Section: Anesthesiology

Original Research Article

A RANDOMIZED COMPARATIVE STUDY OF CLONIDINE AS AN ADJUVANT TO ROPIVACAINE IN ULTRASOUND GUIDED PERICAPSULAR NERVE GROUP (PENG) BLOCK FOR POST OPERATIVE ANALGESIA IN HIP SURGERIES

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ABSTRACT

Background: Various adjuncts were added to local anesthetic agents in peripheral nerve blocks to decrease the postoperative pain. we compared clonidine as an adjuvant to ropivacaine and plain ropivacaine in pericapsular nerve group block for hip surgeries and evaluated the duration of analgesia in both the cases. **Materials and Methods:** 50 ASA Grades I II and III Patients scheduled for various hip surgeries were randomly divided into two equal groups. Both the groups received subarachnoid block with injection 0.5% bupivacaine heavy 3 ml with 0.5 ml (25 mcg) fentanyl. Both the groups were given pericapsular nerve group block under ultrasound guidance. Group A: Patients received 0.5% ropivacaine 20ml alone. Group B: Patients received 0.5% ropivacaine 20 ml with clonidine 1mcg/kg. Duration of analgesia ,mean heart rate, mean blood pressure and mean duration of rescue analgesia time were studied in both the groups. **Result:** The mean rescue analgesia time in group A was 613.5 ± 103.45 mins, and in group B was 884.7 ± 106.7mins, and this mean difference was significant. The mean heart rate between Group A&B varied, i.e., $p < 0.05$, from 7hours to 14hours and 19 hours to 24 hours. The mean MAP between Group A&B varied, i.e., $p < 0.05$, almost all time intervals except at 6, 7, 23, and 24 hours. The mean pain scores (WBS) between Group A&B varied, i.e., $p < 0.05$, from 7hours to 12 hours and 17 hours to 20 hours. **Conclusion:** The addition of clonidine to ropivacaine in ultrasound guided PENG block significantly prolongs the duration of post operative analgesia in patients undergoing hip surgeries without increasing the incidence of adverse effects.

INTRODUCTION

Pericapsular nerve group (PENG) block is gaining importance in hip surgeries due to its efficacy in providing superior pain control with fewer complications compared to traditional techniques.[1,2] PENG block selectively targets the nerves innervating the hip joint- the obturator nerve, femoral nerve and accessory obturator nerve.[3] This ensures focused pain relief reducing systemic side effects. It spares the motor function of quadriceps muscles, preserving mobility. This allows patients to mobilize earlier aiding in rehabilitation and reducing the risk of complications like deep vein thrombosis.

PENG block is administered under ultrasound guidance, improving precision and reducing the risk of complications like vascular injury, nerve damage and local anesthetic systemic toxicity.

Recent studies and case series have demonstrated its effectiveness in reducing pain scores, opioid consumption and improving overall patient satisfaction.[3,4]

Adding clonidine and ropivacaine in nerve blocks offers several advantages due to the synergistic effects of the two drugs.[5-12] clonidine improves the depth of analgesia by directly acting on alpha 2 receptors in peripheral nerves. It indirectly enhances the effects of local anesthetics by hyperpolarizing nerve membranes. A dose of 0.5 to 1mcg/kg avoids side effects like sedation hypotension and bradycardia while maximizing benefits.

Aims and Objectives

To evaluate pain relief after Hip surgery by pericapsular nerve group block (PENG) for early mobilization and discharge of the patient.

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Primary Objective

To compare and evaluate the effect of ropivacaine, ropivacaine-clonidine on the duration of analgesia in pericapsular nerve group block in postoperative hip surgeries.

Secondary Objective

A. Compare the heart rate in both the groups.

B. Compare mean arterial blood pressure (MAP) in both the groups.

C. Compare the mean duration of rescue analgesia time in both the groups.

MATERIALS AND METHODS

After obtaining Institutional Ethics Committee approval, (GMCM/IEC/006/2025) and written informed consent from the participants, this study was conducted at SPV Government Medical College, Machilipatnam, Andhra Pradesh.

Inclusion Criteria

1. Age between 30 – 75 yrs.
2. ASA grade I, II, III.

Exclusion criteria

1. Patients unwilling to participate.
2. ASA grade IV, V, VI.
3. Existence of peripheral neuropathy.
4. Bleeding disorders, anticoagulant, and antiplatelet agents.
5. Local cutaneous infection.
6. Patients with hypersensitivity to drugs used in the study.
7. Contraindications to regional anaesthesia.

Sample size: Based on the previous studies.[11-12]

A total of 50 patients were included in the study and were divided into 2 groups by random number table through Microsoft excel.

Statistical analysis: The data was entered into Microsoft Excel and analysed with Statistical Package for Social Sciences (SPSS) version 25.0. The mean difference between the two groups was measured by independent t test. A p value of <0.05 was taken as significant.

PROCEDURE

Materials required

1. The ultrasound machine with Linear probe [12 - 3MHz]
2. Sterile probe cover.
3. Antiseptic (chlorhexidine 2%) solution for skin disinfection.
4. Sterile ultrasound gel.
5. Sterile gloves.
6. 6)25 G Quincke spinal needle,
7. 7)10cm extension tubing
8. 8) Ropivacaine 0.5%
9. 9) Clonidine

Procedure: Upon arrival in the operation theatre, pre anaesthetic check-up was reviewed, iv access secured with 18 G canula, vital parameters were checked and recorded. Standard anaesthesia monitoring was done in all the patients throughout the procedure. Both the groups received subarachnoid block with injection 0.5% bupivacaine heavy 3 ml with 0.5 ml (25 mcg) fentanyl. Both the groups were given pericapsular nerve group block using ultrasound guidance. After confirming negative aspiration for blood, 20ml of drug was given slowly under ultrasound visualization of the spread of the local anaesthetic drug. Patients were divided into A, and B groups.

Group A: Patients received 0.5% ropivacaine 20ml alone.

Group B: Patients received 0.5% ropivacaine 20 ml with clonidine 1mcg/kg.

Duration of analgesia (time frame: 24 hrs.) was measured by Wong Bakers pain rating scale.

Scoring: The faces are scored from 0 (no hurt) to 10 (hurts worst).

- 0: No hurt
- 2: Hurts a little bit
- 4: Hurts a little more
- 6: Hurts even more
- 8: Hurts a whole lot
- 10: Hurts the worst

RESULTS

Table showing variation in heart rate between the two groups

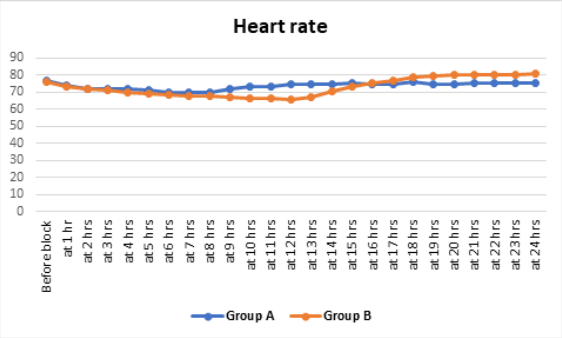

Figure 1: Comparison of Heart rate at different time intervals

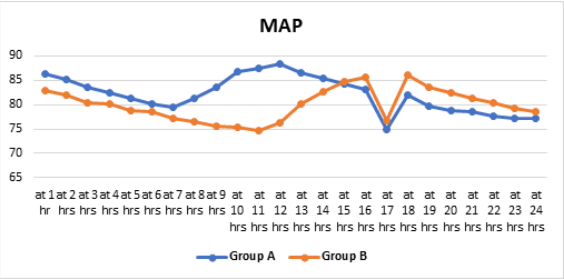

Figure 2: Comparison of mean MAP at different time intervals

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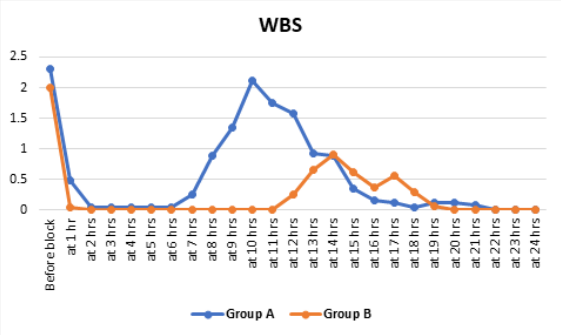

Figure 3: Comparison of WBS at different time intervals

According to the [Figure 1], the mean heart rate between Group A&B varied, i.e., p <0.05, from 7hours to 14hours and 19 hours to 24 hours.

According to the [Figure 2], the mean MAP between Group A&B varied, i.e., p <0.05, almost all time intervals except at 6, 7, 23, and 24 hours.

According to the [Figure 3], the mean pain scores (WBS) between Group A&B varied, i.e., p <0.05, from 7 hours to 12 hours and 17 hours to 20 hours.

Table 1: Mean rescue analgesia (mins)

	Mean rescue analgesia time	S.D	P value
Group A	613.5	103.45	0.001(significant)
Group B	884.7	106.7	

As per the [Table 1], the mean rescue analgesia time in group A was 613.5 ± 103.45 mins, and in group B was 884.7 ± 106.7mins, and this mean difference was significant.

DISCUSSION

Hip surgery, particularly total hip replacement and fracture fixation are the most commonly performed orthopaedic procedures. The rise in hip surgeries is attributed to growing awareness, increased life expectancy, rising incidents of road traffic accidents and early diagnosis of conditions such as avascular necrosis. Effective post operative analgesia is crucial in this regard as it facilitates early mobilization, reduces pulmonary and thromboembolic complications and improves overall functional outcomes. Inadequately treated pain can lead to prolonged immobility, delayed rehabilitation and increased risk of morbidity due to deep vein thrombosis, atelectasis and chronic pain syndromes. Multimodal analgesia including the use of regional nerve blocks like the PERICAPSULAR NERVE GROUP (PENG) BLOCK, offers superior pain control while preserving motor function, allowing early physiotherapy participation.[3,4] Optimizing analgesia also reduces the reliance on opioids, thereby minimizing opioid related adverse effects such as nausea, sedation and constipation.

The PENG block aims to anesthetize articular branches of femoral nerve, obturator nerve and accessory obturator nerve. These nerves supply the anterior capsule of hip joint, which is the primary pain generator in hip surgeries. It preserves the quadriceps function compared to femoral nerve block or fascia iliaca block. The only limitation is it is primarily an analgesic block, cannot produce surgical anesthesia as it does not block the lateral femoral cutaneous nerve, so additional blocks or SA or GA will be required. Hence in our study we performed sub arachanoid block and administered 0.5% bupivicaine to provide anesthesia for surgery and used PENG block for post operative analgesia.

Literatures show that Clonidine an alpha 2 adrenergic agonist when used as an adjuvant to ropivacaine can enhance analgesia by inhibiting nerve fibre conduction via hyperpolarization, suppressing nor epinephrine release and increasing potassium conductance which prolongs local anesthetic effect. Some studies report faster onset and enhanced block quality with clonidine. Side effects like sedation, bradycardia, hypotension, dry mouth can occur at higher doses of >150mcg. Hence, in this study only 1mcg/kg of clonidine was used. After Spinal anesthesia, PENG Block was performed. Group A received with 0.5% ropivacaine, 20ml and Group B received 0.5% ropivacaine 20ml with clonidine 1 microgram per kg. Patients in both the groups were observed for pain relief after PENG block as a primary outcome, hourly till 24 hours. Both the groups were also observed for Heart rate, Mean arterial blood pressure and readiness for discharge hourly till 24 hours as secondary outcomes. In our study we investigated that ultrasound guided PENG block with 0.5% Ropivacine and clonidine has increased duration of analgesia when compared to 0.5% ropivacaine alone, with respect to Wong Baker Faces Scale. In our study, GROUP A (Mean ± SD) is (614±106) mins, where as in GROUP B (Mean ± SD) is (885±107) mins. So, Group B has better quality of pain relief compared to Group A.[13-15]

According to the study there is no variability in heart rate in first 6hrs (p:>0.05), there is variability from 7-14hrs (p <0.05), 15-18hrs there is no variability (>0.05), 19- 24 hrs there is variability (p :<0.05). There is significant difference between two groups over a period of 24 hours. (p:<0.05) in Mean arterial pressure. There is no significant difference between the two groups in terms of age and gender.

There were no clinical studies specifically investigating clonidine as an adjuvant to ropivacaine in PENG Block. However, the effects of clonidine with ropivacaine have been extensively studied in other peripheral nerve blocks which may provide valuable insights. Study conducted by AH EI Saied and Styen MP et al,[11] in 50 patients showed that

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clonidine 150 mcg when administered along with ropivacaine 0.75% for axillary brachial plexus blockade prolonged motor and sensory block and analgesia without an increase incidence of side effects. Clonidine patients showed increase in duration of analgesia from 587 min to 828 min with mean difference of 241 min which is close to our study results. Kumar et al. in 2014 6 proved that adding 150 mcg of clonidine to 0.5% ropivacaine significantly prolonged sensory and motor block with no major side effects. Singelyn et al., in1992 concluded that clonidine prolongs the analgesia produced by continuous femoral nerve block with 0.125% bupivacaine after knee surgery. Ramadan et al in 2015, Mc Cartney et al., and Popping et al. also conducted studies by adding clonidine as adjuvant to local anesthetics for peripheral nerve blocks and found that clonidine prolonged analgesia duration.

To bridge this gap in literature we conducted a prospective randomised study and evaluated its effectiveness and safety in this novel application and concluded that clonidine at a dose of 1mcg/kg may serve as a valuable adjuvant to ropivacaine in the PENG block.[16,17]

CONCLUSION

The addition of clonidine to ropivacaine in ultrasound guided PENG block significantly prolongs the duration of post operative analgesia in patients undergoing hip surgeries without increasing the incidence of adverse effects. Further large-scale studies are recommended to confirm these findings and to evaluate the optimal dose of clonidine for maximizing analgesic efficacy while minimizing potential side effects.

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