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Pre-Treatment With Magnesium Sulphate Before Non-Depolarizing Muscle Relaxants; Effect On Speed Of Onset And Recovery Using Neuromuscular Monitoring

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Abstract
Background: *Laryngoscopy and tracheal intubation are associated with significant sympathetic stimulation, leading to hemodynamic fluctuations. Magnesium sulphate, by inhibiting catecholamine release and enhancing neuromuscular blockade, may attenuate these responses and improve intubating conditions.*
Methods: *This prospective, randomized study included 50 patients undergoing elective surgery under general anesthesia. Patients were divided into two groups: Group I received magnesium sulphate (50 mg/kg loading dose followed by 15 mg/kg/h infusion), while Group II received Ringer lactate. Standard anesthesia was administered using propofol, fentanyl, and vecuronium. Hemodynamic parameters, particularly mean arterial pressure (MAP), and neuromuscular blockade characteristics were recorded and analyzed.*
Results: *Demographic variables were comparable between groups. The magnesium group showed a blunted rise in MAP following intubation and extubation compared to the control group. Additionally, magnesium significantly reduced the onset time of neuromuscular blockade (134–154 seconds vs. 250–300 seconds) and prolonged its duration (40–55 minutes vs. 30–42 minutes). Recovery from neuromuscular blockade was delayed in the magnesium group.*
Conclusion: *Intravenous magnesium sulphate pre-treatment improves hemodynamic stability during laryngoscopy and intubation and enhances the pharmacodynamics of vecuronium by shortening onset time and prolonging neuromuscular blockade. It is an effective and safe adjuvant in general anesthesia.*
Keywords: *Magnesium sulphate, neuromuscular blockade, vecuronium, mean arterial pressure, intubation, hemodynamic response*

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I. Introduction

Laryngoscopy and tracheal intubation trigger sympathetic surges. Magnesium sulphate blunts catecholamine release and is widely used for hemodynamic control and as an anticonvulsant. At the neuromuscular junction, Mg^{2+} inhibits presynaptic acetylcholine release and can potentiate non-depolarizing neuromuscular blockers (NDNMBs).

Magnesium sulphate decreases the need for anesthesia , shortens the time needed for propofol to induce anaesthesia, and decreases the overall amount of postoperative analgesics used without having any negative effects on the mother or the unborn child.

The potential of magnesium sulphate to enhance neuromuscular blockade has been suggested, but requires confirmation through direct neuromuscular monitoring studies.

II. Materials And Methods

After getting Ethical Clearance from the Institutional Ethical Committee, Patients who satisfied inclusion criteria and scheduled for Elective Surgeries under General Anaesthesia,

Patients were randomized using computer generated numbers to one of two groups: Group I (Magnesium) or • Group II (Control). Group I received magnesium sulphate with a priming dose of 50 mg/kg over ten minutes. Infusion started at rate of 15 mg/kg/h throughout the procedure. Group II received balanced salt solution (ringer lactate) with the same volume and infusion rate as of group I.

In Operating room standard monitoring consisting of non-invasive Blood pressure (BP), Pulse-oximetry, and 3-electrodeElectrocardiogram were established. All patients were monitored using Neuromuscular blockade.

Anaesthesia was induced with IV propofol 1.5-2 mg/kg and IV fentanyl 2 µg/kg followed by neuromuscular blockade using IV vecuronium 0.1 mg/kg of body weight.

The patients were ventilated with 2% sevoflurane in 6 L/min of oxygen (O2). After endotracheal intubation, anaesthesia was maintained with nitrous oxide (N2O) and O2, along with 2% Sevoflurane and as and when required vecuronium

III. Results

The demographic and clinical characteristics of patients in both groups were comparable, as shown in Table __.

In Group I (magnesium group), 17 patients (68%) were male and 8 patients (32%) were female, whereas in Group II (control group), 16 patients (64%) were male and 9 patients (36%) were female. The gender distribution between the two groups was statistically not significant ($p > 0.05$).

The mean age of patients in Group I was 54 ± 6.5 years, compared to 51 ± 7.0 years in Group II. This difference was not statistically significant ($p > 0.05$), indicating that both groups were age-matched.

With respect to physical status, 13 patients (52%) in Group I and 12 patients (48%) in Group II belonged to ASA I, while 12 patients (48%) in Group I and 13 patients (52%) in Group II were classified as ASA II. There was no statistically significant difference in ASA distribution between the groups ($p > 0.05$).

Overall, the two groups were comparable in terms of demographic variables (age and gender) and clinical status (ASA classification), ensuring homogeneity and minimizing confounding bias in outcome assessment.

Variables	Group I (Magnesium)	Group II (Control)	p value
Male	17(68%)	16(64%)	>0.05
Female	8 (32%)	9(36%)	>0.05
Age (years)	54 ±6.5	51±7.0	>0.05
ASA I	13 (52%)	12 (48%)	>0.05
ASA II	12(48.0%)	13(52%)	>0.05

Mean arterial pressure (MAP) at different time intervals is shown in Table __.

Baseline (pre-operative) MAP was comparable between Group I (magnesium sulphate) and Group II (control) ($p > 0.05$). Before induction, MAP was significantly higher in the control group ($p < 0.05$).

Following intubation, MAP increased in both groups; however, the rise was more pronounced in the control group, while the magnesium group showed a blunted response. This increase was highly significant in the control group ($p < 0.001$) but not in the magnesium group ($p > 0.05$).

At 5 minutes post-intubation, MAP values in both groups declined toward baseline, with no significant difference between groups. MAP remained stable and comparable at 30 and 60 minutes after intubation ($p > 0.05$).

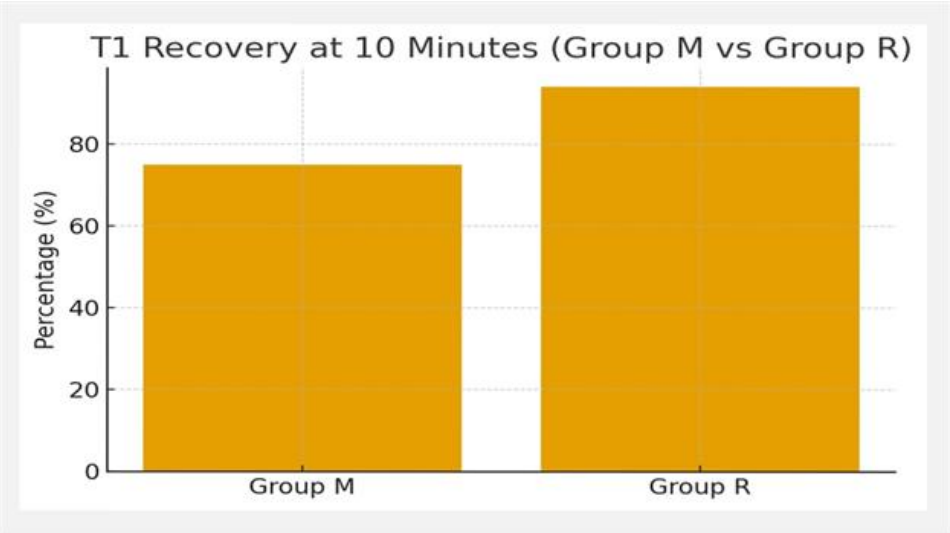
Before reversal, a significant rise in MAP was observed in the control group ($p < 0.05$), whereas the magnesium group remained stable.

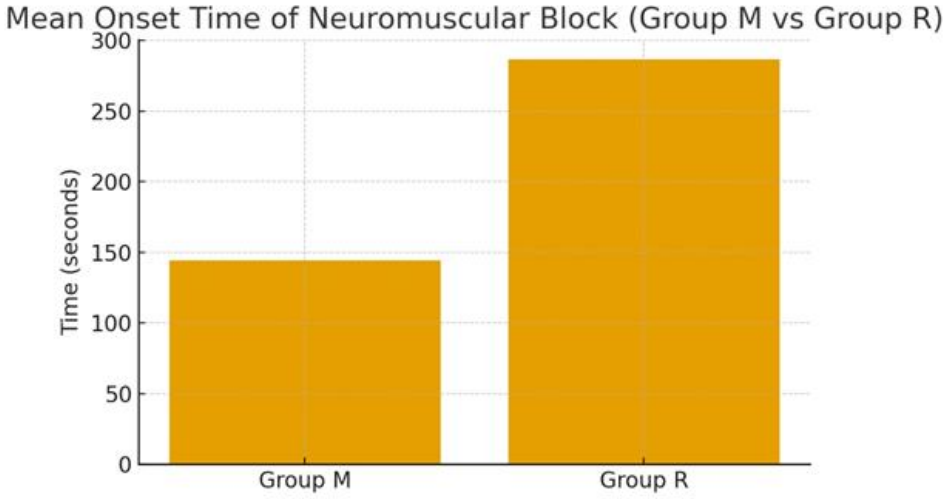
After extubation, MAP increased significantly in both groups, but the rise was greater in the control group, again indicating attenuation by magnesium sulphate. At 5 minutes post-extubation, MAP remained elevated but began to decline in both groups ($p < 0.05$).

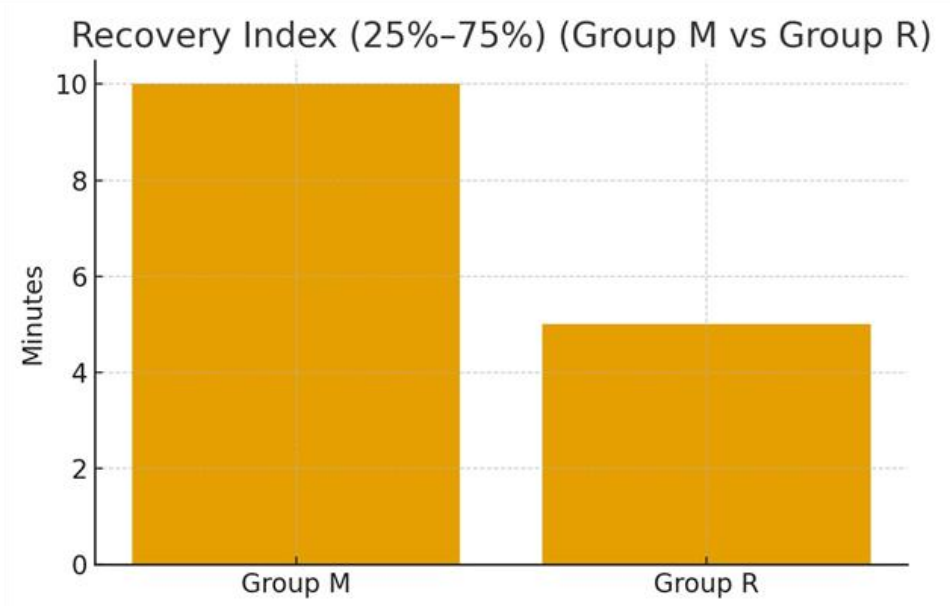
By 10 minutes after extubation, MAP returned close to baseline levels in both groups, with no significant difference ($p > 0.05$).

Time Interval	Group I ($MgSO_4$) Mean ± SD	t	p-value	Group II (Control) Mean ± SD	t	p-value
Pre-operative	94.80 ± 4.75	1.315	>0.05	94.1 ± 7.22	1.912	>0.05
Before Induction	90.55 ± 6.10	2.198	>0.05	101.85 ± 10.22	2.415	<0.05
Just after Intubation	98.10± 11.05	1.145	>0.05	108.20 ± 9.70	4.552	<0.001
5 min after Intubation	93.60 ± 7.10	0.198	>0.05	103.50± 11.00	0.750	>0.05
30 min after Intubation	92.55± 6.10	0.984	>0.05	95.70 ± 10.60	0.410	>0.05
60 min after Intubation	96.60 ± 6.55	1.066	>0.05	97.20 ± 6.40	1.310	>0.05
Before Reversal	103.20 ± 10.75	2.710	>0.05	101.70 ± 10.65	2.095	<0.05
Just after Extubation	109.07 ± 8.87	5.554	<0.001	113.70± 9.35	3.691	<0.01
5 min after Extubation	100.55 ± 7.40	2.510	<0.05	101.55 ± 6.90	2.690	<0.05

10 min after Extubation	96.15 ± 6.55	0.755	>0.05	96.90± 6.20	1.025	>0.05







IV. Discusssion

In our study, we observed that Group M demonstrated a faster onset time of 134–154 seconds compared with Group R, which had an onset time of 250–300 seconds.

Group M had a clinical duration of 40–55 minutes, whereas Group R showed a duration of 30–42 minutes. Thus, Group M exhibited a more prolonged neuromuscular blockade.

Regarding recovery, Group M showed a delayed T1 recovery of 8–12 minutes, whereas Group R recovered faster, with a recovery time of approximately 4–7 minutes.

These findings were consistent with earlier studies, including those by Suresh Singh et al reported that

In Group A, the maximum number of patients had an onset time between 120–140 seconds.

In Group B, the maximum number of patients had an onset time between 160–180 seconds.

In Group C, the maximum number of patients had an onset time between 200–220 seconds.

In Groups A and B, the majority of patients had a clinical duration between 50–60 minutes and 40–50 minutes, respectively.

In Group C, most patients had a clinical duration between 30–40 minutes.

Recovery of T1 during the 10-minute period after reversal of neuromuscular blockade was slower in the magnesium-pretreated groups (Group A and Group B) when compared with the Control Group C.

These findings indicate that magnesium sulphate is an effective and safe adjuvant for optimizing intubation conditions and improving neuromuscular blockade profiles in elective surgical patients.

V. Conclusion

Pre-treatment with intravenous magnesium sulphate significantly enhances the onset characteristics of non-depolarizing neuromuscular blockers and provides smoother haemodynamic stability during the induction of general anaesthesia.

The present study demonstrates that magnesium sulphate pre-treatment significantly influences the pharmacodynamics of vecuronium by shortening the onset time and delaying recovery from neuromuscular blockade under general anaesthesia.

References

[1]. Singh S, Malviya D, Rai S, Yadav B, Kumar S, Sharma A. Pre-Treatment With Magnesium Sulphate Before Non-Depolarizing Muscle Relaxants: Effect On Speed Of Onset, Induction And Recovery. Int J Med Sci Public Health. 2014;3(10):1238-43. Doi:10.5455/Ijmsph.2014.100720144.

[2]. Rehman A, Khaleeq S, Ahmed A, Maan MAM, Siddiq S, Khan L. Effects Of Magnesium Sulphate On The Onset And Duration Of Neuromuscular Blockade By Cisatracurium In Adult Patients Undergoing Transpedicular Screw Fixation Surgery Under General Anesthesia. APMC. 2021;15(2):113-7. Doi:10.29054/APMC/2021.897.

[3]. Ryu JH, Kang MH, Park KS, Do SH. Effects Of Magnesium Sulphate On Intraoperative Anaesthetic Requirements And Postoperative Analgesia In Gynaecology Patients Receiving Total Intravenous Anaesthesia. Br J Anaesth. 2008;100(3):397-403.

[4]. Kaskinoro K. The Effects Of Anesthetic-Induced Loss Of Consciousness On Quantitative EEG, Bispectral And Spectral Entropy Indices. Turku: University Of Turku; 2011.

[5]. Purdon PL, Pierce ET, Mukamel EA, Prerau MJ, Walsh JL, Wong KF, Et Al. Electroencephalogram Signatures Of Loss And Recovery Of Consciousness Under Propofol. Proc Natl Acad Sci U S A. 2013;110(12):E1142–E1151.

[6]. Kaskinoro K, Maksimow A, Långsjö J, Aantaa R, Jääskeläinen S, Kaisti K, Et Al. Wide Inter-Individual Variability Of BIS And Entropy At Loss Of Consciousness. Br J Anaesth. 2011;107(4):573–580.

[7]. Maeßen T, Korir N, Van De Velde M, Kennes J, Pogatzki-Zahn E, Joshi GP. Pain Management After Cardiac Surgery: PROSPECT Recommendations. Eur J Anaesthesiol. 2023;40(10):758–768.

[8]. De Baaij JH, Hoenderop JG, Bindels RJ. Magnesium In Man: Implications For Health And Disease. Physiol Rev. 2015;95(1):1–46.

[9]. Wolf FI, Trapani V. Cell (Patho)Physiology Of Magnesium. Clin Sci (Lond). 2008;114(1):27–35.

[10]. Zaychenko G, Gorchakova H, Klymenko O, Shumeiko O, Babák V. Physicochemical And Pharmacological Properties Of Magnesium. Bull Probl Biol Med. 2023;1(2):74–80.