



Original Research Article

Comparative Evaluation of Intubating Condition and Haemodynamic Effects of Succinylcholine and Different Doses of Rocuronium

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Abstract: Background: Rapid and safe endotracheal intubation is a cornerstone of general anaesthesia. Succinylcholine is traditionally used for rapid sequence induction because of its fast onset and short duration of action. Rocuronium, a non-depolarizing neuromuscular blocking agent, has emerged as an alternative in cases where succinylcholine is contraindicated. This study aimed to compare the intubating conditions, onset time, duration of action, and hemodynamic responses of succinylcholine and two different doses of rocuronium. **Methods:** A prospective, randomized study was conducted on 90 adult patients (ASA I-II) scheduled for elective surgery. Patients were allocated into three groups (n = 30 each): Group 1 received succinylcholine 1.0 mg/kg, Group 2 received rocuronium 0.6 mg/kg, and Group 3 received rocuronium 0.9 mg/kg. Intubating conditions were assessed using Cooper's four-point scale. Hemodynamic parameters including pulse rate, systolic and diastolic blood pressure were recorded at baseline, induction, intubation, and subsequent intervals. **Results:** Excellent intubating conditions were achieved in 100% of patients in Group 1 and 96.7% in Group 3, compared to 56.7% in Group 2 (p < 0.05). Mean onset time was shortest with succinylcholine (61.20 ± 5.73 sec) and rocuronium 0.9 mg/kg (62.70 ± 3.87 sec), and significantly longer with rocuronium 0.6 mg/kg (82.57 ± 7.46 sec) (p < 0.001). Hemodynamic responses showed a transient increase in pulse and blood pressure across all groups, with the greatest changes observed in Group 2. Duration of action was significantly shorter in the succinylcholine group (6.67 ± 0.58 min) compared to rocuronium groups (26.11 ± 2.98 and 45.45 ± 4.10 min, p < 0.001). **Conclusion:** Rocuronium at 0.9 mg/kg provides intubating conditions and onset time comparable to succinylcholine, with stable hemodynamics, making it a safe and effective alternative for rapid sequence induction when succinylcholine is contraindicated.

Keywords: Endotracheal intubation, Succinylcholine, Rocuronium, Hemodynamic effects, Rapid sequence induction, intubating conditions.

INTRODUCTION

Endotracheal intubation is an 'integral part of the anesthesiologists' contribution to the patient's care. The technique of endotracheal intubation has now

advanced to a great extent and has got a key role in clinical practice. Rapid and safe endotracheal intubation is of paramount importance in the practice of general anaesthesia [1]. The ease with which

endotracheal intubation is performed depends upon the degree of muscle relaxation, depth of anaesthesia and skill of anesthesiologist [2]. Succinylcholine chloride within the dose of 1 mg/kg provides excellent intubating conditions in 60–90 s with a short duration of action on the diaphragm and adductor muscles of the larynx involved in respiration and airway protection [3-4]. Rocuronium is a newer non depolarizing muscle relaxant that is used for rapid sequence induction (RSI) when succinylcholine is contraindicated. Rocuronium has an onset of action comparable to succinylcholine when used in doses > 0.9 mg/kg. It has the shortest onset time of all the non depolarizing neuromuscular blocking agents currently available [5-6]. Now-a-days, neuromuscular blocking agents are firmly entrenched as an integral part of everyday anaesthesia practice. The time interval between suppression of the protective reflexes by induction of anaesthesia and the development of satisfactory intubating conditions is a critical period [7]. Among the non depolarizing muscle relaxants vecuronium and atracurium were presented as attractive alternative to succinylcholine. However, neither of these agents had the onset time as short as needed for endotracheal intubation. The various methods like using higher bolus dose, priming principle, timing principle were used to reduce their onset time, but at the cost of a prolonged duration of action or hazardous side effects [8]. Therefore quest for an ideal non depolarizing agent continued for rapid and safe endotracheal intubation until rocuronium was introduced into clinical practice.

Aims and objectives: The purpose of present study was to compare onset time, clinical duration and intubating conditions of rocuronium and succinylcholine and to evaluate the side effects of these agents.

MATERIALS AND METHODS

This prospective, comparative study was conducted in the Department of Anaesthesiology, Govt. medical college, Kota.

Inclusion criteria:

- Patients aged 18 to 65 years, with both gender
- ASA grade I & II posted for a variety of elective surgery
- Patients who provided written informed consent for the study

Exclusion criteria:

- Patients with Age more than 65 year
- Patients assessed as difficult airway, cervical spine abnormalities and with neuromuscular disorder

- Patients who not provided consent for the study

A total of 90 patients were randomly divided into 3 groups (30 each)

- Group 1: received succinylcholine 1.0 mg/kg body wt.
- Group 2: received Rocuronium 0.6 mg/kg body wt.
- Group 3: received Rocuronium 0.9 mg/kg body wt.

Data collections: All patients were thoroughly examined. Pre-anaesthetic assessment was based on the history, physical examination and other laboratory investigations. Patients enrolled had either mallampatti grade 1 or 2 & none were taking drugs known to interfere with neuromuscular transmission.

Preoperative assessment: A thorough preoperative assessment was done. General and systemic examination based on Weight, Pulse rate, blood pressure, and respiratory rate was done. Informed consent was taken after full explanation.

Ethical concern: The study was approved from hospital's ethical committee's

Anaesthetic management: On arrival to the operating room, the patients were reexamined to confirm the finding of pre-anaesthetic checkup and enquired about the fasting status. An IV line inserted. Standard monitoring was applied using multiparameter monitor for noninvasive blood pressure, pulse oximetry, ECG, heart rate, Etco₂. The peripheral nerve stimulator was applied over ulnar nerve.

Neuromuscular monitoring was commenced immediately after induction and a calculated dose of muscle relaxant was given, IV as a single bolus dose (as per group). The neuromuscular block was maintained by applying train of four responses after every 5 min. and injection vecuronium bromide 0.02-0.03 mg/kg was supplemented at 25% recovery of control. Patients were extubated after complete recovery from neuromuscular blockade. 100% O₂ was administered for 3-5 min. after than through mask & then the patients were shifted to recovery room.

Monitoring of vital parameters i.e., pulse, Systolic BP, Diastolic BP, and SPO₂ was done throughout the procedure and recorded at following points in O.T.: basal, pre induction, post induction, during laryngoscopy and intubation. After intubation vital parameter was recorded at 1, 3, 5, 10, 15, 30 min. and

45 min. after laryngoscopy and then postoperatively. All the result were complied, compared and analysed statistically.

Assessment of intubating conditions: By four point scale of Cooper et al

Four point scale of Cooper et al			
Score	Jaw relaxation	Vocal cords	Response to intubation
0	Poor (impossible)	Closed	Severe coughing/bucking

1	Minimal (difficult)	Closing	Mild coughing
2	Moderate (fair)	Moving	Slight diaphragmatic movement
3	Good (easy)	Open	None
Total score	Excellent (8-9), Good (6-7), Fair (3-5), Poor (0-2)		

RESULTS

This table demonstrates that excellent intubating conditions were achieved in 100% (30) patients in group 1 and 96.7% (29) patients in group 3 whereas in group 2 only 56.7% (17) patients achieved excellent intubating conditions. The difference between group 2 & 3 and group 1 & 2 was statistically significant ($p < 0.05$)

Table-1: intubating conditions of the study patients

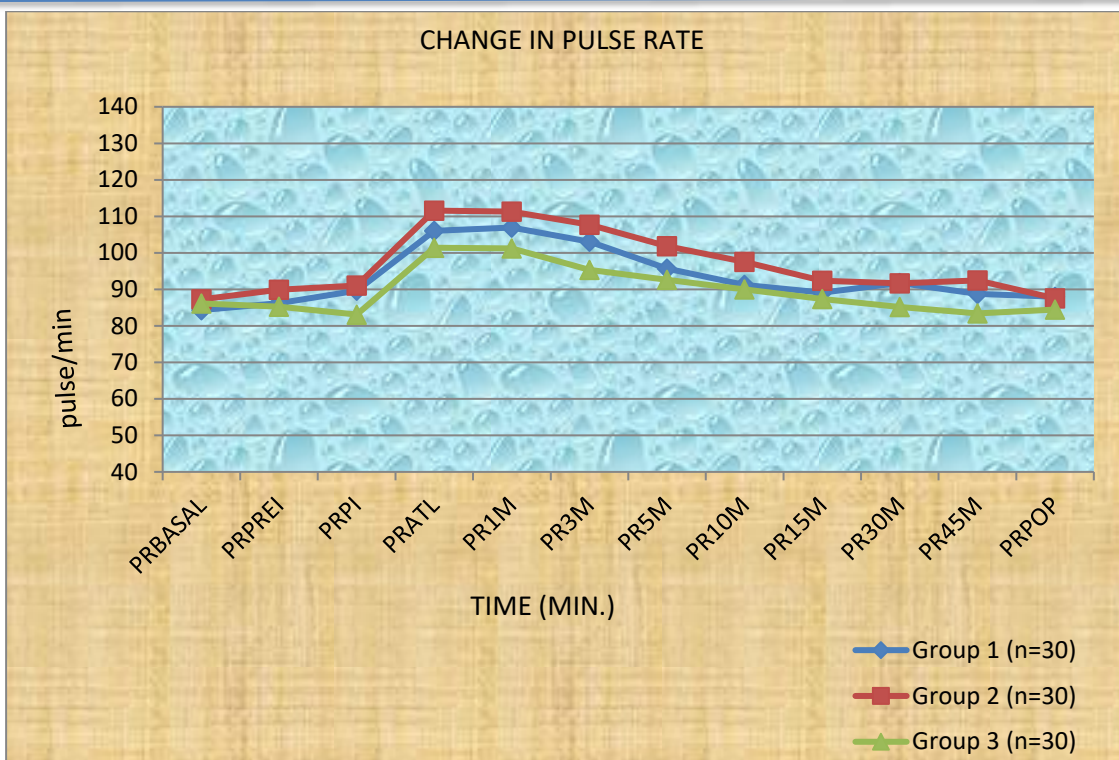
Intubating conditions	Group 1 (n=30)	Group 2 (n=30)	Group 3 (n=30)
Excellent	30 (100.0%)	17 (56.7%)	29 (96.7%)
Good	0 (0.0%)	11 (36.7%)	1 (3.3%)
Fair	0 (0.0%)	2 (6.7%)	0 (0.0%)
Poor	0 (0.0%)	0 (0.0%)	0 (0.0%)

This table shows that there was a statistically significant delay in onset time in group 2 (82.57 ± 7.64 sec) as compared to group 1 (61.20 ± 5.73 sec) ($p < 0.001$) and group 3 (62.70 ± 3.87) ($p < 0.001$) whereas the onset time was comparable between group 1 & group 3. ($p > 0.05$).

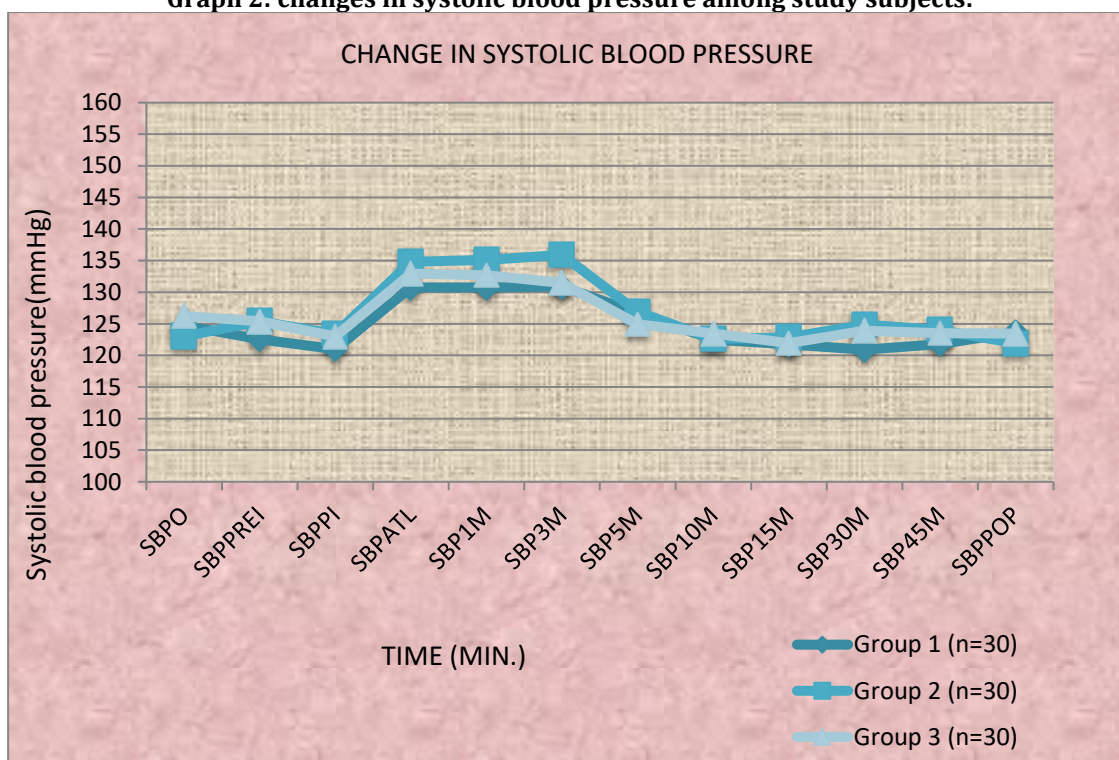
Table 2: Characteristics and Intubating conditions of Different groups

Characteristics	Group 1	Group 2	Group 3	p value
Age (years) Mean $\pm$ SD	38.40 $\pm$ 11.156	41.47 $\pm$ 13.261	38.20 $\pm$ 14.406	0.984
Weight (Kgs) Mean $\pm$ SD	54.23 $\pm$ 7.994	51.13 $\pm$ 7.938	54.07 $\pm$ 8.263	0.934
Sex [n (%)]				
Male	11 (36.7%)	18 (60.0%)	13 (43.3%)	0.563
Female	19 (63.3%)	12 (40.0%)	17 (56.7%)	
Intubating conditions (n)				
Excellent	30 (100.0%)	17 (56.7%)	29 (96.7%)	Group 2 & 3 and group 1 & 2: < 0.05 ; group 1 and group 3: $p > 0.05$
Good	0 (0.0%)	11 (36.7%)	1 (3.3%)	
Fair	0 (0.0%)	2 (6.7%)	0 (0.0%)	
Poor	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Onset time (sec.) Mean $\pm$ SD	61.20 $\pm$ 5.738	82.57 $\pm$ 7.468	62.70 $\pm$ 3.879	Group 2 & 3 and 1 & 2: $p < 0.05$; Group 1 & 3: $p > 0.05$
Duration (min.) Mean $\pm$ SD	6.67 $\pm$ 0.579	26.11 $\pm$ 2.989	45.45 $\pm$ 4.106	< 0.001

Graph 1: changes in pulse rates among study subjects:



Graph 2: changes in systolic blood pressure among study subjects:



Graph 3: changes in diastolic blood pressure among study subjects:

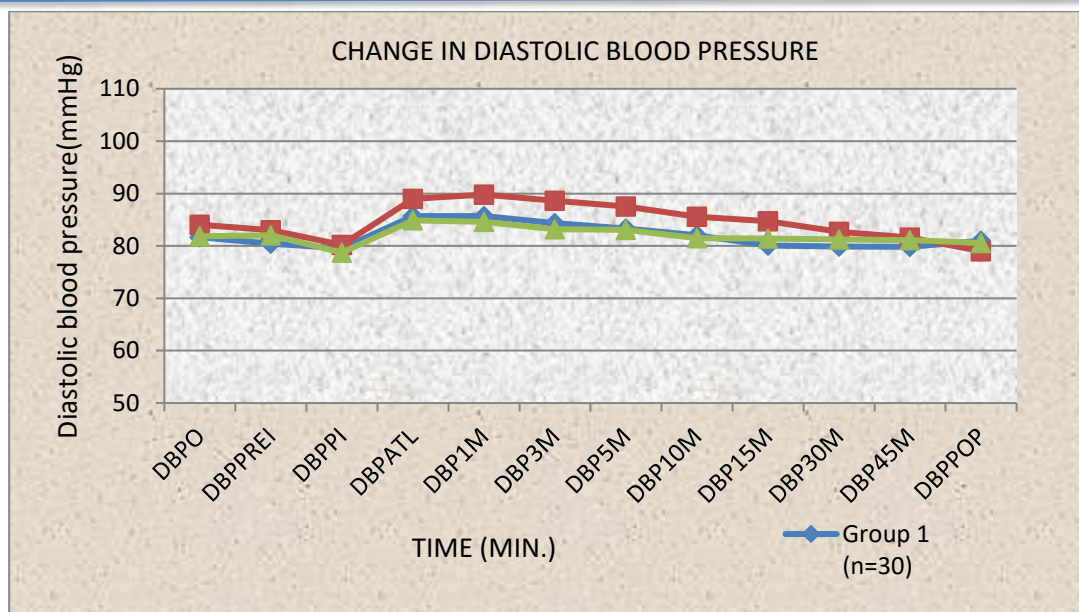
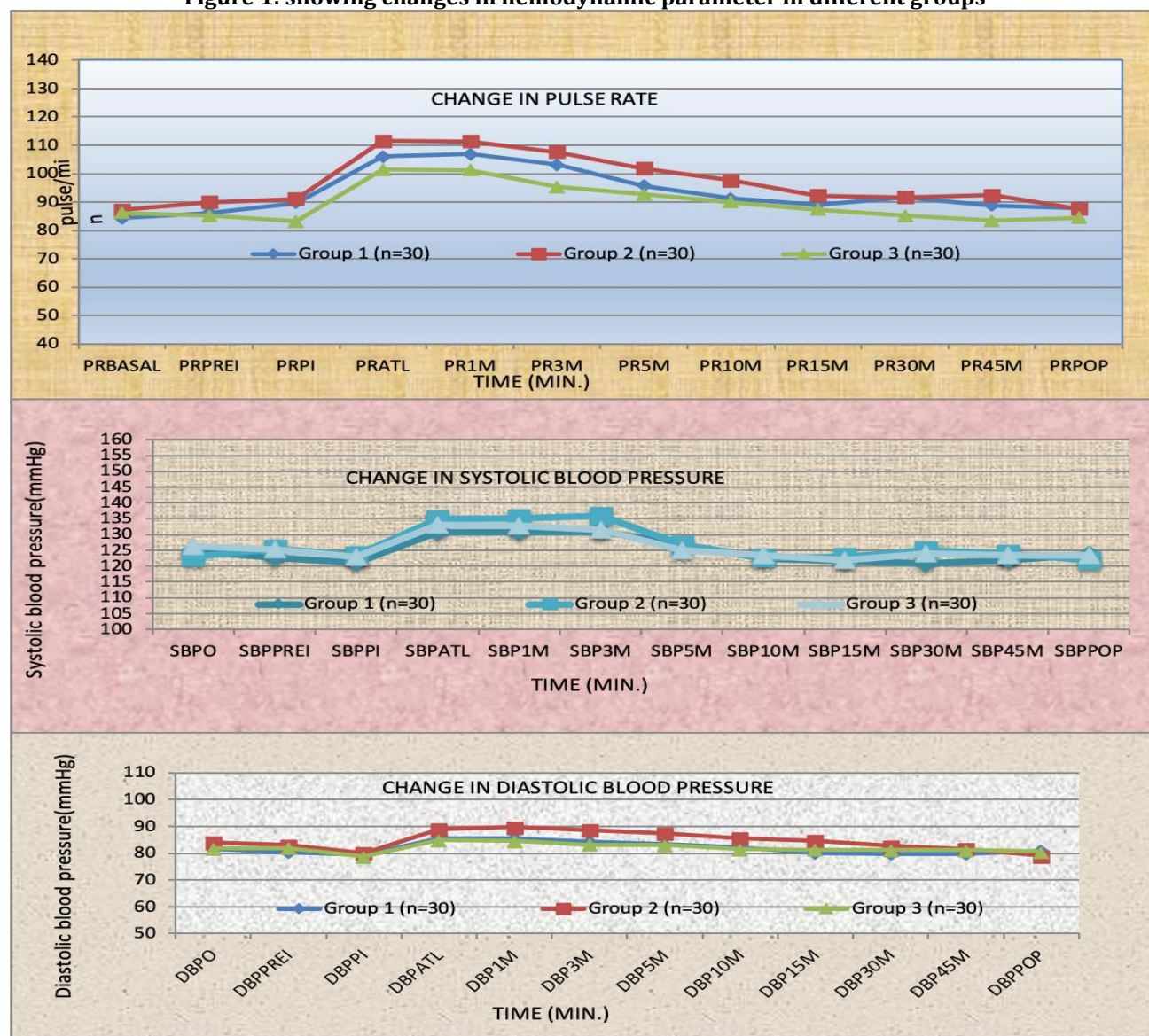


Figure 1: showing changes in hemodynamic parameter in different groups



DISCUSSION

The ideal neuromuscular blocking drug should be competitive and non depolarizing in nature, having rapid onset of action with relatively short duration of action, cessation of neuromuscular blockade should not depend on renal and hepatic functions, should also be highly specific so that no harmful side effects would occur on other systems and last but not least, the neuromuscular blockade should be antagonized by acetylcholine esterase inhibitors. Rocuronium bromide is a mono quaternary aminosteroidal non depolarizing neuromuscular blocking agent. It may provide an alternative to succinyl choline for intubation and especially for rapid sequence induction.

In the present study, Group 1 and 3 demonstrated excellent intubating conditions with the shortest onset time, whereas, Group 2 showed a longer onset with less excellent intubating conditions ($P < 0.05$). These findings highlight a more rapid onset and better intubating profile with agents used in Groups 1 and 3. Similar findings reported by previous studies done by Baidya et al [9], Singh A, et al [10] and Ramkumar V, et al [11] have shown that depolarizing neuromuscular blocking agents like succinylcholine provide rapid onset and excellent intubation conditions, while non-depolarizing agents such as vecuronium or Rocuronium have slower onset but may still offer favorable intubating conditions with appropriate dosing and priming techniques.

In our study as depicted in Graph 1, a transient rise in pulse rate was observed after intubation in all groups. The peak was most prominent in Group 2, followed by Group 1 and Group 3, with values returning toward baseline within 10–15 minutes. This increase is likely due to sympathetic stimulation during laryngoscopy and intubation. The attenuated response in Group 3 suggests a more stable hemodynamic profile.

These results are consistent with previous literature Martyn R, et al [12], Prakash et al [13] and Misra MN, et al [14], reporting that depolarizing agents can cause moderate increases in heart rate, while some non-depolarizing agents, particularly those with vagolytic properties, may result in more pronounced tachycardia.

We have observed that marked increase in systolic blood pressure in Group 2 immediately following intubation, whereas Groups 1 and 3 maintained relatively stable values. Peak systolic values in Group 2 were approximately 135–140 mm Hg, compared to 125–130 mm Hg in Groups 1 and 3. This indicates a stronger pressure response in Group 2, likely reflecting either a slower onset of neuromuscular blockade or greater sympathetic stimulation.

Previous studies performed by Lovina Neil, et al [15], R Verma, et al [16] and Shareef SM, et al [17], have

reported similar findings, with laryngoscopy and intubation producing significant hemodynamic changes, especially when intubating conditions are suboptimal or delayed.

In the current research as shown in Graph 3, diastolic blood pressure followed a similar trend, with the highest peak observed in Group 2. The response was milder and shorter in Groups 1 and 3. Hemodynamic stability is particularly desirable in patients with cardiovascular comorbidities, making Groups 1 and 3 preferable for such cases, these results indicating that rapid onset and smooth intubation are associated with less sympathetic stimulation and lower hemodynamic fluctuations, these findings align with the Kant et al [18], Kumar A, et al [19], Shakeel H, et al [20] and Jain K, et al [21].

CONCLUSION

We have concluded that the significant changes in the heart rate and mean arterial pressure with the use of Rocuronium following one minute after the intubation which became preinduction value. There was rise in heart rate and mean arterial pressure with the use of succinylcholine following the intubation. There is no significant change in hemodynamic variables after the administration of Succinylcholine and Rocuronium. Rocuronium is a better non-depolarizing muscle relaxant for endotracheal intubation where the use of International Journal of Medical Anesthesiology. 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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