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A Comparative Study of Intubating Conditions and Haemodynamic Effects, After Administration of Rocuronium Bromide versus Succinylcholine for Endotracheal Intubation

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Abstract

Background: Succinylcholine chloride has a rapid mechanism of action and causes profound relaxation, making intubation quick, simple. Its potentially dangerous adverse effects, such as bradycardia and other dysrhythmias, increased serum potassium, postoperative myalgia, increased intraoccular, intragastric, and intracranial pressure, and circumstances, such as burns and certain neurological illnesses, will make it contraindicated.

Rocuronium, an aminosteroidal muscle relaxant with no side effects that was launched in 1994, is believed to induce excellent to good intubating circumstances in 60 seconds when given at two to three times the ED95 dose. As a result, the current study compared rocuronium bromide to succinylcholine chloride for evaluating intubating circumstances and haemodynamic responses.

Materials And Methods:

60 adult patients of ASA grade I & II of either sex in the age group of 18-60 years requiring intubation for various surgeries were selected and were randomly divided into 2 groups. Group I received 1.5mg/kg body wt & Group II received 0.6mg/kg body wt of Rocuronium bromide to facilitate endotracheal intubation. Intubating conditions were assessed at 60 seconds based on the scale adopted by four point scales of Cooper et al (1992). The haemodynamic parameters in the present study were compared using p-value obtained from student t-test.

Results and Conclusion:

Rocuronium bromide is a medication with a good haemodynamic stability.

With rocuronium bromide, perfect intubating conditions can be achieved in the 60s, and it can be used as an alternative to succinylcholine in patients who are at risk of succinylcholine-related complications. Intubation with rocuronium bromide at a dose of 0.6 mg/kg may be the best option

Keywords: Succinylcholine, Rocuronium, emergency intubation

Introduction

Bovet introduced succinylcholine chloride, a synthetic depolarizing muscle relaxant, in 1951. It has a rapid onset of action and induces profound relaxation, making intubation simple, easy and non traumatic. Due to its potentially dangerous side effects, such as bradycardia and other dysrhythmias, an increase in serum potassium, postoperative myalgia, and an increase in intraoccular, intragastric, and intracranial pressure, it falls short of being an ideal muscle relaxant. Furthermore, it is contraindicated in burns and certain neurological diseases.

The use of muscle relaxants to facilitate intubation was pioneered by Bourne[1].Rocuronium an aminosteroidal muscle relaxant introduced in 1994 devoid of adverse effects has the most rapid onset of action when given in two to three times the ED95 dose is said to produce excellent to good intubating conditions in 60 seconds. ORG 25969 is a modified γ-cyclodextrin which acts by rapidly encapsulating a steroidal NMBA such as Rocuronium and forming a stable complex which prevents the pharmacological action of the NMBA at the NMJ.[2]The aim of the present study is to compare, the intubating conditions of Rocuronium bromide with that of Succinylcholine and to evaluate the haemodynamic effects of these agents during laryngoscopy and intubation.

Rocuronium bromide, like any other non-depolarizing skeletal muscle relaxant, binds to the acetylcholine receptor subunit in the post junctional membrane and causes competitive blocking, resulting in skeletal muscle relaxation. Its rapid beginning of effect can be explained by its chemical structure, which is slightly different in three places from that of its parent molecule, vecuronium bromide. It is seven to eight times less powerful than vecuronium bromide but has the same molecular weight, allowing a greater number of drug molecules to reach junctional receptors in a shorter period of time, allowing for faster neuromuscular blockade development. The delayed duration of action is due to weaker binding to receptors (lower efficacy).[12,13]

Materials And Methods

The study was conducted in the department of Anaesthesiology at MGM Hospital, Navi Mumbai.

Inclusion criteria

A group of 60 patients belonging to ASA grade I and II of either sex in the age group of 18-60 years requiring intubation.

Exclusion criteria

1. Medication with drugs that interact with neuromuscular transmission viz
2. Aminoglycosides, Calcium channel blockers
3. History of drug allergy.
4. Patient with bradycardia or cardiac issues.
5. Neuromuscular disorder.

Group I received 1.5mg/kg body wt of Succinylcholine to facilitate endotracheal intubation.

Group II received 0.6mg/kg body wt of Rocuronium bromide to facilitate endotracheal intubation.

Informed consent was taken from the patients regarding the procedure. Institutional and Ethical committee clearance was obtained for the study

A thorough pre anaesthetic evaluation has done a day before surgery and all the necessary investigations were done. Tab Alprazolam 0.5 mg and Tab Ranitidine150 mg was given to all patients on the night before the surgery. Patients were maintained nil by mouth for about 6 hrs prior to the surgery.

On the day of surgery, in pre operative room, an appropriate sized iv cannula was inserted. Baseline heart rate, mean arterial pressure were measured. On shifting to operation room, multimodality monitor was connected which included NIBP, Pulseoximeter and Electrocardiogram. Inj Fentanyl 2mcg/kg and Glycopyrolate 0.2 mg iv and Midazolam 1mg iv were given to all patient 5 minutes prior to the administration of induction agent. All the patients were preoxygenated with 100% oxygen for 3 minutes. All were induced with Inj Propofol 2mg/kg as induction agent.

In Group 1 Inj Succinylcholine 1.5 mg/kg iv was given. In Group 2 Inj Rocuronium 0.6 mg/kg iv was given and intubation was attempted at 60 seconds and the intubating condition were graded using score adopted by Cooper et al(1992).[14]

Volume 4, Issue 6; November-December 2021; Page No 951-956

Score	Jaw relaxation (Laryngoscopy)	Vocal cords	Response to intubation
0	Poor(Impossible)	Closed	Severe coughing or Bucking
1	Minimal(Difficult)	Closing	Mild coughing
2	Moderate(Fair)	Moving	Slight diaphragmatic movement
3	Good(Easy)	Open	None

Total score of 8-9 =Excellent 6-7= Good 3-5=Fair 0-2=Poor

Statistical analysis

The patient data were analyzed using the unpaired t test, $P < 0.05$ is considered as statistically significant.

Results

In Group 1, 20 (66.66%) belonged to ASA Grade 1 and 10(33.37%) belonged to ASA Grade 2.

In Group 2, 18(60%) belonged to ASA Grade 1 and 12(40%) belonged to ASA Grade 2

In Group 1, weight range was 40 to 65 kgs and the mean weight was 54.5 kgs.

In Group 2, weight range was 40 to 64 kgs and the mean weight was 50.3 kgs.

Succinylcholine produced "Excellent" intubating conditions in all the 30 (100%) patients.

Rocuronium produced "Excellent" intubating conditions in 27(90%) patients and "Good" intubating conditions in 3(10%) patients. There was no case of failed intubation in both group patients(table 1)

There was a significant ($p < 0.05$) rise in mean heart rate by 37.62% and 29.17% from preinduction value in Group I and II respectively. This increase in mean heart rate declined to 4.33% and 5.15% from base line at 5 minutes following intubation. There were no abnormal ECG findings noted in any of the cases following the administration of drugs.(table 2)

There was a significant ($p < 0.05$) rise in mean arterial pressure by 41.53 and 28.63% from preinduction value at 1 minute following intubation in Group I and Group II respectively. This rise in mean arterial pressure declined to 4.6% and 2.0% from preinduction value at 5 minutes following intubation. In both the groups, there was a trend towards returning to baseline mean arterial pressure at 5 minute following intubation. (table 3)The blood pressure returned towards preinduction value at 10 minutes without any treatment. There was no bronchospasm or rash associated with fall in blood pressure. There were no clinical findings of histamine release in any of the patients in the present study

Volume 4, Issue 6; November-December 2021; Page No 951-956

Table 1 shows the intubating conditions in both the groups based on score adopted by Cooper

	Group 1	%	Group 2	%
excellent	30	100	27	90
good	-	-	3	10
fair	-	-	-	-
poor	-	-	-	-

Table 2 Mean heart rate

	Group 1		**Group 2**	
	Beats/min	**%**	Beats/min	**%**
Pre Induction	86		86.16	
1min after intubation	118.36	37.62	111.3	29.17
3min after intubation	104.23	21.19	101.76	18.1
5min after intubation	89.73	4.33	90.6	5.15

Table 3 Mean arterial pressure

	Group 1		Group 2	
	mmhg	%	mmhg	%
Pre induction	89.56		91.5	
1min after intubation	126.76	41.53	117.7	28.63
3min after intubation	105.6	17.9	106.23	16.09
5min after intubation	93.76	4.6	93.33	2

Discussion

In the practise of general anaesthesia, rapid and safe endotracheal intubation is crutial. Regurgitation and aspiration of stomach contents are reduced when the patient's airway is secured smoothly and rapidly. The degree of muscle relaxation and the depth of anaesthesia determine the ease with which endotracheal intubation can be conducted.

In terms of onset and duration of effect, succinylcholine chloride, launched in 1951, was unrivalled. This medicine provided such a high level of relaxation that it is still considered as a gold standard against which other pharmaceuticals are measured. However, as the negative effects of succinylcholine chloride, such as bradycardia, nodal and junctional rhythms, an increase in intraocular and intracranial pressure, and the development of Phase 2 block after a large dose or continuous infusion became more common, the duration of succinylcholine in patients with pseudocholineestrase deficiency became longer. The efficacy of non-depolarizing neuromuscular blockers is inversely proportional to the rate of onset.

Rocuronium has an ED95 of 0.54mcgM/kg molar potency.Rocuronium bromide (ORG 9426) was introduced in 1994 in order to provide a very rapid relaxation for endotracheal intubation. It was synthesized from its parent molecule vecuronium bromide by various substitutions by Dr. T. Sleigh and Dr. Savage at Organon Lab.

Selection of dosage of neuromuscular blockers is usually based on ED95 value. ED95 is the dose of relaxant needed to produce 95% suppression of the single twitch response. The dose of relaxant needed for endotracheal intubation is usually more and is employed in multiples of ED95 dose.

The ED95 dose of Succinylcholine chloride is 0.392 mg kg-1 body weight. Four times the ED95 dose which approximates 1.5 mg kg-1 body weight has been employed for intubation in the present study which is similar to that of Aleksandra J Mazurek, Bronwyn Rac, Susan Hann, Ikakim J, Barbara Castro, Charles J Cote(1998), Aparna Shukla, Dubey KP, Sharma MSN(2004), Huizinga ACT, Vandenbrom RHG(1992), Wierda MKH, Hommu FDM, Hennis PJ(1990), Weiss JH et al(1997),Neerja B et al(1999) 15.16

The ED95 of Rocuronium is 0.3 mg/kg body weight. In the present study the dose used is 2X ED95 i.e. 0.6 mg/kg body weight.

Levy and Jerrold H. et al. 1993 have demonstrated no increase in plasma histamine levels at 1, 3 and 5 minute after the rapid iv bolus of 0.6, 0.9, 1.2 mg kg-

Volume 4, Issue 6; November-December 2021; Page No 951-956

1 body weight Rocuronium bromide. Clinical signs of histamine release (e.g. flushing, rash, bronchospasm) associated with administration of Rocuronium bromide was reported in 9 of 1137 (0.8%) patients. Thus Rocuronium bromide is proved to have minimal to nil histamine releasing property.

Conclusion

Rocuronium bromide can establish optimal intubating conditions in 60s and can be utilised as an alternative to Succinylcholine, especially in those who are susceptible to Succinylcholine's adverse outcomes. Intubation with rocuronium bromide at a dose of 0.6 mg/kg may be the best option. Rocuronium bromide is a medication with a steady haemodynamic profile. The efficacy of nondepolarizing neuromuscular blockers is inversely proportional to the rate of onset. Rocuronium has an ED95 of 0.54mcgM/kg molar potency.

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Volume 4, Issue 6; November-December 2021; Page No 951-956

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Volume 4, Issue 6; November-December 2021; Page No 951-956