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TRAIN OF FOUR STIMULATION WITH 0.6 Mg/Kg ROCURONIUM FOR INTUBATING STATE

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ABSTRACT

Background: When using neuromuscular blocking drugs, it is advised to employ TO (train of four) stimulation. The assessment of intubating state using a train of four and 0.6mg/kg rocuronium is limited in the literature.

Aims: The current study was conducted to estimate the proportion of subjects with excellent intubating state using 0.6mg/kg rocuronium and train of four at adductor pollicis longus at various time intervals, immediately and 24 hours after extubation, time to reach T0 and T1, and time to achieve sore throat.

Methods: 212 patients were split into two groups: T0 and T1, in which the intubating condition was assessed after 0.6mg/kg rocuronium and monitored by train of four. The acquired data was statistically evaluated using t-tests and Chi-square tests, with a significance threshold of $p<0.05$.

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

Conclusion: A non-significant increase in the proportion of individuals with good intubating circumstances was seen at T0 following 0.6mg/kg rocuronium treatment. It took 20 seconds longer to achieve T0 than T1, with less immediate and late sore throat occurrence.

Keywords: general anesthesia, intubating situation, neuromuscular monitoring, rocuronium, sore throat, train of four.

INTRODUCTION

One of the most significant advances in anesthesiology has been the clinical introduction of neuromuscular blocking agents. This breakthrough has resulted in a revolution in anesthetic practice. Succinylcholine is the only pharmacological muscle relaxant that allows for rapid tracheal intubation. However, the use of succinylcholine has been linked to a variety of negative effects, including increased intracranial tension, increased intra-ocular tension, bradyarrhythmias, hyperkalaemia, myalgia, muscle fasciculation, masseter spasm, malignant hyperthermia, anaphylaxis, and raised intragastric pressure.1

Due to the negative consequences of succinylcholine, it is not recommended for usage in circumstances such as spinal cord damage, open eye injury, intracranial bleed, acute head injury, burns, neuromuscular disorders, renal illnesses, and/or cerebrovascular accidents.

As a result, non-depolarizing muscle relaxants are required for situations with a quick start of effect. One such therapeutically viable option is Rocuronium, which successfully replaces suxamethonium due to its quick action onset for both emergency and elective operations and intubation, with the added benefit of removing the negative side effects associated with suxamethonium.2

Rocuronium is a non-depolarizing muscle relaxant with an intermediate action duration and a quick onset. Rocuronium is administered in two doses: 0.6 mg/kg and 0.9 mg/kg. The most usually administered dosage is 0.6mg/kg for 60 seconds. past literature data has revealed that 0.9mg/kg gives great intubating circumstances after 60 seconds of usage, but other research done in the past literature suggest that 0.6mg/kg rocuronium produces superior intubating conditions than 0.9mg/kg. However, 0.6mg/kg remains the most often utilized dosage in clinical practice.3

In endotracheal intubation instances, rocuronium is still the most regularly utilized non-depolarizing muscle relaxant. Previous literature findings show that using rocuronium at a dosage of 0.6mg/kg for 90 seconds yields clinically acceptable outcomes. However, the limited literature data analyzed the quantitative fraction of participants with superior intubating circumstances and the time required to achieve them. Furthermore, the literature lacks a defined and visible endpoint following training with four (TOF) stimuli, which is the absence of all twitches (T0) and three twitches (T1).

Furthermore, the literature does not provide a clear description of the ideal intubating settings that imply an endpoint.4 As a result, the current study sought to quantify the proportion of participants who achieved good intubating circumstances after receiving 0.6mg/kg rocuronium in TOF stimulation guided intubation during elective surgery. The study also looked at the time it took to achieve T0 or T1 following rocuronium, the incidence of sore throats both immediately and after 24 hours, the influence of anesthetic agents on intubation, and the intubating condition.

MATERIALS & METHODS

The current prospective clinical investigation was carried out at an Indian health care center following approval from the relevant ethical council. The research population was made up of participants receiving elective surgical operations at the Institute.

The study comprised 212 patients of both genders between the ages of 18 and 60, with a mean age of 37.4 ± 6.46 years. The study included patients between the ages of 18 and 60, both males and females, with ASA (American Society of Anesthesiology) physical status I and II, and undergoing elective dental surgery lasting more than an hour under general anesthesia and endotracheal intubation. Exclusion criteria were BMI <20 or >30, problematic airway, and neuromuscular illness. After discussing the complete research design, all subjects provided informed permission in both written and verbal form. After the final inclusion of the research volunteers, vitals were evaluated together with BIS (bispectral index), and an intravenous line was created.

. Premedication for induction included inhalation, inducing, opioid analgesia, and midazolam. Consultant anesthesiologist selected the medication to achieve 40-50 BIS. The neuromuscular transmission was measured using a digital monitor. Following consciousness loss, neuromuscular block monitoring was performed using a four-stimulation train at the APL (adductor pollicis longus). Four 2Hz stimuli with 200μs pulse length were supplied for 0.5 sec and repeated every 10 seconds. A bolus of 0.6 mg/kg rocuronium was administered over 5 seconds. When one of four twitches was present (T1), 90% of the receptors were captured. After all four twitches were lost (T0), 100% of the receptors were declared occupied. Anesthesiologists performed tracheal intubation when three or four twitches had disappeared.

Onset time was calculated from rocuronium administration to T0 or T1 achievement.The TOF endpoint was not revealed to the intubating anesthesiologist. Intubating circumstances were categorized as poor, good, or exceptional. The target BIS of 40-60 was maintained using a volatile inhalational agent. Following surgery, the volatile drug was discontinued, the trachea was extubated, and the remaining neuromuscular block was reversed. Preoperatively, sore throat was evaluated 24 hours after surgery and immediately after extubation. 212 research participants were randomized into two groups for tracheal intubation at T0 and T1.

The acquired data were statistically analyzed using SPSS version 20 from Chicago Inc., USA. The data were presented as percentages, numbers, means, and standard deviations. The level of significance was set at $p < 0.05$. The tests utilized were the Chi-square, student t-test, and ANOVA.

RESULTS

The current study comprised 212 participants divided into two groups for tracheal intubation at T0 and T1. The average age of the research individuals in groups T0 and T1 was 37.52±12.36 and 35.76±11.43 years, respectively. In T0, there were 68.51% (n=74) females and 31.48% (n=34) men, while in T1, there were 70.19% (n=73) females and 29.80% (n=31). 72% (n=) of the study participants were ASA type I, whereas 28% (n=) were ASA type II. The study findings indicated that intubating time was 132.58±30.73 seconds, 142.96±27.06 seconds for Group T0 and 122.36±30.78 seconds for T1, with T0 substantially greater ($p<0.01$).

Intubating conditions were poor in 0.92% (n=1), good in 5.55% (n=6), and excellent in 93.51% (n=101) subjects in Group T0, whereas in Group T1, they were poor, good, and excellent in 1.92% (n=2), 8.65% (n=9), and 89.42% (n=93) subjects, respectively, which was statistically non-significant with p=0.218 (Table 1). Inhalation with sevoflurane resulted in a good condition in 90.90% (n=140) individuals, isoflurane in 76.92% (n=20) subjects, and none in 96.87% (n=31). With nitrous oxide usage, good condition was found in 91.21% (n=135) patients and without nitrous oxide in 87.5% (n=56) subjects, which was non-significant (p=0.264).

. There was also no significant difference with the use of propofol or thiopentone as an IV induction drug (p=0.05), between the two groups, T0 and T1, (p=0.09), or between genders (p=1.000). For onset time, the area under the curve was 0.542, which was not significant (p=0.418). The area under the curve for fentanyl and midazolam doses was 0.564 and 0.536, respectively, with statistically non-significant values at p=0.224 and 0.492 (Table 2).

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

On examining the incidence of sore throat in the two groups, it was revealed that immediate sore throat was noticed in 3.70% (n=4) individuals of Group T0, 13.46% (n=14) subjects of T1, and 8.49% (n=18) subjects in total, which was significantly higher in Group T1 with p=0.02. Late reports of sore throat were recorded by no participants in Group T0, 4.80% (n=5) subjects in T1, 4.80% (n=%) subjects in Group T1, and 2.35% (n=5) subjects in total, with Group T1 substantially higher (p-0.01), as indicated in Table 4.

DISCUSSION

Intubation time in study individuals was 132.58±30.73 seconds, 142.96±27.06 seconds for Group T0, and 122.36±30.78 seconds for T1, with T0 substantially longer at $p<0.01$. Intubating conditions were poor in 0.92% (n=1), good in 5.55% (n=6), and excellent in 93.51% (n=101) subjects in Group T0, respectively, whereas in Group T1, they were poor, good, and excellent in 1.92% (n=2), 8.65% (n=9), and 89.42% (n=93) subjects, respectively, which was statistically non-significant with p=0.218.

These findings were congruent with those of Nakadate Y et al5 in 2021 and Wardhana A et al6 in 2019, who reported comparable intubation settings in their research. Inhalation with sevoflurane resulted in good conditions in 90.90% (n=140) participants, isoflurane in 76.92% (n=20), and none in 96.87% (n=31). Excellent condition was seen in 91.21% (n=135) patients using nitrous oxide and in 87.5% (n=56) subjects not using nitrous oxide, which was non-significant (p=0.264).

There was also no significant difference with the use of propofol or thiopentone as an IV induction drug (p=0.05), between the two groups, T0 and T1, (p=0.09), or between genders (p=1.000). For onset time, the area under the curve was 0.542, which was not significant (p=0.418). The area under the curve for fentanyl and midazolam doses was 0.564 and 0.536, respectively, with statistically insignificant findings (p=0.224 and 0.492). These findings were consistent with those of Fuchs-Buder T et al7 (2007) and Scheiber G et al8 (2007), who found that anesthetic variables and parameters had a comparable influence on good intubation.

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

(n=2) subjects of Group T1, respectively, which was statistically non-significant with p=0.766. These findings were comparable to those of Patel DD et al9 in 2013 and Gupta N et al10 in 2015, who reported similar attempts and grades as the subjects of the current research.

To assess the occurrence of sore throat in two groups, it was discovered that immediate sore throat was experienced by 3.70% (n=4) participants in Group T0, 13.46% (n=14) subjects in T1, and 8.49% (n=18) subjects in total, with Group T 1 having a substantially higher incidence (p=0.02). Late reports of sore throat were recorded by no participants in Group T0, 4.80% (n=5) subjects in T1, 4.80% (n=%) subjects in Group T1, and 2.35% (n=5) subjects in total, with Group T1 reporting substantially more (p-0.01). These findings were consistent with the findings of Khurshid H et al11 in 2015 and Parikh K et al12 in 2014, who observed a similar incidence of early and late sore throat in their individuals.

CONCLUSION

Within its limitation, the present study concludes that proportion of subjects with excellent intubating condition was non-significantly higher at T0 compared to T1 after use of 0.6mg/kg rocuronium with lesser reports of sore throat. However, the present study had a few limitations including small sample size, short monitoring time, and geographical area biases. Hence, more longitudinal studies with larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

Intubation and 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