



Study on the Effects of Pre-Treatment with Magnesium Sulfate on Succinylcholine-Induced Fasciculation During Induction of General Anaesthesia

KEYWORDS

Magnesium sulphate, Succinylcholine, anaesthesia induction, Muscle fasciculation.

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ABSTRACT *General anaesthesia with controlled ventilation through endotracheal tube is an anaesthetic technique used by the anaesthesiologists all over the world. Succinylcholine is a depolarising muscular relaxant which is used to facilitate endotracheal intubation. It is used with non-depolarising neurological blockers that have a relatively short effect in terms of tracheal intubation. To investigate the effects of magnesium sulphate on succinylcholine-induced fasciculation in patients during the induction of general anaesthesia. The cases received magnesium sulphate, while the controls received normal saline. Under the circumstances from the present study we can conclude that, magnesium sulphate can prevent and reduce the degree of fasciculation after succinylcholine. Therefore it can be used to prevent fasciculation.*

Introduction:

General anaesthesia with controlled ventilation through endotracheal tube is an anaesthetic technique used by the anaesthesiologists all over the world. Laryngoscopy and endotracheal intubation is necessary to achieve this technique. Traditionally succinylcholine is drug of choice for induction due to its rapid onset of action.

Succinylcholine is a depolarising muscular relaxant which is used to facilitate endotracheal intubation. It is used with non-depolarising neurological blockers that have a relatively short effect in terms of tracheal intubation.¹ One of its adverse effects is the transient fasciculation after injection which is associated with some other complications of succinylcholine.² Along with the many benefits of using this medication, it can develop some complications like neurological muscle fasciculation. In addition to muscle fasciculation, this medication may also increase post-operative myalgia due to increased phosphokinase.³

The pathophysiology of fasciculation is unclear, but it may be induced by axonal depolarisation caused by the connection between succinylcholine and presynaptic and cholinergic nicotinic receptors. Post-operative 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.^{4,6} Therefore, various methods and drugs have been suggested for the prevention of these complications. Magnesium sulfate is one of the drugs that has recently been investigated largely,⁷⁻¹⁰ but there is still a lot of controversy.¹¹

Magnesium acts as an adrenergic antagonist and inhibits the release of catecholamine. So it probably controls the undesirable effects of laryngoscopy for tracheal intubation such as increased heart rate, increased blood pressure and increased intraocular pressure.^{2,12} On the other hand, magnesium sulfate reduces the negative effects caused by succinylcholine and avoids the increase of potassium concentration after administration. Furthermore, using magnesium sulfate before tracheal intubation reduces the haemodynamic response.^{2,9} magnesium sulfate is also ef-

fective in reducing pain after the administration of succinylcholine.⁹ Nevertheless, there are few studies investigating this drug and it has not been routinely used. Therefore, this study was planned to assess the effects of magnesium sulfate on muscle fasciculation caused by succinylcholine in patients during the induction of anaesthesia.

Material and Methods:

The present study was conducted in the Jhalawar Medical College & Hospital, Jhalawar in 2011. The patients who were admitted for surgery under general anaesthesia were classified as an American Society of Anaesthesiologists (ASA) I and II going for elective surgery between the ages of 20 to 65 years as per inclusion & exclusion criteria.

A pilot study was conducted on 20 patients to determine the sample size. According to the results of the pilot study, mean of fasciculation grade in normal saline and magnesium sulfate groups were 2.6 ± 1.7 and 1.3 ± 1.5 respectively. In the light of the result, assuming type I error of 5% and power of the study being 95%, the sample size was calculated to be 41 participants in each of the two groups. The final study sample size was 90 which was divided into two equal groups of cases and controls.

The intervention group received 6mg/kg of magnesium sulfate in 100cc of normal saline infused in five minutes. It was started 7.0 minutes before anaesthesia and was completed approximately 2.0 minutes before the induction of anaesthesia. The controls received 100cc of normal saline without magnesium sulfate in five minutes which was infused 7.0 minutes before the induction of anaesthesia. The participating anaesthesiologist was unaware of patients group and so were the patients themselves.

Fasciculation was measured immediately, 10 minutes and 30 minutes after the administration of succinylcholine as shown in table 1. 'No visible fasciculation' was termed Nil and scored 0; 'Very fine fingertip or facial muscle movements', Mild and 1; 'Minimal fasciculation on trunk and extremities', Moderate and 2; and 'Vigorous fasciculation on trunk and extremities', Severe and 3. Informed consent was obtained from all the subjects and in case of any ad-

verse side effects, the drug administration was stopped and it was replaced with calcium gluconate. Data was analysed by using SPSS 18 and chi-square test.

Results and Discussion:

This study shows the mean age of the cases and control groups was 35.4 ± 12.5 years and 35.5 ± 12.4 years ($P < 0.0001$). There were 47(52.2%) men and 43(47.7%) women in the study ($P < 0.075$). The overall, 77(81%) patients were classified as ASA-I ($P < 0.36$). After the intervention, fasciculation was observed in cases 2(4.4%) and controls 42(93.3%) whose ($p < 0.001$). Fasciculation grade in the intervention group was significantly lower than that in the control group ($p < 0.001$). The difference between k levels in the two groups was not significant before anaesthesia ($P > 0.05$), but it was significant after anaesthesia ($p < 0.001$). Besides, k level in the cases was reduced after the intervention compared with the time before the intervention, while it increased in the controls ($p < 0.001$) in table.

Table: Comparison of the baseline and outcome variables between the two groups

Variables		Mag-nesium Sulphate	Normal Saline	P-value
sex	Male	20(44.4%)	27(60%)	0.075
	female	25(55.5%)	18(40%)	
ASA	I	41(91.1%)	36(80%)	0.36
	II	4(8.8%)	7(15.5%)	
Fasciculation Grade	0	42(93.3%)	0	<0.001
	1	3(6.6%)	8(17.7%)	
	2	0	25(55.5%)	
	3	0	12(26.6%)	
Fasciculation		2(4.4%)	42(93.3%)	<0.001
Grade of Fasciculation(mean±SD)		0.08 (±0.3)	2.1 (±0.7)	<0.001
K level before intervention (mean±SD)		3.5 (±0.07)	3.5 (±0.06)	0.149
K level after intervention (mean±SD)		3.5 (±0.08)	3.9 (±0.1)	<0.001

Succinylcholine is the gold standard against which all other muscle relaxants are compared due to fast and reliable onset of time. It has some side effects around induction; fasciculation, increased serum potassium concentration and life threatening arrhythmia. It also causes postoperative myalgia. Precurarization with nondepolarizing muscle relaxant is commonly used to limit the complications but not all of them.

In present study, both the cases and the controls had similar baseline characteristics. Therefore, the findings are the results of the intervention. Based on the results, magnesium sulfate can greatly reduce the muscle fasciculation caused by succinylcholine used for the induction of anaesthesia. Other drugs are also suggested for the prevention of post anaesthesia fasciculation, but these drugs may not be available in certain countries or may be very expensive.¹⁻¹³ Therefore, using magnesium sulfate would be less expensive and more useful. Based on the results of this study, fasciculation was observed in 4.4% of magnesium sulfate group and 93.3% of placebo group. In one study¹⁰ 50% of the study subjects who had received magnesium sulfate did not experience fasciculation, while in saline group all patients experienced fasciculation. In another study¹⁴ after the administration of magnesium sulfate and thiopentone, no case of fasciculation was observed in patients who had succinylcholine induced anaesthesia.

One study¹² on the effects of propofol on succinylcholine induced fasciculation reported that 20% of people in the

propofol group did not experience any type of fasciculation. In a meta- analysis⁷ fasciculation was observed in 95% patients in the placebo group and 50% in the intervention group. it concluded that lidocaine and magnesium sulfate were more effective than other drugs. Another study² also showed that magnesium sulfate is useful both for reducing fasciculation and lowering blood pressure and heart rhythm disturbances during anaesthesia. In their study, 33% of the magnesium sulfate group did not experience fasciculation at all. Studies have also shown magnesium sulfate to have beneficial effects on postoperative pain relief.¹⁵ One study¹⁰ investigated the effect of magnesium sulfate on fasciculation induced by intravenous injection of succinylcholine and found that in the group that received magnesium sulfate the degree of fasciculation was significantly lower than the control group. In another study, magnesium sulfate not only reduced fasciculation, but also prevented the undesirable haemodynamic changes such as increased heart rate and blood pressure.² since most of the studies confirm the positive effects of magnesium sulfate on fasciculation, it can, therefore, be suggested that magnesium sulfate should be used to prevent fasciculation which is common in most cases.

Other studies that investigated the effects of magnesium sulfate on reducing fasciculation after using anaesthetic drugs, demonstrated that magnesium sulfate can reduce the severity of fasciculation.¹⁶ moreover, magnesium sulfate can also reduce movements during anaesthesia. In a study, anaesthetic action was observed in 76% of the control group and 44% of the magnesium sulfate group. magnesium sulfate is a natural calcium channel blocker and can have anti-nociceptive effects; therefore, it can be a useful drug during and after anaesthesia.^{9,17,18} In terms of limitations, the study did not investigate the side effects of magnesium sulfate since it is frequently used in eclampsia and preeclampsia in pregnant women and is considered a safe drug. One of its side effects is the reduction of k levels.² However, there was no particular side effects in the administered dose and it was safe.¹⁰

Conclusion:

Under the circumstances from the present study we can conclude that, magnesium sulfate can prevent and reduce the degree of fasciculation after succinylcholine. Therefore it can be used to prevent fasciculation.

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