

Ultrasound Guided Pericapsular Nerve Group Block for Analgesia during Positioning for Spinal Anaesthesia and Postoperative Period in Adult Patients Undergoing Hip Fracture Surgeries

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Received: 19-08-2023 / Revised: 24-09-2023 / Accepted: 07-10-2023

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Conflict of interest: Nil

Abstract

Backgrounds: Spinal anaesthesia is a preferred mode of anaesthesia for hip fracture surgeries. Various analgesic technique was used to relieve pain during positioning for spinal anaesthesia, pericapsular nerve group block (PENG) is a relatively newer technique. Articulate branches of anterior hip capsule, which is the main target for analgesia, can be block with PENG technique. So, we conducted this study to evaluate the clinical effect of PENG block for analgesia during positioning for spinal anaesthesia and postoperative period.

Methods: Sixty patients ≥ 18 years with ASA I-III posted for hip fracture surgeries were randomly divided into two groups; patients in Group P received PENG block while in Group C received conventional analgesia. Intra and post operative VAS score, patient acceptance for positioning, anaesthetist satisfaction providing spinal anaesthesia and associated side effects were compared in both groups.

Results: VAS score 10 minutes after performing the block and during positioning for spinal anaesthesia were significantly lower in Group P (1.5 ± 0.44) compare to Group C (7 ± 0.46). Anaesthetist providing spinal anaesthesia had satisfactory level of good or optimal in 27/30 patients in Group P while in Group C it was only 3/30 patients ($p < 0.00001$). Patients 'acceptance for poisoning was higher in group P (27/3 versus 20/10). Postoperative VAS score in both the Group were comparable.

Conclusion: PENG block is easy to perform, motor sparing, effective for positioning during spinal anaesthesia without any complication with better anaesthetist and patients' satisfaction.

Keywords: Hip fracture surgeries, pericapsular nerve groove block, spinal anaesthesia.

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Introduction

Anesthesiologists are commonly encountered with management of hip surgeries. Regional anaesthesia is the preferred technique by many anaesthetist for management of these surgeries [1-4]. Hip surgeries are challenging because it is more common in older

age group and more ever hip fractures are associated with severe pain during positioning for spinal anaesthesia as well as during postoperative period. Elderly patients have multiple comorbidities so they are more prone to side effects of systemic analgesic

which preclude the use of conventional intravenous analgesic technique (like IV opioid). Pain during poisoning for spinal anaesthesia can make spinal procedure more difficult or may lead to patient refusal for the choice of regional anaesthesia. Restriction of limb movement because of pain during postoperative period may increase recovery time and thus length of hospital stay.

Therefore to manage these issues various peripheral nerve blocks of lower extremity like femoral nerve (FN) block, fascia iliaca block (FIB), and 3-in-1 block are widely used in patients with hip fractures [5-7].

Various studies done before suggested that most of the part of anterior capsule of hip joint has nociceptive fibers while posterior capsule contain mechanoreceptors [8]. The anterior hip capsule is innervated by articular branches of femoral nerve, obturator nerve and accessory obturator nerve (AON) as reported by various anatomic studies. [9-14] so these nerves should be the main targets for hip analgesia.

Before innervating the hip capsule, articular branch from femoral nerve invade the iliacus muscle at L4-L5 level and travel deep to the psoas tendon. While around the L5 level, the AON runs deeply to the medial portion of the psoas muscle and then enters the anteromedial joint capsule. According to research conducted by Marhofer P et al. and Swenson JD et al., the cephalated spread of the LA is unlikely to get over L5 level in FICB and 3in1 blocks thus these articular branches are inconsistently blocked by the aforementioned nerve block [15, 16].

So by using these nerve blocks technique we cannot provide adequate analgesia in hip fracture surgeries.

In 2018 pericapsular nerve block (PENG) was first described by Giron- Arango et al. PENG block target the most richly innervated segment of hip joint –anterior capsule by blocking the articular branches of femoral, obturator and accessory obturator nerves [17, 18]. It has been successfully used as an analgesic technique for hip surgery.

Using this information, we had conducted this prospective and observational study to evaluate the analgesic effect of ultrasound guided PENG block for positioning for spinal anaesthesia and postoperative period for hip surgeries.

Aims and Objectives of Study:-

Primary aim of this study was to evaluate the efficacy of Ultrasound guided PENG block for positioning of hip fracture patients during spinal anaesthesia and post-operative analgesia using visual analogue scale (VAS) with secondary outcome to observe satisfaction of anaesthetist performing spinal anaesthesia, patients acceptance for positioning during spinal

procedure, intra operative and postoperative hemodynamic stability and any side effects.

Materials and Methods

After getting IRB approval and informed and written consent this prospective-observational study was conducted in 60 patients with 30 in each group in our hospital. Age \geq 18yrs, either gender, ASA status I-II posted for elective hip fracture surgeries under spinal anaesthesia at our hospital during study period were included in the study. Exclusion criteria were patients (1) with the known case of local anesthetic allergies (2) with coagulopathy (3) who have infection at site of injection (4) with neurological deficits (5) having difficulty to communicate/ neuropsychiatric disorder (6) refusing to participate in the study. Using closed envelope technique Patients were allocated in two groups- group P and C. Patients in Group P received PENG block. Group C is a control group, in which patients received conventional analgesia. Standard hospital protocol regarding medical optimisation, intravenous line placement, premedication, and antibiotic prophylaxis were followed. After arriving in operation theatre monitors for non-invasive blood pressure, electrocardiogram (ECG), and pulse oximetry (SPO2) were attached. VAS score at rest and before performing PENG block (for group P) or giving conventional analgesic (for group C) were assessed. VAS score is described in appendix. Injection diclofenac 75mg intravenous were given to the patients in Group C. While Patients in group P received ultrasound guided PENG block. Block is performed with the patient in supine position. After taking all aseptic and sterile precaution a curvilinear probe was placed on anterior superior iliac spine (ASIS) than probe was moved caudally to see anterior inferior iliac spine (AIIS), following that probe was moved medially and accordingly to get a clear picture of superior pubic ramus. After getting hyper echoic shadow of pubic ramus psoas tendon was identified just above it, plane between this two structures was our target of entry. We used in plane technique and 25 gauge Quincke needle was introduced laterally and 10 ml of 0.25 % bupivaine and 10 ml of 1% lignocaine were administered. Spread of local anaesthetics between psoas tendon and pubic ramus were noted. Any side effects like local anaesthetic toxicity, local hematoma were noted and managed accordingly. Spinal anaesthesia with 0.5% bupivacaine were given to the patients in both the groups. VAS scores ten minutes after the procedure, at the time of positioning for Spinal anaesthesia and during postoperative period were assessed in both the group. Quality of patient positioning were assessed by anaesthetist giving spinal anaesthesia (0=not satisfactory, 1=satisfactory, 2=good, 3=optimal). Patient acceptance (yes/no) about positioning was noted.

Postoperative complication and time to give first rescue analgesia were observed.

Statistical Methods:-

We used the Statistical Package for the Social Sciences for Windows (SPSS version 20, inc., Chicago, IL, USA). We used chi-square test for categorical values and student’s *t*-test for numerical values. P values of less than 0.05 was considered significant.

Results:-

In our study we included 60 patients posted for hip surgeries, 30 patients in each group. The demographic characteristics of both the groups were presented in Table 1. Demographic data were comparable in both the group. There was no

statistical difference in VAS score for pain before nerve block between Group P (7.6±0.45) and Group C (7.5±0.4) (p =0.36) (Table 2). VAS score 10 minutes after performing the block and during positioning for spinal anaesthesia were significantly lower in Group P (1.5±0.44) compare to Group C (7±0.46). Anaesthetist providing spinal anaesthesia had satisfactory level of good or optimal in 27/30 patients in Group P while in Group C it was only 3/30 patients (p < 0.00001) (Table 3). Patients’ acceptance for poisoning was higher in group P (27/3 versus 20/10) [chart 1]. Postoperative VAS score in both the Group were not statistically significant (Table 4). Time required for first rescue analgesia was comparable in both the group (6 hours in both groups). There were no any complications noted in both the groups, no motor weakness was noted in any group.

Table 1: Demographic parameters

Variables	Group P (MEAN ± SD)	Group C (MEAN ± SD)	P value
Age (years)	51.8±12.1	52.7±13.9	0.79
Gender (male: female)	22:8	27:3	0.39
ASA Status (I:II:III)	12:15:03	15:13:02	1.000

Table 2: Intraoperative VAS Score

Variables	VAS score (MEAN ± SD)		P value
	Group P	Group C	
Before nerve block	7.6±0.45	7.5±0.4	0.36
10 minutes after nerve block	1±0.5	6±0.5	0.0001
During positioning for spinal anaesthesia	1.5±0.44	7±0.46	0.0001

Table 3: Anesthetist Satisfaction level

Satisfaction level	Group P (no of patients)	Group C (no of patients)	P value
Not satisfactory	01	10	<0.00001
Satisfactory	02	17	
Good	20	02	
Optimal	07	01	

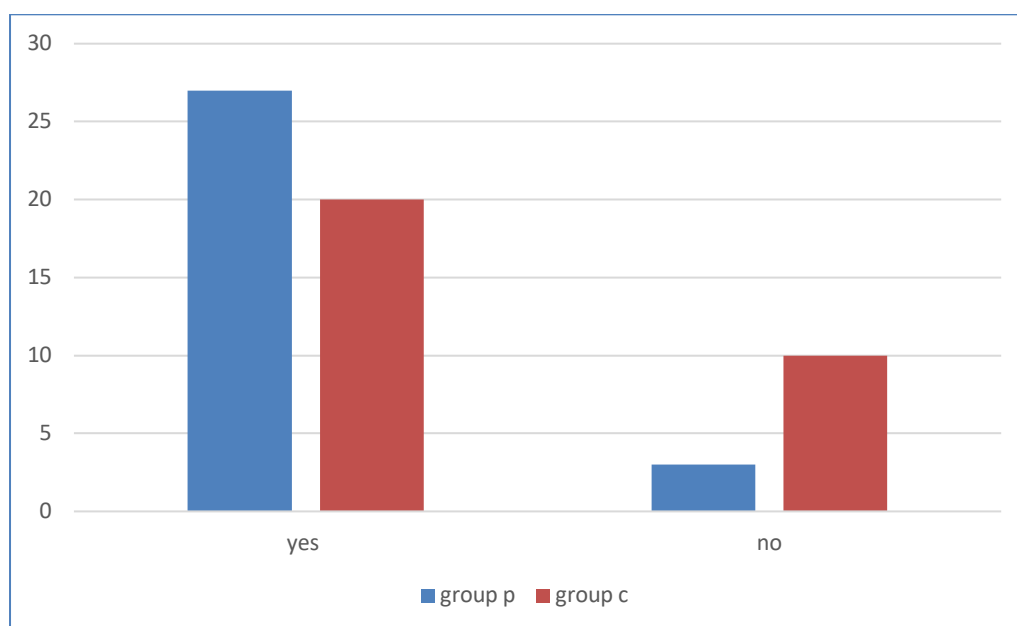
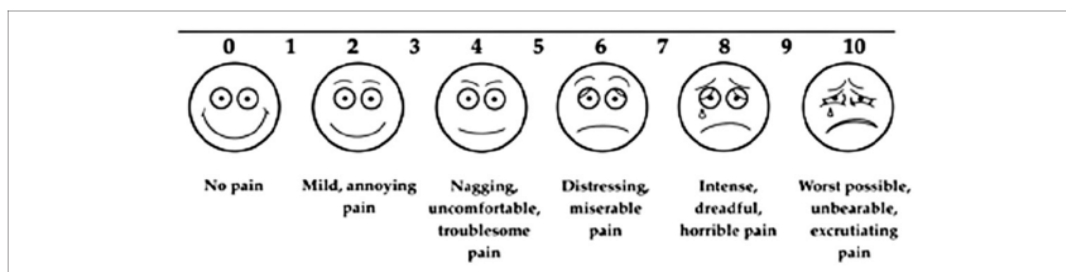


Chart 1: Patients' acceptance about positioning

Table 4: Postoperative vas score

Time	VAS Score (MEAN \pm SD)		P value
	Group P	Group C	
0 hour	4.2 \pm 0.75	4.3 \pm 0.4	0.52
2 hours	4.4 \pm 0.95	4.5 \pm 0.2	0.57
4 hours	4.5 \pm 0.4	4.6 \pm 0.34	0.30
6 hours	5.2 \pm 0.2	5.3 \pm 0.3	0.13

**Figure 2: VAS scale****Discussion:**

Hip surgeries are the common orthopedic procedure in elderly population following trauma. Early reduction and fixation of the fracture is the treatment of choice to prevent complication like bed sore, atelectasis, deep vein thrombosis fat embolism etc. Mode of anesthesia is regional anesthesia for the management of these fractures but pain associated with the positioning during spinal anesthesia may make spinal procedure more difficult.

Various conventional method have been tried to reduce pain during positioning for subarachnoid block like IV analgesic (NSAIDS, Opioids) and peripheral nerve block. As the patients of hip fracture are elderly IV analgesic technique has their side effects more ever this technique are not sufficient to reduce pain.

Short AJ et al. studied the innervation of hip joint in detail [13]. In their study they concluded that anterior hip capsule is the target for analgesia as posterior and inferior capsule have no sensory fibers. Anterior hip capsule is innervated by articular branches of femoral nerve, obturator nerve and accessory obturator nerve (AON).

Peripheral nerve blocks like 3 in 1 block, femoral nerve block and fascia iliaca block for reducing pain are routinely used. However these technique not consistently block the articular branches of hip joint thus can not provide adequate level of analgesia [10, 11, 12].

Pericapsular nerve group block is recently came in practice for analgesic technique in hip surgery patients. Previous study suggested that PENG block covers the articulate branch supplying the hip joint, so it is effective analgesic technique to provide pain relief for positioning during spinal anaesthesia.

In our study we found that VAS score 10 minutes after block and during positioning for spinal

anaesthesia is significantly reduced in patients receiving PENG block (group P). Similarly study done by Utsav Acharya et al found that PENG block as an excellent option for analgesia for positional pain in hip surgeries [19].

Satisfaction level of patient positioning and patients' acceptance for poisoning were better in group P in our study. Similar findings were noted by K Shankar et al in their comparative study of PENG and fascia iliaca block [20].

There was no significant difference in postoperative VAS score in our study in both the groups. G. Pascarella et al. in their study used wound infiltration with local anaesthetic to provide analgesia for the surgical incision during the first postoperative hours, and to eliminate any confounding factor linked to a patient's perception of superficial pain. [21]. As PENG block only blocks the articulate branches of anterior hip capsule, lateral femoral cutaneous nerve spare with this block which covers only part of surgical wound [22].

Moreover other studies done recently suggested that combined use of PENG block with sciatic block or local infiltration analgesia can provide complete hip capsule analgesia [23, 24].

Similar with other study there were no any complication with the use of PENG block in our study.

Limitations of our study are small sample size, we did not compare effect of PENG block with other routinely used peripheral block, we did not check effective coverage of block by checking sensory dermatomal level and we used VAS score for pain assessment which is subjective in nature and can differ in patients to patients. We did not add any adjuvant like dexamethasone, adrenaline etc. which may provide longer postoperative analgesia.

Conclusion

We concluded that PENG block is easy to perform, motor sparing, effective for positioning during spinal anaesthesia without any complication with better anaesthetist and patients satisfaction.

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