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Research Article

To Assess the Time Taken to Provide Ideal Intubating Conditions during Rapid Sequence Intubation of Different Doses of Rocuronium Compared to Single Dose of Succinylcholine

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ABSTRACT
Aim: The aim of the present study was to assess the time taken to provide ideal intubating conditions during rapid sequence intubation of different doses of rocuronium compared to single dose of succinylcholine.
Methods: This prospective, comparative randomized study was conducted at Rajindra hospital, Patiala. A total of 160 patient aged between 18-60 yrs of either gender and ASA physical status I and II who were scheduled to undergo elective surgery under general anaesthesia were divided under 4 categories with each category having 40 people [n=40].
Results: The demographics among the four groups were comparable. The comparison of intubating conditions at 60, 90 and 120 seconds was found to be statistically highly significant. The onset of action with rocuronium at 0.6, 0.9 and 1.2 mg/kg were 71.03 ± 24.05, 65 ± 21.9 and 51.30 ± 17.70 seconds and succinylcholine 39.78 +/- 8.04 seconds.
Conclusion: Rocuronium at a dose of 1.2 mg/ kg is very effective and is a great asset to have during rapid sequence intubation. It provides adequate intubating conditions within a minute of injectio, avoiding the side effects of succinylcholine. So we recommend that rocuronium at a dose of 1.2 mg/kg is better than succinylcholine for the purpose of RSI.

Keywords: Ideal Intubating Conditions, Rapid Sequence Intubation, Rocuronium, Succinylcholine.

INTRODUCTION

Rapid sequence induction and endotracheal intubation using succinylcholine is an established technique in patients at risk of gastric aspiration. But, succinylcholine has a number of undesirable side-effects like muscle fasciculations, myalgias, hyperkalemia, [1] bradyarrhythmias, [2] increased intra-ocular tension, increased intracranial tension, [3] increased intragastric pressure, anaphylaxis, malignant hyperthermia and Masseter spasm.
Hence, it is not suitable in situations like neuromuscular disorders, burns, acute head injury, intracranial bleed, [4] open eye injury, spinal cord injury, [5] Rapid sequence induction (RSI) is a frequently used procedure for endotracheal intubation in the emergency setting or in non fasting patients who are at risk of regurgitation. Succinylcholine remains the muscle relaxant of choice for RSI,[6-7] but it has many adverse effects.[8-9]
There are alternatives that may be used instead of succinylcholine. For instance, with a high dose of rocuronium bromide, 1.0–1.2 mg·kg−1, the same intubating conditions with a similar onset time as with succinylcholine may be achieved.[6-7] Also, pretreatment with intravenous (IV) magnesium may accelerate onset time of a nondepolarizing neuromuscular blocking agent.[10-12] The main problem with high dose nondepolarizing neuromuscular blocking agents is prolonged recovery time.[13]
Today, this might not be perceived as a major problem as even deep, rocuronium-induced neuromuscular block can be antagonized with sugammadex.[14] But in many countries, sugammadex is not available or its use is restricted due to its high costs and strategies to reduce its usage are welcomed.[15]
The aim of the present study was to assess the time taken to provide ideal intubating conditions during rapid sequence intubation of different doses of rocuronium compared to single dose of succinylcholine.

MATERIALS AND METHODS

This prospective, comparative randomized study was conducted at Rajindra hospital,

Patiala. A total of 160 patient aged between 18-60 yrs of either gender and ASA physical status I and II who were scheduled to undergo elective surgery under general anaesthesia were divided under 4 categories with each category having 40 people [n=40].

Group A: received Rocuronium at 0.6 mg per kg Group B: received Rocuronium at 0.9 mg per kg Group C: received Rocuronium at 1.2 mg per kg

Group D: received Succinylcholine at 1.5 mg per kg

160 patients were randomly divided into 4 groups,

Inclusion criteria

1. age group between 18 to 60 yrs
2. ASA physical status 1 and 2
3. Mallampatti grade 1 and 2
4. Patients undergoing elective surgery under general anaesthesia

Exclusion criteria

1. Patients with difficult airway (mallampatti grade 3 and 4)
2. ASA physical status 3 and 4
3. Patients with neuromuscular disorder on medication known to influence neuromuscular function.
4. Anticipated difficult airway (obesity, pregnancy etc)
5. Emergency surgeries
6. Patient with history of cardiovascular, hepatic, and renal disorders.
7. Patient refusal.

A written informed consent was obtained from each patient after explaining the procedure prior to inclusion in this study in their own vernacular language.

PAC was done in every patient which included:

1. Detailed clinical history of patient
2. Detailed general physical examination and baseline pulse rate, blood pressure, O2 saturation and respiratory rate.
3. Systemic examination which included: cardiovascular system, respiratory system,
4. central nervous system
5. Airway assessment
6. Investigations - haemoglobin, bleeding time, clotting time, TLC/DLC, urine complete examination, fasting/random blood sugar, renal function test, ECG and chest X ray (if required), PTI, liver function test, HIV, HBV, HCV, Echo (if indicated), serum electrolytes.
7. Each patient was kept fasting for atleast for 8 hours pre operatively.

METHOD

The study was conducted on 160 patient both males and females, aged between 18 to 60 yrs belonging to ASA physical status I and II scheduled for elective surgery. They were randomly divided into 4 groups. All patients were kept fasting atleast for 8 hrs pre-operatively. Preoperative baseline vital parameters – pulse rate, systolic and diastolic BP , mean arterial pressure, Spo2 were recorded. All these parameters were monitored continuously. Venous access was established with 18 gauge cannula and connected to iv fluid. Injection Glycopyrrolate 0.04mg/kg, Inj Fentanyl 2 microgram/kg given prior to induction. Following preoxygenation with 100% O2 for 5 min, patients of all groups received injection propofol 2 mg/kg and loss of response to verbal command by patient was noted and patient was ventilated with 100% O2 with bag and mask. Group A, B and C received rocuronium at 0.6mg/kg, 0.9mg/kg and 1.2 mg/kg respectively. Group D received succinylcholine at 1.5 mg/kg as intubating dose. The time of onset of apnea was noted. Intubating conditions were assessed at 60 sec, 90 sec and 120 sec after administration of muscle relaxant according to Cooper scoring system. Cooper scoring system was used to assess the intubating condition on basis of jaw relaxation, vocal cord opening and diaphgramatic response. It gave a score of 0 to 9 and divides the intubating conditions as excellent, good, fair and poor.

Oral endotracheal intubation with proper size endotracheal tube was done. After inflating the cuff of endotracheal tube, it was connected to circuit and controlled ventilation was done with bains circuit. Etco2 kept in range of 30-35. The excellent and good intubating condition were taken acceptable; whereas fair and poor intubating conditions were considered as unacceptable. We intubated only in excellent and good intubating condition. Any adverse reaction associated with use of roccuronium and succinylcholine at the time of laryngoscopy was noted. Following the resolution of the effect of induction dose, maintenance was done with O2, N2O, Isoflurane and NDMR [In the groups A, B and C with rocuronium at a dose of 0.1-0.2 mg/kg, Group D received an initial dose of rocuronium 0.6 mg/kg and then maintenance dose of rocuronium at 0.1-0.2 mg/kg]. Hemodynamic parameters of the patient [heart rate, SBP, DBP, MAP, Spo2]

were monitored continuously and noted for first 5 minutes at every minute and any adverse reactions of drugs were noted.

Statistical analysis

The data was entered and compiled. It was descriptively described, whenever required appropriate statistical test was applied. The data was analysed using IBM SPSS version 22. P-value of less than 0.05 was taken as significant.

RESULTS

Table 1: Intubating conditions at 60, 90 and 120 seconds

IS 60 sec	Group 1		Group 2		Group 3		Group 4	
	No.	%	No.	%	No.	%	No.	%
Poor	2	5%	0	0%	0	0%	0	0%
Fair	24	60%	26	65%	10	25%	2	5%
Good	10	25%	8	20%	6	15%	4	10%
Excellent	4	10%	6	15%	24	60%	34	85%
Total	40	100%	40	100%	40	100%	40	100%
P value	<0.001							

IS 90 sec	Group 1		Group 2		Group 3		Group 4	
Poor	0	0%	0	0%	0	0%	0	0%
Fair	9	22.5%	5	12.5%	1	2.5%	0	0%
Good	10	25%	11	27.5%	3	7.5%	4	10%
Excellent	21	52.5%	24	60%	36	90%	36	90%
Total	40	100%	40	100%	40	100%	40	100%
Fisher Exact value	26.298							
P value	<0.001							

IS 120 sec	Group 1		Group 2		Group 3		Group 4	
Poor	0	0%	0	0%	0	0%	0	0%
Fair	1	2.5%	0	0%	0	0%	0	0%
Good	5	12.5%	0	0%	0	0%	1	2.5%
Excellent	34	85%	40	100%	40	100%	39	97.5%
Total	40	100%	40	100%	40	100%	40	100%
P value	0.004							

The comparison of intubating conditions at 60, 90 and 120 seconds was found to be statistically highly significant.

Table 2: Onset Of Action Of Different Doses Of Rocuronium(0.6 Mg/Kg, 0.9 Mg/Kg And 1.2 Mg/Kg) And Succinylcholine 1.5 Mg/Kg.

Dose used (rocuronium)	Onset of action (seconds)
0.6 mg/kg	71.03 ± 24.05 sec
0.9 mg/kg	65 ± 21.9 sec
1.2 mg/kg	51.30 ± 17.70 sec
Succinylcholine at 1.5 mg/kg	39.78+/- 8.04 sec

The onset of action at 0.6, 0.9 and 1,2 mg/kg were 71.03 ± 24.05, 65 ± 21.9 and 51.30 ± 17.70 seconds and onset with succinylcholine at a dose of 1.5 mg/ kg was 39.78 +/- 8.04 seconds.

DISCUSSION

Rapid sequence intubation is the process that involves administration of a sedative (eg, induction agent) followed immediately by a neuromuscular blocking agent to facilitate endotracheal intubation The purpose of emergency RSI is to make emergent intubation easier and safer in patients with delayed gastric emptying time, obese patients, hiatus hernia, esophageal carcinoma or resected esophagus, this increases the success rate of intubation and decreases complications like aspiration. In comparison to elective intubation which is done under controlled, RSI is an emergency procedure.[18] RSI generally consists of seven steps: (1) preparation, (2)

preoxygenation, (3) pretreatment, (4) induction, (5) protection and positioning, (6) placement of the tube in the trachea, and (7) postintubation management. These seven steps can be modified when appropriate to fit the clinical situation. There are several critical factors to remember with RSI. First, a sedative is coadministered with the NMB. The administration of an analgesic is must as pain during surgery can lead to negative physiological effects.[19]

Muscle relaxants have become an essential part of anaesthesiologist armamentarium. They help in endotracheal intubation, Mechanical ventilation, reduce anesthetic requirements, prevent patient movements, facilitate surgery and decrease oxygen consumption.[20] Earlier general anaesthesia was maintained by inhalational agents or intravenous agents. Endotracheal intubation was not common and deep anaesthesia was maintained by intravenous or inhalational agents. Anaesthesia went a drastic change after the invention of muscle relaxants.[21] The Ideal neuromuscular blocking agents for intubation should have a fast onset, brief duration of action, provide profound relaxation should be free from hemodynamic changes. Firstly depolarisng muscle relaxant (succinylcholine) was being used.[22]

The onset of action in the present study is considered as onset of apnoea which was significantly shorter in group 4 i.e. 39.78 ± 8.04 sec (succinylcholine 1.5mg/kg) than group 3 i.e. 51.30 ± 17.71sec (rocuronium 1.2mg/kg) , group 2 i.e. 65.00 ± 21.90 sec (rocuronium 0.9 mg/kg) and group 1 i.e 71.03 ± 24.05 sec (rocuronium 0.6 mg/kg). This is in agreement with the fact that onset of action is inversely proportional with potency and dosage of drugs. The group 4 having more potent drug (succinylcholine) has shortest onset of action while other 3 groups have onset of action inversely proportional to the dosage of drug (rocuronium). The onset of action in our study is contrary to the study done by M Mayor et al[23] reason being that they used drugs like etomidate 0.3 mg/kg, midazolam 0.07 mg/kg and fentanyl 0.05 to 0.1 mg while in our study we used propofol 2 mg/kg and fentanyl 0.002 mg/kg.

The onset of action of rocuronium at a dose of 0.9 mg/kg is 65 ± 21.9 seconds. The onset of action in our study is in accordance with study done by Nuthalapaty et al[24] and Vanlalhmangaaihi Hmar and vanlalhruaii.[25] The onset of action in our study is contrary to study done by Sudharshini, the reason could be due to the difference of age group i.e. age group studied by Sudharshini was more than 80 years while in our study age group was 18-65 years.[26] The onset of action of rocuronium at a dose of 1.2 mg/kg is 51.30 ±17.70 seconds. The onset of action of rocuroinium at a dose of 1.2 mg/kg in our study is in accordance with study done by Shultz et al[27] and M Tomasz et al.[28] The onset of action of rocuronium at a dose of 1.2 mg/kg in our study was contrary to study done by Geoffrey et al because they gave thiopental 3 to 4 mg/kg to 50% subjects and propofol 2 to 3 mg/kg to other 50% subjects in their study while we used fentanyl 0.002 mg/kg and propofol 2mg/kg before giving rocuronium.[29]

CONCLUSION

Rocuronium at a dose of 1.2 mg/ kg is very effective and is a great asset to have during rapid sequence intubation. It provides adequate intubating conditions within a minute of injection which is comparable to succinylcholine. However it doesn't possess side-effects like succinylcholine. Hence, we recommend that rocuronium at a dose of 1.2 mg/kg is a better than succinylcholine for the purpose of RSI.

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