



## Anaesthesiology

## COMPARATIVE STUDY ON ROLE OF MAGNESIUM SULPHATE IN ATTENUATION OF SUCCINYLCHOLINE INDUCED FASCICULATIONS AND POSTOPERATIVE MYALGIA

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**ABSTRACT**

**BACKGROUND:** Succinylcholine, a depolarising muscle relaxant possesses a unique property of rapid onset and short duration of action, but is accompanied by side effects such as fasciculations and myalgia. A prospective randomised-controlled trial was designed to assess the effect of a combination of magnesium sulphate with propofol for induction of anaesthesia on succinylcholine-induced fasciculations and myalgia.

**MATERIALS AND METHODS:** 60 adult patients of ASA status I and II of both sexes for elective surgery under general anaesthesia were randomly allocated into two equal groups, group MG and group NS. The patients of MG group were pretreated with magnesium sulphate 40 mg/kg body weight in 10 mL volume, while patients of NS group were given isotonic saline 0.9% in the same volume (10 mL) intravenously slowly over a period of 10 mins. Anaesthesia was administered with pentazocine 0.6 mg/kg and propofol 2 mg/kg, followed by administration of succinylcholine 2 mg/kg intravenously. Muscle fasciculations were observed and graded as nil, mild, moderate or severe. Postoperative myalgia was assessed after 24 hrs. of surgery and graded as nil, mild, moderate or severe. Observations were made in double blind manner where the observer and the patient were blinded.

**RESULTS:** Demographic data and baseline parameters of both groups were comparable ( $P > 0.05$ ). Muscle fasciculations occurred in 66.7% patients of MG group versus 100% patients of NS group with a significant difference ( $P < 0.001$ ). After 24 hrs. of surgery, 12 patients of MG group and 28 patients of NS group had myalgia with a significant difference ( $P < 0.001$ ). Statistically significant difference was found in MAP and heart rate at various intervals between the two groups ( $P < 0.001$ ).

**CONCLUSION:** Magnesium sulphate 40 mg/kg intravenously maybe used with propofol for induction of anaesthesia to control succinylcholine-induced fasciculations and myalgia.

**KEYWORDS :** Propofol, Magnesium Sulphate, Succinylcholine, Fasciculations And Postoperative Myalgia.

**INTRODUCTION**

Succinylcholine, a depolarising muscle relaxant, has a unique place in clinical practice as it is the only one of its kind, still in use today. It is still being favoured today for its rapid, and excellent skeletal muscle relaxation thereby providing the almost ideal intubating conditions. The duration of action is also brief, followed by a spontaneous recovery. When it is used in a dose of 1 - 1.5 mg/kg, it produces an excellent skeletal muscle relaxation in 30 seconds and its effects last for only 3 - 5 minutes. Its short duration of action becomes life saving in the event of failed or difficult intubation. Hence it is considered to be the gold standard drug for tracheal intubation till now. However, its usefulness is limited by the high incidence of its side effects like muscle fasciculations and postoperative myalgia. Although self-limiting, it is generally agreed that postoperative myalgia is unacceptable in modern day anaesthesia practice.

In our study we used Magnesium sulphate<sup>(1)</sup> in a dose of 40mg/kg IV with Propofol as an induction agent to attenuate this muscle fasciculations and thereby postoperative myalgia. In our study we chosen Propofol, as it have been postulated in many similar studies that Propofol is a better agent in attenuating Scoline induced muscle fasciculations than Thiopentone<sup>(2)</sup>. Also magnesium is a novel, fascinating and upcoming drug in anaesthesia

**MATERIALS AND METHODS**

This study was conducted in K.A.P.V. Government medical college Trichy, after obtaining institutional ethical committee approval. The study was conducted on 60 ASA class I and II patients undergoing elective surgery under general anaesthesia.

After thorough preoperative evaluation, the procedure was explained to all the patients and written informed consent was obtained. In the preoperative assessment patients weight, vital parameters like pulse rate, blood pressure and baseline investigations like haemoglobin, blood sugar, serum urea creatinine, ECG, and chest x ray were noted. Thorough systemic examination and airway assessment was done

**INCLUSION CRITERIA:-**

- Age between 18 and 60 years
- ASA class I and II
- Elective ENT and General surgery under general anaesthesia
- Those who given valid informed consent

**EXCLUSION CRITERIA :-**

- Patients with pre-existing musculoskeletal disorders
- Patients taking calcium channel blockers
- Those on long term analgesics like NSAIDS
- Patients who are hypersensitive to any of the drugs in the study
- Patients with renal dysfunction

Patients were randomly allocated into two groups by draw of lots namely MS and NS group.

**MS GROUP:-**

Patients received Magnesium Sulphate 40 mg/kg slow IV diluted to 10 ml with distilled water about 10 min prior to induction.

**NS GROUP:-**

Patients received Normal Saline 10 ml slow IV about 10 min prior to induction.

All preinduction monitors like NIBP, Pulse oximetry, and ECG were attached. The baseline parameters like pulse rate, systolic and diastolic blood pressure and oxygen saturation were noted. 18 G intravenous cannula was started in all patients and Ringer Lactate started.

Patients in MS group received Magnesium sulphate 40 mg/kg diluted to 10 ml with distilled water over 10 min, whereas patients in NS group received only 10 ml NS over 10 minutes. Preoxygenation done for 5 min. All patients were premedicated with inj. Glycopyrolate 0.2mg IV and inj. Midazolam 2mg IV. They were induced with fentanyl 2 mcg/kg and propofol 2 mg/kg. Subsequently they received Succinylcholine 2 mg/kg IV. Patients were then graded for muscle fasciculations as none, mild, moderate and severe.

**PRIMARY OUTCOME MEASURES :-<sup>(3)</sup>**

Presence / Absence of fasciculations and their grading as follows,

**Table 1 : Grading of severity of fasciculations**

Grading	Severity	Features
I	Nil	Absent fasciculations
II	Mild	Fine fasciculations of eyes, face, neck, fingers without obvious limb movements
III	Moderate	Fasciculations appearing bilaterally or obvious limb movements

IV	Severe	Widespread sustained fasciculations
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**SECONDARY OUTCOME MEASURES :-<sup>(4)</sup>**

Postoperative Myalgia after 24 hours

Patients were assessed for postoperative myalgia after 24 hours on the next day and graded as follows,

**Table 2 : Grading of severity of postoperative myalgia**

Gradings	Severity	Features
I	Nil	Absence of pain
II	Mild	Muscle stiffness or pain on specific questioning in nape of neck, shoulders, and lower chest on deep breathing
III	Moderate	Muscle stiffness and pain complained of by the patient spontaneously requesting analgesia
IV	Severe	Incapacitating generalised muscle stiffness or pain

**OBSERVATION AND RESULTS**

This Prospective, Randomised, Double blinded case control study analyses the effectiveness of Magnesium sulphate in attenuating the side effects of Succinylcholine like Fasciculations and Postoperative myalgia

- The results are expressed as mean and standard deviation
- All statistical analysis were done using Graph pad software
- Student T test was used for quantitative comparison
- Chi square test used for qualitative comparison
- A p – value of less than 0.05 was considered as significant statistically

60 patients were taken into the study and divided into 2 groups containing 30 each.

Group MS – Magnesium sulphate

Group NS – Placebo

**DEMOGRAPHIC PROFILE**

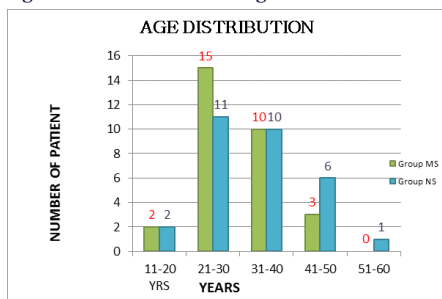
**AGE DISTRIBUTION**

**Table 3: Age Distribution in years**

	N	MEAN (yrs)	STDEV(yrs)	P value df – 58
Group MS	30	30.1	7.68	0.29 (Not significant)
Group NS	30	32.67	10.8	

P value indicates that the mean age between the two groups is not statistically significant. Hence both the groups are comparable in terms of age.

**Figure 1 Age Distribution in Years: Age Distribution in Years**

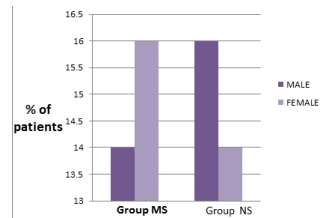


**Table 4: Gender Distribution**

SEX	MALE N =30		FEMALE N = 30		P value Df -1
	N (%)	N (%)	N (%)	N (%)	
MS GROUP	14(46.7)	16(53.3)	16(53.3)	14(46.7)	0.79
NS GROUP	16(53.3)	14(46.7)	14(46.7)	16(53.3)	
TOTAL	30(50)	30(50)	30(50)	30(50)	

The percentage of male patients in MS group is 46.7% and in NS group is 53.3%. The percentage of female patients in MS group is 53.3% and in NS group is 46.7%. P value is found to be 0.79 which is statistically insignificant. Hence both the groups are comparable in terms of sex.

**Fig 2: Gender Distribution**



**Table 5: Weight distribution in (kilograms)**

	MEAN (kg)	STEDV (kg)	P value Df = 58
MS GROUP	57.7	7.6	0.31 (Not significant)
NS GROUP	59.7	7.31	

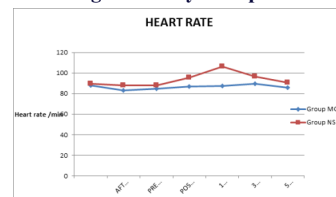
P value implies that the mean weight of two groups is not significant statistically and both the groups are comparable in terms of weight.

**Table 6 : HEART RATE changes (beats/min)**

HEART RATE	MS GROUP MEAN±STDEV	NS GROUP MEAN±STDEV	P VALUE Df = 58
BASELINE	87.9±7.94	89.73±13.05	0.49
AFTER MgSO4	83±9.79	88.2±12.94	0.09
PRE INDUCTION	84.83±8.99	88.2±11.22	0.2
POST INDUCTION	87±9.13	95.46±11.2	0.005
POST INTUBATION			
1 MIN	87.5±8.2	106.3±11.24	0.0001
3 MIN	89.46±8.6	96.53±10.49	0.006
5 MIN	85.63±7.72	90.8±10.36	0.032

Heart rate is measured at baseline, after giving MgSO<sub>4</sub>, before induction, post induction, post intubation at 1<sup>st</sup> min, 3<sup>rd</sup> min and 5<sup>th</sup> minute. Calculated p values are 0.49, 0.085, 0.21, 0.005, 0.0001, 0.006, 0.032 respectively. From the above p values it is evident that heart rate is statistically significant between the two groups during post induction, post intubation at 1<sup>st</sup> min, 3<sup>rd</sup> min and 5<sup>th</sup> minute.

**Fig 3: Heart Rate Changes in Study Groups**

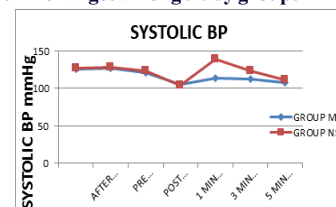


**Table 7: Systolic Blood Pressure changes (in mmHg)**

SYSTOLIC BP	MS GROUP MEAN±STDEV	NS GROUP MEAN±STDEV	P VALUE
BASELINE	125.4 ± 8.58	126.57 ± 8.32	0.616
AFTER MgSO4	126.5 ± 8.9	128.2 ± 8.27	0.45
PRE INDUCTION	121.06 ± 6.8	122.9 ± 6.9	0.302
POST INDUCTION	105.13 ± 7.92	104 ± 5.9	1.0533
POST INTUBATION			
1 MIN	113.5 ± 9.14	139.5 ± 9.83	0.0001
3 MIN	113 ± 9.21	123.9 ± 11.08	0.0001
5 MIN	107.73 ± 5.9	111.9 ± 7.9	0.024

Systolic blood pressure is measured at baseline, after giving MgSO<sub>4</sub>, before induction, post induction, post intubation at 1<sup>st</sup> min, 3<sup>rd</sup> min and 5<sup>th</sup> minute. Calculated p values are 0.6, 0.45, 0.3, 0.0001, 0.0001, 0.024 respectively. The values are statistically significant between the two groups at 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> minute of post intubation period.

**Fig 4 : Systolic BP changes among study groups**

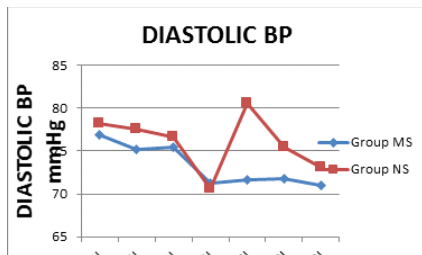


**Table 8: Diastolic Pressure changes (in mmHg)**

DIASTOLIC BP	MS GROUP MEAN±STDEV	NS GROUP MEAN±STDEV	P VALUE
BASELINE	76.86 ± 6.87	78.2 ± 5.92	0.42
AFTER MgSO4	75.17 ± 6.95	77.53 ± 6.53	0.18
PRE INDUCTION	75.5 ± 5.79	76.57 ± 5.48	0.46
POST INDUCTION	71.2 ± 4.9	70.53 ± 6.1	0.64
POST INTUBATION			
1 MIN	71.67 ± 4.46	80.6 ± 5.13	0.0001
3 MIN	71.8 ± 4.75	75.5 ± 5.9	0.0091
5 MIN	71 ± 4.5	73.07 ± 4.24	0.0802

Diastolic blood pressure is measured at baseline , after giving MgSO<sub>4</sub>, before induction , post induction , post intubation at 1<sup>st</sup> min , 3<sup>rd</sup> min and 5<sup>th</sup> minute . Calculated p values are 0.42 , 0.18 , 0.46 , 0.64 , 0.0001 , 0.0091 , 0.08 respectively . The values are statistically significant between the two groups at 1<sup>st</sup> , 3<sup>rd</sup> , and 5<sup>th</sup> minute of post intubation period.

**Fig 5 : Diastolic Pressure Changes among Study Groups**

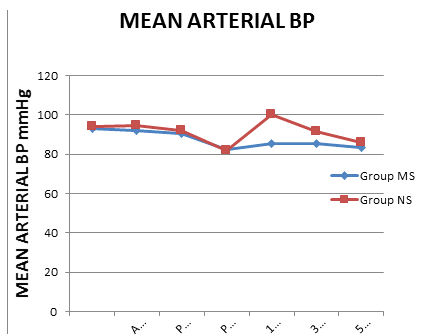


**Table 9 : Mean Arterial Pressure changes (in mmHg)**

MEAN ARTERIAL PRESSURE	MS GROUP MEAN±STDEV	NS GROUP MEAN±STDEV	P VALUE
BASELINE	93.03 ± 6.65	94.32 ± 6.06	0.534
AFTER MgSO4	92.26 ± 6.53	94.42 ± 6.26	0.196
PRE INDUCTION	90.68 ± 5.34	92.01 ± 4.73	0.3117
POST INDUCTION	82.56 ± 4.08	81.68 ± 4.42	0.427
POST INTUBATION			
1 MIN	85.61 ± 4.48	100.2 ± 5.36	0.0001
3 MIN	85.53 ± 4.63	91.65 ± 5.44	0.0001
5 MIN	83.29 ± 3.82	86.01 ± 3.95	0.0088

Mean arterial blood pressure is measured at baseline , after giving MgSO<sub>4</sub>, before induction , post induction , post intubation at 1<sup>st</sup> min , 3<sup>rd</sup> min and 5<sup>th</sup> minute . Calculated p values are 0.53 , 0.19 , 0.31 , 0.42 , 0.0001 , 0.0001 , and 0.0088 respectively . The values are statistically significant between the two groups at 1<sup>st</sup> , 3<sup>rd</sup> , and 5<sup>th</sup> minute of post intubation period.

**Fig 6: Mean arterial Pressure Changes among Study Groups**

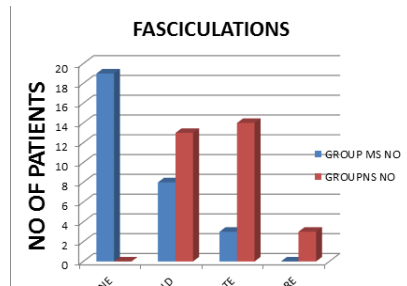


**Table 10 :Fasciculations incidence and severity - distribution**

FASCICULATIONS	GROUP MS		GROUP NS	
	NO	%	NO	%
NONE	19	63.3	0	0
MILD	8	26.61	13	43.3
MODERATE	3	10	14	46.7
SEVERE	0	0	3	10
CHI SQUARE VALUE	14.7			
P VALUE	0.0001			

19 patients had none , 8 had mild , 3 had moderate degree of fasciculations in MS group , whereas in NS group 13 had mild , 14 had moderate , 3 had severe degree of fasciculations . P value is 0.0001 which is extremely significant statistically .

**Fig 7:Incidence and Severity of Fasciculations in study groups**

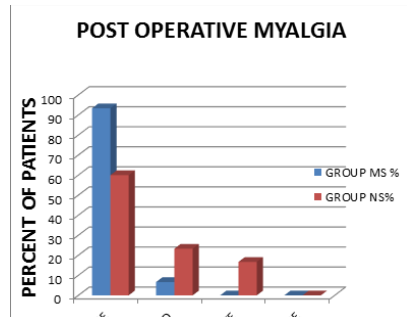


**Table 11: INCIDENCE OF POSTOPERATIVE MYALGIA myalgia**

POSTOPERATIVE MYALGIA	GROUP MS		GROUP NS	
	NO	%	NO	%
NIL	28	93.34	18	60
MILD	2	6.67	7	23.3
MODERATE	0	0	5	16.7
SEVERE	0	0	0	0
CHI SQUARE VALUE	9.317			
P VALUE	0.0023			

28 patients had nil postoperative myalgia in MS group whereas in NS group 7 had mild , 5 had moderate postoperative myalgia . P value is 0.0023 which is significant statistically .

**Fig 8: Incidence and Severity of Postoperative Myalgia at 24 hours**



**DISCUSSION**

Succinylcholine, a depolarizing muscle relaxant, has a unique place in clinical practice because it causes rapid, brief and excellent skeletal muscle relaxation followed by spontaneous recovery and thereby providing the best intubating conditions .Unfortunately, its use is associated with muscular fasciculations and postoperative myalgia.

Pretreatment with various drugs such as rocuronium(1),lignocaine (2),atracurium(2),calcium(3),diclofenac sodium (5), ketorolac(4), magnesium sulphate (7) , diazepam(6), thiopentone sodium(8) , d-tubocurarine(10) , small dose of succinylcholine (self-taming) (9),vecuronium(12) and pancuronium(11) have been tried in the past to reduce these side effects. Intravenous induction agents, like thiopentone and propofol, also modify succinylcholine-induced side effects.

Our study was carried out with the aim of ascertaining the efficacy of pretreatment with Magnesium sulphate in decreasing the intensity and incidence of succinylcholine induced fasciculations and postoperative myalgia at 24 hours.