ORIGINAL ARTICLE

COMPARING THE FUNCTIONAL OUTCOME OF DIFFERENT DOSE REGIMES OF SUCCINYLCHOLINE WHEN USED FOR RAPID INDUCTION AND INTUBATION

Munir Ahmad, Nadeem Ahmed Khan, Aamir Furqan
Department of Anaesthesia, Nishtar Medical University Multan-Pakistan

Background: This study was conducted to compare outcomes of different doses of succinylcholine, in terms of intubation condition, onset of action, duration of action and abdominal fasciculation. **Methods:** Thus, randomized control trial was conducted in the department of anaesthesia and ICU, Nishter Hospital Multan from April 2016 to November 2016. A total number of 60 patients with ASA status I and II were enrolled. All patients were divided into three groups by lottery method. Data was entered and analysed by computer software SPSS version 23.2. Descriptive variables like age and onset of action were presented as mean and SD and continues statistics like gender, abdominal fasciculation and incubation condition were presented as frequency and percentages. Chi square test and one-way ANOVA was applied to see effect modification and significance of results. The *p*-value 0.05 was considered as significant. **Results:** A Total number of 60 patients included in this study and all were female. The mean age of the patients was 28.15±4.5 years. The main outcome variables of this study were the fasciculation, satisfactory intubation, onset time (seconds) and duration of action (in minutes). In group (A) 1mg, abdominal fasciculation was found 80%, 85% and 75% in group A, B, C respectively. It was also observed that satisfactory intubation was found 90%, 80% and 30% in three groups respectively. The mean onset time was 50.95±4.6, 70.7±5.66 and 94.15±8.73 seconds in three groups respectively. Similarly, the mean duration of action was 16.1±3.76, 13.55±3.01 and 8±2.05 minutes respectively. **Conclusion:** Results of our clinical trial suggest that succinylcholine in low doses shorter duration of action and low rate of abdominal fasciculation which is desirable for rapid induction but onset of action is prolonged and intubation conditions were not satisfactory predominantly. So, we concluded that low doses of succnylcholine are not so much beneficial that I can replace full doses of succinylcholine when used for rapid induction and intubation.

Keywords: Succinylcholine, Rapid induction, Intubation, Anaesthesia

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INTRODUCTION

Tracheal intubation before general anaesthesia is a well-known procedure. To facilitate this procedure succinylcholine is widely used drug for satisfactory and rapid intubation. About 50 years ago it was used for first time[1] and in early literature its dose recommended as 0.5 mg/kg, but later on it was recommended as 1 mg/kg as a usual dose. This new recommendation of usual dose is not justified yet. Onset of action at the dose of 1 mg/kg is not rapid enough for normal breathing recovery and to stop desaturation of haemoglobin in unassisted ventilatory patients.[2]

With small doses of succinylcholine rate of complications and side effects can be reduced. Dose of 0.3 mg/kg or less is very effective.[3,4] As a depolarizing agent recommended dose of succinylcholine is two times of effective dose (3.5 mg/kg approximately four time more than 1 mg/kg) considered as appropriate for normal intubation.[5] About one and half time larger dose gives a satisfactory result for intubation, smaller dose from this limit also acceptable but not ideal.[6,7]

In a study Nagib *et al*[8] suggested that 0.56mg/kg dose of succinylcholine give satisfactory results in ASA I and I patients within 60 seconds in more than 95% patients but smaller dose within range if 0.3mg/kg also gives satisfactory results in 92% patients.[9] Several studies recommend the low dose succinylcholine for earlier return to the normal neuromuscular function even in difficult airway and critical condition.[9–11] All previous studies were in favour of smaller dose of succinylcholine in ASA status I,II and well prepared cases and provide rapid induction and intubation, but no study in favour of ASA EIII, IV and non-prepared cases (E for emergency situation. This study will be a new gate towards research on this topic at local level as minimum number available before.

MATERIAL AND METHODS

This randomized control trial was conducted in the department of anaesthesia and ICU, Nishter Hospital Multan from April 2016 to November 2016. A total number of 60 patients with ASA status I, II and BMI more than 28 kg/m^2 were enrolled. Sample size was calculated by an online source Openepi.com with

following stats confidence interval 95%, power of test 80%, prolong fasciculation in group B was 47% and in group C it was 15%. Calculated sample size was 29 patients but we conducted this study on 60 patients in three groups 20 patients in each group. Ethical approval from institutional research board was taken. After informed consent and all information of research procedure to the patient study was started. These 60 patients were divided into three groups by lottery method. Patients in group A were administered with 1 mg/kg Succinylcholine, group B with 0.5 mg/kg and group C administered with 0.25 mg/kg Succinylcholine. Tracheal tube was placed by a consultant anaesthetist having 5-year experience of tracheal intubation. Abdominal fasciculation was noted from start of abdominal contractions to complete abdominal flaccidity, onset of action (time from start of action and complete block of breathing) noted. Similarly, intubation condition was also noted on a pre-designed Performa. Patient at extreme of ages less than 16 years and more than 60 years, BMI less than 28 kg/m^2, pregnant ladies, abnormal airway and arrhythmic patients were excluded from the study.

All data was entered and analysed by computer software SPSS version 23.2. Descriptive variables like age and onset of action and duration of action were presented as mean and SD and continues statistics like gender, abdominal fasciculation and incubation condition were presented as frequency and percentages. To see the significance among groups statistical test ANOVA was applied and for continuous stats among groups were analysed by applying Chi square test. The *p*-value 0.05 was considered as significant.

RESULTS

A total number of 100% (n=60) patients were included in this study, all were females. The mean age, BMI, onset time and duration of action of the patients were 28.15±4.5 years, 28.2±1.88 BMI, 71.93±18.94 seconds and 12.55±4.53 minutes respectively. Out of 100% (n=60), majority of the patients, i.e., 70% (n=42) were present ASA I and 30% (n=18) were present ASA II.

These 60 patients were treated with the different doses of succinylcholine and were divided into 3 groups, 20 in each. Patients of 1mg dose included in group (A), 0.5 mg dose patients were included in group (B) and 0.25 mg dose patients were included in group (C). The mean age and BMI of the patients in group (A) was 28.9±3.29 and 26.15±0.58 respectively, in group (B) 28.05±4.82 and 28.1±0.71 respectively, in group (C) 27.5±5.28 and 30.35±0.93 respectively.

The main outcome variables of this study were the fasciculation, satisfactory intubation, onset time (seconds) and duration of action (in minutes). In group (A) 1 mg, 80% (n=16) patients have abdominal fasciculation, in group (B) 0.5 mg 85% (n=17) patients have abdominal fasciculation. In group (C) 0.25 mg, 75% (n=15) patients have fasciculation. It was also observed that, in group (A) 1mg, 90% (n=18) patients have satisfactory intubation. In group (B), 80% (n=16) patients have satisfactory intubation. In group (C) 0.25 mg, only 30% (n=6) patients have satisfactory intubation. The mean onset time in group A 1mg was 50.95±4.6 seconds, in group B 0.5 mg 70.7±5.66 seconds and in group C 0.25 mg 94.15±8.73 seconds. Similarly, the mean duration of action in group A1mg was 16.1±3.76 minutes, in group B 0.5 mg 13.55±3.01 minutes and in group C 0.25 mg 8±2.05 minutes.

When patients were categorized into different age and BMI categories, it was noted that majority of patients, i.e., 70% (n=42) were falling in age group 26–36 years and 30% (n=18) were aged from 18–25 years. 60% (n=36) patients have BMI from 28–32 and 40% (n=24) patients have BMI from 25–27 respectively.

When Chi-Square was applied to check the effect modification, it was noted that fasciculation was significantly associated with stratified age and BMI with *p*-values 0.023 and 0.034 respectively. Fasciculation was not significantly associated with satisfactory intubation, ASA and Groups with *p*-values 0.086, 0.131 and 0.887 respectively. Similarly, when Chi-Square was applied to check the effect modification, it was noted that satisfactory intubation was significantly associated with stratified BMI and groups with *p*-values 0.001 and 0.000. Satisfactory intubation was not significantly associated with Stratified age, ASA and fasciculation with *p*-values 0.550, 1.0 and 0.086 respectively.

To check the equality of means, one-way ANOVA was applied, it was seen that all the variables, i.e., age, BMI, onset time and duration of action have different means with highly significant *p*-value, i.e., 0.000.

Table-1: Demographics

Characteristics (n=60)	**Frequency**	**Percentage**
Gender		
Female	60	100.0
Total	60	100.0
ASA		
I	42	70
II	18	30
Total	60	100.0
Stratified Age		
18–25years	18	30
26–36 years	42	70
Total	60	100.0
Stratified BMI		
25–27	24	40
28–32	36	60
Total	60	100.0
Descriptive Statistics		
Age in years	28.1500	4.50922
BMI	28.2000	1.88482

Table-2: Demographics in groups

Groups		Mean
Group A 1 mg	Age in years	28.9±3.29
	BMI	26.15±0.58
	Onset time seconds	50.95±4.60
	Duration of action (min)	16.1±3.76
Group B 0.5 mg	Age in years	28.05±4.82
	BMI	28.1±0.71
	Onset time seconds	70.7±5.66
	Duration of action	13.55±3.01
Group C 0.25 mg	Age in years	27.5±5.28
	BMI	30.35±0.93
	Onset time seconds	94.15±8.73
	Duration of action	8±2.05

Table-3: Outcomes in three groups

Fasciculation			
Groups		**Frequency**	**Percent**
Group A 1 mg	Yes	16	80.
	No	4	20
	Total	20	100.0
Group B 0.5 mg	Yes	17	85
	No	3	15
	Total	20	100.0
Group C 0.25 mg	Yes	15	75
	No	5	25
	Total	20	100.0
Satisfactory intubation			
Groups			
Group A 1 mg	Yes	18	90
	No	2	10
	Total	20	100.0
Group B 0.5 mg	Yes	16	80
	No	4	20
	Total	20	100.0
Group C 0.25 mg	Yes	6	30
	No	14	70
	Total	20	100.0

Table-4: ANOVA table

	Source	**Factor**	**Error**	**Total**
Analysis of variance	**D.F**	3	236	239
	Seq SS	118374	22557	141931
	Contribution	83.40%	16.60	100%
	Adj SS	118374	23557	
	Adj MS	39458.1	99.8	
	F-value	395		
	***p*-Value**	0.00		

DISCUSSION

From last few years many non-depolarizing agents have been used as short acting muscle relaxants for endotracheal intubation, but succinylcholine still a drug of choice is superior in efficacy. In this randomized control trial, we evaluated the efficacy of succinylcholine at different small doses (less than 1 mg/kg) that can give satisfactory results for endotracheal intubation in non-prepared patients of ASA I and II Another major benefit of succinylecholin is its short recovery time that was helpful in avoidance of oxygen desaturation in ventilatory patients. All patients of this study both in medical and surgical rooms were unaware of their past history of anaesthesia, with full stomach and critically sick ASA status I and II. Dose more than 1 mg/kg of succinylcholine is triple than effective dose.[12]

In emergency department, many adjuvant trials were used for intubation during time period of this study. But our study 60 patients were treated with the different doses of succinylcholince and were divided into 3 groups, 20 in each. Patients of 1mg dose included in group (A), 0.5 mg dose patients were included in group (B) and 0.25 mg dose patients were included in group (C).

After administration of deplorizing agent for muscle relaxation, their effect can be tested through twitching of adductor policies.[13] But it is not useful for assessment of masseter muscles, pharyngeal muscles and diaphramaic muscles. In many studies, it is reported that recovery of diaphragm muscles is 2 minutes quicker than other muscles after administration of succinylcholine.[14] In these patients of emergency and due to the upper reasons peripheral nerve stimulation cannot be used. At the time of induction and recovery from anaesthesia three main things were recorded in previous studies[15,16] (i) abdominal fasciculation (ii) duration of action of the drug and (iii) onset time. In our study demographic variables (age, gender, BMI, ASA status) were same in all groups. After administration of succinylcholin onset time in three groups was in group A 1mg was 50.95±4.6 seconds, in group B 0.5 mg 70.7±5.66 seconds and in group C 0.25 mg 94.15±8.73 seconds. Results of our study were comparable with results of study conducted by EI Orland *et al*. Results of his study were shows onset time as 65±2.5 sec, 55±2.5 sec and 44.9±1.3.

In previous studies mean duration of apnoea was 5 min, 6 min and 12.5 min. With the reduction of succinylcholine dose recovery time to the spontaneous breathing and normal airway reflexes achieved more quickly which is more important in emergency cases.[17] But duration of apnoea was not assessed in our study.

Abdominal fasciculation time also reduces by small doses of succinylcholine (0.45 mg/kg) as compared to high doses (1 mg/kg) which results in prolong fasciculation time. This reduced fasciculation time is helpful for emergency cases presented with full stomach (full stomach patients are at high risk of aspiration due to intra-abdominal pressure and intra gastric pressure.[18]

In Blobner M *et al* conducted a similar study and reported that different doses of succinylcholine also helpful in incubation condition and laryngeoscopy.[19,20] In another study conducted by Andrews J *et al*[20] reported similar findings. In our study, we accepted intubating condition 90%, 80% and 30% in three groups A, B, C respectively, our results are comparable to the Naguib *et al*[8] who reported that dose of 1 mg/kg was helpful in 80% of cases excellently. In another study conducted by Sparr HJ *et al*[21] and concluded that

succinylcholin and with lesser doses is equally effective as in upper doses.

CONCLUSION

Results of our clinical trial suggest that succinylcholine in low doses shorter duration of action and low rate of abdominal fasciculation which is desirable for rapid induction but onset of action is prolonged and intubation conditions were not satisfactory predominantly. So, we concluded that low doses of succnylcholine are not so much beneficial that I can replace full doses of succinylcholine when used for rapid induction and intubation.

RECOMMENDATIONS

We recommended in view of our clinical trial full dose of succinylcholine 1 mg/kg should use when indicated for rapid induction and intubation. If you want to avoid induction can done by using non-depolarizing agent to avoid abdominal fasciculation.

Limitation: This study was conducted on obstetrical population underwent caesarean section procedure. For better interpretation and to formulate recommendations further trial are recommended of other population.

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AUTHORS' CONTRIBUTION

MA: Conceive idea, design study, Final approval. NAK: Data collection, Manuscript writing. AF: Data collection, Data Analysis, Manuscript writing.

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Address for Correspondence:
Dr. Aamir Furqan, College of Dentistry, Nishtar Medical University Multan-Pakistan
Email: dafurqan52@gmail.com