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Original Article

Prevention of Succinylcholine Induced Postoperative Myalgia by Pretreatment with Lignocaine: A Randomized Controlled Study

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Abstract:

Succinylcholine, a depolarizing muscle relaxant possesses a unique property of rapid onset and short duration of action, but is accompanied by side effects such as fasciculation and myalgia. The aim of this study was to investigate the prophylactic effect of intravenous lignocaine on the incidence and severity of succinylcholine-induced postoperative myalgia. This was a randomized controlled double blind study conducted at National Institute of ENT Dhaka, during September to December 2017. Eighty adult patients of American Society of Anesthesiologists status I and II of both sexes for elective surgery under general anesthesia were randomly allocated into two equal groups, lignocaine group and normal saline group. The patients of lignocaine group were pretreated with lignocaine 1.5 mg/kg body weight in 5 ml volume, while patients of normal saline group were given isotonic saline 0.9% in the same volume (5 ml) intravenously. Thereafter, anesthesia was induced in all patients, by injecting 1.5 mg/kg of fentanyl and 2 mg/kg of propofol intravenously. Following the loss of eyelid reflex, 1.5 mg/kg of succinylcholine was injected intravenously as a muscle relaxant and then the patients were intubated. The incidence and severity of myalgia were assessed by a blinded observer 24 hours after surgery. In terms of demographic data, the results of this study showed that there is no significant difference between patients in both groups ($P>0.05$). Overall, the incidence and severity of succinylcholine-induced myalgia in lignocaine group was significantly less, when compared with normal saline group ($P<0.05$). Pretreatment with intravenous lignocaine is effective in prevention of postoperative succinylcholine induced myalgia.

Key words: Lignocaine, Propofol, Succinylcholine, Fasciculation, Postoperative myalgia.

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]. This succinylcholine induced postoperative myalgia (POM) has been shown to occur in 41%-92% of patients[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. These free fatty acids and free radicals actually cause muscle injury resulting in postoperative myalgia[3]. Many attempts have been made to avoid these undesirable effects, which include pretreatment with rocuronium[4], atracurium[5], lignocaine[5], calcium[6], ketorolac[7], diclofenac sodium[8], diazepam[9], magnesium sulphate[10], thiopentone sodium[11], d-tubocurare[12] and vecuronium[13].

There has been an increasing need to find an easily available, effective and feasible method of reducing the incidence and severity of myalgia. Hence, the purpose of the present study is to evaluate the effect of intravenous lignocaine in succinylcholine induced postoperative myalgia.

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Materials and Methods:

This was a randomized controlled double blind study conducted at National Institute of ENT Dhaka, during September to December 2017. Eighty voluntarily consenting patients with American Society of Anesthesiologists (ASA) physical status class I and class II of either sex, aged 20-50 years who were scheduled to undergo elective ENT surgical procedures that required general anesthesia with orotracheal intubation were recruited into the study. Patients with a history of allergy to medications, substance abuse, malignant hyperthermia, myopathy, cardiovascular, hepatic and advanced renal diseases and the risk of difficult intubation based on physical examination were excluded from the study.

Before surgery, patients were evaluated by the anesthesiologist. The evaluation of myalgia based on Kararmaz's[14] criteria was described to the patients. The patients were enrolled into two groups, lignocaine group and saline group. Each group consisted with 40 patients. The patients did not receive premedication. In the operating room, standard monitoring of the noninvasive blood pressure, electrocardiogram, heart rate, and pulse oximetry was done and the basal values were recorded. Thereafter, a 20 G venous cannula was placed on the dorsum of a patient's hand and Ringer's Lactate solution started. Three minutes before induction of anesthesia in patients of lignocaine group 1.5 mg/kg of lignocaine diluted in 5 ml normal saline was injected intravenously and 5 ml of normal saline was injected intravenously into patients in saline group. Drugs were prepared in 5 ml syringes by an anesthesiologist who was unaware of the grouping. After injecting the study drugs, 1.5 mg/kg of fentanyl was injected intravenously within 60 seconds and subsequently 2 mg/kg of propofol was administered intravenously within 30 seconds for the induction of anesthesia. Following the loss of eyelid reflex, 1.5 mg/kg of succinylcholine was injected intravenously and patients were ventilated with 100% oxygen. After fasciculation, the values of heart rate and blood pressure were measured and recorded, and tracheal intubation was performed. 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 vecuronium was used accordingly. 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 the recovery room and later in the ward.

The incidence and severity of myalgia in the patients were determined 24 hours after surgery by an anesthesiologist who was unaware of the grouping. Postoperative myalgia (POM) is defined as "a pain with no surgical interference" and is graded based on Kararmaz et al's[14] four-point scale as follows: 0= no muscle pain, 1= muscle stiffness limited to one area of the body, 2= muscle pain or stiffness noticed spontaneously by a patient who requires analgesics and 3= incapacitating generalized, severe muscle stiffness or pain.

For comparison of quantitative variables between the two groups, the unpaired t- test and for qualitative variables the Chi-square test was used. The statistically significant level was $P<0.05$.

Results:

There was no significant difference in terms of age, body weight and sex between two groups (Table I). In lignocaine group 8 (20%) out of the 40 patients had postoperative myalgia (POM), whereas 28 (70%) out of the 40 patients had myalgia in saline group ($P<0.05$). Grade 1 POM was lower in lignocaine group when compared with saline group (6 versus 18; $P<0.05$). Grade 2 POM was also lower in lignocaine group when compared with saline group (2 versus 10; $P<0.05$) and there was no grade III POM in any of the two groups (Table II). The baseline values of systolic and diastolic blood pressure and heart rate in both groups were similar.

Table I: Comparison of demographic data between the groups

Parameter	Lignocaine group n=40	Saline group n=40	p value
Age in year (mean±SD)	36.74±8.42	37.12±9.72	p>0.05
Weight in kg (mean±SD)	65.84±9.24	66.47±8.83	p>0.05
Sex (M/F)	22/18	23/17	p>0.05

Table II: Incidence and severity of myalgia

Postoperative myalgia (POM)	Lignocaine group n=40	Saline group n=40	p value
Incidence of myalgia number (%)	8 (20%)	28 (70%)	p<0.05
Incidence of myalgia number (%)			
0	32 (80%)	12 (30%)	p<0.05
1	6 (15%)	18 (45%)	p<0.05
2	2 (5%)	10 (25%)	p<0.05
3	0	0	

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[15]. 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[3,16].

Our study was carried out with the aim of ascertaining the efficacy of pretreatment with intravenous lignocaine in decreasing the incidence and severity of succinylcholine induced postoperative myalgia. Lignocaine was used in a dose of 1.5 mg/kg body weight 3 minutes before induction. Because opioids do not have any impact on the occurrence of succinylcholine induced myalgia, fentanyl 1.5 mg/kg iv was used as the analgesic at the time of induction.

Our study showed, in lignocaine group 8 (20%) out of the 40 patients had postoperative myalgia (POM), whereas 28 (70%) out of the 40 patients had myalgia in saline group ($P<0.05$). Grade 1 POM was lower in lignocaine group when compared with saline group (6 versus 18; $P<0.05$). Grade 2 POM was also lower in lignocaine group when compared with saline group (2 versus 10; $P<0.05$) and there was no grade III POM in any of the two groups.

Pandey AK et al[17] found in their study, POM was present in 45% in lignocaine group and 77.5% in saline group, severity was also lower in lignocaine group. Chatterji et al[18] reported in their study, POM was present in 8% in lignocaine group. Our study result is in between these two study groups.

Other similar studies using lignocaine as pretreatment agent for prevention of POM as Lee TL et al[19] found 12.8% patient experienced POM and Raman et al[20] showed in their study that 30% patient had POM 24 hours after operation. In our study 20% patients experienced POM 24 hours after operation which is nearer to these two studies.

Conclusion:

Pretreatment with intravenous lignocaine 1.5 mg/kg body weight before induction of general anesthesia is effective in reducing the incidence and severity of succinylcholine induced postoperative myalgia.

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