periodic intervals after activating an epidural catheter. So, we concluded that USG-guided iliopsoas plane block was comparable to epidural analgesia in terms of post-operative pain relief.[23]

Hypotension is present in epidural anaesthesia due to sympathetic blockade. Lower limb motor block is uncommon when using low concentrations of bupivacaine. Urinary retention is seen when sacral

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segments S2 to S4 are blocked by epidural analgesia.[24]

Advantages of this USG-guided iliopsoas plane include unilateral analgesia on the side of surgery, less motor blockade and early ambulation. Iliopsoas plane block is devoid of side effects of epidural analgesia such as hypotension, post-operative nausea and vomiting, urinary retention and a motor blockade.[23-24]

CONCLUSION

From this study, it can be concluded that the analgesia following the ultrasound-guided iliopsoas plane block though comparable to epidural analgesia, can be an effective alternative to epidural block because of its relative simplicity in technique and less invasiveness. The iliopsoas plane block holds considerable promise as an effective post-operative analgesia and motor sparing with fewer side effects than Epidural analgesia.

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