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A Prospective Observational Study To Determine The Efficacy Of Ultrasound Guided Pericapsular Nerve Group Block For Positional Pain In Hip Fractures.

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ABSTRACT

Ultrasound guided blocks like femoral nerve block, fascia iliaca compartment block, and femoral 3-in-1 block have been previously used for relieving positional pain in hip fractures. This prospective observational study aimed to evaluate the efficacy and safety of the ultrasound guided PENG (Pericapsular Nerve Group) block for positional pain during spinal anaesthesia in patients with hip fractures. 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 NRS score in PENG Group prior to the administration of the block was 7.66 ± 1.09. The mean NRS score in the Control Group was 7.46 ± 1.04. Both groups had comparable pain scores. The mean block execution time for PENG block was 6.4 ± 0.56 minutes. After the administration of the block, there was 83% reduction in NRS scores by the end of 30 minutes (mean NRS score at 30 minutes was 1.3 ± 0.46). The results showed that patients in the PENG group had significantly better co-operation for spinal anaesthesia as compared to the Control group. 96% of patients in the PENG group could easily give position for spinal anaesthesia, 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 indicating its potential as a safer option for patients with compromised cardiovascular function The study concluded that the PENG block can be a safe and effective alternative to traditional techniques of analgesia for positional pain during spinal anaesthesia in hip fractures.. Further studies are recommended to establish the long-term efficacy and safety of the PENG block.

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

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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 [4-6]. Also, these blocks 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 elective surgical procedures for hip fractures, patients giving consent for the procedure, ASA Grades 1-3 and aged between 18 to 70 years. The exclusion criteria were patients who did not give consent for regional anaesthesia, ASA Grade 4, patients with coagulation disorders or local infection, history of hypersensitivity reaction to local anaesthetics, patients with peripheral neuropathy, sepsis or skin lesion at the site of injection, and patients with no pain during positioning.

The 60 patients were divided into two groups by randomization with 30 patients in each group.

Group PENG (n=30): patients receiving PENG Block

Group non-PENG (n=30): patients who did not receive PENG Block.

Ultrasound guided PENG block was administered 30 minutes prior to the surgery by a trained anaesthesiologist.

The statistical analysis was performed using appropriate tests to determine the efficacy of pericapsular nerve group block for positional pain in hip fractures.

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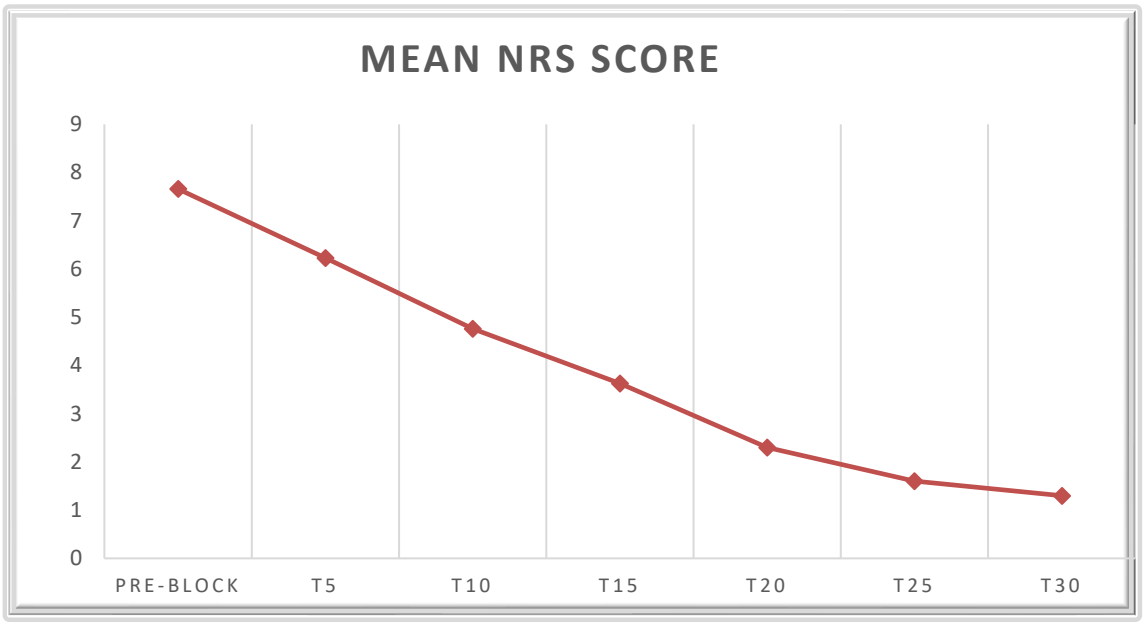
OBSERVATION AND RESULTS

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.

The mean NRS score in PENG Group prior to the administration of the block was 7.66 ± 1.09. The mean NRS score in the Control Group was 7.46 ± 1.04. Both groups had comparable pain scores (p value was not significant: 0.47)

The mean block execution time for PENG block came to about 6.4 ± 0.56 minutes.



Graph 1: NRS scores after administration of PENG Block Block

Following the administration of the block, there was progressive decrease in NRS scores as observed every 5 minutes over 30 minutes. There was 83% reduction in NRS scores by the end of 30 minutes (mean NRS score at 30 minutes was 1.3 ± 0.46). On comparing NRS scores prior to the administration of the block and 30 minutes following administration of block, the difference was found to be statistically significant (Paired t test; p value: <0.001).

NRS scores on dynamic movement was observed 30 minutes after administration of block. Patients were asked to move the affected limb horizontally on the table. On comparing NRS scores on dynamic movement, the mean score in the PENG Group was 0.57±0.63. The mean NRS score in the Control Group was 8.6±0.67 and the difference in NRS scores was found to be statistically significant (Unpaired t test: p value: <0.0001).

Co-operation for positioning by the patient for spinal anaesthesia was assessed on the basis of the following classification.

Grade 1: Sitting without pain and with minimal help
Grade 2: Patient complains of mild pain detected by grimacing or verbal expression
Grade 3: Patient expresses severe pain but can tolerate positioning with help
Grade 4: Patient cannot tolerate positioning and required additional analgesia.

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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 (Grade 2). 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

BEST ANGLE FOR SPINAL ANAESTHESIA	PENG GROUP		CONTROL GROUP	
	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

The best angle obtained by the patient during spinal anaesthesia were categorized into the following categories:

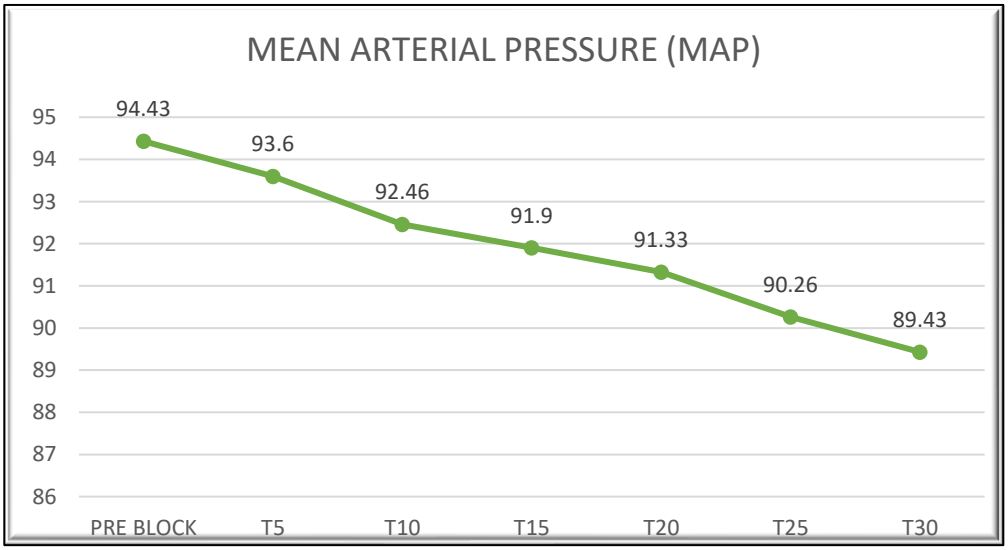
A: Good flexion (angle more than 90)
B: Average flexion (angle less than 90) without twisting or using the hands for support
C: Poor flexion and/or twisting or hand support.

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.

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.

Similarly, pulse rate, saturation and respiratory rates were monitored but there was no statistical difference.

No complications were noticed after the administration of PENG Block.



Graph 2: MAP after 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.

In our study, the difference in age distribution and gender distribution among the two group was not statistically significant. The majority of patients in both groups were in the age range of 51-60 years.

Both the groups had comparable pain scores. The mean block execution time for PENG block was about 6.4 $\pm$ 0.56 minutes. Since the execution time is relatively less, it provides an added advantage to PENG Block in being simple and not time-consuming.

After the administration of the block, the difference in the NRS pain scores became clinically significant by 20 minutes ($p = 0.0005$). There was 83% reduction in NRS scores by the end of 30 minutes (mean NRS score at 30 minutes was 1.3 $\pm$ 0.46).

On comparing NRS scores on dynamic movement, the mean score in the PENG Group was 0.57$\pm$0.63, while in the Control Group it was 8.6$\pm$0.67 which was statistically significant.

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, 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. 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. Although the drop in MAP suggested a reduction in stress response secondary to better analgesia by PENG Block, it was not clinically significant to warrant any medical intervention [8-10]. There was no significant change in pulse rate, respiratory rate and saturation which proved that administration of PENG Block maintained stability of all hemodynamical parameters.

Our findings from the study are in accordance with the studies done by Alrefaey et al [11] in September 2020. They 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.

The results in our study were comparable to the study conducted in August 2021, by Tuhin Mistry [12] et al. They 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 as an effective technique of analgesia for positional pain in hip fracture patients providing good analgesia with good hemodynamic stability and no complications. The PENG block can be considered as a reliable, prudent and satisfying analgesic option for providing analgesia before positioning for neuraxial blockade. It is a suitable alternative to pharmacologic therapy especially in elderly patients with multiple comorbidities. 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.

Limitations

Our study has some limitations It was an observational study, and we did not have a control group that received a placebo. It is a single blinded study which may lead to observer's bias. The sample size was relatively small, and the study was conducted in a single center and hence further randomized study with a larger sample size may be required to strengthen study results.

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