

A Clinical Comparison Between 0.5% Ropivacaine and 0.5% Ropivacaine with Magnesium Sulphate in USG Guided Supraclavicular Brachial Plexus Block for Upper Limb Surgeries

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Introduction: Ropivacaine is one of the recently synthesized long-acting local anaesthetic which belongs to the amide group. Magnesium Sulphate can be a good adjuvant to Ropivacaine in supraclavicular brachial plexus block. Its role in peripheral nerve blocks has only minimal literature and available literature has shown mixed results.

Materials & Methods: This single blind randomized controlled study was conducted on patients undergoing elective upper limb surgeries at tertiary care hospital. Patients were randomized by using random number tables into two study groups with equal patients in both of the study. Group RN: received 30ml 0.5% Ropivacaine plus 1.5ml of normal saline, and Group RM: received 30ml 0.5% Ropivacaine plus 150 mg Magnesium Sulphate. This study was primarily compare the efficacy of supraclavicular block in both the groups in terms of the Duration of sensory block and Motor block, quality of analgesia, complications, and total duration of analgesia.

Result: Patients receiving Ropivacaine & Magnesium Sulphate (446.6 ± 8.06 min) had longer duration of Sensory block than patients receiving Ropivacaine alone (289.43 ± 2.14 min). Patients receiving Ropivacaine & Magnesium Sulphate (368.4 ± 5.59 min) had significantly longer duration of Motor block than patients receiving Ropivacaine alone (242.3 ± 5.09 min). Requirement of first Rescue Analgesia was delayed in group RM (467.7 ± 11.79 min) as compare to group RN (373.5 ± 3.4 min).

Conclusion: Addition of 150 mg Magnesium sulphate to Ropivacaine 0.5% solution in ultrasound guided supraclavicular brachial plexus block for upper limb surgeries speeds up the onset of both sensory and motor blockade. It also lengthens the duration of sensory and motor blockade and reduces the requirement of rescue analgesic in postoperative period.

Keywords: Analgesia, Magnesium Sulphate, Motor Block, Ropivacaine, Sensory Block.

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Introduction

Brachial plexus blockade provides superior pain control with excellent intraoperative anaesthesia as well as post-operative analgesia, eliminating the need for intra-operative opioids and minimizing the need for post-operative opioids.[1] This results in quicker recovery, shortened hospital stay, increased patient satisfaction as well as surgeon satisfaction and ultimately a decrease in financial burden to the patient when compared to general anaesthesia thus permitting its use in day care surgeries. Supraclavicular block offers dense anaesthesia of the brachial plexus for surgical procedures at or distal to the elbow.[2] Ultrasound guided supraclavicular blocks allows the better view of underlying structures, positioning, needle movement and direct spread of local anaesthetic. It also thereby making the procedure a safe and effective as compared to nerve stimulator guided technique.[3]

Ropivacaine is one of the recently synthesized long-acting local anaesthetic which belongs to the amide group. It mediates its effects via the blockade of sodium channels. When compared to Bupivacaine, it is less lipophilic and hence it is associated with minimal cardiovascular and central nervous system effects.[4]

Magnesium has anti-nociceptive effects due to regulation of calcium influx into the cell and antagonism of N-methyl D-aspartate (NMDA) receptors.[5] Magnesium has been used in intravenous, intrathecal, epidural/caudal routes to improve analgesia.[6] In animal models of pain, calcium channel antagonists have been demonstrated to provide analgesia and in chronic pain situations, they synergistically potentiate opioid-induced antinociception.[7] Thus it can be emphasized that Magnesium Sulphate can be a good adjuvant to Ropivacaine in supraclavicular brachial plexus block. Its role in peripheral nerve blocks has only

minimal literature and available literature has shown mixed results. Hence this study was designed to evaluate the efficacy of magnesium when added to ropivacaine in supraclavicular brachial plexus block.

Materials & Methods

Study area & Study population: This Single blind (patient's side was blinded) Randomized controlled study was conducted on patients undergoing elective upper limb surgeries in Department of Anaesthesiology association with Department of Orthopedic and Department of plastic and reconstructive surgery, at Santokba Durlabhji Memorial Hospital cum Medical Research Institute, Jaipur after getting approval from institutional ethical committee.

Sample Size: Sample size was calculated at 80% study power and alpha error 0.05 assuming standard deviation of 30.25 min duration of sensory block as found in reference studies.[1] For minimum detectable difference of 25 min in mean duration of sensory block between the group, 23 patients in each group were required as sample size which further enhanced and rounded off to 30 patients in each group as final sample size for present study expecting 10% to 20% attrition. Formula use for sample size calculation was as follow:

$$n = \frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2 \times \sigma^2}{(M_1 - M_2)^2}$$

Where, n = sample size $Z_{1-\alpha/2} = 1.96$, $Z_{1-\beta} = 0.84$, σ (assumed standard deviation) = 30.25 mmHg $(M_1 - M_2) = 25$ mmHg

Method of Randomization: Patients included in the study were randomized by using random number tables into two study groups with equal patients in both of the study group. Group RN: received 30ml 0.5% Ropivacaine plus 1.5ml of normal

saline, and Group RM: received 30ml 0.5% Ropivacaine plus 150 mg Magnesium Sulphate (diluted in 1.5ml NS) in ultrasound guided supraclavicular brachial plexus block.

Inclusion Criteria: a) Patients in the age group of 18-60 years of age. b) Having ASA [American Society of Anaesthesiologists] grade I & II. c) Patient who gave informed written consent to be included in the study

Exclusion Criteria: a) Pregnant women b) Patients with known allergy to the above drugs. c). Patients with coagulopathies, brachial plexus neuropathies, severe bronchopulmonary disease and patients with diabetes. d) Patients with haemodynamic instability. e). Neurological deficits involving brachial plexus. f). Local infection at the injection site.

The pulse rate, blood pressure, ECG, oxygen saturation (SpO₂) and respiratory rate were noted at 0 minute, thereafter every

5 minutes for the initial 15 minutes, then every 30 minutes till 3 hrs., then every hourly up to 2 hours and then every 2 hourly up to 16 hours in post-operative period. Visual Analogue Score (VAS) was measured every hour after the end of surgery for first 12 hrs. Inj. diclofenac sodium 1.5 mg/kg IV was administered when VAS \geq 4 and time for first rescue analgesia was noted. This study was primarily compared the efficacy of supraclavicular block in both the groups in terms of the Duration of sensory block and Motor block, quality of analgesia, complications, total duration of analgesia.

Statistical analysis: Data was entered and analyzed in Micro soft excel 2010. Categorical variables were compared using the Chi-square test or Fisher's exact probability test; continuous variables compared using unpaired t-test or Mann-Whitney U test.

Result

Table 1: Baseline characteristics of participants

Characteristics	Group RN	Group RM	p value
Age (years)	37.13 \pm 10.41	35.53 \pm 9.98	0.742
Gender			
Male	17 (56.7%)	13 (43.3%)	1.00
Female	13 (43.3%)	17 (56.7%)	
ASA			
Grade 1	15 (50%)	19 (63.3%)	0.297
Grade 2	15 (50%)	11 (36.7%)	

This study was conducted on 60 patients of ASA grade I and II undergoing elective upper limb surgeries. One group was received 30ml 0.5% Ropivacaine with 1.5 ml Normal saline and other group received 30ml 0.5% Ropivacaine with 150 mg

Magnesium sulphate as an adjuvant in ultrasound guided supraclavicular brachial plexus block. Both the groups were comparable in terms of age, sex and ASA grade, which was statistically insignificant ($p > 0.05$) between two groups.

Table 2: Comparison of surgical parameter between two groups

Characteristics	Group RN	Group RM	p value
Duration of Surgery (min)	93.00 \pm 33.54	93.83 \pm 30.16	0.920
Time to onset of Sensory block (min)	6.49 \pm 0.65	5.15 \pm 0.42	0.001
Duration of Sensory block (min)	289.43 \pm 2.14	446.6 \pm 2.14	0.0001
Time to onset of Motor block (min)	11.53 \pm 0.72	11.20 \pm 0.48	0.041
Duration of Motor block (min)	242.33 \pm 5.09	368.43 \pm 5.59	0.0001
Requirement of Analgesia (min)	373.53 \pm 3.40	467.7 \pm 11.79	0.0001

The mean duration of surgery was also comparable between Ropivacaine group (93.0 ± 33.54 min) and Ropivacaine & Magnesium Sulphate group (93.8 ± 30.16 min). The mean time to onset of Sensory block was significantly shorter in Ropivacaine & Magnesium Sulphate group (5.15 ± 0.42 min) than Ropivacaine group (5.15 ± 0.42 min). Patients receiving Ropivacaine & Magnesium Sulphate (446.6 ± 8.06 min) had longer duration of Sensory block than patients receiving Ropivacaine alone (289.43 ± 2.14 min). The time to onset of Motor block was

significantly longer in patients receiving Ropivacaine alone (11.53 ± 0.72 min) than patients receiving Ropivacaine & Magnesium Sulphate (11.2 ± 0.48 min). Patients receiving Ropivacaine & Magnesium Sulphate (368.4 ± 5.59 min) had significantly longer duration of Motor block than patients receiving Ropivacaine alone (242.3 ± 5.09 min). Requirement of first Rescue Analgesia was delayed in Ropivacaine & Magnesium Sulphate group (467.7 ± 11.79 min) as compare to Ropivacaine group (373.5 ± 3.4 min).

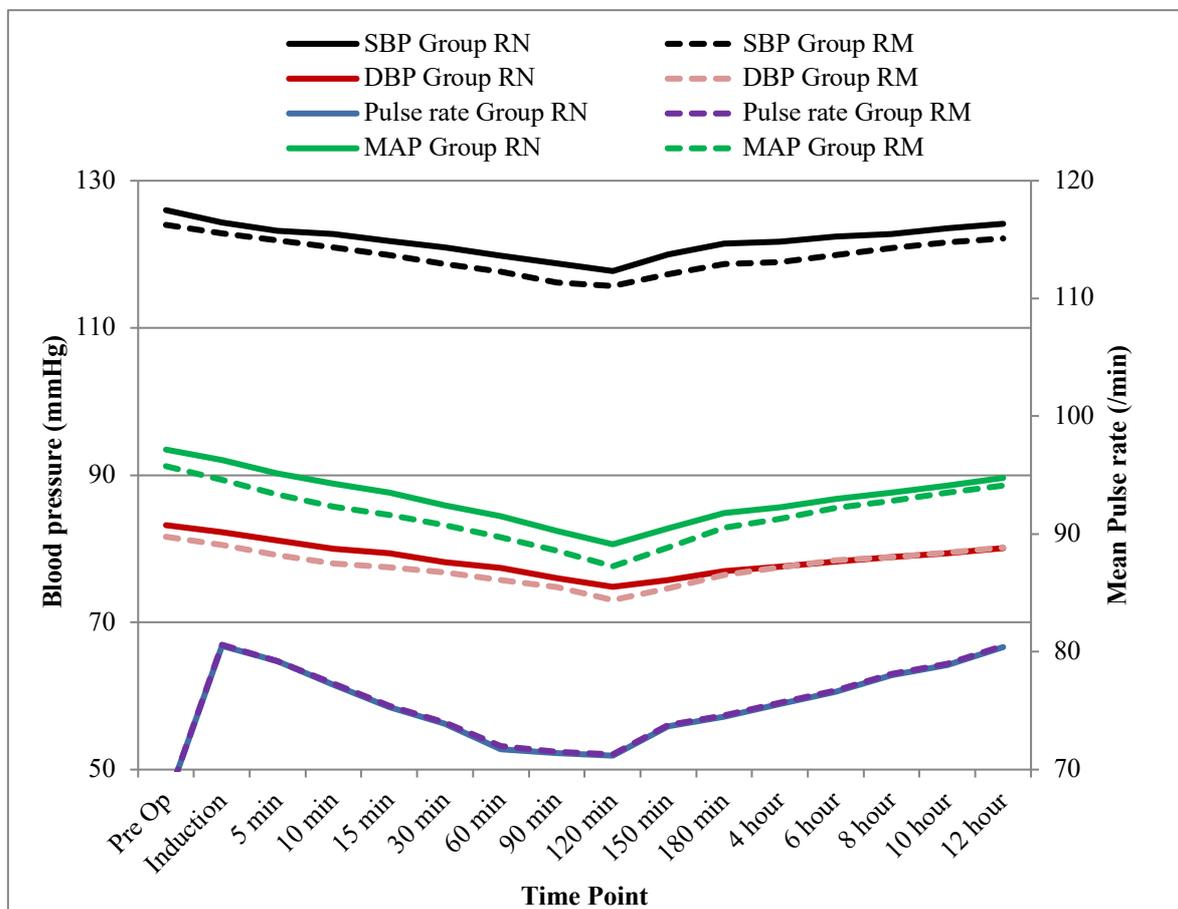


Figure 1: Comparison of Pulse rate and Blood pressure in both the groups

Preoperative pulse rate and blood pressure were comparable and no change was observed during induction in both the groups. Intra-operative and post-operative vitals did not differ in both the groups during course of anesthesia.

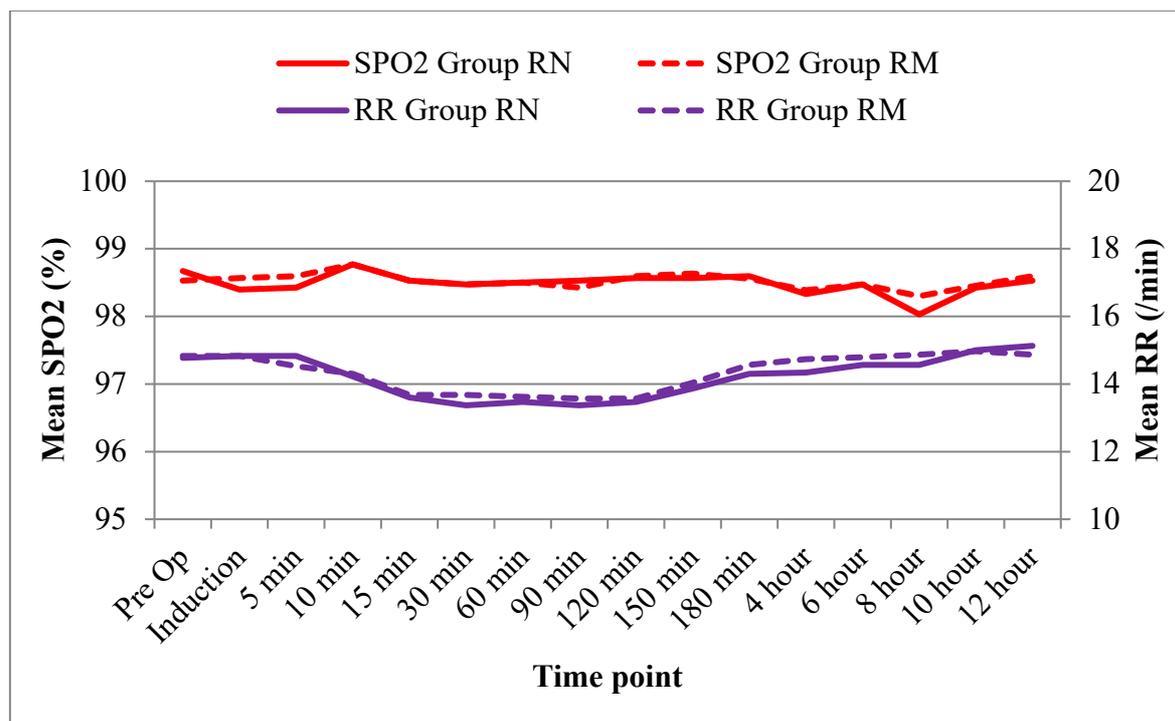


Figure 2: Comparison of SpO₂ and respiratory rate in both the groups

Preoperative, intra-operative and post-operative SpO₂ and respiratory rate did not differ in both the groups during course of anesthesia.

Discussion

In Present study, mean time of onset of sensory and motor block in group RM was significantly shorter (5.15 ± 0.42 min & 11.2 ± 0.48 min respectively) than group RN (6.49 ± 0.65 min & 11.53 ± 0.72 min respectively). This was comparable to study done by Shridevi RJ et al.[8] whose time of onset of sensory block was 14.9 ± 2.02 min vs 11.98 ± 1.08 min and time of onset of Motor block was 31.12 ± 2.47 min v/s 22.7 ± 1.01 min. Verma et al.[9] and Dogru et al.[10] observed quicker onset of sensory and motor block when MgSO₄ was added to bupivacaine and levobupivacaine respectively. Narang et al.[11] investigated the effect of magnesium in a Bier block and reported that the onset of sensory and motor analgesia was faster in the magnesium group than in the placebo group.

In the present study, patients receiving Ropivacaine & Magnesium Sulphate had longer duration of Sensory and Motor block

(446.6 ± 2.14 min & 368.43 ± 5.59 min respectively) than patients receiving Ropivacaine alone (289.43 ± 2.14 min & 242.33 ± 5.09 min respectively). Similar findings for duration of sensory block and motor block was also observed by Mukherjee et al.[12] (Sensory block: 456.21 ± 97.99 min v/s 289.67 ± 62.50 min; Motor block: 366.62 ± 24.42 min v/s 242.16 ± 23.86 min), Shridevi RJ et al.[8] (Sensory block: 229 ± 19.1 min v/s 150 ± 15.1 min; Motor block: 212 ± 18.98 min v/s 134 ± 24.12 min), Karthik GS et al.[13] (Sensory block: 526.32 ± 10.34 min v/s 403.78 ± 14.62 min; Motor block: 428.76 ± 12.76 min v/s 296.16 ± 16.41 min).

Requirement of first rescue Analgesia was delayed in group RM (467.7 ± 11.79 min) as compare to group RN (373.53 ± 3.40 min). These observations correlates with studies done by Gupta et al.[14] in which time to first rescue analgesic prolonged from 377.67 ± 73.31 min to 491.00 ± 100.22 min and similar to Mukherjee et al.[12] whose post op analgesia increased from 379.79 ± 145.52 min to 461.71 ± 152.57 min.

The mean difference in pulse rate, SBP, DBP, MAP, SpO₂, and RR was comparable and no change was observed during preoperative, induction, intra-operative and post-operative time in both the groups in present study. These observations correlates with study by Taneja P. et al.[1] with no statistical significant difference in intra-operative parameters namely pulse, systolic blood pressure and diastolic blood pressure between two groups.

In the present study, complication like nausea, vomiting, sedation and respiratory depression were not noticed in either of the groups in present study. Mukherjee et al.[12] observed two patients of vomiting in RM group while no patients in R group suffered from vomiting. In Taneja P. et al.[1] only three patients in RM group and two patients in RN group had nausea while Hypotension occurred only in five patients in RM group and two patients in RN group but the difference was statistically insignificant.

Conclusion

Addition of 150 mg Magnesium sulfate to Ropivacaine 0.5% solution in ultrasound guided supraclavicular brachial plexus block for upper limb surgeries speeds up the onset of both sensory and motor blockade. It also lengthens the duration of sensory and motor blockade and reduces the requirement of rescue analgesic in postoperative period. The quality of block was enhanced as the duration of analgesia was significantly prolonged and thus it is one of the potential adjuvant for local anaesthetics in peripheral nerve blocks.

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