

A Comparative Study of Duration & Onset of Action and Intubating Conditions Between Rocuronium Bromide and Suxamethonium Chloride in Paediatric Patients at Tertiary Care Centre

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Abstract

Background: The aim of this study was to compare time of onset, duration and intubating conditions associated with use of rocuronium bromide and suxamethonium chloride in pediatric age group. **Material & Methods:** A prospective comparative study was performed on 100 children aged 5 to 10 years of ASA grade I & II in department of anesthesia & department of pediatric at K.D. Medical College, Mathura, U.P. India during one year period. Patients divided in two groups: Group R: 50 patients received Inj. Rocuronium (0.6 mg/kg iv) and Group S: 50 patients received Inj. Suxamethonium (2 mg/kg iv). Intubating conditions were assessed using the criteria (use to attribute scores in evaluating intubating conditions are jaw relaxation, vocal cord position and diaphragmatic activity) proposed for good clinical research practice in studies of neuromuscular blocking drugs. **Results:** Excellent intubating conditions were observed in 100% cases receiving suxamethonium at 60 sec & 90 sec while in 80% and 94% cases receiving Rocuronium at 60 sec & 90 sec respectively. In group S (Suxamethonium chloride 2 mg/kg) onset of action was 42.38 ± 3.57 seconds significantly faster than either group R (Rocuronium bromide 0.6mg/kg) onset of action was 210.62 ± 48.34 seconds. **Conclusion:** The result of this study indicates that this new non-depolarizing neuromuscular blocking agent may be considered as a valuable alternative to Suxamethonium for rapid tracheal intubation, i.e., within 60 seconds.

Key Words: Intubation condition, Suxamethonium chloride, Rocuronium bromide, Intubation score

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Introduction

The introduction of each new muscle relaxant has advanced anaesthetic practice by trying to meet some perceived deficiency in the existing therapeutic armamentarium.

The neuromuscular drugs pharmacologically act by interrupting transmission of nerve impulses at the neuromuscular junction. They act by producing phase I depolarizing blockade, phase II depolarizing neuromuscular blockade or non depolarizing blockade.

Two important uses of muscle relaxation are to facilitate endotracheal intubation and to provide surgical relaxation. Suxamethonium, with its rapid onset time and good Intubating conditions, is still the drug of choice for rapid endotracheal intubation. However, it falls short of the ideal muscle relaxant due to its potentially hazardous side effects, such as hyperkalemia, cardiac arrest and malignant hyperthermia, which are more frequently reported in children when Suxamethonium is administered to facilitate rapid sequence endotracheal intubation[1-4]. Rocuronium bromide, a newer amino-steroidal compound, is a derivative of vecuronium; Rocuronium has a rapid onset time, an intermediate duration of action and rapid recovery with cardiovascular stability[5]. It has no significant histamine release. Onset time of a 0.6 mg/kg⁻¹ dose of Rocuronium ranges from 1 to 1.5 minutes under nitrous oxide opioid anesthesia[6,7]. Nevertheless, with this dose Rocuronium, the intubating conditions at 60 seconds are similar to those observed with Suxamethonium[8,9].

This might persuade many clinicians to use Rocuronium to facilitate endotracheal intubation not only in elective cases under adequate anesthesia but also in emergency situations requiring rapid sequence intubation. The aim of this study was to compare time of onset, duration and intubating conditions associated with use of rocuronium bromide and suxamethonium chloride in pediatric age group.

Material & Methods

A prospective comparative study was performed on 100 children aged 5 to 10 years of ASA grade I & II in department of anesthesia & department of pediatric at K.D. Medical College, Mathura, U.P., India during one year period.

Inclusion Criteria

1. Age group was 5 to 10 years.
2. ASA grade I & II.

Exclusion Criteria

1. Patients having systemic disease (Liver, Kidney, heart disease)
2. Above 10 years of age
3. Obesity, psychiatric illness, others comorbidity
4. Modified Mallampatti Airway Classification III, IV
5. Neuromuscular disease

Methods

After obtaining individual informed consent 100 patients under ASA I and II, in the age group of 5- 10 yr, who are undergoing elective surgery under general anesthesia were included. Patients divided in two groups:

1. Group R:50 patients received received Inj. Rocuronium (0.6 mg/kg iv)

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2. Group S:50 patients received received Inj. Suxamethonium (2 mg/kg iv)

Anaesthetic management were standardized in all patients. Premedication was given to all patients. A 18 G catheter was inserted in a forearm vein for fluid and drug administration. Monitoring with non-invasive blood pressure (NIBP), ECG, saturation of oxygen (SpO₂), end-tidal CO₂ were instituted during the procedure.

All the patients were premedicated with inj. Glycopyrrolate 4 µg/kg i.v., inj. Ranitidine 1 mg/kg i.v., inj. Ondansetron 80 µg/kg i.v. and inj. Tramadol 1 mg/kg i.v. Then pulse, blood pressure, SpO₂ and ECG were noted as pre-induction data. All the patients were pre-oxygenated with 100% O₂ with face mask for 3 minutes. In group R, anesthesia was induced with inj. Sodium Thiopentone 5 mg/kg, slowly followed by inj. Rocuronium bromide 0.6mg/kg i.v. In group S, anesthesia was induced with inj. Sodium Thiopentone 5 mg/kg i.v., slowly followed by inj. Suxamethonium 2 mg/kg.

Preoperative evaluation

In all the patient age, body weight, preoperative blood pressure and pulse rate were recorded. History regarding previous anaesthesia and surgery, any significant medical illness, medications and allergy were recorded. A complete physical examination and airway assessment was done.

In both the groups, jaw relaxation and vocal cord relaxation were considered for atraumatic laryngoscopy at 60 seconds and then at 90 seconds. During laryngoscopy, the patients' cardiovascular response was assessed. From the time of intubation (time=0 minute) and at 2, 5,

10 minutes and then every 10 minutes, pulse, blood pressure and SpO₂ were recorded.

Intubation conditions are usually evaluated using the following factors:

- Ease of laryngoscopy,
- Position and movement of the vocal cords, and
- Response to intubation of the airway and the limbs.

Intubating conditions were assessed using the criteria of Cooper *et al.*¹⁰ the three items of this score (criteria's use to attribute scores in evaluating intubating conditions are jaw relaxation, vocal cord position and diaphragmatic activity) proposed for good clinical research practice in studies of neuromuscular blocking drugs. The intubating anesthesiologist will rate the ease of laryngoscopy, the movement and position of the vocal cords, and the reaction to intubation.

Good and excellent intubating conditions were taken to be "clinically acceptable" by Cooper *et al.*¹⁰ Anesthesia was maintained using of a closed circuit with circle absorber having 50% N₂O 50% O₂ with controlled ventilation. After clinical recovery from intubating dose of muscle relaxant, the period for study was over, and anesthesia was continued using O₂, N₂O, isoflurane and further dose of muscle relaxant.

After completion of the surgery, reversal of neuromuscular blockade was achieved with inj. Neostigmine 0.05 mg/kg and inj. Glycopyrrolate 0.008 mg/kg i.v. After satisfactory recovery, the patients were extubated.

Results

A total of 100 patients were in this study with 50 patients in each group. The two groups were comparable with regard to the demographic data (table 1).

Table 1: Distribution of patients according to demographic variables

Demographic variables	Group R (N=50)	Group S (N=50)	p- value
Age (yrs)	6.82±1.43	7.10±1.86	>0.05
Sex (Male to female ratio)	30:20	28:22	>0.05
ASA physical status	33 (66%)/ 17 (34%)	35 (70%)/15 (30%)	>0.05
Mallampati grade I/II	20 (60%)/30 (60%)	16 (32%)/34 (68%)	>0.05

Ease of laryngoscopy was different in both the groups. Jaw relaxation was good in 38 patients of Rocuronium group but in 42 patients in Suxamethonium group, while the other patients of both the groups had moderate jaw relaxation. Vocal cords were open and immobile at 60 seconds in 43 patients after administration of Rocuronium, while they were open and immobile at 60 seconds in 48 patients after administration of Suxamethonium. But vocal cords were found to be moving in seven patients given Rocuronium and in two patients given Suxamethonium. "No diaphragmatic movements" and "slight diaphragmatic movements" were observed in 42 and 8 patients, respectively, given Rocuronium (group R) and "no diaphragmatic movements" was observed in any patient given Suxamethonium (group S). Excellent intubating conditions were observed in 100% cases receiving suxamethonium at 60 sec & 90 sec while in 80% and 94% cases receiving Rocuronium at 60 sec & 90 sec respectively (table 2,3&4).

Table 2: Distribution of patients according to Intubation condition at 60 seconds

Intubation condition	Group R (N=50)	Group S (N=50)	p- value
Excellent	40	50	>0.05
Good	10	0	>0.05
Poor	0	0	1.00
Inadequate	0	0	1.00

Table 3: Distribution of patients according to Intubation condition at 90 seconds

Intubation condition	Group R (N=50)	Group S (N=50)	p- value
Excellent	47	50	>0.05
Good	3	0	>0.05
Poor	0	0	1.00
Inadequate	0	0	1.00

Table 4: Distribution of patients according to Intubation Scoring system

Intubation Scoring system	Group R (N=50)	Group S (N=50)	p- value
Jaw relaxation (easy of laryngoscopy)			
Good (easy)	38	42	>0.05
Moderate (fair)	12	8	>0.05
Minimal (difficult)	0	0	1.00
Poor (impossible)	0	0	1.00
Condition of vocal cords			

Open	43	48	>0.05
Moving	7	2	>0.05
Closing	0	0	1.00
Closet		00	1.00
Response to intubation			
None	42	50	>0.05
Slight diaphragmatic movement	8	0	>0.05
Mild coughing	0	0	1.00
Severe coughing	0	0	1.00

In group S (Suxamethonium chloride 2mg/kg) onset of action was 42.38 ± 3.57 seconds significantly faster than either group R (Rocuronium bromide 0.6mg/kg) onset of action was 210.62 ± 48.34 seconds (table 5).

Table 5 Time of onset

Time of onset (sec.)	Group R (N=50)	Group S (N=50)	p- value
Mean \pm SD	210.62 \pm 48.34	42.38 \pm 3.57	<0.001***

Discussion

There has been a trend in recent years to focus on the ability of neuromuscular blocking agents to facilitate tracheal intubation, rather than the traditional measure of onset, potency and duration. Intubation studies are difficult to perform and interpret because the details of anaesthesia management, patient age, and anatomy, equipment and experience of the endoscopist all affect the ease of intubation. There is no accepted standardization of the background anaesthesia and time to laryngoscopy. The evaluation of intubating condition although blinded remains subjective.

Excellent intubating conditions were observed in 100% cases receiving suxamethonium at 60 sec & 90 sec while in 80% and 94% cases receiving Rocuronium at 60 sec & 90 sec respectively in our study, which was compatible with Dhara Shah et al (2012)[11]. After Rocuronium administration, the response of diaphragm to intubation was more pronounced than that after administration of Suxamethonium. But the overall intubating conditions were similar to those after Suxamethonium administration.

Similar results about onset time and intubating conditions were found in other studies of Dubois *et al.*[12] and Huizinga *et al.*[13] in these studies, no difference was observed in the frequency distribution of clinically acceptable intubating conditions at 60 and 90 seconds after the administration of Suxamethonium or Rocuronium.

Conclusion

We concluded that intubation can be performed under good to excellent conditions at 60–90 seconds after a bolus dose of Rocuronium of 0.6 mg/kg. The result of this study indicates that this new non-depolarizing neuromuscular blocking agent may be considered as a valuable alternative to Suxamethonium for rapid tracheal intubation, i.e., within 60 seconds, even after induction with Thiopentone as the sole anesthetic agent.

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