Original Research Article

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Effects of Rocuronium Bromide and Suzxamethonium on Intubating Conditions: A Comparative Study

Sushil Vishnu Boraste[1], Nitin Dagdu Waghchoure[2]

[1,2]Assistant Professor, Department of Anaesthesiology, SMBT Institute of Medical Sciences and Research Centre, Dhamangoan, Nashik, Maharashtra 422403, India.

Abstract

Background: In general anaesthesia rapid and safe endotracheal intubation is critical. Aspiration of gastric content, during induction and intubation is a major risk factor which determines the outcome of anaesthesia. The ideal muscle relaxant is the one who produces faster onset of action; resultant in to reduction in the incidence of side effects. With this background present study was done to compare the effects of rocuronium and suxamethonium on intubating conditions.

Material and Methods: Total 90 ASA grade I and II patients who were scheduled to laparoscopic appendectomy under general anesthesia selected. These patients were randomly divided in to 3 groups consisting 30 patients in each. Group I (S60) patients received suxamethonium 2mg/kg with intubation attempted at 60 seconds and patients of groups II (R60) and III (R90) received rocuronium0.6 mg.kg, with intubation attempted at 60 seconds and rocuronium 0.6 mg.kg, with intubation attempted at 90 seconds respectively.

Results: The intubating conditions were acceptable in all the patients belonging to group I (S60) and group III (R90), while 04 patients in group II (R60) had unacceptable intubating conditions. Rocuronium found haemodynamically stable as suxamethonium.

Conclusion: Rocuronium provides acceptable intubating conditions as comparable with suxamethonium with no incidence of side effects or complications.

Keywords: Rocuronium; Suxamethonium; Intubating Conditions; Appendectomy.

Introduction

Tracheal intubation is a routine procedure to ensure a safe protected airway through which one can provide intermittent positive pressure ventilation during all procedures carried out under general anesthesia.

Aspiration of gastric content, during induction and intubation is a major risk factor which determines the outcome of anesthesia. The ease with which endotracheal intubation is performed depends upon degree of muscle relaxation, depth of anesthesia and skill of anaesthesiologist [1]. The ideal muscle relaxant is the one who produces faster onset of action; resultant in to reduction in the risk of side effects.

Traditionally, suxamethonium is being used to facilitate rapid sequence induction and endotracheal intubation. Although suxamethonium has rapid time of onset and brief duration of action, it also produced many adverse systemic effects including cardiac dysrhythmias, muscle fasciculations, hyperkalemia, elevated intracranial, intra-gastric and intra-ocular pressure. Different techniques have been tried, including 'priming' [2] to decrease the effective onset time of nondepolarizing muscle relaxants like vecuronium, pancuronium or atracurium.

Corresponding Author: Nitin Dagdu Waghchoure, Assistant Professor, Department of Anaesthesiology, SMBT Institute of Medical Sciences and Research Centre, Dhamangoan, Nashik, Maharashtra 422403, India.
E-mail: wdnitin@gmail.com

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Rocuronium is a non depolarizing muscle relaxant and whose formula is based on vecuronium bromide. Some studies suggested that; unlike suxamethonium, rocuronium has little or no cardiovascular effects. In contrast to conventional anesthetic neither priming nor marked increased doses are required to achieve a rapid onset. Therefore, rocuronium could be potentially ideal for fast intubation, with no or minimum side effects, in all patients receiving general anesthesia. With this background the present study was conducted with following objectives; 1) To assess the intubating conditions achieved with rocuronium bromide and suxamethonium 2) To compare the changes in hemodynamic parameters due to both drugs.

Material and Methods

The present comparative study was conducted after institutional ethical committee's (IEC) approval. Patients were enrolled, after explaining the purpose and procedure of the study and written informed consent was obtained. Total 90 ASA grades' I and II patients scheduled to undergo laparoscopic appendectomy, under general anesthesia were selected. An increased risk of pulmonary aspiration, neuromuscular disease, medications known to influence neuromuscular function, anticipated difficulty with airway management was excluded from study. Selected patients were randomly divided in to 3 groups consisting 30 patients in each. Group I patients received suxamethonium and patients of groups II and III received rocuronium as follows.

Group I (S60): Suxamethonium 1.5 mg/kg with intubation attempted at 60 seconds;

Group II (R60): Rocuronium 0.6 mg.kg with intubation attempted at 60 seconds;

Group III (R90): Rocuronium 0.6 mg.kg with intubation attempted at 90 seconds.

All minimum necessary investigations were performed before commencing study. All the patients received tablet famotidine 40 mg orally at 10 pm. on the night before surgery and fasted overnight. On the day of surgery baseline pulse rate, blood pressure, body weigh were recorded. Intramuscular premedication in the form of injection glycopyrrolate 0.2 mg was given 30 minutes prior to induction of anesthesia. Inj. Midazolam 1.5 mg and inj.Butorphanol 1 mg given as intravenous premedication. Pre-oxygenation was carried out with 100% O_2 for 5 minutes. Anesthesia was induced with injection propofol2 mg/kg/IV. Abolition of eyelid and eyelash confirmed induction in all cases. Immediately after induction muscle relaxants were administered intravenously according to their dose in specified groups and time onset of apnoea noted. Laryngoscopy and intubation was attempted as specified for the groups i.e. at 60 seconds after the injection of suxamethonium of 2mg/kg in group I (S60) and at 60 and 90 seconds after injection of rocuronium of 0.6 mg/kg in group II (R60) and group III (R90) respectively.

Intubation conditions were assessed according to three point scales (0-2) and if the scores were in between 5 to 8 and 0 to 4, then it labeled as acceptable and unacceptable intubating conditions respectively (Table 1). If the patients having difficult intubating

Table 1: Assessment of intubation conditions

Sr. No	Variables	Conditions		
1	Jaw relaxation	Good	Incomplete	Poor
2	Vocal cord position	Full abducted	Moderately abducted	Slightly abducted
3	Reaction to intubation	None	Bucking	Gross movement
	Score	2	1	0
	Interpretations			
	Excellent (7 to 8)	Acceptable	Fair (2 to 4)	Unacceptable
	Good (5 to 6)		Poor (0 to 1)	

Table 2A: Age wise distribution of patients

Sr. No	Age groups (yrs)	No of patients		
		Group I (S60)	Group II (R60)	Group III (R90)
1.	20-25	23	19	18
2.	26-30	06	10	09
3.	31-35	01	01	03
	Total	30	30	30
	Mean ± Sd.	23.86±2.94	24.46±3.81	25.73±4.09

One way ANOVA F=2.057, P=0.13 Non significant

Table 2B: Weight wise distribution of patients

Sr. No	Weight groups (Kg)	No of patients		
		Group I (S60)	Group II (R60)	Group III (R90)
1.	40-55	17	17	18
2.	56-70	11	10	11
3.	≥ 71	02	03	01
	Total	30	30	30
	Mean ± Sd.	54±9.04	57.26±9.46	54.7±7.89

One way ANOVA F=1.135, p=0.32 Non significant

Table 3: Distribution according to mean apnoea onset time

Study groups	Mean apnoea time (Mean ± SD)
Group I (S60)	25.06 ± 6.89 *
Group II (R60)	32.83 ± 8.63 * #
Group III (R90)	29.76 ± 10.21 * #

* One way ANOVA: F=6.094 p=0.003 Significant
# Un paired t test: 1.258 d.f.=58, p=0.21 Non significant

Table 4: Intubating conditions and acceptability

Groups	Acceptable		Unacceptable		Total
	Excellent	Good	Fair	Poor	
Group I (S60)	30	00	00	00	30
Group II (R60)	15	11	03	01	30
Group III (R90)	30	00	00	00	30

Table 5: Intubating conditions

Study Groups	Intubating scores (Mean ± SD)
Group I (S60)	7.8 ± 0.4 * @ $
Group II (R60)	6.06 ± 1.55 * # $
Group III (R90)	7.5 ± 0.5 # @ $

*Tukey Kramer test: p=0.001 Significant, # Tukey Kramer test: p=0.00 1 Significant @ Tukey Kramer test: p=>0.05 Non significant $ One way ANOVA: F: 27.686 p=<0.0001 Significant

Table 6: Distribution according to mean pulse rate

Study groups	Pre-Op.	Just before induction	After induction	Just before laryngoscopy	Just after Intubation	1 Min later	5 Min. later	Post Op.
Group I (S60)	87.3±8.16*	91.22±9.54	95.2±9.20	96.83±8.82 *	109.03±111.20*	101.86±9.92	95.4±10.21	92.2 ±8.83
Group II(R60)	90.58±10.59$	94.7±10.93	103.46±11.14	108.00±11.14$	118.36±10.86 $	111.36±12.41	111.36±12.41	99.96±11.35
Group III(R90)	93.13±8.83@	89.87±16.91@	98.96±10.51	104.53±14.05@	110.23 ±14.30	105.36±13.92	100.53±11.33	98.96 ±9.96

*One way ANOVA: F=39.574, p<0.001 Significant, $One way ANOVA: F=50.080, p<0.001 Significant @One way ANOVA: F=14.218, p<0.001 Significant

Table 7: Distribution according to systolic blood pressure

Study Groups	Pre-Op.	Just before induction	After induction	Just before laryngoscopy	Just after Intubation	1 Min. later	5 Min. later	Post Op.
Group I (S60)	126.86 ±13.19@	125.33±15.86	114.6 ± 15.70	116.33±13.95	139.93±14.24@	122.13±11.23	114.13±11.28	125.6±11.73
Group II (R60)	121.33 ±10.87#	121.66±9.67	113.53±11.25	112.86± 8.44	135.2± 13.72#	118.4±11.72	113.06±11.35	119.66±8.68
Group III (R90)	120.93 ±11.09 *	115.12±21.81	111.46±12.09	114.26±13.88	132.53 ±12.39*	119.6±14.58	112.8±8.89	123.26±11.99

@ Unpaired 't' test: t=3.668 d.f=58, p=0.0005 Significant
# Unpaired 't' test: t=4.340 d.f=58, p=0.0001 Significant
* Unpaired 't' test: t=3.821 d.f=58, p=0.0002 Significant

Table 8: Mean duration of action of intubating dose of relaxant

	Group I (S60)	Group II (R60)	Group III (R90)
Mean ± SD	7.8 ± 0.4 $ #	24.83 ± 3.62 $ #	25.86 ± 6.87 #
Statistical test	$ Unpaired 't' test: t=0.72 d.f:58, P 0.47 Non-significant # One way ANOVA: F=153.13, P=0.0001 Significant		

condition were managed according to difficult airway management protocol.

At the end of surgery residual neuromuscular blockage was reversed with injection neostigmine 0.05 mg/kg and atropine 0.02 mg/kg or glycopyrrolate 10µg/kg. Vitals were recorded before and after induction, 1 and 5 minutes after intubation and thereafter every 10 minutes throughout the surgical procedure in all the groups. Side effects and complication noted if any.

Data Analysis

Data coding and entry was done in Microsoft Excel spread sheets and descriptive and inferential statistical analysis was done by using SPSS version 21 (Statistical Package for Social Sciences) software. One way ANOVA, Tukey Kramer multiple comparison test, Un-paired 't' test, mean, standard deviation used and differences wereconsidered to be significant if p value was < 0.05.

Results

In present study total 90 patients aged 20-50 years of ASA Grade I and II, scheduled for laparoscopic appendectomy under general anesthesia were selected and divided in equally in three groups.

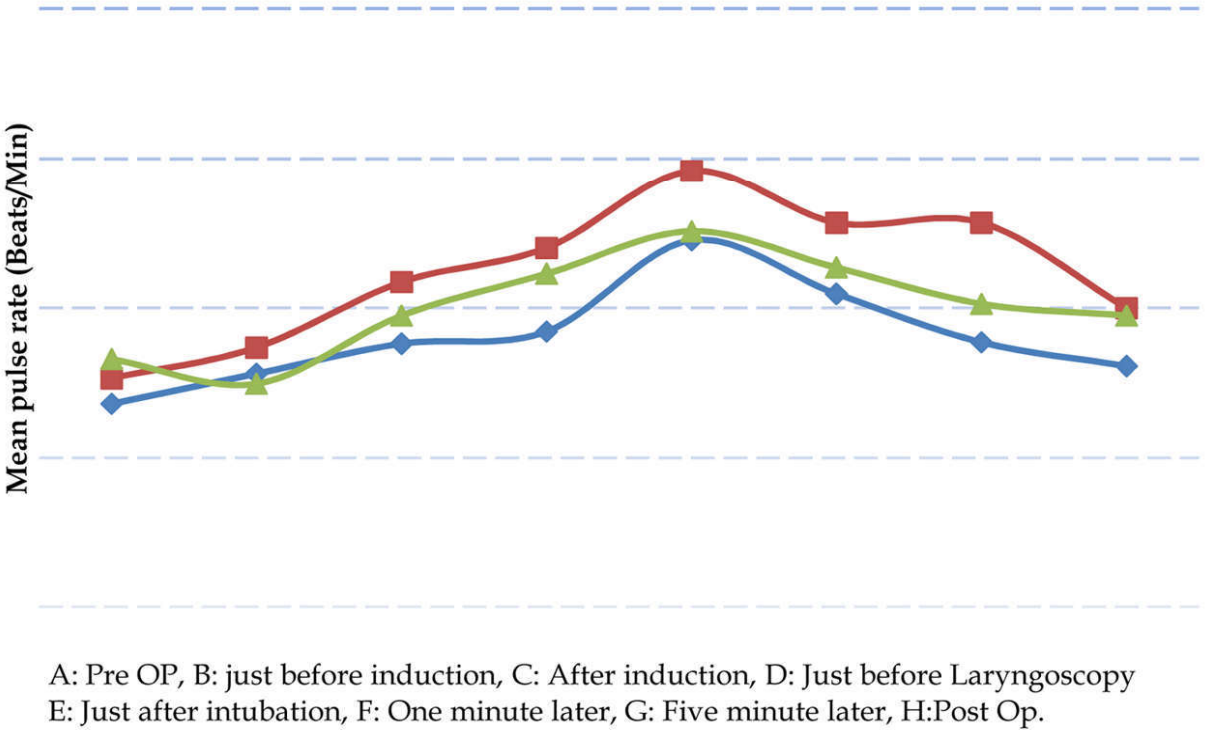
No statistical significance was observed in between mean age of three study groups and also similar result showed with mean weight of the participants (Table 2).

The mean time of apnoea onset of suxamethonium group I (S60) was 25.06±6.89, for group II (R60) and group III (R90) it was32.83±8.63 and 29.76±10.21 respectively. Statistically significant difference was observed in between mean apnoea onset time of all three groups (S60, R60 and R90) but non-significant difference was seen in between two rocuronium groups. i.e. R60 and R90 (Table 3).

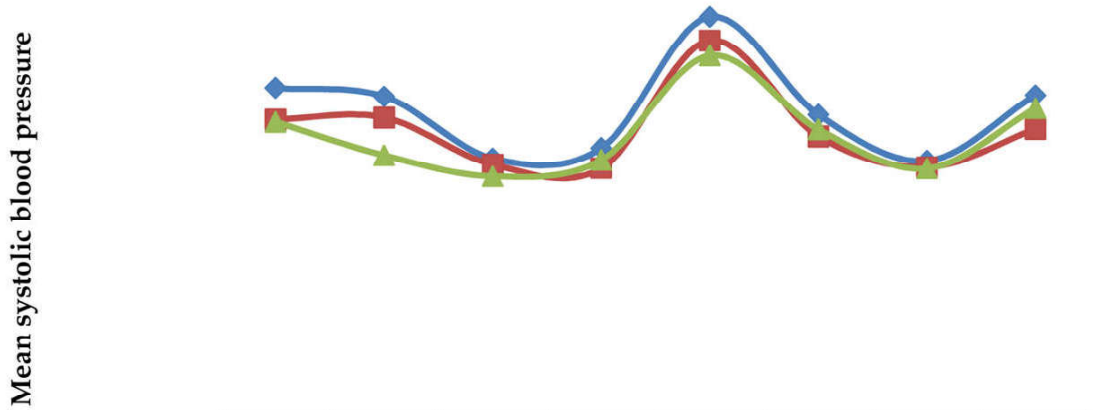
The intubating conditions were acceptable in all the patients belonging to group I (S60) and group III (R90), while 26 patients in group II (R60) had acceptable conditions and remaining 4 patients had unacceptable intubating conditions (Table 4). On statistical analysis the significant difference was observed in the mean intubating score of group I and group II, group II and group III and All three groups except group I and group III (Table 5).

In all three groups mean pulse found to be increased after giving muscle relaxant i.e. just before laryngoscopy and just after induction as compared pre operative reading (Graph 1). The difference found to be significant groups in all (Table 6).

The mean systolic blood pressure rose just after intubation as compared to basal reading. The difference between basal mean systolic blood pressure and mean blood pressure just after the intubation found to be statistical significant in all three study groups (Table 7). The mean systolic blood pressure started decreasing immediately after intubation and



Graph 1: Mean pulse pressure at various stages



	A	B	C	D	E	F	G	H
Group I (S60)	126.86	125.33	114.6	116.33	139.33	122.13	114.13	125.6
Group II (R60)	121.33	121.66	113.53	112.86	135.2	118.4	113.06	119.66
Group III (R90)	120.93	115.12	111.46	114.26	132.53	119.6	112.8	123.26

Graph 2: Systolic blood pressure at various stages

it felt below basal level at one minute after intubation (Graph 2).

The mean clinical duration of action of intubating dose of group I (S60), group II (R60) and group III (R90) were 7.8±0.4, 24.83±3.62 and 25.86±6.87 respectively. The duration of action of both rocuronium groups was more than that ofsuxamethonium and in these three group's difference was found statistically significant ($P < 0.0001$) but was not significant in group II (R60) and group III (R90). (P 0.47) (Table 8). No side effects or complications were encountered in present study also there was no incidence of regurgitation or aspiration of gastric content.

Discussion

Muscle relaxation is used to serve two purposes: one to secure the patients airway quickly and smoothly with minimum chances of hypoxia, regurgitation and aspiration of gastric contents and other to provide surgical relaxation [2]. The ideal neuromuscular blocking agent is one which has brief duration of action, provides profound relaxation and is free from hemodynamic changes.

In present study total 90 patients included randomly who were scheduled for laparoscopic appendectomy under general anesthesia. The mean age of patients was 23.86±2.94 years in group I (S60), 24.46±3.81 years in group II (R60) and 25.73±4.09 in group III (R90). On other hand the mean body weight in group I (S60), group II (R60) and group III (R90) were 54±9.04, 57.26±9.46 and 54.7±7.89 kg respectively. The mean age and weight in all age groups were comparable i.e. no statistical significant difference was observed.

Apnoea onset time is defined as the time interval between injection of muscle relaxant and complete cessation of spontaneous respiration. In this study apnoea time was clinically evaluated. Huizinga et.al [3] used relaxograph to measured apnoea time. In present study mean apnoea onset time was less in suxamethonium group than in both rocuronium groups and the difference were statistical significant; while mean apnoea onset time showed no statistical difference in between two rocuronium groups.

Intubating conditions were acceptable in all patients of group I (S60) and group III (R90) while out of 30 patients of group II (R60), 26 and 4 patients had acceptable and unacceptable conditions respectively. In a study conducted by Wierdaet al [4] found that intubating conditions were excellent at 1 minute and they also found that the mean time to 75% block was faster in rocuronium group compared to vencuronium. Similarly comparable results were obtained in other studies like Cooper et. al [5], Huizinga et. al [3] and Sehgal et. al. [6].

Stability of vital parameters like pulse and blood pressure are highly desirable during anesthetic management. In present study pulse rate and systolic blood pressure were recorded at various stages. In this study mean pulse rate was found to be increased after giving relaxant as compared to pre operative values. The difference between basal mean systolic blood pressure and mean blood pressure just after the intubation found to be statistical significant in all three study groups ($P < 0.001$). Even after decreased in pulse rate 1 minute after intubation it remains high to basal values comparatively. Booth et. al. [7] showed transient to moderate increased heart rate at a dose of 0.6 mg/kg of rocuronium. In a study conducted by Cooper R et. al. [5] no significant change in heart rate was found with rocuronium 0.6 mg/kg.

The current study showed raised in mean systolic blood pressure just after intubation in all three groups and it was statistically significant as compared to basal values. The mean systolic blood pressure decreased at 1 minute after intubation and remained nearly same as basal level in all three groups. Cooper R et. al. [5] reported no significant change in blood pressure.

The clinical duration of action of muscle relaxant was defined as the time interval between injection of muscle relaxant and initiation of spontaneous diaphragmatic activity with increased resistance felt during ventilation. In present study mean clinical duration of action was more in both rocuronium groups as compared to suxamethonium group and difference was found statistically significant ($P < 0.0001$) similar results were observed by Cooper et. al. [5], Huizinga et. al. [3], Magorian et. al .[8]etc.

Conclusion

Rocuronium provides produces comparable results as suxamethonium with no incidence of side effects or complication.

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