COMPARATIVE STUDY OF INTUBATING CONDITIONS AFTER ROCURONIUM AND SUXAMETHONIUM (STUDY OF 50 CASES)

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Abstract

Objective: To compare the Intubating Conditions and Changes in heart rate (HR) achieved after Suxamethonium Chloride and Rocuronium Bromide, during intubation, in patients between ages 11-50 years out of which 4 were in paediatric age group(11-12 years) and 46 in adult age group(19-50years).
Place and Duration: This study was conducted at the Armed Forces Hospital Sharourah Kingdom of Saudi Arabia during six months period starting from 01/02/09.
Patients and Methods: Fifty patients aged between 11-50 years, 4 including in paediatric age group(11-12 years) and 46 in adult age group(19-50 years), requiring general anesthesia for various surgical procedures, were randomly divided in to two groups, i.e. Group A in which Rocuronium bromide, 0.9 mg kg-1 was given for intubation {(n=25) (23 adults, 2 children)} Group B in which Suxamethonium chloride 1.5 mg kg -1 was used for intubation {(n=25)) (23 adults, 2 children)} Intubating conditions were observed at 60 seconds after intravenous bolus administration of suxamethonium or Rocuronium. HR was also observed immediately before induction (Pre- Op), at 60 seconds after bolus of Suxamethonium or Rocuronium (Immediately after relaxation), Immediately after intubation and then five minutes after intubation.
Results: Intubating conditions were rated as excellent in 96 %(n=24 Twenty two adults two children) and good in 4 %(n=1 Adult) of the patients who received Rocuronium and excellent in 100% of the patients who received Suxamethonium. There were no statistically significant changes observed in HR at all observation times between the two groups.
Conclusion: It is concluded from this study that intubation can be performed under good to excellent conditions at 60 seconds after a bolus dose of Rocuronium of 0.9 mg kg-1. As far as affect on HR are concerned, our study indicate no significant difference between the two drugs. The result of this study indicates that to facilitate intubation using rapid sequence induction technique Rocuronium is a reasonably good alternative to Suxamethonium.

Keywords : Intubating Conditions, heart rate (HR), Rocuronium, Suxamethonium.

Article

INTRODUCTION

Maintainance of a patent airway is a basic and essential component of general anaesthesia (GA), regardless of the technique selected. Endotracheal intubation is one of the available means of doing so in day to day practice. Muscle relaxants are useful in providing adequate relaxation and enable laryngoscopy and intubation. Suxamethonium, a depolarizing muscle relaxant with its rapid onset and short duration of action is still a relaxant of choice to facilitate endotracheal intubation. In addition to fasciculation, Suxamethonium has got many side effects such as bradycardia and other dysrrhythmias, rise in serum potassium, post-operative myalgia, and rise in intraocular, intragastric and intracranial pressure, incidences of prolonged recovery in patients with pseudo-cholinesterase deficiency and triggering of malignant hyperthermia.
Because most of the side effects of Suxamethonium reflect its depolarizing mechanism of action therefore research is still going on for an ideal neuromuscular blocking agent focused on non-depolarizing type of relaxant, which has rapid onset time and offers good to excellent intubating

conditions, as rapidly as Suxamethonium and which lacks the above mentioned adverse effects(1-4). Rocuronium bromide a newer amino-steroidal compound is a derivative of Vecuronium. (3-6) Rocuronium has a rapid onset time, an intermediate duration of action and rapid recovery with cardiovascular stability. Keeping these properties in mind it was decided to study two important properties i.e.

1: Intubating conditions. and

2:Changes in HR after Suxamethonium, a time tested popular short acting depolarizing neuromuscular blocking agent and Rocuronium, recently introduced intermediate acting non depolarizing neuromuscular blocking agent, with Propofol as the sole induction agent in elective, otherwise healthy adult population.

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Materials and Methods

The study was conducted at the Armed Forces Hospital Sharourah Kingdom of Saudi Arabia in 6 months period starting from 01/02/2009. After obtained the permission from research and ethics committee of the hospital, informed consent was taken from Fifty patients aged between 11-50 years, out of which 4 were in paediatric age group and 46 in adult age group. They required general anesthesia for various surgical procedures, and were having ASA physical status 1 or 11 and Mallampatti grade 1 or 11. They were randomly divided in to two groups, i.e.

Group A in which Rocuronium bromide, 0.9 mg kg-1 was given for intubation.

Group B in which Suxamethonium chloride 1.5 mg kg -1 was used for intubation.

Inclusion Criteria:

All patients were healthy, no other systemic or metabolic disorder.

All patients advised various surgical procedures like laparoscopic surgery, ENT, thyroid surgery, Hernia repair, hysterectomy dental procedure with expected time of surgery of less than two hours and free of any metabolic disorders.

Patients were excluded if they were known to have neuromuscular disease or were receiving medications known to influence neuromuscular function, and patients scheduled for cesarean section and emergency surgeries were more.

Pre operative all patients were examined thoroughly and a detailed history noted. Systemic examination of respiratory system, cardiovascular system, alimentary system, central and peripheral nervous system were carried out to rule out any pathological condition. Patients vital data e.g. temperature, pulse rate blood pressure and respiratory rate were noted. Routine investigations were done in all cases. A written informed consent was taken from all patients who were found suitable for the study, explaining them the broad outline of the study and procedure. All patients were kept nil by mouth for at least 8 hrs on the day before surgery. Upon arrival in operation theatre peripheral venous line was secured. Patients were monitored with Pulse Oximeter, ECG monitor, NIBP monitor, Capnography. Vital data like pulse rate, blood pressure, SPO2 were recorded. All patients were given premedication with Injection Fentanyl 1 mcg/kg, 5 min before induction of anaesthesia and again pulse, blood pressure, SPO2, ECG were noted as pre-induction data. A number tag was attached with each patients arm who were participating in the study by the nurse in reception area who was blinded to the study.

Intraoperative Management: HR of all patients was recorded from an ECG monitor before starting pre-oxygenation (Pre OP reading) and then patients were pre-oxygenated with 100% O2 with face, induction of anesthesia was done according to a predetermined random number table provided to each anesthesiologist participating in the study.

Group A: Anaesthesia was induced with inj. Propofol 2 mg kg-1 IV followed by inj. Rocuronium bromide 0.9 mg kg-1 IV given over 10 seconds

Group B: Anaesthesia was induced with inj. Propofol 2 mg kg-1 IV followed by inj. Suxamethonium 1.5 mg kg-1given over 10 seconds.

Time was noted at the end of Suxamethonium or Rocuronium administration. The patients were ventilated with 100% oxygen with intermittent positive pressure ventilation on face mask. HR was

observed and recorded from an ECG monitor at this time (Immediately after relaxation reading. In both groups atraumatic laryngoscopy was tried after 60 seconds of I/V bolus administration of either Suxamethonium or Rocuronium. Intubating conditions were observed as given below in (Parameters Observed) and graded according to Cooper's intubation scoring system. Patients were intubated with proper sized endotracheal tube and HR was noted immediately after intubation and Five minutes after intubation. Anesthesia proceeded with O2, N2O, Isoflurane and further doses of muscle relaxant as required with use of closed circuit and circle absorber and controlled ventilation with a ventilator. Other vital signs parameters like ECG, NIBP and SPO2 were continuously observed throughout the operation. At the completion of surgery, reversal of neuromuscular blockade was achieved with injection Neostigmine 0.05 mg kg-1 and Injection Atropine 0.02 mg kg-1 intravenously. After satisfactory recovery, patients were extubated. Post operatively all vital data e.g. pulse, blood pressure, respiratory rate were monitored. Also patients were observed for nausea, vomiting, bradycardia, tachycardia, hypotension, respiratory obstruction.

Parameters Observed: Intubating conditions were assessed using cooper's intubation scoring system (Table 1) (12)

The appropriate values were selected and added up to a total numeric score of a maximum of 9.

A total score of

8 – 9 = excellent

6 - 7 =good

3 - 5 =Fair and

0 - 2 is rated as poor intubating conditions.

Good and excellent intubating conditions were taken to be "clinically acceptable" by Cooper et al. (Table-1)

Table 1: Cooper's intubation scoring system

Score	Jaw Relaxation	Vocal cords	Response to Intubation
0	Poor	Closing	Severe coughing/bucking
1	Nominal	Closing	Mild cough
2	Moderate	Moving	Slight diaphragmatic movement
3	Good	Open	None

HR was observed Pre Operatively, Immediately after relaxation, Immediately after Intubation and Five Minutes after intubation as described above in intra-op management.

Statistical Analysis: Data was analysed using SPSS version 15.Descriptive statistics were used to describe the data. To check the significance of difference chi squire test was applied. Categoric variables and independent sample `t` test was applied for numeric variables. P-value<0.05 was taken as significant.

Results

The two groups were similar in epidimiological characteristics like mean age and sex(Table-2),

Table-2: Epidemiological Data for Both Groups

GROUP	Total Number	Adults (ages 19-50)	Children(Age s11-12)	Males	Females	Mean Age+/_SD
GROUP-A	25	23	2	17	8	27.98+/-SD 8.25
GROUP-B	25	23	2	20	5	28.12+/-SD7.36

duration of surgery and the type of surgery they underwent. Intubating conditions were rated as excellent in 96 % (n=24.Twenty two adults two children) and good in 4% (n=1 Adult) of the patients who received Rocuronium and excellent in 100% (n=25, 23 adults and 2 children) of the patients who received Suxamethonium (Table-3)

Table-3: Intubating Conditions in (Group-A) and (Group-B)

Intubating Condition	Group- A No. of Patients (%)	Group- B No. of Patients (%)
Excellent	24(96%Adults=22 and children=2)	25(100% Adults=23 and children=2)
Good	01(4%Adult=1)	00
Poor	00	00
Inadequate	00	00

P- value >0.05

Changes in HR are shown in table 4.

Table-4: Changes in Mean Heart Rate in (Group-A) and (Group-B)

Time	Group A		Group B		t	df	P value
	Mean+/_SD	Difference from Pre-op. %	Mean+/- SD	Difference from Pre-op. %			
Immediately After relaxation	94.16+/_17.385	5.87	94.52+/_11.417	3.27	0.079	24	>.05
Immediately after Intubation	106.84+/_17.860	6.79	107.24+/_12.726	7.19	0.083	24	>.05
5 min	99.20+/ 16.785	0.83	97.40+/ 12.858	2.6	0.079	24	>.05

Mean Pre –OP HR in Group A was (100.04 +/- SD15.24) and in Group B it was (97.72+/_ SD12.26).Mean HR Immediately after relaxation in Group A was (94.16+/_ SD17.38) and in group B it was(94.52 +/_ SD11.41) and this is not a significant difference when compared with pre-op values(P>.05). Similarly there was no statistically significant difference from pre-OP reading between two groups Immediately after intubation, and Five minutes after intubation

Discussion

An ideal muscle relaxant should have non-depolarizing mechanism of action with rapid onset, short duration of action and rapid recovery. It should be non-cumulative, having no histamine release and no cardiovascular side effects, with high potency, and prompt reversibility by cholinesterase inhibitors and pharmacologically inactive metabolites (7, 8).

Suxamethonium, a depolarizing muscle relaxant with its rapid onset and short duration of action is still relaxant of choice to facilitate tracheal intubation. In addition to fasciculation, Suxamethonium has got many side effects such as bradycardia and other dysrrhythmias, rise in serum potassium, post operative myalgia, rise in intraocular, intragastric and intracranial pressure, incidences of prolonged recovery in patients with pseudo-cholinesterase deficiency and triggering of malignant hyperthermia.

Because most of the side effects of Suxamethonium reflect its depolarizing mechanism of action therefore search for an ideal neuromuscular blocking agent focused on non-depolarizing type of relaxants which has rapid onset time and offer good to excellent intubation conditions, as rapidly as Suxamethonium and which lacks the above mentioned adverse effects. (13, 14)

Rocuronium, a new non-depolarizing amino steroidal muscle relaxant is chemically 2-morpholino, 3-desacetyl, 16-N-allyl pyrrolidino derivative of Vecuronium, differing from it at 3 positions on steroid nucleus. The present study compares intubating conditions and onset time of Rocuronium and Suxamethonium.

Intubating conditions can be influenced by the choice of the anaesthetic agent and the use of adjuvant drugs such as narcotics, sedatives or lidocaine14. In the present study no sedatives were administered in the pre-operative period to maintain the clarity of assessment. Fentanyl was used as an analgesic in a dose of 1 mcg/kg in both groups.

In most studies, an appropriate timing of tracheal intubation has been determined by 3 ways (14, 15).

1.Clinical judgment

2.Neuromuscular monitoring either by twitch Suppression (maximum blockade) or TOF ratio

3.Predetermined time after the administration of Neuromuscular blocking agent e.g. 60 seconds or 90 seconds.

Patients in our study were similar in both groups as far a epidemiological characters, duration of surgery and type of surgery they underwent. We have relied on predetermined time for tracheal intubation. Results of present study, regarding intubating conditions are summarized in table-3 showing total intubating score achieved and the frequency distribution of excellent, good, fair and poor conditions achieved after the administration of either Rocuronium 0.9 mgkg-1 or Suxamethonium 1.5 mgkg-1 following routine induction for elective operations. Taking together those patients with ‘excellent’ and ‘good’ intubating condition, pooled data of our study shows that there is not any significant difference (P>0.05) in the frequency distribution of clinically acceptable intubating conditions, after the administration of Suxamethonium and Rocuronium. The clinically acceptable conditions are present in all the patients of the two groups receiving Rocuronium and

Suxamethonium.
We also recorded heart rate Pre-operatively, Immediately after relaxation before intubation, Immediately after intubation and Five minutes after intubation, Then calculated change in HR from Pre-Op value in both groups at all these times and compared this change among the two groups and found that there is statistically no significant difference in this change from pre op value ($P>0.05$) among the two groups.
The result of this study supported the contention that 0.9 mgkg-1 of Rocuronium might be a suitable alternative to 1.5 mgkg-1 of Suxamethonium for rapid endotracheal intubation in 60 Sec in elective cases. Apparently, Rocuronium was not fully interchangeable with Suxamethonium, as demonstrated by the uniformly excellent intubating conditions after the administration of Suxamethonium (100%) but not with Rocuronium (96%) but clinically both provide acceptable intubating conditions(Good+Ecellent=100%). Results of our study are similar to Pubringer et al and K. K. Bhati & V. S. Parmar which shows 100% clinically acceptable intubating conditions after both drugs where as Coopers et all has shown clinically acceptable intubating conditions in 95% patients in Rocuronium group and 100% in suxamethonium group. Whereas Dr Singh Ajeet series shows 95% clinically acceptable conditions in Rocuronium group 85% in Suxamethonium group13. These differences may be due to different sample size and age groups selected and different doses of two drugs used in these studies. Concerns of bradycardia and arrhythmias with suxamethonium were not proved in our study, may be because of small sample size and very small number of children(total of 4 out of 100 patients in both groups) and Rocuronium was found no better than suxamethonium in this aspect. However further studies are needed to address this issue

Conclusion

It is concluded from this study that intubation can be performed under good to excellent conditions at 60 seconds after a bolus dose of Rocuronium of 0.9 mg kg-1., and there is in no significant difference between two drugs regarding affect on Heart rate. Rocuronium might be a suitable alternative to Suxamethonium 1.5mgkg-1 for rapid endotracheal intubation in 60 Sec, in elective cases if side effects of suxamethonium are to be avoided.

Reference

1.Perry JJ, Lee JS, Sillberg VAH, Wells GA. Rocuronium versus succinylcholine for rapid sequence induction intubation. Cochrane Database of Systematic Reviews 2008, Issue 2. Art. No.: CD002788. DOI: 10.1002/14651858.CD002788.pub2.
2.Dr. Singh Ajeet Dr. Bhatia Pradeep Kumar Dr. Tulsiani Kishan Lal comparison of onset time, duration of action and intubating conditions achieved with Suxamethonium and Rocuronium Indian, j. Anaesth .2004.48:(2)129-133.
3.Kopman A. Rocuronium versus succinylcholine for rapid tracheal intubation. Anesth Analg 2006;102:xxx.
4.Sluga M, Ummenhofer W, Studer W, et al. Rocuronium versus succinylcholine for rapid sequence induction of anesthesia and endotracheal intubation: a prospective, randomized trial in emergent cases. Anesth Analg 2005;101:1356–61.
5.Perry J, Lee J, Wells G. Rocuronium versus succinylcholine for rapid sequence induction intubation. Cochrane Database Syst Rev 2003;CD002788.
6.Heier T, Caldwell JE. Rapid tracheal intubation with large-dose rocuronium: a probability-based approach. Anesth Analg 2000;90:175–9
7.Kirkegaard-Nielsen H, Caldwell JE, Berry PD. Rapid tracheal intubation with rocuronium: a probability approach to determining dose. Anesthesiology 1999;91:131–6.
8.Optimal rocuronium dose for intubation during inhalation induction with sevoflurane in children M. Eikermann*, I. Hunkemöller, L. Peine, W. Armbruster, B. Stegen, J. Hüsing and J. Peters British Journal of Anaesthesia, 2002, Vol. 89, No. 2 277-281
9.Nilesh Patel, Charles E. smith, Alfred C. Pinchak. Emergency surgery and rapid sequence induction after Rocuronium vs. Suxamethonium. Anesthesiology 1995; 83:914. (s) The Dose of Succinylcholine Required for Excellent Endotracheal Intubating Conditions Mohamed Naguib, MB, BCh, MSc, MD, Abdulhamid H. Samarkandi, MB, BS, KSUF, FFARCSI, Mansour Emad El-Din, MD,

Khaled Abdullah, MB, BCh, MSc, AB, MD, Mazen Khaled, MD, and Saleh W. Alharby, MB, BS, FRCS (Glas) Anesth Analg 2006;102:151-155
10.Karcioglu : Dilemma In Rapid Sequence Intubation: Succinylcholine Vs. Rocuronium . The Internet Journal of Emergency and Intensive Care Medicine. 2003 Volume 7 Number 1
11.Cooper. R, Mirakhur RK, Clarke RST et al. Comparison of intubating conditions after administration of ORG 9426 (Rocuronium) and Suxamethonium. Br J Anaesth 1992; 69: 269-73. (s)
12.Magorian T, Flannery KB, Miller RD. Comparison of Rocuronium, succinylcholine induction of anesthesia in adult patients. Anesthesiology 1993; 79: 913-8. (s)
13.Rocuronium versus succinylcholine for rapid sequence induction intubation Perry J, LeeJWells G. Cochrane Database Syst Rev. 2008;(2):CD002788.
14.Larsen PB, Hansen EG, Jacobsen LS, Wiis J, Holst P, Rottensten H, Siddiqui R, Wittrup H, Sørensen AM, Persson S, Engbaek J. Eur J Anaesthesiol. Intubating Conditions after Rocuronium or Succinylcholine for rapid sequence induction with Fentanyl and Propofol in the emergency patients. 2005; 22(10):748-53.
15.Conditions after Rocuronium or Succinylchloine for rapid sequence induction with Fentanyl and Propofol in the emergency patients.2005; 22(10):748-53.