ORIGINAL ARTICLE

Comparative Study of 0.5mg/Kg and 1.0mg/Kg Suxamethonium in Achieving Acceptable Condition for Endotracheal Intubation

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ABSTRACT

Background: Airway management is of utmost importance to the anaesthetist because failure to secure an adequate airway can result to morbidity and mortality. Endotracheal intubation is the cornerstone in airway management. This study investigated the effectiveness of lower dose of 0.5mg/kg suxamethonium in achieving acceptable condition for successful endotracheal intubation.

Objective: To investigate the effectiveness of 0.5mg/kg suxamethonium in achieving the relaxation needed for successful endotracheal intubation.

Methodology: A prospective double-blind study was done on 500 patients of ASA class I or II, undergoing elective surgery requiring general anaesthesia and endotracheal intubation. Patients were randomized into two: Group 'A' received 0.5mg/kg suxamethonium; Group 'B' received 1.0mg/kg suxamethonium intravenously. Anaesthesia was induced with propofol. Intubation conditions were assessed clinically one minute after suxamethonium administration by Viby-Mogensen scoring system.

Result: Clinically acceptable intubation conditions were obtained in 91.6% and 96.4% of the patients after administration of 0.5mg/kg and 1.0mg/kg suxamethonium in groups A and B, respectively. The Mallampati classes of pharyngeal structures, Cormack grade, and laryngoscopy and intubation duration were of similar outcomes in the two groups. Intubation was successful in all (100%) patients. Twenty-one (8.4%) and nine (3.6%) patients in 0.5mg/kg and 1.0mg/kg group respectively required additional 0.5mg/kg of suxamethonium administration.

Conclusion: Acceptable conditions for endotracheal intubation were achieved with lower dose (0.5mg/kg) suxamethonium.

Key words: *Elective surgery, Muscle relaxant, Airway management, Balanced anaesthesia*

INTRODUCTION

Rapid onset of action, allowing early endotracheal intubation is a desirable feature of a neuromuscular blocking agent, as it will reduce the risk of gastric aspiration. Suxamethonium also known as Succinylcholine has this property. Traditionally, the dose of suxamethonium recommended for this purpose is 1-2mg/kg. Suxamethonium is the most preferred for facilitating intubation during the induction of anaesthesia due to its fast blocking and recovering time.[1] Decreasing dose of suxamethonium would allow a more rapid recovery of spontaneous ventilation after endotracheal intubation with minimal side effects such as fasciculation, cardiac arrhythmias, and post-operative muscle pain.

Considering the prevailing economic downturn in Nigeria, it became tasking for patients to meet up with the high cost of drugs and surgery. This challenge is more predominant in the Northern Nigeria where poverty rate is high, in addition to the high rates of inflation. Having the interest and well-being of the patient as our utmost priority, we attempted to improvise an effective means of circumventing the huge financial burden on the patients, yet availing the patients' access to the same ideal drugs. The outcome is not meant to displace the traditional dosage but a means that enable patients to access low dose of an ideal drug, yet effective in achieving desired result. To this effect, we carried out prospective, randomized double-blinded study, designed to evaluate the effectiveness of 0.5mg/kg suxamethonium in achieving the relaxation needed for endotracheal intubation.

METHODOLOGY

Ethical approval and Selection of Participants

Following approval from the Ahmadu Bello University Teaching Hospital's Ethics Committee, (with approval number ABUTH/PGO/Comm/16), a prospective double-blind study was done. Informed consent was obtained from the participating patients. Five hundred patients aged 15 to 60 years, scheduled for elective surgery requiring general anaesthesia and endotracheal intubation at Ahmadu Bello University Teaching Hospital were recruited for the study. To ensure the safety of the participants, we routinely had anaesthetic check list as well as resuscitation drugs such as adrenaline, atropine, ephedrine etc. available in the operating suite. In case of inadequate response to the lose dose, safety measure was to top up the dose. In such case, the patient was to be excluded from the study.

Inclusion Criteria

All patients that fall within the American Society of Anesthesiologist (ASA) physical status I and II.

Exclusion Criteria

Patients with known history of allergic reaction to suxamethonium, hypertension, liver and/or kidney disorders, pregnant women, body mass index >35kg/m^2 and suspected difficulty with endotracheal intubation were excluded from the study

Patients Grouping

The selection of the patients was based on the elective surgeries booked in the operating theatres that met the inclusion criteria. The

grouping of the patients was done using a computer-generated table of random numbers enclosed in envelopes. Patients were randomly grouped into two of 250 each: Group 'A' received 0.5mg/kg of suxamethonium, while Group 'B' received 1.0mg/kg of suxamethonium. All drugs were prepared by the nurse anaesthetists who were not involved with the study to keep the study investigator blinded.

Prior to the study procedures proper, patient's airway was assessed clinically; mouth opening, Mallampati assessment, thyromental distance, range of neck movement. Any obvious head or neck pathology was excluded from the study.

Study Procedure

All patients were pre-oxygenation using a tight-fitting mask for 3minutes with 100% oxygen, followed by induction of anaesthesia with propofol 2mg/kg, and then the administration of suxamethonium intravenously by trained nurse anaesthetist. Laryngoscopy was performed one minute after the administration of suxamethonium using mackintosh laryngoscope blades sizes 3 or 4 as appropriate. An experienced physician anaesthetist who did not know which drug and dose given to the patients undertook the trachea intubation. A cuffed tracheal tube of 7mm was used on the male while 8mm was used on the female patients.

The Cormack and Lehane grade of laryngoscopy was recorded by physician anaesthetist: Grade 1(complete visualization of the vocal cords), grade 2 (visualization of the inferior portion of the glottis), grade 3 (visualization of only the epiglottis), grade 4 (non-visualized epiglottis).[2] Viby-Mogensen system was used to evaluate the intubating conditions, and were scored as excellent (Jaws relaxed, vocal cords apart and immobile, no diaphragmatic movement), good (same condition except slight coughing) or poor (cord moving, moderate coughing, bucking).[3] Excellent and/or good intubating conditions were considered as clinically acceptable, poor intubating conditions were regarded as clinically unacceptable as shown below.

Table 1. Viby-Mogensen scoring system for assessment of intubating condition

Parameters	**Intubating conditions**		
	Clinically acceptable		**Clinically Not acceptable**
	Excellent	**Good**	**Poor**
Laryngoscopy	Easy	Fair	Difficult
Focal cord position	Abducted	Intermediate	Closed
Movement	None	Moving	Closing
Coughing (>10sec)	None	Diaphragm	Sustained
Limbs movement	None	Slight	Vigorous

The time from start of laryngoscopy until tracheal intubation was recorded. After intubation, all patients were mechanically ventilated and maintained with 0.6% of isoflurane in oxygen using carbon dioxide absorption. $EtCO_2$ was therefore maintained between 35 and 45 mmHg. Patient's abdomen was continuously monitored to observe respiratory movements. In the case of difficult intubation following inadequate relaxation, the lung was ventilated by face mask, and suxamethonium 0.5mg/kg was administered. The study endpoint was achieving the conditions for successful endotracheal intubation using 0.5mg/kg suxamethonium. Anaesthesia was continued as usual.

Statistical Analysis

The data obtained were expressed as mean ± standard error of mean and comparison were done using student's t-test. *P*-value < 0.05 was considered statistically significant. The number of patients was presented in percentages.

RESULTS

There were no cases of inadequate response to the low dose administered, hence, safety measure (dose top up) was not applied and no enrolled patient was exited since adequate response was obtained with the low dose.

Patient's data and grading based on the administration of the two doses of suxamethonium is presented in Table 2. Patient's compliance to intubation was 100%. The male to female ratio was 1.4:1 in group A, while in group B, the male to female ratio was 1:1.6. Similar outcomes were observed in the Mallampati classes, Cormack grade, laryngoscopy and intubation duration.

Table 2. Patient's data and grading

Parameters assessed	**Group A (received 0.5mg/kg) n=250**	**Group B (received 1mg/kg) n=250**
Age (years)	38±5	35±7
Gender (Male/Female)	134:98 (53.6%:46.4%)	98:152 (39.2%:60.8%)
Mallampati		
Class 1	228 (91.2%)	230 (92%)
Class 2	22 (8.8%)	20(8%)
Cormack & Lehane laryngoscopic view		
Grade 1	250 (100%)	250 (100%)
Grade 2	0	0
Duration of Laryngoscopy and intubation (Sec)	32.4±1.2	29.1±1.7

p-value = 0.16

Table 3. Assessment of intubating conditions

	Group A (0.5mg/kg), n=250	**Group B (1mg/kg), n=250**
Grading of intubating conditions		
Excellent	124 (49.6%)	148 (59.2%)
Good	105 (42%)	93 (37.2%)
Poor	21 (8.4%)	9 (3.6%)
General intubating conditions		
Clinically acceptable	229 (91.6%)	241 (96.4%)
Clinically unacceptable	21 (8.4%)	9 (3.6%)

P-value = 0.10

Table 4. Details of intubating conditions

Parameters assessed	**Group A (0.5mg/kg) n=250**	**Group B (1mg/kg) n=250**
Laryngoscopy		
Easy laryngoscopy	242	247
Fair laryngoscopy	8	3
Difficult laryngoscopy	0	0
Vocal cords position		
Abducted vocal cord position	250	250
Intermediate vocal cord position	0	0
Closed vocal position	0	0
Vocal cords movement		
No movement	250	250
Moving	0	0
closing	0	0
Coughing		
No coughing	250	250
Diaphragm	0	0
Sustained >10sec	0	0
Limb Movements		
No limbs movement	240	243
Slight limbs movement	10	7
Vigorous limbs movement	0	0

Results of the assessment of the intubation conditions are presented in Table 3. After the administration of 0.5mg/kg suxamethonium, out of the 250 patients in group A, 124 (49.6%) patients had excellent intubation conditions. Good intubating conditions were observed in 105 (42%) patients, while only 21 (8.4%) had poor intubation condition.

Following the administration of 1mg/kg suxamethonium in group B, excellent intubation conditions were observed in 148 (59.2%) patients, while 93 (37.2%) patients had good intubation conditions. However, 9 (3.6%) had poor intubation conditions.

Compared to the patients in group B, acceptable intubating conditions was achieved in patients in group A that received a low dose 0.5 mg/kg suxamethonium.

Table 4 showed the detailed outcome of the intubating conditions. In group A, 242 patients had easy laryngoscopy; it was fair in 8 patients. No difficult laryngoscopy was observed. Similarly, in group B, laryngoscopy was easy in 247 patients, fair in 3 patients but no difficulty was observed. No patient had closed or closing vocal cord in both groups. Also, there was no vocal cords movement in both groups. No sign of coughing was observed in both groups. A slight limb movement was observed in 10 patients in group A, a vigorous limb movement was not observed. In group B, 7 patients had slight limb movements but no vigorous limbs movement was observed.

DISCUSSION

An important finding from this study is that an acceptable and satisfactory condition for successful endotracheal intubation can be achieved with the administration of suxamethonium dose of 0.5mg/kg, which is a lower dose than the traditionally prescribed dose of 1-2mg/kg. Previous studies have shown that small doses of suxamethonium are effective in achieving satisfactory intubating conditions.[4,5] The low dose of suxamethonium has the advantage of less side effect, shorter apnoea time and earlier return of spontaneous respiration.

Despite the fact that there was an anticipated possibility of using a top up dose in patients that did not have muscle relaxation with a low dose (0.5 mg/kg) of suxamethonium, none of our patients required a top up dose, hence, none of the patients were exited from the study.

As shown in summary of the intubating conditions under group A (Table 3), clinically acceptable intubating conditions was achieved in 229 (91.6%) patients, following the administration of low dose 0.5mg/kg suxamethonium. This implies that intubating conditions following administration of 0.5mg/kg suxamethonium was similar to those achieved with the traditional dose of 1mg/kg, thereby demonstrating the effectiveness of lower dose of 0.5mg/kg. The observed effectiveness of the lower dose could be attributed to a number of factors which may include the sensitivity to suxamethonium, and also the variability of genetic polymorphism in individuals.[6]

When compared with other studies, our findings are in agreement with the work by Prakash *et al.* who showed that there was a clinically acceptable intubating condition

when 0.6mg/kg and 1mg/kg of suxamethonium were administered.[7] Naguib *et al*. also found the incidence of excellent intubating conditions following induction with 2µg/kg fentanyl and 2mg/kg propofol to be 0.0%, 43.3%, 60.0%, 63.3%, 80.0% and 86.7% of patients after 0.0, 0.3, 0.5, 1.0, 1.5, and 2.0 mg/kg succinylcholine, respectively.[8] Although in their study, different agents were used for induction of anaesthesia; this could explain the variation in the result.

The observed variation could also be linked to the human species difference. Previous studies have shown that the response to muscle relaxants differs between geographical areas. Katz *et al*. reported that the neuromuscular blocking effect of succinylcholine (1 mg/kg) in adults was shorter in London (9.1±2.9 min) than in New York (14.6±3.6 min).[9] Hosseini *et al*. showed that Irish subjects had more serum cholinesterase activity (7.82±0.14 U/mL) than Iranian subjects (4.22±0.90 U/mL).[10] These inter-racial differences in drug response could be due to differences in drug kinetics or sensitivity. However, our study was done with human subjects of the same racial background.

CONCLUSION

In conclusion, suxamethonium dose of 0.5mg/kg provides acceptable intubation conditions at time duration of 60 seconds compared with the use of standard anaesthesia dose of 1-2mg/kg.

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