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COMPARATIVE ASSESSMENT OF THE EFFICACY OF TWO DOSES OF 0.25% BUPIVACAINE FOR PERICAPSULAR NERVE BLOCK FOR POSITIONING SUBJECTS FOR A SUBARACHNOID BLOCK FOR HIP FRACTURE SURGERY

Dr. Sandhya Kashyap Kawachi,[1] Dr. Shrikant Gopal Lanje [2*]

[1]Associate Professor, Department of Anesthesiology, Gouri Devi Institute of Medical Sciences & Hospital, Durgapur, West Bengal
[2*]Assistant Professor, Department of Anesthesiology, Rama Medical College Hospital &Research Centre, Hapur, Uttar Pradesh

Corresponding Author

Dr. Shrikant Gopal Lanje

Email Id- Shri2481@gmail.com

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ABSTRACT

Background: PENG (peri-capsular nerve block) is an ultrasound-guided nerve block procedure that is commonly used to provide regional anesthesia in patients with hip fractures.

Aim: The current study sought to compare the efficacy of two doses of 0.25% bupivacaine (15 mL and 20 mL) for pericapsular nerve block in ultrasound-guided PENG block for positioning participants for subarachnoid block for hip fracture surgery.

Methods: The research examined 120 patients receiving hip fracture surgery under subarachnoid block. The PENG block was performed using an ultrasound-guided technique with individuals lying supine. The individuals were separated into two groups of 60 each, with Group I receiving 20 mL of 0.25% bupivacaine and Group II receiving 15 mL. The simplicity of placing the individuals was evaluated and contrasted when administering subarachnoid block. Pain was measured in two groups using VAS at rest and 15-degree leg lifts at baseline, 10, and 20 minutes after the block.

Result: Group I had a substantially higher mean ease of placement for subarachnoid block (2.45±0.75, 95% CI 2.17-2.67) than Group II (1.84±0.64, 95% CI 1.63-2.3, p=0.001). Group I showed a substantial decrease in pain levels using VAS compared to Group II at rest and 15 leg lift postures at all evaluation periods ($p<0.05$). **Conclusions**: The current study found that 20 mL of 0.25% bupivacaine produced better surgical results than 15 mL of 0.25% bupivacaine in terms of patient placement during subarachnoid block during hip fracture procedures. Keywords: analgesia, anesthetic, bupivacaine, ease of positioning, hip fractures, and PENG

INTRODUCTION

Fracture of the hip joints is a common problem observed by orthopedic surgeons throughout their practice with

elderly patients. A greater prevalence is observed in the elderly worldwide, especially in India. Surgical reduction and fixation are the definitive treatments for hip joint fractures.

The greatest cause of morbidity in people with hip joint fractures is related with considerable pain, which makes positioning problematic during the administration of the subarachnoid block during surgical treatment.1,2 Perioperative analgesia and subject positioning for spinal nerve administration typically necessitate the use of regional nerve blocks such as FIB (fascia iliaca block) and FNB (femoral nerve block), which are not adequately affected because they are located near the inferno-medial acetabulum.3

PENG, or pericapsular nerve block, is a traditional and unique approach established in 2018 by Giron-Arango et al for providing regional anesthetic during the treatment of hip fractures. PENG is an ultrasound-guided procedure for anesthetizing the articular branches of the accessory spinal nerve, femoral nerve, and spinal nerve.4,5 The local anesthetic is applied at the Musculo-fascial plane, between the pubic ramus and the psoas muscle. There is limited research on the assessment of different amounts of local anesthetic drugs for the delivery of PENG blocks. Different researchers have evaluated local anesthetic amounts ranging from 10 mL to 30 mL at various doses in the PENG block.6,7

The current clinical trial sought to compare the efficacy of two doses of 0.25% bupivacaine (15 mL and 20 mL) for pericapsular nerve block in ultrasound-guided PENG block for pain relief and positioning patients for subarachnoid block for hip fracture surgery.

MATERIALS AND METHODS

The current randomized controlled clinical comparison trial sought to evaluate the efficacy of two doses of 0.25% bupivacaine (15 mL and 20 mL) for pericapsular nerve block in ultrasound-guided PENG block for pain relief and positioning individuals for subarachnoid block for hip fracture surgery. The study was conducted after receiving authorization from the relevant institutional ethical committee. Participants in the research were from the Institute's Department of Orthopedic Surgery.

All individuals provided verbal and written informed permission before participating in the study. The study evaluated 120 patients of both genders between the ages of 40 and 85, with a BMI of 18.5 to 29.9 kg/m2, an ASA (American Society of Anesthesiologists) physical status of I-III, and a willingness to participate in the study.

The study excluded participants with parturients, neuropathies, coagulopathies, infection at the puncture site, refusal of spinal anesthetic, and refusal to provide permission for study participation. The 120 participants who satisfied the inclusion criteria were randomly split into two groups of 60 subjects each.

Group I individuals received 20 mL of 0.25% bupivacaine for PENG block, whereas Group II received 15 mL. All of the blocks in both groups were administered by the same anesthesiologist, who was well-versed in the anesthetic method. The anesthesiologist who administered the block differed from the anesthesiologist who treated the participants intraoperatively. The anesthesiologist who cared for the individuals during surgery took note of the research parameters. All individuals were given extensive information regarding their VAS (visual analog scale) scores on a numeric range of 0 to 10, with 0 denoting no pain and 10 denoting the greatest possible discomfort.

During the procedure, monitors such as a pulse oximeter (SpO2), a 5-lead continuous ECG (electrocardiogram), and a non-invasive blood pressure (NIBP) were installed. Under aseptic and sterile settings, the individuals were positioned supine, and a 3-5 MHz curvilinear ultrasound probe was inserted at the anterior inferior iliac spine and guided towards the pubic ramus. The probe was then advanced caudally and medially to reveal the superficial pulsing femoral artery above the iliacus muscle, pubic ramus, iliopsoas muscle and tendon, and IPE (ilio-pubic eminence).

After injecting the local anesthetic agent into the needle entry point using a 23-gauge spinal needle, the needle was moved in an in-plane lateral to medial direction until it reached the ilio-pubic eminence. Then, in Groups I and II, 20 mL or 15 mL of 0.25% bupivacaine was administered between the iliopsoas tendon and the ilio-pubic eminence, respectively. Following assessing all of the research parameters, a subarachnoid block was administered 20 minutes following the PENG block. The study's primary result was the convenience of situating the participants with the hip fracture to deliver the subarachnoid block.

The ease of positioning was graded as Grade 0, 1, 2, and 3, respectively, as not satisfactory when the patient is extremely uncomfortable, complains of pain, and has a VAS score of 8-10 during positioning, satisfactory when the patient is uncomfortable and needs support for positioning, and VAS scores of 4-7. Good if the patient is comfortable, has minimum positional assistance, and has a VAS score of 1-3; optimal if the patient is comfortable, requires no support, and has a VAS score of zero. Block failure was determined when the subject had ease of positioning for Grade 0 for doing the subarachnoid block with the patient being highly uncomfortable, pain complaint, and VAS score of 8-10 during patient positioning.

The secondary aim was to measure pain at rest and with 15o leg lifts at baseline before block (T0), 10 minutes after block (T10), and 20 minutes after block (T20) using VAS ratings. The collected data were statistically analyzed using the SPSS software version 21.0 (IBM Corp., Armonk, NY, USA) and the chi-square test. The data were presented as mean and standard deviation, 95% confidence interval (CI), frequency, and percentage. Statistical significance was maintained at a p-value < 0.05.

RESULTS

The current randomized controlled clinical comparison trial sought to evaluate the efficacy of two doses of 0.25% bupivacaine (15 mL and 20 mL) for pericapsular nerve block in ultrasound-guided PENG block for pain relief and positioning individuals for subarachnoid block for hip fracture surgery. The 120 participants who satisfied the inclusion criteria were randomly split into two groups of 60 subjects each. Group I individuals received 20 mL of 0.25% bupivacaine for PENG block, whereas Group II received 15 mL. The average age of study participants in Groups I and II was 70.48±2.12 and 71.02±1.88 years, respectively.

In Group I, there were 56.66% (n=34) men and 43.33% (n=26) females, whereas Group II included 50% (n=30) males and 50% (n=30) females. In Group I, there were 23.33% (n=14) patients with ASA status I and 76.66% (n=46) with ASA status II, whereas Group II had 16.66% (n=10) with ASA status I and 83.33% (n=50) with ASA level II.

Table 1 shows that sub-trochanteric fractures were detected in 33.3% (n=20) and 56.6% (n=34) participants from Group I and II, respectively, whereas inter-trochanteric fractures were seen in 66.66% (n=40) and 43.33% (n=26) subjects from Group I and II. All demographics were comparable between the two groups, with statistically insignificant variations.

The study found that Group I had a significantly higher mean ease of positioning for subarachnoid block (2.45±0.75 with 95% CI of 2.17-2.67) than Group II (1.84±0.64 with 95% CI of 1.63-2.3, p=0.001). Grade I ease of positioning was seen in 13.33% (n=8) and 26.66% (n=16) participants from Groups I and II, respectively. Grade 2 was greater in 60% (n=36) subjects from Group II and 26.66% (n=16) subjects from Group I, while Grade 3 was higher in 60% (n=36) individuals from Group I and 13.33% (n=8) subjects from Group II.

The difference was statistically significant ($p = 0.001$). 13.33% (n=8) of Group I respondents required assistance during positioning, whereas 26.66% (n=16) of Group II subjects did as well. 86.66% (n=52) of Group I respondents required minimal or no help, whereas 73.33% (n=44) of Group II subjects did. The change was statistically insignificant (p=0.31), as seen in Table 2.

At T0 (baseline), before administering the block, mean VAS ratings in Group I and Group II research subjects were comparable at rest and in the 15o leg lift position. The block significantly reduced VAS ratings in both groups at T10 (10 minutes after treatment) ($p<0.001$) and T20 (20 minutes later) at rest and 15o leg lift position ($p<0.001$). It was discovered that when the VAS scores of two groups of research subjects were compared at different time intervals, the VAS scores at rest and at baseline were comparable (p=0.262). At T10 and T20, Group II had substantially higher VAS values at rest than Group I (p=0.003 and 0.03, respectively). At the 15o leg lift position, the two groups had equal mean VAS values (p=0.08).

At T10 and T20, Group I had substantially higher mean VAS ratings than Group II (p=0.001 and $p<0.001$, respectively), as shown in Table 3.

DISCUSSION

The current study comprised 120 patients who satisfied the inclusion criteria and were randomly assigned to two groups of 60 subjects each. Group I individuals received 20 mL of 0.25% bupivacaine for PENG block, whereas

Group II received 15 mL. The average age of study participants in Groups I and II was 70.48±2.12 and 71.02±1.88 years, respectively. In Group I, there were 56.66% (n=34) men and 43.33% (n=26) females, whereas Group II included 50% (n=30) males and 50% (n=30) females.

In Group I, there were 23.33% (n=14) patients with ASA status I and 76.66% (n=46) with ASA status II, whereas Group II had 16.66% (n=10) with ASA status I and 83.33% (n=50) with ASA level II. Sub-trochanteric fractures were observed in 33.3% (n=20) and 56.6% (n=34) of Group I and II participants, respectively, whereas inter-trochanteric fractures were observed in 66.66% (n=40) and 43.33% (n=26) of Group I and II patients. All demographics were comparable between the two groups, with statistically insignificant variations. These findings were similar to those of Giron-Arango L et al9 and Yu HC et al10 in 2019, who evaluated participants with demographic data similar to the current research following PENG block for hip fracture procedures.

The study found that Group I had a significantly higher mean ease of positioning for subarachnoid block (2.45±0.75 with 95% CI of 2.17-2.67) than Group II (1.84±0.64 with 95% CI of 1.63-2.3, p=0.001). Grade I ease of positioning was seen in 13.33% (n=8) and 26.66% (n=16) participants from Groups I and II, respectively. Grade 2 was greater in 60% (n=36) subjects from Group II and 26.66% (n=16) subjects from Group I, while Grade 3 was higher in 60% (n=36) individuals from Group I and 13.33% (n=8) subjects from Group II. The difference was statistically significant (p = 0.001).

13.33% (n=8) of Group I respondents required assistance during positioning, whereas 26.66% (n=16) of Group II subjects did as well. 86.66% (n=52) of Group I respondents required minimal or no help, whereas 73.33% (n=44) of Group II subjects did. The change was statistically insignificant, with p=0.31. These findings are congruent with those of Ahiskalioglu A et al11 in 2020 and Ahiskalioglu A et al12 in 2019, who found improved positioning with 20 mL of 0.25% bupivacaine compared to 15 mL of 0.25% bupivacaine, as demonstrated in the current investigation.

The study found that at T0 (baseline), before administering the block, mean VAS ratings in Group I and Group II study subjects were comparable at rest and in the 15o leg lift position. The block significantly reduced VAS ratings in both groups at T10 (10 minutes after treatment) (p<0.001) and T20 (20 minutes later) at rest and 15o leg lift position (p<0.001).

These findings were consistent with the findings of Ahiskalioglu A et al13 in 2019 and Bilal B et al14 in 2020, who, like the current study, observed a substantial decrease in pain following PENG block compared to baseline (before providing anesthetic).

In terms of comparing VAS ratings in two groups of research subjects at different time intervals, VAS values at rest and baseline were similar in both groups (p=0.262). At T10 and T20, Group II had substantially higher VAS values at rest than Group I (p=0.003 and 0.03, respectively). At the 15o leg lift position, the two groups had equal mean VAS values (p=0.08).

However, at T10 and T20, Group I had substantially higher mean VAS values than Group II (p=0.001 and <0.001, respectively). These findings were consistent with the studies of Ayub A et al15 in 2020 and Lin DY et al16 in 2021, who found considerably superior pain relief with 20 mL of 0.25% bupivacaine in PENG block.

CONCLUSIONS

Considering its limitations, the present study concludes that better surgical outcomes are seen with 20 mL of 0.25% bupivacaine compared to 15 mL of 0.25% bupivacaine concerning the ease of positioning the patients during subarachnoid block during hip fracture surgeries. However, further longitudinal studies with larger sample sizes and longer monitoring are needed in the future.

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TABLES

S. No	Characteristics	Group I (n=60)	Group II (n=60)
1.	**Mean age (years)**	70.48±2.12 (55.73-79.23)	71.02±1.88 (63.98-71.83)
2.	**Gender**		
a)	Males	34 (56.66)	30 (50)
b)	Females	26 (43.33)	30 (50)
3.	**ASA status**		
a)	I	14 (23.33)	10 (16.66)
b)	II	46 (76.66)	50 (83.33)
4.	**Fracture type**		
a)	Sub-trochanteric	20 (33.33)	34 (56.66)
b)	Inter-trochanteric	40 (66.66)	26 (43.33)

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

S. No	Parameters	Group I (n=60)	Group II (n=60)	p-value
1.	**Ease of positioning**	2.45±0.75 (2.17-2.67)	1.85±0.64 (1.63-2.3)	**0.001**
2.	**Grades for EOP**			
a)	1	8 (13.33)	16 (26.66)	**0.001**
b)	2	16 (26.66)	36 (60)	
c)	3	36 (60)	8 (13.33)	
3.	**Positioning support**			
a)	Required	8 (13.33)	16 (26.66)	0.31
b)	Minimal/no support is needed	52 (86.66)	44 (73.33)	

Table 2: Comparison of ease of positioning for subarachnoid block in the two groups of study subjects

S. No	Parameters	Time	Group I (n=60)	Group II (n=60)	p-value
1.	**VAS at rest**	**T0**	6.7±0.78 (6.61-7.17)	7.15±1.06 (6.75-7.56)	0.262
		T 10	1.11±0.55 (0.90-1.33)	1.61±0.69 (1.36-1.89)	**0.003**
		T 20	0.31±0.45 (0.14-0.49)	0.95±0.49 (0.27-0.63)	**0.03**
2.	**VAS at 15^{o} leg raise**	**T0**	9.94±0.16 (9.87-10)	9.6±0.48 (9.62-9.92)	0.08
		T 10	5.5±1.46 (5.15-6.23)	6.81±0.96 (6.44-7.17)	**0.001**
		T 20	2.7±1.62 (2.27-3.3)	5.51±1.10 (5.10-5.89)	**<0.001**

Table 3: Comparison of VAS scores in two groups of study subjects at different time intervals