International Journal of Biomedical and Advance Research
ISSN: 2229-3809 (Online); 2455-0558 (Print)
Journal DOI: https://doi.org/10.7439/ijbar
CODEN: IJBABN **Original Research Article**

Comparison of Intubating Conditions after Administration of Rocuronium with that of Suxamethonium

Pooja G. Kulkarni[1], Vaishnavi V. Kulkarni[1] and Sachin Wagh[*2]

[1]*Department of Anaesthesiology, Dr Vaishampayan Memorial Medical College, Solapur, Maharashtra, India-413003*
[2]*Dr. D. Y. Patil Dental College & Hospital, Sant Tukaram Nagar, Pimpri, Pune, Maharashtra- 411018*

Abstract

Background: Rapid and safe endotracheal intubation are of paramount importance in general anaesthesia. Rocuronium was shown to have the fastest onset of action of all currently available non-depolarizing neuromuscular blocking drugs and to provide intubating conditions similar to those of suxamethonium within 60 seconds after administration. Hence the present study was under taken to evaluate and compare the effects of Rocuronium and Suxamethonium with respect to the onset of action, intubating conditions, duration of action, haemodynamic effects and side effects.
Method: Total 80 patients were enrolled and divided into two groups of 40 patients in each. All patients were induced with Inj. Thiopentone 5mg/kg after preoxygenating with 100% oxygen. Group I received inj Rocuronium 0.6mg/kg and group II received Suxamethonium 1.5mg/kg. Patients were ventilated with 100% oxygen for 60 seconds, at the end of 60 seconds laryngoscopy was performed and intubating conditions were graded.
Results: Rocuronium produced clinically acceptable i.e. excellent and good intubating conditions in 33 patients (82.5%) at 60 sec. while Suxamethonium produced clinically acceptable intubating conditions in 37 patients (92.5%). The mean onset of action of Rocuronium and Suxamethonium was 81.07±17.41 and 59.05±7.48 seconds respectively. The mean duration of action of Rocuronium was 25.42 ± 5.90 minutes and 9.77 ± 2.47 minutes for Suxamethonium. Haemodynamic changes were clinically not significant. Rocuronium had lesser side effects (only in 1 patient) than suxamethonium (in 8 patients).
Conclusion: Rocuronium (0.6mg/kg) has a brief onset of action and can produce satisfactory Intubating conditions that are comparable to Suxamethonium (1.5mg/kg) with no side effects.
Keywords: Intubation, General anaesthesia, Rocuronium, Suxamethonium, Thiopentone, Laryngoscopy, Oxygen.

***Correspondence Info:**
Dr. Sachinkumar Wagh,
Department of Anaesthesiology,
D. Y. Patil Dental College, Pimpri, Pune,
Maharashtra- 411018, India

***Article History:**
Received: 03/06/2019
Revised: 26/06/2019
Accepted: 28/06/2019
DOI: https://doi.org/10.7439/ijbar.v10i6.5207

QR Code

How to cite: Kulkarni PG, Kulkarni VV and Wagh S. Comparison of Intubating Conditions after Administration of Rocuronium with That of Suxamethonium. *International Journal of Biomedical and Advance Research* 2019; 10(6): e5207. Doi: 10.7439/ijbar.v10i6.5207 Available from: https://ssjournals.com/index.php/ijbar/article/view/5207

1. Introduction

During general anaesthesia, anaesthestic gases are introduced through the lungs. This state of deliberate pharmacological unconsciousness might also cause airway obstruction or pulmonary aspiration. In addition, various types of surgeries mandate to cease the patient's spontaneous respiration and require controlled ventilation. The common denominator of all of the above-mentioned factors is the wide spread necessity to protect the patient's airway by creating a safe artificial corridor for the air to enter the lungs without obstruction. This task is accomplished by introducing the endotracheal tube in the trachea by tracheal intubation [1].

Good Intubating conditions minimize the risk of trauma associated with tracheal intubation. Intubating conditions (muscle tone, the position of vocal cords, reaction to laryngoscopy and tube positioning) depend on the anaesthetic depth and kind of anesthesia used. Tracheal intubation is commonly facilitated by neuro-muscular blockade [2].

Suxamethonium is the most commonly used depolarizing muscle relaxant because of its rapid onset of action and its various advantages. The popularity of Suxamethonium has been questioned mainly due to its association with its side effects varying from myalgia, sore

throat, hyperkalemia to the life threatening conditions like arrhythmias and malignant hyperthermia. With the advent of newer, non-depolarizing muscle relaxants, anaesthesiologists have the luxury of other options where suxamethonium is contraindicated [3].

Rocuronium bromide is a new steroidal non-depolarisingneuro-muscular blocking agent, which is structurally related to vecuronium. It has been shown to have rapid onset of action than vecuronium, an intermediate acting non-depolarizing muscle relaxant. It has also been reported to develop optimal tracheal Intubating conditions more rapidly than vecuronium [4]. In initial studies the ED_{95} of Rocuronium was found to be 0.3 mg/kg [5]. For tracheal intubation, at least 2x ED_{95} of any neuromuscular blocker is necessary [6, 7]. Fast onset of time resulting in rapid development of optimal intubating conditions and brief time course of neuro-muscular blockade are of prime importance in anaesthesia. Therefore, the present study was undertaken to compare tracheal intubating conditions and time course of action (onset, duration and recovery rate) of a single bolus dose of 0.6 mg/kg Rocuronium (2x ED_{95}) [8] with those after single bolus dose of 1.5 mg/kg Suxamethonium for endotracheal intubation.

2. Materials and Methods

After obtaining Institutional Ethical Committee approval and written inform consent from patients, this study was conducted on total 80 patients of ASA grade I and II, age between 18-60 years underwent elective surgery. All these patients were divided into two groups of 40 patients in each. Group I received Injection Rocuronium Bromide and Group II received Injection Suxamethonium as the muscle relaxant. Patients with cardiovascular, respiratory and renal disease, history of drug sensitivity, patients on medication which interact with muscle relaxants, patients with predicted airway problem (MPG III and IV) and all patients with neuromuscular disease were excluded from the study.

All the patients were pre-medicated with the injection of Ranitidine 1mg/kg, Metoclopramide 0.2 mg/kg, Midazolam 0.03mg/kg, Glyccopyrrolate 0.004mg/kg and Pentazocine 0.3mg/kg. IV access was secured. Standard monitoring devices- NIBP, ECG, pulse oximeter and neuromuscular monitor were applied to the patient and baseline parameters like systolic/diastolic/mean BP, pulse rate, SPO2, along with respiratory rate were noted. After premedication, pre-oxygenation was done with 100% oxygen. Induction was done with Inj. Thiopentone sodium 5mg/kg till the loss of eye lash reflex and anaesthesia was maintained on O_2: N_2O; 40:60 on Bain's circuit. With the help of neuromuscular monitor ulnar nerve was stimulated percutaneously at the wrist joint. The current strength was increased progressively and single twitch response was elicited till maximal response of contraction of adductor pollicis was achieved. The current strength was noted and one and half times of this strength was used for subsequent elicitation of train of four stimuli. After establishing the current strength, patients were randomly given Inj. Suxamethonium 1.5 mg/Kg. or Inj. Rocuronium 0.6 mg/Kg as a neuromuscular blocking agent to facilitate the intubation. After injecting either of the muscle relaxant patientswas intubated at sixty second. Simultaneously patients were monitored every 15 seconds with the help of train of four responses. Haemodynamic changes were noted. The intubating conditions were graded according to "Intubation rating score" by 'Cooper *et al*' [9].

After intubation patients were maintained on O2: N2O; 50: 50 with Isoflurane 0.8% as an inhalational agent. Inj. Vecuronium was used as a muscle relaxant and top-up doses were given when required. Patients were maintained on controlled ventilation. After the completion of operation patients were reversed with Injection Glyccopyrrolate 0.008mg/kg and Neostigmine 0.05 mg/kg. After extubation patients were shifted to recovery room. Observations like intubating conditions produced by the muscle relaxant at 60 seconds, Pulse rate, Blood pressure, SpO_2 for every 5 minute for first 45 minutes or till the 1st dose of maintenance muscle relaxant was required, onset and duration of action, side effects and complications were recorded.

2.1 Statistical Analysis

All data was recorded and mean, standard deviation (SD), minimum and maximum values were calculated for both the groups. Two groups were compared statistically with the help of chi square test and student's t test. Significance of these tests was determined by probability value (p-value) of 0.05 or less.

3. Observations and Results

The demographic profiles of the patients were comparable between two groups and difference was not statistically significant as shown in Table 1.

Table 1: Demographic profile of patients

Parameters	Group I	Group II	P value
Age (years)	36.8± 9.74	37.65 ± 9.73	>0.05
Weight (kg)	61.65 ± 5.81	62.67 ± 5.55	
Male/Female	21/19	22/18	
ASA Grade I/II	26/14	24/16	

Table 2 show the information about intubating conditions. Rocuronium produced clinically acceptable i.e. excellent and good Intubating conditions in 33 patients (82.5%) at 60 sec. Suxamethonium produced clinically acceptable Intubating conditions in 37 patients (92.5%). Both the groups were comparable with respect to clinically acceptable intubating conditions and difference was not statistically significant, (p>0.05).

Table 2: Intubating Conditions (Laryngoscopic view at 60 seconds after administration of skeletal muscle relaxant)

Intubating Conditions	Group I	Group I	P value
Excellent (Score 8-9)	24(60%)	33(82.5%)	<0.05
Good (Score 6-7)	9(22.5%)	4(10%)	<0.05
Fair (Score 3-5)	7(17.5%)	3(7.5%)	<0.05
Poor (Score 0-2)	-	-	-
Clinically Acceptable (excellent + good) (Score 6-9)	33 (82.5%)	37 (92.5%)	>0.05

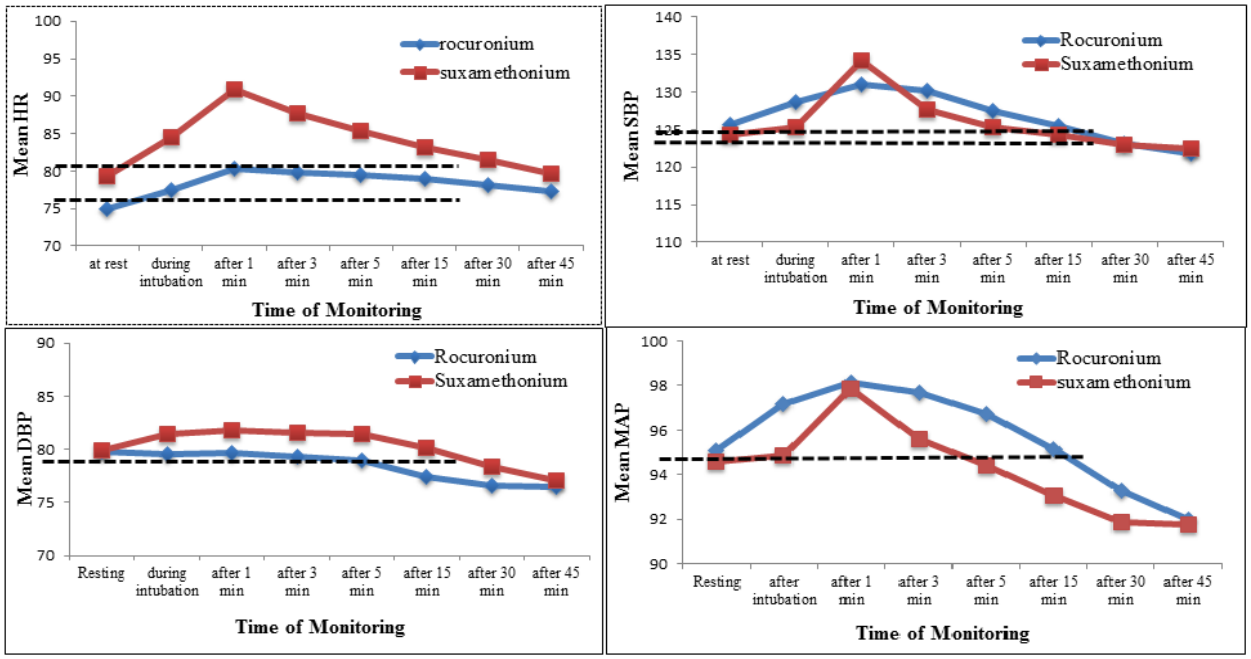
The range and mean onset of action as well as duration of action are shown in table 3. The p value was<0.001, thus the difference between two groups with respect to onset and duration of action was highly significant.

Table 3: Mean Onset and Duration of action in two groups

Parameters		Group I	Group I	P value
Onset of Action (In seconds)	Range	60-112	45-75	<0.001 Highly significant
	Mean± S.D.	81.07+17.41	59.05±7.48	
Duration of Action (In minutes)	Range	11-34	6-15	
	Mean± S.D.	25.42+ 5.90	9.77+ 2.47	

Following laryngoscopy and intubation there was increase in haemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure. The increase was maximum 1 minute after intubation. It gradually decreased towards resting values later, (Figure 1). The increase in these parameters after 1 minute was greater with Suxamethonium. Though we had statistically significant haemodynamic changes at few places, they were clinically not significant as the haemodynamic parameters were never increased more than 30%. No pharmacological interventions were needed.

Figure 1: Comparison of haemodynamic parameters between two groups



Out of 40 patients, who received Suxamethonium showed side effects in 8 (20%) patients (Myalgia and sore throat in 4 patients each). Only 1 patient (2.5%) out of 40 who received Rocuronium had sore throat.

4. Discussion

Muscle relaxation is used to facilitate endotracheal intubation and to provide surgical relaxation [10]. The ideal neuromuscular blocking agentis one which has brief duration of action provides profound relaxation and is free from haemodynamic changes. Suxamethonium reliably produces muscle relaxation within60 seconds of its administration, but it can produce many undesirable side effects and is contraindicated in certain patients. Due to this reasons, various clinical efforts have been taken to find a non-depolarising muscle relaxant with rapid onset of action, preferably of a shorter duration is desirable, the quality which Rocuronium is supposed to have [11].

Fast onset time resulting in rapid development of optimal tracheal Intubating conditions and brief time-course of neuromuscular blockade are of prime importance in anaesthesia. In initial studies, the ED_{95} of rocuronium was found to be 0.3 mg/kg [5].Therefore, in present study, we have decided to compare tracheal Intubating conditions and time course (onset, duration and recovery rate) of action of a single dose of 2 x ED_{95} i.e. (0.6mg/kg) of Rocuranium bromide [6, 7] with 1.5 mg/kg of Suxamethonium as the intubating dose. Rocuronium produces earlier blockade of laryngeal muscles than adductor pollicis [12-14]. Therefore, onset of time has become overestimated as a predictive parameter for the rate of development of adequate Intubating conditions and is not meaningful quantifiable endpoint determining optimal Intubating conditions. Thus patient's readiness for intubation could not be judged by the depression of single twitch height monitored at adductor pollicis.

In the Group I (Rocuronium), Excellent intubating conditions were seen in 60% of patients, good in 22.5% and fairin 17.5% of patients while in group II (Suxamethonium), excellent intubating conditions were seen in 82.5% of patients, good in 10% and fair in 7.5% of patients. Clinically acceptable intubating conditions were seen in 82.5% and 92.5% of patients administered Rocuronium and Suxamethonium respectively. These results are concordance with previous studies [9, 15, and 16]. All these studies used rating scale by Krieg *et al* [17] and CCC rating scale (Copenhagen Consensus Conference) [18] and used a combination of thipentone opioid (+ benzodiazepine) or propofol + opioid. The variations seen in the intubation conditions in current study and in previous studies [9, 15, and 16] could be attributed to various factors like different anaesthetic agents used, different rating scale used and large room for personal and subjective interpretation of data.

The onset of action was noted from the time from injection of muscle relaxant until the occurrence of maximal block [9] i.e. complete loss of train of four responses. Rocuronium had rapid onset of action than Suxamethonium and the difference was highly significant. Similar results regarding onset of action are reported by Mirakhur *et al* [12]. Also, present study confirmed the rapid onset of action of both the drugs at given doses and which is comparable with the other studies [9, 12]. Duration of action' was noted from 'onset of complete absence of train of four responses to the recovery of twitch height to 25% [9]. Suxamethonium has shorter duration of action than Rocuronium and the difference between two groups was statistically highly significant which was coincides with prior studies [12, 19]. All these studies recommended Rocuronium (0.6 mg/kg) can be used as an intermediate acting muscle relaxant.

Various haemodynamic parameters like heart rate, systolic, diastolic and mean arterial pressure were evaluated. Upto 30 minutes there were significant differences in Heart rate after administration of Rocuronium or suxamethonium. Rocuronium had greater stability than suxamethonium. In suxamethonium, there was much increase in systolic blood pressure after 1 minute after intubation. Rocuronium had less variation with systolic blood pressure. In both the groups, there was no significant variation in diastolic and mean arterial blood pressure. Though all these parameters increased following laryngoscopy and intubation, the increase was maximum during intubation and at 1 minute after intubation and decreased thereafter towards resting values in both the groups. The increase of heart rate, systolic, diastolic blood pressure, was more with suxamethonium than Rocuronium after 1 minute of intubation. These findings are correlated with earlier studies [20, 21]. The animal studies by Booji *et al* [22] proved Rocuronium have less cardiovascular effects and in toxicological studies in two species toxic effects on organs and changes in biochemical variable could not be demonstrated, even at high doses upto 10 minutes the ED90 in the relevant species.

No serious side effects were noted in the two groups. There are very little reports about the side effects of rocuronium. Abouleish *et al* [20] observed cutaneous reactions in two patients while in current study, only one patient (2.5%) of group I complained about sore throat. In group II, 4 patients (10%) had myalgia and 4 patients (10%) had sore throat. Myalgia and sore throat are known side effects of suxamethonium [23]. Thus, Rocuronium had much less side effects as compared to suxamethonium.

5. Conclusion

Rocuronium (0.6mg/kg) has brief onset of action and can produce satisfactory Intubating conditions that are comparable to Suxamethonium (1.5mg/kg) with no side effects. Higher doses of Rocuronium (>0.6mg/kg) may be used as an alternative to Suxamethonium for endotracheal

intubation if the latter is contraindicated, provided there is no anticipated difficult airway.

References

[1]. Dror Lederman, PhD, EMT-P. Endotracheal intubation confirmation- a review. Department of Radiology, University of Pittsburgh 3362 Fifth Avenue, Pittsburgh, PA, 15217, USA, pp-1-16.

[2]. Mencke *et al*.: Intubating conditions and side effects of propofol, remifentanil and sevoflurane compared with propofol, remifentanil and rocuronium: a randomised, prospective, clinical trial. *BMC Anesthesiology* 2014; 14:39.

[3]. Heather H. Hager; Bracken Burns. Succinylcholine Chloride. NCBI Bookshelf. A service of the National Library of Medicine, National Institutes of Health. StatPearls [Internet]. Treasure Island (FL): Stat Pearls Publishing; 2019 Jan-March, pp. 1-5.

[4]. Witkowsky TA, Bartkowsky RR, Azad SS *et al*. ORG 9426, a new short acting muscle relaxant: onset and duration of action (abstract). *Anesth Analg* 1990; 70: 5437.

[5]. Wierda JM, De Wit AP, Kuizenga K, Agoston S. Clinical observational on the neuromuscular blocking action of ORG 9426, a new steroide non depolarizing agent. *Br. J. Anaesth* 1990; 64: 521-3.

[6]. Prien T, Zahn P, Mariges M, Brussel T. IXED90 dose of rocuronium bromide: Tracheal intubating conditions and time course of action. *Eur J Anaesth* 1995; 12(11): 85-90.

[7]. Larsen PB *et al*. Intubating condition after Rocuronium or succinylcholine for rapid sequence induction with Alfeatamil and propofol in the emergency patients. *Ear J Anaesthesiology* 2005; 22(10):748-53.

[8]. Huizeuga ACT *et al*. Intubating conditions and outlet time to neuromuscular block of ORG 9426 (tocuronicem), a new depolarizing neuromuscular blocking agent, a comparison with suxamethonium. *Acta Anaesthesiol Scand* 1992 (in prets).

[9]. Cooper R. *et al*. Comparison of intubating conditions after administration of ORG 9426 (rocuronium) and suxamethonium: *Br. J. Anaesth* 1992; 69(3):269-273.

[10]. Misra MN, Agarwal M, Pandey RP, Gupta A. A comparative study of rocuronium, vecuronium and succinylcholine for rapid sequence induction of anaesthesia. *Ind J Anaesth*. 2005; 49(6); 469-473.

[11]. Kumar RR, Kumari R, Kumar A. Rocuronium versus succinylcholine: a clinical comparison of two muscle relaxants for rapid sequence induction of anaesthesia. *Int J Adv Med* 2016; 3:596-601.

[12]. Mirakhur RK, Cooper RSJ. Clarke onset and intubating condition. Rocuronium bromide compared to those of cuxamethonine. *Eur J A* 1994; 4(9):41-43.

[13]. Meistelman CB *et al*. A comparison of neuromuscular blocking effect of rocuronium bromide at the adductor pollicis and laryngeal adductor muscles. *Eur J A* 1994; 11(9):83-86.

[14]. Heir Tom, James Caldwell. Rapid tracheal intubation with large dose rocuronium. *Aaesth. Analg* 2000; 90: 175-179.

[15]. Huiziuga AC *et al*. Intubating conditions and onset of neuromuscular block of rocuronium (ORG 9426); a comparison with suxamethonium. *Acta Anaesthesiol Scand* 1992; 36(9):463-468.

[16]. Puhringer FK *et al*. Evaluation of endotracheal intubating conditions of rocuronium (ORG 9226) and succinylcholine in outpatient surgery. *Anaesth Analg* 1992; 75(1):37-40.

[17]. Krieg N *et al*. Intubation conditions and reversibility of a new non-depolarizing neuromuscular blocking agent NC-45. *Acta Anaesthesiol Scand* 1980; 24: 423-425.

[18]. Agoston S. Onset time and evaluating of intubating conditions: rocuronium in perspective. *Eur J Anesthesiol* 1995; 12(suppl 11):31-37.

[19]. Stoddart PA and Mather SJ. Onset of neuromuscular blockade and intubating conditions one minute after the administration of rocuronium in children. *Paediatr Anaesth* 1998; 8(1):37-40.

[20]. Abouleish E *et al*. Rocuronium for caesarean section. *Br J Anaesth* 1994; 73:336-341.

[21]. Fracis F, Foldes *et al*. The neuromuscular effects of Org 9426 in patients receiving balanced anaesthesia. *Anaesthesiology* 1991; 75:191-196.

[22]. Booji LHDJ *et al*. Cardiovascular and neuromuscular blocking effects of four new muscle relaxants in anesthetized beagle dogs. *Eur J. Anaesthesiol* 1989; 9:70.

[23]. Pharmacology and physiology in anesthetic practice, 4th edition, Robert K, Stoelting MD; Simon C, Hillier MB, Ch B, FRCA, Ch. 8. Neuromuscular blocking drugs. P. 208-250.