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Original Research Article

Rocuronium and Suxamethonium: A Comparison of Duration of Action in Patients Undergoing Elective Thyroidectomy.

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Abstract

Aim and Objective: The purpose of this study was to compare the duration of action of Rocuronium and Suxamethonium during elective thyroidectomy.

Methodology : This double-blind experimental study included 60 patients ranging in age from 18 to 60 years old who underwent elective thyroidectomy under general anaesthesia after approval from the Institutional Ethics Committee and written patient consent

Result: The Duration of action was comparable between the groups with statistically significant difference (p value is less than 0.05). For analysis of difference in duration of action "t" test was used. P value is less than 0.05, (p=0.000) indicating that highly significant difference between the groups in the duration of action.

Conclusion: The study found that Rocuronium has a significantly longer duration of action than Suxamethonium.

Key Words: Neuromuscular blocking agent, TOF

Introduction

Succinylcholine, a depolarizing neuromuscular blocking agent (NMBA), is most frequently used as a first-line tracheal intubation support. Due to its quick onset and short duration of action, it is very helpful in emergency situations where a neuromuscular block needs to be induced and the airway needs to be quickly secured to prevent aspiration of gastric contents. A short duration of action is essential for restoring spontaneous respiration as quickly as feasible in patients with a difficult airway who cannot be ventilated or intubated. [1,2,3]

Of all the NMBAs that are currently available, succinylcholine has the shortest half-life. At 1 mg/kg, the recovery time ranges from 6 to 9 minutes (first train-of-four twitch [T1] to 10%) to 10 to 13 minutes (T1 to 90%). The average block time is one minute. Various adverse effects and contraindications are associated with succinic acid [4]. Unfortunately, decades of research have not succeeded in developing a new non-depolarizing NMBA that is safer and has a shorter half-life than succinylcholine [5].

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 02, 2023

The medicine Rocuronium has replaced succinylcholine, which was formerly used to facilitate endotracheal intubation easier. Intubation can be performed successfully 60 seconds after an intravenous Rocuronium injection. Among the currently available nondepolarizing neuromuscular blocking drugs, Rocuronium has the quickest onset of action [6]. Rocuronium's low potency is considered to be largely responsible for its fast onset of action. There were no noticeable adverse effects from Rocuronium. [7]

Succinylcholine and Rocuronium, on the other hand, differ in their ability to provide excellent intubation conditions, with the former being superior. To improve Rocuronium's ability to produce optimal conditions for tracheal intubation, the dose administered could be increased. [7]
The purpose of this study was to compare the duration of action of Rocuronium and Suxamethonium during elective thyroidectomy.

Material and methods

Type of study
It was a double-blind, controlled, experimental study.

Study duration
6 months

Study Approval
This study was approved by the institutional research committee of Government Medical College Kottayam, Kerala. Written and informed consent was obtained from all participants included in this study.

Study population
Sixty patients were divided into two groups, each with 30 participants.

Selection of the participants
The study included 60 patients ranging in age from 18 to 60 years old who underwent elective thyroidectomy under general anaesthesia after approval from the Institutional Ethics Committee and written patient consent. All of these patients had Mallampati grades of 1 or 2 and ASA grades of 1 or 2. Our exclusion criteria included patients with difficult airways (Mallampati grade 3 or 4). Patients with neuromuscular disease, QT prolongation syndrome, a history of allergy, asthma, carcinomatosis, valvular heart disease, pulmonary hypertension, patients on medications known to interact with neuromuscular blocking drugs, patients with a full stomach, obese patients, pregnant and lactating patients, and liver and kidney disease patients were excluded.

Study Groups
- Group A: Patients received injection Rocuronium bromide 6mg/kg intravenously and
- Group B: Patients received injection Suxamethonium chloride 1 mg/kg intravenously

Throughout the surgery, a skilled anaesthesia assistant and two professional anesthesiologists provided assistance. Senior anesthesiologist conducted the intubation. In this study, the anesthesiologist who performed the intubation and the drug administrator were both blinded. The intubation score was recorded.

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 02, 2023

Study material

Suxamethonium chloride, Rocuronium bromide, laryngoscope, endotracheal tube, TOF Apparatus

Preoperative evaluation: A complete preoperative evaluation is performed the day before surgery to rule out any systemic illness. Body weight is measured. Informed consent was obtained.

All patients were kept nil per oral for 8 hours prior to surgery. Patients were given Ranitidine 150 mg, Metoclopramide 10 mg, and Alprazolam 0.25 mg at bedtime before anaesthesia. At 6 a.m., Ranitidine 150 mg and Metoclopramide 10 mg were given before surgery. The pre-medication chamber received 500 mL of saline through a good intravenous line. To avoid Thiopentone and Rocuronium-induced hypotension.

All patients received intravenous glycopyrrolate 0.2 mg, ondansetron 4 mg, and pethidine 0.5 mg/kg 30 minutes before general anaesthesia.

Each patient was comfortably supine on the operating table. ECG, non-invasive blood pressure, and pulse-oximeter monitors were connected. A peripheral nerve stimulator was used in all cases to monitor neuromuscular blockade. The mechanical reaction of the adductor pollicis muscle (thumb adduction) following electrical stimulation of the ulnar nerve proximal to the wrist was visually seen. Two ECG electrodes were placed on the patient's right forearm along the ulnar nerve, with the distal negative electrode 1-2 cm proximal to the proximal wrist crease and the proximal positive electrode 2–5 cm proximal to the other. Both electrodes were cabled to the peripheral nerve stimulator.

The process measured heart rate, blood pressure, oxygen saturation, and an ECG. All patients received three minutes of 100% oxygen through a face mask. To reduce laryngoscopy stress, group A received intravenous thiopentone sodium (6 mg/kg of body weight) and lignocaine (1.5 mg/kg). Next, 0.6 mg/kg Rocuronium bromide was injected intravenously. Group B received intravenous thiopentone sodium (6 mg/kg body weight), lignocaine (1.5 mg/kg), and Suxamethonium (1 mg/kg). After 60 seconds of relaxant injection, both groups underwent laryngoscopy.

After losing consciousness, the peripheral nerve stimulator was activated to give 1 Hz twitches. Increase the current until the adductor pollicis twitches. Supramaximal stimuli were 20–25% above the maximal response. Four TOF-induced jerks followed.

Each group got the muscle relaxant as scheduled as a 5-second bolus dosage into a freely running intravenous infusion. Ten-second TOF stimuli followed. The same skilled anesthesiologist blindly intubated the patients after 60 seconds. A Kreig et al. modification was used to score intubation conditions [8].

Intubation condition evaluated on the following criteria

Table 1:

Score	Jaw Relaxation(Laryngoscopy)	Vocal Cords	Response to Intubation
0	Poor(impossible) Mouth opening	Closed	Severe coughing or bucking
I	Minimal(difficult) Mouth opening	Closed	Mild Coughing
2	Moderate(fair)	Moving	Slight diaphragmatic movement
3	Good(easy)	Open	None

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 02, 2023

The overall grade for intubation conditions was 8-9 Excellent, 6-7 Good. 3-5 Fair and 0-2 Poor After inflating the cuff of the endotracheal tube, it was attached to the Bains circuit and regulated ventilation was initiated. The time it took for twitch height to return to 25% of its initial value was used to calculate the duration of action of a muscle relaxant. The study was then ended, and anaesthesia was maintained as needed for surgical procedures.

Statistical Analysis

All the data was selected randomly and was entered in to the Microsoft excel and tabulated, then the data will be analyzed with appropriate statistical tools "SPSS version 24". Data was presented as mean with standard deviation or proportions as appropriate. Mean, median, standard deviation and variance was calculated and appropriate statistical significance tests were applied. t-test was applied to compare Group A vs Group B, as shown below.

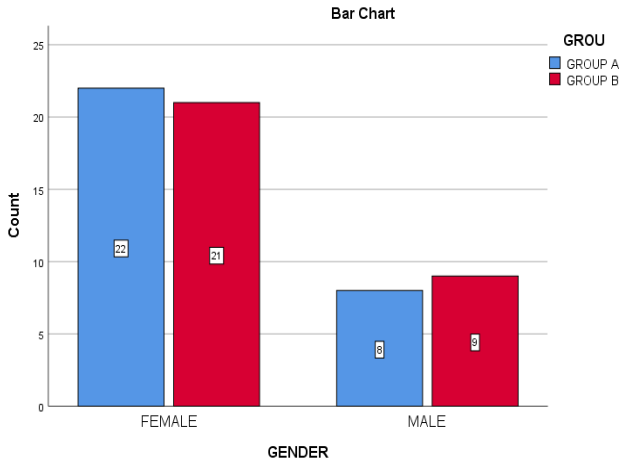
Results

Demographic Profile

The subjects were divided into two groups: Group A (Rocuronium 0.6 mg/kg) and Group B (succinylcholine 1 mg/kg). The majority of the patients were females (43, or 71.7%).

Table 2:

Variable	Characteristics	N(%)
Group	Group A- Rocuronium 0.6 mg/kg Group B- Suxamethonium 1 mg/kg.	30(50%) 30(50%)
Gender	Female Male	43(71.7%) 17(28.3%)
Total		**60(100%)**



Graph 1:

Graph 1. Despites majority of the study participants were females and group A 22(51.2%) and Group B 21(48.8%). 28.3% of the participants were males and out of which 47.1% of them belong to group A and 52.9% of them belong to group B

ISSN: 0975-3583, 0976-2833 VOL 14, ISSUE 02, 2023

Table 2 Basic Demographic and Anthropometric Variables of the study subjects Group A (30) and group B (30)

Variable s	Group A			Group B			P value
	Mean	SD	SE	Mean	SD	SE	
Age in years	31.97	6.54	1.19	41.53	14.21	2.5	0.001
Height in Cm	154.2	7.8	1.4	156.7	7.6	1.3	0.2
Weight in Kg	54.9	7.2	1.3	62.6	10.9	1.9	0.002
BMI Kg/m2	23.02	2.02	0.3	25.67	5.1	0.9	0.00

Table 2 shows the distribution of Age ,antropomatric,weight(kg) of the study participants enrolled. The mean age (yrs.) of the participants in A Group 31.97±6.54 and B group 41.53±14.21, there is a statistically significant difference was observed between Group A, and Group B (p is Less than than 0.05 ie, 0.001)

The mean Height in (cm) of the participants in A Group 154.2±7.8 and B group156.7±7.6 there is no statistically significant difference was observed between the Groups
The mean weight (kg) of the participants in A Group 54.9±7.2and B group 62.6±10.9, there is a statistically significant difference was observed between Group and Group B, (p is Less than than 0.05 ie, 0.002)

The mean BMI (kg/M2) of the participants in A Group 23.02±2.02 and B group 25.67±5.1, there is a statistically significant difference was observed between Group and Group B, (p is Less than than 0.05 ie, 0.00

Table 3: Unpaired t-test

Variable s	Group A			Group B			P value
	Mean ±SD		t	Mean ±SD		t	
Duration of Action in minutes	34.43	8.8	16.240	8.20	0.4	16.240	0.00

Duration of action: The duration of action is taken from the onset of muscle relaxant up to the reappearance of the response (25% of the initial stimuli) single twitch height.

Time for appearance of twitch height to 25% of initial response is taken as duration of that muscle relaxant. In Group A who received Rocuronium 0.6mg/kg body weight the mean±SD Duration of action (in minutes) was 34.43±8.8. In group who received succinylcholine 1 mg/kg body weight the mean±SD Duration of action (in minutes) was B 8.20±0.4

The Duration of action was comparable between the groups with statistically significant difference (p value is less than 0.05). For analysis of difference in duration of action t test was used. p value is less than 0.05 , (p=0.000) indicating that highly significant difference between the groups in the duration of action.
The duration of action Rocuronium was significantly longer than that of suzamethonium.

Discussion

The purpose of the current study was to evaluate the differences in the half-lives of Suxamethonium and Rocuronium during elective thyroidectomy. In this study, 60 patients

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undergoing general surgery were split into two groups of 30 individuals each. Group A received 0.6 mg/kg of Rocuronium. Suxamethonium 1 mg/kg body weight) was administered to group B. By adapting the Kreig et al. approach, intubating circumstances were evaluated.

The current study also demonstrated that Rocuronium is similar to Suxamethonium at a dose of l mg/kg body weight for providing adequate intubating circumstances at 60 seconds. In patients who received anaesthesia with these relaxants, there was a substantial difference in pulse rate, with greater tachycardia being related to Rocuronium, and a considerable increase in blood pressure following Suxamethonium.

The length of that muscle relaxant is measured from the time that the first twitch appears to 25% of the original reaction. Rocuronium was administered to Group A at a dose of 0.6 mg/kg of body weight. The action lasted for 34.438.8 minutes. The mean SD in the group that received succinylcholine at a dose of 1 mg/kg body weight The activity lasted for B 8.200.4 minutes. The length of that muscle relaxant is measured from the time that the first twitch appears to 25% of the original reaction. Rocuronium has a substantially longer period of action than syxamethonium. Using a common peripheral nerve stimulator at the ulnar nerve, the length of the action was evaluated visually.

Rocuronium has a start of action of 1 to 1.5 minutes and a duration of action of 20 to 75 minutes, according to a study by Robertson, E. et al. (longer in geriatric patients). With the exception of mivacurium, these medications have negligible cardiovascular effects, limited histamine release, and no additive effects. In our investigation, the mean Rocuronium dose was 0.6 mg/kg body weight (mean SD). The action lasted for 34.438.8 minutes. [8]

According to a study by Dronen, S. C., succinylcholine is frequently dosed at 1.0–1.5 mg/kg. With an onset time of 45–60 seconds and a duration of action of 4–6 minutes of paralysis, it is regarded as a rapid onset, one circulation time, quick-offset drug. In our investigation, the average number of minutes for succinylcholine at 1 mg/kg was 8.200.4. Robertson, E. N., et al. conducted a dose response study in "Suxamethonium administration prolongs the duration of action of subsequent Rocuronium," but did not assess the duration of action of a bolus dose of Rocuronium after Suxamethonium. [9]

The present study revealed that the quick (mean) onset periods of Rocuronium 0.6 mg kg1 and Suxamethonium 1 mg kg1 were 74 s and 49 s, respectively. In comparison to Rocuronium, Suxamethonium had a much quicker onset time. Additionally, it was confirmed that Rocuronium has a longer clinical duration of action than Suxamethonium (30 min vs. 12 min, respectively) [10, 11, and 12].

Conclusion:

In this study, the duration of action was assessed visually, by using an ordinary peripheral nerve stimulator at the ulnar nerve. The study found that Rocuronium has a significantly longer duration of action than Suxamethonium.

Conflict of interest: Nil

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