COMPARATIVE EVALUATION OF ULTRASOUND-GUIDED FASCIA ILIAC BLOCK TO PERIVASCULAR NERVE BLOCK IN PERIOPERATIVE ANALGESIA BEFORE USING SPINAL ANESTHESIA IN SUBJECTS UNDERGOING HIP SURGERIES

Dr Supratim Dasgupta,[1*] Dr Sanjeev Kumar Agrawal,[2] Dr Roseline Zohra Ali[3]

[1*]Associate Professor, Department of Anaesthesiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai, Durg, Chhattisgarh

[2]Associate Professor, Department of Anaesthesiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai, Durg, Chhattisgarh

[3]Professor and Head, Department of Anaesthesiology, Shri Shankaracharya Institute of Medical Science, Bhilai, Durg, Chhattisgarh

Corresponding author

Dr Supratim Dasgupta

Email id: supratim.med@gmail.com

Conflict of Interest: None
Type of study: Original Research Paper
Date of submission: 12 December 2022
Date of acceptance: 27 December 2022
Date of publication: 10 January 2022

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ABSTRACT

Background: Following hip surgeries, adequate perioperative analgesia can help in better postoperative recovery. Fascia iliaca compartment block (FICB) and PENG block both have been used for perioperative analgesia.

Aim: To comparatively assess the analgesic effects of PENG (per capsular nerve block) to ultrasound-guided fascia iliac block in elderly subjects undergoing hip surgeries.

Methods: 160 subjects undergoing hip fracture surgeries under spinal anesthesia were divided into 2 groups where Group I was given ultrasound-guided fascia iliac block and Group II subjects were given per capsular nerve block for perioperative analgesia. The VAS scores and quality of subjects were assessed.

Results: Demographic data were comparable for both groups. Patient acceptance in Group I have been seen in 45% (n=36) of subjects. In Group II, acceptance was seen in 90% (n=72) subjects which were significantly higher for Group II compared to Group I. Quality of patient positioning was significantly higher for Group II, 3.135±0.736 compared to group I, 21.65±0.15. This difference was statistically significant with p=0.004. 30 minutes following block, during hip movement and positioning, mean VAS scores were significantly higher for Group I than Group II with p<0.001. Postoperative analgesia duration was significantly higher for Group II (PENG block).

Conclusion: PENG block has better analgesic effects along with higher patient satisfaction and optimal positioning compared to the fascia iliaca block for the central neuraxial block for subjects undergoing hip fracture surgeries. Also, PENG had a better safety profile and comparable postoperative analgesia as with fascia iliaca block.

Keywords: Fascia iliaca block, Hip surgeries, Pericapsular nerve group block, Ultrasound, ultrasound-guided block

INTRODUCTION

Hip arthroplasty remains the surgical treatment choice for elderly subjects with fractures of the femoral neck. Owing to the high population density in India, hip arthroplasty is a frequently and commonly performed surgical procedure. Various literature data has shown that hip arthroplasty can result in severe pain in the perioperative interval which can further cause various complications.[1] These complications can cause unwanted outcomes in the long-term prognosis following hip arthroplasty as well as increase the risk in the perioperative period. Optimal analgesia during perioperative time can help in better recovery following hip arthroplasty. One of the most widely used blocks for perioperative analgesia is the Fascia iliaca block. However, previous literature data have reported that Fascia iliaca block is associated with delayed recovery, quadriceps weakness, and neurovascular injury.[2]

In the hip capsule, sensory nerve patterns are different in posterior and anterior regions where most of the mechanoreceptors and sensory fibers are in the anterior hip capsule and are innervated by foramen ovale branches and femoral nerve. Most of the innervation to the superior medial and lateral aspect of the hip capsule is provided by the articular branch of the femoral nerve.[3,4] The branches of the foramen ovale nerve provide innervation to the medial portion of the capsule. Between the anterior inferior iliac spine and iliopubic eminence, foramen ovale branches and proximal articular branches of the femoral nerve innervates. Branches from the foramen ovale are seen near the medial aspect of the acetabulum. The sciatic nerve branch innervates the posterior hip capsule with both nerves of the quadriceps muscle and the superior gluteal nerve branch.[5]

PENG (per capsular nerve group) block is a new modality of regional blocks that provide analgesia by blocking the branches from AON (accessory obturator nerve), nerves from the foramen ovale, and femoral nerve.[6] PENG targets the anterior branches of the hip joint. PENG block usually omits the sensory branches to the femoral nerve appearing distal to the groin. PEGN can achieve the ideal analgesia without affecting muscle strength and help in better functional recovery postoperatively. A marked advantage of PENG block is that it is done in the supine position which is vital and advantageous for subjects having acute hip fractures or chronic pain.[7] Most of the studies conducted on hip surgeries are either short-term or case reports. Hence, the present study was done to assess the efficacy of ultrasound-guided perivascular nerve group block to ultrasound-guided fascia iliaca block technique for positioning the subjects for hip fracture.

MATERIALS AND METHODS

The present prospective observational study was done to assess the efficacy of ultrasound-guided perivascular nerve group block to ultrasound-guided fascia iliaca block technique for positioning the subjects for hip fracture. The study was done at Department of Anaesthesiology, Shri Shankaracharya Institute of Medical Sciences, Bhilai, Durg, Chhattisgarh. The study population was comprised of subjects undergoing hip fracture surgeries at the Institute under spinal anesthesia.

The study included 160 subjects in the age range of 18 years to 80 years, operating within the defined study period, posted for surgical treatment of hip fractures, and gave consent for study participation. The exclusion criteria for the study were subjects having blood diathesis, altered coagulation profile, pregnant and lactating females, and subjects not willing to participate in the study. After explaining the detailed study design, informed consent was taken from all the subjects in both written and verbal format.

After the final inclusion of the study subjects, 160 subjects were divided into two groups of 80 subjects each where Group I was given ultrasound-guided fascia iliac block and Group II subjects were given per capsular nerve block for perioperative analgesia. Group, I subjects

were given 25 ml of 0.25% Bupivacaine injection in fascia iliaca block with the help of ultrasound-assisted landmarks including Fascia lata, Iliacus bone and muscle, sartorius muscle, internal oblique muscle, and fascia iliaca by point of injection between iliacus muscle and fascia iliaca.

For Group II, subjects were given PENG as pericapsular nerve block with 25 ml of 0.25% bupivacaine using the ultrasound-guided landmarks including Pectineus muscle, femoral artery, Iliopsoas tendon and muscle, Ilio-pubic eminence, anterior inferior iliac spine, and point of injection at Musculo fascial plane between Ilio-pubic eminence and Psoas tendon.

After the subject was shifted to the surgical room following routine preparation and surgical sterilization protocols, SpO2, mean arterial pressure, blood pressure (both systolic and diastolic), and heart rate were recorded at baseline for all the subjects of both groups. This was followed by a pre-decided intervention for the two groups. After placing subjects for spinal anesthesia following pre-anesthetic evaluation, a subarachnoid spinal block was given after recording the VAS scores.

After the completion of the surgical procedure, subjects were shifted to the postoperative recovery room and the pain relief duration was noted by communication with the subjects at 0 hours (time of block), 2, 4, 6, 8, 12, and 24 hours. The data collected were assessed statistically using logistic regression and multivariate statistical techniques. The data were presented in tabulated and descriptive formats. SPSS version 22.0, 2013, Armonk, NY: IBM Corp and chi-square and Man-Whitney U test were utilized. The data were expressed as mean and standard deviations and as percentages and numbers with a 0.05% significance level.

RESULTS

The present prospective observational study was done to assess the efficacy of ultrasound-guided perivascular nerve group block to ultrasound-guided fascia iliaca block technique for positioning the subjects for hip fracture. 160 subjects were divided into two groups of 80 subjects each where Group I was given ultrasound-guided fascia iliac block and Group II subjects were given per capsular nerve block for perioperative analgesia. The mean age of study subjects was 51.26±23.29 years for Group I and 55.41±21.39 years for group II which was comparable with p=0.46. The subjects in ASA status I, II, and III were comparable between the two groups with p=0.82. There were 60% (n=48) males and 40% (n=32) females in group I and 52.5% (n=42) males and 47.5% (n=38) females in Group II. This was statistically non-significant with p=0.21. The mean weight of the study subjects was comparable in the two groups with p=0.56. Proximal femur fracture was seen in 25% (n=20) subjects of Group I and 17.5% (n=14) subjects of Group II, and the intertrochanteric fracture was seen in 42.5% (n=34) subjects of group I and 40% (n=32) subjects of group II, and femur neck fracture in 22.5% (n=18) subjects of group I and 32.5% (n=26) subjects of Group II as seen in Table 1.

For the VAS scores, before nerve block, VAS scores were comparable in both groups with p=0.97. 30 minutes following block at rest, VAS scores were 3.4±1.2 for FIB (fascial iliaca block) and 0.9±0.4 with PENG block which was significantly higher for group I with p<0.001. 30 minutes following block, during hip movement and positioning, mean VAS scores were significantly higher for Group I than Group II with p<0.001 for both. Mean pain reduction following block was significantly higher for Group II, PENG compared to FIB (Group I) with p<0.001. At 0 hour, 30 minutes, 1 hour, 4 hours, 12 hours, and 24 hours post-surgery, VAS scores were statistically non-significant between two groups with respective p-values of 0.4, 0.69, 0.74, 0.41, 0.42, and 0.47 and shows a gradual increase with passing time. Postoperative analgesia duration was significantly higher for Group II (PENG block),

502.23±42.6 compared to Group I (FIB), 491.4±42.55. This difference was statistically non-significant with p=0.08 as depicted in Table 2.

On assessing various vitals at baseline and the following positioning in the study participants, it was seen that SpO2 at baseline and positioning was higher for Group II compared to Group I with respective p-values of 0.08 and 0.95. Heart rate at baseline was 79.36±10.3 for Group I and was lesser, 78.43±10.3 for Group II. This difference was statistically non-significant with p=0.51. Mean arterial pressure at baseline was 80.25±9.5 for Group I and 78.15±9.6 for Group II which was non-significant with p=0.34. At positioning, mean arterial pressure was 83.6±8.4 and 90.65±6.2 for Groups I and II respectively which was also statistically non-significant with p=0.36 as shown in Table 3.

For other patient-related parameters, additional fentanyl was not required by any subject of either group. Patient acceptance in Group I was seen in 45% (n=36) subjects and not in 55% (n=44) subjects. In Group II, acceptance was seen in 90% (n=72) subjects and not seen in 10% (n=8) subjects which were significantly higher for Group II compared to Group I. Quality of patient positioning was significantly higher for Group II, 3.135±0.736 compared to group I, 21.65±0.15. This difference was statistically significant with p=0.004 as summarized in Table 4. Analgesics needed were comparable between the two groups. Mobility in both the groups was seen within 6 hours of surgery and no complications were seen in any subject of either group.

DISCUSSION

The mean age of study subjects was 51.26±23.29 years for Group I and 55.41±21.39 years for group II which was comparable with p=0.46. The subjects in ASA status I, II, and III were comparable between the two groups with p=0.82. There were 60% (n=48) males and 40% (n=32) females in group I and 52.5% (n=42) males and 47.5% (n=38) females in Group II. This was statistically non-significant with p=0.21. The mean weight of the study subjects was comparable in the two groups with p=0.56. Proximal femur fracture was seen in 25% (n=20) subjects of Group I and 17.5% (n=14) subjects of Group II, and the intertrochanteric fracture was seen in 42.5% (n=34) subjects of group I and 40% (n=32) subjects of group II, and femur neck fracture in 22.5% (n=18) subjects of group I and 32.5% (n=26) subjects of Group II. These data were compared to the studies of Unneby A et al[8] in 2017 and Haines L et al[9] in 2012 where authors assessed subjects with demographics comparable to the present study.

The VAS scores, before nerve block, VAS scores were comparable in both the groups with p=0.97. 30 minutes following block at rest, VAS scores were 3.4±1.2 for FIB (fascial iliaca block) and 0.9±0.4 with PENG block which was significantly higher for group I with p<0.001. 30 minutes following block, during hip movement and positioning, mean VAS scores were significantly higher for Group I than Group II with p<0.001 for both. Mean pain reduction following block was significantly higher for Group II, PENG compared to FIB (Group I) with p<0.001. At 0 hour, 30 minutes, 1 hour, 4 hours, 12 hours, and 24 hours post-surgery, VAS scores were statistically non-significant between two groups with respective p-values of 0.4, 0.69, 0.74, 0.41, 0.42, and 0.47 and shows a gradual increase with passing time. Postoperative analgesia duration was significantly higher for Group II (PENG block), 502.23±42.6 compared to Group I (FIB), 491.4±42.55. This difference was statistically non-significant with p=0.08. These results were consistent with the findings of Vermeylen K et al[10] in 2018 and Shankar K et al[11] in 2020 where authors reported better outcomes were seen in the PENG group with higher analgesia duration and better analgesic effects than the FIB group along with lesser VAS scores showing better pain control.

Concerning various vitals at baseline and following positioning in the study participants, it was seen that SpO2 at baseline and positioning was higher for Group II compared to Group I with respective p-values of 0.08 and 0.95. Heart rate at baseline was 79.36±10.3 for Group I and was lesser, 78.43±10.3 for Group II. This difference was statistically non-significant with p=0.51. Mean arterial pressure at baseline was 80.25±9.5 for Group I and 78.15±9.6 for Group II which was non-significant with p=0.34. At positioning, mean arterial pressure was 83.6±8.4 and 90.65±6.2 for Groups I and II respectively which was also statistically non-significant with p=0.36. These vitals results were in agreement with the results of Bhattacharya A et al[12] in 2019 and Yamada K et al[13] in 2020 where authors suggested a non-significant change in vitals from baseline with either FIB or PENG block.

In patient-related parameters, additional fentanyl was not required by any subject of either group. Patient acceptance in Group I was seen in 45% (n=36) subjects and not in 55% (n=44) subjects. In Group II, acceptance was seen in 90% (n=72) subjects and not seen in 10% (n=8) subjects which were significantly higher for Group II compared to Group I. Quality of patient positioning was significantly higher for Group II, 3.135±0.736 compared to group I, 21.65±0.15. This difference was statistically significant with p=0.004. Analgesics needed were comparable between the two groups. Mobility in both the groups was seen within 6 hours of surgery and no complications were seen in any subject of either group. These findings were similar to the studies of Ueshima H[14] in 2018 and Guay J et al[15] in 2017 where authors reported better patient acceptance and quality with PENG compared to FIB.

CONCLUSION

Considering its limitations, the present study concludes that the PENG block has better analgesic effects along with higher patient satisfaction and optimal positioning compared to the fascia iliaca block for the central neuraxial block for subjects undergoing hip fracture surgeries. Also, PENG had a better safety profile and comparable postoperative analgesia as with fascia iliaca block. The limitations of this study were smaller considered population, shirt monitoring, and biased related to the geographic location warranting further long-term studies planned longitudinally.

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TABLES

Demographics	**Group I (n=80) FIB**	**Group II (n=80) PENG**	**p-value**
Mean age (years)	51.26±23.29	55.41±21.39	0.46
ASA status			
I	22 (27.5)	18 (22.5)	0.82
II	48 (60)	46 (57.5)	
III	10 (12.5)	16 (20)	
Gender			
Males	48 (60)	42 (52.5)	0.21
Females	32 (40)	38 (47.5)	
Mean Weight (kg)	64.1±12.9	62.3±15.52	0.56
Fracture type			
Proximal femur	20 (25)	14 (17.5)	0.51

Intertrochanteric	34 (42.5)	32 (40)	
Femur neck	18 (22.5)	26 (32.5)	

Table 1: Demographic data of the two groups of the study subjects

VAS scores	Group I (n=80) FIB	Group II (n=80) PENG	p-value
Before nerve block	8.3±0.63	8.6±0.56	0.97
30 minutes following block (rest)	3.4±1.2	0.9±0.4	<0.001
30 minutes following block (dynamic hip movement)	3.3±1.4	0.9±0.4	<0.001
30 minutes following block (during positioning)	3.3±1.7	0.9±0.7	<0.001
Mean Pain reduction	6.2±1.3	8.5±0.7	<0.001
0 min	0.7±0.36	0.06±0.36	0.4
30 min	1.7±0.85	1.94±0.6	0.69
1 hour	2.2±0.67	1.85±0.93	0.74
4 hours	2.52±1.14	2.93±1.36	0.41
12 hours	6.7±1.36	6.65±1.35	0.42
24 hours	6.9±1.4	6.7±1.3	0.47
Postoperative analgesia duration (min)	491.4±42.55	502.23±42.6	0.08

Table 2: VAS scores at different time intervals, mean pain reduction, and postoperative analgesia in study subjects

Vitals	Group I (n=80) FIB	Group II (n=80) PENG	p-value
SpO2 at positioning	98.37±1.19	98.66±1.04	0.95
SpO2 at baseline	82.4±8.6	89.66±6.8	0.08
Mean arterial pressure (baseline)	80.25±9.5	78.15±9.6	0.34
Mean arterial pressure (at positioning)	83.6±8.4	90.65±6.2	0.36
Heart rate	79.36±10.3	78.43±10.3	0.51

Table 3: Vital parameters at baseline and during positioning of the study subjects

Vitals	Group I (n=80) FIB	Group II (n=80) PENG	p-value
Additional Fentanyl requirement	-	-	-
Patient acceptance			
Yes	36 (45)	72 (90)	
No	44 (55)	8 (10)	
Quality of subject positioning	21.65±0.15	3.135±0.736	0.004

Table 4: Additional fentanyl dose, patient acceptance, and quality of subjects with two blocks