Comparison of Suxamethonium with Rocuronium for Endotracheal Intubation

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Research Article

Abstract: **Background**: In the present day practice, muscle relaxation is used for facilitation of endotracheal intubation and to provide muscle relaxation throughout the surgery. Rocuronium bromide is a nondepolarizing aminosteroidal, vecuronium derivative drug with intermediate duration Side effects of suxamethonium are not observed with rocuronium bromide. Present study is aimed at determining the efficacy of rocuronium for routine endotracheal intubation within 60 seconds in general population**. Objective:** To compare the intubating conditions of rocuronium bromide with suxamethonium chloride. **Methods:** Patients were premedicated with inj. midazolam 0.05mg kg^{-1}, inj. Pentazocine 0.5mg kg^{-1} and inj. glycopyrolate 0.005 mg kg^{-1}, after which patients were preoxygenated for 03min with 100% oxygen. Induction was done with inj.thiopentone at the dose of 5mg kg^{-1}. After loss of eye lash reflexes, muscle relaxant (rocuronium bromide/ suxamethonium chloride) was given as iv bolus. Intubating conditions were assesed at 60 seconds after injection of muscle relaxant, if intubating conditions were unsatisfactory, then repeat scopy was attempted after every 30sec interval (90, 120, 150 and 180 sec). Bag mask ventilation with 100% oxygen was continued till the repeat scopy was attempted. Monitoring of pulse rate, oxygen saturation, systolic and diastolic blood pressures, electrocardiogram were recorded immediately after laryngoscopy, at 5 and 10min after intubation. **Results:** Suxamethonium showed acceptable intubating conditions in 100% of cases at 60 Sec. out of which 93.24% were excellent. In rocuronium Group 100% of cases had acceptable intubating conditions at 60 sec. out of which 77.7% excellent and 22.2% good intubating conditions were observed. **Conclusion:** Rocuronium bromide at 0.9 mg kg^{-1} is a safe and good alternative for suxamethonium 1.5mg kg^{-1} for endotracheal intubation at 60 seconds. We advice rocuronium bromide 0.9 mg kg can be used for Rapid Sequence induction and Intubation, if there is no prediction of difficult intubation.

Keywords: Anaesthesia, intubating conditions, neuromuscular blockers, succinylcholine, rocuronium bromide.

Introduction

Suxamethonium has got rapid onset, profound muscle relaxation and short duration which made it drug of choice for tracheal intubation.[1,2,] It has got many side effects like hyperkalemia, bradycardia, nodal rhythm, ventricular dysrhythmias, myalgia, rise in IOP, intra gastric and ICP, malignant hyperthermia.[1,4,5,6] If suxamethonium is undesirable or contraindicated then non depolarizing muscle relaxant drugs are used for endotracheal intubation,[1,3] therefore research is still going on for an ideal neuromuscular blocking agent focused on non-depolarizing drugs. Recently developed NDMR agents are of intermediate duration of action and major extent free from adverse effects of suxamethonium. Rocuronium bromide was recently introduced by Dr. Sleigh and late Dr. Savage in 1990[4] and approved by FDA in 1994. It is a non depolarizing aminosteroidal, vecuronium derivative drug with intermediate duration[1,4,11]. Intubating dose of rocuronium in ED95 X 2 onset of action is 83±33 sec and ED95 X 3 dose onset is equal to that of suxamethonium 55±14 sec.[1,4,8] Side effects of suxamethonium are not observed with rocuronium bromide.[1,4,7,8] Present study is aimed at determining the efficacy of rocuronium for routine endotracheal intubation within 60 seconds in general population.

Methods

It is a prospective, randomized, non-blind and controlled study; which was carried out in 90 adult patients of age group 20 to 60 years of either sex, who were posted for elective surgery, after getting approval from the hospital ethical committee. The study population was randomly divided into two groups consisting of 45 patients in each. Group I(R) patients received rocuronium at the dose of 0.9 mg kg^{-1} and Group II(S): patients received suxamethonium at the doses of 1.5 mg kg^{1}. Patients with anticipated difficult intubation, neuromuscular disease or having family history of neuromuscular disease, Morbid obesity, patients with the history of gastro esophageal reflux disease and liver disease increased ICP and IOP, renal disease, hyperkalemia, patients receiving drugs known to interfere with the action of neuromuscular blocking agents.(Eg: Calcium channel blockers, Magnesium sulphate, anticonvulsant drugs) were excluded from the study. Patients were explained in their own language, about the purpose of the study and the procedure. Informed and written consent was obtained from all. Routine blood and urine investigations were done. After thorough pre anaesthetic evaluation a day before surgery patients were advised to be nil by mouth 6hrs before surgery and cap.omeprazole 40mg night before surgery. On the day of surgery, base line pre

operative PR, BP, SPO2and ECG were recorded. They were premedicated with inj. midazolam 0.05mg kg^{-1}, inj. Pentazocine 0.5mg kg^{-1} and inj.glycopyrolate 0.005 mg kg^{-1}, after which patients were preoxygenated for 03min with 100% oxygen.[9] for induction inj.thiopentone was given at the dose of 5mg kg^{-1}. After loss of eye lash reflexes, muscle relaxant (rocuronium bromide/suxamethonium chloride) was given as iv bolus. Laryngoscopy was attempted at 60 seconds after injection of muscle relaxant, if intubating conditions were unsatisfactory, then repeat scopy was attempted after every 30sec interval (90, 120, 150 and 180 sec). Bag mask ventilation with 100% oxygen was continued till the repeat scopy was attempted.[2] Patients were intubated by an anesthesiologist with 2yrs of experience with proper size endotracheal tube (cuffed), after confirming bilateral equal air entry the tube was firmly secured. Maintenance of anaesthesia was done with 60% oxygen, 40% nitrous oxide, Sevoflurane and IPPV was given with Bain's circuit. Monitoring of pulse rate, oxygen saturation, systolic and diastolic blood pressures, electrocardiogram were recorded immediately after laryngoscopy, at 5 and 10min after intubation. Muscle relaxation was maintained subsequent doses of NDMR drug. At the end of surgery, all anesthetics were stopped and 100% oxygen was resumed. After appearing of spontaneous respiratory efforts patient was reversed with slow iv injection of neostigmine 0.05mg kg^{-1} and glycopyrolate 0.001mg kg^{-1}. When respiration became normal and tidal volume was adequate, extubation was done. After extubation, patients were oxygenated with 100% oxygen for 5min and shifted to post operative ward. Assessment of intubating conditions was done based on cooper *et al*' scoring system.[2]

Table 1: Cooper *et al*' scoring system

Score	Jaw relaxation	Vocal cord movements	Response to Intubation
0	Poor	Closed	Severe coughing and bucking
1	Nominal	Closed	Mild coughing
2	Moderate	Moving	Slight diaphragmatic movements
3	Good	Open	No response to intubation

Total score 9. (8- 9= Excellent, 6- 7 Good, 3-5 =Poor and 0-2 bad).

Individual scores were added to give overall intubation score. An intubation score of 8-9 was considered excellent, 6-7 good, 3-5 poor and 0-2 bad. Good to excellent intubation scores were taken as clinically acceptable intubating conditions.

Statistical analysis

- Statistical analysis was done using the software SPSS version 16.
- Summary measures like mean and SD were used for all variables.
- Unpaired't' test was used for comparing between two groups.
- Results were found to be significant if 'p' value was <0.05

Results

90 eligible patients were enrolled in the study, 45 in each group. There were no significant differences in patient characteristics among the two groups. Intubation was completed successful in all patients. Suxamethonium showed acceptable intubating conditions in 100% of cases at 60 Sec. out of which 93.24% were excellent. In rocuronium group 100% of cases had acceptable intubating conditions at 60 sec. out of which 77.7% excellent and 22.2% good intubating conditions were observed. There was no significant difference in jaw relaxation & vocal cord movements in both groups. there is significant difference in response to intubation. In rocuronium group 06 (13%) patients had mild coughing on intubation where as no patients had in suxamethonium group. In group-I 11 (24%) patients had slight diaphragmatic movements on intubation where as in group-II only 05 (11%) patients had. There were significant hemodynamic changes in group II post muscle relaxant and intubation.

Table 2: Sex distribution in Rocuronium Group (I) and Suxamethonium Group (II)

SEX	Rocuronium Group-I		Suxamethonium Group-II	
	No.	%	No.	%
Male	14	31%	14	31%
Female	31	69%	31	69%
Total	**45**	**100%**	**45**	**100%**

Table 3: Age and weight distribution in Group I (R) and Group II (S)

	Group I (R)		Group II (S)	
	Mean	SD	Mean	SD
Age	31.67	10.81	32.02	10.64
Weight	49.43	9.52	49.78	9.34

Table 4: Comparison of total intubation score among Group I (R) and Group II (S)

Total Intubation score	Group I		Group II		Chi-square value	p-value
	No.	%	No.	%		
Poor (3-5)	00	00%	00	00%	**5.89**	**0.042 S**
Good(6-7)	10	22.2 %	03	06.6%		
Excellent (8- 9)	35	77.7 %	42	93.24 %		
Mean ± SD	8.22± 0.97		8.71±0.59			

Table 5: Comparison of jaw relaxation among Group I (R) and Group II (S) at 60sec muscle relaxant

State	Group I		Group II		Chi-square Value	p-value
	No.	%	No.	%		
Minimal	0	00%	0	00%	**0.212**	**0.654 NS**
Moderate	3	07%	2	04%		
Good	42	93%	43	96%		
Total	**45**	**100%**	**45**	**100%**		

Table 6: Comparison of state of vocal cords at intubation among Group I (R) and Group II (S) at 60 sec after muscle relaxant

State	Group I		Group II		Chi-square Value	p-value
	No.	%	No	%		
Closing	0	0	0	0	000	P= 1 **NS**
Moving	6	13%	6	13%		
Open	39	87%	39	87%		
Total	**45**	**100%**	**45**	**100%**		

Table 7: Comparison of response to intubation among Group I (R) and Group II (S) at 60sec after muscle relaxant

Response	Group I		Group II		Chi-square Value	p-value
	No.	%	No.	%		
Mild Coughing	6	13%	0	00%	**10.4**	**0.006 S**
Slight Diaphragmatic Movement	11	24%	05	11%		
None	28	63%	40	88.8%		
Total	**45**	**100%**	**45**	**100%**		

Table 8: Comparison of PR in Rocuronium Group (I) and Suxamethonium Group (II) at pre-operative, after muscle relaxant, 0 min, 5 min and 10 min after intubation

	Group	Mean±S.D.	t-value	p-value
PR pre-operative	Group I	88.35±16.15	0.359	P= 0.72 **NS**
	Group II	87.24±13.02		
PR after muscle relaxant	Group I	103.06±15.45	0.757	P= 0.45 **NS**
	Group II	105.38±13.45		
PR at 0 min of Intubation	Group I	110.98±11.22	0.223	P= 0.223 **NS**
	Group II	110.37±14.82		
PR 5min after Intubation	Group I	100.64±11.49	0.35	P= 0.73 **NS**
	Group II	101.62±14,62		
PR 10min after Intubation	Group I	94.35±11.89	0.467	P= 0.64 **NS**
	Group II	93.04±11.24		

Table 9: Comparison of SBP in Rocuronium Group (I) and Suxamethonium Group (II) at pre-operative, after muscle relaxant, immediately (0 min), 5 min and 10 min after intubation

	Group	Mean±S.D.	t-value	p-value
SBP pre-operative	Group I	120.78±11.74	1.797	P=0.079 **NS**
	Group II	117.60± 10.12		
SBP after muscle relaxant	Group I	124.82± 12.64	2.78	P=0.008 **S**
	Group II	132.51 ± 13.77		
SBP immediately after Intubation	Group I	130.71± 15.37	3.07	P=0.004 **S**
	Group II	138.89±11.45		
SBP 5min after Intubation	Group I	117.22±13.29	2.37	P=0.022 **S**
	Group II	122.64±11.73		
SBP 10min after Intubation	Group I	112.00±8.86	2.74	P=0.009 **S**
	Group II	117.50±10.57		

Table 10: Comparison of DBP in Rocuronium Group (I) and Suxamethonium Group (II) at pre-operative, after muscle relaxant, 0min, 5min and 10min after intubation

	Group	Mean±S.D.	t-value	p-value
pre-operative DBP	Group I	76.60± 8.58	1.90	P=0.072 **NS**
	Group II	74.15±8.81		
DBP after muscle relaxant	Group I	80.33±11.27	1.95	P=0.057 **NS**
	Group II	84.96±10.61		
DBP 0 min of Intubation	Group I	86.60±13.21	1.31	P=0.198 **NS**
	Group II	89.95±9.48		
DBP 5min after Intubation	Group I	73.96±11.68	2.92	P=0.006 **S**
	Group II	79.35±9.44		
DBP 10min after Intubation	Group I	71.84±10.18	1.27	P=0.208 **NS**
	Group II	74.17±9.16		

Discussion

In the present study sex distribution in both groups were comparable – (14 males and 31 females in each group.) Age and weight distribution was also comparable in both groups. (Mean age in Group I 31.67% and in Group II 32.02%. Mean weight in Group I (R) 49.43% and in Group II (S) 49.78). The intubating conditions were assessed by 'Cooper *et al*' scoring system. In our study suxamethonium showed acceptable intubating conditions in 100% of cases at 60 Sec. out of which 93.24% were excellent our findings are similar with study of 'Shizan Hamid *et al*', 'Aparna Shukla *et al*', 'K. K. Bhati *et al*' and 'Mishra M.N. *et al*'. They also found good to excellent intubating conditions in most of the patients at 60 Sec. In rocuronium Group I (R) 100% of cases had acceptable intubating conditions at 60 sec. Out of which 77.7% were excellent and 22.2% were good. Our findings are similar with 'Magorian *et al*', 'Weiss JH *et al*', 'Aditi Ponskhe *et al*', 'R.K. Verma *et al*' and 'Shizan H.F. *et al*'. In the present study Group I, at 60 sec. good jaw relaxation was noted in 93% of cases. This

finding was not similar with other studies i.e. 'Mishra *et al*' (63.6%), 'Jamshid *et al*' (68.8%) and 'Liaquatunnoor *et al*' (60%). This difference might be because they have used lower dose of rocuronium (0.6mg kg^{-1}) for endotracheal intubation. In Group II (S) at 60 sec. good jaw relaxation was noted in 96% of cases. This finding was similar with 'Mishra *et al*' (86.7%) and 'Jamshid *et al*' (81%). In the present study at 60 sec. in Group I(R) open vocal cords found in 87% of cases. This finding was similar with 'Mishra *et al*' (93.3%). This finding was not similar with 'Jamshid *et al*' (60%), 'Liaquatunnoor *et al*' (56.7%).This difference in Vocal cord relaxation might be because they have used less dose of rocuronium (0.6 mg kg^{-1}).In our study, in Group II (S) open vocal cords were found in 87% of the cases. This finding was similar with 'Jamshid *et al*' (80%). In the present study at 60 sec. in Group I (R) mild coughing was noted in 13% of the cases. In 24% of cases there was slight diaphragmatic movements were observed. Our findings were similar with 'Jamshid *et al*' (28%) and not correlating with the study of 'Mishra *et al*' (56.6%) and 'Liaquatunnoor *et al*' (56.7%).This difference might be because they have used lower dose of rocuronium (0.6 mg kg^{-1}). In Group II (S) at 60 sec. slight diaphragmatic movements were observed in 11.2% of the cases. In the present study pre-operative values of PR and BP were taken as control. In Group I (R) mean PR increased to 15 bpm from preoperative value to just after muscle relaxant. In Group II (S) mean PR increased to 17 bpm from preoperative value just after muscle relaxant. There was no significant difference noted in mean PR from preoperative value to just after muscle relaxant in both groups. In Group I (R) there was increase in mean PR by 22bpm from base line preoperative value at 'O' min of intubation. In Group II (S) there was increase in mean PR by 23bpm from base line preoperative value at 'O' min of intubation. In Group I (R) there was increase in mean PR by 12bpm from base line preoperative value at '5' min of intubation. In Group II (S) there was increase in mean PR by 14bpm from base line preoperative value at '5' min of intubation. In both groups (Group I & II) there was increase in mean PR by 6bpm from base line preoperative value to 10min after intubation. There was rise in mean PR in both groups from base line preoperative value to just after muscle relaxant, 0 min, 5min and 10min after intubation. The rise in mean PR was similar in Group I & II. There was no significant difference noted in mean PR in both groups. These findings were similar with other studies i.e. 'K.K. Bhati *et al*'. In their study they have observed rise in mean PR from base line preoperative value at just after muscle relaxant, peaks at '0' min of intubation and declined to base line value at 5 min after intubation.

In the present study in Group I (R) there was rise in mean SBP by 4mm of Hg from base line preoperative value at just after muscle relaxant. In Group II (S) there was rise in mean SBP by 15mm of Hg from base line preoperative value at just after muscle relaxant. This difference of rise in mean SBP was more in Group II (S) as compared to Group I (R). This can be explained on the basis of stimulation of autonomic ganglion and more histamine release by suxamethonium. There was increase in mean SBP by 10mm of Hg in Group I (R) from base line preoperative value at immediately after intubation. There was increase in mean SBP by 21mm of Hg in Group II (S) from base line preoperative value at immediately after intubation. This increase in mean SBP after intubation is due to stress response i.e. stimulation of sympathetic nervous system during laryngoscopy and tracheal intubation. In Group I (R) mean SBP was decreased by 3mm of Hg at 5min after intubation from baseline preoperative value. In Group II (S) mean SBP was raised by 5mm of Hg at 5min after intubation from baseline preoperative value. This difference might be due to stimulation of autonomic ganglion by suxamethonium. In Group I (R) mean SBP decreased by 8mm of Hg at 10min after intubation from baseline preoperative value. In Group II (S) mean SBP returned to base line preoperative value at 10min after intubation. This finding in Group I (R) is similar with 'K.K. Bhati *et al*', where mean SBP returned to preoperative value at 5min after intubation. In the present study in Group I (R) mean DBP was increased by 4mm of Hg just after giving muscle relaxant from preoperative value. In the present study in Group II (S) mean DBP was increased by 10mm of Hg just after giving muscle relaxant from preoperative value. In Group I (R) mean DBP was increased by 10mm of Hg at 0min of intubation from preoperative value. In Group II (S) mean DBP was increased by 15mm of Hg at 0min of intubation from preoperative value. In Group I (R) there was decrease in mean DBP by 3mm of Hg at 5min after intubation from base line value. In Group II (S) there was decrease in mean DBP by 5mm of Hg at 5min after intubation from base line value. In Group I (R) there was decrease in mean DBP by 5mm of Hg at 10min after intubation from base line value. In Group II (S) there was decrease in mean DBP to base line value after 10min of intubation. There was rise in mean DBP from base line preoperative value after muscle relaxant and at 0min of intubation in both groups. There was decline in mean DBP to base line pre operative value in Group I (R) at 5min after intubation, where as in Group II (S) at 10 min after intubation. This rise in men DBP in Group II (S) slightly more than Group I (R). This finding was similar with 'K.K. Bhati *et al*'. This suggests, that rocuronium was hemodynamically more stable.

Conclusions

- Suxamethonium chloride 1.5 mg kg^{-1} produced excellent intubating conditions in 93.2% and good intubating conditions in 6.8% patients at 60 seconds.
- Rocuronium bromide 0.9 mg kg^{-1} produced 77.7% excellent and good intubating conditions in 22.2% patients at 60 seconds.
- More hemodynamic stability is obtained with rocuronium bromide than suxamethonium chloride.
- Rocuronium bromide at 0.9 mg kg^{-1} is a safe and good alternative for suxamethonium 1.5mg kg^{-1} for endotracheal intubation at 60 seconds.
- We advice rocuronium bromide 0.9 mg kg can be used for Rapid Sequence induction and Intubation, if there is no prediction of difficult intubation.
- With availability of sugammadex (SRBA) in India, in the future rocuronium bromide can replaces suxamethonium chloride for difficult intubation.

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