



A STUDY COMPARING TWO DOSES OF ROCURONIUM WITH SUXAMETHONIUM FOR INTUBATION IN CHILDREN IN 60 SECONDS

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ABSTRACT

Background and goals of study: Succinylcholine is an ultra short acting depolarizing muscle relaxant, but has many undesirable side effects, some of which may be life threatening. Rocuronium bromide is a steroidal non-depolarizing neuromuscular blocker with a rapid onset and may be a suitable alternative to succinylcholine for rapid control of airway. Comparison of the two drugs in terms of intubating conditions, hemodynamics and adverse effects is important. **Methods:** Sixty patients were grouped into three groups of twenty each in this randomised, prospective, parallel group study. Group — I (R6) Thiopentone 5mg/kg + Rocuronium 0.6mg/kg, Group —II (R9) Thiopentone 5mg/kg + Rocuronium 0.9mg/kg, Group-III (S) Thiopentone 5mg/kg + Suxamethonium 1.5mg/kg. Intubating conditions, hemodynamics and adverse effects are compared. **Results:** The mean score for Jaw Relaxation was significantly higher in Group II and Group III. Mean score for vocal cord position was significantly higher in Group II & Group III when compared to Group I. Mean score for response to intubation was significantly higher in Group II and Group III when compared to Group I. Mean total intubating score in Group II (R9) and Group III (S) were identical which is significantly higher than Group I. The mean heart rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pressure during intubation in Group I (R6) was higher than in Group II and Group III. **Conclusion:** Rocuronium 0.9mg/kg (3xED95) can be used as an alternative ideal agent to suxamethonium for intubation in children. But while choosing Rocuronium as an alternative to suxamethonium factors such as intubation difficulty and surgical duration should be considered against the potential side effects of suxamethonium.

KEYWORDS : Rocuronium, Suxamethonium, Intubation

INTRODUCTION: Neuromuscular blocking agents are commonly used to facilitate tracheal intubation. An ideal muscle relaxant should have rapid onset, profound relaxation of all muscles and short duration of action so that the patient's own respiratory function can be restored, should intubation proved to be impossible.

These requirements are best met With Succinylcholine, an ultra short acting depolarizing muscle relaxant¹. Unfortunately, succinyl choline has many undesirable side effects, some of which may be life threatening.

Rocuronium bromide is a steroidal non-depolarizing neuromuscular blocker with a rapid onset and may be a suitable alternative to succinylcholine for rapid control of airway². There is dose dependent decrease in onset time with Rocuronium and dose of Rocuronium used may influence the rate of onset of satisfactory intubating conditions³. Large doses of Rocuronium (more than 1mg/kg) produces ideal intubating conditions in 30-60 seconds but the duration of action is very much prolonged⁴.

The aim of my study is to evaluate the intubating conditions in 60 seconds using two different doses of Rocuronium with suxamethonium for intubation in children. It is a study comparing two doses of Rocuronium 0.6mg/kg (2xED95) and 0.9mg/kg (3xED95) with suxamethonium 1.5mg/kg for intubation in children in 60 seconds and intubating conditions, hemodynamics and adverse effects are compared.

METHODOLOGY:

After institutional approval and informed consent, 60 patients were enrolled in the study.

INCLUSION CRITERIA:-

- Children between 2 — 10years
- ASA Physical status I & II
- For Elective surgeries posted under GA.

EXCLUSION CRITERIA:-

- Infants

- Known / suspected difficult Intubation
- History of any neuromuscular disorder
- Renal / Hepatic disorder
- Known allergy to study drugs.
- Surgical procedures of very short duration.
- Patients receiving any medication known to interact with neuromuscular blocking agent.

PRE OPERATIVE EVALUATION:-

In all the patients, Age, I.P.No, Body Weight, Baseline vital parameters were recorded. History regarding previous anaesthesia, surgery, any significant medical illness, medications and allergy were recorded. Complete physical examination and Airway assessment was done. Following laboratory Investigations were done: Haemoglobin %

- Packed cell volume
- Urine — Albumin and sugar
- Chest X-Ray (in selective patients)

PREMEDICATION:

All children received syrup Triclofos 50mg/kg orally one hour before procedure.

INDUCTION OF ANESTHESIA:

After shifting the children to operation theatre, Intravenous line was secured using 22G Cannula in a vein in the dorsum of hand and Isolyte-P infusion was started

Following monitors were connected to the patients:

- 1) Non Invasive Blood Pressure
- 2) Electro Cardiogram Monitor
- 3) Pulse Oximeter.
- 4) Precordial stethoscope

These patients were systematically randomized into three groups of twenty each.

- Group — I (R6) Thiopentone 5mg/kg + Rocuronium 0.6mg/kg
- Group —II (R9) Thiopentone 5mg/kg + Rocuronium 0.9mg/kg

Group-III (S) Thiopentone 5mg/kg + Suxamethonium 1.5mg/kg
 Each patient was given Inj. Pentazocine 0.5mg/kg intravenously.
 After pre-oxygenating these children for three minutes, anaesthesia was induced with Inj. Thiopentone 5mg/kg 2.5% solution given over 15 seconds and followed by:

Inj. Rocuronium 0.6mg/kg (2xED95)
 Or
 Inj. Rocuronium 0.9mg/kg (3xED95)
 Or

Inj. Suxamethonium 1.5mg/kg depending on the group given in less than 5 seconds. Intubation was performed in all children by an experienced anesthetist.(who did not know which relaxant was used for Intubation).

After Intubation and observation of the Intubating conditions and hemodynamic profiles, anesthesia was maintained with 40% oxygen and 60% Nitrous oxide using Jackson-Rees Circuit or closed circuit system with controlled ventilation.

In both Rocuronium groups, if additional dose is required, Inj Rocuronium 0.15mg/kg was used. In suxamethonium group Inj. Atracurium 0.5mg/kg and then 0.2mg/kg doses was repeated. And at the end of surgery, reversal of neuromuscular blockade was achieved with Inj. Neostigmine 50mcg/kg and Inj. Atropine 20mcg/kg.

No Regional blockade was given to any of these children before surgery.

The following observations were recorded:-

Intubating Conditions:

Intubating conditions were scored by a scoring system used by Mirakhar RK., Cooper A.R. and Clarke R.S.J

Score	Jaw Relaxation	Vocal Cords	Response to Intubation
0	Impossible to open	Closed (adducted)	Severe coughing
1	Open with difficulty	Closing	Mild coughing
2	Moderate Opening	Moving Movement	Slight Diaphragmatic movement
3	Easy Opening	Open (relaxed)	No movement

GRADING

Intubating Conditions	Score
Excellent	8-9
Good	6-7
Poor	3-5
Bad	0-2

The following hemodynamic parameters were recorded

- Heart rate
- Systolic blood pressure
- Diastolic blood pressure
- Mean arterial pressure

-before induction, during intubation and 1 min, 3 minutes and 5 minutes after intubation and clinical duration of the intubating dose was recorded.

Evaluation of Side Effects:

Patients were monitored for side effects such as signs of histamine release — wheal, flush, bronchospasm, and bradycardia, pain on injection, etc.

Statistical Analysis:

The data was computed and all values were expressed as mean ±SD.

The data was analysed using one way anova test, unpaired t test, chi-square test, mann-whitney u test, and kruskal wallis test as appropriate.

RESULTS:

1. Statistical Analysis showed that there was no significant difference between distribution of age, sex, and weight among study groups.
 2. All children were successfully intubated in 60 seconds without need for second attempt after administration of neuromuscular relaxant.

3. (a) Statistical analysis showed that mean score for Jaw Relaxation was significantly higher in Group II (R9) and Group III (2.65±0.49 in Group II, 2.89±0.3 in Group III, and 2.16±0.4 in Group I)

Jaw relaxation:

(b) Mean score for vocal cord position was significantly higher in Group II & Group III when compared to Group I (2.35 ± 0.49, 2.85 ± 0.37, 2.95 ± 0.22 in group I, II & III respectively).

Vocal Cord Position:

Score	Group I	Group II	Group III
0	-	-	-
1	-	-	-
2	13	3	1
3	7	17	19
Mean±S.D.	2.35±0.49	2.85±0.37	2.95±0.20

(c) Mean score for response to intubation was significantly higher in Group II and Group III when compared to Group I. (2.1± 0.44, 2.7± 0.47, 2.8±0.41 in Group I, II & III respectively)

Response to Intubation:

(d) Mean total intubating score in Group II (R9) and Group III (S) were identical which is significantly higher than Group I. (6.7+ 0.86, 8.2±0.61, 8.7±0.57 in Group I, II & III respectively).

4. Acceptable Intubating Conditions (Excellent and Good Scores) are Observed

Score	Group I	Group II	Group III
0	-	-	-
1	-	-	-
2	15	7	2
3	5	13	18
Mean±S.D.	2.16±0.44	2.65±0.49	2.89±0.32

in almost all the patients except in one patient in Group I (100% in Group II & Group III and 95% in Group I).

But, Excellent Intubating Conditions were produced in most of the patients Group II and Group III which was significantly higher than Group I.

5. Statistical analysis showed that Mean heart rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pressure during intubation in Group I (R6) was higher than in Group II and Group III. (123.6±9.88, 121.2±7.93, 83±5.3, 93.5±5.94 in Group I and in Group II 120.9 ±11.114, 120.1±9.7, 79+7.85, 92.4+7.65 and in Group III 106.8±15, 112±8.56, 75.6±6.28, 88.95±6.4 respectively)

6. Mean heart rate at the end of 5 minutes was higher in Group II (R9) compared to Group I (R6) and Group III (S). (112.7±11.5, 116.64±11.5, 99.75±7.38) in Group I, II and III respectively)

Score	Group I	Group II	Group III
0	-	-	-
1	1	-	-
2	16	6	4
3	3	14	18
Mean±S.D.	2.1±0.42	2.70±0.47	2.8±0.41

7. Clinical duration of the intubating dose was significantly lower in Group III and among Group I & II, the duration significantly longer in Group II. (20.35±2.08 minutes in Group I, 29.35±2.64 minutes in Group II and in Group III 4.6±0.7 minutes).

DISCUSSION:

Succinylcholine is an ideal muscle relaxant of choice for Intubation as it is an ultra short acting muscle relaxant producing excellent intubating conditions in seconds and effect wears off in 4-5 minutes usually. But it has got potential adverse effects such as asystole, bradycardia, malignant hyperthermia, Raised Intraocular pressure, Raised Intra gastric pressure, Post operative muscle pain, hyperkalemia etc. and reports of sudden cardiac arrests in patients with undiagnosed muscular dystrophy. Therefore, need exists for a non depolarizing muscle relaxant with a fast onset of action.

Rocuronium is a new steroidal non depolarising muscle relaxant with rapid onset of action and Rapid Onset is believed to be primarily due to its low potency and duration of action is dose dependent. It is short acting with a dose of 0.3mg/kg (1xED95) and Intermediate duration of action with 0.6-0.9mg/kg when more than 1mg/kg is used for Intubation, onset is very quick (less than 45 seconds) but the duration of action is prolonged (more than 1 hour). In this study we aimed to evaluate the intubating conditions in 60 seconds using smaller doses of Rocuronium (0.6mg/kg (2xED95) & 0.9mg/kg (3xED95) and compared them with the intubating conditions after 1.5mg/kg of suxamethonium.

There have been several adult studies comparing various doses of Rocuronium with Suxamethonium during rapid sequence induction of anaesthesia.

We wanted to confirm that Rocuronium is a suitable alternative to suxamethonium even in pediatric age group because the onset time and duration of action are somewhat different in children compared with adults.

In the study conducted by R.Cooper 95% patients had developed acceptable intubating conditions at 60 seconds with Rocuronium 0.6mg/kg when the patients were induced with Thiopentone 5mg/kg and Fentanyl 1-3 mcg/kg.

Similarly J.F Crul and colleagues observed clinically acceptable intubating conditions at 45 seconds with Rocuronium 0.6mg/kg in patients induced with propofol and alfentanil 20 mcg/kg.

In the present study, intubating conditions were excellent with Suxamethonium group and Rocuronium 0.9mg/kg group. When comparing with suxamethonium, Rocuronium 0.6mg/kg was inadequate. We did not use Atropine with induction as we wanted to observe the intubation response and vagolytic properties of Rocuronium and Atropine 0.1mg/ml was diluted and kept ready and one patient in Suxamethonium group required 0.2mg bolus once.

The average clinical duration of Rocuronium in pediatric patients is shorter than in adults (26+ 7 min observed by J. Viby — Moganson). It may be due to larger volume of distribution of central compartment (V₁) in pediatric population than in adults.

In our study it was 20.35 +/- 2.08 minutes for Group I and 29.35 +/- 2.64 minutes in Group II, and 4.60 +/- 0.7 minutes in Group III.

Shorter duration of action for both groups in our study may be due to avoidance of Inhalational agents and potent opioids No Regional

Anaesthesia like Caudal Block was given to any patients in the beginning of surgery.

Agoston S et al (1995) studied the onset time and Intubating conditions of Rocuronium bromide and declared that since there is no parallel correlation between adductor pollicis and laryngeal muscle relaxation, neuromuscular transmission monitoring is probably obsolete in regard to intubating conditions⁵.

Cantineau JP, et al (1994) studied the neuromuscular effect of rocuronium on the diaphragm and adductor pollicis muscles in anaesthetized patients and showed that the onset time for diaphragm is slower than for adductor pollicis⁶.

Wright PMC, Caldwell JE, Miller RD., et al (1994) studied onset and duration of rocuronium and succinylcholine at the adductor pollicis and laryngeal adductor muscles in anaesthetized patients and showed that onset of action of rocuronium is slower at the diaphragm than at the adductor pollicis, but faster at the laryngeal muscles than at the adductor pollicis⁷.

We did not monitor the development of neuromuscular block as it has been clearly shown that there is poor correlation between onset time measured at the adductor pollicis and the quality of intubating conditions. So, for more than 40 years authors have abandoned instrumental means to evaluate laryngoscopy and intubating conditions and are using scales which assess clinical criteria only to assess the quality of tracheal intubation. The scale used in the study was used originally by Cooper et al. in their study and is recommended for studies with neuromuscular blockers⁸.

CONCLUSION:

Rocuronium 0.9mg/kg (3xED95) can be used as an alternative ideal agent to suxamethonium for intubation in children. But while choosing Rocuronium as an alternative to suxamethonium factors such as intubation difficulty and surgical duration should be considered against the potential side effects of suxamethonium.

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