ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 8, Issue – 1, February - 2025, Page No. : 88 – 92

Comparison of Dexamethasone and Magnesium Sulphate As Adjuvants To 0.5% Ropivacaine in Ultrasound Guided Supraclavicular Brachial Plexus Block- A Prospective, Randomized, Double Blind Study

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How to citation this article: Dr. Vandhana S, Dr. Bhagyashree Amingad, Dr. Hanumanthappa V Airani, "Comparison of Dexamethasone and Magnesium Sulphate As Adjuvants To 0.5% Ropivacaine in Ultrasound Guided Supraclavicular Brachial Plexus Block- A Prospective, Randomized, Double Blind Study", IJMACR- February - 2025, Volume – 8, Issue - 1, P. No. 15 – 21.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction

Peripheral nerve blocks (PNB) are preferred over general anesthesia in upper limb surgeries. Regional nerve blocks work on the principle of blocking conduction of painful stimulus along the pathway of nerve fibres in the region. Ultrasound has made the technique of giving the block easier. Brachial plexus block is the most preferred PNB for upper limb surgeries and supraclavicular approach is used for surgeries for elbow, forearm and hand. Ropivacaine, a long acting S-enantiomer of Bupivacaine, has better sensorimotor differentiation and is less cardiotoxic[1]. Magnesium Sulphate (MgSO4), a N-methyl-D-aspartate (NMDA) receptor antagonist, plays a role in modulating inflammatory and pain responses by preventing central sensitization caused by peripheral nociceptive stimulation.[2]

Dexamethasone, a highly potent, long acting glucocorticoid which decreases activity of nociceptive C-fibres and prolongs analgesic duration through systemic anti-inflammatory and local vasoconstrictor effects.[2]

Aims and Objectives

1. To evaluate and compare the onset of sensory and motor block between the groups.
2. To evaluate and compare the total duration of sensory and motor block between the groups.
3. To compare the total duration of analgesia between the groups

Material and Methods

Study Design: Prospective, double blinded and randomized study

Study setting: Major operation theatre, Department of Anaesthesiology, Hassan Institute of Medical Sciences, Hassan.

Study Population: Patients undergoing upper limb surgeries.

Study Duration: 6 months

Study Outcome: Sensory and motor blockade with postoperative analgesia.

Inclusion Criteria

1. Aged 18-60years
2. ASA I and II
3. Patients posted for elective and emergency upper limb surgeries.
4. Willing for informed and written consent
5. Adequate nil per oral status

Exclusion Criteria

1. Aged <18years and >60 years
2. Allergy to study drugs
3. ASA III and IV
4. Patients with neuropathies

Based on the study by Shambavi T et al[4] → Rescue analgesia administered in Group BM was 154.55+59.11 mg and that of Group BD was 270.25+105.72 mg.

$n = 2^* Z^2 S^2 / d^2$

n → Sample size per group

Z→ α/2 + 1- ß = 4.286

S→ Common standard deviation = 82.415

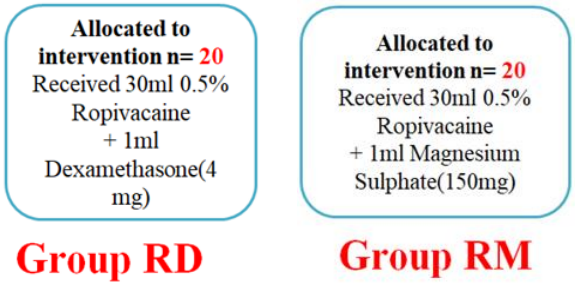
d → precision = 115.7

So, $n= 2^*(4.286)^2 (82.415)^2 / (115.7)^2 = 19$ (approx) → per group

Total sample size will be 40

Methodology

- Approval from Institutional ethical committee was obtained.
- Patients fulfilling the inclusion criteria, was allocated into 2 groups randomly by sequentially numbered, opaque, sealed envelope (SNOSE) method.



- Pre-anaesthetic evaluation was done, informed and written consent was taken.
- All the patients were kept 6 hours nil per oral prior to surgery.
- On arrival to the operation theatre, baseline vitals were recorded and intravenous infusion of Ringer lactate started using 18G cannula.
- Under USG guidance, brachial plexus block performed through supraclavicular approach.
- Group RD - 30ml 0.5% Ropivacaine+ 1ml Dexamethasone(4 mg)
- Group RM - 30ml 0.5% Ropivacaine+ 1ml Magnesium Sulphate(150mg)
- Sensory block was assessed using 3-points scale over C5-T1 dermatomes every 5 minutes till the loss of sensation to pinprick, using 22-guage hypodermic needle.

0 - sharp pain,

1 - Dull pain (analgesia),

2 - No pain (anesthesia).

- Motor block was assessed using modified bromage scale.

Grade 1 – ability to flex or extend the forearm

Grade 2 – ability to flex or extend only wrist or fingers

Grade 3 - ability to flex or extend only fingers

Grade 4- inability to move the forearm, wrist or fingers

- Recovery from sensory block → Time to return of complete sensation.
- Recovery from motor block → Time when patient regains strength to move the relevant muscle group against gravity.
- Duration of analgesia → till VAS score >3 and asked for rescue analgesia. (Inj. Diclofenac aqueous 75mg IV slow).

VAS score: 0-10 score

0-No pain

1, 2-Mild pain

3, 4, 5-Moderate pain

6, 7-Severe pain

8, 9-Very severe pain

10-Worst possible pain

- Hemodynamic parameters and side effects were also recorded.

Statistical Analysis

Data was entered in microsoft excel and SPSS software was used for analysis. Categorical data expressed in percentages and proportions. Chi Square test is the test of significance. Continuous data is expressed as mean and standard deviation. Unpaired t test is the test of significance to identify the mean difference between the groups. Observations was evaluated statistically and P value <0.05 is taken as significant.

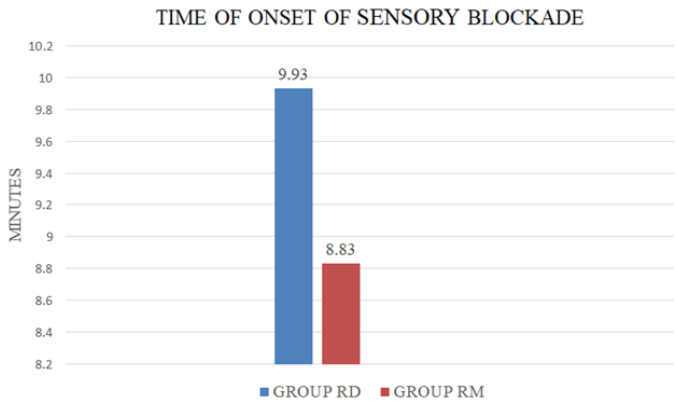
Results

Comparison of Demographic characteristics between Group RD and Group RM.

Table 1:

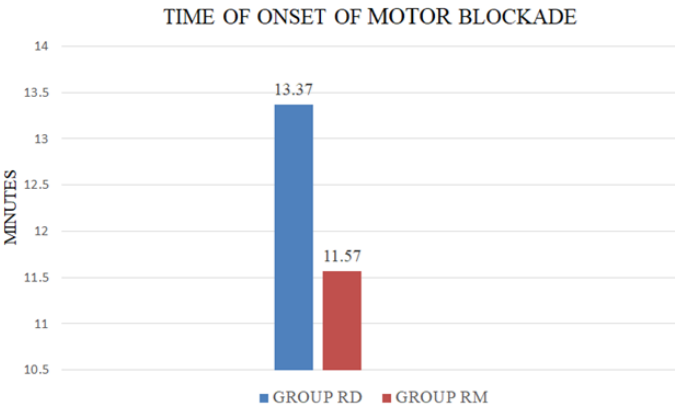
	Group RD (N=20)	Group RM (N=20)	p value
Age (years)	42.21 ± 3.8	44.35±4.08	0.87
Sex (M:F)	18:7	20:5	0.43
Height (cm)	158±1.3	156±1.8	0.80
Weight (kg)	65.13±13.4	64.42±9.6	0.83
ASA I : II	21:9	22:8	0.48

Graph 1:



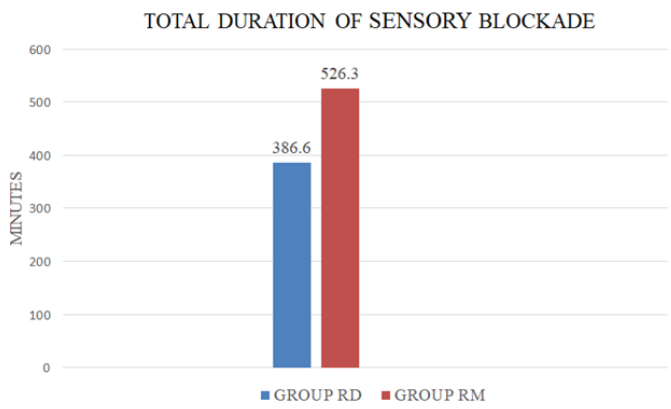
Onset of sensory block was faster in Group RM (8.83 mins) than Group RD (9.93 mins) p< 0.024.

Graph 2:



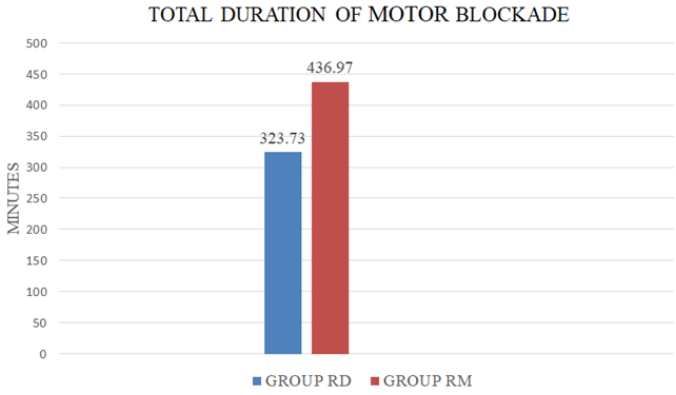
Onset of motor block was faster in Group RM (11.57 mins) than Group RD (13.37 mins) p< 0.048.

Graph 3:



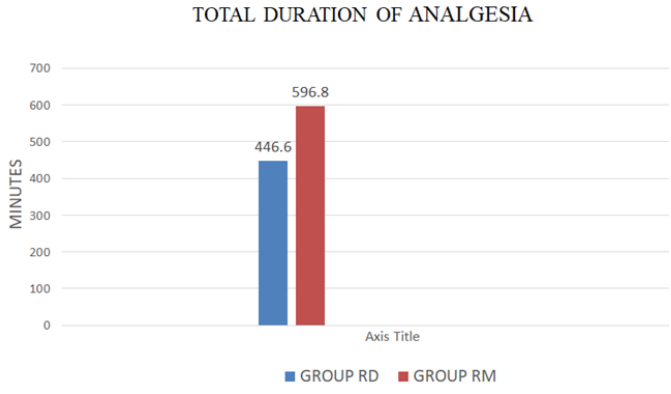
Total duration of sensory block was higher in Group RM (526.3 mins) than Group RD (386.6 mins), p< 0.001.

Graph 4:



Total duration of motor block was higher in Group RM (436.97 mins) than Group RD (323.73) , p< 0.001.

Graph 5:



Total duration of analgesia was higher in Group RM (596.8 mins) than Group RD (446.6 mins) , p< 0.001.

Discussion

From this study, it can be elicited that MgSO4, when used as an adjuvant, hastens the onset, prolongs the duration of block and postoperative analgesia.

Many studies had used different doses of MgSO4 as adjuvant with Bupivacaine. But only few studies are available with 150mg MgSO4.

In this study, 150mg of Magnesium Sulphate was used based on the study done by Deshpande et al[1] which prolonged duration of analgesia with no significant side effects. A study conducted by Gad et al, concluded that MgSO4 along with Ropivacaine provided prolonged analgesia compared to Dexamethasone in TAP block for Total Abdominal Hysterectomy.

A study by Deshpande JP, et al concluded that Magnesium along with Ropivacaine in axillary brachial plexus block, hastened the onset and prolonged the duration of anaesthesia and postoperative analgesia.

Shridevi RJ, et al concluded that MgsO4 as adjuvant to Ropivacaine in supraclavicular block had faster onset and prolonged anaesthesia.

A study conducted by Mukherji et al, concluded that onset time and time to first analgesic were significantly longer and total need for rescue analgesia was lower in Ropivacaine- MgSO4 group in supraclavicular block.

As concluded by Gunduz, et al Magnesium when added to Prilocaine, prolonged the duration of axillary plexus block. MgSO4 – Non-competitive NMDA receptor antagonist that blocks voltage dependent ion channels and preventions pain perception. Dexamethasone – Binds to glucocorticoid receptor and inhibits K+ conductance and thus decreases activity of nociceptive C-fibres. There were no block failures or adverse events noted in patients of either groups which could be

attributed to the use of ultrasound and careful aspiration before injection.

The results of the aforementioned study are consistent with the results of the present study in this regard.

Limitation

- Plasma levels of drugs was not measured in the study.
- We have not included ASA III and IV patients and hence results cannot be applied to them.

Conclusion

We conclude that using Magnesium sulphate as an adjuvant to 0.5% Ropivacaine in supraclavicular brachial plexus block has faster onset and prolonged duration of sensory and motor blockade, as compared to Dexamethasone.

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