

Comparison of 0.5% Ropivacaine with 0.5% Ropivacaine and Magnesium sulphate in supraclavicular brachial plexus block for forelimb and hand surgeries

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Abstract

Objectives: Supraclavicular Brachial Plexus is commonly used for forelimb and hand surgeries. A lot of research is going on to increase the duration of sensory and motor blockade by the addition of adjuvants with the local anesthetics. We evaluated the effect of adding magnesium sulphate to ropivacaine for supraclavicular brachial plexus blockade. Our primary parameters were the onset and duration of sensory and motor block and duration of analgesia. **Methods:** 60 patients posted for elective forearm and hand surgeries under supraclavicular brachial plexus block were divided into two equal groups (Group RM and RN) in a double blind fashion. In Group RM 30ml 0.5% ropivacaine plus 150 mg magnesium sulphate in (1 ml 0.9% saline) and in group RN 1ml of normal saline was added to ropivacaine. **Results:** Both the groups have similar demographic profile and time of onset of sensory and motor block but the duration of sensory and motor blockade and duration of analgesia were significantly longer in RM group than RN group. Intraoperative hemodynamics were comparable among two groups and no considerable side effects were noted in both the groups. **Conclusion:** It can be concluded from our study that by addition of magnesium sulphate to local anesthetics in supraclavicular brachial plexus block may increase the duration of sensory and motor blockade and duration of analgesia with no appreciable side effects, however duration of onset of sensory and motor blockade was more in magnesium sulphate group.

Key words: Supraclavicular brachial plexus block, Ropivacaine, Magnesium sulphate.

Introduction

Brachial plexus block provide a useful alternative to general anesthesia for upper limb surgery. It results in obtaining ideal operating conditions by producing complete muscular relaxation and stable intra-operative hemodynamics. Regional Anesthesia has particular importance in the orthopedic surgery than general anaesthesia due to better preservation of pharyngeal and laryngeal reflexes results in decreasing the risk of aspiration[1], decreased stress response in compromised patients and avoidance of difficult intubation [2]. Regional Anaesthesia also results in better post-operative analgesia without undue sedation and

facilitating early mobilization and discharge from the hospital.

Supra clavicular approach is commonly used for brachial plexus block because of its ease, reliability and high success rate. Moreover, this approach doesn't results in sparing of musculocutaneous or axillary nerves. Ropivacaine is a newer long acting amide local anesthetic having improved safety profile as compared to bupivacaine[3]. Ropivacaine has several other advantages namely to produce differential blockade with less motor blockade along with reduced cardiovascular and neurological toxicity. Local anesthetics alone for supraclavicular brachial plexus block provide ideal operative conditions but have

shorter duration of postoperative analgesia. So various adjuvants like opioids [4], clonidine [5] and dexamethasone [6] were added to local anesthetics to prolong the duration and intensity of brachial plexus block but the results were equivocal.

Magnesium[7] is second most intracellular cation present in the body in abundant quantities after potassium. It blocks competitively the entry of calcium in presynaptic nerve endings leading to reduced release of acetylcholine from nerve endings and can produce similar effects like calcium channel blockers. Magnesium also antagonize NMDA (N-methyl D-aspartate) receptors and thereby augment antinociceptive effect. Many authors in their studies have demonstrated the decreased requirement of anaesthetics during general anesthesia and postoperative analgesic consumption after magnesium administration [8,9,10]. Magnesium also results in decreased postoperative opioid consumption when administered through epidural route [11]. so due to these analgesic properties it can be tried as an adjuvant with local anesthetics to prolong the duration and intensity of brachial plexus block.

Hence our study was designed to test the hypothesis that magnesium if added as an adjuvant to ropivacaine while administering supraclavicular brachial plexus block may enhance the duration of analgesia, duration of sensory and motor block.

Aims and Objectives

The primary aim of our study was to compare:

1. The efficacy and clinical characteristics of ropivacaine 0.5% plus magnesium sulphate and ropivacaine 0.5% in supraclavicular brachial plexus block posted for forearm and hand surgery.
2. To note the onset and duration of sensory and motor block in both the groups

The secondary aim of our study was to see the effects of these drugs on haemodynamics and complications if any.

Material and Methods

This study was conducted in department of anesthesia of one of the leading medical college in Punjab. The present study was done on 60 cases of either sex of American Society of Anesthesiologists (ASA) I or II between age group of 18 and 50 years, weighing between 40 to 60 kilograms, scheduled for forearm and hand surgeries of one hour duration under

supraclavicular brachial plexus block after approval by ethical committee.

A detailed history was taken and the patients were thoroughly examined on the previous day before the surgery. The procedure to be performed was explained to each patient one day before the day of operation during pre anesthetic evaluation.

Exclusion Criteria: History of respiratory, cardiac, hepatic or renal disease, convulsions, pregnant women. Patient with the history of bleeding disorders, local infection at the site of injection, anomalies of neck and shoulder, fracture clavicle, patients sensitive or allergic to ropivacaine and other local anesthetics..

BP and Pulse was measured in preanesthesia room, intravenous line was established and the patients was premedicated with Inj. glycopyrrolate 0.2 mg.kg⁻¹ of body weight intramuscularly half an hour before performing the block. Patient was shifted to operation theatre and monitor was attached. Inj. midazolam 0.1 mg.kg⁻¹ of body weight i.v was given before administering brachial plexus block. The patients were randomly and equally divided into two groups of 30 each. The group RM (Ropivacaine with magnesium sulphate) patients was given 30 ml of 0.5% ropivacaine plus 150 mg MgSO₄ (in 1ml 0.9% normal saline) while Group RN (ropivacaine plus normal saline) patients received 30 ml of 0.5% ropivacaine plus 1ml 0.9% normal saline. After turning the head to opposite side, painting and draping of the supraclavicular region was done. The supraclavicular block was performed by classical approach with a 23 gauge 4 cm long needle. The neurovascular bundle was located with peripheral nerve locator and the drug was injected on obtaining parasthesia after negative aspiration for blood.

During surgery pulse, systolic blood pressure, diastolic blood pressure, oxygen saturation and ECG were monitored. Pulse, systolic blood pressure, diastolic blood pressure were recorded every 15 mins till the end of surgery. Oxygen was routinely administered via oxygen face mask at the rate of 4 litre per min. Maximum duration of all the surgery was upto 60- 90 mins.

Sensory blockade was assessed by 3 point sensory score:

- 0-Sharp pain on pinprick,
- 1-Touch sensation on pinprick,
- 2-Not even touch sensation on pinprick.

Onset of sensory blockade was taken as the time between injection and the complete abolition of pinprick

test (sensory score-2). Duration of sensory block will be defined as the time from complete block to return of the parasthesia (sensory score-0). If a sensory score of 2 was not achieved even after 45 minutes or if there was sparing in any segment, the sensory analgesia was deemed to be not satisfactory and these patients were excluded from the study. Complications of brachial plexus block and side effects of local anesthetics used were also noted.

Motor blockade was also assessed by a 3 point motor score described by Bromage:

- 0-Full flexion and full extension of elbow, wrist and fingers,
- 1-Ability to move fingers only
- 2-Inability to move fingers.

Onset of motor blockade was considered as the time from performance of block to the time when a complete inability to move fingers (score-2) was achieved. Duration of motor blockade was considered as time from complete motor blockade to the restoration of full flexion and extension of elbow, wrist and fingers (score-0).

Results

There was no statistical significant difference in age, weight & sex distribution between two groups

Onset and duration of Sensory and Motor Block- As Table 1 shows, mean duration of onset of sensory block in ropivacaine with MgSo4 group was 6.5 ± 0.89 mins and in ropivacaine with normal saline group was 5.5 ± 0.65 mins. Mean duration of onset of motor block in ropivacaine with MgSo4 was 14.3 ± 2.64 mins and in ropivacaine with normal saline group was 12.4 ± 2.06. but on inter group comparison there was no statistical significant difference in onset of sensory block and onset of motor block between two Groups (p>0.05).

Table-1: Onset and duration of Sensory and Motor Block in two Groups (min) (Mean ± SD)

Variables	Group RM (Ropivacaine plus MgSo ₄)	Group RN (Ropivacaine plus normal saline)	p-value
Onset of sensory block	5.5 ± 0.89	6.5 ± 0.65	> 0.05
Onset of motor block	14.3 ± 2.64	12.4 ± 2.06	> 0.05
Duration of sensory block	420±30.25	290 ± 26.95	< 0.05
Duration of motor block	350 ± 15.25	236 ± 20.06	< 0.05

Mean duration of sensory block in ropivacaine with MgSo₄ group was 420±30.25 mins and in ropivacaine with normal saline group was 290 ± 26.95 mins. Mean duration of motor block in ropivacaine with MgSo₄ group was 350 ± 15.25

Postoperative analgesia was assessed by the 10 point visual analogue scale.

- No pain = 0
- Mild pain = 1-3
- Moderate pain = 4-7
- Severe = more than 7

Injection Diclofenac Sodium (1.5 mg.kg⁻¹ intramuscularly) was given when VAS > 5. Total duration of Analgesia(time from onset of sensory block to time when patient has a visual analogue scale of >5) was recorded between two groups.

Sample size was calculated keeping in view at most 5% risk, with minimum 80% power and 5% significance level (significant at 95% confidence interval). Raw data were entered into a Microsoft Excel Spreadsheet and analyzed using Statistical Package for the Social Sciences (SPSS Inc., version 14, Chicago, IL, USA). The results was expressed as mean±SD. Statistical analysis consisted of Z test.ANOVA was used to analyze hemodynamic variations between two groups. p<0.05 considered as significant and p<0.01 considered as highly significant.

mins and in ropivacaine with normal saline group was 236 ± 20.06 . but on inter group comparison there was statistical significant difference in duration of sensory blockade and motor blockade ($p < 0.05$).

Intra-operative Parameters- There was no statistical significant difference in intra-operative parameters namely pulse, systolic blood pressure and diastolic blood pressure between two groups ($p > 0.05$).

Duration of Analgesia- As fig.1 shows, duration of Analgesia in Group RM (Ropivacaine plus $MgSO_4$) was 440 ± 18.2 mins and in Group RN (Ropivacaine plus normal saline) was 310 ± 20.3 mins and data was statistically significant ($p < 0.05$).

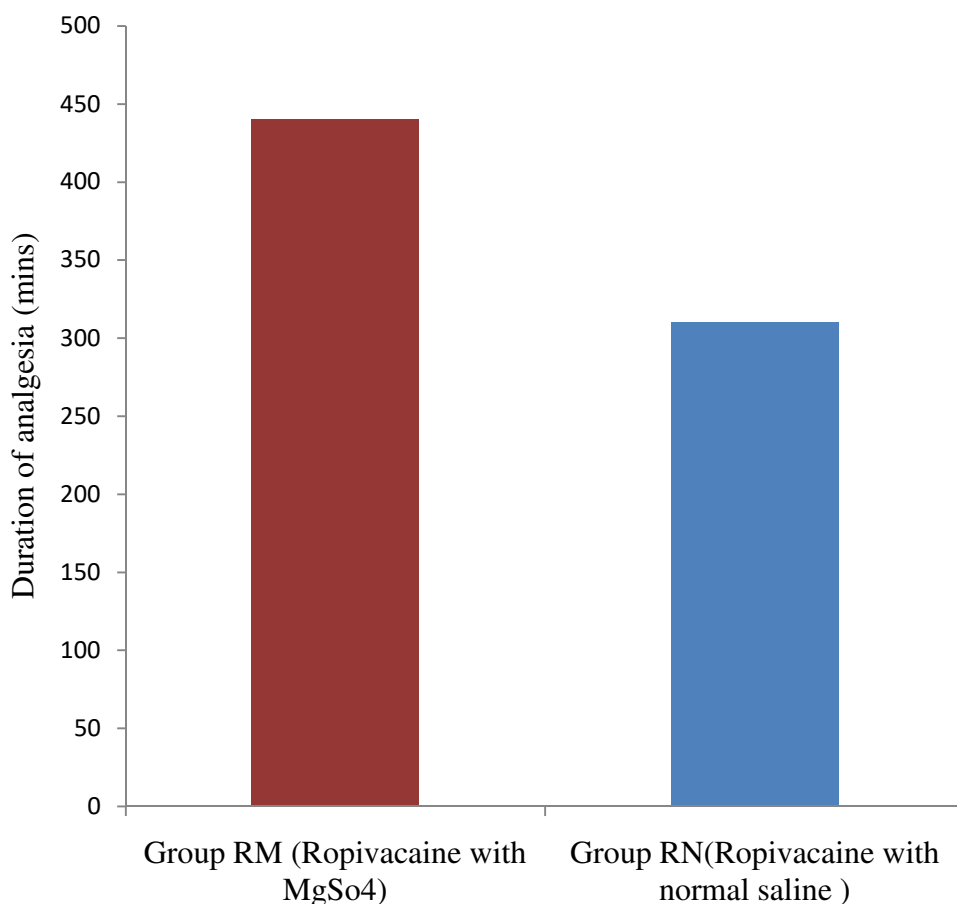


Fig-1: Duration of Analgesia between two Groups (mins)

Comparison of Complications- In our study, 3 patients had incidence of nausea, 5 patients had hypotension in Ropivacaine plus $MgSO_4$ group as compared to 2 patients had incidence of nausea and 3 had hypotension in Ropivacaine plus normal saline group after 30 mins of administration of block but the difference was statistically insignificant. ($p > 0.05$) (Table 2).

Table-2: Comparison of Complications in two Groups

Complication	Group RM (Ropivacaine plus $MgSO_4$)	Group RN (Ropivacaine plus normal saline)
Nausea	3	2
Hypotension	5	3

Discussion

In our prospective randomised clinically study we have compared 30 patients (Group RM) 30 ml of 0.5% Ropivacaine plus 150 mg MgSO₄ (in 1ml 0.9% normal saline) Versus 30 patients of (Group RN) 30ml 0.5% ropivacaine with 1ml normal saline. There was no statistical significant difference regarding age, weight and sex distribution between two groups.

The onset of sensory block in Group RM was 6.5 mins while in Group RN was 5.5 mins and the onset of motor blockade in Group RM was 14.3 mins and in Group RN was 12.4 mins. Although Sensory onset and motor onset were little delayed in group RM than in group RN but there was no statistical significant difference between two groups ($p > 0.05$).

Khezri et al[12], Malleeswaran et al[13] and Ekmecki et al[14] also observed similar results while performing femoral nerve block found significantly delayed onset of sensory block in the levobupivacaine plus magnesium group than in the levobupivacaine group though it was statistically insignificant.

In our study ,duration of sensory block was (420 ± 30.25 mins in RM group and 290 ± 26.95 mins in RN group) significantly higher in the magnesium group than normal saline group ($p < 0.05$).

The duration of motor block was (350 ± 15.25 mins in RM group and 236 ± 20.06 mins in RN group) also significantly higher in magnesium group than normal saline group ($p < 0.05$). Malleeswaran et al[12], Ekmecki et al[14] and Lee et al[15] also found similar results in their studies .

Total duration of analgesia in our study was (440 ± 18.2 mins in RM group and 310 ± 20.3 mins in RN group)

Conclusion

We conclude that addition of 150 mg Magnesium sulphate to ropivacaine 0.5% solution in supraclavicular brachial plexus block prolongs the duration of sensory, motor blockade and duration of analgesia but results in slight delay in the onset time of sensory and motor blockade.

So we recommend adding Magnesium sulphate as adjuvant to ropivacaine in brachial plexus block for upper limb surgeries.

Contribution by Authors

Detail contribution is as mentioned below:

significantly higher in ropivacaine with magnesium group than ropivacaine with normal saline group.

Our findings were correlated to Malleeswaran et al[12] who found total duration of analgesia after interscalene brachial plexus block with bupivacaine and bupivacaine plus magnesium sulphate were 10.6 h and 11.6 h respectively.

Regarding complication, only three patients in RM group and two patients in RN group had nausea which was easily managed by only increasing the fluid transfusion rate and no active intervention was required. Hypotension occurred only in five patients in RM group and two patients in RN group and they were managed by only increasing the rate of intravenous fluids except one patient required intravenous mephenteramine sulphate 5mg . on intergroup comparison for both nausea and hypotension data was statistically insignificant ($p > 0.05$).

Choi et al[16] also found similar complications (nausea, hypotension) in their study and the difference between magnesium group and normal saline group was statistically insignificant ($p > 0.05$).

Several mechanisms of actions have been advocated to explain the analgesic effect of magnesium. The analgesic activity of Magnesium is chiefly exerted by NMDA receptor antagonism in a noncompetitive manner and at the same time by blocking competitively the entry of calcium in presynaptic endings leading to decreased release of acetylcholine[17,18].

This also results in reduced post synaptic activity of slow conducting unmyelinated C-fibers which are chiefly afferent fibers conveying input signals from periphery to Central Nervous System[19,20].

-	Contributor 1	Contributor 2		Contributor 3 and 4
Concepts	Yes	Yes		No
Design	Yes	Yes		No
Definition of intellectual content	Yes	Yes		No
Literature search	Yes	Yes		No
Clinical studies	Yes	Yes		No
Experimental studies	Yes	Yes		No
Data acquisition	Yes	Yes		No
Data analysis	Yes	Yes		No
Statistical analysis	Yes	Yes		No
Manuscript preparation	Yes	No		Yes
Manuscript editing	No	No		Yes
Manuscript review	Yes	Yes		Yes
Guarantor	Yes	Yes		No

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Permission of IRB: Yes

References

1. McKenzie PJ, Loach AB. Local anaesthesia for orthopedic surgery. *Br J Anaesth* 1986;58:779-89.
2. Khanduri KC. Regional Anaesthesia Techniques for Orthopaedic Surgery. *Med J Armed Forces India*. 2008 Apr;64(2):108-10. doi: 10.1016/S0377-1237(08)80048-2. Epub 2011 Jul 21.
3. Klein SM, Greengrass RA, Steele SM, D'Ercole FJ, Speer KP, Gleason DH, DeLong ER, Warner DS. A comparison of 0.5% bupivacaine, 0.5% ropivacaine, and 0.75% ropivacaine for interscalene brachial plexus block. *Anesth Analg*. 1998 Dec;87(6):1316-9.
4. Bazin JE, Massoni C, Groslier D, Fenies V, Bittar M, Schoeffler P. [Brachial plexus block: effect of the addition of sufentanil to local anesthetic mixture on postoperative analgesia duration]. *Ann Fr Anesth Reanim*. 1997;16(1):9-13.
5. Kohli S, Kaur M, Sahoo S, Vajifdar H, Kohli P. Brachial plexus block: Comparison of two different

doses of clonidine added to bupivacaine. *J Anaesthesiol Clin Pharmacol* 2013;29:491-5. doi: 10.4103/0970-9185.119147.

6. Yadav RK, Sah BP, Kumar P, Singh SN. Effectiveness of addition of neostigmine or dexamethasone to local anaesthetic in providing perioperative analgesia for brachial plexus block: A prospective, randomized, double blinded, controlled study. *Kathmandu Univ Med J (KUMJ)*. 2008 Jul-Sep;6(23):302-9.

7. Sirvinskas E, Laurinaitis R. [Use of magnesium sulfate in anesthesiology]. *Medicina (Kaunas)*. 2002;38(7):695-8.

8. Telci L, Esen F, Akcora D, Erden T, Canbolat AT, Akpir K. Evaluation of effects of magnesium sulphate in reducing intraoperative anaesthetic requirements. *Br J Anaesth*. 2002 Oct;89(4):594-8.

9. Koinig H, Wallner T, Marhofer P, Andel H, Hörauf K, Mayer N. Magnesium sulfate reduces intra- and postoperative analgesic requirements. *Anesth Analg*. 1998 Jul;87(1):206-10.

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10. Panda NB, Bharti N, Prasad S. Minimal effective dose of magnesium sulfate for attenuation of intubation response in hypertensive patient. *J Clin Anesth* 2013;25:92-7. doi: 10.1016/j.jclinane.2012.06.016. Epub 2013 Jan 17.
11. Agrawal A, Agrawal S, Payal YS. Effect of continuous magnesium sulfate infusion on spinal block characteristics: A prospective study. *Saudi J Anaesth* 2014;8:78-82. doi: 10.4103/1658-354X.125945.
12. Khezri MB, Yaghobi S, Hajikhani M, Asefzadeh S. Comparison of postoperative analgesic effect of intrathecal magnesium and fentanyl added to bupivacaine in patients undergoing lower limb orthopedic surgery. *Acta Anaesthesiol Taiwan*. 2012 Mar;50(1):19-24. doi: 10.1016/j.aat.2012.03.001. Epub 2012 Mar 31.
13. Malleeswaran S, Panda N, Mathew P, Bagga R. A randomised study of magnesium sulphate as an adjuvant to intrathecal bupivacaine in patients with mild preeclampsia undergoing caesarean section. *Int J Obstet Anesth*. 2010 Apr;19(2):161-6. doi: 10.1016/j.ijoa.2009.08.007. Epub 2010 Feb 18.
14. Ekmekci P, Bengisun ZK, Akan B, Kazbek BK, Ozkan KS, Suer AH. The effect of magnesium added to levobupivacaine for femoral nerve block on postoperative analgesia in patients undergoing ACL reconstruction. *Knee Surg Sports Traumatol Arthrosc*. 2013 May;21(5):1119-24. doi: 10.1007/s00167-012-2093-4. Epub 2012 Jun 14.
15. Lee AR, Yi HW, Chung IS, Ko JS, Ahn HJ, Gwak MS, Choi DH, Choi SJ. Magnesium added to bupivacaine prolongs the duration of analgesia after interscalene nerve block. *Can J Anaesth*. 2012 Jan;59(1):21-7. doi: 10.1007/s12630-011-9604-5. Epub 2011 Oct 20.
16. Choi IG, Choi YS, Kim YH, Min JH, Chae YK, Lee YK, et al. The Effects of Postoperative Brachial Plexus Block Using MgSo4 on the Postoperative Pain after Upper Extremity Surgery. *Korean J Pain* 2011;24:158-63. doi: 10.3344/kjp.2011.24.3.158.
17. Woolf CJ, Thompson SW. The induction and maintenance of central sensitization is dependent on N-methyl-D-aspartic acid receptor activation; implications for the treatment of post-injury pain hypersensitivity states. *Pain*. 1991 Mar;44(3):293-9.
18. Ascher P, Nowak L. Electrophysiological studies of NMDA receptors. *Trends Neurosci* 1987;10:284-8.
19. Woolf CJ, Chong MS. Preemptive analgesia--treating postoperative pain by preventing the establishment of central sensitization. *Anesth Analg*. 1993 Aug;77(2):362-79.
20. Liu HT, Hollmann MW, Liu WH, Hoenemann CW, Durieux ME. Modulation of NMDA receptor function by ketamine and magnesium: Part I. *Anesth Analg*. 2001 May;92(5):1173-81.

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