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Original research article

Comparative Study of Rocuronium Bromide and Succinylcholine Chloride for Endotracheal Intubation During General Anesthesia

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Abstract

Background: Rocuronium mimics the actions of succinylcholine which is the quick onset of neuromuscular blockade without the latter's side effects and can be used in place of it. The goal is to compare rocuronium bromide and succinylcholine chloride intubating settings and hemodynamic consequences.

Methods: N= 60 patients belonging to ASA I and ASA II of either sex posted for various elective surgeries requiring endotracheal intubation were selected for the study. They were randomly allotted into 2 groups containing N=30 each. Group I received Rocuronium Bromide 1.2 mg/kg i.v and Group II received Succinylcholine Chloride 1.5 mg/kg i.v to facilitate endotracheal intubation. Intubation was attempted at 60 seconds Hemodynamic responses were recorded before intubation, immediately after intubation, and every 2 min for 15 min and compared in two groups

Results: The intubating conditions in group I, N=28 patients out of n=30 had excellent intubating conditions with n=2 patients having good intubating conditions. In group II patients, N=27 patients had excellent intubating conditions with N=3 patients having good intubating conditions. We did not find any case with fair or poor intubating conditions in this study. The clinical duration of action of Group I range from 60 to 75 minutes with a mean duration of 66.79 minutes. The clinical duration of action of Group II ranges from 4 to 8 minutes with a mean duration of 5.83 minutes.

Conclusion: Rocuronium bromide 1.2 mg kg body weight produces good to excellent intubating conditions in all the patients at 60 seconds with a mean onset time of 76.09 ± 9.15 seconds. Rocuronium bromide is a safe alternative to succinylcholine chloride for rapid sequence induction in adult patients in situations where succinylcholine is contraindicated and in whom there is no anticipated difficult airway.

Keywords: Hemodynamic Response, Intubating Conditions, Onset Time, Rocuronium Bromide, Succinylcholine

Introduction

The neuromuscular drugs pharmacologically act by interrupting the transmission of nerve impulses at the neuromuscular junction. They act by producing phase I depolarizing blockade, phase II depolarizing neuromuscular blockade, or non-depolarizing blockade. Endotracheal intubation and surgical relaxation are two key applications of muscle relaxation. Succinylcholine chloride, introduced in 1951, was a synthetic depolarizing muscle relaxant. One of the main reasons for the popularity of succinylcholine is its propensity to create good intubating conditions rapidly. [1] This increases safety, as it allows the early establishment of the patient airway, reducing the risk of aspiration. Because of its fast onset and brief duration of action, it was first widely recognized as an intubation medication. The short duration of effect in most patients, as long as the patient did not have a pseudocholinesterase deficit, was a notable benefit of this medicine over other muscle relaxants. This advantage no longer exists after the introduction of the rocuronium-specific quick-acting reversal drug sugammadex. [2] Rocuronium bromide is a novel amino-steroidal chemical that is derived from vecuronium. Rocuronium has a fast start time, a medium duration of action, and a quick recovery period while maintaining cardiovascular stability. [3] It does not produce a considerable amount of histamine. Under nitrous oxide opioid anesthesia, a 0.6 mg/kg dosage of Rocuronium takes 1 to 1.5 minutes to take effect. [4, 5] Nonetheless, at 60 seconds, the intubating circumstances with this dosage of Rocuronium are identical to those seen with Suxamethonium. [6, 7] Many clinicians may be persuaded to employ Rocuronium to assist endotracheal intubation not just in elective instances with appropriate anesthetic, but also in emergency circumstances needing quick sequence intubation. This research aimed to study intubating conditions and hemodynamic effects after administration of Rocuronium bromide and Succinylcholine chloride.

Material and Methods

This cross-sectional study was conducted on the patients admitted to Kakatiya Medical College and MGM hospital. Institutional and Ethical committee clearance was obtained for the study. Informed consent was taken from the patients regarding the procedure. The cases included patients who underwent various surgeries requiring intubation. N= 60 patients belonging to ASA I and ASA II of either sex posted for various elective surgeries requiring endotracheal intubation were selected for the study. They were randomly allotted into 2 groups containing N=30 each. Group I received Rocuronium Bromide 1.2 mg/kg iv and Group II received Succinylcholine Chloride 1.5 mg/kg iv to facilitate endotracheal intubation Neuromuscular monitoring was done immediately after the injection of neuromuscular blocking drugs. Intubation was attempted at 60 seconds Hemodynamic responses were recorded before intubation, immediately after intubation, and every 2 min for 15 min and compared in two groups

Inclusion criteria

1. Males and Females
2. Aged 18 – 50 years
3. Elective Surgeries
4. ASA Grade I and II
5. Mallampatti Grade 1 and 2

Exclusion criteria

1. Airway abnormalities and history of difficult intubation
2. Pregnancy, obesity, and neuromuscular disorders
3. Medications with drugs that interact with neuromuscular transmission viz

4. aminoglycoside, calcium channel blockers
5. Those who do not qualify as per inclusion criteria

A thorough pre-anesthetic evaluation was done a day before surgery and all the necessary investigations were done. Tab Alprazolam 5 µg/kg and Tab Ranitidine 150 mg were given to all patients on the night before the surgery. Patients were maintained nil by mouth for about 8 hrs before the surgery. On the day of surgery, in the pre-operative room, an 18 G i.v cannula was inserted. Baseline heart rate, systolic BP, diastolic BP, mean arterial pressure, and SpO_2 were measured. On shifting to the operation room, the multiparameter monitor was connected which include NIBP, Pulse oximeter, and Electrocardiogram. Neuromuscular monitoring was done with the neuromuscular monitor. Neuromuscular electrodes were placed along the ulnar aspect of the distal forearm. Inj. Fentanyl 1µg/kg and midazolam 0.05 mg/kg i.v were given to all patients 5 minutes before the administration of the induction agent. All the patients were pre-oxygenated with 100% oxygen for 3 minutes and were induced with inj. Thiopentone 5 mg/kg body weight iv. After induction height of the single twitch response to the supramaximal stimulus was determined with the neuromuscular monitor. In Group I inj Rocuronium 1.2 mg/kg iv. In Group II inj Succinylcholine 1.5 mg/kg iv. Neuromuscular monitoring was done immediately after the injection of a neuromuscular blocking drug. The nerve stimulator delivered a supramaximal single twitch stimulus after every 6 seconds. The time interval from the injection of the neuromuscular blocking drug to the cessation of the visible motor response of adductor pollicis to single twitch nerve stimulation of the ulnar nerve was recorded.

Hemodynamic parameters, pulse rate, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), continuous ECG, and SPO_2 were recorded after giving premedication, before intubation, immediately after intubation and every 2 mins for 15 mins and every 15 mins until the surgery is completed. The patients were ventilated with 100% oxygen with intermittent positive pressure ventilation on the mask. The patient was intubated with a proper sized endotracheal tube and anesthesia was proceeded with O_2, N_2O, halothane 0.5%, and further doses of muscle relaxant. After completion of the surgery, reversal of neuromuscular blockade was done with inj. Neostigmine 0.05 mg kg-1 and Inj. Glycopyrrolate 0.01 mg/kg iv. After satisfactory recovery, patients were extubated. Postoperatively all vital data i.e., pulse rate, blood pressure, and respiratory rate was monitored, and the patient was observed for nausea, vomiting, bradycardia, tachycardia, hypotension, and respiratory obstruction. The hemodynamic parameters in the present study were uploaded on an MS Excel spreadsheet and analyzed by SPSS version 22 in windows format and p values of <0.05 were considered significant.

Results

Out of the total n=60 cases divided into the two groups in Group, I the mean age was 34.87 years In Group II the mean age was 33.50 years. The age range was 18 – 50 years. In Group I, there was n=13 males and n=17 female patients. In Group II, there were n=19 males and n=11 female patients. Most included cases in group I was age group from 18 – 30 years with n=13(43.33%) of cases and in group II n=14(46.7%) of cases. The mean weight distribution of the cases in group I was 55.10 ± 7.89 Kgs and in group II it was 59.03 ± 9.13 Kgs the p values were not found to be significant.

Onset time is taken as a time interval from the administration of the neuromuscular blocking drug to the cessation of the visible motor response of adductor pollicis muscle to single twitch nerve stimulation of the ulnar nerve. For group, I the duration of time was 76.09 ± 9.15 seconds, and the range was 60 – 89 seconds for group II the mean duration was 59.13 ± 3.76 seconds, and the range was 48 – 62 seconds the p values were found to be < 0.05 hence considered

significant. The intubating conditions in group I patients who received rocuronium 1.2 mg/kg body weight, N=28 patients out of n=30 had excellent intubating conditions with n=2 patients having good intubating conditions. In group II patients, who received succinylcholine 1.5 mg/kg body weight, N=27 patients had excellent intubating conditions with N=3 patients having good intubating conditions. We did not find any case with fair or poor intubating conditions in this study. The clinical duration of action of Group I (Rocuronium 1.2 mg/kg body weight) ranges from 60 to 75 minutes with a mean duration of 66.79 minutes. The clinical duration of action of Group II (succinylcholine 1-5 mg/kg body wt) ranges from 4 to 8 minutes with a mean duration of 5.83 minutes.

As shown in Figure 1, there was a rise in mean heart rate from the pre-induction value at 1 minute following intubation in Group I and Group II respectively. This rise in mean heart rate declined from the pre-induction value at 5 minutes following intubation. In both the groups, there was a trend towards returning to baseline mean heart rate following intubation. There were no abnormal ECG findings noted in any of the cases following the administration of drugs.

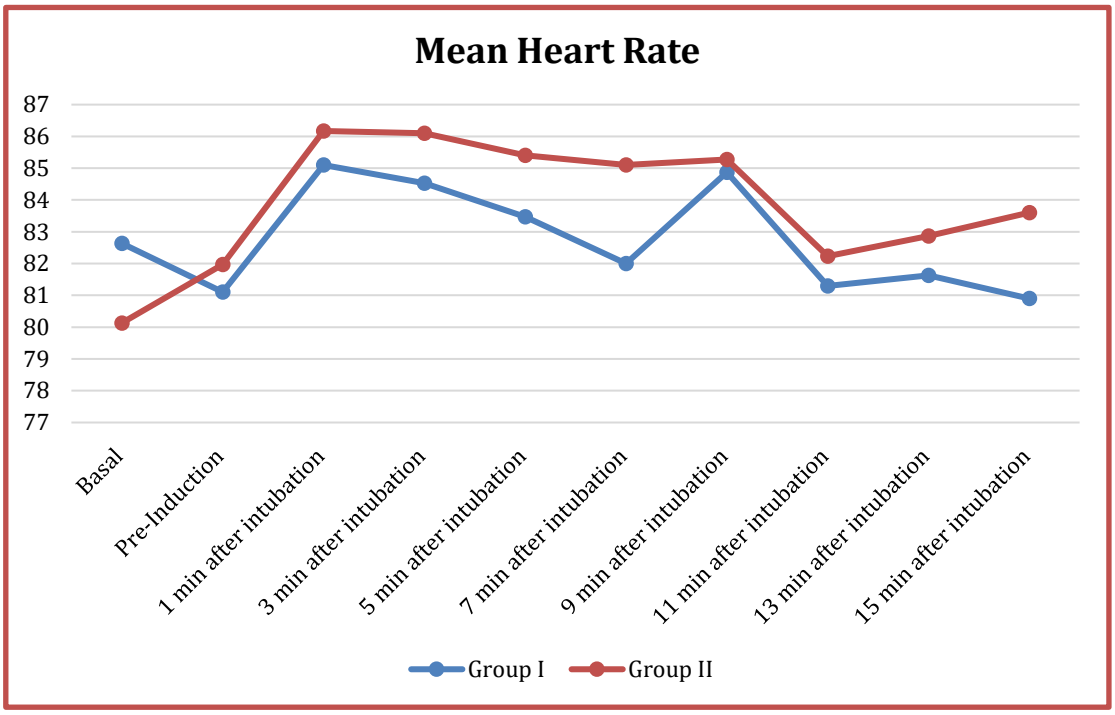

Figure 1: showing the mean heart rate in both groups at various intervals

A critical analysis of Figure 2 shows there is a rise in mean systolic pressure from the pre-induction value at 1 minute following intubation in Group I and Group II respectively. This rise in mean systolic pressure declined from the pre-induction value at 5 minutes following intubation. In both the groups, there was a trend towards returning to baseline mean systolic pressure following intubation.

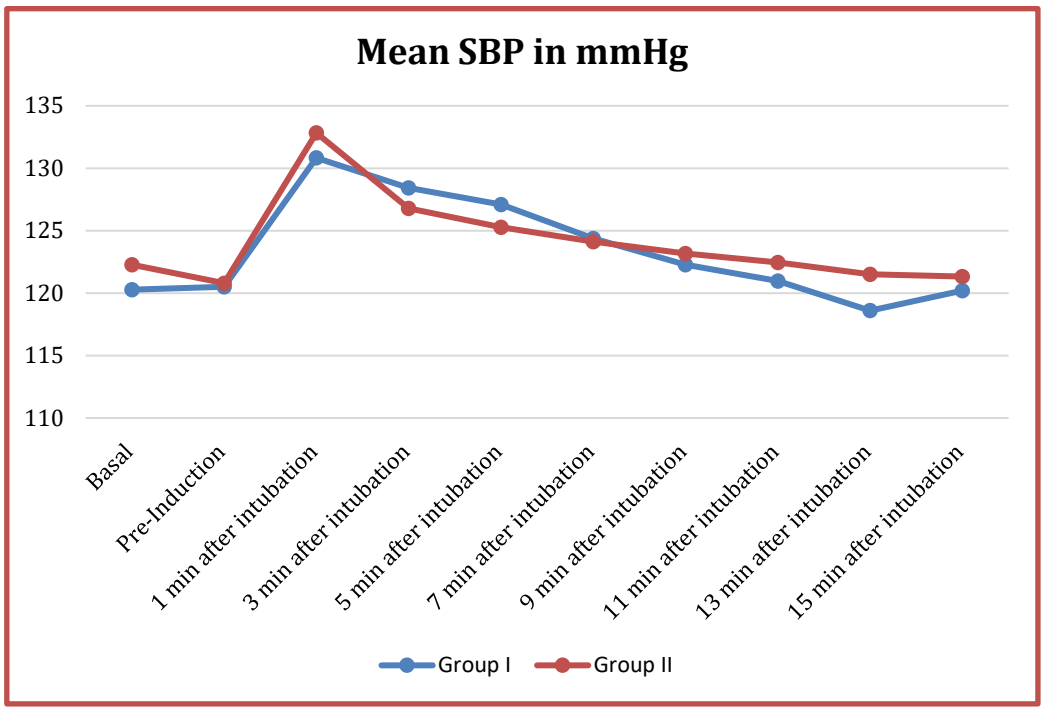

Figure 2: showing the mean Systolic Blood pressure in both groups at various intervals

Figure 3 shows there was a rise in mean diastolic blood pressure from the pre-induction value at 1 minute following intubation in Group I and Group II respectively. This rise in mean diastolic pressure declined from production value at 5 minutes following intubation. In both the groups, there was a trend towards returning to baseline mean diastolic pressure following intubation.

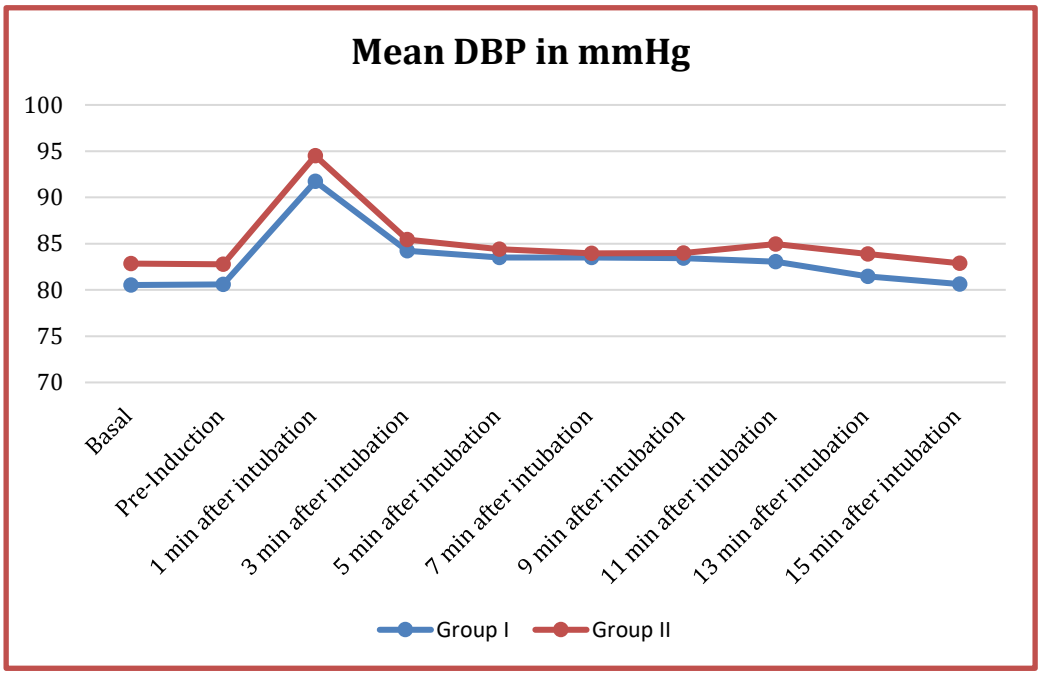

Figure 3: showing the mean Diastolic Blood pressure in both groups at various intervals

Figure 4 shows there was a rise in mean arterial pressure from the pre-induction value at 1 minute following intubation in Group I and Group II respectively. This rise in mean arterial pressure declined from the pre-induction value at 5 minutes following intubation. In both the

groups, there was a trend towards returning to baseline mean arterial pressure following intubation.

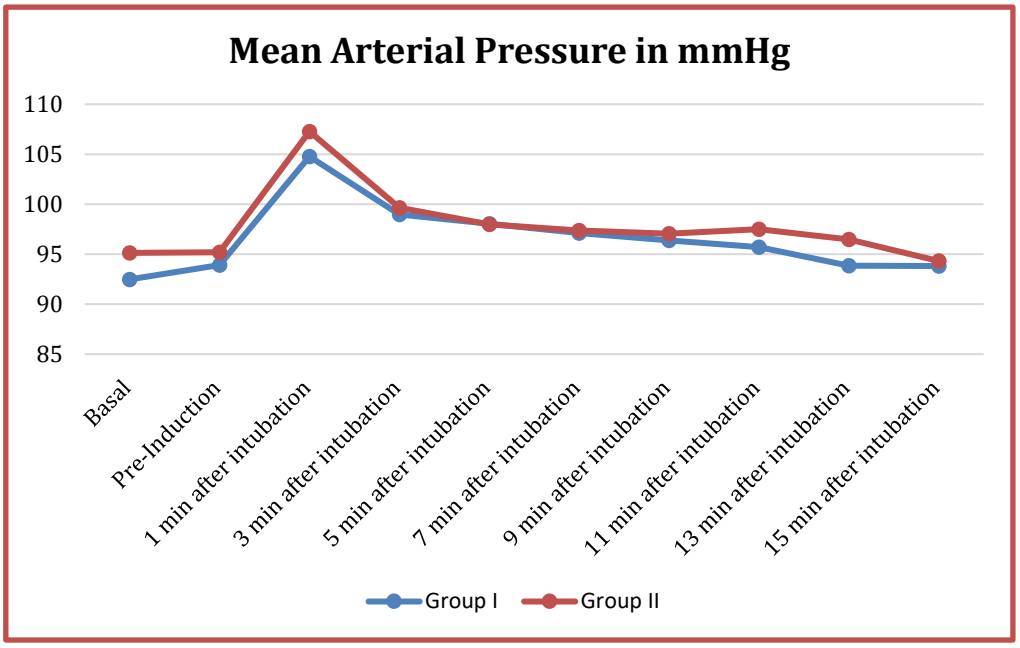

Figure 4: showing the mean arterial pressure in both groups at various intervals

Discussion

Securing the airway by an endotracheal tube rapidly and safely is of paramount importance to minimize the chances of regurgitation and aspiration of gastric contents in the practice of general anesthesia. Before the introduction of muscle relaxants, inhalational agents were used for endotracheal intubation and associated with many complications like laryngospasm, and bronchospasm when intubation was attempted with inadequate depth and sensitization of myocardium to catecholamines leading to hemodynamic changes because of higher concentration of inhalational agents that were used for making the patient sufficiently deep to obtain intubating conditions. In the present study, induction was done with the Injection of Thiopentone sodium 5 mg/kg I.V and Rocuronium bromide 1.2 mg/kg, and succinylcholine chloride 1.5 mg/kg are given according to the group. Raghavan L et al., [8] in their study induced patients with Injection of Thiopentone sodium. Anesthesia was maintained with oxygen, nitrous oxide, sevoflurane, and Injection of Rocuronium bromide (0.15 mg/kg). The ED95 dose of Succinylcholine chloride is 0.392 mg kg body weight. Four times the ED95 dose which approximates 1.5 mg kg body weight has been employed for intubation in the present study. It is like that of Aleksandra J et al., [9] and Neerja B et al., [10] The ED95 of Rocuronium is 0.3 mg/kg body weight. In the present study, we used a dose is four times the ED 95 (1.2 mg/kg body weight). It has been shown to provide good to excellent intubating conditions at 60 sec by Toni Magorian et al., [4] and Wright C et al., [11] Therefore, in this study intubating dosages of both the drugs are taken four times the ED95 i.e., rocuronium bromide 1.2 mg/kg and succinylcholine chloride 1.5 mg/kg. In the present study, it is found that intubating conditions were considered excellent or good in most patients in both groups. The reason for a good, rather than an excellent, score was usually vocal cord movement. Thus, we can conclude that intubating conditions with Rocuronium 1.2 mg/kg are comparable with that of succinylcholine 1.5 mg/kg at 60 seconds. S Aparna et al., [12] obtained excellent intubating conditions in 70%, and 95% respectively which is comparable with the results of our study. However, Aleksandra et al., [9] and Huizinga et al., [13] have noted poor intubating conditions in 7.69% and 10%

respectively. The mean duration of action of Rocuronium bromine 1.2 mg/Kg in this study was noted to be 66.79 minutes. Tony Magorian et al., [4] in their study noted the mean duration of action to be 73.0 minutes. and C Wright et al., [6] found the mean duration of action of 66.79 minutes. The mean duration of action of succinylcholine 1.5 mg/kg in the present study was 5.83 minutes and J Aleksandra et al., [9] found the mean duration of 5.8 minutes in concordance with the observation of the present study. In this study, there was a rise in hemodynamic responses following administration of Rocuronium bromide, one minute following intubation. There was a hemodynamic response to laryngoscopy and endotracheal intubation, which subsided to near pre-induction, values 5 minutes after intubation. Similar trends were seen following the administration of Succinylcholine chloride. After intubation, hemodynamic parameters (pulse rate, systolic and diastolic blood pressure, mean arterial pressure) were comparable in both groups. No adverse effects were noted in both groups. The trend in hemodynamic changes to laryngoscopy and intubation was similar in both Rocuronium bromide and Succinylcholine chloride groups. Levy et al., [14] in a similar study found Heart rate systolic blood pressure, diastolic blood pressure, and mean arterial pressure were recorded and he did not find any difference between the groups based on the hemodynamic parameters. Roberton et al., [15] found the dose of rocuronium 0.3 mg/Kg produced some cardiovascular effects which included a 10 – 15% increase in mean arterial pressure and 5 – 10 increases in heart rates. They concluded that these effects are not likely to be clinically significant.

Conclusion

Rocuronium bromide 1.2 mg kg body weight produces good to excellent intubating conditions in all the patients at 60 seconds with a mean onset time of 76.09 ± 9.15 seconds. Succinylcholine chloride 1.5 mg kg body weight produces good to excellent intubating conditions in all the patients at 60 seconds with a mean onset time of 56.13±3.76 seconds. Rocuronium bromide is a safe alternative to succinylcholine chloride for rapid sequence induction in adult patients in situations where succinylcholine is contraindicated and in whom there is no anticipated difficult airway.

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