Original Article

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Comparision of High Dose Rocuronium with Succinylcholine for Intubation

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Abstract

Context: Succinylcholine has extremely rapid onset of action and its shorter duration of action make it the ideal muscle relaxant for rapid sequence intubation. Because of these adverse effects and risks associated with succinylcholine, extensive laboratory research has been undertaken to synthesize a nondepolarising neuromuscular blocking agent. Rocuronium a structural analogue of vecuronium was recently synthesized and has been demonstrated to have fastest onset of action compared to any nondepolarizing neuromuscular blocking agent. *Aims:* To compare the two muscle relaxants i.e., succinylcholine and rocuronium on tracheal intubating conditions. *Settings and Design:* This study was a double blinded, randomized, controlled trial, carried out at tertiary care centre in India between March 2014 and June 2016. The sample size for this study was calculated to be 45 in each group. *Methods and Material:* All patients included in the study were premedicated with inj.glycopyrolate 0.2mg intramuscularly ½ hr before surgery. General anaesthesia was induced with propofol 2mg/kg and fentanyl 2mg/kg intravenously. All Group A patients received succinylcholine (2mg/kg) and all patients of group B received rocuronium (1.2 mg/kg). After giving the muscle relaxant, patient was ventilated with oxygen, nitrous oxide, and isoflurane for 90 seconds. The intubating condition is evaluated and scored according to the four step scale proposed by Goldberg and colleagues. *Statistical Analysis Used:* Analysed using Microsoft Excel 2010 and SPSS (Version 19) software. All data on categorical variables were presented as frequencies and percentages. Chi square test was used to compare the frequencies and percentages. All the statistical analysis were carried out at 5% level of significance and p value <0.05 was considered significant. Chi square test was used to compare the frequencies and percentages. *Results:* There were no statistically significant changes in heart rate, systolic and diastolic between the succinylcholine group (A) and rocuronium group (B) at various time intervals. In succinylcholine group (A) 95.5% had excellent intubating conditions at 90 seconds. In rocuronium group (B) 93.3% of patients had excellent intubating conditions at 90 seconds. All the patients of rocuranium group could be intubated at 90 seconds. *Conclusion:* Rocuronium does not produce significant haemodynamic changes. Higher dose (1.2 mg) of Rocuronium would be suitable for rapid intubation conditions.

Keywords: Succinylcholine; Rocuronium; Intubation; Haemodynamic Changes.

Introduction

Tracheal intubation is one of the common procedure performed during general anesthesia. It is also a life saving intervention that is performed in the emergency department. Neuromuscular blocking agents like succinylcholine, pancuronium, vecuronium, atracurium, rocuronium are used to achieve muscle relaxation for tracheal intubation. Succinylcholine has extremely rapid onset of action

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and its shorter duration of action (less than 2 to 3 minutes) make it the ideal muscle relaxant for rapid sequence intubation [1]. It can cause fasciculation, which may lead gastric regurgitation and aspiration. It can increase intracranial and intraocular pressure. Potentially life-threatening effects like hyperkalemia which may precipitate severe dysarrythmias and cardiac arrest are seen with this drug. Because of these adverse effects and risks associated with succinylcholine, extensive laboratory research has been undertaken to synthesize a nondepolarising neuromuscular blocking agent with a speed of onset comparable to succinylcholine but with none of its adverse effects [2]. Fazadinium bromide (ah8165) with onset of paralysis within two minutes was introduced however fazadinium has longer duration of action (more than 50 minutes) and was associated with significant tachycardia and hypotension [2-4].

Subsequently Pancuronium, Pipecuronium, Doxacuronium, Atracurium were introduced but the onset of action was not rapid. Vecuronium was tried for rapid sequence induction with high doses of 0.15mg/kg but it did not have faster onset of action as compared to succinylcholine [2]. Rocuronium a structural analogue of vecuronium was recently synthesized and has been demonstrated to have fastest onset of action compared to any nondepolarizing neuromuscular blocking agent [4,5]. Its onset time approaches to that of succinylcholine. It virtually has no clinically significant cardiovascular effects and it does not cause hyperkalemia. Our purpose of study is to compare the two muscle relaxants i.e., succinylcholine and rocuronium on tracheal intubating conditions.

Materials and Methods

This study was conducted with aim to compare and evaluate the tracheal intubating conditions of succinylcholine and rocuronium. This study was a double blinded, randomized, controlled trial, carried out at tertiary care centre in India between March 2014 and June 2016. This trial was approved by institute ethical committee. The sample size for this study was calculated to be 45 in each group. Patients aged between 18 to 60 years undergoing surgical procedure with ASA physical status grade I – II and Mallampatti class I – II airway were included in the study. Patients having neuromuscular disease, receiving medications known to influence neuromuscular function., with cardiac, renal, hepatic and metabolic diseases and Mallampatti III – IV were excluded from study. All patients included in the study were premedicated with inj.glycopyrolate 0.2mg intramuscularly ½ hr before surgery.

After obtaining informed written consent from patients fulfilling the inclusion criteria, allocation of participants to specific treatment groups (Group A and Group B) was carried out using a computer-generated sequence of random numbers. Allocation concealment was done using sealed envelopes. Anesthetist who was not involved in the study did random number generation, concealment and assignment of intervention. Before induction vital signs were recorded. ECG, peripheral oxygen saturation (pulse oximetry), pulse rate, non-invasive arterial blood pressure was monitored throughout the procedure. General anaesthesia was induced with propofol 2mg/kg and fentanyl 2mg/kg intravenously. All Group A patients received succinylcholine (2mg/kg) and all patients of group B received rocuronium (1.2 mg/kg). After giving the muscle relaxant, patient was ventilated with oxygen, nitrous oxide, and isoflurane for 90 seconds. At the same time, the anesthetist blinded by the type of the relaxant used did laryngoscopy. The intubating condition is evaluated and scored according to the four step scale proposed by Goldberg and colleagues [6].

Following intubation, anaesthesia was maintained with oxygen, nitrous oxide and 0.2 - 0.5 % isoflurane. Patients were given intermittent positive pressure ventilation. Throughout the procedure changes in heart rate, blood pressure, were measured. Heart rate and blood pressure were recorded before induction (pre induction); at direct laryngoscopy (0 minute); 1 minute after laryngoscopy; 5 minute after laryngoscopy; 10 minute after laryngoscopy.

The data was analysed using Microsoft Excel 2010 and SPSS (Version 19) software. All data on categorical variables were presented as frequencies and percentages. Chi square test was used to compare the frequencies and percentages. All the statistical analysis were carried out at 5% level of significance and p value <0.05 was considered significant. Chi square test was used to compare the frequencies and percentages. All the statistical analysis were carried out at 5% level of significance and p value <0.05 was considered significant.

Results

This is a prospective study comprising of two groups, with sample size of 45 cases in each group. The haemodynamic changes up to 20 minutes and

intubation condition were studied. There is no statistically significant heart rate variation within the succinylcholine group. In the rocuronium group, after intubation the heart rate is significantly increased from the mean of 81.50 ± 12.65 at pre induction to 85.53 ± 17.21 at intubation and 86.28 ±17.01 at 1 minute after intubation. At 10 minutes heart rate of group B has settled towards pre induction. However, there were no statistically significant changes in heart rate between the succinylcholine group (A) and rocuronium group (B) at various time intervals.

Figure 1 shows the distribution of mean Systolic Blood Pressure in two groups of patients at various time intervals. There was no significant difference in systolic blood pressure between group A and B at pre-induction, intubation, 1 min, 5 min, 10 min and 20 min. In succinylcholine group (A) there was statistically significant fall in systolic blood pressure from 121.00 ± 14.54 at pre induction to 107.50 ± 14.74 at intubation. There is a steady rise in systolic blood pressure at 5, 10, 20 minutes. In the rocuronium group (B) there was fall in systolic blood pressure from 122.69 ± 18.43 at pre induction to 115.73 ± 20.56 at intubation. This was followed by fall in systolic blood pressure at 1 and 5 minute. There after there was a steady rise in systolic blood pressure at 10 and 20 minutes. Figure 2 shows the diastolic blood pressure variation in two groups at various intervals. There was no significant difference in systolic blood pressure between group A and B at pre-induction, intubation, 1 min, 5 min, 10 min and 20 min.

Table 2 shows the comparison of intubation conditions between the two groups. In succinylcholine group (A) 95.5% had excellent intubating conditions at 90 seconds. In rocuronium group (B) 93.3% of patients had excellent intubating conditions at 90 seconds.

All the patients of rocuranium group could be intubated at 90 seconds.

Table 1: Comparison of heart rate between groups

Time Interval	Succinylcholine (Group A) (n=45)	Rocuronium (Group A) (n=45)	Significance between two Groups
Pre Induction	81.34 ± 10.40	81.50 ± 12.65	P > 0.05
0 Minute	81.57 ± 11.96	85.53 ± 17.21	P > 0.05
1 Minute	81.2 ± 12.11	86.28 ± 17.01	P > 0.05
5 Minutes	81.63 ± 12.32	85.67 ± 16.84	P > 0.05
10 Minutes	81.88 ± 11.32	80.60 ± 12.34	P > 0.05
20 Minutes	81.33 ± 11.01	77.83 ± 10.98	P > 0.05
Pair wise significance with in each group	Pre – 0 Minute P > 0.05 Pre – 1 Minute P > 0.05 Pre – 5 Minutes P > 0.05 Pre – 10 Minutes P > 0.05 Pre – 20 Minutes P > 0.05	Pre – 0 Minute P > 0.05 Pre – 1 Minute P > 0.05 Pre – 5 Minutes P > 0.05 Pre – 10 Minutes P > 0.05 Pre – 20 Minutes P > 0.05	

Table 2: Comparison of intubation condition between groups

Intubation Condition	Succinylcholine (Group A) (n=45)	Rocuronium (Group B) (n=45)	Significance between two groups
Excellent	43 (95.5%)	42 (93.3%)	P > 0.05
Good	2 (4.5%)	3 (6.7%)	P > 0.05
Poor	0	0	
Impossible	0	0	

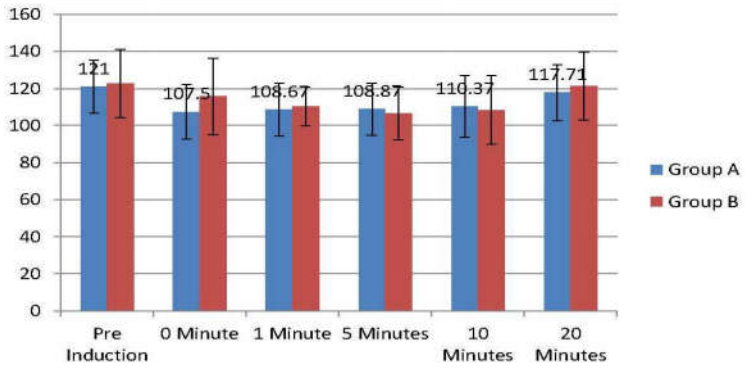

Fig. 1: Comparison of systolic blood pressure between groups

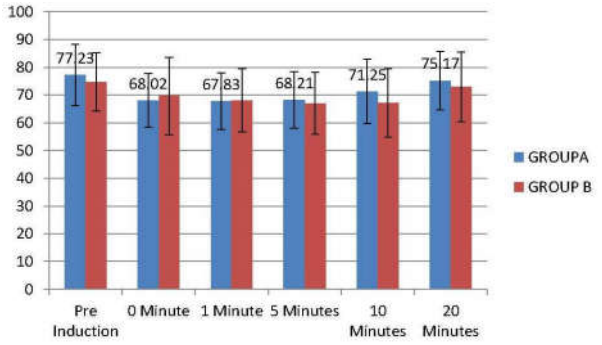

Fig. 2: Comparison of diastolic blood pressure between groups

Discussion

We conducted this study with the aim to compare the intubating conditions and hemodynamic changes following administration of rocuronium (1.2 mg/kg) and succinylcholine (2 mg/kg). Haemodynamic responses to both groups of patients who receive propofol (2mg/kg) and fentanyl (2mg/kg) were followed by initial fall of systolic and diastolic blood after induction. The initial fall can be attributed to the haemodynamic effects of propofol. At 20 minutes, the blood pressure was returned to pre induction level in both group of patient. The rise in heart rate was seen in rocuronium group. Heart rate rose from 80.53±12.65 at pre induction to 86.67±18.06 at intubation and to 88.30±18.61 at 1 minute after intubation with $P<0.05$ within the group between pre induction and 1 minute after intubation. However, this rise was not statistically significant between the both groups at 1 minute.

Recent studies had noted similar haemodynamic response [7,8]. Chamorro et al found that there were no significant hemodynamic changes with the exception of an increase in the heart rate in the first minute of 103 bpm to 113 ($p < 0.05$) and found that Rocuronium is an efficacious and safe drug for the emergency intubation of critically ill patients [7]. Susan et al also showed in her study that the heart rate transiently increased ($P < 0.01$) within 1 min after ORG-9426 (2 X ED95) administration [8]. Whereas Lincoln who studied in a group of cardiac children after the administration of rocuronium at average dose of 0.6 mg per kg of body weight and found no haemodynamic effects which were attributed to the use of rocuronium. Shorten also concluded that use of rocuronium in elderly patients did not result in a clinically significant change in heart rate, blood pressure and plasma catecholamine concentration in 2 groups of 30 patients of 60 years or more, not receiving Beta – blocks [9].

Both Group A and B had excellent intubating conditions at 90 seconds. Cheng et al showed that sixty seconds after administration of rocuronium 1 1.2mg/kg, intubating conditions are similar to those produced by succinylcholine 1.5 mg/kg. Rocuronium 0.6 mg/kg did not provide adequate intubating conditions [10]. Other study showed that at 60 sec 65% of rocuronium patients could be intubated and 100% at 90 sec; while all were intubated at 60 sec with succinylcholine [11]. Here they used rocuronium 0.6 mg/kg and succinylcholine 1 mg/kg. This difference could be due to use of low dose rocuronium. Walls et. al in his study showed that only 65% of rocuronium patients had excellent intubating conditions as compared to 80% of succinylcholine patients at 60 seconds [12]. Cooper et a1 showed that Intubating conditions after (rocuronium) 0.6 mg kg^{-1} at 60 or 90s were found to be clinically acceptable (good or excellent) in 95% of patients at 60s and in all patients at 90s and in all patients at both times after suxamethonium [13].

Our study correlates well with Khuenl who concluded that rocuronium provided good intubating conditions after 30s to 90s after injection of 0.6 mg/kg (2x ED 90) and was equal to that observed with succinylcholine. Although the onset time of rocuronium at the adductor pollicis muscle is slower than that of succinylcholine [14].

Conclusion

We conclude that rocuronium does not produce significant haemodynamic changes. Because of Excellent intubating conditions and minimum haemodynamic response, higher dose (1.2 mg) of Rocuronium would be suitable for rapid intubation conditions.

Conflict of Interest: NIL

References

1. Hughes R, Payne JP, Sugai N; Studies on fazadinium bromide (ah 8165); a new non-depolarizing neuromuscular blocking agent. Can Anaesth Soc J. 1976; 23(1):36-47.
2. Dhir A, Misra VK, Mital S, Tyagi SK, Mitra A, Basu Roy A. Cardiovascular changes by fazadinium bromide. Indian Journal of Anesthesia. 1985; 33(6):14-7.
3. Kaul HL, Mehta M, Bhanumati G, Mandal NG. Veruronium is not suitable for rapid sequence

intubation for caesarean section. Journal of Anesthesiology clinical Pharmacology. 1998; 19: 241-4.

4. Maria Cristina Simoes de Almeida, TSA, Rugerio Silveira Martins, Ana Lucia Costa Martins. Tracheal Intubation conditions at 60 seconds in children, adults and elderly patients. Revista Brasileira de Anesthesiologia, 1999; 12:35-41.
5. M.M. Salpeter; The Vertebrate Neuromuscular junction; Alan R. Liss, New York. 1987.p.182-184.
6. Goldberg ME, Larijani GE, Azad SS, Sosis M, Seltzer JL, Ascher J, et al. Comparision of tracheal intubating conditions and neuromuscular blocking profiles after intubating doses of mivacurium chloride or succinylcholine in surgical outpatients. Anesth Analg. 1989; 69:93-99.
7. C Chamorro J, Martinez-Melgar, MA Romera, R Ruiz de Luna, N de Ia Calla, Borralla. The efficacy and safety of rocuronium, for the rapid sequence of induction-intubation among critically ill patients Journal Watch Emergency Medicine, 1997; 12:72-77.
8. Toni Magorian, M.Q., K. B. Flannery Ronald D. Miller, M.D. Comparision of rocuronium with Succinylcholine and vecuronium for rapid-sequence induction of anesthesia. Anesthesiology. 1993; 79: 913--918.
9. Dr. Lincoln de la Parte Perez1. The conditions for tracheal intubation in a group of cardiac children after the administration of rocuronium. Rev Cubana Pediatr, 2002; 74(2):145-50.
10. Cheng CAY, Aun CST, Gin T. Comparion of intubating conditions during rapid tracheal intubation children ranging in age following suxamethonium, rocuronium. Paediatric Anaesthesia, 2002; 12:140.
11. Dr. Madhavi Barvel Dr. Roopa Sharma Evaluation of onset time , tracheal intubating conditions and clinical duration of muscle relaxant. Indian J. Anaesth. 2002; 46(6):465-468.
12. Walls, RM . Comparision of intubating conditions of rocuronium and succinylcholine with thiopentone. Journal Watch Emergency Medicine, 1998-11-01.
13. K. C McCourt, L. Salmela, R. K. Mirakhur, M.Carroll, M.-T. Makinen, M. Kansanhao, et al. Study designed to compare the tracheal intubating conditions during a rapid sequence induction of anaesthesia using rocuronium 0.6 (n = 61) or LO mg. kg^{-1} (n= 130) or suxamethonium 1.0 $mg.kg^{-1}$ (n = 127) as the neuromuscular blocking drugs. Anesthesia 1998; 53:867-871.
14. Cooper RA, Mirakhur Maddinenl VR. Neuromusular effects of rocuronium bromide (org 9426) during fentanyl and halothane anaesthesia. Anaesthesia, 1993; 48:103-05.