

COMPARATIVE EVALUATION OF ONSET TIME INTUBATING CONDITION JUDGED BY CLINICAL CRITERIA AND HAEMODYNAMIC RESPONSE AFTER THE INTUBATING DOSE OF ROCURONIUM AND VECURONIUM

***Namita Gupta¹, Mamta Sharma², Pusplata Gupta³ and Dhiraj Agarwal⁴**

¹Department of Anesthesia, M.G. Mahatma Gandhi Medical College, Sitapura, Jaipur 302022

²Department of Anesthesia, Govt Medical College, Kota

³Bhagwan Mahaveer Cancer Hospital, Jaipur

⁴Department of Surgery, M.G. Mahatma Gandhi Medical College Jaipur, Sitapura 302022

**Author for Correspondence*

ABSTRACT

Rapid and safe endotracheal intubation is of paramount importance in practice of general anesthesia. Rocuronium (R) bromide and vecuronium (V) are monoquaternary aminosteroid compounds. The aim of our study was to evaluate the onset time, conditions of intubation and duration of action of equipotent doses (ED₉₅) of R and V. The study was carried out in 60 adult American Society of Anesthesiologists physical status 1–2 patients of age 18–60 years. The patients were divided into two groups of 30 each and received either 0.6 mg/kg of R (Group R) or 0.1 mg/kg of V (Group V) to facilitate endotracheal intubation. Neuromuscular blockade was assessed at adductor pollicis muscles to evaluate onset time and duration of neuromuscular block, respectively. Overall intubating conditions were excellent in 100% of patients in Group R as compared to Group V. At equipotent doses, R provides clinically acceptable intubation conditions much earlier than V without significant variation in clinical duration of action.

Keywords: Rocuronium, Vecuronium, Train of Four

INTRODUCTION

The principal use of neuromuscular blocking drugs is to provide skeletal muscle relaxation to facilitate endotracheal intubation and to improve surgical working condition during general anesthesia (Hunter, 1995). The time interval between suppression of the protective reflexes by induction of anaesthesia and the development of satisfactory intubating condition is a critical period (Mishra *et al.*, 2005). It is desirable that this period should be as short as possible.

Suxamethonium due to its rapid onset of action is still the drug of choice for rapid endotracheal intubation (Singh *et al.*, 2004), but this drug has got many side effects. Vecuronium is monoquaternary aminosteroid non-depolarizing neuromuscular blocking drug with an ED₉₅ of 50 µg/kg that has an onset of action in 3–5 min (Miller *et al.*, 1984). Its intubating dose (2xED₉₅) is 0.08–0.1 mg/kg. Rocuronium is related to vecuronium but has greater lipophilicity, decreased potency and a faster onset, good to excellent tracheal intubating condition within 60–90 sec. of 2xED₉₅ dose of rocuronium 0.6 mg/kg (Smith *et al.*, 1998). The aim of this studies to compare intubating condition and hemodynamic effects after a bolus dose of Vecuronium and Rocuronium and also examined the correlation between the clinical assessment of the relaxation and TOF monitoring.

MATERIALS AND METHODS

After taking written informed consent and ethics committee approval, sixty (60) adult patient of aged (18–60 years) with ASA grade I–II and Mallampati I–II undergoing elective surgery requiring oral intubation were studied. Patient with neuromuscular disorders, those receiving drug which might interfere with neuromuscular function and those with anticipated difficult intubation were excluded. All patients were

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premedicated with Tab. valium (diazepam 0.2 mg/kg) night before surgery. All patients were randomly divided into two groups.

Group A – Received Rocuronium bromide 0.6 mg/kg (n=30)

Group B – Received Vecuronium bromide 0.1 mg/kg (n=30)

All patients underwent thorough preoperative evaluation and investigation.

Following placement of standard monitors and intra venous access, anaesthesia was induced with fentanyl 2 μ g/kg thiopentone sodium in doses of (4-6 mg/kg) till loss of eye – lash reflexes. Once the eye lash reflexes are abolished, train of four (TOF) monitoring by using train of four (TOF) monitor surface electrode (TOF guard Fisher and Poykee) which were attached to the ulnar nerve side of the palmar aspect of hand opposite to that used for I.V. line. TOF stimulation a series of four twitches in 2 sec, 2 Hz frequency each 0.2 ms long with current intensity of 40 ma is used. Patient was given either Rocuronium bromide 0.6 mg/kg or Vecuronium bromide 0.1 mg/kg. TOF stimuli were repeated at every 12 seconds and the response of adductor pollicis muscle was measured till disappearance of twitch by visual method (this was the onset time of the drug).

Laryngoscopy and intubating condition were assessed at 60 sec. If the condition good to excellent, intubation was performed, and if found unsatisfactory, patient were ventilated and were reassessed at further interval of 30 seconds (90 s, 120s, 150s, 180s), till the intubation condition were found to be good to excellent ((Smith *et al.*, 1998).

This done by anesthetic which is blinded to the allotted group. The intubating conditions were graded using Cooper *et al.*, scoring system.

Following intubation intermittent positive pressure ventilation (IPPV) was continued until completion of surgery with 60% nitrous oxide and 40% oxygen under isoflurane anesthesia and intermittent dose of opioids. Hemodynamic parameter comprising of heart rate, systolic mean and diastolic blood pressure, SpO₂ were recorded at Preinduction, after neuromuscular blocking drug and 1 min. after intubation and 3 min, 5, 10 min, after intubation.

At the end of surgery, all anaesthetic agents were stopped and 100% O₂ was given. Respiratory efforts were allowed to return and residual neuromuscular blockade was reversed with slow I.V. injection of neostigmine 0.05 mg/kg. And 0.02 mg/kg atropine or 0.01 mg/kg glycopyrrolate. All the result were complied, compared and analyzed statistically.

Statistical Analysis

For the calculation sample size the power of study was kept 0.80 and alpha in taken as 0.05. The difference of means to be detected between two groups with the help of unpaired t test is taken as 10, expected standard deviation with in groups in 13.5. The sample size thus calculated in 30 for each group. Data were analyzed by Chi-squared test and other observation by student's t test. p<0.05 was considered as statistically significant.

RESULTS AND DISCUSSION

Result

The groups were comparable with respect to demographic data, ASA, physical status. A difference between them is statistically non significant (p>0.05) (Table-1).

Table 1: Demographic Data

Variable	Group R	Group V	p value
Age (yrs.)	43.57±11.12	43.97±10.96	0.731
Sex (male / female)	6/24	5/25	1.000
ASA physical status I/II	24/6	28/2	0.255

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Table 2: Comparison of different relaxant groups in onset time, intubation time and intubation score

Variable	Group R	Group V	p value
Onset time	162.9 (55.82) S.D.	196.7 (66.84) S.D.	p=0.038
Intubation time	83.27 (17.43) S.D.	139.2 (28.02) S.D.	p<0.001
Intubation score	7.633 (0.9279) S.D.	7.567 (1.073) S.D.	p=0.796

Independent 't' Test

Difference in mean onset time and intubation time between two group is highly significant (p<0.05) but there is no difference in mean intubation score between two group (p=0.798) because in both group intubation was done when condition were good to excellent (Table-2).

Table 3: Mean \pm S.D. changes in Heart Rate (H.R.)

	Rocuronium Mean \pm S.D.	Vecuronium Mean \pm S.D.
Pre induction	78.7 \pm 15.53	91.6 \pm 14.63
After relaxant	81.9 \pm 13.41	83.73 \pm 14.56
1 min after intubation	93 \pm 16.08	98.6 \pm 20.31
3 min after intubation	88.17 \pm 13.95	88.8 \pm 18.95
5 min after intubation	82.2 \pm 14.14	82.57 \pm 13.21
10 min after intubation	78.17 \pm 13.16	79.33 \pm 12.06
p value from induction		
Post muscle relaxation	(0.397) 3.2	(0.041) - 7.867
Post intubation 1 min	(0.000) 14.3	(0.131) 7
3 min	(0.016) 9.467	(0.524) -2.8
5 min	(0.365) 3.5	(0.015) -9.003
10 min	(0.887) -0.533	(0.000) -12.27

In group Rocuronium after giving the relaxant heart rate increase by 3.2 (78.2 to 81.7) from its preinduction value, but this decrease is non significant.

In group Vecuronium after giving the relaxant heart rate decrease by 7.867 (83.73 from 91.60) and this decrease is statistically significant, decrease in H.R. 5 min and 10 min after intubation is also highly significant (Table-3).

Table 4: Mean \pm S.D. changes in Mean Arterial Pressure (MAP)

	Rocuronium Mean \pm S.D.	Vecuronium Mean \pm S.D.
Pre induction	96.89 \pm 10.04	97.21 \pm 7.477
After relaxant	88.73 \pm 13.09	80.99 \pm 11.15
1 min after intubation	114.5 \pm 16.1	113.4 \pm 18.08
3 min after intubation	96.88 \pm 13.29	96.12 \pm 12.15
5 min after intubation	88.5 \pm 8.377	88.11 \pm 10.26
10 min after intubation	85.38 \pm 6.667	84.9 \pm 7.276
p value from induction		
Post muscle relaxation	-8.157 (0.009)	-16.22 (0.000)
Post intubation 1 min	17.57 (0.000)	16.2 (0.000)
3 min	-0.0122 (0.997)	-1.089 (0.677)
5 min	-8.39 (0.000)	-9.5 (0.000)
10 min	-11.53 (0.000)	-12.3 (0.000)

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In Rocuronium group mean blood pressure decrease by 8.157 from its preinduction value. This decrease is highly significant. Decrease in mean blood pressure 5 min, 10 min after is also significant.

In Vecuronium group mean blood pressure decrease by 16.22 from its preinduction value. This decrease is also highly significant (Table-4).

Discussion

In describing the characteristics of an ideal neuromuscular blocking agent Savarese and Kitz in 1973, pointed out the importance of a fast onset of action, short duration of action, cardiovascular stability, lack of cumulation and easy reversibility. Other desirable features of ideal muscle relaxant are the absence of histamine liberation, no increased effect on intraocular or intracranial pressure (Hunter, 1995). Rocuronium bromide is a low potency intermediate acting derivative of Vecuronium with shorter onset time. It is also devoid of cardiovascular side effect and does not cause histamine release (Zhou *et al.*, 2000).

Intubation Time and Condition of Intubation

In our study intubation time was found statistically highly significantly shorter ($p < 0.001$) in Rocuronium group 83.27 sec (60-116 sec) as compare to Vecuronium group 139.2 sec (90-180 sec.). In Rocuronium group 30% patient had acceptable intubating condition at 60 sec, at 90 sec. 73.33% patient is having acceptable intubating condition, at 120 sec. all patient have excellent intubating condition.

In Vecuronium group none of the patient is having acceptable intubating condition at 60 sec. at 90 sec. 13.3 patient is having acceptable intubating condition, at 120 sec. 33% of patients and at 150 sec. 80% of patient is having acceptable intubating conditions. At 180 sec all patients have excellent conditions.

Mishra *et al.*, (2005) found in Rocuronium group at 60 sec 90% of patient had acceptable intubating condition and 90 sec all having acceptable intubating condition. In their study in Vecuronium group only 13.3% patient is having acceptable condition at 60 sec and none of them is excellent.

Lin *et al.*, (1997) show intubation time in Vecuronium group in 102.8 sec, Rocuronium group 54.9 sec.

Zhou *et al.*, (2000) showed that after Rocuronium administration 84% had well to excellent intubating condition at 60 sec.

Onset Time

In our study onset time in Rocuronium group is 162.9 sec (100-300 sec) and in Vecuronium group is 196.7 (104-358 sec) and their difference is also statistically significant ($p < 0.05$).

Bharti *et al.*, (2001) calculated onset time of rocuronium; vecuronium group is 176.5 and 270 sec respectively. Fuchs-Burder *et al.*, (72) found onset time of 0.6 mg/kg rocuronium is (148±323).

Bhattacharya *et al.*, (2008) also showed onset time of rocuronium 128.32 sec (±) 5.77 sec and vecuronium is 189.28 (± 10.40 sec).

Hemodynamic Parameter

Heart rate – In Vecuronium group there is significant decrease ($p < 0.05$) in heart rate from preinduction value. These decreases in heart rate persist up to 10 minute after intubation.

In Rocuronium group heart rate increase after relaxant but it was non significant.

Virmani *et al.*, (2006) suggest in group Vecuronium, heart rate decrease significantly ($p < 0.001$).

Harvey *et al.*, (1999) suggest 5% patient receiving vecuronium had a period of transient asystole, and patient given rocuronium had significantly fewer episode of bradycardia than patient given vecuronium ($p < 0.05$) whereas Kane *et al.*, (2007), Deepak *et al.*, (2005), Maddalie *et al.*, (1999) and Hudson *et al.*, (1998) suggest no significant changes in heart rate after rocuronium administration.

Our results are consistent with their result.

Mean Blood Pressure – In rocuronium group mean blood pressure decrease significantly from 96.89 to 88.73 ($p < 0.001$) and this significant decrease in mean blood pressure persist 5 and 10 min after intubation. In vecuronium group also mean blood pressure decrease from 97.21 to 80.99 and this is highly significant ($p < 0.001$)

Deepak *et al.*, (2005) study in rocuronium group heart rate does not change significantly, but mean arterial pressure decreased from 75±11 to 67±11 mmHg ($p < 0.01$) and stroke volume from 44±19 to 39±17 ml ($p < 0.05$). Virmani *et al.*, (2006) suggest that rocuronium (0.6 mg/kg) 5 min after injection cause decrease

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in heart rate from 93.9 ± 21.3 to 82.41 ± 20.7 beats / min ($p < 0.001$). In group vecuronium heart rate decreased from 99.9 ± 22.3 to 83.8 ± 19.6 beats / min ($p < 0.001$). The decrease in heart rate in group R and V was accompanied by a significant decrease in systolic, diastolic and mean arterial pressure. Our results are comparable to their result with few differences which are insignificant.

When significance of difference between changes in hemodynamic parameter were considered in systolic, diastolic and mean blood pressure there is no significant difference between two group at various time interval in our study. Kane *et al.*, (2007) also found no statistically significant ($p < 0.05$) difference between both these group.

Conclusion

Our study indicates that Rocuronium bromide provide earlier intubation with better intubating condition as compared to Vecuronium bromide in equipotent effective doses. Earlier intubation done by Rocuronium bromide is not associated with any hemodynamics instability as compared to Vecuronium bromide.

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