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Original Research Paper

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STUDY OF EFFECT OF ROCURONIUM, VECURONIUM AND SUCCINYLCHOLINE IN RAPID SEQUENCE INDUCTION OF ANAESTHESIA.

Dr Ravi Anand	Fellowship Senior Resident, Department Of Trauma And Emergency, Indira Gandhi Institute Of Medical Sciences, Patna-800014.
Dr Amar Nath Gupta*	Associate Professor, Department Of Anaesthesiology, I Q City Medical College And Hospital, Durgapur, West Bengal. *Corresponding Author
Dr Kamla Kant Das	Associate Professor, Department Of Anaesthesiology, Gouri Devi Institute Of Medical Sciences And Hospital, Durgapur, West Bengal.
Dr Sanjeev Kumar	Professor, Department Of Anaesthesiology, Indira Gandhi Institute Of Medical Sciences, Patna-800014.

ABSTRACT The study was conducted in 60 patients aged 20-60 years, of ASA I - II and Mallampati I - II who were scheduled to undergo various surgeries under general anaesthesia. All the patients were divided into three groups. The groups were compared for the time of onset of muscle relaxation, intubating conditions, and haemodynamic changes. Techniques for Anaesthesia in the groups were same with difference in the neuro-muscular blocking agent given for intubation. After induction, group I, II and III received succinylcholine1.5 mgkg-1, rocuronium 0.6 mgkg-1 and vecuronium 0.1 mgkg-1 respectively. Results: Succinyl choline and rocuronium have statistically comparable duration of onset of muscle relaxation while vecuronium had longer time. Good to excellent intubating conditions achieved by Succinylcholine and rocuronium in all the patients at 90 seconds but vecuronium was acceptable in only 83.3% of cases.

KEYWORDS : Succinylcholine, Rocuronium, Vecuronium, Rapid sequence induction.

INTRODUCTION

In day today practice, muscle relaxation is used for two purposes: to facilitate endotracheal intubation and to provide surgical relaxation. The time interval from the suppression of protective reflexes by induction, to accomplishment of intubation is a critical period, during which risk of regurgitation is very high. RSI(RSI) is the technique of choice in these situations. The ideal neuro-muscular blocking agent for RSI should have a fast onset, brief duration of action, provide profound relaxation and be free from haemodynamic changes.

Succinylcholine, is the gold standard muscle relaxant for RSI. When succinylcholine is undesirable or contraindicated, the non-depolarizing neuromuscular blocking agents are used for this purpose. But no any nondepolarisers available are found to be consistently effective. Newer, rapidly acting agents like rocuronium and mivacurium have given promising results in RSI but their availability and cost, limit their routine use. This study is aimed at determining the efficacy of rocuronium, a newer nondepolarizing neuromuscular blocking agent for RSI in the local population. We have also tried to compare its action to the routinely used nondepolarizing neuromuscular blocking agent vecuronium and the gold standard succinylcholine.

MATERIAL AND METHOD

After approval from ethical committee of Gouri Devi Institute of Medical Sciences and Hospital, Durgapur (April 2020 to September 2020), 60 patients of ASA I - II and Mallampati I - II, aged 20 to 60 years and of either sex were selected. Height and weight criteria were not taken into account. They were randomly divided into three groups.

Group I (n-20): received succinylcholine 1.5 mgkg-1 body weight

Group II (n-20): received rocuronium 0.6 mgkg-1 body weight

Group III (n-20): received vecuronium 0.1 mgkg-1 body weight

After putting monitor patients were pre-oxygenated with 100% oxygen for three minutes. Anaesthesia was induced with Propofol 2 mg/kg I.V. After loss of consciousness, each patient received respective neuromuscular blocking agent I.V. as a single bolus over 5 seconds. The time was recorded. Time taken to complete stop of respiration or only weak diaphragmatic contractions was also noted. IPPV was gently given with 100% oxygen. The time of onset of action was taken from the completion of injection of neuro-muscular blocking agent to the cessation of respiration.

Laryngoscopy was performed and intubating conditions were assessed at 60 seconds after injection of neuromuscular blocking agent and if found unsatisfactory, lungs were ventilated and patients were reassessed at further intervals of 30 seconds (90 S, 120 S, 150 S, 180 S) till the intubating conditions were found to be good to excellent. Endotracheal intubation was then done with appropriate sized cuffed endotracheal tube.

Table - 1 : Cooper et al scoring system.

Score	Jaw relaxation	Vocal cord	Response to intubation
0	Poor	Closed	Severe coughing/bucking
1	Nominal	Closing	Mild cough
2	Moderate	Moving	Slight diaphragmatic movement
3	Good	Open	None

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 score were taken as clinically acceptable.

The intubating conditions were graded using 'Cooper et al' scoring system (table 1).

Anaesthesia was maintained with nitrous oxide along with oxygen (60: 40) and halothane. The vital signs of the patient were noted shortly after giving neuro-muscular blocking agent, immediately after performing intubation and then at 5 minutes, 10 minutes, 20 minutes and 30 minutes after intubation. The duration of action of neuromuscular blocking agent was taken as the time period from injection of intubating

dose of neuromuscular blocking agent to return of spontaneous respiration. For maintainance subsequent doses of non-depolarizing neuro-muscular blocking agent was given.

At the end of surgery, all anaesthetics were stopped and 100% oxygen was given. Respiratory efforts were allowed to return and residual neuromuscular blockade was reversed with slow I.V. injection of Neostigmine 0.05 mg/kg and 0.01 mg/kg Glycopyrrolate.

When respiration became normal and tidal volume was adequate, extubation was done. After extubation, patients were oxygenated with 100% oxygen for 5 minutes and shifted to post operative ward. All the results were compiled, compared and analysed statistically.

DATA COLLECTION

The following parameters were collected: age, sex,wight and the time of onset of action of neuro-muscular blocking agent to the cessation of respiration were recorded.

Sample size and statistical analysis

We calculated that a sample size of 60 patients (20 patient per group) were required for the study to have 85% power of the study. Statistical analysis were performed using SAS statistical software version 9.4 (SAS Institute, Cary, NC). Qualitative variables were compared between the two groups with the Chi-square of the Fisher's exact test when needed, and continuous variables were compared using the Student's *t*-test or the Wilcoxon rank-sum test as appropriate. All *P* values were one-sided, and $P < 0.05$ were considered statistically significant.

RESULTS

Table - 2 : Demographic profile of different study group.

	Group I	Group II	Group III
n	20	20	20
Age (Years)	40.63±10.08	40.1±9.83	40.37±9.01
Weight (Kg)	59.3±14.02	59.23±13.83	59.1±13.53
Male:Female	18:12	20:10	17:13

Table - 2 shows that there is a statistically even distribution of age, weight and sex among all the groups.

Table - 3 : Onset of action in different study groups.(Time interval from injection of neuro-muscularblocking agent to cessation of respiration).

	Number of patients		
Onset of action (Sec)	Group I	Group II	Group III
21 – 30	2	0	0
31 – 40	13	1	0
41 – 50	5	9	0
51 – 60	0	7	3
61 – 70	0	2	4
71 – 80	0	1	7
81 – 90	0	0	2
91– 100	0	0	2
101 – 110	0	0	1
111 – 120	0	0	1
Mean±SD	46.69±14.78	53.67±11.87	78.20±14.89

Table - 3 shows that the mean time of onset of action of group I was 46.69±14.78 sec, of group II was 53.67±11.87 sec and of group III was 78.20±14.89 sec. Statistically, there was no significant difference in the time of onset between group I and group II ($p>0.05$), but the time of onset was significantly longer in group III when compared to other two groups ($p<0.001$).

In group I 96.7% of cases had acceptable intubating conditions at 60 seconds, out of which 90% were excellent. In group II, 90% of patients showed acceptable intubating conditions, which were graded excellent in 70% cases. None of the patients had excellent intubating conditions at 60 seconds in group III and only 13% showed acceptable intubating conditions.

Just after injection of the drug, statistically there is no significant change in mean pulse rate in group I and group III but group II shows a significant change in mean pulse rate (4-5 beats/minute).

All the groups are showing a significant change in mean pulse rate just after intubation; this change could be due to the stress of intubation. There is statistically significant change in mean blood pressure in group I after administration of the drug (89.91 mmHg to 91.34 mmHg) while the changes in group II and group III are not statistically significant. There is a significant change in mean blood pressure in all the three groups just after intubation, which could be attributed to the stress of intubation.

DISCUSSION

In this study, onset of action of neuromuscular blocking agents was assessed by clinical methods, which depended on the onset of apnoea and cessation of chest movements. The mean time for the onset of action of succinylcholine {1.5 mgkg-1} was 46.69±14.78 seconds, which is consistent with Puhringer et al6 [0.8 minutes] and Magorion et al [50±17 seconds].

Rocuronium had shown the mean onset time to be 53.67±11.87 seconds, which is consistent with the results of Cooper et al [45-59 seconds depending upon the dose (0.5 – 0.9 mgkg-1)]. But Folds et al and Wierda et al reported considerably longer time.

In the study, the mean time of onset for vecuronium (0.1 mgkg-1) was 78.2±14.89 seconds. Viby et al found the onset of action to be 77.4±16.50 seconds and Cason et al found it to be 85±27 seconds. Hence our results are consistent with theirs.

As per Cooper et al scoring system. succinylcholine showed acceptable intubating conditions in 96.70% of cases at 60 seconds, out of which 90% were excellent. Our findings are consistent with that of Goldberg et al and Cooper et al, who found good to excellent intubating conditions in most patients at 60 seconds.

In rocuronium group, 90% of intubating conditions at 60 seconds out of which 70% were excellent and at 90 seconds all patients had acceptable intubating conditions. Wierda et al9 found that intubating conditions were good to excellent one minute after administration of rocuronium at a neuromuscular block of 88%. Zhou et al showed that 84% of cases had good to excellent intubating conditions at 60 seconds after rocuronium. These results are consistent with ours. At 60 seconds, the rocuronium showed good jaw relaxation in 86.70% cases and fully relaxed vocal cords in 93.3% cases. But 56.70% patients showed mild coughing, reason being the delayed effect of rocuronium on diaphragm.14

In our study, vecuronium group had acceptable intubating conditions in only 13.3% cases at 60 seconds and none of them were excellent. At 90 seconds 83.3% cases had acceptable intubating conditions of which 33.3% were excellent All except one patient showed acceptable intubating conditions at 120 seconds, who was intubated at 150 seconds with excellent intubating conditions. The optimum time of intubation with vecuronium was found to be 90-120 seconds. Our results were consistent with that of Agoston et a1 who found that with a dose of 0.08 mgkg-1 vecuronium provided ideal intubating conditions with complete relaxations of cords at 90-100 seconds. Mayer et al stated that satisfactory intubating conditions were found with vecuronium at 60 seconds and none of them were excellent. At 90 seconds conditions were

acceptable in all the patients but excellent in only 25%.

The results of our study showed that rocuronium as well as succinylcholine produced better intubating conditions than vecuronium at 60 and 90 sec. Wierda et al compared intubating conditions of rocuronium and vecuronium at 90 sec and found that good to excellent intubating conditions were present in all the patients in rocuronium group at 90 seconds and only in 80% cases in vecuronium group (only 30% were excellent). Boek et al found better intubating conditions with rocuronium than vecuronium at 90 seconds. These results are consistent with our results.

In the present study, preoperative values of pulse rate and blood pressure were taken as control. Among all the three groups, rocuronium group showed slight tachycardia (4-5 beats per minute) in 63% patients just after the injection of the drug. These results are consistent with Booth et al who reported that during first minute following injection of rocuronium, heart rate increased by 36%.

There was a significant change in mean arterial pressure just after administration of succinylcholine. The findings are consistent with Theshelf et al who reported that there was a rise in blood pressure following succinylcholine and it was explained on the basis of stimulation of the autonomic ganglion.

The findings of rise in heart rate and mean arterial pressure in all the groups just after intubation is due to the stress response of intubation.

CONCLUSIONS

It was concluded from this study that rocuronium produces intubating conditions which are satisfactory in comparison to succinylcholine. Rocuronium is haemodynamically stable except for a slight tachycardia and has no adverse effects. It may be a suitable alternative for succinylcholine during rapid sequence induction especially in patients who are at risk of adverse effects of succinylcholine. Vecuronium which is also haemodynamically stable with no adverse effects, but for its delayed onset of action, cannot be considered as a better alternative to rocuronium and succinylcholine for rapid sequence induction.

REFERENCES:

1. Murdoch H. Induction for rapid sequence induction: a tri-deanery survey. Anaesthesia 2012; 67:1047-8.
2. Naguib M, Brull SJ. Update on neuromuscular pharmacology. Curr Opin Anaesthesiol 2009; 22:483-90.
3. Rao MH, Venkatraman A, Mallleswari R. Comparison of intubating conditions between rocuronium with priming and without priming: randomized and double-blind study. Indian J Anaesth 2011; 55:494-8.
4. Czarnetzki C, Lysakowski C, Elia N, Tramèr MR. Time course of rocuronium-induced neuromuscular block after pre-treatment with magnesium sulphate: a randomised study. Acta Anaesthesiol Scand 2010; 54:299-306.
5. Park SJ, Cho YJ, Oh JH, Hwang JW, Do SH, Na HS. Pretreatment of magnesium sulphate improves intubating conditions of rapid sequence tracheal intubation using alfentanil, propofol, and rocuronium - a randomized trial. Korean J Anesthesiol 2013; 65:221-7.
6. Robertson EN, Hull JM, Verbeek AM, Booij LH. A comparison of rocuronium and vecuronium: the pharmacodynamic, cardiovascular and intra-ocular effects. Eur J Anaesthesiol Suppl 1994; 9:116-21.
7. Verma RK, Goordayal R, Jaiswal S, Sinha G. A comparative study of the intubating conditions and cardiovascular effects following succinylcholine and rocuronium in adult elective surgical patients. Internet J Anesthesiol 2007; 14:11-16.
8. Nitschmann P, Oberkogler W, Hertsig M, Schwarz S. Comparison of haemodynamic effects of rocuronium bromide with those of vecuronium in patients undergoing CABG surgery. Eur J Anaesthesiol Suppl 1994; 9:113-5.
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; 49:469 -73.
10. Williamson RM, Mallaiah S, Barclay P. Rocuronium and sugammadex for rapid sequence induction of obstetric general anaesthesia. Acta Anaesthesiol Scand 2011; 55:694-9.
11. *Boek M, klippel K, Nitsche B et al*. Rocuronium potency and recovery characterstics during steady state desflurane, sevoflurane, isoflurane or propofol anaesthesia. Br J anaesth 2000; 84: 43- 47.
12. *Goldberg ME, Larijani GE, Azad SS, Sosis M, Seltzer JL,Ascher J, Weakly JN*. Comparison of intubating conditions and neuromuscular blocking profile after intubating dose of mivacurium chloride or succinylcholine in surgical outpatient. Anesth Analg 1990; 70: S131.
13. *Zhou T J, White P F, Chiu JW et al*. Onset/offset characteristics and intubating conditions of rapacuronium: a comparison with rocuronium. Br J Anaesth 2000; 85(2): 246-50.
14. *Contineau J P, Porte F, Homs JB , Liu N, Duvaldestin P*.Neuromuscular blocking effect of rocuronium on human diaphragm. Anesthesiology 1991; 75(3): A785.
15. *Agoston S, Salt P, Newton D, Bencini A, Boomsma P,Erdmann W*. The neuromuscular blocking action of org NC-45, a new pancuronium derivative in anaesthetized patient;a pilot study. Br J Anaesth 1980; 52: 53S-59S.
16. *Mayer M, Doenicke A, Hofmann A, Peter K*. Onset and recovery of rocuronium (Org 9426) and Vecuronium under enflurane anaesthesia. Br J Anaesth 1992; 69(5): 511-12.