

# To Study The Effect Of Magnesium Sulfate With Propofol Induction Of Anaesthesia On Succinylcholine-Induced Fasciculations And Myalgia

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## ABSTRACT

**BACKGROUND:** Succinylcholine is a commonly used muscle relaxant in anaesthesia that is associated with significant side effects, including muscle fasciculations and postoperative myalgia. Succinylcholine is used to facilitate tracheal intubation, especially in emergency situations when the risk of aspiration of gastric contents is present.

**AIM AND OBJECTIVE:** This research paper investigates the effect of administering magnesium sulfate in conjunction with propofol induction on succinylcholine-induced fasciculations and myalgia.

**MATERIAL & METHODS:** A total of 80 adult patients scheduled for elective surgery under general anaesthesia were divided into two groups (group I and II). The group I patients were treated with magnesium sulphate (40 mg/kg weight) in 10 ml volume while Group II patients were pretreated with normal saline (0.9% in 10 ml volume). They were given slowly intravenously over a period of 10 min. Then Anaesthesia was induced with fentanyl 1.5 mcg/kg and propofol 2 mg/kg,

followed by administration of succinylcholine 2 mg/kg intravenously. Muscle fasciculation and Myalgia were observed after 24 hours of surgery. They were graded as nil, mild, moderate and severe.

**RESULTS:** The overall incidence of muscle fasciculation in group I was 52.5% while it was 100% in group II. In group I, 22.5% ,12 % mild and moderate muscle fasciculation were developed and no severe cases of fasciculation were observed. While in group II, 52.5% moderate, 40 % mild and 7.5% severe muscle fasciculation were observed. Postoperative myalgia was observed after 24 hrs, and it was observed that patients of Group I were not showing any sign and symptoms of myalgia while in group II, 12.5% were mild, 7.5% were moderate and 80% were negative for myalgia.

**CONCLUSION:** The study found that the administration of magnesium sulfate significantly reduced both the incidence and severity of succinylcholine-induced fasciculations and myalgia, suggesting a beneficial role for magnesium sulfate in anesthesia protocols.

**KEYWORDS:** Myalgia, Muscle fasciculation, Anaesthesia, Elective surgery, Magnesium sulfate.

## INTRODUCTION

Anaesthesia is a state of temporary, induced, loss of sensation or awareness to allow surgical procedures that would otherwise be intolerably painful to the patient. Muscle relaxation allows surgery within major body cavities such as the abdomen and thorax, and also facilitates endotracheal intubation [1]. Magnesium sulfate (MgSO<sub>4</sub>), a substance called Epsom salt, has become significant in several medical fields because of its many uses and therapeutic benefits [1]. MgSO<sub>4</sub> has drawn a lot of interest in the field of general anesthesia. Although not the main aesthetic, its supplemental use in anesthesia protocols has demonstrated the potential to improve perioperative care and patient outcomes. Achieving the best possible muscle relaxation, managing discomfort like nausea and vomiting, and maintaining hemodynamic stability are essential components of aesthetic care for successful surgical procedures. Due to its well-known muscle relaxant, analgesic, and vasodilatory qualities, MgSO<sub>4</sub> has become a valuable adjunct to supplement these essential aspects of aesthetic care [2,3].

Succinylcholine is considered by many clinicians, to be the best drug for providing ideal intubating conditions for surgical procedures, anticipated difficult airways and rapid sequence induction and intubation due to its fast onset of action, profound neuromuscular blockade and an ultra-short duration of action.

Postoperative muscle damages and myalgia are attributed to different mechanisms including increased myoplasmic calcium concentration, changes in membrane phospholipids, releasing free fatty acids and the involvement of free radicals . Therefore, various methods and drugs have been suggested for the prevention of these complications. Magnesium Sulphate is one of the drugs that has recently been investigated largely [2]

Fasciculations and postoperative myalgia are well-known disadvantages of succinylcholine. Many attempts have been made to control these undesired effects caused by succinylcholine, which include pretreatment with nondepolarizing muscle relaxants [4] lignocaine [5] calcium gluconate [6] nonsteroidal antiinflammatory drugs (NSAIDs) [7,8] diazepam [9] etc., with variable results. Induction of anesthesia with magnesium sulfate and thiopentone has been tried for this purpose also [10]. Propofol has also been identified to be a better agent than thiopentone sodium to control succinylcholine-induced myalgia [11].

In order to evaluate the impact of magnesium sulphate pretreatment on the occurrence and severity of succinylcholine-induced fasciculations and postoperative myalgia, we investigated the induction of anaesthesia with propofol.

## **MATERIAL AND METHODS**

This was a one year Hospital based Cross-sectional study conducted in Department of Anaesthesia, Rama medical college hospital & research centre Kanpur, Uttar Pradesh. A total 80 patients undergone for elective surgery under general anaesthesia were selected randomly.

**Inclusion criteria:** Patients aged between 18 -65 years of age underwent for elective surgery were included in this study.

**Exclusion criteria:** Patients with neuromuscular disorder, history of severe allergic reactions and renal insufficiency were excluded from this study.

**Ethical clearance:** Ethical clearance was duly obtained from the Institutional ethics committee.

The patients were divided into two groups i.e.. Group I and Group II. Before the induction of anaesthesia in patients, group I patients were given magnesium sulfate 40 mg/ kg of body weight in 10 ml solution. While patients of group II were given 0.9% normal saline in the same volume intravenously. It was given slowly over the period of 10 mins [12]. Continuous monitoring of ECG, Blood Pressure, SpO<sub>2</sub> level, heart rate and a neuromuscular monitoring device was attached to the free hand of the patients. After administration of normal saline and magnesium sulfate, Anaesthesia was induced with fentanyl 1.5 mcg/kg and propofol 2 mg/kg body weight, followed by succinylcholine 2 mg/kg IV. After the administration, Muscle fasciculations and myalgia were observed. Fasciculations were observed and graded as nil (absent), mild (fine fasciculation of the eyes, face, neck, or fingers without movements of the limbs), moderate (obvious muscle twitching at more than one sites or movement of limb), or severe (vigorous, sustained, and widespread fasciculations) [8]. Postoperativemyalgia was assessed after 24 h of surgery in all patients and graded as nil (absence of pain), mild (muscle stiffness or pain on specific questioning in nape of neck, shoulders, and lower chest on deep breathing), moderate (muscle stiffness and pain complained of by the patient spontaneously requesting analgesia), or severe (incapacitating generalized muscle stiffness or pain) [8].

## **Statistical analysis**

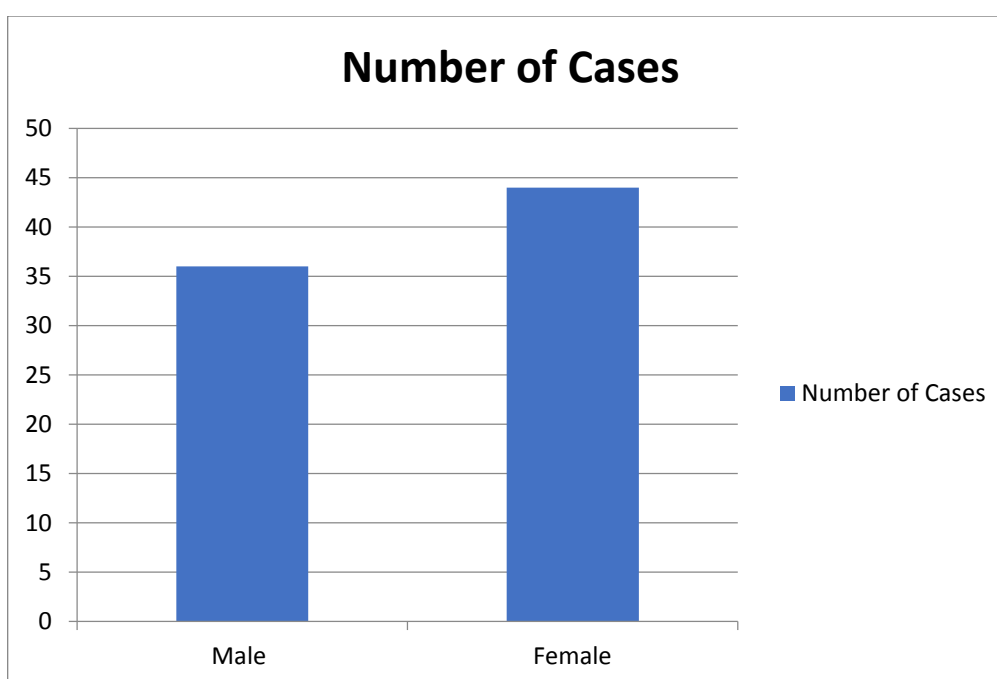
Data were analyzed using SPSS version 25.0. Continuous variables were compared using ANOVA, while categorical variables were analyzed using chi-square tests. A p-value of <0.05 was considered statistically significant.

## **RESULTS**

In the present study out of the total 80 patients, there were 45% and 55% male and female respectively. Among them 32.5% of patients were belonging to the age group of 26-35 years and only 7.5% belongs to the age group of 55-65 years of age. The demographic data of the patients were given in Table1.

**Table 1: Demographic data of the patients.**

DEMOGRAPHIC DATA	NUMBER(n=80)	PERCENTAGE(%)
<b>AGE</b>		
18-25	11	13.75
26-35	26	32.5
36-45	21	26.25
46-55	16	20
55-65	6	7.5
<b>GENDER</b>		
Male	36	45
Female	44	55
<b>TOTAL</b>	<b>80</b>	<b>100</b>



**Graph No. 1: Graphical Representation of the Genderwise distribution of the cases**

The overall incidence of muscle fasciculation was observed to be 52.5% in group I, and 100% in group II. [Table 2]. The different grades of muscle fasciculation were given in table 2. In group I, 22.5% ,12 % mild and moderate muscle fasciculation were developed and no severe cases of fasciculation were observed. While in group II, 52.5% moderate, 40 % mild and 7.5% severe muscle fasciculation were observed. As given in Table 2.

**Table 2: Different grade of muscle fasciculation.**

FASCICULATION	Group I(n=40)	Group II (n=40)
NIL	19(47.5%)	0(0%)
MILD	9(22.5%)	16(40%)
MODERATE	12(30%)	21(52.5%)
SEVERE	0(0%)	3(7.5%)
Overall fasciculation occurred	21(52,5%)	40(100%)

Postoperative myalgia was observed after 24 hrs, and it was observed that patients of Group I were not showing any sign and symptoms of myalgia while in group II, 12.5% were mild, 7.5% were moderate and 80% were negative for myalgia. As given in Table 3.

**Table 3: Different grades of Myalgia.**

MYALGIA	Group I(n=40)	Group II (n=40)
NIL	40(0%)	32(80%)
MILD	0	5(12.5%)
MODERATE	0	3(7.5%)
SEVERE	0	0(0%)

Not any single patients showed prolonged neuromuscular blockage.

## DISCUSSION

Succinylcholine, a depolarizing muscle relaxant, has a unique place in clinical practice because it causes quick and excellent skeletal muscles relaxation for few minutes followed by spontaneous recovery. Unfortunately, its use is associated with muscular fasciculations and postoperative myalgia. Pretreatment with various drugs such as rocuronium [4] atracurium [5] lignocaine [5] calcium [6] ketorolac [7] diclofenac sodium [8] diazepam [9] magnesium sulfate[10] thiopentone sodium [11] small dose of succinylcholine (self-taming) [13] d-tubocurare [14] and pancuronium [15] vecuronium [16] have been tried to reduce these side effects.

Magnesium sulfate along with thiopentone for induction of anesthesia has been used to reduce succinylcholine-induced fasciculations and myalgia. Aldrete *et al.* observed no fasciculations following thiopentone and succinylcholine in four out of six patients who were given magnesium sulfate in the dose of 40 mg/kg body weight IV [17].

Chestnut and Dundee [18] reported that after induction of anesthesia with thiopentone, magnesium sulfate controlled succinylcholine induced fasciculations but not myalgia.

In the present study, the incidence of fasciculation was observed to be 52.5% in group I (administrated with magnesium sulfate) and 100% fasciculation were observed in group II (administrated with normal saline). Our results was in accordance with the study conducted by kumar et al, in which incidence of muscle fasciculation in patients administrated with magnesium sulfate was 50% and 100 % fasciculation was observed in patients injected with normal saline [12].

In our study, myalgia in group I patients were zero while 20% was observed in group II, which was also correlated with the study conducted by kumar et al [12].

On comparison of our results with those of Stacey *et al.*, [19] who used magnesium sulfate 40 mg/kg body weight with thiopentone induction, we found no fasciculations in 50% patients receiving magnesium sulfate as against 40% in their study; and after 24 h, no patient of magnesium group had myalgia, while 9 patients of normal saline group had myalgia, as against no difference in the incidence of myalgia between control and magnesium groups in their study.

Fasciculations following succinylcholine administration are associated with muscle damage with a rise in serum concentration of creatinine kinase and myoglobin [20,21]. Literature, however, shows no correlation between fasciculations and postoperative myalgia [22,23]. Laurence[20] observed no correlation between myalgia and rise in creatine kinase, an indicator of muscle damage.

Many studies have shown the use of magnesium sulfate in the dose of 40–60 mg/kg without any sign of hypermagnesemia or clinically significant rise in serum magnesium levels after infusion of magnesium sulfate for many hours. Tauzin-Fin *et al.*[24] used magnesium sulfate 50 mg/kg over a period of 20 min preoperatively without any rise in serum magnesium level. Trameret *et al.*[25] estimated serum magnesium level after giving a bolus of 3 g (20% 15 ml) followed by a continuous infusion of 500 mg/h for 20 h (total amount of magnesium: 13 g).

Ryu *et al.*[26] injected magnesium sulfate 50 mg/kg IV as bolus and then 15 mg/kg/ hr IV infusion till the end of surgery. Serum magnesium levels were found to be significantly higher in patients who received magnesium sulfate than those who received saline only ( $1.5 \pm 0.2$  vs.  $0.9 \pm 0.1$  mmol/l). Magnesium toxicity begins at the concentration of 2.5–5 mmol/l, which is much higher than highest level observed in their study [27]. When serum magnesium level reaches 3.1 mmol/l, depression of deep tendon reflexes occurs as a sign of toxicity [28]. We used a bolus of magnesium 40 mg/kg without infusion which is a safe dose considering the result of above studies and no patient had any sign of magnesium toxicity.

To summarize it, magnesium sulphate 40 mg/kg intravenously can be used as a pre-treatment in conjunction with propofol to induce anaesthesia and manage myalgia and fasciculations brought on by succinylcholine.

## CONCLUSION

One useful approach to lessen succinylcholine-induced fasciculations and myalgia is to administer magnesium sulphate before propofol induction. This method has the potential to improve postoperative outcomes and greatly increase patient comfort. Subsequent investigations ought to concentrate on enhancing dosing procedures and enhancing the depth of studies to encompass a number of patient populations.

## Declarations:

**Conflicts of interest:** There is no any conflict of interest associated with this study

**Consent to participate:** We have consent to participate.

**Consent for publication:** We have consent for the publication of this paper.

**Authors' contributions:** All the authors equally contributed the work.

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