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Original article:

A prospective observational study to determine the efficacy of ultrasound guided pericapsular nerve group block for positional pain in hip fractures

***Dr. Namitha Mariam John, Dr. Shital Dalal, Dr. Vaishali C. Shelgaonkar**

Department of Anaesthesiology
Indira Gandhi Government Medical College and Hospital, Nagpur
Corresponding author *

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Abstract:

Ultrasound guided femoral nerve block, fascia iliaca compartment block, and femoral 3-in-1 block are the commonest nerve blocks used for relieving positional pain in hip fractures. The study aimed to evaluate the efficacy and safety of the PENG (Psoas compartment, Erector spinae, Nerve of T9) block for spinal anesthesia in patients undergoing lower abdominal surgeries. A total of 60 patients were included in the study and were divided into two groups - the PENG group (n=30) and the Control group (n=30). The mean age in the PENG group was 58.3±4.81 years, while in the Control group, it was 59.73±3.95 years. The age group distribution was comparable between the two groups. The results showed that patients in the PENG group had significantly better co-operation for spinal anesthesia as compared to the Control group. 96% of patients in the PENG group could easily give position for spinal anesthesia, while none of the patients in the Control group could do so. The PENG group also had a statistically significant reduction in mean arterial pressure post-block administration, with no significant hypotension or other complications observed.The study concluded that the PENG block can be a safe and effective alternative to traditional techniques for spinal anesthesia in lower abdominal surgeries. The PENG block resulted in significantly better co-operation for positioning and lower means arterial pressure post-block administration, indicating its potential as a safer option for patients with compromised cardiovascular function. Further studies are recommended to establish the long-term efficacy and safety of the PENG block.

Keywords: PENG block, spinal anesthesia, hemodynamics, vitals, complications.

Introduction:

Ultrasound guided femoral nerve block, fascia iliaca compartment block, and femoral 3-in-1 block are the commonest nerve blocks used for relieving positional pain in hip fractures[1]. However, recent anatomical studies have shown that the articular branches of both the femoral and the obturator nerve which innervate the hip

capsule, originate at a higher level along the course of the nerve and may not be optimally blocked by these techniques making femoral block or the fascia iliaca compartment block insufficient for hip analgesia.[2] The elderly population, who are more likely to present with injuries to the hip and pelvis, tend to have atrophied muscles with less definable fascia, making it more difficult to identify landmarks for femoral nerve and fascia iliaca compartment blocks[3]. Although the probability of injecting anaesthetic into the epineurium with the femoral nerve block is minimized with the use of ultrasound, there is still a risk.[4,5,6] These blocks also caused a degree of motor blockade, which delayed post-operative mobilization.

The pericapsular nerve group (PENG) block has recently been proposed as a novel method to treat pain due to hip or pelvis fractures as an alternative to other nerve blocks. It targets, with a single injection, the nerves supplying the anterior hip capsule- terminal sensory articular nerve branches of the femoral nerve (FN), obturator nerve (ON), and accessory obturator nerve (AON) [7]. The PENG block targets the more clearly defined ilium as a tactile backstop instead of an intermuscular fascial plane or nerve sheath, which may theoretically increase the likelihood of a successful block and decrease the incidence of intramuscular injection or direct nerve injury[8]. In addition, blocking nociceptive nerve branches instead of motor branches helps in adequate positioning of the patient and in further analysis of the motor effects after administration of spinal or epidural anaesthesia. Although still in its infancy, multiple case reports have shown the potential of the PENG block to successfully reduce pain in hip fractures as well as reduce opioid consumption essential in the elderly patient cohort. Current evidences of using PENG block for hip pain are limited to case reports and case series only. Hence, this study is being done to analyze the efficacy of the block as well as to monitor its effects on administration of spinal anaesthesia and other hemodynamic parameters of the patient.

Material and methods:

The present study was a prospective observational study that aimed to determine the efficacy of pericapsular nerve group block for positional pain in hip fractures. The study was conducted in the Department of Anaesthesiology at a tertiary care hospital from September 2020 to September 2022. The study protocol had been approved by the Institutional Ethics Committee (IEC) before its initiation. A total of 60 patients were included in the study after applying the inclusion and exclusion criteria.

The inclusion criteria were patients undergoing surgical procedure for hip fracture, patients giving consent for the procedure, ASA GRADE 1-3, age between 18 to 70 years, and weight between 30 to 80kg. The exclusion criteria were patients who did not give consent for regional anesthesia, ASA GRADE 4, patients with coagulation disorders or local infection, history of hypersensitivity reaction to local anesthetic, patients with peripheral neuropathy, sepsis or skin lesion at the site of injection, and patients with no pain during positioning.

The study was designed as a prospective observational study, and the clinical setting was Orthopaedics operation theatre and Department of Anaesthesiology at a tertiary care hospital. Data were collected prospectively, and the patients were observed for any adverse events. The statistical analysis was performed using appropriate tests to determine the efficacy of pericapsular nerve group block for positional pain in hip fractures.

Results:

The mean age in the PENG Group was 58.3 ± 4.81 years with majority of the patients in the age group of 51 to 60 years (63.33%). The mean age in the non- PENG group was 59.73 ± 3.95 years with maximum patients in

the 51-60 years age group (56.67%). Both the groups were comparable with respect to age group distribution (p value by Student t test was insignificant: 0.212).

In the PENG group 10 patients (33.33%) were males and 20 patients (66.67%) were females whereas in non-PENG group 11 patients (36.67%) were males and 19 patients (63.33%) were females.

On comparison of patient co-operation between the two groups, 90% of patients in the PENG group could easily give position for spinal anaesthesia (Grade 1), while 10% patients had mild discomfort while positioning. Not a single patient in the Control group had painless positioning for spinal anaesthesia. 10% patients required additional analgesics for giving position (Grade 4).

Table 1: Best angle for spinal anaesthesia

SPINAL ANAESTHESIA				
	Number	%	Number	%
A	29	96	0	0
B	1	3	0	0
C	0	0	3	10
D	0	0	27	90
Total	30	100	30	100

On positioning for spinal anaesthesia, 96% patients in the PENG group could give adequate flexion on sitting, while no patients in the Control group could do so. 90% patients in the Control Group could not give good flexion and required twisting of hands for support.

TIME	MEAN ARTERIAL PRESSURE (MAP)		P VALUE
	MEAN	S.D	
PRE BLOCK	94.43	1.52	
T5	93.6	1.94	
T10	92.46	1.69	
T15	91.9	2.26	
T20	91.33	2.32	
T25	90.26	1.98	

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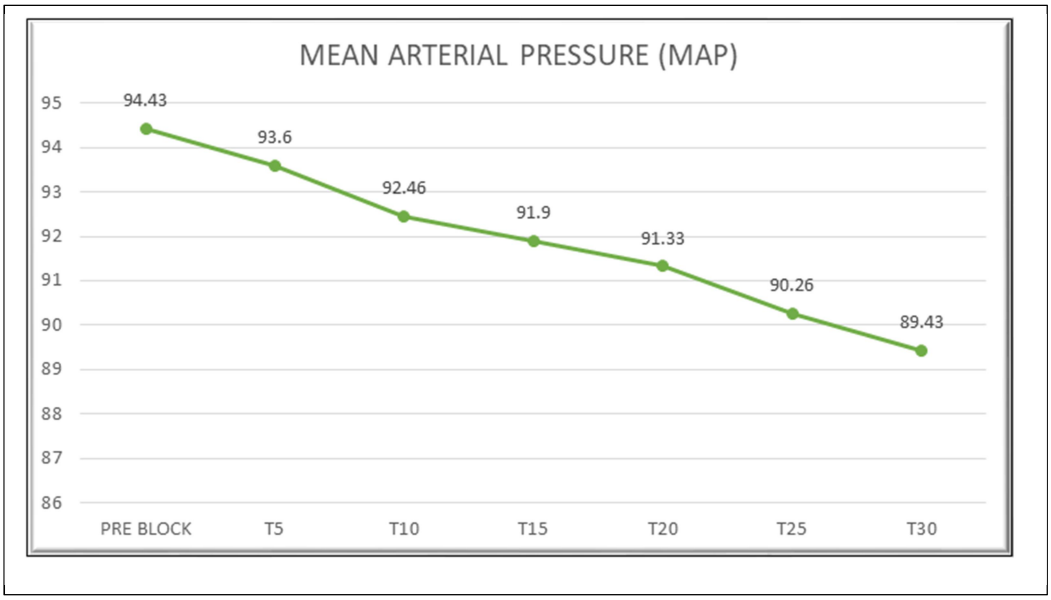
T30	89.43	2.29	P value: <0.0001

Table 2: MAP after administration of PENG Block



Graph 1: MAP after administration of PENG Block

After administration of PENG Block, patients who received the block are monitored for 30 minutes for any hemodynamic variations. On recording of vitals, it was noticed that the mean MAP prior to the administration of the block was 94.43+1.52 mm of Hg. At the end of 30 minutes, the mean MAP is 89.43+2.29 mm of Hg. On comparing the MAP prior to the administration of block and at the end of 30 minutes, the difference was found to be statistically significant. (Paired t test; p value <0.0001). There was a drop in MAP, but there was no significant hypotension to warrant any medical intervention.

The mean respiratory rate prior to administration of the block is 16.57$\pm$1.57/min. The mean respiratory rate 30 minutes after the administration of the block is 16.2$\pm$2.11. On comparison, there was no statistical significance (p value: 0.224) The mean pulse rate prior to administration of the block was 101.93$\pm$7.92/minute. 30 minutes after administration of the block, the mean pulse rate reduced to 92.06$\pm$7.08/minute. This difference was found to be statistically significant (p<0.0001), but not clinically significant to warrant any medical intervention.

On monitoring of saturation, the mean spO2 prior to the administration of the block as tabulated below is 99.03+0.85%. 30 minutes after the administration of the block, the mean spO2 is 98.47+0.86. The difference was analysed with the paired t test and it was found that the difference was not statistically significant (p value: 0.06).

No complications were noticed after the administration of PENG Block.

Discussion:

The present study was designed to determine the efficacy of pericapsular nerve group block (PENG) for positional pain in hip fractures. The study was carried out prospectively in the Department of Anaesthesiology at a tertiary care hospital over a period of two years. A total of 60 patients were studied, and they were divided into two groups: PENG group and Control group.

The results of our study showed that the PENG group had a higher percentage of female patients than male patients. However, there was no statistically significant difference in the age group distribution between the two groups. The majority of patients in both groups were in the age range of 51-60 years. Our study found that patients in the PENG group had a better co-operation and positioning for spinal anaesthesia than the Control group. Almost all patients in the PENG group could easily give position for spinal anaesthesia (Grade 1), while none of the patients in the Control group had painless positioning. In fact, 10% of patients in the Control group required additional analgesics for giving position (Grade 4). Moreover, on positioning for spinal anaesthesia, a higher percentage of patients in the PENG group could give adequate flexion on sitting, while none of the patients in the Control group could do so.

In terms of hemodynamic variations, our study found that there was a statistically significant drop in mean arterial pressure (MAP) after administration of the PENG block. However, this drop was not clinically significant to warrant any medical intervention. There was also a statistically significant reduction in mean pulse rate after administration of the block, but it was not clinically significant. The respiratory rate remained unchanged after administration of the block. (8,9,10)

Our study has some limitations. Firstly, it was an observational study, and we did not have a control group that received a placebo. Secondly, the sample size was relatively small, and the study was conducted in a single center. Therefore, the results may not be generalizable to other populations or settings

In September 2020, Alrefaey et al[11], conducted a randomized controlled study to evaluate Pericapsular Nerve Group Block for analgesia of positional pain during spinal anaesthesia in hip fracture patients. The authors concluded that preoperative PENG block is an effective option to control positioning related pain during spinal anesthesia, improved patient sitting angle, thus decreased the time required for spinal block and improved the anesthesiologist and patient experience.

In August 2021, Tuhin Mistry[12] et al reported a case series study on preemptive pericapsular nerve group block to facilitate sitting position for neuraxial anesthesia in patients with acetabular fractures. It was concluded that PENG block provided adequate analgesia in patients with ACAF, facilitating positioning for the neuraxial block.

Conclusion:

In conclusion, our study provides evidence to support the use of PENG block for patients with hip fractures who require positioning for spinal anaesthesia. The block was found to be safe and effective, and it significantly improved co-operation and positioning for spinal anaesthesia. However, further studies with larger sample sizes and randomized controlled trials are needed to confirm the efficacy and safety of PENG block in this population.

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