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"TO COMPARE THE ONSET TIME OF ACTION BETWEEN VECURONIUM AND ROCURONIUM"

Anaesthesiology

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ABSTRACT

Introduction The use of neuromuscular blocking agents remains an essential part of general anaesthesia. The muscle relaxation, they produce enables interventions both by anaesthetists and the surgeons. They aid endotracheal intubations, mechanical ventilation, decrease anaesthetic requirement, prevent patient's movement, facilitate surgery, and decrease oxygen consumption. Vecuronium bromide and Atracurium besylate are attractive choices. However neither of these agents have been demonstrated to have significantly shorter onset time as needed for rapid tracheal intubation. Rocuronium is a widely used and representative neuromuscular blocking agent, due to possessing a relatively fast onset of peak effects and short duration of muscle relaxation. Clinical studies with these new compounds showed that rocuronium produced a neuromuscular block similar to that of vecuronium, differing only in having a faster onset time. **Materials And Methods** In this prospective, randomized, comperative study total 54 patient taken.The patients will be randomly divided into two groups with 27 patients allocated in each group: Group – R received Rocuronium 0.6 mg/kg Group – V received Vecuronium 0.1 mg/kg .Train-of-Four (TOF) monitor was attached to the patient to determine the onset time and duration of action of neuromuscular blocking drug given. For stimulation of ulnar nerve.

Result Following results were drawn from the study :

1. The demographic data was comparable between both the groups in respect of age, gender, weight ($p > 0.05$).
2. Statistical analysis showed that the mean onset time of Group-R(rocuronium 0.6 mg/kg) was significantly shorter than Group-V (vecuronium 0.1 mg/kg) (2.19 ± 0.24 vs 3.59 ± 0.33 min) ($p<0.05$). (Table 1)

Conclusion when compared to both Vecuronium and Rocuronium, Rocuronium resulted in faster development of clinically acceptable and higher quality intubating conditions. We conclude that Rocuronium is better choice for intubation in perioperative and critical care settings than Vecuronium.

KEYWORDS

Vecuronium, Rocuronium, Train-of-Four (TOF) monitor

INTRODUCTION

The use of neuromuscular blocking agents remains an essential part of general anaesthesia. The muscle relaxation, they produce enables interventions both by anaesthetists and the surgeons. They aid endotracheal intubations, mechanical ventilation, decrease anaesthetic requirement, prevent patient's movement, facilitate surgery, and decrease oxygen consumption Role of muscle relaxation is used to serve two prime purposes[2], to facilitate endotracheal intubation and the other, to provide surgical relaxation[3].The ease in performing endotracheal intubation, depends upon degree of muscle relaxation, depth of anaesthesia and skill of anaesthesiologist Adequate control of the duration and quality of neuromuscular blockade during surgery is essential for safe and successful surgery. Incomplete recovery of neuromuscular blockade can endanger patients, decrease the sensitivity to hypoxia, augment the risk of lung complications, cause aspiration, upper airway obstruction, visual trouble, and dysphagia[6,7]. Thus, the proper use of neuromuscular blockers is important[8].

Vecuronium bromide and Atracurium besylate are attractive choices. However neither of these agents have been demonstrated to have significantly shorter onset time as needed for rapid tracheal intubation. The work carried out by various workers[4] have confirmed the long held belief, that a rapid onset of action can be produced by the compounds of relatively low potency. This concept was in part the basis for the development of rocuronium.

Rocuronium is a widely used and representative neuromuscular blocking agent, due to possessing a relatively fast onset of peak effects and short duration of muscle relaxation[5]. Rocuronium is a steroid-based, intermediate acting relatively low-potency neuromuscular blocker, primarily eliminated via the liver. Its main advantage is the rapid onset of neuromuscular block.

Clinical studies with these new compounds showed that rocuronium produced a neuromuscular block similar to that of vecuronium, differing only in having a faster onset time[12,1].

We designed this study to compare the onset time of action, intubating conditions and ease of laryngoscopy following vecuronium and rocuronium.

Neuromuscular monitoring has four patterns of electrical stimulation which are Single Twitch, Tetany, Double-burst stimulation and Train-of-Four, out of which we will compare our drugs here using Train-of-Four.

Study Setting :

The present study titled as **"To compare the onset time of action, intubating conditions and ease of laryngoscopy following Vecuronium and Rocuronium"** was carried out in Moti Lal Nehru Medical College and associated hospitals (Swaroop Rani Nehru Hospital), Prayagraj over a period of one year after approval from Institutional Ethical Committee. Written and informed consent was obtained from all the patients/ guardian. A comparative, randomized, prospective study was carried out on 54 patients undergoing surgery under general anaesthesia aged between 20-60 years of either sex of ASA Grade I-II.

Randomisation And Group Allocation : Patients fulfilling the inclusion criteria were randomly allocated and divided into two groups (27 patients in each group) using computer generated random number table.

GROUP – V(VECURONIUM)	27 Patients	Each patient received Vecuronium 0.1 mg/kg
GROUP – R(ROCURONIUM)	27 Patients	Each patient received Rocuronium 0.6 mg/kg

Inclusion Criteria :

1. Patients who gave informed and written consent.
2. Age between 20-60 years of either sex.
3. ASA grade I and II patients.
4. Mallampatti class I and II patients.
5. Patients scheduled for elective surgery under general anaesthesia.

Exclusion Criteria:

1. Patient refusal.
3. ASA physical status III or > III.
4. Mallampatti Grading III or > III.

5. Patient having BMI > 35 kg/mt2.
7. Patients with neuromuscular weakness and diseases affecting neuromuscular transmission (myopathies).
8. Patients having major cardiovascular, pulmonary diseases.

Methodology

Pre-anaesthetic Examination Included :

In pre-anaesthetic visit one day prior to surgery, a detailed pre-anaesthetic examination including history, general examination, and systemic examination was done and examination of spine for any deformity or infection was noted. Airway assessment was done. Informed and written consent was obtained from each patient after the procedures were fully explained to patients in their own language. Age, weight, height, side of surgery were noted in all patients. Baseline parameters like pulse rate, blood pressure, SpO_2, respiratory rate was recorded during pre anaesthetic checkup. Baseline investigations like hemoglobin, blood sugar, blood urea, serum creatinine, platelet count, bleeding time, clotting time, chest X ray, ECG, were advised. All patients were kept nil per orally 6 - 8 hours. Tab. Ranitidine 150 mg and tab. Alprazolam 0.25 mg were given orally night before the surgery

Train-of-Four (TOF) monitor was attached to the patient to determine the onset time and duration of action of neuromuscular blocking drug given. For stimulation of ulnar nerve, two ECG electrodes were placed on the volar aspect of the wrist of the patient, one proximal and one distal electrode. Proximal electrode is the positive electrode and distal electrode is the negative electrode. The ulnar nerve motor point is located 1.5 to 2.5 cm proximal to the pisiform bone on the thumb side of flexor carpi ulnaris tendon. The distal electrode was placed about 1 cm proximal to proximal flexion crease of the wrist. The proximal electrode was placed 2-6 cm proximal to the distal electrode. Electrical stimulation elicits thumb adduction. Placement of negative electrode distally elicits greatest neuromuscular response normally.

Following loss of consciousness, the ulnar nerve was stimulated using the neuromuscular monitor. The current strength was progressively increased, and single twitch noted, Current strength for maximal thumb adduction was noted and 25% above that strength which is supramaximal stimulus was used for train of four stimulation. Vitals parameters were recorded.

A bolus of i.v. Inj. Vecuronium(0.1 mg/kg) or i.v. Inj. Rocuronium Bromide (0.6 mg/kg) depending on the group was given over a period of 5 to 10 seconds.

Patient was ventilated with 66.7 % Nitrous oxide and 33.3% Oxygen, Train of four was elicited every 10 seconds and intubation was attempted after disappearance of all 4 responses (onset time- Interval from end of muscle relaxation injection and disappearance of all 4 responses).

Intubation was done with appropriate sized cuffed endotracheal tube under direct laryngoscopy. Position of the tube was confirmed with auscultation of bilateral equal air entry with bilateral equal chest expansion and capnography, then the tube was fixed with adhesive. The conditions of intubation were evaluated and scored according to the scoring system described by Cooper et al.[75]

After confirmation of position of tube, intermittent positive pressure ventilation (IPPV) was started. Anaesthesia was maintained with Oxygen and Nitrous Oxide mixture (33.3% : 66.7%) and inhalational anaesthetic agent Isoflurane at 0.8-1% MAC using closed circuit system with controlled ventilation. Ventilation parameters were tidal volume of 6-8 ml/kg, respiratory rate of 12-14/min, and peak inspiratory pressure of 30 cm H2O. End-tidal CO2 was maintained between 35-45 mm Hg. Blood pressure and pulse rate were noted at baseline, induction, intubation, and 5, 10,15,30,45,60 minutes after intubation.

Neuromuscular function monitored using TOF stimuli every 5 minutes, The interval between injection of bolus dose to reappearance of 2 responses to TOF was taken as the duration of action.

Reversal of neuromuscular blockade of vecuronium and rocuronium was done with i.v. Inj. Neostigmine (0.05 mg/kg) and i.v. Inj. Glycopyrrolate (0.01 mg/kg). Extubation was done when the TOF ratio is 0.9 and the patient became awake, with regular respiration and clinically adequate tidal volume, after thorough suctioning of oral cavity. The post-operative analgesia was provided with i.v. Inj. Diclofenac sodium (75 mg).

The following parameters were recorded :

1. The mean onset of neuromuscular blockade and duration of action were calculated for both the groups.

OBSERVATION AND RESULT

Table 1: Mean onset time (minute) of drugs used in both groups

ONSET TIME(MIN)	GROUP-V Mean ± SD	GROUP-R Mean ± SD	P-VALUE
	3.59 ± 0.33	2.19 ± 0.24	t=17.92 p<0.0001*

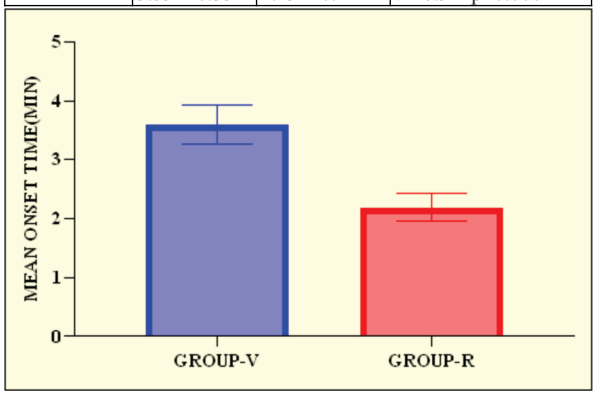

Figure 1: Graphical representation of mean onset time (minute) of drugs used in both groups

The mean onset time of Vecuronium used was 3.59 while Rocuronium was 2.19 which was found to be significant [p<0.0001]. **[Table 1,Figure 1]**

Following results were drawn from the study :

1. The demographic data was comparable between both the groups in respect of age, gender, weight (p >0.05).
2. Statistical analysis showed that the mean onset time of Group-R(rocuronium 0.6 mg/kg) was significantly shorter than Group-V (vecuronium 0.1 mg/kg) (2.19 ± 0.24 vs 3.59± 0.33 min) (p<0.05). (Table 1)

DISCUSSION

We observed that the time for onset of action in Group-V(Vecuronium 0.1mg/kg) was 3.59 minutes and Group-R(Rocuronium0.6mg/kg) was 2.19 minutes; Hence, Group-R was having shorter onset time as compared to Group-V and the result was statically significant(p<0.05). This is in concurrence with findings of the study done by **I. Smith and colleagues [9],** who had also reported the onset time similar to our study. They compared the onset of action and intubating conditions that occurred following the administration of Rocuronium 0.6 mg kg1 or vecuronium 0.1 mg kg1 in a simple observational study where the timing of tracheal intubation was determined solely by clinical judgement. In the rocuronium group, the mean time to laryngoscopy was 89 seconds (standard deviation of 20 seconds), and the time to complete intubation was 119 seconds (standard deviation of 28 seconds), whereas, in the vecuronium group, those times were 110 seconds (26 seconds) and 142 seconds (32 seconds), respectively (P<0.05 for each comparison).

M Priyanka Basavaraj Chougule et al.2019[10] conducted a comparative study of rocuronium and vecuronium for time of onset and durarion of acrion in 80 patients ,who were randomly assigned to group A and B, each consisting of 40 individuals. They concluded that the average onset time of Rocuronium (104.7+18.43 sec) was significantly shorter than that of Vecuronium (184.8+30.72 sec)

Wierda J.M.K.H et al (1995)[11] conducted a comparative study between Vecuronium, Rocuronium and Mivacurium in anaesthetised patients at a dose of 2x ED90 and studied the onset time of action of three drugs. They concluded that the average time of Rocuronium(172+71 sec) and Vecuronium (192+49 sec) was significantly shorter than that of Mivacurium(229+60 sec) with(p<0.05). This result is consistent with our study.

CONCLUSION

In our study when compared to both Vecuronium and Rocuronium, Rocuronium resulted in faster development of clinically acceptable and higher quality intubating conditions.We conclude that

Rocuronium is \ a better choice for intubation in perioperative and critical care settings than Vecuronium.

Limitations

However, our study also had certain limitations:

- The sample size of 54 for such a specifically important study was comparatively moderate. A larger sample size and multicentric analysis with high precision and accuracy may be recommended for a more reliable interpretation of results.
- One of the significant limitations of our study includes a prospective randomized study with a lack of case-control experimental analysis.
- To bypass the confounders and increase the reliability, the study needs to evade additional variables like more parameters and control groups also etc.
- Results were limited to a single tertiary care centre that may not be generalized for all settings. Hence, it cannot be incorporated into a larger population.

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