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Original Research Article

Comparative Evaluation of Pericapsular Nerve Group Block Along With Spinal Anaesthesia in Patients Undergoing Total Hip Arthroplasty

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Abstract

Introduction: Peri-capsular Nerve Group Block (PENG) provides good post-operative analgesia. PENG provides coverage of the hip joint, targeting the proximal articular branches that innervate the joint capsule. So, we compared the post-operative analgesic requirement of patient after giving PENG block along with spinal anesthesia.

Methodology: 60 patients were equally divided into 2 groups i.e., Group P & Group S. In group P, we gave PENG block after giving spinal anesthesia while in Group S, we gave spinal anesthesia alone. Our primary outcomes were comparison of analgesic requirement post-operatively. While our secondary outcomes were recovery of motor functions, length of hospital stay etc.

Result: In Group P, pain score, analgesic requirement were less as compared to Group S post operatively. And we also found less VAS score, early motor function recovery, and less hospital stay in Group P as compare to Group S.

Conclusion: PENG along with spinal anesthesia in THA surgeries, decreases post-operative pain and other complications as compared to spinal anesthesia alone in group S.

Keywords: Total Hip Arthroplasty, Spinal Anaesthesia, Peri-capsular Nerve Group Block (PENG).

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Introduction

Hip fracture is the commonest clinical fractures with increased incidence among elderly people. Cause of hip fracture can be due to osteoporosis, trauma etc. It is associate with severe pain, inflamation & certain complications which results into disabling or even can be life-threatening for the patients, and commonly surgical treatment is used for its primary treatment [1].

Inadequate post-operative pain control has been associated with delayed rehabilitation, impaired functional recovery, and decreased patient satisfaction after surgery [2-4]. But we can use systemic analgesic administration, intra-articular local anaesthetic injection, neuraxial, and peripheral nerve blocks combination are during the peri-operative as well as post-operative period for pain control. Among these, intra-articular injection of local anesthetics have been shown to play a potential role in providing analgesia after THA [5-7]. For systemic analgesics, most commonly used drugs are NSAIDS & opioids. The incidence of opioid prescribing following THA can be as high as 89.7% [8-9]. There are certain post-operative complications after opioids administration like, nausea, vomiting, abdominal discomfort etc. Recent studies have suggested a multi-modal analgesia approach to reduce adverse effects and dependence on opioid based medications in THA [10-11] Regional anaesthesia especially spinal anesthesia is one of the most commonly used method for anaesthesia [12].

Severe pain because of fracture often leads to difficulty in positioning of patient for spinal anesthesia, making it more challenging to perform, and results into poor management of post-operative pain and other complications which significantly impact the patient's recovery [13]. But duration of spinal anaesthesia is generally limited to peri-

operative period. Pericapsular Nerve Group (PENG) block of the hip joint has gained attention recently. PENG block is usually performed under ultrasound guidance & is performed by injecting local anesthetic drugs to block the articular branches of the Femoral nerve (FN), Obturator nerve (ON), & the accessory obturator nerves (AON), among others. These nerves provide sensory innervation to the hip capsule.

PENG block has increasing popularity because of easy operational procedure, fewer complications, & better postoperative analgesia without affecting motor functions [14]. Therefore, patients receiving PENG block has reducing incidence of post-operative complications and facilitating early recovery [15]. So, we decided to conduct a study in which we compare post-operative analgesia and any complications (if present) of PENG block along with spinal anaesthesia.

Our primary outcome was assessing post-operative pain with VAS score. Secondary outcomes includes post-operative adverse effects, hip joint range of motion, mobilisation, total opioid requirement and length of hospital stay.

Methodology

This Prospective, Observational study was conducted in LNMC & JK Hospital, Bhopal (M.P.). The duration of our study was 2 years from January 2024 to December 2025, in which we had taken 60 patients who was posted for total hip arthroplasty under spinal anaesthesia. After taking permission from Institutional Ethical Committee, we had divided these patients into 2 groups. We divided these 60 patients into 2 equal groups of 30 each (Group P and Group S), by using coin method. Patients aged between 18 to 60 years, having American Society of Anesthesiologists (ASA) physical status I and II, and undergoing total hip arthroplasty (should be less than 2 hours) were included in the study. Patients with ASA status III & above, allergy to local anaesthetic drug, bleeding disorder, surgical time exceeded 2 hours, pregnancy or not willing to attend the study were excluded.

On the day of surgery, after taking Verbal & Written informed consent from the patients as well as after complete Pre-anaesthetic check-up, we transfer the patient in operation theatre. 2 wide bore cannulas were already taken & now all multi para monitors were connected like pulse oximeter, NIBP, SpO2, ECG etc. All base line vitals parameter were recorded & collected in observation sheet. Patients in group P (n = 30) received PENG block with 10 mL of the 0.5% Ropivacaine before administration of spinal anaesthesia in supine position by USG guided technique. Group B (n = 30) patients did not receive PENG block (Control group). A low frequency, curvi-linear transducer was placed in transverse fashion over the anterior inferior iliac spine (AIIS) and move inferiorly and medially to locate the ilio-pubic eminence, psoas tendon, and femoral artery. A hyperechoic needle was advanced in-plane from lateral side to medial side, and a local anesthetic was deposited between the psoas tendon and the iliopubic eminence.

Next we asked the patient to change his posture from supine to sitting position so as to gave the sub arachnoid block. In both the Groups (Group P & Group S), we gave 0.5% Bupivacaine heavy 3.0ml. After 15 mins, the onset and peak of sensory and motor block were observed with pin prick method and bromage scale. After the completion of surgery, all patients were transferred to post Anaesthesia Care Unit (PACU) for postoperative monitoring during first 24 hours. In the PACU, pain intensity was assessed using the pain Visual Analogue Scale (VAS), and the time taken for the first request of analgesia was noted (period from the PACU arrival to the first request made by the patient for rescue analgesics). Both for intra-operative & post-operative analgesia, we use Inj. Tramadol for mild to moderate pain and Inj. Fentanyl for severe pain. For any increase from 15%-20% in heart rate & blood pressure, we gave rescue analgesia. Patients having any complications like PONV, Anxiety, etc. were noted. Pain scores and opioid consumption data were collected and recorded by nursing staff who were not involved in the study.

Result

This study included 60 patients by the Coin sampling method. Patient's demographic data were statistical non-significant with a p-value of more than 0.1. Mean age of patients were 48±0.8 years, Mean weight of patients were of 68±0.1 kgs, & Mean height of patients were 159±0.4cms. We had observed the analgesic requirement in both the groups, by measuring intra-operative & post-operative hemodynamic variation as well as postoperative VAS score. In Table 1, we compared the mean heart rate during intraoperative & postoperative period. O hours is considered as time of anaesthesia given. On comparing 2 groups, there was a very well differentiation of heart rate between 2 groups. As in group E, heart rate was very well maintained within normal range, with statistical significant (p-value< 0.003).

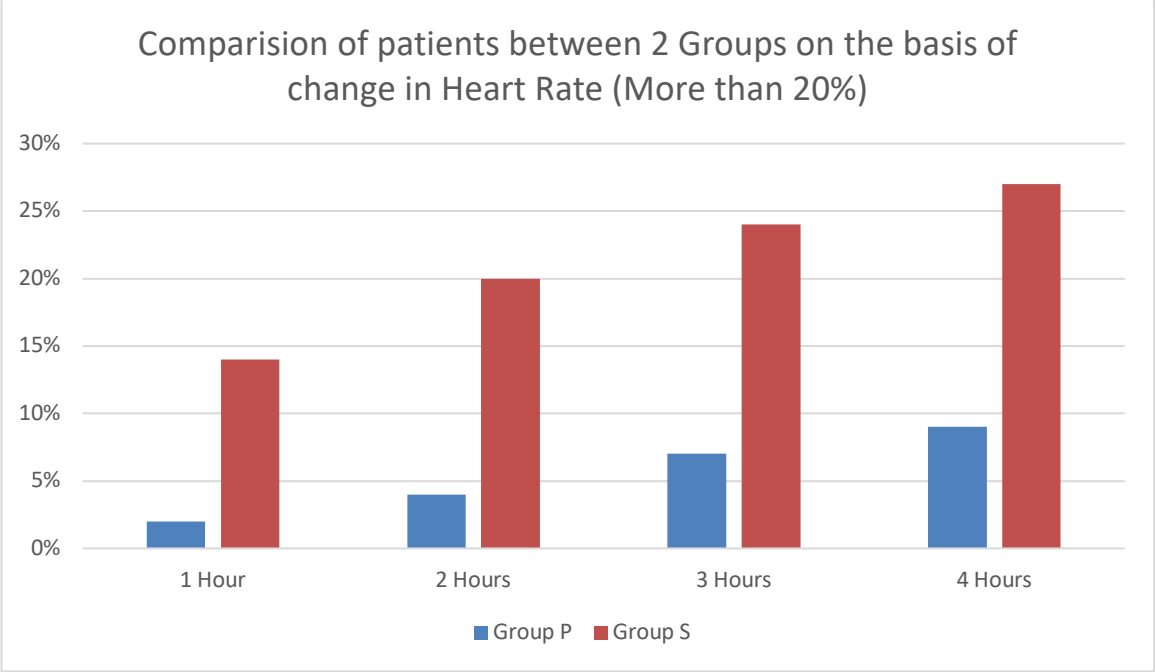

Figure 1: Comparision of patients between 2 Groups on the basis of change in Heart Rate (More than 20%)

In Table 2, we compared the mean blood pressure during intraoperative & postoperative period. O hours is considered as time of anaesthesia given. On comparing 2 groups, there was a significant difference in mean blood pressure between 2 groups. In group E, at different time interval blood pressure was not fluctuating from normal range, and it was statistically significant also (p-value< 0.003).

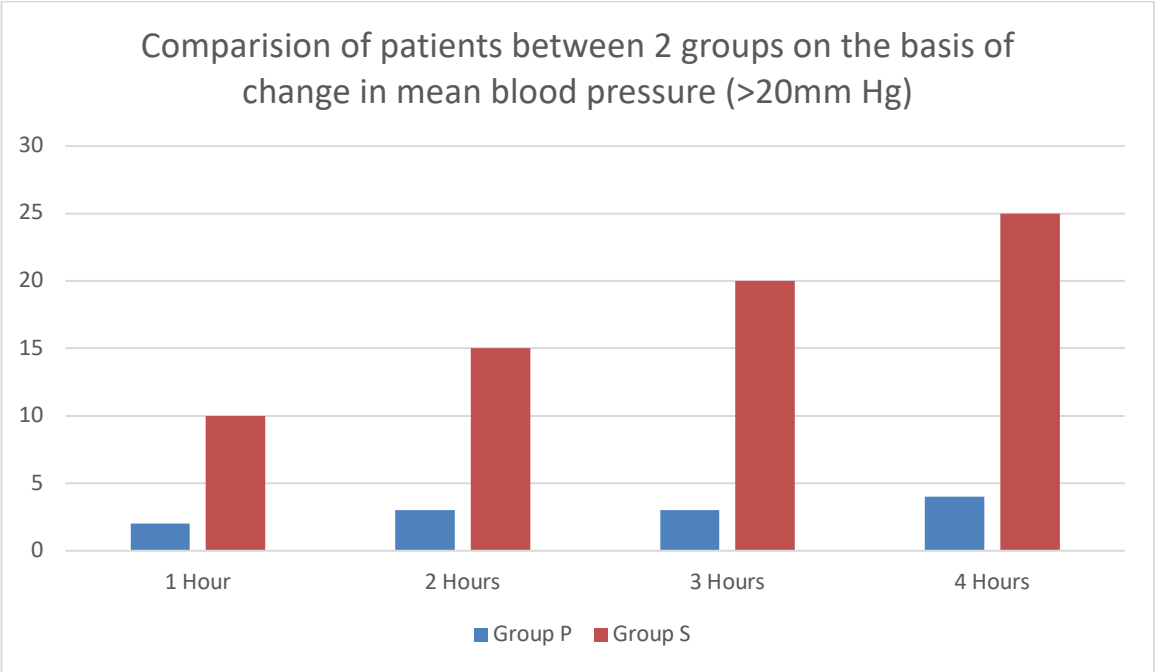

Figure 2: Comparision of patients between 2 groups on the basis of change in mean blood pressure (>20mm Hg)

In Table 3, we compared the analgesic requirement of patients both in intraoperative as well as postoperative period. 0 hour is considered as time of anaesthesia given & time of nerve blocks. During intra-operative period, only 3 patients required analgesic supplement in P group while a total of 18 patients required analgesic supplements in group S. And if we compared post-operative analgesic requirement, almost all 30 patients requires analgesic drug in group S while in group

P, approx. 50% of the patients doesn't required analgesic drug up to 6 hours of surgery. Certain patients doesn't feel any pain upto 24 hours of surgery. We gave Inj. Tramadol for mild (VAS>3) to moderate (VAS 3-6) pain & Inj. Fentanyl for severe (VAS<7) pain during postoperative period. For intraoperative period, we gave Inj. Tramadol as analgesic supplement. During postoperative period, patients of group S was having moderate to severe pain while patients of group P had only mild pain. 5 patients of group S had PONV while only 1 patient of group P had the same.

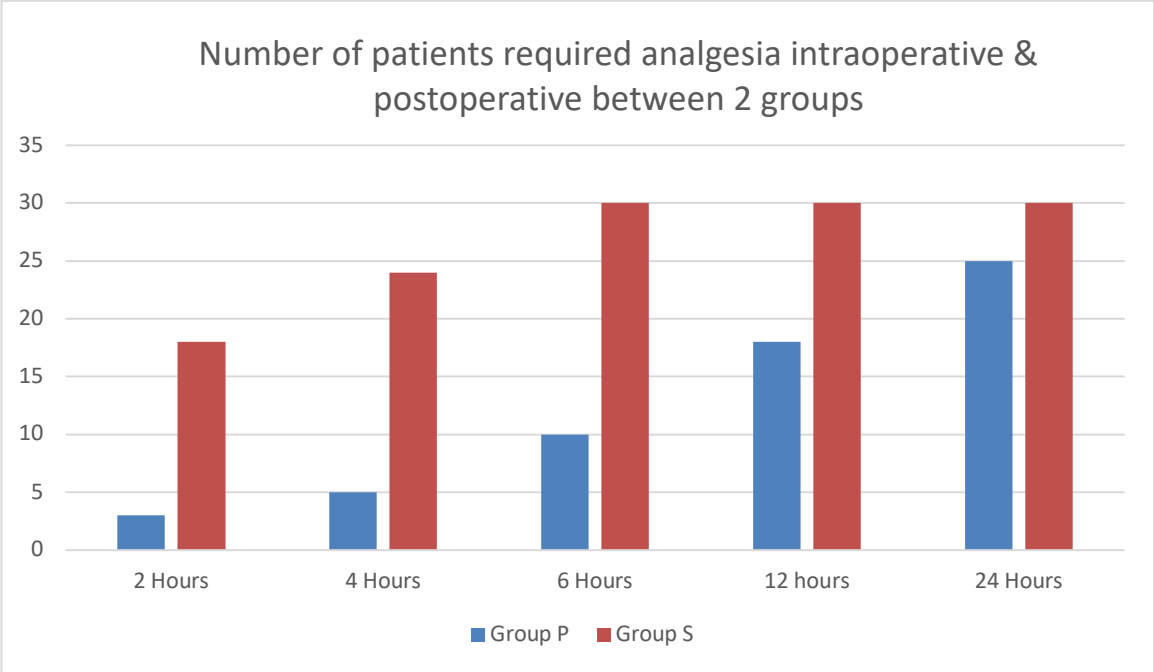

Figure 3: Number of patients required analgesia intraoperative & postoperative between 2 groups

Discussion:

During hip fracture surgeries, the most common side effect is patient's discomfort along with intraoperative as well as post-operative pain. Hip arthroplasty surgical procedure can be associated with incidence of pain, bleeding and increased hospital stay, thereby delaying recovery.[16] Multiple interventions or drugs are applied to the patient before, during and after surgery for the above reason's & the commonest be the combined use of Narcotic and NSAIDS. However, they can be associated with GIT and Neurological side effects, which may cause patient's discomfort.[17,18] Post-operative pain is characterized as acute inflammatory pain that originates with surgical trauma and typically resolves with tissue healing. When pain triggers,there is a release of catecholamines, which may precipitate cardiovascular incidents, undesirable neuro-endocrine or metabolic changes, thromboembolic events, pulmonary complications, and prolonged hospital stays.[19] After surgical procedures, pain becomes a significant factor influencing patient well-being. Early analgesic approaches or the introduction of additional interventions, that aim to reduce the need for analgesics and improve patient well-being is become important.[20,21]Therefore, many patients often undergo treatment using a mix of non-opioid analgesic agents, or known as multimodal analgesia.[22] The main goal of this approach is to achieve an additive beneficial effect while reducing individual analgesic doses. This will not only helps in preventing adverse effects but also reduces dependence on opioids and its related side effects.[23,24] Commonly used non-opioid drugs included in multimodal analgesic strategies are Paracetamol, NSAIDs, Corticosteroids, Ketamine, Local anaesthetics, and Gaba-pentinoids.[25]

Peripheral nerve blocks involve the injection of a local anesthetic drug near the nerve that serves the surgical area. These anesthetic drugs work by changing the sodium permeability of cell membranes, effectively halting nerve impulse transmission and leading to pain relief.[26] A distinctive feature of peripheral nerve blocks is their tendency to produce fewer side effects and complications, such as reduced swelling at the surgical site and lessened pain perception. With this background, we decided to conduct a study in which we gave PENG blocks along with spinal anaesthesia for hip arthroplasty surgeries. This blocks not only provide the intra-operative hemodynamic stability but also decrease the post-operative overdose of intravenous analgesic drugs.[27-28] The efficacy of local anaesthetic infiltration technique combined with spinal anaesthesia during hip arthroplasty surgery has also

shown decreased post-operative pain and opioid consumption.[29,30] However, regional nerve blocks have an advantage over infiltration techniques due to various reasons, including reduced tissue distortion at the operative site and better pain control during handling of deeper tissues.[32]

Our study showed the intra as well as post-operative analgesic efficacy of PENG block in adults undergoing hip arthroplasty surgery under spinal anaesthesia. When compared with placebo (no block), PENG block provides better post-operative analgesia at various interval of time and reduced opioid consumption within 24 hr after surgery. Furthermore, PENG block was associated with a longer time to first rescue analgesia and a lower incidence of side effects like PONV postoperatively, after hip arthroplasty surgery.

Pascarella et al.[33] explained that patients who underwent PENG block had lower VAS scores, less opioids requirement, greater hip ROM, and shorter mobilization time and was no significant difference between study and control groups regarding the length of hospital stay and adverse effects. Lin et al.[34] said that randomized, double-blind study with the inclusion of 60 patients, the PENG block group had lower pain scores and greater quadriceps strength than the femoral block group. Similarly, Kukreja et al.[35] reported that retro-spective study of a total of 120 patients, the VAS score and opioid use within postoperative 24 hours were lower at all times compared to other patients.

They said that PENG block analgesia is only effective for the anterior hip capsule and it's inadequate for analgesia of the posterior capsule, which is innervated by nerve to the quadrates femoris and superior gluteal nerve, both from the sacral plexus. Aliste et al.[36] randomized study of a total of 40 patients compared pain scores, cumulative morphine consumption, opioid-related adverse effects; The ability of patients to undergo physiotherapy at the 24 and 48th hours; And the length of hospital stay in patients who underwent primary THA and received either PENG block or supra-inguinal fascia iliaca compartment block.

In the PENG group, better preservation of hip adduction was observed at the 3rd hour, and less sensory block in the hip's anterior, medial, and lateral regions was observed at all measurement times. Mosaffa et al.[37], randomized controlled study including 52 patients undergoing hip fracture surgery, pre-operative fascia iliaca compartment block was compared with PENG block; Reported that in the PENG block group, the VAS score at 15 minutes after the block and at 12 hours postoperatively was comparatively lower, the time to 1st additional analgesia was significantly longer, and opioid consumption post-operatively was significantly lower. In our study, PENG block along with spinal anaesthesia, not only decrease the time to PACU discharge following hip arthroplasty surgical procedures but also have a useful effect on post-operative pain management. Although the group receiving PENG block had a significantly longer mean time to first analgesia (8±4 hours versus 2±2 hours) when compared with the control group, the mean time to PACU discharge and the incidence of PONV was comparable between the groups and didn't show early recovery. Our findings suggest that PENG block administered to patients undergoing hip arthroplasty surgeries provide effective pain control with minimal complications and reduce the dependence not only peri-operative but also post-operative opioids. The block were performed by USG Guided technique because of their ease of performance and increased accuracy.

Conclusion

PENG block along with spinal anesthesia provides better hemodynamic stability (intraoperative as well as post-operative) and it also decreases the post-operative analgesic consumption. Therefore, we recommends PENG block as a supplemental block to the multimodal analgesic regimen for total hip arthroplasty surgery along with spinal anaesthesia.

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