

## Rocuronium For Tracheal Intubation In Patients Undergoing Emergency Surgery

Virendrakumar Rewaram Belekar<sup>\*1</sup> and Shubhangi Khamankar<sup>2</sup>

Department of Anaesthesia, Jawaharlal Nehru Medical College, Sawangi(Meghe), Wardha. India.

Department of Pathology, Jawaharlal Nehru Medical College, Sawangi(Meghe), Wardha. India.

Corresponding author\*: [vbelekar@gmail.com](mailto:vbelekar@gmail.com)

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### Abstract

**Aims:** To compare the intubating conditions between inj. Rocuronium and inj. Succinylcholine during rapid sequence intubation in patients posted for emergency surgeries. The primary outcome was excellent intubation conditions. The secondary outcome was acceptable conditions and complications associated with rocuronium.

**Methods and Material:** 60 patients posted for emergency surgeries were randomly divided randomly in to two groups. Intubating conditions at 60 seconds were compared in group-A (inj.succinylcholine 1mg/kg) and group-B(inj. rocuronium 0.6mg/kg), 30 patients in each group. Intubating conditions were judged based on the scoring of ease of jaw opening, position of the vocal cords and degree of straining after tracheal intubation.

**Statistical analysis used:** Data obtained were be analysed by t-test, chi-square test and fisher exact test wherever applicable.

**Results:** Mean apnoea onset time was 28.37 sec in group-A whereas it was 41.13 seconds in group-B. The mean intubation score was  $9.00 \pm 00$  in group-A and  $8.43 \pm 0.85$  in group-B. No side effects were observed in both the groups.

**Conclusions:** Rocuronium (0.6mg/kg) provided acceptable intubation conditions in most of the patients at 60 seconds but, unable to provide excellent intubating conditions in all of them during rapid sequence intubation. Suxamethonium is still the best muscle relaxant to accomplish intubation in emergent cases. If suxamethonium is contraindicated, Rocuronium may be used as an alternative.

**Key words:** endotracheal intubation, laryngoscopy, intubation score, succinylcholine, rocuronium, rapid sequence intubation.

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### 1. Introduction

Rapid sequence intubation is proved to be the technique of choice to prevent aspiration of gastric contents and thereby protect the airway within 60 – 90 seconds of administration of induction drugs.

Suxamethonium is most commonly and widely used for more than 40 yrs as muscle relaxant in patients with full stomach or the patients requiring emergent intubation. In addition to fasciculation, suxamethonium has got many side effects such as bradycardia, and other dysrhythmias, rise in serum potassium, post operative myalgias, incidence of prolonged recovery in patients with pseudocholinesterase deficiency and triggering of malignant hyperthermia.

Rocuronium fills the gap for an agent with rapid onset, while it lacks the adverse effects associated with suxamethonium and retains medium duration of action.

Wierda *et al* (1990)<sup>1</sup> concluded in their study that intubating conditions were excellent at one minute with a dose of 0.5mg/kg of rocuronium. Cooper R *et al* (1992)<sup>2</sup> found that intubating conditions were 100% acceptable at 90seconds as compared to 95% acceptable at 60sec with 0.6mg/kg rocuronium given in adult patients.

Considering its favourable reports the study was conducted to determine whether intubating conditions provided by rocuronium are comparable to those of succinylcholine during rapid sequence intubation.

### 2. Subjects and Methods

The randomized, prospective study entitled ‘Rocuronium for tracheal intubation in patients undergoing emergency surgery’ was carried out during the period July – 11 to August 12.

Adult patients posted for emergency surgical procedures requiring general anaesthesia were included in this study. The study was approved by hospital ethics committee. Patients were explained about the purpose and procedure and informed risk consent was obtained.

**Inclusion criteria**

1. ASA grade I/II
2. either sex
3. age group between 18-60 years
4. mallampatti grade I and II.

**Exclusion criteria**

1. ASA grade III/IV
2. Mallampatti grade III/IV
3. Patients with increased risk of aspiration
4. Contraindications to suxamethonium
5. Contraindications to rocuronium

Total 60 patients were randomly divided into two groups of 30 patients each group.

Informed consent was taken and procedure of the study was explained to them. Minimum basal investigations like Hb%, CBC, blood Urea, blood sugar, BT, CT, urinalysis, blood group were obtained in all patients. When ever indicated, X-ray chest, ECG, arterial blood gas analysis and serum electrolytes were obtained.

On arrival in operative room, baseline pulses rate, systolic and diastolic blood pressure, Spo2 were recorded. Patients body weight was also recorded. An intravenous line was secured using appropriate size cannula preferably on non-dominant hand. Ranitidine 50 mg intravenously was given 30 min before induction of anaesthesia in all patients. All patients were given premedication in the form of inj glycopyrrolate 0.2 mg IV, inj Midazolam 0.03 mg/kg IV, inj pentazocine 0.3 mg to 0.4 mg/kg IV.

Preoxygenation was done with magillis arcuit. Anaesthesia was induced with inj. Propofol 1.5 mg/kg to 2.5 mg/kg IV till loss of eyelash reflex.

Patients were subdivided in two group of 30 patients each group A received IV suxamethonium 1mg/kg and group B received IV rocuronium 0.6 mg/kg after loss of eye lash reflex. Time of relaxant administration was noted which was to be given after propofol.

Laryngoscopy And Intubation was performed after 50-55 sec. As all the patients were for an emergency surgery, rapid sequence intubation was done and cricoid pressure was applied as soon as the eyelash reflex was lost and it was maintained till airway was secured with proper sized cuffed ET.

Bradypnoea/apnoea was considered as very minimal spontaneous effects < 6 breaths per minute or cessation of spontaneous respiration.

Onset of action of muscle relaxant was the time from the injection of muscle relaxant to the onset bradyphoea / apnoea and was recorded.

All patients were maintained with Oxygen and nitrous oxide mixture and inhalational agent halothane/isoflurane as per need/condition of the patient and muscle relaxant.

Jaw relaxation, position of vocal cords during laryngoscopy and response to endotracheal intubation were noted and score from 0 to 3 was given as shown in **table 1**.

**Table 1- Criteria and score of intubating conditions**

Jaw relaxation	Vocal Cords	Response to intubation	Score
Poor (Impossible)	Closed	Server coughing bucking	0
Minimal (Difficult)	Closing	Mild coughing	1
Moderate (Fair)	Moving	Slight diaphragmatic movement	2
Good (easy )	Open	None	3

Intubating conditions in all patients were graded as excellent, good, fair, poor after calculating scores of vocal cords and response to intubation as shown in **Table 2**.

**Table 2-Grading of intubation**

Intubating conditions	Score
Excellent	8-9
Good	6-7
Fair	3-5
Poor	0-2

The excellent and good intubating conditions were taken as acceptable where as the fair and poor intubating condition were considered as unacceptable. In the perioperative period, side-effects and complications, if any were noted in all patients.

At the end of surgery residual neuromuscular blockade was reversed with inj. neostigmine 0.05 mg/kg and glycopyrrolate 10 micrograms/kg after ensuring adequacy of reversal and thorough suctioning.

Data obtained were analysed by t-test, chi-square test and fisher exact test wherever applicable.

### 3. Results

In the present study, all 60 patients were adults and their age ranged from 18-65 years. The mean age of the patients in Group A was  $34.37 \pm 11.94$  and in Group B was  $31.87 \pm 13.07$ . [ $t=0.773$ ,  $p>0.44236$ ].

Both the group had patients of almost comparable weight. [ $t=-0.080$ ,  $p >0.9368$ ].

Surgical procedures performed in patients in group A and group B included abdominal , neurosurgical procedures and limb surgeries. Chi-square test was applied to compare the data. Both the groups are comparable with respect to surgical procedures ( $\chi^2=1.33$ ,  $p=0.51$ ).

The mean apnoea onset time in a group A was  $28.37 \pm 7.51$  while in group B, it was  $41.13 \pm 9.00$ . [ $t=5.962$ ,  $p < 0.001$ ] \*\*

Jaw relaxation was found to be good and satisfactory [score 3] in all patients [100%] in both groups at 50-55 seconds. Vocal cords were found to be open [score 3] in all patients [100%] in group A while 25 patients in group B [83.33%] had open vocal cords [score 3] and 5 patients [16.66%] showed moving vocal cords [score 2].

Vocal cords were found to be open in all patients in group A while 23 patients in group B had open vocal cords and 7 patients showed moving vocal cords.

No response to intubation [score 3] was observed in all [100%] patients in group A while in group B, 19 patients [63.33%] showed no response to intubation, 10 patients [33.33%] showed slight diaphragmatic movements [score 2] and 1 patients after the placement of the endotracheal tube.

In the present study, each variable of the intubating conditions was graded on four point scale (0-3) and given a score. Total intubation score was given by adding these points together. Table No. 3 shows the intubation scores observed in patients in group A and group B.

**Table No. 3: Intubation scores**

Intubation Scores	No. of Patients		Total
	Group A (Suxamethonium)	Group B (Rocuronium)	
8 – 9	30	25	55
6 – 7	--	05	05
Total	30	30	60
Mean ± S.D.	$9.00 \pm 00$	$8.37 \pm 0.85$	

The Mean Intubation Score was less in rocuronium group. Therefore, the score was subjected for statistical test and found to be statistically insignificant (Fisher exact test  $p=0.052$ ) \*. Therefore it can be concluded that the Rocuronium is not inferior to Suxamethonium with respect to intubation scores.

### 4. Discussion

Suxamethonium is the most commonly used muscle relaxant for intubation in both elective and emergency settings. Suxamethonium has got few but serious side effects. To avoid the side effects of suxamethonium, non depolarizing muscle relaxants like pancuronium, vecuronium and atracurium were used for intubation but the longer onset time of about 2-4 min with these agents may be detrimental in patients with increased risk of aspiration.

There has been a constant search for newer non-depolarising muscle relaxant with shorter onset time of action and intermediate duration of action matching with those of suxamethonium.

Prien *et al*<sup>3</sup> studied different doses of rocuronium for tracheal intubation and concluded that good-to-excellent tracheal intubating conditions could be achieved not only at the standard intubating dose of 0.6 mg/kg but also at lower doses of 0.3-0.45mg/kg. It creates intubating conditions similar to those of succinylcholine and its time of onset of action is comparable with that of suxamethonium <sup>4</sup>. In present study, 0.6 mg/kg dose of rocuronium was used for tracheal intubation.

For tracheal intubation, at least 2X ED<sub>95</sub> of any neuromuscular blocker are necessary<sup>5,6</sup>. The ED<sub>95</sub> of rocuronium is 0.3mg/kg. To mimic the onset of action of suxamethonium, large doses of rocuronium [3to4'ED<sub>95</sub>] is needed which produce a duration of action that resembles the long acting non-depolarising neuromuscular blocking drugs like Pancuronium<sup>6</sup>.

The onset of maximum single-twitch depression after administration of 3 to 4 x ED<sub>95</sub> of rocuronium resembles the onset of action of suxamethonium 1mg/kg IV<sup>6</sup>.

Schlaich *et al*<sup>7</sup> stated that by reducing the dose of rocuronium from 0.6 to 0.3 mg/kg for tracheal intubation, its pharmacodynamic profile changes from fast onset of action and intermediate duration to intermediate onset of action and short duration which may not be desirable in patients undergoing rapid sequence intubation.

Perry *et al*<sup>8</sup> in a meta-analysis concluded that succinylcholine creates excellent intubation conditions more reliably than rocuronium, and should be used as a first-line muscle relaxant for rapid-sequence induction intubations. If an alternative agent is required, rocuronium, when used with propofol, will reliably create excellent intubation conditions equivalent to those of succinylcholine.

Rocuronium 0.6mg/kg produced acceptable intubating condition in 100% patients which was equivalent to suxamethonium in the dose of 1.5mg/kg at 60 seconds in the study carried out by Puhlinger *et al* 1992<sup>9</sup> and in 80% patients in the study carried out by Shukla *et al* 2004<sup>10</sup>.

Rocuronium 0.6mg/kg when compared to 1mg/kg succinylcholine was found to produce acceptable intubating condition at 60 seconds in 100% patients in the study carried out by Huizinga *et al* (1992)<sup>11</sup> and in 95% patients in the study carried by Cooper *et al* 1992<sup>2</sup>.

In the present study, Rocuronium was used in the dose of 0.6mg/kg and intubating conditions were assessed at 60 second in emergency patients.

The onset of neuromuscular blockade after administration of non-depolarising neuromuscular blocking drug is more rapid but less intense at the laryngeal muscles [vocal cords]<sup>12</sup>.

Tony Magorian *et al* (1993)<sup>13</sup> recommended to wait for 90 seconds after 0.6mg/kg rocuronium to achieve optimum intubating conditions in rapid sequence intubation while the onset times for the two larger doses of rocuronium were similar to that for suxamethonium. Duration of action was longer with 1.2 mg/kg dose of rocuronium. Hence, increasing the dose of rocuronium will lead to longer duration of action which may be undesirable in the patients requiring rapid sequence intubation. Hence, optimal intubating dose of rocuronium will be advisable for rapid sequence intubation in such patients.

The use of opioids like fentanyl may contribute to favourable intubation condition if given 60 second prior to rocuronium<sup>14</sup>. In the present study, inj. Pentazocine was used in a dose not having any significant potentiating effect on either of the relaxants<sup>12</sup>.

All the patients in the study were induced with inj. propofol 1.5-2.5mg/kg. Propofol has been shown to be a superior agent in blocking laryngeal reflexes than other induction agents<sup>12</sup>. Rocuronium when used with propofol reliably creates acceptable intubating conditions in patient's equivalent to those of suxamethonium.

Krieg *et al* (1980)<sup>15</sup> introduced a numeric value using jaw relaxation, vocal cord position and mobility and reaction to intubation criteria to signify quality of intubating condition. Cooper modification<sup>16</sup> of this rating scale was used in the present study.

The laryngeal muscle and diaphragm are most resistant to the effect of rocuronium than the adductor pollicis muscle<sup>12</sup>. Initiating direct laryngoscopy for tracheal intubation at the time of peak laryngeal muscle paralysis could result in abdominal muscle and diaphragmatic movement when tracheal tube is placed. These responses are particularly undesirable if the patient is considered to be at risk of pulmonary aspiration of gastric contents. 3 patients in rocuronium group had slight diaphragmatic movements in our study.

The score of 6 to 9 are labelled as clinically acceptable by Cooper *et al*<sup>2</sup> in elective surgeries. In present study, patients receiving succinylcholine, intubating conditions were excellent whereas patients receiving rocuronium had excellent to good intubating conditions. The intubating conditions consisting of moving vocal cords, diaphragmatic movements and response to intubation may not be desirable in the patients who are at increased risk of pulmonary aspiration of graphic contents. Hence, the intubating conditions which are labelled as acceptable in elective patients by Cooper<sup>2</sup> may not be acceptable in the emergency patients.

The results of the present study are comparable with other studies described above. All these studies show that rocuronium in the dose of 0.6mg/kg provided excellent intubating conditions of 60 seconds in variable percentage of

patients ranging from 40 to 100% while good intubating conditions were observed in 15-60% of patients. Poor intubating conditions were found only in few patients. The intubating conditions observed with Rocuronium were not exactly matching with those produced by suxamethonium at 60 seconds. But the over all intubating conditions were acceptable in high percentage of the patients in Rocuronium group.

Edema at the injection site was observed in few studies (Puhlinger *et al* 1992 (1/30)<sup>10</sup>, Laurin G *et al* <sup>17</sup> in 2000 (0/138). In the present study, only one patient had edema at injection site in rocuronium group. No other side effects or complication was observed in the study.

Rocuronium in the dose of 0.9mg/kg offers excellent intubating conditions at the expense of prolonged duration of action which may be hazardous if the airway proves to be difficult or surgery is of short duration.

## 5. Conclusion

Suxamethonium is still the best short acting muscle relaxant to accomplish rapid sequence intubation in emergent cases. If suxamethonium is contraindicated in certain situation, Rocuronium may be used as an alternative muscle relaxant used in adequate doses at 60 seconds. Rocuronium in dose of 0.6mg/kg does not seem to have any advantages over suxamethonium 1mg/kg in rapid sequence intubation.

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