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A randomized double blind comparative study on onset time and intubating conditions achieved with succinylcholine 1.5mg/kg and Rocuronium 0.6mg/kg & 0.9mg/kg IV

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Abstract

Introduction: A perfect setting for tracheal intubation include a rapid onset, and short duration of action. These requirements are best met by succinylcholine, an ultrashort acting depolarizing muscle relaxant. However its many unwanted side effects have necessitated a search for an alternative drug. Rocuronium bromide is a steroid, non-depolarizing neuromuscular blocking agent with a rapid onset and an intermediate duration of action. It may be a suitable alternative to succinylcholine.

Aim of Study: To study and compare the efficacy of rocuronium bromide in two dosage schedules – 0.6mg / kg (2 x ED95) and 0.9mg / kg (3 x ED95) IV, with succinylcholine chloride 1.5mg / kg IV in patients with respect to:

1. Intubating conditions at one minute
2. Onset of action
3. Adverse effects

Materials and Method: This study was conducted at Government Stanley Hospital, Chennai, in the patients undergoing general surgical procedures. After institutional approval and informed consent, 60 patients were enrolled in the study.

Group A: Succinylcholine 1.5 mg/kg (Sch 1.5)

Group B: Rocuronium bromide 0.6 mg/kg (2 x ED 95)(Roc 0.6)

Group C: Rocuronium bromide 0.9 mg/kg (3 x ED 95)(Roc 0.9)

Anaesthesia was induced with Thiopentone sodium 5mg/kg over a period of 20 seconds. The ulnar nerve was stimulated at the wrist using 0.1 Hz single twitch stimulation mode and the supramaximal current was determined. Once a control twitch height was established the bolus of randomly assigned neuromuscular blocking agent was administered intravenously in less than 5 seconds. When injection was completed, a timer was started and after 20 seconds the ulnar nerve was stimulated using single twitch mode at a frequency of 1 Hz. At one minute, intubation was performed and scored by a blinded experienced anaesthesiologist. anaesthesia was maintained with Nitrous oxide, oxygen and Neuromuscular blocking agents.

Results and Observations: Vocal cord relaxation is comparable between group a and c. Excellent intubating conditions was seen with Group A (Sch 1.5mg/kg) with 100% score. Excellent intubating conditions with Group B (Roc 0.6 mg/kg) and Group C are 30% and 85% respectively. P value of Succinylcholine 1.5 mg/kg and Rocuronium 0.9 mg/kg is 0.466 statistically not significant.

Conclusion: Succinylcholine is an ideal agent for intubation in all surgical procedures. Intubating conditions of Rocuronium bromide at a dose of 0.9mg/kg (3xED95) is comparable to Succinylcholine 1.5mg/kg at 1minute.Rocuronium bromide 0.9 mg/kg can be used safely in patients where Succinylcholine is contraindicated.

Keywords: Neuromuscular blocker, Rocuronium, Succinylcholine, Hemodynamics, Intubating conditions

Introduction

A perfect setting for tracheal intubation include a rapid onset, profound paralysis of all muscles and short duration of action so that the patient's own respiratory function can be restored should intubation prove to be impossible. These requirements are best met by succinylcholine, an ultrashort acting depolarizing muscle relaxant. However its many unwanted side effects have necessitated a search for an alternative drug or technique to facilitate tracheal intubation. Rocuronium bromide is a steroid, non-depolarizing neuromuscular blocking agent with a rapid onset and an intermediate duration of action. It may be a suitable alternative to succinylcholine.

Aim of Study

To study and compare the efficacy of rocuronium bromide in two dosage schedules – 0.6mg / kg (2 x ED95) and 0.9mg / kg (3 x ED95) IV, with succinylcholine chloride 1.5mg / kg IV in patients with respect to:

1. Intubating conditions at one minute
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3. Adverse effects

Materials and Method

This study was conducted at Government Stanley Hospital, Chennai, in the patients undergoing general surgical procedures. After institutional approval and informed consent, 60 patients were enrolled in the study.

Randomization: Computer generated random numbers.

Inclusion Criteria

- All ASA Physical status 1 and 2 patients aged between 20-60 years

- Scheduled for elective surgery under general anaesthesia.

Exclusion Criteria

- Modified Mallampatti Airway Classification III, IV
- Morbidly Obese
- Pregnant women
- Neuromuscular disease
- Hepatic or renal disease
- Patients receiving any medication known to interact with neuromuscular blocking agents.

Preoperative Evaluation: In all the patient's age, body weight, preoperative blood pressure and pulse rate were recorded. History regarding previous anaesthesia and surgery, any significant medical illness, medications and allergy were recorded. A complete physical examination and airway assessment was done.

On arrival in the operating room intravenous access was secured with 18G cannula in a vein in dorsum of hand. Ringer lactate infusion started. Following monitors are connected.

Pulseoximeter, Electrocardiogram and Non-invasive blood pressure monitor, Basal recording were noted

Premedication

Inj. Midazolam 0.01mg intravenously 15 min before surgery.

Inj. Pentazocine 0.5mg/kg intravenously. The patients were systematically randomized in to three groups of twenty each.

Group A: Succinylcholine 1.5 mg/kg (Sch 1.5)

Group B: Rocuronium bromide 0.6 mg/kg (2 x ED 95)(Roc 0.6)

Group C: Rocuronium bromide 0.9 mg/kg (3 x ED 95)(Roc 0.9)

After preoxygenation for 3 minutes anaesthesia was induced with Thiopentone sodium 5mg/kg over a period of 20 seconds. Respiration was assisted with 100% oxygen following loss of consiousness, the ulnar nerve was stimulated at the wrist using 0.1 Hz single twitch stimulation mode and the supramaximal current was determined. Once a control twitch height was established the bolus of randomly assigned neuromuscular blocking agent was administered intravenously in less than 5 seconds. When injection was completed, a timer was started and after 20 seconds the ulnar nerve was stimulated using single twitch mode at a frequency of 1 Hz. At one minute, intubation was performed and scored by a blinded experienced anaesthesiologist. After intubation and observation of onset time, anaesthesia was maintained as appropriate for surgical needs with Nitrous oxide, oxygen and Neuromuscular blocking agents.

The following observations were recorded:

1. **Intubating Conditions:** Intubation conditions were scored at one minute by a scoring system used by Mirakhur R.K., cooper A.R. and Clarke R.S.J.
2. **Onset of action:** The time taken for 100% suppression of single twitch was noted.
3. **Adverse effects:** Patients were monitored for signs of histamine release such as wheal, flushing, bronchospasm, tachycardia and hypotension analysis. The data was computed and all values expressed as mean ± SD. The data was analyzed using CHI–SQUARE test, ANOVA F-test, P value < 0.05 was considered significant

Observation and Results

All the three groups were comparable with respect to the age, weight & sex distribution. The scores for jaw relaxation, vocal cord position and response to intubation and the total scores and compared between three groups at 1 minute. All three groups had good jaw relaxation score of 3.vocal cords were moving in three patents in Group A (Sch 1.5mg/kg) g, 12 patients in Group B (Roc 0.6 mg/kg) & 1 patient in Group C (Roc 0.6 mg/kg). Group B (Roc 0.6 mg/kg) 11 patienta had bad intubation score of 1 with bucking during intubation compared to other two groups.

Excellent intubating conditions was seen with Group A (Sch 1.5mg/kg) with 100% score. Excellent intubating conditions with Group B (Roc 0.6 mg/kg) and Group C are 30% and 85% respectively. P value of Succinylcholine 1.5 mg/kg and Rocuronium 0.9 mg/kg is 0.466 statistically not significant.

In group A (Sch 1.5 mg/kg) onset of action was 43.75 ± 3.582 seconds significantly faster than either group B (Roc 0.6mg/kg) and group C (Roc .9mg/kg), 220.75 ± 51.638 seconds vs 105.55 ± 22.993 seconds. The difference in onset of action between the three groups are statistically significant.

Evaluation of Adverse Effect: No signs of histamine release such as wheal, flushing, bronchospasm, tachycardia or hypotension were not seen in any of the three group

Discussion

In our study, intubating conditions at one minute, onset of action and adverse effects were studied following administration of Succinylcholine 1.5mg/kg IV, Rocuronium 0.6 and 0.9mg/kg IV in adults anaesthetized with Thiopentone sodium 5mg/kg IV. All the three groups were similar with regards to age, sex and weight. Succinylcholine, a depolarizing muscle relaxant with its rapid onset and shorter duration of action is still the relaxant of choice to facilitate rapid tracheal intubation. Succinylcholine has got many side effects such as rise in serum potassium, bradycardia etc. Because most of the side effects of Succinylcholine is due to its depolarizing mechanism of action, search for ideal neuromuscular blocking agent is being focused on non-depolarizing type of relaxants which has rapid onset and offers good to excellent intubating conditions.

Rocuronium, a non-depolarizing amino steroidal muscle relaxant a low potency compound offers early onset of action and excellent to good intubating conditions. The dosage of Succinylcholine was selected as per text book description and studies done by Weiss et al[23] and Bhatia Pradeep Kumar et al.[4] They concluded that Succinylcholine 1.5 mg /kg IV provides ideal intubating conditions and quicker onset of actions. Studies of Bhatia Pradeep Kumar[4] et al, Mirakhur. K[17] et al and Cooper[6] et al have shown shorter onset time and intubating conditions at 60 seconds are excellent to good with a dose of 0.6 mg/kg IV of Rocuronium. R.K. Verma[19] et al, Cheng CAY et al[5] and Weiss[23] et al compared two doses of Rocuronium at 60 seconds and concluded that 0.9 mg/kg provides similar intubating conditions to Succinylcholine and 0.6 mg/kg did not provide adequate intubating conditions. In our study, all three groups showed good Jaw relaxation, 3 patients in Succinylcholine 1.5 mg/kg group showed moving vocal cords and 12 patients in Rocuronium 0.6 mg/kg and 1 patient in Rocuronium 0.9 mg/kg group. Regarding response to intubation 11 patients in Rocuronium 0.6 mg/kg group, showed mild coughing, 6 patients – light diaphragmatic movement, and 3 patients showed no response. In Rocuronium 0.9 mg/kg group, 3 patients showed light – light diaphragmatic movement, and 17 patients showed no response. In Succinylcholine 1.5 mg/kg group, no patient showed any response to intubation. In our study excellent intubating condition was significantly higher with Succinylcholine 1.5 mg/kg (100%) compared with either dose of Rocuronium. Rocuronium 0.9 mg/kg (95%) had a significantly higher incidence of excellent intubating condition than Rocuronium 0.6 mg/kg (30%). There is no significant statistical difference between Rocuronium 0.9 mg/kg and Succinylcholine 1.5 mg/kg. This is comparable to study of R.K. Verma[19] et al, Cheng CAY[5] et al and Weiss[23] et al. Mirakhur R.K,[17] Cooper A.R[6] et al showed 95% at 60 seconds and all patients in 90 seconds. In our study mean onset time were (43.75 ± 3.6) seconds with Succinylcholine 1.5 mg/kg and (105.6 ± 23) seconds with Rocuronium 0.9 mg/kg and (220 ± 52) seconds with Rocuronium 0.6 mg/kg. Significant Statistical difference exist between all the three groups. Succinylcholine had a quicker onset than either dose of Rocuronium.

This is similar to study of R.K. Verma 19et al showing onset time of 52.8 seconds with Succinylcholine 1.0 mg/kg and 102.6 seconds with Rocuronium 0.9 mg/kg and 163 seconds Rocuronium 0.6 mg/kg. Bhatia Pradeep kumar4 et al showed the onset of Succinylcholine 1.5 mg/kg as 65.89 seconds and 87.94 seconds with Rocuronium 0.6mg/kg. Fuchs-Buder[8] et al showed 193 seconds with Rocuronium 0.6mg/kg and 118 seconds with Rocuronium 0.9 mg/kg Wierda[24] et al. showed mean onset time of 172 seconds with Rocuronium 0.6 mg/kg .No evidence of histamine release was observed in any of the patients in the three groups in our study.

Conclusion

Succinylcholine is an ideal agent for intubation in all surgical procedures. Intubating conditions of Rocuronium bromide at a dose of 0.9mg/kg (3xED95) is comparable to Succinylcholine 1.5mg/kg at 1minute. Rocuronium bromide 0.9 mg/kg can be used safely in patients where Succinylcholine is contraindicated.

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