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Original Research Article

# Evaluation of Magnesium Sulfate as an Adjuvant to 0.5% Ropivacaine in Infraclavicular Brachial Plexus Block

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**Abstract**

**Background:** The Infraclavicular brachial plexus block is one of the common regional techniques for upper limb surgeries below the elbow. But the duration of analgesia is often a limiting factor. To overcome this problem various adjuvant have been added to local anaesthetic agents for prolongation of postoperative analgesia as well as to increase the duration of sensory and motor block.

**Aims:** The Aim of our study was to evaluate the effects of Magnesium sulfate as an adjuvant to 0.5% Ropivacaine for Infraclavicular brachial plexus block in terms of duration of postoperative analgesia and to evaluate onset and duration of sensory and motor block.

**Material and Method:** A Prospective, Double- blinded, Randomized Controlled study was carried out on 60 adult patients (30 patients in each group) aged between 18-60 years with ASA physical status I and II undergoing elective orthopaedic surgeries of elbow, forearm, hand and wrist under infraclavicular brachial plexus block by using peripheral nerve stimulator. Patients were randomized into two groups: Group RP(n=30) received inj. 0.5% Ropivacaine 30 ml. Group RM(n=30) received inj. 0.5% Ropivacaine + inj Magnesium sulfate 2mg/kg total volume 30 ml. The onset and duration of sensory and motor block and duration of postoperative analgesia were assessed.

**Results:** The mean duration of postoperative analgesia was significantly longer in Group RM (588.32±18.98) as compared to Group RP (421.66±28.20) min and mean duration of sensory and motor block was prolonged in Group RM (SB 562.00±26.10 min, MB 532.69±28.62 min) as compared to Group RP (SB 356.00±18.94 min, MB 335.01±24.30 min).

**Conclusion:** Addition of Magnesium sulfate to Ropivacaine for Infraclavicular brachial plexus block significantly prolongs the duration of postoperative analgesia as well as duration of sensory and motor block.

## Introduction

As science is evolving every day, it's been proved that brachial plexus block is more safe and effective method of providing anaesthesia for upper limb surgeries.[1] Infraclavicular brachial plexus block provides Anaesthesia for elbow, forearm, hand and wrist surgeries. Infraclavicular brachial plexus block not only provides good intraoperative anaesthesia but also provides good postoperative analgesia.[2] But duration of postoperative analgesia is often a limiting factor. Hence various adjuvant like Opioids, [3] Clonidine,[4] Midazolam[5] and Dexamethasone[6] have been used along with local anaesthetics in Brachial plexus block to achieve quick, dense and prolonged effect.

Ropivacaine is a local anaesthetic drug belonging to the amino amide group. Ropivacaine causes reversible inhibition of sodium ion influx and blocks impulse conduction in nerve fibers. Ropivacaine has less cardiac and central nervous system toxicity as compared to Bupivacaine local anaesthetic.

Magnesium sulfate is commonly used as an antihypertensive agent[7]. It is a physiological calcium channel blocker and has N- Methyl-D-aspartate (NMDA) receptor antagonist effect in the central and peripheral nervous system, because of that property it has an anti-nociceptive effect and has been used as an adjuvant to local anaesthetic drug to improve the quality and prolong the duration of block and to decrease postoperative analgesic requirement.[8-11] There are so many studies which demonstrated that if we use magnesium sulfate during general anaesthesia it reduces the anesthetic requirement and reduces the postoperative analgesic consumption[9,10].

The primary objective of our study was to evaluate the effect of Magnesium sulphate as an adjuvant to 0.5% ropivacaine for Infraclavicular brachial plexus block on duration of postoperative analgesia. The secondary objective of our study was to evaluate onset and duration of sensory and motor block, to evaluate the haemodynamic variations and to study the complications if any.

## Method and Material

After obtaining permission from institutional ethics committee, patient's written informed consent was taken. A Prospective Randomized double blinded Controlled study was carried out on 60 adult patients aged 18-60 years with ASA physical status I and II undergoing elective orthopedic surgeries of elbow, forearm, hand and wrist under infraclavicular brachial plexus block. Patients were randomly allocated by chit method into two groups. 30 patients in each group. Patients, anesthesiologist performing infraclavicular block and resident doctors maintaining records of VAS scores postoperatively were unaware of the constituent of drugs and group allotment.

Patients with the following conditions were excluded from the study: patients refusal, coagulopathy, local skin site infection, any known hypersensitivity or contraindication to Ropivacaine and Magnesium sulphate, pregnancy, patient with any history of hepatic, renal, cardiac and pulmonary disease and patient with psychiatric, neurological and neuromuscular disorder.

Patients were randomized into two groups:

Group RP (n=30) received infraclavicular brachial plexus block with inj. 0.5% Ropivacaine 30 ml.

Group RM (n=30) received infraclavicular brachial plexus block with inj. 0.5% Ropivacaine + inj Magnesium sulfate 2mg/kg total volume 30 ml.

The present study was conducted in department of Anaesthesiology, MGM medical college and M.Y. hospital Indore. All routine investigation were done and after obtaining preanaesthetic fitness, the whole procedure and visual analog scale ( VAS scale ) was explained to the patient. In the operating room intravenous fluid infusion was started and all standard monitor like SPO2, NIBP, ECG, HR were connected to the patient. After proper positioning infraclavicular brachial plexus block was done by Coracoid technique using Peripheral nerve stimulator. At the site of entry point, subcutaneous skin infiltration done with 2% lignocaine with adrenaline and 22-gauge 5 cm insulated needle was inserted. The stimulated current was initially set to 1.5 mA and gradually decreased to 0.3-0.5 mA after eliciting a distal motor response in forearm and hand. After that local anaesthetic solution was injected slowly with every 2 ml aspiration to avoid any accidental intravascular injection. After the procedure sensory and motor block was assessed every 2 mins, after the completion of injection till the first 30 min and then every 15 mins till the surgery continued and then 4 hourly postoperatively till the motor block is worn off. The sensory block was assessed by 'pin prick test'.

Grading of sensory block was 0=normal sensation, 1=loss of sensation to pinprick, 2=loss of touch sensation. Motor block was assessed by using 'Modified Bromage Scale'. 0=no movements in finger, wrist and elbow, 1=finger movement only, 2=flexion of wrist against gravity, 3=flexion of elbow against gravity.

Time interval between the injection of local anaesthetic till the complete sensory block achieved is defined as the onset time of the sensory block and the time interval between the onset of complete sensory block and the perception of first postoperative pain is defined as the duration of sensory block.

Time interval between the injection of local anaesthetic till the time of complete motor blockade is defined as onset time of motor block and the time interval between the onset of complete motor block and complete resolution of the motor block is defined as the duration of motor block.

The block was considered successful when the grading of sensory block is 2 and of motor block is 0 within 30min after the injection of local anaesthetics. Rescue analgesia (inj diclofenac sodium 75 mg intramuscularly) was given when VAS score >3. Quality of postoperative analgesia was assessed by using VAS scale (0=no pain and 10=worst pain). Side effects like bradycardia, hypotension, breathlessness, nausea and vomiting were recorded and treated accordingly.

## Results

In each group 30 patients were recruited. There was no significant difference between both the groups in terms of age, sex, weight, ASA grading and duration of surgery.

**Table 1: Comparison of demographic data between the two study groups**

| Parameter | Group RM | Group RP | P value |
|---|---|---|---|
| Age (yrs) | 36.90 ± 11.65 | 38.4 ± 15.21 | 0.094 |
| Sex male/female | 24/6 | 27/3 | 0.585 |
| Weight (kg) | 60.74 ± 8.40 | 62.21± 7.29 | 0.82 |
| ASA physical status I/II | 24/6 | 20/10 | 0.469 |
| Surgery time (mins) | 86.4 ±29.4 | 91.4 ± 27.1 | 0.51 |

**Table 2: Comparison of mean onset and duration of sensory and motor block between the two groups.**

| | Group | No. | Mean onset and duration of sensory and motor block (mins) | P value |
|---|---|---|---|---|
| **Onset of sensory block** | **RP** | **30** | **16.61±1.42** | **0.570** |
| | **RM** | **30** | **17.01±1.48** | |
| **Duration of sensory block** | **RP** | **30** | **356.00±18.94** | **0.001** |
| | **RM** | **30** | **562.00±26.10** | |
| **Onset of motor block** | **RP** | **30** | **18.86±2.10** | **0.984** |
| | **RM** | **30** | **18.91±1.25** | |
| **Duration of motor block** | **RP** | **30** | **335.01±24.30** | **0.001** |
| | **RM** | **30** | **532.69±28.62** | |
| **Total patients** | | **60** | | |

One way ANOVA followed by Post-hoc Tukey applied. P value <0.05 was taken as statistically significant.

There were no statistically significant differences found in the onset of sensory and motor blockade in both the group.

The mean duration of sensory block between the two groups was found to be statistically significant (P=0.001) it was higher in group RM (562.00±26.10 mins) as compared to group RP (356.00±18.94 mins).

Duration of motor block between the two groups was found to be statistically significant (P=0.001). Duration of motor block in group RM was 532.69±28.62 min which was higher than group RP where it was found to be 335.01±24.30 mins.

**Table 3: Comparison of mean duration of analgesia between the two groups**

| | Group | No. | Mean duration of analgesia (min) | P value |
|---|---|---|---|---|
| **Duration of analgesia** | **RP** | **30** | **421.66±28.20** | **0.001** |
| | **RM** | **30** | **588.32±18.98** | |
| **Total patients** | | **60** | | |

One way ANOVA followed by Post-hoc Tukey applied. P value <0.05 was taken as statistically significant

Comparison of mean duration of analgesia between the two groups was found to be statistically significant (P=0.001). It was higher in group RM 588.32±18.98 mins as compared to the group RP 421.66±28.20 mins.

In our study we didn't find any significant haemodynemic changes and Side effects of drugs like hypotension, bradycardia, nausea, vomiting and breathlessness.

## Discussion

The results of our study demonstrated that the addition of magnesium sulfate to 0.5% ropivacaine for infraclavicular brachial plexus block improve the intraoperative anaesthesia quality, Prolongs the duration of sensory and motor block and also prolongs the duration of postoperative analgesia.

Addition of magnesium sulfate decreases the requirement of rescue analgesia and significantly lowers the VAS scores.

However, addition of magnesium sulfate did not decrease the onset time of sensory and motor block. Onset of sensory and motor block was delayed in magnesium sulfate as compared to ropivacaine alone. But it was statistically insignificant.

Mukherjee et al.[12] studied the effects of using 150 mg Magnesium sulfate as an adjuvant to ropivacaine 0.5% for supraclavicular brachial plexus block in 100 patients undergoing upper limb surgeries and concluded that the addition of Mgso4 to ropivacaine 0.5% resulted in prolongation of the sensory and motor block duration and the time for the first rescue analgesia as well as decreased total analgesic consumption without any side effects.

Lee et al.[13] studied the addition of 2 ml Mgso4 to 0.5% Bupivacaine with epinephrine(1:200000) for the interscalene nerve block in 66 patients underwent arthroscopic rotator cuff repair resulted in increased the duration of analgesia and reduces the postoperative pain.

Elyazed and Mogahed et al.[14] studied the effects of adding 150 mg Mgso4 to 0.5% Ropivacaine in infraclavicular brachial plexus block and observed significant prolongation of both sensory and motor block and duration of analgesia without any side effects.

Kaur et al.[15] studied comparison of Mgso4 and Ketamine with ropivacaine in supraclavicular Brachial plexus block and concluded that both 250 mg Mgso4 and 2 mg per kg Ketamine when added to 0.5% ropivacaine for supraclavicular BPB improve the quality of postoperative analgesia when compared to ropivacaine alone. [16]

## Conclusion

Addition of Magnesium sulfate 2mg/kg to 0.5% Ropivacaine for infraclavicular Brachial plexus block prolongs the duration of sensory and motor block as well as prolongs the duration of postoperative analgesia with better patients satisfaction.

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