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Comparison between Two Different Doses of Succinyl Choline on Intubating Conditions - A Prospective, Randomized, Double Blinded Study

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ABSTRACT

Succinylcholine is widely used for rapid sequence induction of anaesthesia. Even though the traditional dose of succinylcholine(1mg/kg) has brief duration of neuromuscular block, functional recovery of respiratory activity does not occur fast enough to prevent critical oxyhaemoglobin desaturation , if ventilation is not assisted. So the search for an ideal intubating dose which will provide satisfactory intubating conditions as well as lesser duration of apnoea becomes a necessity.

Materials and Methods: The study was designed to be a prospective, randomized double blinded study in the department of Anaesthesiology, Government medical college, Kottayam in 60 patients aged 20- 65 years belonging to ASA grade 1 and 2 requiring general endotracheal anaesthesia for general surgical procedures who were randomized to two groups. Sch 1.0 (to receive 1mg/kg succinyl choline) or sch0.5 (to receive 0.5mg/kg succinyl choline). The two groups were compared for the intubating conditions and duration of apnoea. Statistical analysis was done by independent samples-t test, chi-square test, likelihood ratio and Fischer's exact test.

Results: Succinyl choline in a dose of 0.5 mg/kg provides clinically acceptable intubation conditions and a lesser duration of apnoea.

Conclusion: Low dose succinyl choline (0.5mg/kg) can be used to decrease the window of vulnerability in airway management during induction of anaesthesia without compromising intubating conditions

Keywords: Succinyl choline, low dose, comparison, intubating conditions, duration of apnoea

INTRODUCTION

Succinylcholine is widely used for rapid sequence induction of anaesthesia. It is still considered as the "gold standard" against which all other muscle relaxants are compared with to assess intubating conditions. Though Rocuronium, with a speed of onset similar to succinylcholine, was introduced to replace succinylcholine, it did not match succinylcholine in its duration of action. Traditionally succinylcholine in a dosage of 1mg/kg has been recommended for intubation. Despite the brief duration of neuromuscular block, functional recovery of respiratory activity after this dose does not occur fast enough to prevent critical oxyhaemoglobin desaturation, if ventilation is not assisted. So the search for an ideal intubating dose which will provide satisfactory intubating conditions as well as lesser duration of apnoea becomes a necessity.

The purpose of this study was to compare;

(a) The intubating conditions during rapid tracheal intubation after 0.5 mg/kg succinylcholine and 1.0mg/kg succinylcholine when induced with standard dosage of propofol in adults.

(b) The duration of apnoea between the groups receiving 0.5mg/kg and 1mg/kg succinylcholine.

MATERIALS AND METHODS

The study was designed to be a prospective, randomized, double blinded study.

Study Population

Patients aged 20 – 65 years belonging to ASA physical status I and II, requiring general endotracheal anaesthesia for elective surgical procedures were included in the study.

Setting - Department of Anaesthesia, Government Medical College, Kottayam, Kerala, India

Study period - From 09/05/2009 to 09/01/2010.

Sample Size

It was calculated that in order to detect a difference of 0.25 between the proportions of acceptable intubating conditions per group, with 80% power and 5% level of significance, 20 patients were included in each group.

Inclusion Criteria

ASA – I or ASA – II patients of either sex, in the age group of 20-65yrs, posted for elective surgeries under general endotracheal anaesthesia.

Exclusion Criteria

1. Patients with neuromuscular, renal and hepatic diseases
2. Anticipated difficult airway
3. Allergy to any of study drugs
4. Patients at risk of succinylcholine induced hyperkalemia
5. Pregnant women

METHODOLOGY

Patients were evaluated one day prior to surgery and written informed consent was obtained. . Age and weight were noted. Pulse rate, blood pressure, respiratory rate, relevant clinical signs if any were recorded. Intra venous access was secured in all patients before shifting to the operating room. Patients were randomised to one of the two groups:

sch1.0 - to receive 1mg/kg succinyl choline

sch0.5 - to receive 0.5mg/kg succinyl choline.

Premedication

The patients were asked to keep nil orally for 8 hours prior to the procedure. All were given Tab. Alprazolam,0.25 mg, PO and Tab. Ranitidine, 150 mg on the preoperative day at night and on the morning of the surgery.

On the morning of surgery after securing intravenous access. Inj. Glycopyrrolate 0.004 mg/kg, Inj. Midazolam 0.02 mg/ kg and inj. Ondansetron 4mg, were given 15 minutes prior to induction.

Monitors

ECG, Pulse Oximeter, Non-invasive blood pressure monitor, End-tidal CO_2 monitor, Peripheral nerve stimulator.

Procedure

The administration of oxygen with a tight fitting mask was performed for at least 3 minutes. Anaesthesia was induced with fentanyl l 1.5µg/kg and propofol 2mg/kg. After loss of verbal contact and eye lash reflex, patients were manually ventilated with 100% oxygen with a tight fitting mask to maintain an end tidal carbon dioxide between 35 - 40 mm Hg. Following this, patients received either 1mg/kg or 0.5mg/kg succinyl choline depending on randomization. One minute after succinyl choline administration tracheal intubation was attempted by an experienced anaesthesiologist using Macintosh laryngoscope blade and tracheal tube.

Intubation conditions were graded using copenhagan consensus conference criteria (Table 1).

After confirming the tracheal position by check ventilation (1-2 positive pressure breaths), ventilation was gently assisted manually to maintain an end tidal carbon dioxide between 36.5 -40 mmHg. Spontaneous breathing attempts were recognised by a positive trace in capnograph or by noting patient's thoraco abdominal movement. The time to first visible diaphragmatic contraction that coincided with the reservoir bag movement (apnoea time) was recorded. Neuromuscular monitoring was done with peripheral nerve stimulator monitoring the contractions of the adductor pollicis muscle after stimulating the ulnar nerve using train-of- four.

The time to the first reservoir bag movement followed by regular movements producing a well formed end tidal carbon dioxide waveform indicated the time to spontaneous breathing.

In case of failed intubation attributable to poor intubating conditions, patients were administered an additional dose of propofol 0.5mg/kg IV. Ability to mask ventilate was confirmed again before paralysing the patient with an additional dose of

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succinyl choline 0.5mg/kg IV. Ventilation was assisted for one minute with 100% oxygen and laryngoscopy and intubation performed thereafter.

During extubation, tracheal tube was examined for presence of any blood or blood tinged secretions (suggestive of airway trauma during intubation). Incidence of sore throat and myalgia were also recorded.

Statistical Tests

Independent samples – t test and chi-square test were used in analysing apnoea duration and demographic data. Likelihood ratio, a variant of chi-square test, and Fischer's exact test were used in comparing intubating conditions between two groups.

P value of <0.05 was taken as significant.

RESULTS

- Demography
  There were no significant differences between the two groups on the basis of age and weight. In both the groups proportion of male gender has been on higher side and there was statistically no significant difference between the two groups.
- Comparison of Intubating Conditions (Table2).

  Clinically acceptable intubating conditions were noted in both the groups and there was no statistical difference between the two groups. Applying likelihood ratio, a variant of chi-square test, statistically significant difference was noted between the proportions of patients having excellent intubating conditions. Excellent intubating conditions were significantly higher in Sch 1.0 group.

- Duration of Apnoea (Table 3).
  The mean duration of apnoea in Sch 1.0 group was calculated to be 252 seconds as against 180 seconds in Sch 0.5 group. Applying independent samples t test p value was found to be less than 0.001 indicating that there is very high significant difference between the two groups with regard to duration of apnoea. There was no episode of desaturation below 95% in any of the 60 patients that were included in the study.
- Adductor pollicis T1 twitch – height recovery after different doses of succinyl choline for tracheal intubation (Table 4).

It was seen that duration to different levels of twitch height recovery was dose dependent. Recovery occurs much earlier with succinyl choline 0.5mg/kg.

DISCUSSION

The generally recommended dose of succinyl choline for tracheal intubation is 1.0 mg/kg. In this study we found that succinyl choline 0.5 mg/kg provided comparable clinically acceptable intubation conditions as with the traditional dose (1mg/kg). However the proportion of patients with excellent intubating conditions was significantly higher in succinyl choline 1mg/kg group compared to the succinyl choline 0.5mg/kg group. The duration of apnoea was significantly less in succinyl choline 0.5mg/kg group.

Robinson et al[1] reported that more than 80% of the anaesthesiologists were using succinyl choline for both elective and emergency purpose in paediatrics. Mirakhur et al[2] also came up with similar findings in their survey, where more than 90% were using succinyl choline in both adults and children. As of now, there is no other neuromuscular blocking agent that matches the short duration of action of succinyl choline. Minor side effects associated with succinyl choline such as bradycardia, myalgia and increased jaw tension are preventable.

The effectiveness of small doses of succinyl choline in achieving acceptable tracheal intubation conditions has been reported in adult age groups. These studies were taken seriously in view of observations by Benumof et al[3]. They observed that respiratory recovery does not occur fast enough to save the patients in whom ventilation cannot be assisted after administration of 1.0 mg/kg succinyl choline in adult patients. To offset this grave problem interest was kindled in lowering the dose of succinyl choline to reduce the duration of action (and hence the apnoea) without compromising intubating conditions.

Naguib et al[4,5] suggested that acceptable intubating conditions can be obtained in 95% of the patients with just 0.56 mg/kg of succinyl choline. Kopman et al[6] reported that a reduction in the dose by 40% from 1.0 to 0.6 mg/kg resulted in a decrease in duration of action by 90 seconds.

The traditional intubation dose (1.0 mg/kg) recommended for succinyl choline was 2 to 3 times more than the ED_{95} dose of succinylcholine. With

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non depolarizing neuromuscular blockers, doses equivalent to 1.5 times the ED_{95} are recommended for intubation purposes. Hence a dose of 0.5 mg/kg of succinyl choline which would roughly correspond to 1.5 times the ED_{95} was chosen as the dose for the present study.

Studies on muscle relaxants and intubating conditions performed before 1994 have used various scoring systems to grade the intubation conditions. Thus it becomes difficult to compare the results between the different studies that have been conducted before 1994. The internationally accepted guidelines of Copenhagen Consensus conference have standardized the assessment of intubating conditions in 1994. We also used the same to compare intubating conditions.

In our study intubating conditions achieved after 0.5mg/kg are comparable to those after 1.0mg/kg. Naguig et al[4,5] recommended that 0.5-0.6 mg/kg succinyl choline can be used for tracheal intubation in patients anaesthetized with propofol 2.0mg/kg and fentanyl 2.0ug/kg. El-Orbany et al[7,8,9] reported that intubating conditions with were acceptable, although not ideal, in comparison with traditional dose of 1.0mg.kg. With regards to frequency of excellent intubating conditions, we found that 53% of the patients in 0.5mg/kg group has excellent intubating conditions as against 83% in 1.0 mg/kg group. El-Orbany et al[7,8,9] also had a similar finding in their study. Nearly half the patients in 0.5mg/kg succinyl choline group were found to have slight diaphragmatic reaction upon tracheal tube placement.

The apnoea time was also found to be dose dependent in our study. There was 70 seconds (mean value) difference between the 1.0mg/kg succinyl choline group and the 0.5mg/kg group. Kopman et al[6] also reported a decrease in duration of action on lowering the dose of succinyl choline and hence apnoea time also.

It is very important to address any side effects that might be associated with reduction in the dose of succinyl choline for intubation purposes. In our study we didn't find any conclusive evidence of airway trauma such as blood tinged tracheal tube after extubation.

In the current study it was found that succinyl choline in a dose of 0.5mg/kg has a significantly lesser duration of apnoea in comparison with standard dose of succinyl choline. Lesser duration of succinyl choline can be extrapolated to mean that low dose succinyl choline will allow a rapid return of spontaneous respiration and airway reflexes, thereby decreasing the window of vulnerability in airway management during induction of anaesthesia without compromising intubating conditions.

CONCLUSION

1. Succinyl choline in a dose of 0.5mg/kg provides clinically acceptable intubating conditions comparable to succinyl choline 1.0mg/kg
2. The proportion of patients with excellent intubating conditions was significantly higher in succinyl choline 1.0mg/kh group than in succinyl choline 0.5mg/kg group.
3. The duration of apnoea with succinyl choline 0.5 mg/kg was significantly less when compared with 1.0mg/kg succinyl choline.

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Table 1: Intubating conditions

	Clinically acceptable	Clinically acceptable	Clinically unacceptable
Criteria	**Excellent**	**Good**	**Poor**
Jaw relaxation	Easy	Fair	Difficult
Limb movement	None	Slight	Vigorous
Post intubation coughing	None	Diaphragm	Sustained (>10s)
Vocal cords position	Abducted	Intermediate	Closed
Vocal cords movement	None	Moving	Closing

Table 2: Comparison of Intubating Conditions

		Intubation conditions			Total	P value
		Clinically acceptable		Clinically unacceptable		
		Excellent	Good	Poor		
Group	Sch 1.0	25	4	1	30	0.043
	Sch 0.5	16	12	2	30	
Total		41	16	3	60	

Table 3: Duration of Apnoea

	Group	Total	Mean	Standard deviation	P value
Apnoea period (seconds)	Sch 1.0	30	252.0	44.599	< 0.001
	Sch 0.5	30	180.2	46.363	

Table 4: Adductor pollicis T1 twitch – height recovery after different doses of succinyl choline for tracheal intubation

	Sch 0.5	Sch 1.0
Time to initial twitch (min)	3.0±0.2	4.0±1.2
Time to T1 = 90% (min)	5.5±1.0	9.5±1.3

Table 4 shows that duration to different levels of twitch height recovery was dose dependent. Recovery occurs much earlier with succinyl choline 0.5mg/kg

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