Research Article

INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

INTUBATING STATE USING TRAIN OF FOUR STIMULATION WITH 0.6 MG/KG ROCURONIUM IN SUBJECTS UNDERGOING ELECTIVE SURGERIES

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How to Cite: Singh P, Paul K. Intubating State Using Train Of Four Stimulation With 0.6 Mg/Kg Rocuronium In Subjects Undergoing Elective Surgeries. International Research Journal Of Pharmacy, 2022,13:6:17-21.

Doi: 10.32937/2230-8407.3730

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ABSTRACT

Background: To maximise the effects of neuromuscular blocking drugs, train of four stimulation is advised. There is limited research on the evaluation of intubating condition with train of four and 0.6 mg/kg rocuronium. With the use of 0.6 mg/kg rocuronium and a train of four at the adductor pollicis longus at various time intervals, including immediately and 24 hours after extubation, time to reach T0 and T1, and time to attain sore throat.

Aim: The present study was conducted to estimate the proportion of subjects with excellent intubating state.

Methods: 212 patients were split into two groups, designated T0 and T1, and their intubating status was assessed after receiving 0.6 mg/kg of rocuronium and being observed using a train of images. The t-test and Chi-square test were used to statistically analyse the acquired data, with a significance threshold of $p<0.05$.

Results: The intubating time was 132.58±30.73 seconds; for Group T0, it was 142.96±27.06 seconds, and for T1, it was 122.36±30.78 seconds. T0 had a substantially longer intubating time ($p<0.01$) than T1. In group T0, the intubating condition was good in 5.55% (n=6), excellent in 93.51% (n=101), and poor in 0.92% (n=1) of the participants, respectively. In group T1, the intubating condition was good in 8.65% (n=9), excellent in 89.42% (n=93), and bad in 1.92% (n=2).

Conclusion: Following 0.6 mg/kg of rocuronium injection, there were a non-significantly increased proportion of individuals having good intubating circumstances at T0. Compared to T1, T0 took 20 seconds longer to reach, and there was a lower incidence of sore throat both immediately and later.

Keywords: General anesthesia, intubating condition, Neuromuscular monitoring, rocuronium, sore throat, train of four

INTRODUCTION

The introduction of neuromuscular blocking agents into clinical practice is one of the most notable developments in the area of anesthesiology. The field of anaesthesia has revolutionised as a result of its introduction. Succinylcholine is the only muscle relaxant that is currently accessible that causes rapid tracheal intubation. But succinylcholine use has been associated with a number of negative side effects, such as elevated intracranial tension, elevated intraocular tension, bradyarrhythmias, hyperkalemia, myalgia, muscle fasciculation, masseter spasm, anaphylaxis, and elevated intragastric pressure.[1]

Because succinylcholine has so many negative side effects, it is not recommended to use it in situations involving burns, neuromuscular disorders, renal illnesses, open eye injuries, spinal cord injuries, severe brain injuries, or

cerebrovascular accidents. For such situations, a non-depolarizing muscle relaxant with a quick start of action is therefore required.[2]

A clinically viable equivalent for suxamethonium is rocuronium, which has the benefit of not having the unfavourable side effects of suxamethonium and acting quickly for both elective and emergency procedures as well as intubations. Rocuronium is a fast-acting, non-depolarizing muscle relaxant with an intermediate duration of action. There are two dosages of rocuronium: 0.6 mg/kg and 0.9 mg/kg. The dosage that is most frequently used is 0.6 mg/kg for 60 seconds.[3]

Previous research in the literature has demonstrated that 0.9 mg/kg of rocuronium administered for 60 seconds produces good intubating circumstances. However, other studies done in the past have demonstrated that 0.6 mg/kg of rocuronium produces superior intubating conditions than the 0.9 mg/kg dosage. In clinical practice, the most often utilised dosage is still 0.6 mg/kg.3.[4]

Rocuronium continues to be the most extensively utilised non-depolarizing muscle relaxant in endotracheal intubation instances. Clinically satisfactory outcomes using rocuronium at a dosage of 0.6 mg/kg for 90 seconds have been shown in earlier literature research. The limited body of literature, however, evaluated the time required to achieve good intubating circumstances as well as the numerical percentage of patients who met these goals.[5]

Furthermore, there is a lack of evidence in the literature about the usual and visible endpoint—the elimination of all twitches (T0) and three twitches (T1)—after the train of four (TOF) stimulus. Moreover, the literature does a poor job of describing the optimal intubating settings that predict endpoint.[6,7]

Therefore, the goal of the current study was to measure the percentage of patients who had good intubating circumstances after receiving 0.6 mg/kg of rocuronium during TOF stimulation guided intubation during elective surgery. Time to attain T0 or T1 following rocuronium, incidence of sore throat both immediately and 24 hours later, impact of anaesthetic drug on intubation, and intubating condition were also evaluated in the study.

MATERIALS AND METHODS

After receiving approval from the relevant ethical council, the current prospective clinical investigation was carried out at an Indian healthcare facility. Subjects receiving elective surgical operations at the Institute made up the research population. There were 212 participants in the research, with a mean age of 37.4±6.46 years and a range of ages from 18 to 60. Male and female individuals in the age range of 18 to 60 years, ASA (American Society of Anesthesiology) physical status I and II, and subjects undergoing elective surgery lasting more than an hour under general anaesthesia and endotracheal intubation were the inclusion criteria for the study.

Subjects having a BMI of less than 20 or more, those who were expected to have a problematic airway, and those who had neuromuscular illness were excluded. All subjects gave their informed permission after being fully told about the study's design.

Following the research subjects' final inclusion, an intravenous line was placed, vital signs were assessed, and the bispectral index (BIS) was calculated. Premedication for induction included opioid analgesia, inducing agent, inhalation agent, and midazolam premedication. The agent was chosen by the consulting anesthesiologist in order to achieve 40–50 BIS. A digital monitor was used to track neuromuscular transmission. Following loss of consciousness, train of four stimulation at the APL (adductor pollicis longus) was used to detect neuromuscular block. Every ten seconds, four different stimuli with a frequency of 2Hz and a pulse length of 200μs for 0.5 seconds were given.

A 5-second bolus of 0.6 mg/kg rocuronium was administered. When one of the four twitches was present, 90% of the receptors were taken (T1). Once all four twitches were gone, 100% of the receptors were deemed to be occupied (T0). Anesthesiologist performed tracheal intubation after three or four twitches vanished. The rocuronium injection to T0 or T1 achievement was regarded as the onset time. The intubating anesthesiologist was blinded to the TOF endpoint. The status of the intubation was noted as poor, good, or exceptional. Target BIS of 40–60 was kept using the volatile inhaler. Following the end of operation, the trachea was extubated, the volatile agent was withdrawn, and the residual neuromuscular block was reversed. Preoperatively, the sore throat was evaluated right after extubation and 24 hours after surgery. Two groups of 212 research participants had trachea intubation at T0 and T1.

The collected data were subjected to statistical evaluation using SPSS version 20, Chicago Inc., USA. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$. The tests used were Chi-square, student t-test, and ANOVA.

RESULTS

212 participants in total were split into two groups for trachea intubation at T0 and T1. For groups T0 and T1, the average age of the research participants was 37.52±12.36 and 35.76±11.43 years, respectively. There were 31.48% (n=34) and 68.51% (n=74) females and males in T0, and 70.19% (n=73) and 29.80% (n=31) females and men in

T1. Of the research participants, 28% (n=) were ASA type II and 72% (n=) were ASA type I. The study's findings revealed that the intubating time was 132.58±30.73 seconds, with Group T0 taking 142.96±27.06 seconds and T1 taking 122.36±30.78 seconds. T0's intubating time was substantially greater, with p<0.01, than T1's.

According to Table 1, intubating conditions were good in 5.55% (n=6), excellent in 93.51% (n=101) and poor in 0.92% (n=1) of group T0 subjects, respectively. In contrast, in Group T1, intubating conditions were good in 8.65% (n=9), 89.42% (n=93) and poor in 1.92% (n=2) of subjects, respectively. This difference was statistically non-significant at p=0.218.

After evaluating the study participants' great and non-excellent circumstances, it was found that 90.90% (n=140) of the subjects had excellent conditions for sevoflurane inhalation, 76.92% (n=20) had isoflurane, and 96.87% (n=31) had none at all. Excellent condition was seen in 91.21% (n=135) of the patients who used nitrous oxide, and in 87.5% (n=56) of the subjects who did not, a non-significant difference with a p-value of 0.264.

Non-significant difference was also seen with use of propofol or thiopentone as iv induction agent with p=0.05, among two groups, T0 and T1 with p=0.09, and between genders with p=1.000. Area under curve for onset time was 0.542, and p=0.418 indicated that it was not significant. Regarding the dosage of midazolam and fentanyl, the area under the curve was 0.536 and 0.564, respectively, and both showed findings that were statistically non-significant (p=0.224 and 0.492, respectively) (Table 2).

One and two intubation attempts were performed on 95.37% (n=103) and 4.62% (n=5) of the participants in Group T0, respectively. In contrast, one and two efforts were performed on 93.26% (n=97) and 6.73% (n=7) of the subjects in Group T1, which was statistically non-significant with p=0.598. 66.6% (n=72), 31.48% (n=34), and 1.85% (n=2) of the subjects in group T0 and 69.23% (n=72), 28.84% (n=30), and 1.92% (n=2) of the subjects in group T1 respectively had Cormack-Lehane grades of 1, 2, and 3, which was statistically non-significant with p=0.766 (Table 3).

After comparing the incidence of sore throat in the two groups, it was shown that Group T0 had 3.70% (n=4) individuals with immediate painful throat, whereas Group T1 had 13.46% (n=14) participants and 8.49% (n=18) subjects overall, with Group T1 having a substantially higher incidence of sore throat (p=0.02). No participants in Group T0, 4.80% (n=5) subjects in Group T1, 4.80% (n=%) subjects in Group T1, and 2.35% (n=5) subjects overall reported having a sore throat after the fact. As Table 4 illustrates, this percentage was substantially higher for Group T1 with p-0.01.

DISCUSSION

The research individuals' intubating times were 132.58±30.73 seconds, 142.96±27.06 seconds for Group T0, and 122.36±30.78 seconds for T1, with T0 having a substantially longer intubating time (p<0.01). The intubating condition was found to be poor in 0.92% (n=1), good in 5.55% (n=6), and excellent in 93.51% (n=101) of the subjects in Group T0. In contrast, the intubating condition was found to be poor, good, and excellent in 1.92% (n=2), 8.65% (n=9), and 89.42% (n=93) of the subjects in Group T1, respectively. This difference was statistically non-significant with p=0.218. These results were in line with the findings of two other studies by authors who reported comparable intubating conditions: Wardhana A et al. in 2019 and Nakadate Y et al. in 2021.

When it came to evaluating the study participants' excellent and non-great circumstances, 90.90% (n=140) of the individuals had excellent conditions after inhaling sevoflurane, 76.92% (n=20) had isoflurane, and 96.87% (n=31) had none at all. Excellent condition was seen in 91.21% (n=135) of the patients who used nitrous oxide, and in 87.5% (n=56) of the subjects who did not, a non-significant difference with a p-value of 0.264. A non-significant difference was also seen between the genders (p=1.000), between the two groups (T0 and T1), and whether propofol or thiopentone was used as an IV induction agent (p=0.05).

Area under curve for onset time was 0.542, and p=0.418 indicated that it was not significant. The area under the curve for the doses of fentanyl and midazolam was 0.564 and 0.536, respectively, and both showed statistically non-significant findings (p=0.224 and 0.492, respectively). These findings corroborated research by Fuchs-Buder T et al. (2007) and Scheiber G et al. (2007), which found that anesthesia-related variables and parameters had a comparable impact on good intubating settings.

In terms of intubation attempts, 95.37% (n=103) and 4.62% (n=5) of the participants in Group T0 and 93.26% (n=97) and 6.73% (n=7) of the subjects in Group T1, respectively, had one and two tries, which was statistically non-significant at p=0.598. 66.6% (n=72), 31.48% (n=34), and 1.85% (n=2) of the participants in group T0 and 69.23% (n=72), 28.84% (n=30), and 1.92% (n=2) of the subjects in group T1 respectively had Cormack-Lehane grades of 1, 2, and 3, which was statistically non-significant with p=0.766. These results were in line with those of Gupta N et al. (2015) and Patel DD et al. (2013), whose authors reported comparable attempts and grades to those of the study's subjects.

When the incidence of sore throat in the two groups was compared, it was found that Group T0 had 3.70% (n=4) subjects with sore throat, whereas Group T1 had 13.46% (n=14) subjects with sore throat and 8.49% (n=18)

participants overall, with Group T1 having a substantially higher incidence of sore throat (p=0.02). No participants in Group T0, 4.80% (n=5) subjects in Group T1, 4.80% (n=%) subjects in Group T1, and 2.35% (n=5) subjects overall reported having a sore throat after the deadline. This percentage was substantially higher for Group T1 with p-0.01. These findings corroborated those of Khurshid H et al. (2011) in 2015 and Parikh K et al. (2014), whose individuals experienced similar rates of early and late sore throat.

CONCLUSION

Within the bounds of its limitations, the current study suggests that after using 0.6 mg/kg of rocuronium, the proportion of participants with satisfactory intubating condition was non-significantly greater at T0 compared to T1 with less reports of sore throat. Nevertheless, there were several drawbacks to the current study, such as biases related to geographic location, short monitoring periods, and small sample sizes. Therefore, further long-term research with bigger sample sizes and longer observation periods will aid in coming to a conclusive result.

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TABLES

Intubation related conditions	**Group T0 (n=108)**	**Group T1 (n=104)**	**Total**	**p-value**
Intubating time (seconds)	142.96±27.06	122.36±30.78	132.58±30.73	<0.01
Intubating condition % (n)				
Poor	0.92 (1)	1.92 (2)	1.41 (3)	0.218
Good	5.55 (6)	8.65 (9)	7.07 (15)	
Excellent	93.51 (101)	89.42 (93)	91.50 (194)	

Table 1: Intubation time and conditions in the study subjects

Factor	**Excellent % (n)**	**Non-excellent % (n)**	**p-value**
Inhalation			

Sevoflurane	90.90 (140)	9.09 (14)	0.132
Isoflurane	76.92 (20)	23.07 (6)	
None	96.87 (31)	3.12 (1)	
Nitrous oxide			
Yes	91.21 (135)	8.78 (13)	0.264
No	87.5 (56)	12.5 (8)	
IV induction agents			
Propofol	91.35 (148)	8.64 (14)	0.05
Thiopentone	86 (43)	14 (7)	
Groups			
T0	95.19 (99)	4.80 (5)	0.09
T1	84.25 (91)	15.74 (17)	
Gender			
Females	87.82 (137)	12.17 (19)	1.000
Males	94.64 (53)	5.35 (3)	
Variables	**Condition**	**Area under curve**	**p-value**
Onset time	**Excellent (202)**	0.542	0.418
	Non-excellent (10)		
Fentanyl Dose	**Excellent (202)**	0.564	0.224
	Non-excellent (10)		
Midazolam Dose	**Excellent (202)**	0.536	0.492
	Non-excellent (10)		

Table 2: Intubation time and conditions in the study subjects

Parameter	**Group T0 (n=108)**	**Group T1 (n=104)**	**Total (n=212)**	**p-value**
Intubation attempts (n)				
One	95.37 (103)	93.26 (97)	94.33 (200)	0.598
Two	4.62 (5)	6.73 (7)	5.66 (12)	
Cormack-Lehane Grade				
1	66.6 (72)	69.23 (72)	67.92 (144)	0.766
2	31.48 (34)	28.84 (30)	30.18 (64)	
3	1.85 (2)	1.92 (2)	1.88 (4)	

Table 3: Intubation attempts and Cormack-Lehane Grade in the study subjects

Sore throat	**Group T0 (n=108)**	**Group T1 (n=104)**	**Total (n=212)**	**p-value**
Immediate				
Yes	3.70 (4)	13.46 (14)	8.49 (18)	**0.02**
No	96.26 (104)	86.53 (90)	91.50 (194)	
Late				
Yes	0 (0)	4.80 (5)	2.35 (5)	**0.01**
No	100 (108)	95.19 (99)	97.64 (207)	

Table 4: Incidence of immediate and late sore throat in the study subjects