COMPARISON OF ONSET TIME, DURATION OF ACTION AND INTUBATING CONDITION SACHIEVED WITH SUXAMETHONIUM AND ROCURONIUM BROMIDE

Ajit P. Singh[1], Alok P. Singh Baghel[2], Devendra Singh Kushwah[3]

HOW TO CITE THIS ARTICLE:
Ajit P. Singh, Alok P. Singh Baghel, Devendra Singh Kushwah. "Comparison of onset time, duration of action and intubating condition sachieved with Suxamethonium and Rocuronium Bromide". Journal of Evolution of Medical and Dental Sciences 2013; Vol. 2, Issue 52, December 30; Page: 10236-10248.

BACKGROUND: Adverse event profile ofSuxamethonium which is still the relaxant of choice to facilitate tracheal intubation inspired us to conduct a study in which we compared Onset time, Duration of Action and Intubating Conditions Achieved with Suxamethonium and Rocuronium Bromide with the Help of TOF Guard.**AIMS:** We compared the onset of relaxation time, intubating condition, and duration of action, the cardiovascular effect, side effects between Suxamethonium and Rocuronium to ascertain the place of Rocuronium as a relaxant for rapid sequence intubation as compared to the Suxamethonium. **METHODS AND MATERIAL:** The present study was carried out with the association of Department of Anesthesiology, S.S. Medical College and Associated S.G.M. and G.M. Hospitals, Rewa (M.P.), and Department of Pharmacology NSCB Medical College Jabalpur (M.P.) in 100 patients of either sex of ASA grade I and II between the ages of 16 to 70 years. The patients were randomly divided in two groups of 50 each. Group I & II received Suxamethonium 1.5 mg/kg B.W. or Rocuronium 1.0 mg/kg B.W.**RESULTS:** Onset time of maximum relaxation is < 60 seconds in each relaxants under study i.e. Rocuronium 1 mg/kg and Suxamethonium 1.5 mg/kg. Intubating conditions after Rocuronium 1 mg/kg are clinically acceptable in 100% of cases and are equivalent to that after Suxamethonium 1.5 mg/kg. Rocuronium upto dose of 1 mg/kg does not have any clinically significant cardiovascular effect. Rocuronium does not have any side effects including the sign of histamine release and anaphylactic or anaphylactoid reactions. Duration of action after Rocuronium 1 mg/kg is about 2346.4 seconds (39.14 minutes) so it is not suitable for surgeries of short duration.**CONCLUSIONS:** Rocuronium can replace Suxamethonium for rapid sequence intubation in conditions where use of Suxamethonium is either hazardous or contraindicated provided there is no anticipated difficulty in intubation.

INTRODUCTION: Today endotracheal intubation is an integral part of administration of anesthesia during surgical procedures. Suxamethonium, a depolarizing muscle relaxant with its rapid onset and short duration of action is still relaxant of choice to facilitate tracheal intubation[1, 2, and 3]. In addition to fasciculation, Suxamethonium has got many side effects such as bradycardia, other dysrhythmias, rise in serum potassium, postoperative myalgia, rise in intraocular, intragastric and intracranial pressure, incidences, of prolonged recovery in patients with pseudo-cholinesterase deficiency and triggering of malignant hyperthermia[3].

Kare's and Gissen first described the profile of an ideal neuromuscular blocking agent in 1971 and that was further elaborated bySavarese and Kitz in 1973 which includes[4,5,6]:

1. Non depolarizing mechanism of action.
2. Rapid onset of action.
3. Short duration of action.

4. Rapid recovery.
5. Non-cumulative.
6. No cardiovascular side effects.
7. No histamine release.
8. Reversible by cholinesterase inhibitors.
9. High potency.
10. Pharmacologically inactive metabolites

The search for such an ideal agent continued until Rocuronium Bromide came into existence. Amongst the currently available nondepolarizing agents Rocuronium has the most rapid onset, intermediate duration of action, minimum cardiovascular side effects, no histamine release, therefore almost fulfilling the criteria of ideal neuromuscular blocking agent for endotracheal intubation[7, 8].

Observations of above studies inspired us to conduct a study "Comparison of Onset time, Duration of Action and Intubating Conditions Achieved with Suxamethonium and Rocuronium Bromide".

AIMS & OBJECTIVE:

1. To compare the onset of relaxation time between Suxamethonium and Rocuronium Bromide following administration of-
   (i) Suxamethonium- 1.5mg/kg
   (ii) Rocuronium - 1.0 mg/kg
2. To assess the intubating condition after Suxamethonium and Rocuronium Bromide.
3. To compare duration of action, the cardiovascular effects, side effects between Suxamethonium and Rocuronium Bromide group and to ascertain the place of Rocuronium as a relaxant for rapid sequence intubation as compared to the Suxamethonium.

MATERIAL AND METHODS: The present study "Comparison of Onset time, Duration of Action and Intubating Conditions Achieved with Suxamethonium and Rocuronium Bromide was carried out with the association of Department of Anesthesiology, S.S. Medical College and Associated S.G.M. and G.M. Hospitals, Rewa (M.P.), and Department of Pharmacology NSCB Medical College Jabalpur (M.P.).

The study was conducted in 100 patients of either sex of ASA grade I and II between the age of 16 to 70 years, scheduled for major surgical procedures in Department of Surgery, Orthopaedics and E.N.T. The patients were randomly divided in two groups of 50 each.

Group I Received Suxamethonium 1.5 mg/kg B.W.

Group II Received Rocuronium 1.0 mg/kg B.W.

All patients were scheduled for major surgical procedures in Department of Surgery, Orthopaedics and E.N.T.

The patients excluded from the study were pregnant females, patients suffering from neuromuscular disorders, obese patients and patients with ASA grade III and IV.

A detailed Oropharyngeal and laryngeal examination was done. Patients who seemed to have factors responsible for difficult intubation (Receding mandible, buck teeth, Bull Neck) were excluded

from this study. Weights of all the patients were recorded. Written consent was taken from all the patients and they were kept fasting overnight if they were scheduled for routine surgeries.

Patients were premedicated 30-45 minutes before induction of anesthesia. Premedication included intramuscular Atropine 0.6 mg/kg. Inj. Pentazocine 30 mg IV and Inj. Midazolam 0.05 mg/kg B.W. was given just before the induction.

Preinduction observations included pulse rate and blood pressure measurements. An IV line was established with an intracath of suitable gauge and Dextrose normal saline was started. Oxygen saturation was measured by pulse oximeter using a finger probe.

Neuromuscular blockade was measured by twitch height in response to ulnar nerve stimulation. For monitoring of neuromuscular transmission, surface electrode of biometer accelograph was fixed on ulnar side of volar surface of wrist and the transducer fixed on corresponding thumb.

Preoxygenation was done for 3 minutes with 100% oxygen. Anesthesia was induced with thiopentone sodium (2.5%) 4-7 mg/kg B.W. till eyelash reflex disappeared. For seeking supramaximal stimulation, single twitch stimulation at 1 Hz was used. Once the control response was gained, neuromuscular blocking agent for intubation was injected. In Group I injection Suxamethonium was given in a dose of 1.5 mg/kg B.W. and patients in group II received Rocuronium bromide (Esmeron) 1.0 mg/kg B.W. approximately 3X ED_{95}).

The time duration from injection of relaxant to maximum suppression of twitch height was noted and that represented the onset time for that relaxant. After injection of muscle relaxant, on cessation of respiration lungs were ventilated using IPPV with mask. Direct laryngoscopy and orotracheal intubation was performed. The patients were intubated orally by a different observer and simultaneously intubating conditions were noted and scored according to a modification of the method described by Krieg et al (1980).

This was followed by the muscle relaxant to be studied. Intubating conditions were assessed using standard scoring system. The ease of laryngoscopy, condition of vocal cords and response to tracheal intubation was taken under consideration. Intubating conditions were scored on a four point scale (0-3) and the total scores added together to give an overall intubation score for each patient. In case intubation could not be performed due to poor intubating conditions at first attempt, patient was again oxygenated for 30 seconds, after which intubation was again attempted. But for all practical purposes, the intubating conditions at first attempt tointubation were recorded.

Score	Jaw relaxation (laryngoscopy)	Vocal cords	Response to intubation
0	Poor (impossible	Closed	Severe coughing or Bucking
1	Minimal (difficult)	Closing	Mild coughing
2	Moderate (fair)	Moving	Slight diaphragmatic Movement
3	Good (easy	Open	None

Table: 1 Grading of Intubating Conditions

Total score of intubation conditions-

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

After inflating the cuff of endotracheal lube, it was connected to baine's circuit and controlled ventilation was started. Anesthesia was maintained on oxygen (40%) and Nitrous oxide (60%) and traces of Halothane with Atracurium as required.

Pulse and blood pressure were recorded just after the injection of muscle relaxant, after intubation and again at 5 minutes after intubation and thereafter at 10 minutes interval.

Time for reappearance of twitch height upto 25% of initial response, from the injection of relaxant was noted and it represented the duration of action of relaxant.

At the end of surgical procedure the reversal of residual neuromuscular block was done with Inj. Atropine and Inj. Neostigmine. Patients were extubated after orotracheal suction and then oxygenated for 5 minutes. Assessment of recovery was done by clinical parameters such as handgrip and head raising test. Patients were shifted to recovery room for further observation.

The onset of relaxation time, intubating conditions and duration of action in both groups were compared. The observations were recorded, tabulated, analyzed statistically and discussed.

Statistical analysis: The different groups were compared using ANOVA followed by post-hoc Dunnett T3 test. All statistical analysis was done using StatisticalPackage for Social Science (SPSS) 16.0 software. P value < 0.05 was considered as significant.

OBSERVATION: The present study entitled "Comparison of Onset time, Duration of Action and Intubating Conditions Achieved with Suxamethonium and Rocuronium Bromide" was carried out with the association of Department of Anesthesiology, S.S. Medical College and Associated S.G.M. and G.M. Hospitals, Rewa (M.P.), and Department of Pharmacology NSCB Medical College Jabalpur (M.P.).

The study was conducted in 100 patients of either sex of ASA grade I and II between the age of 16 to 70 years, scheduled for major surgical procedures in Department of Surgery, Orthopaedics and Obstetrics and Gynecology. The patients were randomly divided in two groups of 50 each.

Group	Relaxant	No. of Case	Dose
I	Suxamethonium	50	1.5mg/ kg B.W.
II	Rocuronium	50	1.0mg/ kg B.W.

Table No. 1: Distribution of Groups

Above table shows the distribution of groups according to dose of muscle relaxant.

S. No.	Age (Yrs.)	No. ofPatients	Percentage
1.	15-25	17	34.0
2.	26-35	13	26.0
3.	36-45	10	20.0
4.	45-55	6	12.0
5.	>55	4	8.0

Table No. 2: Age Wise Distribution of the Patients in – group I

Above table shows the age wise distribution of patients in Group I. The youngest patient was of 17 years and eldest was of 65 years. Mean age of patient was 32.92 ± 12.76 years. The maximum number of patients (60%) was in age group of 15-35 years.

S. No.	Age (Yrs.)	No. ofPatients	Percentage
1.	15-25	10	20.0
2.	26-35	15	30.0
3.	36-45	13	26.0
4.	45-55	5	10.0
5.	>55	7	14.0

Table No. 3: Age Wise Distribution of the Patients in group II

Above table shows the age wise distribution of patients in Group II. The youngest patientwas of 16 years and eldest was of 70 years. Mean age of patient was 37.94 ±13.88 years. The maximum number of patients were in age group of 15- 35 (50%).

Sex	Group I		Group II		Total	
	No.	%	No.	%	No.	%
Male	27	54.0	23	46.0	50	50.0
Female	23	46.0	27	54.0	50	50.0

Table No. 4: Sex Wise Distribution of the Patients

Above table shows the sex wise distribution of patients in both the groups. Male to female ratio is 1.17: 1 in group I, 1: 1.17 in Group II.

S. No.	Weight (kg.)	No. of Patients	Percentage
1.	40-50	3	6.0
2.	51-60	16	32.0
3.	>60	31	62.0

Table No. 5: Weight Wise Distribution of the Patients in- group I

Above table shows the weight wise distribution of patients in group I. Weight of the patients varied from 48-84 kg and the mean weight of the patient was 62.60 ± 8.58 kg.

S. No.	Weight (kg.)	No. of Patients	Percentage
1.	40-50	11	22.0
2.	51-60	13	26.0
3.	>60	26	52.0

Table No. 6: Weight Wise Distribution of the Patients in- group II

Above table shows the weight wise distribution of patients in group II. Weight of the patients varied from 42-86 kg and the mean weight of the patient was 60.20 ± 10.42 kg.

Above table shows the various surgical procedures which were performed on the patients under study. The table shows a wide range of different surgical procedures.

Jaw Relation	Group I		Group II	
	No.	%	No.	%
Poor (Impossible)	-	-	-	-
Minimal (Difficult)	-	-	-	-
Moderate (Fair)	4	8.0	4	8.0
Good (Easy)	46	92.0	46	92.0

Table No. 7: Condition of Jaw relaxation (Laryngoscopy)

Jaw Relation	Group I		Group II	
	No.	%	No.	%
Closed	-	-	-	-
Closing	-	-	-	-
Moving	5	10.0	6	12.0
Open	45	90.0	44	88.0

Table No. 8: Condition of Vocal Cords

Response	Group I		Group II	
	No.	%	No.	%
Severe coughing or bucking	-	-	-	-
Mild coughing	-	-	-	-
Slight diaphragmatic movement	2	4.0	6	12.0
None	48	96.0	44	88.0

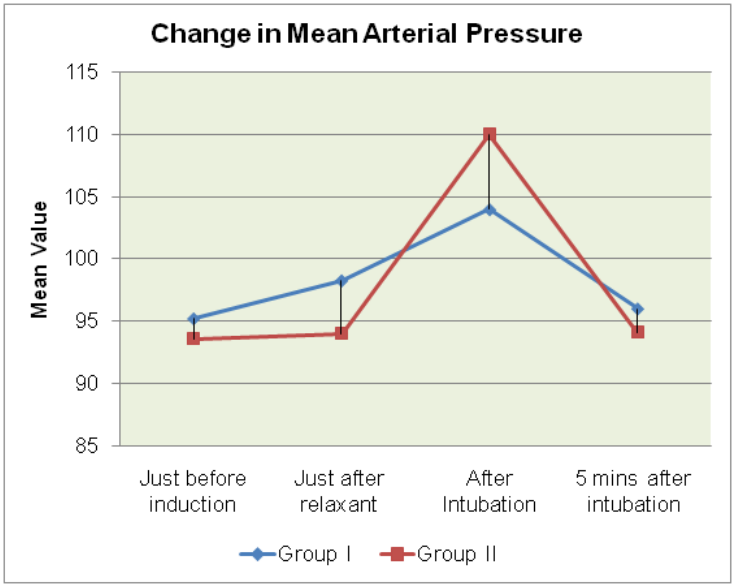
Table No. 9: Response to Intubation

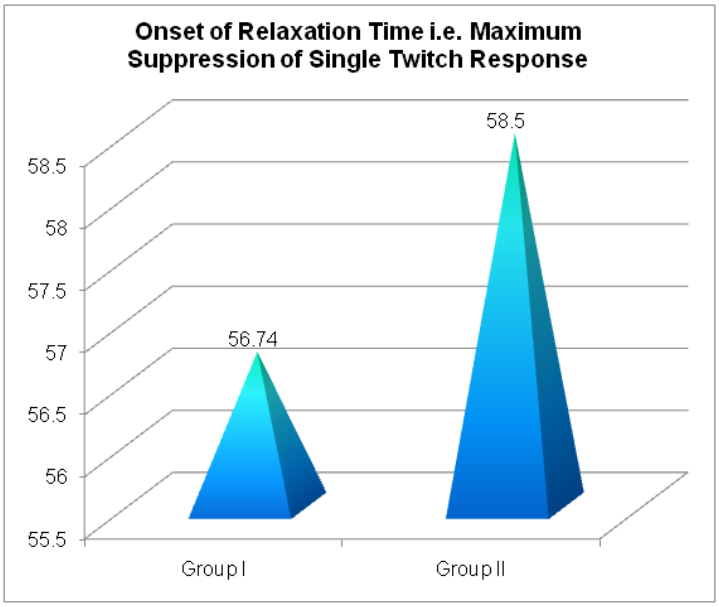
Intubating Conditions	Group I		Group II	
	No.	%	No.	%
Excellent (8-9)	49	98.0	48	96.0
Good (6-7)	1	2.0	2	4.0
Fair (3-5)	-	-	-	-
Poor (0-2)	-	-	-	-

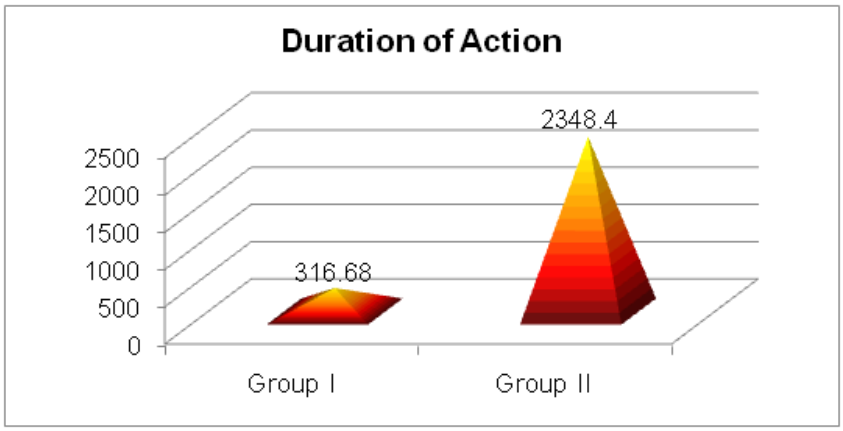
Table No. 10: Overall Intubating Condition

Pulse Rate	Group I	Group II
Just Before Induction		
Mean ± SD	84.48 ± 8.68	87.06 ± 12.53
Just After Relaxant		
Mean ± SD	86.26 ± 8.56	88.73 ± 12.75
T value	0.45	0.67
P value	>0.05	>0.05
After Intubation		
Mean ± SD	102.8 ± 14.38	98.83 ± 13.6
T value	7.29	4.50
P value	<0.001	<0.001
5 Minutes After Intubation		
Mean ± SD	86.9 ± 8.04	87.63 ± 11.82
T value	0.85	0.23
P value	>0.05	>0.05

Table No. 11: Change in Pulse Rate


Change in Mean Arterial Pressure
Mean Value
115
110
105
100
95
90
85
Just before induction
Just after relaxant
After Intubation
5 mins after intubation
Group I
Group II


Onset of Relaxation Time i.e. Maximum Suppression of Single Twitch Response
58.5
56.74
58.5
58
57.5
57
56.5
56
55.5
Group I
Group II


Duration of Action
2348.4
316.68
2500
2000
1500
1000
500
0
Group I
Group II

Side Effects	Group I	Group II
Fasciculation	42	-
Erythema	-	-
Flushing	-	-
Hypotension	-	-
Bronchospasm	-	-

Table No. 12: Side Effects

Above table shows that the fasciculation was present in 42 patients of Group I only. No other side effects were observed in any of the groups.

DISCUSSION: Traditionally Suxamethonium has been the neuromuscular blocking drug of choice for rapid sequence induction and minimizing the chances of regurgitation and aspiration. However the use of Suxamethonium is associated with fasciculation, myalgia, bradycardia, increased plasma potassium level, raised intraocular and intra-abdominal pressure. It may also act as a trigger for malignant hyperthermia and its use is contraindicated in many conditions including burns, certain neurological diseases, liver diseases and patients with pseudocholine esterase deficiency. Hence a non-depolarizing neuromuscular blocker with a rapid onset of action, preferably of a shorter duration is often desirable.

Initial studies in animals showed that Rocuronium being a low potency compound, was associated with a rapid onset of effect when compared with other compounds such as Pancuronium and Vecuronium (Bowman et al, 1988 and Muir et al, 1989)[9, 10]. This has since been demonstrated in many clinical studies that the onset of action of Rocuronium is significantly faster when compared to equipotent dose of Atracurium and Vecuronium, although slightly slower than that of Suxamethonium (Bartkowski et al, 1990)[11]. That's why Rocuronium was selected for the purpose of rapid sequence induction, in the present study.

In present study, 100 patients are randomly divided into 2 groups of 50 each. Onset of relaxation time, intubating conditions and duration of action are assessed in-group I after Suxamethonium 1.5 mg/kg and in-group II after Rocuronium 1.0 mg/kg.

In present study the mean age is 32.92 years in-group I, 37.94 years in-group II. This shows that the study population is of middle age and comparable in each group.

Similar age group population was included in the study carried out by Tony Magorian et al (1993) with the mean age of 37, 30, 34, 32 years in the four groups[12]. R. Cooper studied the population with the mean age of 38, 32 and 35 years in three groups[3].

In our study the mean weight is 62.60 kg in group I and 60.30 kg in group II. The mean weight is also comparable in each group.

R. Cooper et al (1992) studied the population with mean weight as 67, 65, and 67 in three groups[3]. Toni Magorian et al (1993) studied the population with mean weight in kg as 64, 73, 77, 69 and 58 in five groups. The mean weight in our study is also comparable with these studies[12].

The male to female ratio is 1.17: 1 in group I and 1: 1.17 in group II. This shows that male to female ratio in our study is also comparable in each group.

In our study mean onset of relaxation time i.e. maximum suppression of single twitch response was found 56.74±10.34 seconds in-group I while it was 58.5±6.49 seconds in group II.

Cooper et al (1992) studied that Rocuronium had shown the mean onset time to be 45-59 seconds depending upon the dose (0.5 - 0.9 mg/kg) [3].

Wierda et al (1995) compared the onset time of Rocuronium 250 µg/kg and found it to be 190 seconds[13]. Puhringer et al (1992) and Dubois et al (1995) found the onset times as 72 seconds and 48 seconds for Rocuronium 600 µg/kg and Suxamethonium 1000 µg /kg respectively[14, 15].

M. Naguib et al (1997) compared onset of relaxation time between Rocuronium (0.6 mg/kg) and Rocuronium (0.9 mg/kg) and Suxamethonium (1 mg/kg) and it was found that onset time for neuromuscular block decreased by 28% (from 97.9 to 70.5 s; $p<0.05$) as the dose of Rocuronium increased from 0.6 to 0.9 mg/kg and that of Suxamethonium it was 55.1 seconds[16].

McCourt (1998) compared onset of relaxation time between Suxamethonium (1.0 mg/kg) and Rocuronium (1.0 mg/kg) and found it was < 60 seconds in each group[17].

Thus the present study is in accordance with the finding of other authors. In present study the intubating conditions are graded using a method described by R. Cooper et al (1992)[3]. This was done taking into consideration the ease of laryngoscopy, condition of vocal cords, and response to tracheal intubation. These are scored on four point scale (0-3) and total score addedtogether to give and overall intubating score for each patient.

Grading of Intubating Conditions:

Score	Jaw relaxation (laryngoscopy)	Vocal cords	Response to intubation
0	Poor (impossible	Closed	Severe coughing or bucking
1	Minimal (difficult)	Closing	Mild coughing
2	Moderate (fair)	Moving	Slight diaphragmatic movement
3	Good (easy)	Open	None

A score of 8-9 was considered excellent, 6-7 as good, 3-5 as fair and 0-2as poor. Good and excellent intubating conditions were taken as clinically acceptable.

Jaw relaxation after administration of muscle relaxant is good in 46 patients in group I 46 in group II. Vocal cords are completely open in 45 patients of group I and 44 in group II.

There is no response to intubation in 48 patients of group I and 44 of group II. Slight diaphragmatic movement is visible in 2 patients of group I and 6 of group II.

In our study overall intubating conditions are excellent in 49 patients in group I and 48 patients in group II and it is statistically highly significant ($p<0.001$) between group I and group II.

Good intubating conditions are present in 1 patient of group I and 2 in group II and it is statistically highly significant ($p<0.001$) between group I and group II.

As in our study, similar observations were recorded by K.C. McCourt et al (1998)[17]. They found clinically acceptable intubating conditions in 75% of patients with excellent condition in 28% of the patients. J.I. Andrews (1999) found clinically acceptable intubating conditions in 77% of patients with excellent condition in 40% of patients. Sharma S. et al (2000) reported clinically acceptable intubating conditions in 80% of patients with excellent intubating conditions in 30%.

However Puhringer et al (1992) observed clinically acceptable intubating conditions in 100% of patients with excellent conditions in 85% with Rocuronium 0.6 mg/kg at 60 seconds[14]. R.

Cooper et al (1992) also found clinically acceptable intubating conditions in more than 95% of patients with excellent condition in 65%[3].

In our study clinically acceptable intubating conditions were found in all the patients after Rocuronium 1 mg/kg with excellent conditions in 96%.

Similar observations were recorded by De Mey et al (1994) who found clinically acceptable intubating conditions in 100% of patients with excellent condition in 80%[18]. Patel N.K. (1995) also reported clinically acceptable condition in 100% of patients with excellent condition in 87%. Somboon viboon W. et al (2000) reported that 97% of patients have clinically acceptable intubating conditions in with excellent in 78%[19].

The reason for this rapid onset of neuromuscular block has been suggested to be relatively low potency of the drug. This ensures the presence of more relaxant molecules in the blood stream and results in large concentration gradient towards the biophase. Another possible explanation could be the earlier occurrence of the block at the adductor muscle of larynx (although the block is less intense) than adductor pollicis muscle, it appears that intubation may be performed before complete block is obtained as measured at the thumb.

In the patients of group I, after administration of Suxamethonium 1.5 mg/kg intubating conditions are clinically acceptable in all the patients with excellent condition in 98% which is consistent with clinical practice.

Various previous studies and the studies of R. Cooper et al (1992), Toni Magorian et al (1993), Tyrba M (1994), Patel N.K. (1995), Mazurck (1998) and Sharma S. (2000) have reported the same findings[3, 12,20,21,22].

The results from the present study show that intubating conditions after Rocuronium 1 mg/kg are similar to that observed after Suxamethonium 1.5 mg/kg.

The results of priming technique with Rocuronium are conflicting. Tryba et al (1994) found similar intubating conditions with Rocuronium 0.6 mg/kg at 60 seconds either in primed or non-primed patients[86]. Similar results were also obtained in the study of Folds et al, but Naguib et al were able to show more rapid onset with the use of priming[16, 23].

Tryba et al (1994) also concluded that when Rocuronium if administered immediately before induction agents offers better intubating conditions than administered after[20].

Cardiovascular stability is an important feature of any muscle relaxant. Cardiovascular effects of muscle relaxant may be produced by muscarinic receptor block, ganglion block, increased noradrenaline release and blockage of its reuptake or histamine liberation.

Initial animal study with Rocuronium suggested occurrence of muscarinic receptor and ganglion blocking effects only with the doses, which are higher than those required for neuromuscular block (Muir A.W., 1989)[24]. Further studies in dogs confirmed that cardiovascular effects are minimal with the doses of up to 3xEDy5 although heart rate tended to increase with the doses greater than $5xED_{95}$. (Cason et al, 1989)[25].

In men, routine measurement of heart rate and arterial pressure during neuromuscular studies showed that Rocuronium has minimal effects on these variables with the doses of 2-3ED95. (Wieda et al 1990, Quill et al 1991, Cooper et al 1993, Robertson et al, 1994)[3, 13, 26, 27].

In our study mean pulse rate just before induction was 84.48 in group I and 87.06 in-group II.The change in pulse rate remains statistically insignificant ($p>0.05$) at different time intervals except after intubation when the increase in mean pulse rate is statistically highly significant in

group I and group II. These effects however, are fairly minimal although statistically significant are not likely to be of clinical importance.

R. Cooper (1992), ACT Huizinga et al (1992), McCoy et al (1993), Levy et al (1994) reported no significant evidence of cardiovascular affect after Rocuronium[3.17,28,29]. However Robertson et al (1994) found 5-10% increase in pulse rate after a dose of 0.9 mg/kg of Rocuronium[27]. Wierda JMKH et al (1997) reported limited increase in heart rate after Rocuronium, which has attributed to its slight vagolytic activity[13].

In our study the increase in pulse rate after intubation could bedue to sympathetic stimulation.

Mean preinduction value of mean arterial pressure is 95.02 in group I and 93.6 in-group II patients. The changes in mean arterial pressure from preinduction value remain statistically insignificant at different time intervals except slight increase after intubation, which is statistically highly significant ($p<0.001$).

Cooper et al (1992) and McCoy et a I (1992), Wierda et a I (1997) and Sharma S. (2000) reported that there was no significant change inarterial pressure after a dose of 0.6 mg/kg of Rocuronium[3,13,17,22]. Levy et al (1994) also reported similar findings at a dose of 0.6, 0.9 and 1.2 mg/kg or Rocuronium[29]. However Robertson et al (1994) reported 10- 15% increase in mean arterial pressure at a dose of 0.9 mg/kg of Rocuronium[27].

In our study neither signs of histamine release liberation (erythema, hypotension or bronchospasm) were observed in any patients following Rocuronium administration nor any other side effects including anaphylactic and/or anaphylactoid reactions were observed. Thus it appears that Rocuronium like Vecuronium is safe in this respect.

In our study fasciculation were observed in 42 patients of Suxamethonium group, which are considered to occur routinely and are consistent to the clinical practice. No other side effects are observed in any of the patients with this group.

From the foregoing paragraphs of the discussion it can be remarked that Rocuronium upto 1 mg/kg has clinically acceptable and/or equivalent intubating conditions as that after Suxamethonium. It can also be said that there are no clinically significant cardiovascular effects and side effects including signs of histamine release after Rocuronium administration. Fasciculation's are observed in 42 patients after Suxamethonium administration.

In our study the mean duration of action in group I was 316.68 seconds (5.27 minutes) and in group II it was 2348.4 seconds 39.14 minutes).

Magorian et al (1991) compared the duration of action of Rocuronium in doses of 0.6 mg/kg, 0.9 mg/kg and 1.2 mg/kg with that of Suxamethonium i n the dose of 1 mg/kg. The were found 2220 seconds, 3180 seconds, 4380 seconds and 540 seconds respectively[12].

M. Naguib et al (1997) compared the mean duration of action between Rocuronium (0.9 mg/kg) and Suxamethonium (1.0 mg/kg) and found that it was 4.2 minute in Suxamethonium group and 36.4 minute in Rocuronium group[16].

The present study is in accordance with the finding of other authors.

BIBLIOGRAPHY:

1. Aaron F, Kopman, Vijaya Shenailanjekar, Monika M: Re-examined: the Intubating Dose of Rapacuronium and Rocuronium for Routine Tracheal Intubation. Anesthesiology, SaintVincents Medical Centre of N.Y., New York City, New York.

2. Agoston S: Interactions of volatile anesthetics with Rocuronium bromide in perspective. Eur. J. Anaesth. 1994; 11(9): 107-111.
3. Cooper R., Mirakhur R.K., Clarke R.S.J.: Comparison of intubating conditions after administration of Org 9426 and Suxamethonium; British Journal of Anaesthesia (1992); 69: 269-273.
4. Andrews J.I., Kumar N. Olkkala K.T.: A large sample randomized trial of Rocuronium Vs. Succinylcholine in rapid sequence induction of anaesthesia along with propofol, Acta Anaesthesiologica Scandinavica (1999); 43: 4-8.
5. Atkinson R.S., Rushman G.B. Lee's synopsis of Anaesthesia. 11t h Ed. 1993. Bartkowski R.R., Witkowski T.A., Azad S.S. Dose Response and Recovery of Org. 9426 under Enflurane Anaethesia. Anesthesiology 1990; 73(3A): A902.
6. Bowman W., C. Rodger I.W., Houstman J Structure action Relationship among some disacetomy Analogues of Pancuronium and Vecuronium in Anaesthetized Cat.Anesthesiology 1988; 69: 57-62.
7. Alfred C, Pinchak P.E.: Emergency surgery and rapid sequence intubation Rocuronium Vs. Succinylcholine, Dept. of Anaesthesiology, Metro Health Medical Centre, Case Western Reserve University, Cleveland, OH 44109.
8. Alvarez - Gornej J. A., Estelles M.E.: Pharmacokinetics and pharmaco-dynamics of Rocuronium Bromide in adult patients; European Journal of Anaesthesiology (1994); 11: 53-56.
9. Bowman W.C. Nicotinic cholinoceptors at the neuromuscular junction in: Eds. Bowman W.C. et al, neuromuscular blocking agents; past, present and future. Excorpta Medica Amsterdam, 1990: 20: 35.
10. Muir AW, Houston J, Green K.L. and Marshall R.J.: Effects of a New Neuromuscular blocking agent (Org 9426) in Anaesthetised Cats and Pigs and i n Isolated Neuromuscle Preparations. Br. J. Anes. 1989; 63: 400-410.
11. Bowman WC: Micotinic cholincoceptors at the neuromuscular junction in: Eds Bowman WC et al Neuromuscular blocking agents; past, present and future. Excerpta medica Amsterdam, 1990; 20: 35.
12. Magorean T, Word P, Coldwell J: The pharmacokinetics and neuromuscular effects of Rocuronium bromide in patients with liver disease; Anaesthesia Analgesia 1995; 80: 754-9.
13. Wierda KMKH, De Wit APM Kuizenga K. Clinical observations on the neuromuscular blocking of Org. 9426, a new steroidal nondepolarizing agent. Br. J. Anaesth. 1990; 64: 521-523.
14. Puhringer F.K., Khuenl Brady K.S.: Evaluation of the endotracheal intubating conditions of Rocuronium (Org. 9426) and Succinylcholine in outpatient surgery; Anaesthesia Analgesia 1992; 75: 37-40.
15. Dubois M Y. Lead D.E. Kaaria B Dwivedi S et al Feldman S.A. Pharmacology of Rocuronium with and without prior Administration of Suxamethonium. Jour of Clinical Anesthesiology 1995; 7(1): 44-8.
16. Naguib M, Samarkandi H, Ammar A and Turkistani A: Comparison of Suxamethonium and Different Combinations of Rocuronium and Mivacurium for Rapid Tracheal Intubation in Children. British Journal of Anesthesia 1997; 79: 450-455.
17. McCoy EP, Maddineni VR, Elliot P: Haemodynamic effects of Rocuronium during fentanyl anaesthesia comparison with Vecuronium. Can. J. Anaesth. 1993; 40(8): 703- 708.

18. De May JC, Decrock M, Rolly G: Evaluation of the onset and intubating conditions of Rocuronium bromide. Eur. J. Anaesth. 1994; 11(9), 37-40.
19. Somboonviboon W, Bunburaphong P, WhartnO: Intubating conditions after three different doses of Rocuronium. J. Med. Assoc. Thai 2000, Aug 83(8); 850-5.
20. Tryba M: Rapid sequence orotracheal intubation with Rocuronium: Comparison suxamethonium; European Journal of Anaesthesia 1994; 11: 44- 48
21. Mazurck AJ, Rac B, Hann S: Rocuronium versus Succinylcholine: Are they equally effective during rapid sequence induction of anaesthesia; Anaesthesia- Analgesia 1998, 87: 1259-62.
22. Sharma S., Mehrotra A Comparison of intubating conditions after Rocuronium and suxamethonium. 2000.
23. Foldes F.F., Nagashima H, Nguyen H, Ohta Y.: The clinical pharmacology of Org. 9426 In: Eds. Bowman W.C. et al neuromuscular blocking agents: Past, present and future. Excerpta Medica Amsterdam, 1990; 171-181.
24. Muir A.W., Houston J. Green: Effects of a new neuromuscular blocking agent (Org 9426) in anaesthetized cats and pigs and in isolated nerve muscle preparations. Br. J. Anaesth. 1989; 63: 400-410.
25. Cason B, Baker D.G., Hickey RF, Miller RJ: Cardiovascular and neuromuscular effects of three steroidal neuromuscular blocking drugs in dogs (Org 9619, Org 9426, Org 9991). Anesth Analg. 1990; 70: 382-388.
26. Quill T.J. Begin M,Glass ISA: Clinical response to Org. 9426 during isoflurane anaesthesia. Anesth. Analg. 1991; 72: 203-206.
27. Robertson E.N., Hull T.M.: A comparison of Rocuronium and Vecuronium: the pharmacodynamic, cardiovascular and intraocular effects: European Journal of Anaesthesia 1994; 11: 116- 121.
28. Huizinga A.C.T., Vandenbram R.H.C., Wierda J.M.K.H. Intubating conditions and onset of neuromuscular block of Rocuronium (Org. 9426); a comparison with suxamethonium, Acta Anaesthesiol Scand. 1992; 36: 463-468.
29. Levy JH, Davis G, Duggan J Szlam F: Determination of the hemodynamics and histamine release of Rocuronium (Org. 9426) when administered in increased doses under N_2O/ O_2sufentanil anaesthesia. Anesth Analg. 1994; 78: 318-321.

AUTHORS:

1. Ajit P. Singh
2. Alok P. Singh Baghel
3. Devendra Singh Kushwah

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Pharmacology, NSCB Medical College, Jabalpur.
2. Assistant Professor, Department of Anaesthesia, S.S. Medical College, Reewa.
3. Assistant Professor, Department of Pharmacology, NSCB Medical College, Jabalpur.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Devendra Singh Kushwah,
c/o. H.S. Singotia,
HIG. 161, Dhanvantri Nagar,
Jabalpur, (M.P.).
Email- dev_singh433@yahoo.com

Date of Submission: 02/12/2013.
Date of Peer Review: 02/12/2013.
Date of Acceptance: 12/12/2013.
Date of Publishing: 26/12/2013