Original Article

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Comparison of Intubating Conditions of Two Doses of Rocuronium Bromide with Succinylcholine in Children undergoing Elective Surgeries under General Anaesthesia- A Randomised Control Trial

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ABSTRACT

Introduction: Succinylcholine is a muscle relaxant of choice for paediatric intubation due to its fast onset and ultrashort duration of action but it is associated with unwanted side-effects. Rocuronium bromide can be used alternatively to avoid those unwanted side-effects because of its fast onset and intermediate duration of action.

Aim: To compare two doses of rocuronium bromide with succinylcholine in terms of intubating conditions, duration of action, haemodynamic variations, and complications to get a better alternative dose of rocuronium bromide in children undergoing elective surgeries.

Materials and Methods: The present randomised, double-blinded clinical trial study was conducted in the Department of Anaesthesiology, Jawaharlal Nehru Medical College (JNMC), Sawangi, Wardha, Maharashtra, India from January 2021 to October 2022. Ninety American Society of Anaesthesiology (ASA) Grade-I-II children of both sexes of 1-10 years age, undergoing elective surgery were equally divided into three groups. Group-R9 (n=30) and Group-R12 (n=30) received rocuronium bromide 0.9 mg/kg and 1.2 mg/kg, respectively while Group-S (n=30) received succinylcholine 1.5 mg/kg. Comparative evaluation of intubating conditions was done around 60 seconds in all three groups and duration of action, haemodynamic variations, and complications were noted. All data were entered in a microsoft excel sheet and results were expressed as percentages, mean Standard Deviation (SD), Chi-square test, and Analysis of Variance (ANOVA), test where the difference was considered statistically significant if the p-value <0.05 by using the software Statistical Package for the Social Sciences version 11.0 (SPSS version 11.0).

Results: Rocuronium bromide 1.2 mg/kg and succinylcholine 1.5 mg/kg provided excellent intubating conditions in 96.7% children and good intubating conditions in 3.3% children in both groups, while rocuronium bromide 0.9 mg/kg provided excellent intubation conditions in 83.3% of children and good intubating conditions in 16.7% of children There was a significant difference present in intubation scores between three groups (p=0.01). The duration of action was longer with rocuronium bromide 1.2 mg/kg (38.93±4.323 minute) as compared to rocuronium bromide 0.9 mg/kg (26.07±2.791 minute) while it was shortest with succinylcholine 1.5 mg/kg (6.00±1.74 minute). Adverse effects like fasciculations were only found in children (n=30) receiving succinylcholine (p=0.01) but not in rocuronium bromide groups.

Conclusion: Rocuronium bromide 1.2 mg/kg gives the same intubating conditions as succinylcholine 1.5 mg/kg with good haemodynamic stability and no side-effects but the duration of action was longer with rocuronium bromide 1.2 mg/kg as compared to rocuronium bromide 0.9 mg/kg. So, to avoid unwanted side-effects of succinylcholine in children, rocuronium bromide 1.2 mg/kg can be used as an alternative to succinylcholine 1.5 mg/kg in children undergoing elective surgeries where early return of spontaneous recovery is not needed.

Keywords: Complications, Dosage, Intubation, Muscle relaxant, Paediatric, Ultrashort

INTRODUCTION

The Neuromuscular Blocking Drugs (NMBDs) are used to provide muscle relaxant during intubation, which is most important process that involved in surgeries of children undergoing General Anaesthesia (GA). The main goal of NMBDs is to provide paralysis of vocal cords and muscles of jaw during intubation. To achieve successful tracheal intubation with less laryngeal injuries, rapid onset of neuromuscular blockade is required [1]. In 1952, Thesleff and Foldes and associates have introduced succinylcholine, which rapidly gained attention and changed anaesthesia practise because of the rapid onset of effect and ultrashort duration of neuromuscular blockade. Due to this, rapid endotracheal intubation and rapid recovery from neuromuscular blockade is possible [2,3]. Succinylcholine is the only depolarising muscle relaxant in clinical use producing prolonged depolarisation of end plate region. The ultrashort action is due to its rapid hydrolysis by butyrylcholinesterase [2,3].

Although, being a muscle relaxant of choice for intubation, succinylcholine has also received significant attention because of the severity of the possible complications. Cardiac arrythmia may follow intravenous (i.v.) administration. Cardiac sinus arrest may follow after first i.v. bolus but it is most commonly seen in children after second bolus administration. Cardiac arrest may occur in children at any age [4]. Therefore, a vagolytic drug should be administered just before the first dose in all children unless a contraindication to tachycardia. The bradycardia may be prevented by administration of atropine, ganglion blocking agent and NMBDs [5]. The potential of rhabdomyolysis and hyperkalaemia as well as the risk of malignant hyperthermia, suggest that

succinylcholine should not be routinely used in children [6]. To avoid these complications in normal healthy children, a routine administration of succinylcholine during intubation should be avoided.

Because of unwanted complications that are associated with administration of succinylcholine in normal healthy children, its use is only reserved for emergency airway management including severe laryngospasm and as a part of a Rapid Sequence Induction (RSI) where the child has a full stomach [7]. So, there is a need to find out alternative NMBD for intubation in healthy children undergoing elective surgeries which provide intubation conditions with a fast onset of action like succinylcholine.

Rocuronium bromide, as an intermediate-acting non depolarising NMBD with faster onset of action has low potency as compared to other NMBDs. When succinylcholine is contraindicated or its side-effects are undesired, RSI can be accomplished using high dose of rocuronium bromide, this provides adequate intubating condition in less than 90 seconds [8]; although the use of a large dose of rocuronium bromide can lead to long duration of action [9].

According to clinical studies [8,10-13] excellent to good intubating conditions can be achieved in 60 seconds after administering 0.6 mg/kg of rocuronium bromide while some researchers [14-16] found that a dose of 0.9 mg/kg significantly decreased the onset time and enhanced circumstances for RSI at 45 seconds. Increasing the dose further shortens the onset time but has clinical drawback due to the increase in duration. Neither histamine release nor cardiovascular effects have been observed with rocuronium bromide [17,18]. When compared with other NMBDs like vecuronium [1,19], cis-atracurium [20], and mivacurium [21], it was observed that rocuronium bromide has fast onset of action.

Because of the availability of such excellent muscle relaxant, succinylcholine is commonly used during intubation in children undergoing elective surgeries. Although, it can be associated with unwanted side-effects [4,6]. Therefore, it is important to discover an alternative muscle relaxant of choice that provided the same intubating conditions as succinylcholine without known side-effects. The aim of the present study was to compare intubating conditions of two doses of rocuronium bromide (0.9 mg/kg and 1.2 mg/kg)and compared it with succinylcholine 1.5 mg/kg by using cooper scoring system at 60 seconds and to compare the duration of action, haemodynamic variations and complications between three groups to get better alternative dose of rocuronium bromide in the children undergoing elective surgeries under GA.

MATERIALS AND METHODS

This randomised, double blinded clinical study trial was carried out in the Department of Anaesthesiology, Jawaharlal Nehru Medical College (JNMC), Sawangi, Wardha, Maharashtra, India from January 2021 to October 2022. The approval from Institutional Ethical Committee was obtained {DMIMS(DU/IEC/2020-21/9360)}. Informed, verbal and written consents were obtained from the parents/guardians during pre-anaesthesia check-up as per CONSORT guidelines.

Inclusion criteria: Children aged between 1-10 years of ASA I-II undergoing elective surgeries under GA were included in the study.

Exclusion criteria: Children undergoing emergency procedures, history of hyperkalemia, neurological disorders and burns, family history of malignant hyperthermia and those with difficult airway were excluded from the study.

Sample size calculation: Sample size formula for difference between two means used for study size calculation with confidence level 95% and margin of error 5%.

$n=(Z\alpha+Z\beta)^2(\sigma_1^2+\sigma_2^2/K)/\Delta^2$

Where; Za is the level of significance at 5 i.e., 95% Confidence interval=1.96, Zß is the power of test=80 %=0.84, s1=SD of MBP in Group-A=5.53, s2=SD of MBP in Group-B=5.18, Δ=Difference between the two means=85.8- 81.07=4.43

K=1, n=(1.96+0.84)2 ((5.53)2+(5.18)2/1/(4.43)2

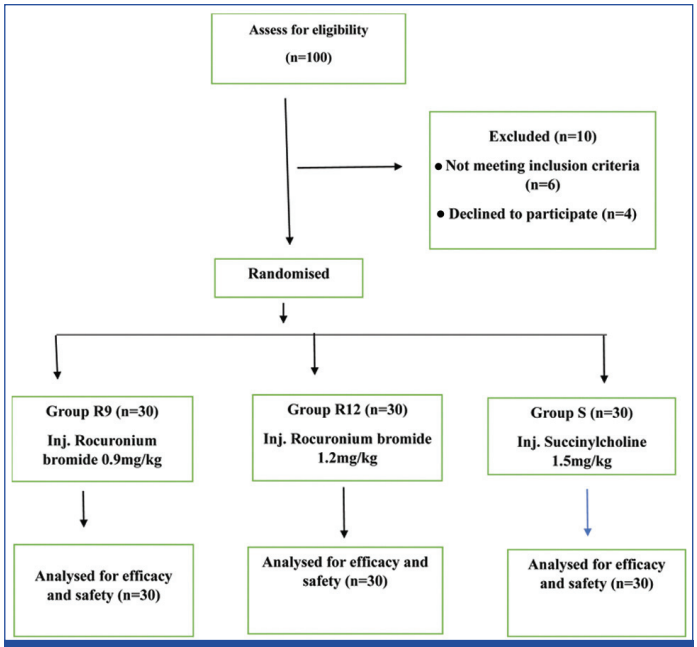
n=22.93; n=25

Study reference for calculating sample size was taken from study of Kulkarni KR et al., [22]. Sample size was found to be 25 per group. Considering the error and attrition, the authors have selected sample size of 30 cases per group.

Study Procedure

A thorough pre-anaesthesia check-up was done prior to surgery. All children were routinely investigated for complete blood count, random blood sugar, renal function test and liver function test. Chest X-ray was done. An intravenous access was secured one night prior to surgery in the ward. Informed, verbal and written consents from parents/guardians were taken after explaining study procedure.

A total of 90 children whose parents/guardians gave informed, verbal and written consents were selected for the study. Those children were randomly allocated into three groups of 30 children each. Randomisation was done with the help of computer-generated random number table [Table/Fig-1].



[Table/Fig-1]: CONSORT flow diagram.

- Group-R9: Children received rocuronium bromide 0.9 mg/kg
- Group-R12: Children received rocuronium bromide 1.2 mg/kg
- Group-S: Children received succinylcholine 1.5 mg/kg

Nil per oral was confirmed prior to surgery as per paediatric fasting guidelines. To avoid separation anxiety in children i.v. Inj. Midazolam (0.05 mg/kg), Inj. Glycopyrrolate (0.004 mg/kg) and Inj. Ketamine (1 mg/kg) were given in the pre-operative room and then shifted to the operative room. Standard ASA monitors were attached and baseline parameters were noted. All children were pre-oxygenated with 100% oxygen for three minutes. Children were induced with Inj. Propofol (2 mg/kg). Inj. Fentanyl (2 mg/kg) was given for analgesia. A check for ventilation was done. The present study involved double blinding of the drug loader, the drug administrator and the anaesthesiologist performing intubation.

The muscle relaxant of choice was given as per group allocation. Group-R9 and Group-R12 received 0.9 mg/kg and 1.2 mg/kg, respectively while Group-S received succinylcholine 1.5 mg/kg. Intubation was done with suitable sized endotracheal tube at

60 seconds and intubating conditions were assessed by coopers scoring system [Table/Fig-2] [10].

Score	Jaw relaxation	Vocal cords	Response to intubation
0	Impossible to open	Closed (adducted)	Severe coughing or bucking
1	Opens with difficulty	Closing	Mild coughing
2	Moderate opening	Moving	Slight diaphragmatic movement
3	Easy opening	Open (relaxed)	No movement

[Table/Fig-2]: Coopers scoring of intubating conditions; Scores were graded as follows: 8-9=excellent; 6-7=good; 3-5=fair; 0-2=poor [10].

Intubation was performed if the intubating condition was excellent or good while it was postponed and re-attempted every 30 seconds if it was inadequate or poor. The children were maintained on Oxygen+N_2O and Sevoflurane (MAC of 2-3%). Normocarbia was maintained with end-tidal CO_2 (Et CO_2) between 35-40 mm Hg on mechanical ventilation.

Duration of action of the neuromuscular blockade was noted and a supplement dose of atracurium (0.5 mg/kg) was given if needed in all three groups haemodynamic variables like Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP) were noted at the following intervals: Before Intubation (BI), After Intubation (AI), and 1,5 and 10 minutes AI. Side-effects like fasciculations, bradycardia, flushing, erythema and hypotension were noted.

At the end of the surgery, sevoflurane was discontinued and 100% oxygen was given. Neuromuscular blockade was reversed with Inj. Neostigmine (0.05 mg/kg) and Inj. Glycopyrrolate (0.004 mg/kg). After the return of spontaneous respiration, extubation was done once the child was awake, maintaining adequate spontaneous respiration, normal SpO_2, Et CO_2, and normal vital signs. After extubation, the children were shifted to the recovery room for observation and post-operative care.

STATISTICAL ANALYSIS

The data was recorded in the proforma and transferred to a spreadsheet in Microsoft excel. Statistical analysis was done by using the software SPSS version 11.0. Quantitative data like age, weight, intubation scores, duration of action, and haemodynamic variables were expressed as mean±SD and compared via using ANOVA test. Qualitative data like sex and intubating conditions were compared using the chi-square test. The difference was considered statistically significant if the p-value <0.05.

RESULTS

A total of 90 children (30 children in each group) were analysed. Children of the study groups were comparable for demographic data. Statistical analysis revealed there were no significant differences with regard to age, weight, and sex between the three different groups [Table/Fig-3].

Parameters	Group-R9 (n=30)	Group-R12 (n=30)	Group-S (n=30)	p-value
Age (years) Mean±SD	3.50±2.610	3.50± 2.713	4.57±2.775	0.22
Weight (kg) Mean±SD	14.30±5.920	14.47±6.196	16.97±6.162	0.17
Sex (M:F)	15:15	17:13	18:12	0.73

[Table/Fig-3]: Comparison of demographic data between three groups.
SD: Standard deviation; M: Males; F: Females

After induction of anaesthesia, a muscle relaxant of choice was given and intubation was performed. There was a significant difference present between the three groups with regard to intubation score [Table/Fig-4].

The grading of intubation conditions was compared between three different groups. In Group-R9, excellent Intubating Conditions (IC) was present in 25 (83.3%) children and good intubating condition was seen in five children (16.7%). In Group-R12 and Group-S,

Parameters	Group-R9 (n=30)	Group-R12 (n=30)	Group-S (n=30)	ANOVA	p-value
JR	2.76±0.36	2.90±0.27	2.90±0.18	3.06	**0.046***
VCM	2.69±0.26	2.73±0.29	2.80±0.13	3.19	**0.031***
RTI	2.77±0.28	2.97±0.17	2.97±0.20	3.32	**0.028***
TS	8.17±0.874	8.60±0.563	8.67±0.597	4.81	**0.01***

[Table/Fig-4]: Comparison of intubation score between three groups.
JR: Jaw relaxation; VCM: Vocal cord movement; RTI: Response to intubation; TS: Total score; *: p-value <0.05 was statistically significant

excellent intubating conditions were seen in 29 (96.7%) children, and only in one child (3.3%) good intubating condition was seen. So, there was a statistically significant difference present between Group-R9 and Group-S (p=0.027) while no difference was present between Group-R12 and Group-S (p=1.00) [Table/Fig-5].

Grading [10]	Group-R9 (n=30)	Group-R12 (n=30)	Group-S (n=30)
Excellent	25 (83.3%)	29 (96.7%)	29 (96.7%)
Good	5 (16.7 %)	1 (3.3 %)	1 (3.3 %)

[Table/Fig-5]: Grading of intubating conditions among three groups.
IC: Intubating conditions [10]; *:p-value <0.05 was statistically significant
Chi-square (between Group-R9 and S) p=0.027*
Chi-square (between Group-R12 and S) p=1.00

The duration of action was compared between the three groups. It showed that the duration of action was significantly higher in Group-R12 (39.93±4.323 min) than in Group-R9 (26.07±2.79 min) while in Group-S, the shortest duration of action (6.00±1.74 min) was noticed as compared with Group-R9 and Group-R12. The difference in duration of action was statistically significant in between three groups [Table/Fig-6].

	Group-R9 (n=30)	Group-R12 (n=30)	Group-S (n=30)	p-value
DOA (min)	26.07±2.791	38.93±4.323	6.00±1.174	**0.01***

[Table/Fig-6]: Comparison of DOA (in minutes) among three groups.
DOA: Duration of Action; *: p-value <0.05 was statistically significant (by using ANOVA test)

The supplement dose of atracurium (0.5 mg/kg) was given in Group-S while there were no requirement of supplemental doses of muscle relaxants in Group-R9 and R12 till the end of surgery. The haemodynamic parameters like Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP) were comparable between the three groups. There was no significant difference present between the three groups regards to all haemodynamic parameters. There was an increase in all parameters AI and one minute AI while decreased at five minute and 10 minute AI and came to near baseline values but statistical difference was not significant in all three groups [Table/Fig-7-10].

Group		BI	AI	1 m	5 m	10 m
R9	Mean	103.50	108.50	113.50	103.50	100.00
	SD	4.075	8.075	7.075	5.93	8.576
R12	Mean	101.73	110.00	112.70	102.70	97.70
	SD	6.583	7.000	9.418	7.49	7.32
S	Mean	102.50	106.32	108.93	102.20	101.15
	SD	7.36	9.196	6.437	6.46	7.23
ANOVA test		1.29	1.67	2.08	1.02	0.94
p-value		0.48	0.28	0.21	0.67	0.78

[Table/Fig-7]: Comparison of Heart Rate (HR) (beats/min) among the study groups.
BI: Before intubation; AI: After intubation

Group		BI	AI	1 m	5 m	10 m
R9	Mean	115.70	119.67	122.97	112.07	110.00
	SD	1.291	1.398	1.884	4.337	3.742
R12	Mean	115.53	119.33	122.00	113.83	112.07
	SD	1.279	1.269	1.390	5.487	3.617

S	Mean	116.00	120.00	123.97	115.07	112.07
	SD	1.554	2.533	2.141	3.311	4.530
ANOVA test		0.88	1.02	3.67	2.73	2.52
p-value		0.42	0.37	0.09	0.14	0.19

[Table/Fig-8]: Comparison of Systolic Blood Pressure (SBP) (mm Hg) among the study groups.
BI: Before intubation; AI: After intubation

Group		BI	AI	1 m	5 m	10 m
R9	Mean	72.07	75.07	77.73	72.07	72.07
	SD	1.617	1.617	9.363	1.617	4.617
R12	Mean	74.33	75.00	82.00	74.33	74.33
	SD	2.171	3.661	6.626	2.171	2.171
S	Mean	75.00	78.00	80.00	75.00	73.00
	SD	0.743	2.98	7.486	0.743	3.743
ANOVA test		2.39	2.07	2.81	2.39	2.66
p-value		0.23	0.38	0.12	0.23	0.15

[Table/Fig-9]: Comparison of Diastolic Blood Pressure (DBP) (mm Hg) among the study groups.
BI: Before intubation; AI: After intubation

Group		BI	AI	1 m	5 m	10 m
R9	Mean	83.33	85.53	107.87	89.10	89.07
	SD	4.241	4.833	5.502	3.062	4.285
R12	Mean	84.13	85.23	109.00	91.80	90.23
	SD	5.756	3.455	7.462	5.990	3.695
S	Mean	89.93	94.83	106.63	90.70	91.43
	SD	3.785	6.291	4.928	4.622	6.040
ANOVA test		1.61	3.02	1.18	1.11	1.17
p-value		0.36	0.055	0.41	0.47	0.42

[Table/Fig-10]: Comparison of Mean Arterial Pressure (mm Hg) among the study groups.
BI- Before intubation; AI: After intubation

The complications after giving the muscle relaxant were comparable. Only fasciculations were present in all 30 children of Group-S. No other complications like flushing, bradycardia, erythema and hypotension were present in all three groups.

DISCUSSION

Succinylcholine is associated with unwanted side-effects [4]. In this study, two doses of rocuronium bromide were compared with succinylcholine in children to evaluate the dose that provide the acceptable intubating conditions with haemodynamic stability and minimal side-effects. So, the use of succinylcholine could be avoided in children planned for elective surgeries under GA.

In the present study, two doses of rocuronium bromide 0.9 mg/kg and 1.2 mg/kg were compared with succinylcholine 1.5 mg/kg with regards to demographic parameters like age, weight and sex but there was no significant difference present between three groups (p>0.05).

Kapdi M and Patel S have compared three doses of rocuronium bromide 0.6 mg/kg, 0.9 mg/kg and 1.2 mg/kg in 20 paediatric subjects and found that demographic data like age, weight and sex were comparable (p>0.05) in all the three groups [23]. Sardhara NV et al., also found no significant difference in demographic variables i.e., age, gender and weight of subjects in three groups (0.6 mg/kg, 0.9 mg/kg and1.2 mg/kg of Rocuronium bromide) [24]. According to a study done by Chatrath V et al., there were no significant demographic differences among groups with respect to age, weight and sex [25]. In the present study, two doses of rocuronium bromide 0.9 mg/kg and 1.2 mg/kg compared with succinylcholine 1.5 mg/kg for intubation scoring at 60 seconds after giving muscle relaxant. There was a significant difference present in intubation scores between three groups (p=0.01).

In a study done by Chavan SG et al., the intubation score of Group-B (rocuronium bromide 0.9 mg/kg) was the best (17.75), which was comparable with Group-C (succinylcholine 2 mg/kg). However, the intubation score obtained with Group-A (rocuronium bromide 0.6 mg/kg) was found to be inferior. There was a statistically significant difference present in the mean value of the Intubation score when compared between the different three groups (p<0.001) [26].

In the present study, two doses of rocuronium bromide 0.9 mg/kg and 2 mg/kg compared with succinylcholine 1.5 mg/kg to find out which dose of rocuronium bromide provided the same intubating conditions as succinylcholine. Rocuronium bromide 1.2 mg/kg provided excellent IC in 96.7% of children which was the same as succinylcholine 1.5 mg/kg. There was no statistically significant difference present in IC of rocuronium bromide 1.2 mg/kg with succinylcholine while rocuronium bromide 0.9 mg/kg provided excellent IC in 83.3% of children and good IC in16.7% of children. So, there was statistically significant difference present between rocuronium bromide 0.9 mg/kg and succinylcholine 1.5 mg/kg (p=0.027).

Sardhara NV et al., compared rocuronium bromide dosages (0.6, 0.9, and 1.2 mg/kg) in 20 adults. 60%, 85%, and 100% of patients had excellent intubating conditions with 0.6, 0.9, and 1.2 mg/kg of rocuronium bromide, respectively. A 25% and 15% of patients had good intubating conditions with 0.6 and 0.9 mg/kg of rocuronium bromide respectively) only 0.6 mg/kg rocuronium bromide group had the poor intubating condition in 15% of patients [24].

Kapdi M and Patel S compared the intubating conditions of 0.6, 0.9, and 1.2 mg/kg rocuronium bromide at 60 seconds in paediatric ASA I and II patients aged 2-12 years and found that 60%, 85%, and 100% of children in 0.6, 0.9, and 1.2 mg/kg rocuronium bromide groups had excellent intubating conditions. The intubating conditions of 25% of patients in the Group of 0.6 mg/kg rocuronium bromide and 15% in the group of 0.9 mg/kg rocuronium bromide were good, while 15% in group of 0.6 mg/kg were poor [23].

Kumar A and Suchetha S performed a study in which Group-A received 0.9 mg/kg and Group-B received 0.6 mg/kg of rocuronium. Intubating conditions were found to be excellent in 13 (65%) in Group-A in comparison to nine (45%) in Group-B and they were good in seven (35%) in Group-A versus 11 (55%) in Group-B [27]. Khatri C et al., found that after 0.3 mg/kg, 0.6 mg/kg, and 0.9 mg/kg of Rocuronium had excellent intubating circumstances were seen respectively in 0%, 60%, and 85% of patients. Sixty percent of those in the 0.6 mg/kg group showed good and 40% showed satisfactory intubating conditions. In the 0.9 mg/kg group, 85 percent of intubations went very well and 15 percent were only good [28].

Naguib M et al., found that rocuronium bromide 0.9 mg/kg provided acceptable intubating conditions for rapid tracheal intubation in children when compared with succinylcholine [20]. Similar finding was depicted in few other studies as well [29]. According to the criteria developed by Cooper RA et al., intubating conditions were deemed clinically satisfactory (good and outstanding) in 95% of patients after 60 seconds and in 100% of patients after 90 seconds in the rocuronium group [10].

Wahid F et al., conducted a randomised control trial to examine the frequency of excellent intubation condition using Succinylcholine and rocuronium for RSI in patients undergoing GA surgery. This study found that succinylcholine and rocuronium provided optimal intubation conditions for RSI in GA patients with no significant difference between each groups [30].

Wang J et al., compared rocuronium bromide by using modified timing principle to succinylcholine and found that rocuronium bromide group had excellent and good intubating conditions like succinylcholine group. However, in rocuronium group apnoea time

was less as compared to succinylcholine group due to modified timing principle [29].

Paul AP et al., conducted a randomised clinical research to compare two dosages of rocuronium bromide to suxamethonium chloride on intubating conditions, duration of action, haemodynamic changes following intubation, and adverse effects and found that rocuronium at 0.6 and 0.8 mg/kg generated clinically acceptable intubating circumstances and can be utilised as a safer alternative to succinylcholine [31].

Venkateswaran R et al., have done the study to determine if a lower intubating dose of rocuronium shortens the duration of action with clinically acceptable intubating conditions or not and found that rocuronium at a dose of 0.3 mg/kg has a shorter duration of action but does not provided clinically acceptable intubating conditions at 60 or 90 seconds. Clinically, acceptable intubating circumstances can be achieved with 0.6 mg/kg rocuronium, which was comparable to 1 mg/kg of succinylcholine in terms of intubation [32].

Sluga M et al., compared succinylcholine 1 mg/kg with rocuronium 0.6 mg/kg during RSI of anaesthesia for endotracheal intubation conditions in emergency situations. They found that succinylcholine facilitates a rapid endotracheal intubation that 0.6 mg/kg rocuronium [33]. In the present study, the mean duration of action between the three groups were compared. The mean duration of action in Group-R12 was 38.93±4.423 minutes while it was 26.07±2.79 minutes in Group-R9. The mean duration of action was the shortest (6.00±1.74 minutes) in Group-S as compared to the other two groups. So, there was a statistically significant difference (p=0.01) present between all three groups with regard to the duration of action.

Raizada N et al., compared three same above-mentioned doses of rocuronium bromide. They reported that with 1.2 mg/kg i.v. dose a rapid onset of action, longer duration and excellent intubating conditions is achieved as compared to other two doses of rocuronium bromide. So, the large dose can be used for intubation where succinylcholine is contraindicated [34].

Narasimha Gnani BC and Uma BR compared rocuronium bromide (0.9 mg/kg and 1.2 mg/kg) with succinylcholine for paediatric intubation and concluded that duration of action is slightly different in two doses of rocuronium bromide although suitable intubating conditions can be achieved with two doses of rocuronium bromide [9]. In a study done by Chavan SG et al., duration of action was shortest (6.00±1.987 min) with succinylcholine 2 mg/kg (Group-C). The duration of action was prolonged when the dose of rocuronium is increased from 0.6 (Group-A, i.e., 22.55±4.979 min) to 0.9 mg/kg (Group-B, i.e., 43.95±8.338 min). There was a statistically significant difference present in mean duration of action between different groups (p<0.001) [26].

Raghavan L et al., compared the duration of action of two doses of rocuronium bromide (0.9 mg/kg and 1.2 mg/kg) and found that the duration of action was substantially longer with rocuronium bromide 1.2 mg/kg as compared to rocuronium bromide 0.9 mg/kg [35]. In the present study, all haemodynamic variables were increased at AI and one minute AI. After that, at five minutes and 10 minutes AI all variables were decreased and came to near BI values with no significant difference noted at any interval for all variables in each group. Kapdi M and Patel S conducted a study to determine the effects of rocuronium bromide on the HR and blood pressure immediately AI and they found no significant differences between the three clinically-administered doses [23].

According to study done by Sardhara NV et al., there was no significant difference present in HR, SBP, DBP and MAP between three different groups when recorded BI, AI, one minute AI, three minutes AI and five minutes AI [24]. No statistically significant difference in HR or MAP was seen between groups given 0.6, 0.9, or 1.2 mg/kg Rocuronium bromide, as reported by Raizada N et al., [34]. In a study done by Kulkarni KR et al., no significant changes were recorded in the haemodynamic parameters with both the intubating doses (0.6 mg/kg, 0.9 mg/kg) of rocuronium versus succinylcholine group [22].

In the present study, fasciculations were observed only in Group-S and the difference was statistically significant when compared between other three groups (p=0.01). No side-effects like flushing, bradycardia, erythema and hypotension were observed in all three groups. Kapdi M and Patel S found that in three groups given 0.6, 0.9, and 1.2 mg/kg Rocuronium bromide, there were no detrimental side-effects [23]. According to study done by Sardhara NV et al., no adverse effects were noted in three different doses of Rocuronium bromide [24].

Compared to other non depolarising NMBDs, rocuronium bromide has a relatively fast onset of action. So, it is a beneficial drug for intubation in children undergoing elective surgeries under GA where spontaneous recovery is not needed [1,19-21]. Therefore, a high dose of rocuronium bromide can be used as better alternative to succinylcholine to avoid its unwanted complications in normal healthy children in the terms of intubating conditions and stable haemodynamics.

Limitation(s)

The limitation of a high dose of rocuronium bromide is the long duration of the neuromuscular blockade as compared to succinylcholine. So, its use can be limited to elective surgeries in which early spontaneous recovery of respiration is not needed. Although, with the availability of sugammadex, as a rapid onset selective binding agent for rocuronium, rapid return of spontaneous ventilation can be possible during intubation and RSI with high dose of rocuronium bromide.

CONCLUSION(S)

From the present study, it can be concluded that rocuronium bromide 1.2 mg/kg provided the same intubating conditions as succinylcholine 1.5 mg/kg with haemodynamic stability and no side-effects. There was a significant difference present in intubating conditions of rocuronium bromide 0.9 mg/kg as compared with succinylcholine 1.5 mg/kg. Though, the duration of action was longer with rocuronium bromide 1.2 mg/kg as compared to rocuronium bromide 0.9 mg/kg. Rocuronium bromide was found to be haemodynamically stable. Rocuronium bromide was not associated with any complications as compared to succinylcholine. So, Rocuronium bromide 1.2 mg/kg can be used as an alternative to succinylcholine 1.5 mg/kg in children planned for elective surgeries where the return of spontaneous recovery is not needed to avoid undesirable side-effects of succinylcholine.

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