International Journal of Medical Anesthesiology

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2022; 5(2): 28-31
Received: 16-02-2022
Accepted: 18-03-2022

Amrutha Elizebath Jose
Department of Anesthesiology, KVG Medical College and Hospital, Rajiv Gandhi University of Health Sciences, Sullia, Karnataka India

Corresponding Author:
Amrutha Elizebath Jose
Department of Anesthesiology, KVG Medical College and Hospital, Rajiv Gandhi University of Health Sciences, Sullia, Karnataka India

Comparative study of intubating conditions and hemodynamic effects after administration of rocuronium and succinylcholine for endotracheal intubation in adult patients for elective surgeries: A randomized control study

Amrutha Elizebath Jose

DOI: https://doi.org/10.33545/26643766.2022.v5.i2a.347

Abstract
Background and Objective: Rocuronium provides faster neuromuscular blockade compared with other neuromuscular blocking drugs. It produces comparable intubating conditions to that of Succinylcholine conditions depending upon the dose administered. In our study, the effects of Rocuronium 0.9 mg/kg (3x ED95) was compared with Succinylcholine 2 mg/kg when used for endotracheal intubation in adult patients for elective surgeries under general anesthesia and assessed the hemodynamic stability.
Method: A prospective double blinded randomized controlled study was conducted at KVG medical college hospital, Sullia on 60 Adult patients 30-50yrs of age with ASA I or II grades who were undergoing elective surgeries under general anesthesia. Patients were premedicated with glycopyrrolate 0.2 mg intravenous. Patients randomly received either succinylcholine 2 mg/kg or rocuronium 0.9 mg/kg after induction with propofol 2 mg/kg and fentanyl 2µg/kg intravenously. Onset of action was assessed with adequate jaw relaxation. Intubating conditions and the time to intubation was assessed by modified grading given by Cooper *et al*. Hemodynamic changes were noted before and after intubation.
Results: We observed that succinylcholine chloride 2 mg/kg body weight and rocuronium bromide 0.9 mg/kg body weight produced well to excellent intubating conditions in all patients. Rocuronium bromide 0.9 mg/ kg body weight showed excellent intubating conditions in 83.4% of patients, which was comparable to that of 83.33% observed with succinylcholine chloride. Onset of action (60 sec) was faster with succinylcholine in 73.3% of patients than with rocuronium 66.7%. There was a transient rise in the hemodynamic variables but was not statistically significant 5 minutes after induction.
Conclusion: Rocuronium 0.9 mg/kg provides good to excellent intubating conditions in 60 – 90 seconds with no hemodynamic side effects and is a better alternative to succinylcholine for intubation in patients where succinylcholine chloride is contraindicated.

Keywords: Rocuronium, succinylcholine, intubating conditions

Introduction
Rapid and safe tracheal intubation is of paramount importance for the airway maintenance in general anaesthesia [1].The ease of tracheal intubation depends upon anatomy of the airway, the degree of muscle relaxation, depth of anesthesia and skill of anaesthesiologist [2]. Neuromuscular blocking agents play an important role in establishing airway control by providing adequate laryngopharyngeal relaxation and also provide muscle relaxation during surgery. Succinylcholine is a short acting depolarizing muscle relaxant with quick onset of action [1] but has untoward effects like myalgia, hyperkalemia, bradyarrhythmia, and rise in intra-ocular, intracranial and intragastric pressure etc. [3]. Rocuronium is a non-depolarizing muscle relaxant with fast onset of action[1] producing good muscle relaxation without the side effects of succinylcholine. The onset of maximum single-twitch depression after the administration of 3 to 4 times ED95 of rocuronium resembles the onset of action of succinylcholine 1mg/kg [4]. Rocuronium has been shown to possess most of the properties of an ideal muscle relaxant such as rapid recovery, noncumulative, free from cardiovascular side effects, histamine release, pharmacologically inactive metabolites [5]. Rocuronium in doses of 0.9-1.2mg/kg has proven to be as effective as succinylcholine for rapid tracheal intubation [6].

Our study is designed to compare rocuronium 0.9mg/kg and succinylcholine 2 mg/kg for tracheal intubation at 60 seconds after the administration of muscle relaxants in patients undergoing elective surgeries.

Materials and Methods

Source of Data

This is a Randomized, prospective double-blind study conducted from November 2019 -September 2021 at KVG medical college hospital, Sullia on 60 adult patients 30-50yrs of age with ASA I or II grades scheduled for elective surgeries under general anesthesia.

Formula used

n=(s 1 2 +s 2 2) (z 1 - α +z 1 - β)
(x - 1 -x - 2) 2
S 1 = 3.35 X 1 =15.1 α=0.01=2.58
S 2 = 2.18 X 2 =12.5 β at 80% = 0.84

Methodology

A randomized controlled study conducted on 60 adult patients American society of anesthesiologist grade I and II patients. All patients underwent pre-anesthetic evaluation and relevant investigations one day prior to surgery. Written informed consent was obtained from all patients.

Inclusion criteria

1. Age 30-50 years.
2. ASA grade I and II.
3. Malampatti classification 36 up to class 2.
4. Patients undergoing elective surgeries under general anesthesia.

Exclusion criteria

1. ASA grade III and IV.
2. Anticipated difficult airway.
3. Conditions like hyperkalemia, uncontrolled diabetic mellitus, hypertension, obesity, bronchial asthma, epilepsy.
4. Patients with neuro-muscular disease, history of cardiac, renal or hepatic disease.
5. History of allergy to the drugs being used.
6. Patients receiving medication known to influence neuromuscular function eg. aminoglycoside antibiotics.

Study Protocol

Following approval from the Institutional Ethics Committee of KVG Medical College Hospital, 60 patients aged 30-50yrs were selected for the study. All patients underwent pre-anesthetic evaluation prior to surgery and written informed consent was obtained. Oral Pantoprazole 40 mg, Alprazolam 0.25mg were given. Patients were randomly assigned to 2 equal groups R and S {n=30} according to computer generated list. The procedure was then double blinded maintaining randomization list. On the day of surgery after shifting the patient to preoperative room, intravenous line was secured with 18G cannula on nondominant hand and ringer lactate 10-15ml/kg was connected and premedicated with Inj. Glycopyrrolate 0.2mg intravenous. ECG leads, Pulse oximeter and NIBP were attached. Baseline pulse rate, systolic and diastolic blood pressure, mean arterial pressure and SpO2 were recorded. Patients were preoxygenated for 3 minutes with 100% oxygen and Injection Fentanyl 2µg/kg was given 3 minutes before intubation. General anesthesia was induced with intravenous propofol 2mg/kg over 20 seconds. After loss of verbal response, mask ventilation was confirmed.

Patients randomly allocated to two groups

Group S: Received Succinylcholine 2 mg/kg intravenous.
Group R: Received Rocuronium 0.9 mg/kg intravenous.

The intubating anesthesiologist was blinded to the muscle relaxant given. Direct laryngoscopy was performed using a size 3 Macintosh Laryngoscope blade at 60 sec after injection of the muscle relaxant and Cormack Lehane grading was noted. Trachea was intubated with appropriate size, cuffed tracheal tube. Intubating conditions were assessed according to Cooper *et al* grading [7]. Tracheal intubation was not be performed until the intubating conditions are excellent or good. Subsequent attempts were noted. The pulse rate and blood pressure were recorded before and after induction, after injection of muscle relaxant and at 1-, 2-, 3- and 5-min following intubation. Our study was concluded at this point.

The parameters observed were

1. Time of administrating the muscle relaxant
2. Cormack Lehane grading.
3. Intubating conditions assessed according to four point scale of Cooper *et al*. [8]
4. Number of attempts taken for intubation
5. Time taken for intubation
6. Non-invasive blood pressure, heart rate, spo2 were recorded before and after induction, after injection of muscle relaxant and at 1, 2, 3 and 5 min following intubation.

Statistical methods applied

1. t' test, to test the significance of difference in quantitative variables like heart rate and mean arterial blood pressure indicating the hemodynamic status
2. Chi square test to test the significance of difference in qualitative variables.

Results

Table 1: Intubating conditions

Cooper *et al* score	Rocuronium		Succinylcholine		Total	
	N	%	N	%	N	%
7	5	16.7%	5	16.7%	10	16.7%
8	4	46.7%	15	50%	29	48.3%
9	11	36.7%	10	33.3%	21	35%
10	30	100%	30	100%	60	100%

* Statistically significant; Test statistic used: Chi square test

Table 2: Heart rate

	Rocuronium (Mean± SD)	Succinylcholine (Mean± SD)	P value
Pre induction	77.07 ± 11.41	76.97 ± 11.85	0.487
Post induction	74.33 ± 10.87	77.70 ± 10.65	0.384
Post muscle relaxant	73.73 ± 10.52	78.13 ± 10.44	0.352
0 min	75.37 ± 10.10	80.17 ± 10.13	0.344
1 min	74.23 ± 9.54	79.63 ± 9.78	0.126
2 min	75.67 ± 8.45	79.23 ± 8.27	0.037*
5 min	74.93 ± 9.10	78.40 ± 9.66	0.403

* Statistically significant; Test statistic used: t test

Table 3: Systolic Blood Pressure

	Rocuronium (Mean± SD)	Succinylcholine (Mean± SD)	P value
Pre induction	120.83 ± 7.97	120.27 ± 6.83	0.197
Post induction	119.50 ± 6.49	122.57 ± 6.60	.063
Post muscle relaxant	118.23 ± 6.07	125.83 ± 6.34	0.000*
0 min	126.13 ± 7.25	125.77 ± 5.61	0.024*
1 min	124.17 ± 6.72	127.07 ± 4.62	0.001*
2 min	123.27 ± 6.53	126.87 ± 5.08	0.043*
5 min	121.63 ± 6.47	125.13 ± 4.34	0.414

* Statistically significant; Test statistic used: t test

Table 4: Diastolic Blood Pressure

	Rocuronium (Mean± SD)	Succinylcholine (Mean± SD)	P value
Pre induction	65.13 ± 8.58	64.30 ± 8.27	0.080
Post induction	65.73 ± 8.89	66.27 ± 8.91	.0.226
Post muscle relaxant	64.80 ± 8.68	68.93 ± 8.06	0.022*
0 min	70.67 ± 8.07	67.77 ± 8.70	0.028*
1 min	69.57 ± 7.44	68.13 ± 7.56	0.216
2 min	68.07 ± 7.25	69.40 ± 7.79	0.483
5 min	67.30 ± 8.15	67.47 ± 8.59	0.074

* Statistically significant; Test statistic used: t test

Table 5: Mean Arterial Pressure

	Rocuronium (Mean± SD)	Succinylcholine (Mean± SD)	P value
Pre induction	83.60 ± 7.67	82.83 ± 7.08	0.07
Post induction	83.37 ± 6.98	84.87 ± 6.52	.0.233
Post muscle relaxant	82.30 ± 6.63	87.93 ± 6.10	0.080
0 min	88.37 ± 6.97	87.07 ± 6.31	0.090
1 min	87.73 ± 6.54	87.80 ± 6.22	0.008*
2 min	86.47 ± 6.20	88.63 ± 6.58	0.465
5 min	85.43 ± 7.01	86.63 ± 7.14	0.226

* Statistically significant; Test statistic used: t test

In the present study, based on intubating conditions in Rocuronium group, 16.7% showed score 7, 46.7% scored 8 and 36.7% scored 9. Whereas in Succinylcholine group, score 7 was noted in 16.7%, score 8 in 50% and score 9 in 33.3%. There was no statistically significant association observed with relation to intubating conditions between the study groups as the p value calculated to be > 0.05.

A higher Heart rate was recorded in Succinylcholine group compared to Rocuronium group at Post induction, Post muscle relaxant use, at 0 minute, 1 minute, 2 minute, and 5minutes. At Post induction, 0 min, 1 min, 2 min this difference was observed to be statistically significant as the p value calculated was < 0.05.

A higher SBP was recorded in Succinylcholine group compared to Rocuronium group at Post induction, Post muscle relaxant use, 1 Min, 2 Min, and 5 min. At Post induction, Post muscle relaxant use, 1 min this difference was observed to be statistically significant as the p value calculated to be < 0.05. A higher DBP was recorded in Succinylcholine group compared to Rocuronium group at Post induction, Post muscle relaxant use, at post muscle relaxant use, this difference was observed to be statistically significant as the p value was < 0.05.

In the present study, a higher MAP was recorded in Succinylcholine group compared to Rocuronium group at Post induction, Post muscle relaxant use, 1 minute, 2 minute, and 5 minutes. At post muscle relaxant use, this difference was observed to be statistically significant at 1 minute as the p value calculated to be < 0.05 and showed back to baseline after 5 minutes.

Discussion

With non-depolarizing muscle relaxants like Rocuronium, it has been found that the onset of paralysis at laryngeal muscles preceded that at adductor pollicis and hence monitoring of train of four at adductor pollicis may not give the correct picture of intubating conditions. So, intubating conditions are usually assessed using clinical criteria such as jaw relaxation, vocal cord movements and diaphragmatic relaxation. Hence in the present study, clinical criteria as adopted by Cooper R. A. *et al.* [7] were used for scaling intubating conditions at 60 seconds. In our study we got excellent intubation conditions with succinylcholine in 83.3% of patients which concurs with the findings of the studies conducted by Toni Magorian *et al.* [9] and Shaik Mira Shareef [10]. We got excellent to good intubation conditions with 2mg/kg in 100% of cases which can be comparable to the study conducted previously except for Friedrich K., Puhringer *et al.* [11] and K.C. McCourt *et al.* [12] In the studies conducted by, Aparna Shukla *et al*. 2004 [2], Shaik Mira Shareef *et al*. 2016 [10] concluded that there is no significant changes in the hemodynamic variables after the administration of succinylcholine and Rocuronium. In our study, we observed no significant change in hemodynamic variables following the administration of rocuronium bromide 5 minutes after induction. There was a change in mean heart rate by 1.9% following administration of rocuronium bromide 0.9 mg/ kg body weight, one minute following intubation. There was a similar increase in mean arterial pressure by 4.38% following the administration of 0.9 mg/ kg body weight one minute following intubation. This was a hemodynamic response to laryngoscopy and endotracheal intubation which subsided to near pre induction values 5 minutes after intubation. Similar trends were seen following the administration of succinylcholine chloride 2 mg / kg body weight. There was a rise in mean heart rate by 5.2% from pre induction value two minutes after intubation. There was also a rise in mean arterial pressure by 5.66% from pre induction value one minute after intubation. These values returned towards pre induction values 5 minutes following intubation. There was no significant change in the hemodynamic variables following administration of succinylcholine chloride and rocuronium bromide after 5 minutes of post induction and rise in mean heart rate and blood pressure which returned to the baseline value after 5 minutes was a response to laryngoscopy and intubation.

Conclusion

We have studied that the intubating conditions of Rocuronium bromide 0.9mg/kg body weight are comparable to Succinylcholine bromide. There was significant changes in the heart rate and mean arterial pressure with the use of Rocuronium following one minute after the intubation which became preinduction value after 5 minutes. There was rise in heart rate (one minute) and mean arterial pressure (two minute) with the use of succinylcholine following the intubation and touched baseline after 5 minutes. There is no significant change in hemodynamic variables after the administration of Succinylcholine and Rocuronium. Rocuronium is a better non-depolarizing muscle relaxant for endotracheal intubation where the use of

succinylcholine is contraindicated.

Acknowledgement
I am extremely thankful to the Management, Head of the department and all staff of Anesthesia department for their whole hearted support in successful completion of my study.

Conflicts of interest
There are no conflicts of interest.

References
1. Gnani NBC, Uma BR. A clinical comparative study of succinylcholine versus rocuronium in various doses for paediatric intubation. Ind J Anaesthesia. 2017;4(2):214-218.
2. Shukla A, Dubey KP, Sharma MSN. Comparative evaluation of haemodynamic effects and intubating conditions after the administration of org 9426 (rocuronium) and succinylcholine. Ind J Anaesth. 2004;48(6):476-479.
3. Rao MH, Venkatraman A, Mallleswari R. Comparison of intubating conditions between rocuronium with priming and without priming: Randomized and double-blind study. Indian J Anaesth. 2011;55:494-8.
4. Pamela Flood, James P Rathmell, Steven Shafer. Neuromuscular blocking drugs: Stoelting RK, Hillier SC, editors. Pharmacology and Physiology in Anaesthesia practice.4th edition. Philadelphia: Lippincott Williams and Wilkin, 2005, 238-9.
5. Bhandari R, Verma AP, Singh RP, Agrawal M, Mitra S, Krishan G. A clinical evaluation of the intubating conditions using two different doses of rocuronium and its comparison with succinylcholine for rapid sequence induction: a prospective single blind study. International Journal of Contemporary Medical Research. 2018;5(2):B34-B39.
6. Chavan SG, Gangadharan S, Gopakumar AK. Comparison of rocuronium at two different doses and succinylcholine for endotracheal intubation in adult patients for elective surgeries. Saudi J Anaesth. 2016;10:379-83.
7. Cooper R, Mirakhur RK, Clarke SJ, Boules Z. Comparison of intubating conditions after administration of ORG 9426 (Rocuronium) and Suxamethonium. Br J Anaesth. 1992;69:269-273.
8. Cooper RA, Mirakhur RK, Maddineni VR. Neuromuscular effects of rocuronium bromide during fentanyl and halothane anaesthesia, Anaesthesia. 1993;48:103-105.
9. Toni Magorian, Flannery KB, Ronald D Miller. Comparison of rocuronium, succinylcholine and vecuronium for rapid sequence induction of anaesthesia in adult patients; Anaesthesiology. 1993;79:913-918.
10. Shareef SM, Sudharani G. Comparitive study of succinylcholine, rocuronium and vecuronium for intubation and hemodynamic changes during general anaesthesia. IOSR Journal of Dental and Medical Sciences. 2016;15(10):14-19.
11. Friedrich K Puhringer, Karin S, Khuenl-Brady, Johann Koller, Gottfried Mitterschiffthaler. Evaluation of endotracheal intubating conditions of Rocuronium and succinylcholine in outpatient surgery; Anaesthesia Analgesia. 1992;75:37-40.
12. McCourt KC, Salmela L, Mirakhur RK, Carroll M, Rout GJ. Comparison of rocuronium and suxamethonium for use during rapid sequence induction of anaesthesia. Anesthesia. 1998;53:867-871.