



COMPARATIVE STUDY OF ROCURONIUM AND SUCCINYLCHOLINE FOR RAPID SEQUENCE INDUCTION OF ANAESTHESIA IN EMERGENCY

Anaesthesiology

Dr. Seema*

Senior Resident, Department of Anaesthesia, PGIMS, Rohtak-124001, Haryana, India.

*Corresponding Author

**Dr. Deepika
Budhwar**

Junior Resident, Department of Anaesthesia, PGIMS, Rohtak-124001, Haryana, India.

ABSTRACT

Background: Rapid sequence induction (RSI) is the technique of choice in emergency situations in the patients with full stomach. Succinylcholine is gold standard neuromuscular blocking agent of choice for RSI.

Objective: To determine the efficacy of rocuronium bromide 0.9 mg/kg in comparison with succinylcholine 1.0 mg/kg for RSI in adult patients undergoing emergency surgery.

Material and Methods: A prospective study conducted at tertiary care hospital in department of Anaesthesia from January 2019 to April 2020. A total of 60 patients undergoing emergency surgery requiring general anesthesia were randomly divided into two groups of 30 each after a thorough pre-anesthetic assessment.

Result: Succinylcholine 1.0 mg/kg produced excellent intubating conditions in 100% of the patients. Rocuronium bromide 0.9 mg/kg produced excellent intubating conditions in 90% of the patients and good conditions in 10% of the patients.

Conclusion: Rocuronium bromide in dose of 0.9 mg/kg produce satisfactory intubating conditions which are comparable to succinylcholine. It may be considered as a suitable alternative to succinylcholine in RSI when succinylcholine is contraindicated.

KEYWORDS

Rapid sequence induction, Succinylcholine, Rocuronium

INTRODUCTION

Rapid sequence induction (RSI) is the technique of choice in emergency situation in the patients with full stomach to prevent gastric aspiration. The ideal neuromuscular blocking agent for RSI should have a rapid onset, short duration of action and provide profound relaxation free from hemodynamic changes¹. Traditionally, succinylcholine a depolarizing muscle relaxant has been the gold standard neuromuscular blocking agent of choice for RSI. However, it is associated with many adverse effects like bradycardia, hyperkalemia, myalgia, hyperpyrexia, increased intraocular and intragastric pressures. It is also contraindicated in certain conditions like neuromuscular diseases, burns which may trigger malignant hyperthermia². To overcome these drawbacks, the search for an ideal neuromuscular blocking agent is focused on nondepolarizing type of relaxants which can provide intubating conditions similar to that of succinylcholine. Rocuronium bromide is 2 morpholino 3-disacetyl 16 N-allyl pyrrolidino derivative of vecuronium. It has a more rapid onset of action compared to other non depolarizing muscle relaxants i.e. vecuronium and atracurium and is devoid of any adverse effects that are commonly seen with succinylcholine³.

The present study was undertaken to determine the efficacy of rocuronium bromide 0.9 mg/kg in comparison with succinylcholine 1.0 mg/kg for RSI in adult patients undergoing emergency surgeries by comparing the intubating conditions.

METHODOLOGY

After the approval by institutional ethical committee a total of 60 patients were enrolled into study after obtaining written informed consent from them and they were randomly divided into two groups of 30 each after a thorough pre-anesthetic assessment.

INCLUSION CRITERIA:

All ASA Physical status I and II patients of either gender, aged between 18-65 years scheduled for emergency surgery under general anesthesia.

EXCLUSION CRITERIA:

Modified Mallampatti Airway Classification III & IV, morbidly obese, pregnant women, neuromuscular disease, patients with comorbid conditions like coronary artery disease, diabetes mellitus, hypertension, bronchial asthma, neurological diseases, myopathies, burns, dyselektroemia, family history of allergy & malignant hyperthermia and those taking drugs which might interact with the study drugs.

On arrival in the operation theatre, IV access was secured with 18G

cannula and ringer lactate infusion started. A multichannel monitor consisting of pulse oximeter, ECG, heart rate, non-invasive blood pressure and capnography was connected. The baseline pre-induction HR, oxygen saturation, SBP, DBP and capnography values were recorded. After premedication & pre oxygenation for 3 minutes, anaesthesia was induced with thiopentone sodium 5 mg/kg over a period of 20 second till there was loss of eyelash reflex. Cricoid pressure was applied after loss of consciousness followed by the rapid administration of the study drug. Groups S received injection succinylcholine 1.0 mg/kg and group R received rocuronium bromide 0.9 mg/kg. In both groups of patients, atraumatic laryngoscopy and oral endotracheal intubation was commenced at 60 seconds after the study drug was given with an appropriate sized cuffed endotracheal tube and intubating conditions were graded using the Cooper R et al scale (1992)⁴. The anaesthetist who secured airway was blinded by covering the patient with a drape sheet while another anaesthetist loaded the muscle relaxant and administered it. The time taken for laryngoscopy was kept within 15 seconds.

Table 1: Cooper R et al Scale (1992)

Score	Jaw relaxation	Vocal cords	Response to intubation
0	Poor(Impossible)	Closed	Severe coughing bucking
1	Minimal (Difficult)	Closing	Mild coughing
2	Moderate (Fair)	Moving	Slight diaphragmatic movement
3	Good(Easy)	Open	None
Total Score	Excellent 8-9, Good 6-7, Fair 3-5 Poor 0-2		

Endotracheal tube placement was confirmed by bilateral air entry and capnography. Controlled ventilation was started and anaesthesia was maintained with 33% oxygen, 66% nitrous oxide and sevoflurane. The clinical duration of action of initial bolus doses (from the time of administration of the study drug to the first respiratory attempt) was noted and subsequently all groups were maintained with a requisite dose of inj. vecuronium bromide till the completion of surgery. If laryngoscopy and intubation attempt failed at 60 seconds, it was repeated at 90 seconds and intubating conditions were assessed again. At the end of surgery all anaesthetic agents were stopped and 100% oxygen was given. Patients were reversed with inj. neostigmine 0.05 mg/kg and inj. glycopyrrolate 0.01 mg/kg and were extubated after ascertaining adequacy of reversal of neuromuscular blockade stopped and 100% oxygen was given.

RESULTS

The results were analyzed using SPSS v16 and Epi Info v7 was used for trend analysis. Qualitative data were analyzed using CHI-SQUARE test, ANOVA F-test; P value < 0.05 is significant.

Table 2: Demographic Data

	Group S	Group R	p-value with significance
Age (Mean $\pm$ SD)	38.70 $\pm$ 17.8	37.30 $\pm$ 16.0	0.824 (NS)
BMI (Mean $\pm$ SD)	23.49 $\pm$ 2.7	22.92 $\pm$ 3.11	0.329 (NS)
Gender (M/F)	18/12	19/11	0.615 (NS)

Table 3: Comparison of the overall intubating conditions

Intubating conditions	Group S		Group R		Chi square Test	p-value with significance
	N	%	N	%		
Excellent (8-9)	30	100	27	90	3.28	P = 0.08 Non significant
Good (6-7)	00	00	03	10		
Fair (3-5)	00	00	00	00		
Poor (0-2)	00	00	00	00		
Total	30	100	30	100		

Table 4: Comparison of jaw relaxation during intubation

Jaw relaxation	Group S		Group R		Chi square Test	p-value with significance
	N	%	N	%		
Good	30	100	26	86.6	2.68	P = 0.138 Non significant
Moderate	00	0	04	13.3		
Poor	00	0	00	0		
Minimal	00	0	00	0		
Total	30	100	30	100		

Table 5: Comparison of vocal cords at intubation

Vocal cords	Group S		Group R		Chi square Test	p-value with significance
	N	%	N	%		
Open	30	100	27	90%	3.28	P = 0.08 Non significant
Moving	00	0	03	10%		
Closing	00	0	00	0		
Closed	00	0	00	0		
Total	30	100	30	100		

Table 6: Comparison of response to intubation

Response to intubation	Group S		Group R		Chi square Test	p-value with significance
	N	%	N	%		
None	30	100	24	80%	2.064	P = 0.146 Non significant
Slight diaphragmatic movement	00	00	06	20%		
Mild coughing	00	00	00	00		
Severe coughing/ bucking	00	00	00	00		
Total	30	100	30	100		

Table 7: Duration of Action

	Group S	Group R	p-value with significance
DOA (mins)	3.5-7	26-37	P value = 0.0001
Mean $\pm$ SD	4.15 $\pm$ 1.12	31.50 $\pm$ 3.25	*Significant

DISCUSSION

Rapid sequence intubation is most effective means in securing the airway especially when there was usual risk of gastric aspiration.

In the present study we compared rocuronium bromide with succinylcholine in a quest to analyze whether it was sufficiently efficacious to obtain clinically acceptable intubating conditions at 60 seconds and so replace succinylcholine which was a time tested muscle relaxant of choice for rapid endotracheal intubation. Rocuronium has been used in doses of at least two to three times of the ED95 to obtain clinically acceptable intubating conditions comparable with succinylcholine at 60 seconds. The ED95 of rocuronium bromide was 0.3 mg/kg body weight⁷. Magorian T et al (1993) recommended that larger doses of rocuronium bromide (0.9-1.2 mg/kg) may be necessary to obtain optimal effect but, increasing the dose of rocuronium led to a longer duration of action⁶.

Rocuronium 0.9 mg/kg had a clinical duration of 53 $\pm$ 21 minutes and rocuronium 1.2 mg/kg had a clinical duration of 73 $\pm$ 32 minutes. Hence we decided to use rocuronium at a dose of 0.9 mg/kg in comparison with succinylcholine 1.0 mg/kg body weight in order to keep the duration of action to the minimum.

In our study succinylcholine 1.0 mg/kg produced excellent intubating conditions in 100% of the patients. The results were comparable to those studies conducted by Shukla A et al (2004)⁷, Misra MN et al (2005)⁸, Bhati K and Parmar Parikh K et al (2014)⁹, Gupta S and Kirbahar R (2010)¹⁰, Parikh K et al (2014)¹¹ and Khurshid H et al (2015)¹². Rocuronium bromide 0.9 mg/kg produced excellent intubating conditions in 90% of the patients and good conditions in 10% of the patients. This was in consensus to the studies conducted by Magorian T et al (1993)⁶, Dwivedi S and Dwivedi R (2015)¹³, Penchalaiah CH et al (2015)¹⁴, Heggeri VM et al (2015)¹⁵ and Khurshid H et al (2015)¹². Also at this dose we did not see moving vocal cords except in three patients. Slight diaphragmatic movements were also not observed except in six patients. These responses will be undesirable if the patient was considered to be at risk of pulmonary aspiration of gastric contents though no such complication arose in our study. With succinylcholine 1.0 mg/kg the clinical duration of action in this study was found to be with a mean duration of 4.15 $\pm$ 1.12 minutes. The minimum duration was 3.5 minutes and the maximum was 7 minutes.

The results were comparable with the studies by Shukla A et al (2004)⁷, Parikh K et al (2014)¹¹ and Khurshid H et al (2015)¹². Rocuronium at a dose of 0.9 mg/kg body weight had a minimum duration of action 26 minutes and the maximum duration of action was 37 minutes. The mean duration of action was 31.50 $\pm$ 3.25 minutes. This was comparable to the study done by Khurshid H et al (2015)¹². In our study, no desaturation or any adverse changes in ECG occurred. Other side effects such as bradycardia, tachycardia, hypotension, hypertension, bronchospasm, erythema, urticaria, or rashes were also not observed. After the administration of succinylcholine the muscle fasciculations were noticed as predicted.

In our study we used thiopentone at the usual dosage and a relatively small dose of fentanyl just like the study done by McCourt KC et al (1998)¹⁶. The intubating conditions could have been better if propofol or alfentanil or even a higher dose of fentanyl had been used as a part of the induction technique. This was proved by Crul JF et al (1995)¹⁷ who reported excellent intubating conditions within 45 seconds with rocuronium 0.9 mg/kg and concomitant use of propofol and alfentanil but then it may have interfered with the intubating conditions.

CONCLUSION

From this study, it can be concluded rocuronium bromide in dose of 0.9 mg/kg produce early satisfactory intubating conditions comparable with succinylcholine. It may be considered as a suitable alternative to succinylcholine in RSI in emergency situations when succinylcholine is contraindicated.

REFERENCES

- Savarese JJ, Kitz RJ. The quest for a short-acting non depolarizing neuromuscular blocking agent. Acta Anaesthesiol Scand Suppl. 1973; 53: 43-58.
- Hopkinson J.M., Meakin G., McLuskey A. and Baker R.D. Dose response relationship and effective time to satisfactory intubation condition after rocuronium in children. Anaesthesia 1997; 52:428-32.
- Jean Paul Cantineau, Frederick Porte, Gilles d'Honneur, Philippe Duvaldestin. Neuromuscular effects of rocuronium on the diaphragm and adductor pollicis muscles in anesthetized patients. Anaesthesiology 1994; 81 :585-90.
- Cooper R, Mirakhur RK, Clarke RSJ, Boules Z. Comparison of intubating conditions after administration of ORG 9426 (Rocuronium) and Suxamethonium. Br J Anaesth 1992; 69: 269-73.
- Miller RD, Cohen NH, Eriksson LI, Fleisher LA, Weiner-Kronish JP, Young WL. Miller's Anesthesia. Pharmacology of Neuromuscular Blocking Drugs. 8th edition, p 970-5.
- Magorian T, Flannery KB, Miller RD. Comparison of rocuronium, succinylcholine and vecuronium for rapid sequence induction of anesthesia in adult patients. Anesthesiology. 1993; 79(5):913-8.
- Shukla A, Dubey KP, Sharma MSN. Comparative evaluation of haemodynamic effects and intubating conditions after the administration of org 9426 (rocuronium) and succinylcholine. Indian J Anaesth. 2004; 48(6): 476-9.
- Misra MN, Agarwal M, Pandey RP, Gupta A. A Comparative Study Of Rocuronium, Vecuronium and Succinylcholine for Rapid Sequence Induction Of Anaesthesia. Indian J Anaesth. 2005; 49(6): 469-73.
- Bhati K, Parmar V. Comparative study of intubating conditions after Rocuronium and Suxamethonium (study of 80 cases). The Internet Journal of Anesthesiology. 2008; 20(1): 1-6.
- Gupta S, Kirubahar R. A comparative study of intubating conditions of rocuronium bromide and suxamethonium in adult patients. Anesth Essays Res. 2010; 4: 15-9.
- Parikh K, Modh DB, Upadhyay MR. Comparison Of Rocuronium Bromide With Suxamethonium Chloride For Tracheal Intubation. International Journal of Medical Science and Public Health. 2014; 3(5): 610-5.
- Kurshid H, Muneer K, Wani S A. A comparative study of intubating conditions using succinylcholine and two doses of rocuronium. International Journal of Advanced Research. 2015; 3(5): 1152-9.
- Dwivedi S, Dwivedi R. Comparative Evaluation of Intubating Conditions after Succinylcholine and different Doses of Rocuronium. Journal of Evolution of Medical

- and Dental Sciences 2015; 4 (52): 9011-9.
14. Penchalaiah Ch, Babu NJ, Kumar T. Comparison of Rocuronium Bromide and Succinylcholine Chloride for Use during Rapid Sequence Intubation in Adults. *Journal of Evidence based Medicine and Healthcare*. 2015; 2(32): 4796-806.
 15. Heggeri VM, Harbishettar AS, Deka A, Rajkhowa T. Intubating Conditions of Two different doses of Rocuronium at 60 seconds by clinical assessment; and with T.O.F response of Adductor Pollicis Muscle. *Journal of Clinical and Diagnostic Research*. 2015 Sep; 9(9): 24-8.
 16. McCourt KC, Salmela L, Mirakhur RK, Carroll M, Makinen MT, Kansanaho M et al. Comparison of rocuronium and suxamethonium for use during rapid sequence induction of anaesthesia. *Anaesthesia*. 1998; 53: 867-71.
 17. Crul JF, Vanbellegheem V, Buyse L, Heylen R, Egmond JV. Rocuronium with alfentanil and propofol allows intubation within 45 seconds. *European J of Anaesthesiol*. 1995; 12(11): 111-2.