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Original Article

Evaluation of the Effect of Addition of Clonidine to 0.5% Ropivacaine in Supraclavicular Brachial Plexus Block

D Elavarasan[1], Sendhil Kumar Mohan[2], K Kavitharani[3]

[1]Senior Assistant Professor, Department of Anaesthesiology, K.A.P. Viswanatham Government Medical College, Trichy, Tamil Nadu, India, [2]Associate Professor, Department of Anaesthesiology, Government Pudukkottai Medical College Hospital, Pudukkottai, Tamil Nadu, India, [3]Assistant Professor, Department of Anaesthesiology, K.A.P. Viswanatham Government Medical College, Trichy, Tamil Nadu, India

Abstract

Background and Aims: The aim of the study was to evaluate the effect of addition of clonidine to 0.5% Ropivacaine in supraclavicular brachial plexus block (Ultrasound Guided) in terms of onset and duration of sensory motor blockade, post-operative analgesia, and intraoperative sedation score.

Methods: In this randomized, double-blind, and placebo-controlled study, supraclavicular brachial plexus block was performed in 60 patients divided into two groups – RC Group: Patient receiving 1 mL of Clonidine (150 μg) ± 35 mL of 0.5% Ropivacaine (175 mg), R Group: Patient receiving 1 mL of Normal saline ± 35 mL of 0.5% Ropivacaine (175 mg). Both groups were compared with the onset and duration of sensory motor blockade and post-operative analgesia.

Results: There was a significant decrease in onset time of sensory ($P = 0.007$) and motor blockade ($P = 0.05$) in RC Group which was statistically significant. There was a significant prolongation in the duration of sensory ($P < 0.001$), motor blockade ($P < 0.001$), and analgesia ($P < 0.001$) in RC Group which was statistically significant.

Conclusion: The addition of 150 μg clonidine to 0.5% Ropivacaine in supraclavicular brachial plexus block provides rapid onset and extends the duration of sensory motor blockade and post-operative analgesia.

Key words: Clonidine, Post-operative analgesia, Ropivacaine, Supraclavicular brachial plexus block, Ultrasound

INTRODUCTION

Supraclavicular brachial plexus is commonly practiced for upper limb surgeries. Ropivacaine[1] is an aminoamide local anesthetic prepared as pure S-enantiomer with lesser toxicity profile. Clonidine[2] is an α2 agonist that has been used as an additive to peripheral nerve blocks. Ultrasound-guided supraclavicular brachial plexus block has become popular due to reliable block and lesser complications.[3] The present study is a randomized, double-blinded, placebo, and control study to evaluate the effects of clonidine administration with Ropivacaine in supraclavicular brachial plexus block.

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METHODS

After getting approval from the Institutional Ethical Committee KAPV Medical College and Mahatma Gandhi Memorial Government Hospital, we performed the study from October 2021 to September 2021. Sixty patients aged between 18 and 60 years with ASA I and II scheduled for various elective surgeries lower arm, at the level of elbow, forearm, and hand were included in the study. Those with age <18 years and >60 years, on anticoagulant drugs, allergy to study drugs, history of peripheral neuropathy, history of brachial plexus injury, and infection at the site of injection were excluded from the study.

Patients were randomly allocated into two groups by computer generation table, Group RC: ($n = 30$) received 175 mg of 0.5% of Ropivacaine (35 mL) ± 150 μg (1 mL) of Clonidine (36 mL) and Group R: ($n = 30$) received 175 mg of 0.5% of Ropivacaine (35 mL) ± 1 mL of Normal saline (36 mL).

Corresponding Author: Dr. D Elavarasan, Flat No: BB1, SE, VP ParkView Apt., Tennur, Anna Nagar, Trichy - 620 017, Tamil Nadu, India.

To ensure blinding, the study drug solutions were prepared by another assistant professor who was not involved in the study. In the preparation room, anesthetic procedure and visual analogue scale (VAS) score was thoroughly explained to the patients. After getting informed consent, patient shifted to operation theater. Intravenous access secured by 18 G I.V cannula in the non-operating limb and Ringer lactate was started. After attaching standard monitors, baseline heart rate, blood pressure, and oxygen saturation were recorded. Under strict aseptic precautions, supraclavicular brachial plexus block performed by ultrasound-guided approach in plane technique using 18G I.V. cannula needle after adequate local anesthetic skin infiltration. Time at the end of drug injection was taken as 0 min.

Assessment of sensory block in the cutaneous distribution of musculocutaneous, radial, median, and ulnar nerves was assessed every 3 min by pin pricking method using 24 G hypodermic needle.[4] The sensory block was graded as Grade 0: Sharp pin felt, Grade 1: Analgesia, dull sensation feltm and Grade 2: Analgesia, no sensation felt.

Motor blockade was assessed every 3 min by "3-point Modified Bromage Scale"[4] for upper limb as Grade 0: Normal motor function with full extension and flexion of elbow, wrist, and finger, Grade 1: Decrease motor strength with ability to move finger only, and Grade 2: Complete motor block with inability to move finger.

If any one or more of the nerve segments did not get blocked even after 30 min after drug injection, the block was considered incomplete or failed. These patients were either supplemented with rescue blocks or general anesthesia as appropriate and the surgery was completed and they were excluded from the study. Hemodynamic parameters such as blood pressure, heart rate, and oxygen saturation every 15 min during the surgery and every 60 min postoperatively were monitored. Patient's sedation score was assessed by Ramsay sedation score.[5] The sedation score was assessed every 5 min during the surgery till it reached maximum level whereas it was assessed every 30 min till the patient was fully awake in the post-operative period.

Post-operative pain was assessed as per visual analog score using word scale (VAS).[6] Score recorded every 60 min after the surgery (post-operative period) till the score reached 4. If the score reached 4, rescue analgesia was given in the form of Inj. Diclofenac 1.5 mg/kg i.m. All the patients were observed for any side effects such as dry mouth, nausea, vomiting, bradycardia, hypotension, and complication such as pneunothorax, local anesthesia toxicity, and hematoma at the site of injection.

The sensory block duration was defined from the time of injection of study drug solution to complete sensory [Table 1] recovery of all nerves whereas the motor block [Table 2] duration was defined as the time interval between the injection of study drug solution to complete recovery of motor function of hand and forearm. The primary outcome measures were the onset and duration of sensory motor block and duration of analgesia whereas the secondary outcomes were the sedation score and occurrence of any side effects and complications.

Statistical Analysis

Statistical analysis was done with SPSS 16 version. Qualitative data were analyzed by Chi-square test. Quantitative data such as time of onset of sensory and motor blockade, duration of sensory and motor blockade, and a duration of analgesia were expressed as mean ± SD. These data were analyzed by unpaired Student's "t"-test.

RESULTS

Demographic characteristics such as age, sex, weight, and ASA status were comparable among the two groups. There was no statistically significant difference noted between these demographics [Chart 1].

The mean onset time of sensory block in Group RC was 5.8 ± 2.72 when compared with 7.70 ± 2.53 min in Group R that was statistically significant ($P = 0.007$).

The motor block onset was 9.03 ± 2.72 min and 10.63 ± 2.785 min in Group RC and R, respectively, with $P = 0.05$. The mean duration of sensory block in Group RC and Group R were 534.67 ± 62.449 and Group R 441.50 ± 41.004 min, respectively, ($P < 0.001$). The mean duration of motor block in Group RC was 498.00 ± 53.233 min and in Group R was 400.67 ± 38.200 min ($P < 0.001$).

The duration of analgesia was significantly prolonged in RC group (656.7 ± 86.256 min) than R group (502 ± 53.169 min), which was also statistically highly significant ($P < 0.001$) [Figure 1].

The pain score was observed at the end of surgery. At 2 h, the mean VAS score in both groups was zero. After 8 h, the mean VAS score in RC group which was not statistically significant. Sedation score of patients was maximum at 30 min in RC group 2.37 ± 0.669 and in R group 1.70 ± 0.466. Thereafter, the sedation score was decreased. The statistical analysis showed significant difference. In RC group, 10 patients had dry mouth. None of the patient had headache, nausea, or vomiting. Incidence of dry mouth was 16.4% in RC group which was highly significant. In R group, only three patients had headache (4.9%), nausea

and vomiting noted in one patient only (1.6%) that was not statistically significant.

DISCUSSION

In our study, supraclavicular brachial plexus block was performed under ultrasound guidance. All the patients had successful brachial plexus block and hence satisfactory surgical anesthesia. We observed that 150 μg of Clonidine added to 175 mg of 0.5% Ropivacaine, resulted in excellent quality of supraclavicular brachial plexus block for upper limb surgeries. The advantage of Clonidine added as an adjuvant to Ropivacaine was rapid onset and prolonged duration of sensory and motor blockade and the duration of post-operative analgesia.

We observed that onset time of sensory blockade was significantly decreased in RC group when compared to R group. The mean onset time of sensory blockade in RC group was (5.8 ± 2.72) min and in R group (7.7 ± 2.5) min. Routary *et al.*[7] showed the mean onset time of sensory blockade in their study group was 10.44 ± 5.7 min and in control group was 15.85 ± 6.55 min. The delayed onset of sensory block in the study by Routary *et al.* in spite of adding clonidine would have been due to the landmark technique used in administering the block. In our study, we administered the block under ultrasound guidance which has helped in deposition of the local anesthetic in close proximity to the plexus contributing to the early onset of the sensory block.

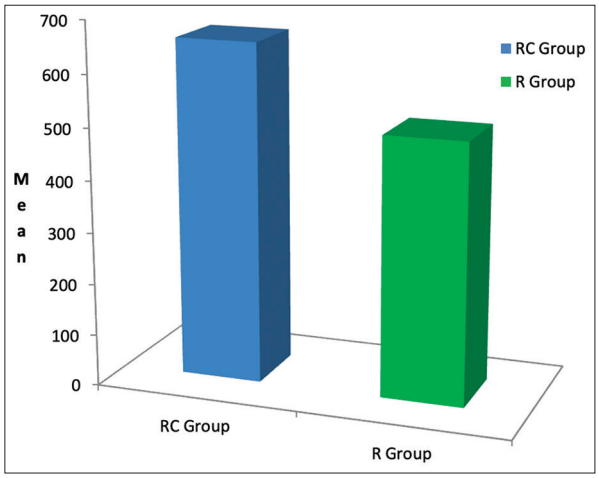

Figure 1: Duration of analgesia

The mean onset time of motor blockade in RC group was (9.3 ± 2.72) min. as compared to R group (10.63 ± 2.785) min which was statistically significant. Ali *et al.*[8] showed the mean onset time of motor blockade in study group (Ropivacaine 0.5% ± 75 mcg clonidine) was 13 ± 3.69 min and in control group was 15.05 ± 4.21 min.[6] The reason for early onset of motor blockade in our study would have been due to accuracy of needle placements close to the plexus, higher volume of local anesthetic (35 mL instead of 30 mL) and higher dose of clonidine (150 μg instead of 75 μg).

The mean duration of sensory blockade in RC group was (534.67 ± 62.449) as compared with R group (441.50 ± 41.004) min. The mean duration of motor blockade in RC was (498.00 ± 53.233) min, compared with R group (400.67 ± 38.200) min. Prolongation of sensory and motor blockade was in RC group was statistically significant. Our observation concur with those obtained by Ali *et al.*

The duration of motor block was less than the sensory block due to increased requirement of local anesthetic for larger motor fiber than small sensory fiber. Gupta *et al.*[9] have shown earlier onset of sensory and motor blockade and prolonged duration of sensory and motor

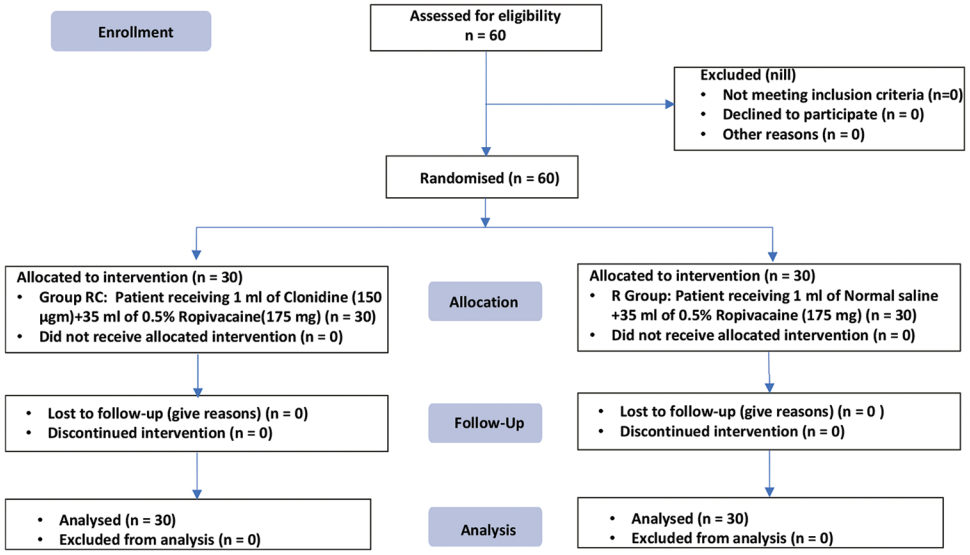

Chart 1: Consort flow chart

Table 1: Demographic profile between RC and R group

Demographic profile	Group RC	Group R	*P*-value
Sex (Male: Female)	18:12	20:10	0.437
Mean age (years)	36.77±11.913	39.20±12.169	0.599
Mean weight (kg)	59.33±9.245	55.47±8.244	0.068
ASA status (%) 1:2	48.2%: 75.00%	51.8: 25.00%	0.301

Table 2: Onset and duration of sensory and motor block

Onset time and duration of sensory and motor block	Group RC	Group R	*P*-value
	Mean±SD		
Sensory block			
Onset (min)	5.8±2.72	7.70±2.53	0.007
Duration (min)	534.67±62.449	441.50±41.004	<0.001
Motor block			
Onset (min)	9.03±2.72	10.63±2.785	0.05
Duration (min)	498.00±53.233	400.67±38.200	<0.001

blockade with ultrasound versus other nerve localization techniques. The combined administration of clonidine and ropivacaine local anesthetics (synergistic mechanism) results in prolonged effect of sensory and motor blockade.

Duration of analgesia was significantly prolonged in RC group than control R group which was statistically highly significant. Gupta *et al.* showed the duration of analgesia in study group was 956.47 ± 38 min and in control group was 736.53 ± 47 min. "Sia and Lepri"[10] observed the synergistic mechanism between clonidine and ropivacaine. The mechanism of action of Clonidine to enhance the peripheral nerve block by "Vasoconstriction theory"[11] α2 Adrenergic stimulation causes decreased systemic absorption of local anesthetics (Ropivacaine) and Ropivacaine has an intrinsic vasoconstriction effect. This intrinsic vasoconstriction effect of Ropivacaine is not enhanced by Epinephrine. Clonidine has direct-action on A delta and C fibers and inhibits the nerve conduction, which further augments conduction block of local anesthetics.

VAS score in post-operative period up to 6 h was comparable in both groups. RC group reached maximum VAS score at 10 h and R group at 8 h, showing extended duration of analgesia in RC group. Ali *et al* also has similar results.

Sedation score was measured as per Ramsay sedation scale. Maximum sedation level in RC group means score was 2.37 at 30 min as compared with 1.63 at 45 min in R group. Our observation concurs with those obtained by Gupta *et al.*

None of the patients had significant bradycardia and hypotension. Our observation concurs with those obtained by Routary *et al.* Dry mouth was observed in Clonidine group (16%) whereas it was nil in Ropivacaine group. Nausea, vomiting, and headache was present only in R group. Similar results were obtained by other investigators. No other complications were present in both the groups.

The limitations of our study were small sample size and drugs (Clonidine and Ropivacaine) were not calculated as per body weight. All the patients irrespective of body weight received the same dose of Ropivacaine and Clonidine. However, body weight was comparable in both two groups.

CONCLUSION

The addition of clonidine to 0.5% Ropivacaine in supraclavicular brachial plexus block in patients undergoing upper limb surgeries provided rapid onset as well as prolonging the duration of sensory and motor blockade. In addition, it extends the duration of analgesia with good hemodynamic stability with optimum sedation.

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