A COMPARATIVE STUDY TO EVALUATE THE EFFICACY OF ROCURONIUM AND VECURONIUM FOR RAPID SEQUENCE INTUBATION IN ADULTS

Manisha Bhatt Dwivedi¹, Sachreet Kaur², Ritika Jindal³, Sankalp Dwivedi⁴

HOW TO CITE THIS ARTICLE:

ABSTRACT: AIMS AND OBJECTIVES: To determine the efficacy of Rocuronium and Vecuronium – the two newer non depolarizing neuromuscular blocking agents for rapid sequence intubation in adults undergoing surgical operations. MATERIAL AND METHOD: The present study was conducted on 60 healthy adult patients of ASA grade I and II, of either sex, requiring intubation for various surgical operations. Patients were randomly divided into 2 groups of 30 each: GROUP I (n=30) received i.v 1.2mg/kg body wt. of Rocuronium. GROUP II (n= 30) received i.v 0.15mg/kg body wt of Vecuronium. Intubation done at 60 seconds in both the groups. RESULTS: Excellent intubating conditions were achieved in almost 66% of patients whereas 33% had good intubating conditions in group I. On the other hand only 10% of patients showed excellent intubating conditions whereas majority (56%) showed good intubating conditions in group II. Both the groups showed significant increase in heart rate 1 min after intubation. In rocuronium group this increase in heart rate was significant at 3 min as well. CONCLUSION: Intubating conditions for rapid sequence intubation are significantly better with rocuronium group. Rocuronium may be considered a suitable alternative for succinylcholine especially in patients who are at risk of adverse effects of succinylcholine. Rocuronium and Vecuronium are haemodynamically stable drugs with no significant adverse effects. KEYWORDS: Rocuronium, Vecuronium, Succinylcholine, Rapid sequence intubation, Hemodynamic parameter.

INTRODUCTION: Rapid endotracheal intubation is a lifesaving procedure of securing the airway in critically ill and injured patients as it results in rapid unconsciousness and paralysis in patients who are not fasting and are at risk of vomiting and aspiration.¹ Rapid sequence intubation (RSI) minimizes the time between the loss of consciousness and tracheal intubation. Preoxygenation is a standard component of RSI² Preoxygenation on high fresh gas flows of 100% oxygen via face mask with a good mask fit for 3 to 5 minutes is recommended. Alternatively, a series of 4 vital capacity breaths of 100% oxygen may be used in an emergency.³,⁴ The present study was undertaken to study the efficacy of Rocuronium, a newer non-depolarizing muscle relaxant in the dose of 1.2mg/kg and compare it with Vecuronium, 0.15mg/kg for rapid sequence intubation in adults.

METHODS: After approval by the hospital ethical committee and obtaining written informed consent, the present study was conducted on 60 healthy adult patients of ASA grade I and II, of either sex, requiring intubation for various surgical operations. Patients were randomly divided into 2 groups of 30 each: GROUP I (n=30) received i.v 1.2mg/kg body wt. of Rocuronium and intubation done at 60 seconds. GROUP II (n= 30) received i.v 0.15mg/kg body wt. of Vecuronium and intubation done at 60 seconds. A thorough pre-anesthetic evaluation was done a day before surgery and all the necessary
routine investigations were carried out. A written informed consent was taken from every patient.

All the patients were pre-medicated half an hour prior to surgery with intravenous: Inj Midazolam 1mg, Inj. Ondensetron 4mg, Inj. Glycopyrollate 0.2mg and Inj. Tramadol 60mg.

In the operation theatre Heart Rate, Blood pressure (Systolic, Diastolic and Mean), SpO\textsubscript{2} and ETco\textsubscript{2} were monitored using a multimodality monitor. Patients were pre-oxygenated with 100% oxygen for 3 minutes and then induced with Inj. Propofol (1%) 2mg/kg followed immediately either by i. v Inj. Rocuronium 1.2mg/kg (Group I) or Inj. Vecuronium 0.15mg/kg (Group II). Laryngoscopy was attempted at 60 seconds after giving muscle relaxant.

The intubating condition were graded using score adopted by Cooper et al scoring system

<table>
<thead>
<tr>
<th>Intubation Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-9</td>
<td>excellent.</td>
</tr>
<tr>
<td>6-7</td>
<td>good.</td>
</tr>
<tr>
<td>3-5</td>
<td>fair.</td>
</tr>
<tr>
<td>0-2</td>
<td>poor.</td>
</tr>
</tbody>
</table>

Following the tracheal intubation; endotracheal tube was fixed and connected to breathing circuit. Haemodynamic changes (HR, BP, SpO\textsubscript{2}, arrhythmia) after intubation at 1min, 3min and at 5min were noted. Anaesthesia was maintained by Nitrous oxide: Oxygen (2:1), halothane (0.2-0.8%) and Rocuronium (0.6mg/kg) or Vecuronium (0.1mg/kg) as per requirement. At the end of surgical procedures, all patients were reversed with Inj. Neostigmine 0.05mg/kg and Glycopyrrrolate 0.01mg/kg administered intravenously.

The parameters were recorded and statistically analysed. P-values<0.05 were considered as statistically significant.

**RESULTS:** In our study, patients in both groups were comparable in respect to demographic data such as age, sex, body weight. [Table 1]

![Table 1: Demographic Characteristics of the Patients in Two Groups](image)

In group I, when the mean baseline heart rate was compared with subsequent readings at 1, 3 and 5min it was found that readings were significantly higher (P<0.05) at 1 and 3min. In group II, readings were significantly higher at 1min. [Table 2]

![Table 2: Heart Rate at different Time Interval](image)
In group I, when the mean baseline arterial pressure was compared with subsequent readings at 1, 3 and 5 min it was found that readings were significantly higher (P<0.05) at 1. In group II, readings were significantly higher at 1 and 3 min. [Table 3]

<table>
<thead>
<tr>
<th>MAP</th>
<th>Group I (mean)</th>
<th>P value</th>
<th>Group II (mean)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal</td>
<td>88.1±10</td>
<td>-</td>
<td>90.6±8.31</td>
<td>-</td>
</tr>
<tr>
<td>Pre induction</td>
<td>90.8±12</td>
<td>-</td>
<td>91.9±6.57</td>
<td>-</td>
</tr>
<tr>
<td>Post intubation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 min (mmHg)</td>
<td>109.63±14.80</td>
<td>&lt;0.01, S</td>
<td>113.87±11.75</td>
<td>&gt;0.1, NS</td>
</tr>
<tr>
<td>3 min (mmHg)</td>
<td>93.87±14.77</td>
<td>&gt;0.1, NS</td>
<td>104.3±9.35</td>
<td>&lt;0.001, S</td>
</tr>
<tr>
<td>5 min (mmHg)</td>
<td>86.67±10.86</td>
<td>&gt;0.1, NS</td>
<td>92.03±8.25</td>
<td>&gt;0.1, NS</td>
</tr>
</tbody>
</table>

**TABLE 3: Mean Arterial Pressure at Different Time Interval**

Mean arterial pressure:

When the overall intubating conditions were compared intubating conditions were significantly better with rocuronium group (P<0.05). [Table 4]
**DISCUSSION:** The ideal neuro-muscular blocking agent for RSI should have a fast onset, brief duration of action, provide profound relaxation & be free from hemodynamic changes. Succinylcholine is usually the relaxant of choice because of its rapid onset of action. However, succinylcholine may produce muscle fasciculations, myalgia, hyperkalemia and increases in intragastric, intraocular and intracranial pressures. Succinylcholine should be avoided in patients with burns, renal failure, and in patients with a history of malignant hyperthermia or pseudocholinesterase deficiency. Considering these adverse effects and the contraindications, succinylcholine cannot be taken as an ideal agent of choice for rapid sequence intubation.

So the search for ideal muscle relaxant for intubation continued and drugs like vecuronium, atracurium and rocuronium were introduced. These drugs did not have side effects of succinylcholine. Newer non-depolarizing agents like rocuronium and vecuronium have given promising results in RSI. The non-depolarizing intermediate acting muscle relaxant, vecuronium, is essentially free of cardiovascular side effects.

Vecuronium, a nondepolarizing muscle relaxant with an intermediate duration of action and minimal hemodynamic side effects, has been reported to be a suitable alternative to succinylcholine for producing muscle relaxation during rapid-sequence induction in nonpregnant patients.

---

### Table 4: Intubating Conditions at 60 Seconds

<table>
<thead>
<tr>
<th>Intubating conditions</th>
<th>Group 1</th>
<th></th>
<th>Group 2</th>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of patients</td>
<td>% age</td>
<td>No. of Patients</td>
<td>% age</td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>20</td>
<td>66</td>
<td>3</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>10</td>
<td>33</td>
<td>17</td>
<td>56</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Fair</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>33</td>
<td></td>
</tr>
</tbody>
</table>

---

DISCUSSION: The ideal neuro-muscular blocking agent for RSI should have a fast onset, brief duration of action, provide profound relaxation & be free from hemodynamic changes. Succinylcholine is usually the relaxant of choice because of its rapid onset of action. However, succinylcholine may produce muscle fasciculations, myalgia, hyperkalemia and increases in intragastric, intraocular and intracranial pressures. Succinylcholine should be avoided in patients with burns, renal failure, and in patients with a history of malignant hyperthermia or pseudocholinesterase deficiency. Considering these adverse effects and the contraindications, succinylcholine cannot be taken as an ideal agent of choice for rapid sequence intubation.

So the search for ideal muscle relaxant for intubation continued and drugs like vecuronium, atracurium and rocuronium were introduced. These drugs did not have side effects of succinylcholine. Newer non-depolarizing agents like rocuronium and vecuronium have given promising results in RSI. The non-depolarizing intermediate acting muscle relaxant, vecuronium, is essentially free of cardiovascular side effects.

Vecuronium, a nondepolarizing muscle relaxant with an intermediate duration of action and minimal hemodynamic side effects, has been reported to be a suitable alternative to succinylcholine for producing muscle relaxation during rapid-sequence induction in nonpregnant patients.
Rocuronium Bromide, an aminosteroidal, non-depolarizing muscle relaxant was introduced in 1994. It is devoid of any adverse effects of succinylcholine. It has rapid onset of action, as well as intermediate duration of neuromuscular blocking effect. It may provide an alternative to succinylcholine for induction of anaesthesia. The decrease in onset time and prolonged duration of action with rocuronium is dose dependant.

Vercuronium may be superior to other non-depolarizing muscle relaxants for rapid-sequence induction because of its relatively short onset and duration of action and its lack of cardiovascular side effects even at doses up to 12 times the ED90.

In this study we compared rapid sequence intubation with rocuronium and vecuronium. Our study is consistent with several studies like. Booth MG et al, Robertson EN et al, Neilson K et al, Misra M. N. et al, Yorukoglu D et al, and Schramm WM et al.

Booth MG et al, found increased heart rate by 36% in the Rocuronium group during the first minute following injection of Rocuronium, but remained stable in those patients who received Vecuronium. Robertson EN et al, observed that rocuronium caused a 10-15% rise in mean arterial pressure and 5-10% rise in heart rate whereas Vecuronium had no significant cardiovascular effects. Misra M. et al found that the changes in mean arterial blood pressure with rocuronium and vecuronium group were not statistically significant and there is slight increase in mean blood pressure in both the groups immediately after intubation. This could be attributed to the stress of intubation. There was no significant change in pulse rate in vecuronium group but rocuronium group shows a significant change in pulse rate. Yorukoglu D et al, observed that with rocuronium mean arterial blood pressure decreased after induction of anesthesia (P<0.01) compared with baseline and increased significantly after tracheal intubation compared with the levels after induction of anesthesia (P<0.01). Schramm WM et al, concluded in their study that patients in the Rocuronium group showed significant increase in heart rate that might be due to a vagal blocking effect.

Intubating conditions were assessed with Cooper et al scoring. An Intubation Score of 8-9 was considered excellent, 6-7 good, 3-5 poor and 0-2 bad. When compared, the jaw relaxation and the overall intubating conditions were found to be significantly better with rocuronium group (P<0.05). Misra MN, et al also found similar results in their study. According to which in rocuronium group, 90% of cases had acceptable intubating conditions at 60 seconds, out of which 70% were excellent. Weirda et al, found that intubating conditions were good to excellent (88%) one minute after administration of rocuronium. Zhou et al, showed that most of the patients had good to excellent intubating condition at 60 seconds after intubation with rocuronium. These results were consistent with our study.

Mayer et al, stated that satisfactory intubating conditions were found with vecuronium at 60 seconds and none of them were excellent.

CONCLUSION: On the basis of data analyzed from the present study we concluded that rocuronium and vecuronium both are haemodynamically stable drugs and the intubating conditions for rapid sequence intubation are significantly better with rocuronium. So, rocuronium is a suitable alternative for succinylcholine especially in patients who are at risk of adverse effects of succinylcholine.
REFERENCES:


AUTHORS:
1. Manisha Bhatt Dwivedi
2. Sachreet Kaur
3. Ritika Jindal
4. Sankalp Dwivedi

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Anaesthesiology, MM Institute of Medical Sciences and Research, Mullana, Ambala.
2. Post Graduate Student, Department of Anaesthesiology, MM Institute of Medical Sciences and Research, Mullana, Ambala.
3. Post Graduate Student, Department of Anaesthesiology, MM Institute of Medical Sciences and Research, Mullana, Ambala.

FINANCIAL OR OTHER COMPETING INTERESTS: None

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:
Manisha Bhatt Dwivedi,
F-13 Residential Complex,
M. M. I. M. S. R, Mullana,
Ambala, Haryana.
E-mail: manishabhattdwivedi@gmail.com

Date of Submission: 15/05/2015.
Date of Peer Review: 16/05/2015.
Date of Acceptance: 27/05/2015.
Date of Publishing: 02/06/2015.