

Fasciculations and Hyperkalaemia Associated with Suxamethonium: Efficacy of Magnesium Sulphate

Tokunbo Olumide Olajumoke*, J. M. Afolayan, S. A. Raji

Department of Anesthesia and Intensive Care, LAUTECH Teaching Hospital, Ogbomosho, Nigeria
Email: *busamide@yahoo.com

How to cite this paper: Olajumoke, T.O., Afolayan, J.M. and Raji, S.A. (2022) Fasciculations and Hyperkalaemia Associated with Suxamethonium: Efficacy of Magnesium Sulphate. *Open Journal of Anesthesiology*, 12, 255-260.
<https://doi.org/10.4236/ojanes.2022.128023>

Received: June 17, 2022

Accepted: August 23, 2022

Published: August 26, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

General anesthesia with controlled ventilation through endotracheal tube is an anaesthetic technique used by the anesthesiologists 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. **Aim:** This study compared the efficiency of magnesium sulphate in reducing fasciculation and increase in serum potassium which are the common complications associated with suxamethonium administration. **Methods:** Fifty six patients being planned for lower abdominal surgery under general anaesthesia were randomized into two groups M and S. Serum potassium was taken in the theatre, three minutes before induction of anesthesia patients in M group were given 6 mg/kg of magnesium sulphate diluted in 10 ml normal saline intravenously while in S group 10 ml of normal saline was injected intravenously. The occurrence and degree of fasciculation were recorded after administration of suxamethonium in both groups while serum potassium was also taken at the end of fasciculations. The researcher was blinded to the content of the syringes until after the study. **Results:** More patients in the S group had fasciculations compared to the M group while the degree of fasciculations was more in the S group, the serum potassium increase was more in the saline group.

Keywords

Suxamethonium, Fasciculation, Magnesium Sulphate

1. Introduction

Succinylcholine, a depolarizing muscle relaxant was introduced in 1952 by Sleff and Foldes and has a unique place in clinical practice, because it causes quick

and excellent skeletal muscle relaxation for few minutes followed by spontaneous recovery. It possesses a unique property of rapid onset and short duration of action, but is accompanied by side effects like muscular fasciculation, myalgia, masseter muscle spasm, hyperkalemia, rhabdomyolysis, increase intracranial pressure, intraocular pressure and intragastric pressure. [1]

The succinylcholine induced postoperative myalgia (POM) has been shown to occur in 41% - 92% of patient. [2] The pathophysiology of fasciculation and myalgia is unclear and exact mechanism of succinylcholine induced myalgia is still unknown. However, according to some proposed mechanisms, sustained muscle contractions cause increased calcium ion concentration in cytoplasm of muscle cells and cause degradation of cell membrane phospholipid resulting in increased release of free fatty acids and free radicals. [3]

Many attempts have been made to avoid these undesirable effects, which include pretreatment with rocuronium [4], atracurium [5], lignocaine [5], calcium [6], ketorolac, diclofenac sodium [6], diazepam, magnesium sulphate [7], thiopentone sodium [8], d-tubocurarine and vecuronium [9]. It was noticed that many studies have not been carried out in this sub region on trials in attempt to reduce the complications associated with Suxamethonium which is the common readily available short acting muscle relaxants available.

This study aimed at studying the efficiency and potency of magnesium sulphate in reducing muscle fasciculation and increment in serum potassium associated with suxamethonium use.

2. Material and Methods

This randomized double blind study was conducted at LAUTECH Teaching Hospital between March and December 2021 on fifty six ASA1-11 aged 40 - 60 years being planned for lower abdominal surgeries under general anesthesia... The patients were randomized into two groups; M and S by picking from envelopes that contained computer generated table of random numbers. The computer generated numbers were put in an opaque envelope all in box. Patients were made to pick from the box without replacement. Patients were examined both generally and systemically, while basic investigations like Packed Cell Volume, Electrolyte urea & creatinine were done and blood grouped and cross-matched if there is likelihood of transfusion. Patients were premedicated on oral diazepam 10 mg nocte and were fasted overnight. A resident doctor in the department prepared the intervention drugs M and S both in 10 mls Needle and syringe. On the morning of surgery patients were brought to the theatre, after general check on the equipments have been done. Drugs for general anesthesia were well labelled, thereafter, a 20 G venous cannula was placed on the dorsum of a patient's hand, blood sample was taken for baseline serum potassium and Normal saline was commenced. Three minutes before induction of anesthesia in patients in M group 6 mg/kg of magnesium sulphate diluted in 10 ml normal saline was injected intravenously and 10 ml of normal saline was injected intrave-

nously into patients in S group. After injecting the study drugs, 0.6 mg of atropine was given followed by 2 mg/kg of propofol. Following the loss of eyelid reflex, 1.5 mg/kg of succinylcholine was injected intravenously and patients were ventilated with 100% oxygen. Fasciculation was measured immediately 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” The degree of fasciculation were noted as well as the duration were noted.

After fasciculation, the values of heart rate and blood pressure were measured and recorded, and tracheal intubation was performed. Immediately after intubation serum potassium sample was taken. The maintenance of anesthesia was continued using a mixture of oxygen, nitrous oxide and halothane. After 5 minutes of tracheal intubation, the values of heart rate and blood pressure were obtained and recorded again. For maintenance of muscle relaxation IV pancuronium was used at dose of 0.1 mg/kg. At the end of the surgery, muscle relaxation was reversed using neostigmine and atropine. After the desired spontaneous ventilation, the patients were extubated. The patients were transferred to recovery room and later to the ward where postoperative analgesia. The researcher was blinded to the contents of the needle and syringes. The M and S grouped were uncoded as magnesium sulphate and normal saline at the end of the study.

3. Data Analysis

Data was analyzed using SPSS version 16 Measure of association was determined using the chi square test for categorical variables and the student t test for continuous variables. A p value of less than 0.05 was considered significant.

4. Results

There was no significant difference in terms of age, body weight and sex between two groups (**Table 1**), they were evenly distributed in terms of demography. In Magnesium sulphate group 8 (28%) out of the 28 patients had fasciculations, whereas 27 (96.4%) out of the 28 patients had fasciculations in saline group S.

In terms of severity of fasciculations out of the 8 patients that fasciculated in the magnesium sulphate group (representing 28% of the total population); majority of them 6 had only grade 1 fasciculation while majority of the saline group

Table 1. Comparison of demographic data between the groups.

VARIABLE	GROUP M	GROUP S	P value
AGE	32.84 ± 8.46	34.64 ± 9.42	0.06
WEIGHT	58.20 ± 6.74	58.74 ± 6.82	0.07
SEX (M/F)	15/13	14/14	0.065

Table 2. Incidence of fasciculation.

	GROUP M N (%)	GROUP S N (%)	P value
Incidence of myalgia	8 (28)	27 (96.4)	0.0001

Table 3. Severity of fasciculation.

Severity of fasciculation	Group M N (%) N = 28	Group S N (%) N = 28	P value
0	22 (78.6)	1 (3.6)	0.00001
1	6 (21.4)	5 (17.9)	0.006
2	2 (7.1)	9 (32.1)	0.005
3	0 (0)	13 (46.4)	0.00001

Table 4. Average serum potassium change between both groups.

Groups	Pre induction serum potassium	Post op Serum Potassium	P Value
Group M	3.52 ± 0.42	3.54 ± 0.44	0.075
Group S	3.34 ± 0.38	3.89 ± 0.62	0.04

had severe fasciculation with significant p values as shown above (**Table 2** & **Table 3**).

The Serum potassium changes between the preinduction and postoperative values were significant between the two groups p values 0.075 and 0.04 respectively (**Table 4**).

5. Discussion

Succinylcholine is a quaternary ammonium depolarizing muscle relaxant. It produces sustained depolarization of prejunctional membrane of neuromuscular junction without repolarization resulting in initially fasciculation followed by muscle relaxation [10]. It has rapid onset and short duration of action. It provides ideal intubation conditions and it is a drug of choice for short day case procedures requiring tracheal intubation. However, these advantages of succinylcholine are compromised because of postoperative myalgia and other side effects in these patients. Exact mechanism of succinylcholine induced myalgia is still unknown. However, according to some proposed mechanisms, sustained muscle contractions cause increased calcium ion concentration in cytoplasm of muscle cells and cause degradation of cell membrane phospholipid resulting in increased release of free fatty acids and free radicals. These free fatty acids and free radicals actually cause muscle injury resulting in postoperative myalgia [11].

Several methods had been tried to attenuate the side effects of suxamethonium, however our study aimed at determining the efficacy of magnesium pre-treatment in reducing fasciculations and increase in serum potassium associated

with suxamethonium administration.

Our study has shown that there was only few incidence of fasciculations with magnesium pretreatment compared with the saline group. It was also demonstrated that the few fasciculations observed in the magnesium sulphate group were mild. The serum potassium levels were significantly affected in the saline group when compared with the magnesium sulphate group. No complication was observed in the magnesium sulphate group while the vital signs were comparable in both groups.

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 [4] [5] [6].

6. Conclusion

Magnesium sulfate can prevent and reduce the degree of fasciculation after succinylcholine and also attenuate increase in serum potassium associated with suxamethonium administration. Therefore it can be used to prevent fasciculation.

Recommendation

In situations where suxamethonium could not be avoided for specific reasons, its side effects could be attenuated with magnesium sulphate.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Roy, S., Mrunalini, K., Venkateshwarlu, G. and Sowmya Sri, A. (2015) Comparative Study on the Effects of Pretreatment with Magnesium Sulphate and Propofol Induction on Serum Creatine Phosphokinase and Urinary Myoglobin Levels Associated with the Use of Succinylcholine. *Journal of Evolution of Medical and Dental Sciences*, **4**, 9568-9580.
- [2] Pandey, C.K., Tripathi, M., Joshi, G., Karna, S.T., Singh, N. and Singh, P.K. (2012) Prophylactic Use of Gabapentin for Prevention of Succinylcholine-Induced Fasciculation and Myalgia: A Randomized, Double-Blinded, Placebo-Controlled Study. *Journal of Postgraduate Medicine*, **58**, 19-22.
<https://doi.org/10.4103/0022-3859.93248>
- [3] McLoughlin, C., Elliott, P., McCarthy, G. and Mirakhur, R.K. (1992) Muscle Pains and Biochemical Changes Following Suxamethonium Administration after Six Pretreatment Regimens. *Anaesthesia*, **47**, 202-206.
- [4] Demers-Pelletier, J., Drolet, P., Girard, M. and Donati, F. (1997) Comparison of Rocuronium and *d*-Tubocurarine for Prevention of Succinylcholine-Induced Fasciculations and Myalgia. *Canadian Journal of Anaesthesia*, **44**, Article No. 1144.
<https://doi.org/10.1007/BF03013334>
- [5] Raman, S.K. and San, W.M. (1997) Fasciculations, Myalgia and Biochemical Changes

- Following Succinylcholine with Atracurium and Lidocaine Pretreatment. *Canadian Journal of Anaesthesia*, **44**, 498-502. <https://doi.org/10.1007/BF03011938>
- [6] Shrivastava, O.P., Chatterji, S., Kachhawa, S. and Daga, S. (1983) Calcium Gluconate Pretreatment for Prevention of Succinylcholine-Induced Myalgia. *Anesthesia and Analgesia*, **62**, 59-62.
- [7] Leeson-Payne, C., Nicoll, J.M. and Hobbs, G.J. (1994) Use of Ketorolac in the Prevention of Suxamethonium Myalgia. *British Journal of Anaesthesia*, **73**, 788-790. <https://doi.org/10.1093/bja/73.6.788>
- [8] Kahraman, S., Ercan, S., Aypar, U. and Erdem, K. (1993) Effect of Preoperative IM Administration of Diclofenac on Suxamethonium-Induced Myalgia. *British Journal of Anaesthesia*, **71**, 238-241. <https://doi.org/10.1093/bja/71.2.238>
- [9] Fahmy, N.R., Malek, N.S. and Lappas, D.G. (1979) Diazepam Prevents Some Adverse Effects of Succinylcholine. *Clinical Pharmacology & Therapeutics*, **26**, 395-398. <https://doi.org/10.1002/cpt1979263395>
- [10] James, M.F., Cork, R.C. and Dennett, J.E. (1986) Succinylcholine Pretreatment with Magnesium Sulfate. *Anesthesia & Analgesia*, **65**, 373-376.
- [11] McClymont, C. (1994) A Comparison of the Effect of Propofol and Thiopentone on the Incidence and Severity of Suxamethonium-Induced Myalgia. *Anaesthesia and Intensive Care*, **22**, 147-149. <https://doi.org/10.1177/0310057X9402200204>