

Comparison of atracurium and methocarbamol for preventing succinylcholine-induced muscle fasciculation: A randomized controlled trial

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ABSTRACT

Fasciculation is a minor adverse effect of succinylcholine and may be an unpleasant experience for patient. The aim of this study was to compare the use of atracurium and methocarbamol to decrease the occurrence and severity of succinylcholine-induced muscle fasciculation. Fifty-nine adults with American Society of Anesthesiologists I or II hospitalized for elective surgery were randomly assigned to two groups: Group A ($n = 29$) who received succinylcholine 1 mg/kg body weight (BW) intravenously followed by 0.2–0.5 mg/kg BW atracurium and patients in Group B ($n = 29$) who received succinylcholine 1 mg/kg BW intravenously followed by methocarbamol 0.2–0.5 mg/kg BW. Anesthesia was induced in all patients with thiopental sodium 3–5 mg/kg. Fasciculation was scored on a four-point (0–4) Likert scale. There were no statistically significant differences in demographic variables between two groups, whereas in Group A, 27 patients (93.1%) suffered from mild fasciculation and two (6.9%) from moderate fasciculation. In Group B, twenty patients (68.9%) suffered from mild fasciculation, five (17.2%) from moderate fasciculation, and four (13.9%) from severe fasciculation. The difference between the groups was statistically significant ($P < 0.05$). Atracurium is more effective than methocarbamol in decreasing the occurrence and severity of succinylcholine-induced fasciculations. In addition, the use of methocarbamol before succinylcholine administration can decrease the incidence of severe fasciculation.

Key words: Atracurium, fasciculations, methocarbamol, muscle, succinylcholine

INTRODUCTION

Succinylcholine (Anectine) is a depolarizing skeletal muscle relaxant that remains the accepted standard for facilitating endotracheal intubation in Iran and other developing countries.^[1] This medication may cause some

adverse effects in patients such as increased levels of creatinine kinase (CK) and potassium in blood,^[2] apnea, malignant hyperthermia, increased intraocular pressure and increased intracranial pressure,^[3,4] emesis with aspiration,^[3] fasciculation during induction, and postoperative myalgia.^[3,5] Although fasciculation and postoperative myalgia are minor adverse effects of succinylcholine, they may be very unpleasant experiences for the patient till 24–48 h after surgery.^[5,6] To decrease the rate of fasciculation and postoperative myalgia, various methods have been

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tested. For example, use of Vitamin C,^[7] ketamine and propofol,^[8,9] calcium gluconate,^[10] lidocaine,^[11] magnesium sulfate,^[9] diclofenac,^[12] benzodiazepines,^[13] thiopentone,^[14] dexmedetomidine,^[15] remifentanyl,^[16] isoflurane,^[17] and nondepolarizing neuromuscular blocking agents.^[18]

Yun *et al.* studied the effect of remifentanyl on succinylcholine-induced muscle fasciculations. They reported that pretreatment with remifentanyl decreased the intensity of muscle fasciculations by succinylcholine. They also reported that remifentanyl affected the postoperative level of CK in blood. However, they have also found that remifentanyl cannot decrease postoperative myalgia.^[17]

Methocarbamol (Robaxin) is a sedative and muscle relaxant that is structurally related to the expectorant guaifenesin and certain muscle relaxants such as chlorphenesin and mephenesin.^[19] It is a centrally acting muscle relaxant that suppresses spinal polysynaptic reflexes and has no direct effect on skeletal muscle. Methocarbamol is used alongside rest, and physical therapy to treat skeletal muscle conditions such as pain or injury.^[20] Regarding that no study has yet been conducted to compare these two drugs, the aim of the present study is to compare the effect of atracurium and methocarbamol on incidence and intensity of succinylcholine-induced muscle fasciculation.

MATERIALS AND METHODS

This study is a randomized controlled trial conducted from September 2012 to January 2013 in Ayatollah Kashani Hospital, Shahrekord, Southwest Iran. The ethical approval was obtained from the Ethics Committee of the Shahrekord University of Medical Sciences. The inclusion criteria were American Society of Anesthesiologists (ASA) physical status I and II, need for general anesthesia, not being addicted to opiate, being 18–60 years, and having body mass index <30 kg/m². The exclusion criteria were spinal injuries, hepatic or renal failure, cardiac ischemia, pulmonary, neuromuscular or metabolic diseases, and pregnancy. All participants provided written consent to participate in the study.

Preoperative evaluation included examination of medical history, physical and upper airway examination. A complete blood test, renal function tests, liver function tests, and electrocardiogram were conducted on all patients. Routine monitoring was conducted after patients arriving in operating room with a monitor (ER-630S). At admission to operating room, eligible patients ($n = 58$) were randomly assigned to Group A (atracurium) or Group B (methocarbamol) by the supervisor of the operating room, who chose the next using serially numbered sealed opaque envelope containing a simple 1:1 randomization sequence.

First, the patients were administered with fentanyl 3 μ g/kg body weight. Group A was administered with atracurium 0.02 mg/kg, and after the effects appeared, succinylcholine 1 mg/kg was administered.^[21] In Group B, 1 g methocarbamol was administered instead of atracurium to prevent fasciculation. Then, both groups were administered with 0.2–0.5 mg/kg atracurium during the surgery.^[22]

Direct laryngoscopy was performed and endotracheal tube inserted orally 1 min after administering medications for intubation. Anesthesia was induced in all patients with thiopental sodium 3–5 mg/kg and morphine 3–5 mg/kg.

Fasciculation after the administration of medications was examined and graded by an anesthesiologist using four-point Likert scale: Grade 0 = no fasciculation; Grade 1 = mild, fine fasciculations of the eyes, neck, face, or fingers, without limb movement; Grade 2 = moderate fasciculations occurring at more than two sites or obvious limb movement; and Grade 3 = vigorous or severe, sustained, and widespread fasciculations in the trunk and limbs. The patients' vital signs, i.e., systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate (P), were also measured and recorded at 5 min before succinylcholine administration and 1 and 5 min after succinylcholine administration. Data analysis was conducted by SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0. (Chicago: SPSS Inc.). $P < 0.05$ was considered statistically significant. Descriptive statistics were expressed as a mean and standard deviation, ANOVA used to compare the samples over time in each group, and independent *t*-test to compare the mean scores between the two groups at a specific point of time.

RESULTS

Of the 58 patients, 41 (70.6%) were women and the rest men. The mean age of the patients was 33.6 ± 13.9 years. The mean weight of patients was 68.8 ± 11.3 kg. Race of all patients in both groups was Asian. Of the 58 patients, 50 patient (82.2%) had ASA physical status I and the rest had ($n = 8$) ASA physical status II. The demographic characteristics including age, sex, weight, and ASA physical status in the two groups were similar ($P > 0.05$).

The mean scores of SBP, DBP, and P, 5 min before administration of succinylcholine, were similar in the two groups ($P > 0.05$). ANOVA was used to compare the mean blood pressure and P at 5 min before and 1 and 5 min after administration of succinylcholine. The results of this test did not show significant differences in SBP, DBP, and P among the three times. For comparison of mean SBP, DBP, and P, 1 and 5 min after succinylcholine administration, between the two groups, we used independent *t*-test. The results of this test did not show a significant difference in mean SBP, DBP, and P between the groups at these times [Table 1 and Figure 1].

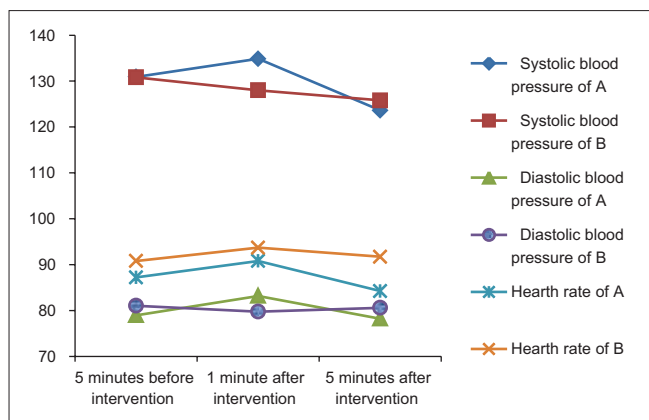


Figure 1: Trend of hemodynamic parameters during the study

In terms of fasciculation, in Group A, 27 patients (93.1%) suffered from mild and two (6.9%) from moderate level of fasciculation. In Group B, twenty patients (68.9%) suffered from mild, five (17.2%) from moderate, and four (13.9%) from severe level of fasciculation. The results of independent *t*-test showed that incidence of all forms of fasciculation was significantly higher in patients in Group "B" compared to that in the patients in Group A [Table 2].

DISCUSSION

Succinylcholine is a depolarizing muscle relaxant drug with unique status in clinical practice because it quickly and acceptably relaxes muscles followed by spontaneous recovery.^[9] Despite its limitations and side effects, succinylcholine is still a drug of choice for endotracheal intubation in operating rooms.^[23] Fasciculation is an adverse effect of succinylcholine that may be a very unpleasant experience for patients. Administration with nondepolarizing neuromuscular blocking agents few minutes before succinylcholine administration is widely used to prevent succinylcholine-induced fasciculations^[2,5] by blocking presynaptic nicotinic receptors.^[6] However, because of their side effects such as heavy eyelids, ptosis, blurred vision, diplopia, difficulty breathing, swallowing and speaking, bronchoconstriction caused by histamine release, and intensified need for a higher dose of succinylcholine,^[5] many studies have been conducted to identify alternative treatments. To the best of our knowledge, the present study was first to compare the effect of methocarbamol and atracurium on succinylcholine-induced muscle fasciculation. The results of the present study showed that succinylcholine-induced muscle fasciculation occurred in all patients of both groups, but incidence of all forms of fasciculation was significantly higher in patients who received methocarbamol compared to patients who received atracurium. Moreover, vital signs (SBP, DBP, and P) were similar between patients in both groups before and after administration of drugs. Consistently, Fatemeh *et al.* reported that pretreatment

Table 1: Hemodynamic parameter before and after intervention in Group A and B

Hemodynamic parameters	Group A	Group B	P
SBP			
5 min before intervention	130.9±18.7	130.8±14.3	>0.05
1 min after intervention	134.9±20.3	128±16.1	>0.05
5 min after intervention	123.6±18.3	125.8±16.6	>0.05
DBP			
5 min before intervention	79±10.6	81±12	>0.05
1 min after intervention	83.2±9.2	79.8±14.2	>0.05
5 min after intervention	78.2±8.8	80.6±15.6	>0.05
Heart rate			
5 min before intervention	87.2±12.8	90.8±12.3	>0.05
1 min after intervention	90.8±12.7	93.7±19	>0.05
5 min after intervention	84.2±13.2	91.7±16.1	>0.05

SBP: Systolic blood pressure, DBP: Diastolic blood pressure

Table 2: Incidence and grade of fasciculation in Group A and B

Degree of fasciculation	Group A, n (%)	Group B, n (%)	P
Nil	0	0	>0.05
Mild	27 (93.1)	20 (69)	<0.05
Moderate	2 (6.9)	5 (17.2)	<0.05
Severe	0	4 (13.8)	<0.05

with atracurium decreased incidence and severity of fasciculations.^[3]

CONCLUSION

Atracurium is more effective than methocarbamol in decreasing the occurrence and severity of fasciculations induced by succinylcholine. Moreover, use of methocarbamol before succinylcholine administration decreased the incidence of severe fasciculation. Hemodynamic parameters remained stable after administration of both drugs. Limitation of our study was a lack of measuring postoperative myalgia. Further research is recommended to study the effect of methocarbamol use on postoperative myalgia and blood potassium level.

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Conflicts of interest

There are no conflicts of interest.

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