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A COMPARISON BETWEEN INTUBATING CONDITIONS OF SUCCINYLMCHOLINE AND ROCURONIUM BROMIDE

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ABSTRACT

Neuromuscular blocking agents are an integral part of balanced general anaesthesia and they have been routinely used in anaesthesia practice. The present study presents the onset of action of succinylcholine and rocuronium bromide (ORG 9426) for optimal intubating conditions. The study reveals that rocuronium is a good muscle relaxant and can be used as an alternative to succinylcholine.

Keywords: *Anaesthesia, Rocuronium Bromide, Succinylcholine*

INTRODUCTION

Booij *et al.*, (1988) published the first abstract on rocuronium at Ninth world congress of Anaesthesiologists at Washington. Since then many abstracts and publication on rocuronium have followed.

Muir *et al.*, (1989) studied the effects of ORG 9426 in anaesthetized cats and pigs and in isolated neuromuscular preparations. They concluded that ORG 9426 was 20% as potent as vecuronium, onset of action was twice rapid and duration of action of two drugs was similar.

Wierda *et al.*, (1990) clinically observed that ORG 9426 was 6-8 times less potent than vecuronium and showed a faster rate of development of neuromuscular blockade with good to excellent intubating conditions within 60 seconds after administration of 0.5 mg/kg. The duration of action and recovery index appeared to be similar to that of vecuronium. Side effects were not noted.

O' Kelly *et al.*, (1992) studied the time course of 0-8 mg/kg rocuronium in children (1.5-7.5 yrs.) under N₂O – halothane anaesthesia. Following this dose, a rapid onset time of 28 seconds was found while clinical duration and recovery index were 32.3 and 8.6 minutes respectively. No significant changes in haemodynamic parameter were observed.

Wierda *et al.*, (1991) also studied the pharmacodynamic and kinetics of ORG 9426 in great detail at university of Groningen, The Netherlands and published their study in Canadian Journal of Anaesthesia.

Pubringer and Pearson *et al.*, (1992) evaluated the endotracheal intubating conditions of rocuronium and succinylcholine in outpatient surgery. They concluded that inspite of pharmacodynamic difference between two, intubating conditions after administration of both compounds, are similar and develop at the same rate.

Huizinga *et al.*, (1992) studied the intubating conditions and onset of neuromuscular block of rocuronium and also compared it with succinylcholine. Rocuronium produced good to excellent intubating conditions at 60 seconds as well as at 90 seconds after administration, even though there was only a partial blockade of adductor pollicis muscle.

Cooper and Crawford *et al.*, (1992) compared intubating conditions after administration of ORG 9426 and succinylcholine. They found that clinically acceptable intubating conditions were attained in 95% of patients at 60 second and in all patients at 90 seconds who received rocuronium. Clinically acceptable conditions were attained in all patients on both times after succinylcholine. All patients were premedicated with oral temazepam and anaesthesia was induced with thiopentone and fentanyl. Prior administration of succinylcholine did not appear to influence the potency of ORG 9426.

Woelfel *et al.*, (1992) studied the effect of bolus administration of intubating dose of 0.6 mg/kg of ORG 9426 in children during N₂O – Halothane anaesthesia.

The onset time of 90% and 100% neuromuscular block was 0.8 and 1.3 min respectively. A clinical duration around 25 minutes was seen. Only a minimal transient rise in heart rate was observed. The

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author concluded that rocuronium bromide is useful in children in situations when rapid tracheal intubation is desired.

Szenohrdszky *et al.*, (1992) pointed out that the pharmacokinetics and onset of action of 2x ED₉₅ dose of rocuronium were not altered in patients with renal failure undergoing renal transplantation. In addition, onset of action of rocuronium appeared to be more rapid than that of other currently available non-depolarizing neuromuscular blocking drugs.

Khuenl – Brady and Jansen *et al.*, (1993) studied the use of ORG 9426 in patients with chronic renal failure and concluded that rocuronium is a reliable neuromuscular blocking agent of intermediate duration of action that can be safely used in moderate doses in absence of renal function without risk of prolonged neuromuscular block.

MATERIALS AND METHODS

Present study is a double blind, prospective study to compare the intubating conditions and time course of action of succinylcholine and rocuronium bromide.

The present study was undertaken at the Department of Anaesthesiology, Khaja Bandanawaz Institute of Medical Sciences Gulbarga and was carried out from Sept 2015 to February 2016. 90 patients fulfilling the required criteria were selected for this study.

- The various inclusion criteria were as follows:
 - / patients belonging to age group between 20-60 years.
 - / patients belonging to ASA grade I and grade II
 - / Patients posted for elective surgery under general anaesthesia for various surgical indications.
- The various exclusion criteria were as follows:
 - / patients not meeting the inclusion criteria.
 - / Patients known or suspected to have renal, hepatic, metabolic or neuromuscular disease.
 - / patients who were known or suspected to have allergy to neuromuscular blocking drugs and other drugs used during general anaesthesia.
 - / patients receiving drugs known to interfere with the action of neuromuscular blocking agents.
 - / patients with previous history of difficult intubation or anticipated to have difficult intubation.
 - / patients weighing less or more than 30% of their ideal weight.

Methods

- Preoperative evaluation of each patient was done. A detailed history, thorough general examination and necessary and relevant investigations (haemogram, BT, CT, Chest X-ray, ECG) were done.
- These patients were divided in three groups of 30 cases each; group A, group B and group C.
- After routine laboratory investigations informed written consent was taken to carry out the study as well as for the administration of general anaesthesia.
- Patients were premedicated with oral diazepam 5 mg, one tablet on the previous night and one tablet in the morning on the day of surgery.
- Baseline parameters of pulse, B.P. and Oxygen saturation were recorded.
- I/V access was obtained with 18-20 G canula. A slow infusion of 0.9% DNS was started for all patients.
- No opioids were administered to the patients. All patients were preoxygenated for 3 minutes with 6 lit/minutes of 100% oxygen.
- Induction was done with Inj. Thiopental sodium 5mg/kg I/V.
- Group 'A' received Inj. Succinylcholine 2 mg/kg I/V.
- Group 'B' received Inj. Rocuronium bromide 0.6 mg/kg I/V.
- Group 'C' received Inj. Rocuronium bromide 1.2 mg/kg. I/V.
- Laryngoscopy and assessment of intubating conditions were done by the same trained anaesthesiologist.

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- Intubation was attempted at 60 seconds and if not at 90 seconds.
- Clinical assessment of intubating conditions were done on the basis of a scoring system described by Cooper and Crawford (1992).

Score	Jaw Relaxation (Laryngoscopic)	Vocal Cords	Response to Intubation
0	Poor (impossible)	Closed	Severe coughing or bucking
1	Minimal (difficult)	Moving	Coughing / bucking
2	Relaxed (fair)	Immobile	Minimal diaphragmatic
3	Good relaxation (easy)	Apart & immobile	No bucking / coughing

Total Score	Intubation Condition
8-9	Excellent
6-7	Good
3-5	Fair
0-2	Poor

- Intubating conditions were assessed at 60 seconds and if required at 90 seconds after the injection of the muscle relaxant till appropriate intubating conditions were attained.
- Assessment was based on first attempt.
- Good to excellent intubating conditions according to Cooper R et al scoring system were taken to be clinically acceptable.
- Onset time of action of drug was noted.
- Effect of the dose of rocuronium on the onset of action was noted.

RESULTS & DISCUSSION

Table I: Age Distribution

Age Group (Years)	No. of Patients
20-30	59
31-40	21
41-50	10
51-60	--

The study consists of total 90 cases of which 59 cases (65.55%) belong to age group 20-30 years, 21 cases (23.33%) belong to age group 31-40 years and 10 cases (11.11%) belong to age group 41-50 years, as indicated in Table 1.

Table II: Sex Distribution

Sex	No. of Patients
Male	42
Female	48

Out of 90 cases, 42 patients (46.66%) were males and 48 patients (53.33%) were females, as presented in Table II.

Table III: Group Distribution

Group	Drug Received	Dose	No. of Cases
A	Succinylcholine	2 mg/kg	30
B	Rocuronium Bromide	0.6 mg/kg	30
C	Rocuronium Bromide	1.2 mg/kg	30

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Each group consists of 30 patients, as mentioned in Table III. Drug received by each group is also mentioned.

Table IV: Intubating Conditions at 60 Seconds

Table IV-A: Succinylcholine 2 mg/kg

Intubating Condition	No. of Cases	Percentage
Excellent	28	93.33%
Good	2	6.66%
Fair	--	--
Poor	--	--

From the above table IV-A it was observed that 92.33% patients gave excellent and 6.66% patients gave good intubating conditions after administration of 2 mg/kg of succinylcholine.

Table IV-B Rocuronium Bromide 0.6 mg/kg

Intubating Condition	No. of Cases	Percentage
Excellent	16	53.33%
Good	11	36.6%
Fair	3	10%
Poor	--	--

From the above Table IV-B it observed that 53.33% patients gave excellent, 36.66% patients gave good and 10% patients gave fair intubating conditions after administration of rocuronium bromide 0.6 mg/kg.

Table IV-C: Rocuronium Bromide 1.2 mg/kg

Intubating Condition	No. of Cases	Percentage
Excellent	26	86.66%
Good	3	10%
Fair	1	3.33%
Poor	--	--

From the above Table IV-C it was seen that 86.66% patients gave excellent 10% patients gave good and 1% patients gave fair intubating conditions after administration of rocuronium bromide 1.2 mg/kg.

Table V: Comparison between Acceptable Intubating Conditions at 60 Seconds

Intubating Condition	Group A		Group B		Group C	
	No.	%	No.	%	No.	%
Excellent	28	93.33%	16	53.33	26	86.66%
Good	2	6.66%	11	36.66	3	10
Fair	--	--	3	10	1	3.33
Poor	--	--	--	--	--	--

It was found that 100% of patients in Group A, 89.99% of patients in Group B, 97% of patients in Group C, showed acceptable intubating conditions (excellent and good) at 60 seconds as shown in Table V.

Table VI: Comparison of Onset of Action

Onset Time	Group A		Group B		Group C	
	No.	%	No.	%	No.	%
60 seconds	30	100%	27	90%	29	97%
90 seconds	--	--	3	10%	1	3%

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Above Table VI showed that 100% were intubated at 60 seconds with succinylcholine 1 mg/kg. 90% patients were intubated at 60 seconds and remaining 10% patients were intubated at 90 seconds with rocuronium bromide 0.6 mg/kg. 97% of patients were intubated at 60 seconds and remaining 3% patients were intubated at 90 seconds with rocuronium 1.2mg/kg.

Table VII: Comparison between Rocuronium Bromide 0.6mg/kg and 1.2 mg/kg on Onset of Time of Action

Onset time	Rocuronium 0.6mg/kg		Rocuronium 1.2mg/kg	
	No.	%	No	%
60 seconds	27	90%	29	97%
90 seconds	3	10%	1	3%

From the above Table VII it was found that 90% of patients showed optimal intubating conditions at 60 seconds with rocuronium 0.6mg/kg and 97% of patients with rocuronium 1.2mg/kg.

From the time rocuronium bromide was first used in humans in 1990, various clinical studies have been done on it. Since then these studies have shown that rocuronium has number of advantages over other available muscle relaxants. Rocuronium is a non-depolarising neuromuscular blocking agent with rapid onset and intermediate duration of action. It provides excellent to good endotracheal intubating conditions in approximately 60 seconds, making it a most suitable alternative to succinylcholine. In this study an attempt has been made to compare the intubating conditions and time for optimal intubation after use of rocuronium bromide and succinylcholine. There is a need to substitute succinylcholine with a non-depolarising neuromuscular blocking agent in view of adverse effects of succinylcholine.

In the patient study:

- Majority of the patients belonged to age group 20-30 years (Table – I).
- Almost equal numbers of males and females were studied (Table-II).
- Patients were divided into three groups (Table III):

Group A – succinylcholine 2 mg/kg

Group B – rocuronium bromide 0.6mg/kg

Group C – rocuronium bromide 1.2 mg/kg

- In the present study 93.33% of patients showed excellent and 6.6% of patients showed good intubating conditions, after administration of 2 mg/kg of succinylcholine.

Thus, almost 100% of patients showed clinically acceptable intubating conditions at 60 seconds (Table IV-A).

From this study it can be concluded that there is a dose dependent decrease in onset time with rocuronium. The brief onset time achieved with rocuronium indicates that administration of 0.9 – 1.2 mg/kg is an acceptable alternative to succinylcholine for rapid sequence induction of anaesthesia.

The present study, we also studied the effect of dose of rocuronium 0.6 mg/kg and 1.2 mg/kg on onset time of action (Table VII). After administration of rocuronium 0.6 mg/kg, 90% of patients were intubated at 60 seconds and remaining all patients were intubated at 90 seconds.

With rocuronium 1.2 mg/kg, 96.66% of patients were intubated at 60 seconds and remaining at 90 seconds.

By comparing the onset of action between two doses of rocuronium it was seen that, 1.2 mg/kg of rocuronium gave early onset of action as compared to 0.6 mg/kg rocuronium.

Following conclusions are drawn from the present study:

1. This was a double blind randomized prospective study. 90 patients belonging to age group 20-60 years and to ASA Grade I and Grade II were selected for this study.
2. These patients were divided into three groups of 30 patients each;

Group A received 2 mg/kg of Succinylcholine

Group B received 0.6 mg/kg of Rocuronium Bromide

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Group C received 1.2 mg/kg of Rocuronium Bromide

3. All patients underwent elective general surgery under General Anaesthesia. The exclusion and inclusion criteria were strictly followed. The method of anaesthesia was thoroughly standardized.

4. All the patients were given oral diazepam 5 mg on the previous night and on the day of surgery. All the patients were induced with inj. Thiopental sodium 5 mg/kg and either succinylcholine or rocuronium.

5. Onset of optimal intubating condition after the administration of each drug, after 60 seconds and 90 seconds was observed and recorded.

The intubating score suggested by Cooper et al was used to grade the intubating conditions. The influence of the two doses of rocuronium (0.6 mg/kg and 1.2 mg/kg) on the onset of action of optimal intubating conditions was studied and compared.

6. All the data was tabulated and analyzed.

7. Rocuronium, a non-depolarising muscle relaxant, provides clinically acceptable intubating conditions like that of succinylcholine.

8. There is a dose dependent decrease in the onset of action of intubating conditions with Rocuronium; larger doses (1.2 mg/kg) giving better results.

Thus, Rocuronium is a good muscle relaxant and can be used as an alternative to Succinylcholine.

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