Original Research Article

A Comparative Study Between Rocuronium And Succinylcholine In Evaluating Endotracheal Intubating Conditions In Day Care Surgeries

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Abstract

Background: Succinylcholine has been the main neuromuscular blocking agent for the endotracheal intubation in rapid sequence induction with some adverse effects. This study was conducted to find a better alternate drug with minimal adverse effects and easy for intubations. Thus, our study aimed to compare the onset time, duration of action, intubating condition and hemodynamic effect of rocuronium bromide at the dose of 0.8 mg/kg and Succinylcholine at the dose of 1.5 mg/kg.

Materials and methods: A double blinded randomized control study was conducted among 60 patients undergoing surgery each groups having 30 patients, Duration of action, Hemodynamic parameters, and intubating conditions were assessed after administering drugs in each group. Appropriate statistical tests were applied P value < 0.05 was considered to be significant

Results: The mean of onset of action of succinylcholine is significantly shorter than that of rocuronium (48.07 ± 4.04 Vs 74.4 ± 9.1); and duration of action succinylcholine is significantly shorter than that of the rocuronium (3.85 ± 0.33 Vs 44.4 ± 4.7). Both the drugs significantly elevated mean Heart rate, Systolic Blood Pressure, Diastolic Blood pressure, MAP from intubation to subsequent intervals.

Conclusion: The rocuronium bromide (0.8 mg/kg) has longer duration of action and slower onset of action than succinylcholine (1.5 mg/kg) with excellent intubating condition and minimal alteration in hemodynamic profile. Hence rocuronium bromide (0.8 mg/kg) can be used as an alternative to Succinylcholine (1.5 mg/kg) in selected situations.

Key words

Succinyl choline, Intubating Conditions, Rocuronium, Endotracheal Intubation.

Introduction

Introduction of succinylcholine has been the main neuromuscular blocking agent for the endotracheal intubation with special application in rapid sequence induction and difficult intubation [1]. The succinylcholine has ultra-rapid onset and ultra-short duration of action [2]. For these qualities, the succinylcholine still occupies the first position in providing excellent conditions for endotracheal intubations in many conditions. Rocuronium has the most rapid onset of action among the currently available non-depolarizing neuromuscular blocking agents [3]. Unlike succinylcholine, its use is not associated with muscle fasciculations, hyperkalemia, post-operative myalgias etc., It exhibits a low potential for systemic histamine release [4] and does not produce any significant changes in cardiovascular parameters [3]. It also does not show any significant cumulative effect in most of the patients. Thus, the current study was conducted to compare the intubating conditions, onset and duration of action, and cardiovascular effects after the administration of rocuronium and succinylcholine in adult patients undergoing elective surgery.

Materials and methods

This study double blinded, randomized controlled clinical trial was carried out in Department of anesthesiology, Thiruvarvur Medical College, Thiruvarvur, Tamil Nadu. The study consisted of two groups each group 30 patients:

Group S: The patients who received Succinylcholine 1.5 mg/Kg dose.
Group R: The patients who received Rocuronium 0.8 mg/Kg dose.

From the previous studies comparing the onset of action and duration of action between succinylcholine and rocuronium, the mean difference was noted (55 ± 14 Vs 75 ± 28 seconds). Keeping the α- error as 0.05 (confidence level as 0.95), β-error as 0.2 (power = 0.8), ratio of patients to both the groups as 1:1, and mean differences between the groups as 20, the sample calculated as 26 per groups. Hence, after rounding the value to nearest ten, the final sample size obtained was 30 subjects per group.

Methods

The patients aged 18-65 who were admitted under the Department of Surgery/Anesthesia for the day care surgery at Thiruvarvur Medical College Hospital, Thiruvarvur were selected. After the consent by the subjects, they were allotted to either Succinylcholine 1.5mg/Kg group or Rocuronium 0.8mg/Kg group as per random allocation sequence generated earlier. Baseline heart rate, non-invasive blood pressure, arterial oxygen saturation, and electrocardiogram were recorded for each patient.

The patients were then induced with sodium thiopentone 5 mg/kg intravenous injection. Subsequently, they received their respective group drug. In addition to this, the intubating condition was assessed according to the four-point scale of Cooper, et al. (**Table - 1**).

The total Cooper score =9 (Max) was further grouped into Excellent (8– 9), Good (6 – 7), Fair (3 – 5), and poor (0 – 2). Good and excellent scores were taken as clinically acceptable.

Statistics:

- The data were entered into the Microsoft excel sheet (MS Office 2010). Data were expressed and analyzed using SPSS 19 and appropriate tests were applied
- Unpaired ‘t’ test was used to compare the means of data that followed normal distribution between the two groups.
- Mann-Whitney U test was used to compare the Cooper scores between the two groups, as scores tend to have non-normal distribution.

- Chi square test was used to compare the frequency of the parameter between the groups with sample more than 30.
- p value <0.05 was considered statistically significant.

Table -1: Cooper score for assessing the intubating conditions.

Score	Jaw relaxation	Vocal cord position	Response to intubation
0	Poor	Closed	Severe coughing or bucking
1	Minimal	Closing	Mild coughing
2	Moderate	Moving	Slight diaphragmatic movement
3	Good	Open	None

Table - 2: Distribution of Age between groups.

Parameter	S Group (N=30)	R Group (N=30)	P value	Statistical test
Mean age (years)	26.37 ± 7.44	26.4 ± 6.6	<0.05 (NS)	Unpaired 't' test

Table - 3: Distribution of gender between groups.

Gender	S group (n=30)		R group (n=30)		P value	Statistical test
	N	%	N	%		
Male	14	46.7	13	43.3	>0.05 (NS)	Chi square Test
Female	16	53.3	17	56.7		

Table – 4: Distribution of type of surgery.

Type of surgery preformed	S group (n=30)		R group (n=30)		P value
	N	%	N	%	
Breast lump excision	2	6.7	0	0	.>0.05 (NS)
Fibro adenoma excision	2	6.7	3	10	
Lap cholecystectomy	3	10	0	0	
Lymph node excision	0	0	2	6.7	
Myringoplasty	4	13.3	3	10	
Nasal polypectomy	1	3.3	0	0	
Septoplasty	3	6.7	5	16.7	
SMR with FESS	8	26.7	9	30	
Tonsillectomy	7	23.3	8	26.7	

Table - 5: Comparison of distribution of type of intubating-condition between the groups.

Intubating-condition	S group (n=30)		R group (n=30)		P value	Statistical test
	n	%	n	%		
Excellent	27	90	27	90	>0.05 (NS)	Fisher's exact test
Good	3	10	3	10		

Results

The mean age in succinylcholine groups was 26.37 years with a standard deviation of 7.4 years. The mean age in rocuronium groups was 26.4 years with standard deviation of 6.6 years. Hence, no statistical difference was noted between the groups in terms of age. Thus, in both the groups, the distribution of age was similar (**Table – 2**).

Table - 6: Comparison of hemodynamic parameter between the groups.

Heart rate at various time points	**S group (n=30)**		**R group (n=30)**		**P value**
	Mean HR	**SD**	**Mean HR**	**SD**	
Baseline	82.9	9.4	86.1	9.4	>0.05
Intubation	96.1	9.3	97.1	9.6	>0.05
10^{th} minute	83.9	8.2	82.6	6.6	>0.05
SBP	**Mean SBP**	**SD**	**Mean SBP**	**SD**	
Baseline	118.7	9.1	120.3	7.4	>0.05
Intubation	124.5	8.1	127.4	7.2	>0.05
10^{th} minute	116.6	8.2	117.5	6.9	>0.05
DBP	**Mean DBP**	**SD**	**Mean DBP**	**SD**	
Baseline	72.9	6.4	71.5	6.7	>0.05
Intubation	78.5	6.4	76.4	6.5	>0.05
10^{th} minute	70.1	6.3	69.1	6.3	>0.05
MAP	**Mean MAP**	**SD**	**Mean MAP**	**SD**	
Baseline	88.1	6.9	87.8	6.7	>0.05
Intubation	93.8	6.6	93.4	6.4	>0.05
10^{th} minute	85.5	6.6	85.1	5.8	>0.05

p>0.05 not significant by applying Unpaired T test

Table - 7: Comparison of onset and duration of action between the study groups.

Parameter	**S group (N=30)**	**R group (N=30)**	**P value**	**Statistical test**
Onset of action (seconds)	48.07 ± 4.04	74.4 ± 9.1	<0.0001*	Unpaired 't' test
Duration of action (minutes)	3.85 ± 3.3	44.4 ± 4.7	<0.0001*	

Table - 8: Comparison of total Cooper score and its various components.

Parameter	**S group (N=30)**	**R group (N=30)**	**P value**	**Statistical test**
Total Cooper score	9 (8 – 9)	9 (8 – 9)	>0.05	Mann Whitney U test
Jaw relaxation score	3 (2 – 3)	3 (2 – 3)	>0.05	
Vocal cord position score	3 (3 – 3)	3 (3 – 3)	>0.05	
Intubation response score	3 (3 – 3)	3 (3 – 3)	>0.05	

The p value was >0.05 and indicates that no statistical difference was noted between the groups in respect to the frequency distribution of gender in the study (**Table – 3**).

In both the groups, the highest number of surgery performed was SMR with FESS (26.7%) followed by tonsillectomy (23.3%) and myringoplasty (13.3%) as per **Table - 4**.

The proportions of excellent intubating condition observed in the succinylcholine group was 90% and good intubating condition observed was 10%. Similarly, in rocuronium group also, P value comes to be >0.05 not statistically significant (**Table – 5**).

Both the drugs significantly elevated the heart rate, SBP, DBP, MAP at various time points from the baseline (**Table – 6**).

The onset of action and duration of action of succinylcholine is significantly shorter when compared with rocuronium (**Table – 7**).

Comparison of total Cooper score and its various components was as per **Table – 8**.

Conclusion

In our study, the onset of action of succinylcholine 1.5 mg/kg was significantly shorter than that of onset of action of rocuronium bromide 0.8 mg/kg (48.07 ± 4.04 Vs 74.4 ± 9.1). The onset of action of succinylcholine was similar to that of Mishra MN, et al. [5], Sluga M, et al. [6], Hemmerling TM, et al. [7], However, studies conducted by Venkateswaran, et al. [8], Laurin EG, et al. [9], and Cooper RA, et al. [10] showed different onset of action for Succinylcholine due to selection of different dose in their studies.

The onset of action of rocuronium was similar to that of study conducted by Shukla, et al. [11], Cooper RA, et al., Magorian T, et al. [12], Ajeet S, et al. [12], Parikh K, et al. [14].

We found no differences between the Cooper score for intubating condition between the drugs in our study. However, in our study we observed similar results comparable with succinylcholine (1.5 mg per kg) even at the dose of 0.8 mg/kg of rocuronium.

A meta-analysis has concluded that succinylcholine and rocuronium produced similar intubating condition when propofol was used as an inducing agent. In our study, we used thiopental (5 mg/kg) and we have noted the similar observation like the above meta-analysis. Hence, not only propofol but also thiopental has no interference with the intubating conditions with rocuronium bromide and succinylcholine.

Succinylcholine is relatively safer in altering hemodynamic status and the fact that rocuronium 0.8 mg/kg did not alter hemodynamic status different from succinylcholine indicates that rocuronium could be a good alternative to succinylcholine.

However, both rocuronium 0.8 mg/kg and succinylcholine have increased the heart rate, SBP, DBP, and MAP at the time points of intubation, 1st, 2nd, 3rd minutes after intubation from the baseline value. The reason for such statistically significant increase of all these parameters when compared to baseline is due to the adrenergic response to laryngoscopy and to intubation. Various studies have demonstrated the similar changes in hemodynamic parameter during and after intubation with the drugs [15, 16]. Hence, these changes are purely due to stimulation of physiological reflexes during intubation and not because of drug actions. In our study, no adverse effects were noted in both the groups.

Conclusion

We have observed that

- Onset of action is shorter for succinylcholine 1.5 mg/kg than that of Rocuronium 0.8 mg/kg
- Duration of action of succinylcholine 1.5 mg/kg is shorter than that of Rocuronium 0.8 mg/kg
- No differences were noted in regards to the intubating conditions when succinylcholine 1.5 mg/kg and rocuronium 0.8 mg/kg were compared.
- Succinylcholine 1.5 mg/kg produced similar hemodynamic changes with that of rocuronium 0.8 mg/kg.
- Both succinylcholine 1.5 mg/kg and rocuronium 0.8 mg/kg elevated the hemodynamic parameters from baseline at intubation and three minutes after intubation.
- The rocuronium bromide (0.8 mg/kg) has longer duration of action and slower onset of action than succinylcholine (1.5 mg/kg) with excellent intubating condition and minimal alteration in hemodynamic profile.
- Hence, rocuronium bromide (0.8 mg/kg) can be used as an alternative to Succinylcholine (1.5 mg/kg) in selected situations.

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