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Research Article

Comparison of the Effects of Rocuronium, Vecuronium and Atracurium on Intraocular Pressure

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Abstract: The aim of our study was to compare the effects of non-depolarising muscle relaxants, rocuronium, vecuronium and atracurium on the intraocular pressure. Patients were randomly allocated to 3 groups of 30 each, receiving non depolarising muscle relaxants viz group R - Rocuronium Bromide 0.6mg/kg body weight, group V - Vecuronium Bromide 0.12mg/kg and group A – Atracurium Besylate 0.5mg/kg. The changes in intra ocular pressure were measured using a Schiotz tonometer. There is a minimal reduction in IOP with all the three muscle relaxants with return to baseline in 20 minutes. Rocuronium is a safe muscle relaxant that can be used in intraocular surgeries and penetrating eye injuries and emergencies.
Keywords: intraocular pressure, rocuronium, atracurium, vecuronium.

INTRODUCTION

The maintenance of the intraocular pressure forms the mainstay of anaesthetic management of intraocular surgery. Therefore this study was undertaken to evaluate the action of different muscle relaxants on intraocular pressure.

The eye, which has to be opened as a part of the surgical procedure or a result of injury has the risk of impairment or even loss of vision if the anaesthesia is mismanaged. Therefore, the anaesthetist must be familiar with the factors which control the volume and tension of the intraocular contents and the means by which these factors can be controlled if necessary.

One of the major requirements of intraocular surgery is that the intraocular pressure should be optimal and if not so, the sudden release through the incision may result in iris prolapse, vitreous loss and even retinal detachment. Sudden release of pressure in a hard eye may produce rupture of short ciliary blood vessels leading to an expulsive hemorrhage.

It is important to know the effect of a drug on intraocular pressure before declaring it useful for the safe anaesthetic management of ocular surgery.

Non depolarising muscle relaxants do not cause a significant rise in intra ocular pressure unlike Succinylcholine, a depolarizing muscle relaxant [1-3].

METHODS

This study was carried out in Bowring & Lady Curzon Hospitals and Victoria Hospital under Bangalore Medical College and Research Institute.

90 subjects aged between 18 and 55 years of both genders, belonging to ASA grade1 and 2, were included in this study after the approval from the institutional Ethical Committee and with informed written consent by the patients. Patients who were scheduled for elective non ophthalmologic surgeries requiring general anaesthesia for general, laparoscopic and orthopaedic surgeries were included in this study. Patients with co-morbid cardiovascular and metabolic diseases, ocular diseases with or without raised IOP, anticipated difficult intubation were excluded from this study.

Patients were randomly allocated to 3 groups of 30 each, receiving non depolarising muscle relaxants viz group R - Rocuronium Bromide 0.6mg/kg body weight, group V - Vecuronium Bromide 0.12mg/kg and group A – Atracurium Besylate 0.5mg/kg. All patients received Diazepam 5mg oral, on the night before surgery. Baseline IOP, heart rate, NIBP, Spo_2, were recorded in the operating room.

IOP was measured using Schiotz tonometer. In this procedure, the tonometer was calibrated to the zero reading using the 5.5g, 7.5g & 10g weights on a test block. The eyes were then anaethetised by instilling 2

drops of 0.5% Proparacaine eye drops in each eye. After 1 minute, the same procedure was repeated to ensure good corneal anaesthesia. The patient was asked to look up towards the ceiling and the tonometer footplate rinsed in 0.5% Proparacaine was placed vertically on the center of the cornea, after gently retracting the eyelids and taking care not to exert any pressure on the eyeball. Readings in both eyes were measured, recorded and then converted according to the Friedenwald chart. The weight used in our study was 7.5g.

Patient was pre-medicated with Glycopyrrolate 0.04µg/kgi.v, inj. Fentanyl 2 µg/kg. Study drug (muscle relaxant) followed by induction agent Thiopentone Sodium 5mg/kg was administered. Patient was intubated 2 minutes after induction. IOP readings were taken before pre-medication, after pre-medication, after induction, just after intubation, 2, 5, 10, 20 and 30 minutes after the intubation. After all the readings were taken, the patient's eyes were instilled with antibiotic eye drops. All patients were followed post-operatively for any eye complaints.

Intubating conditions were graded using a simple scoring system (Goldberg Criteria) as follows:

- **Excellent** – jaw relaxed, vocal cords abducted & immobile, no diaphragmatic movement
- **Good** – jaw relaxed, vocal cords abducted & immobile, some diaphragmatic movement.
- **Poor** – jaw relaxed, vocal cords moving, coughing.
- **Inadequate** – jaw not relaxed, vocal cords closed.

Anaesthesia was maintained with 70% Nitrous Oxide, Oxygen and IPPV using normocapneic conditions.

RESULTS

Results are expressed as mean and standard deviation of mean. Paired t-test and one way analysis of variance (ANOVA) for repeated measurements (within the same group) were used to analyse changes in IOP. Dunnett's multiple comparison test was used to compare IOP values within same group. Two tailed probability value of <0.05 was considered statistically significant.

The mean age, body weight and gender distribution of the patients in each of the three groups were comparable (Table 1).The baseline IOP readings in both eyes in all three groups are comparable. Range 9.93 to 11.23 mmHg (Fig. 1).

In Group R, there was significant decrease in IOP (1.2±0.79 mmHg) after administration of the drug which returned to baseline by 30 minutes (Fig. 2). In Group V, there was no significant change in IOP after receiving vecuronium (Fig. 3). In group A, there was a minimal change in IOP after receiving Atracurim, which returned to baseline values by 10 minutes (Fig. 4).

All three groups showed a minimal increase in IOP after intubation.In comparison with atracurium and vecuronium, rocuronium showed a significant decrease in the IOP (Fig. 5 and Table 2).

Table 1: Patient Demographic Data

	Group R	Group A	Group V
Male	14	14	12
Female	16	16	18
Age	39±13.6	32.9±12.4	35.9±11.2
Weight	50.3±9.4	54.3±6.6	56.7±8.3

Table 2: Comparative Data

	Before pre-medication	After pre-medication	After induction+muscle relaxant	Just after intubation	2 MIN	5 MIN	10 MIN	20 MIN	30 MIN
R	11.3	11.3	10.1	10.8	10.3	10.6	10.9	11,1	11.2
A	10.6	10.6	10.4	10.2	10.9	10.9	10.5	10.5	10.5
V	10.1	10.1	10.1	10.1	11.0	10.8	10.4	10.2	10.2

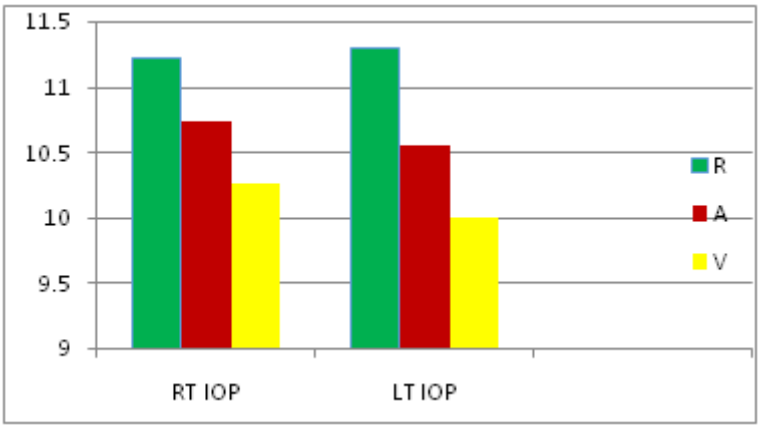

Fig.1: Baseline IOP readings

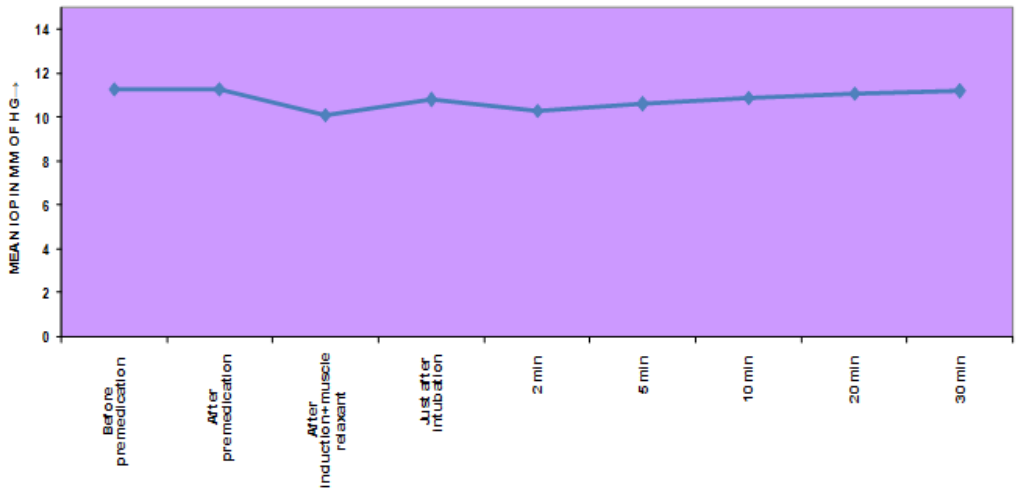

Fig. 2: Effect of Rocuronium on IOP at different time intervals

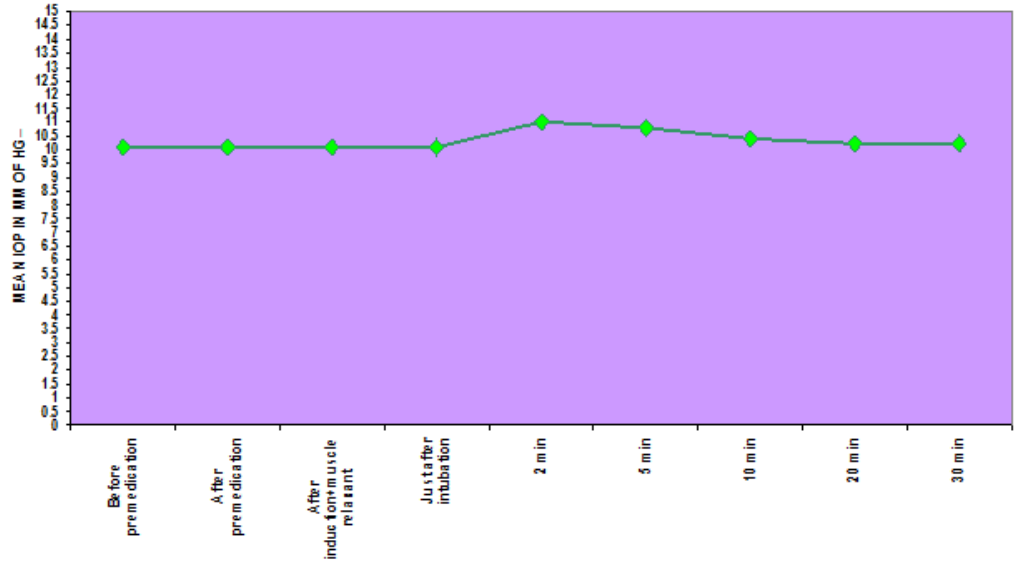

Fig. 3: Effect of vecuronium on IOP at different time intervals

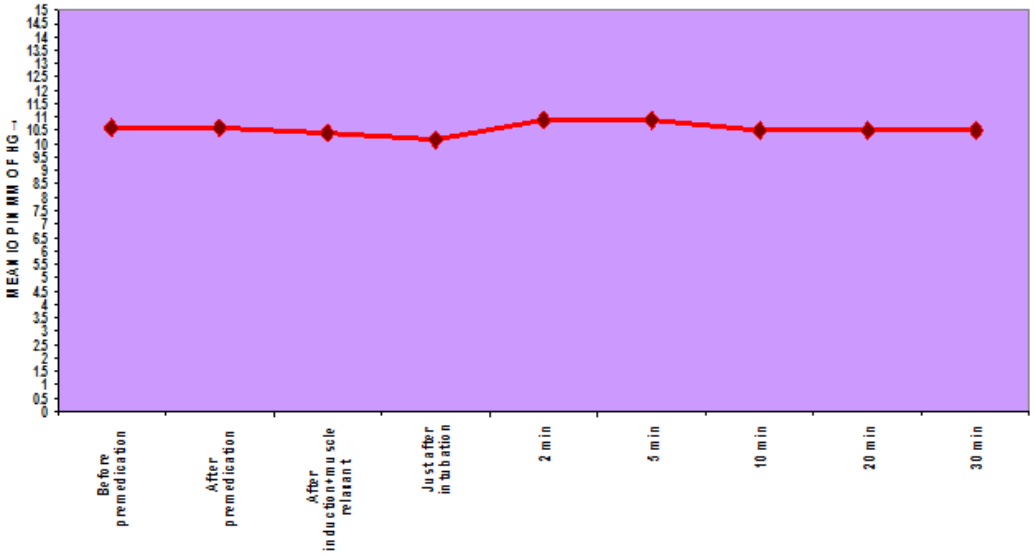

Fig. 4: Effect of atracurium on IOP at different time intervals

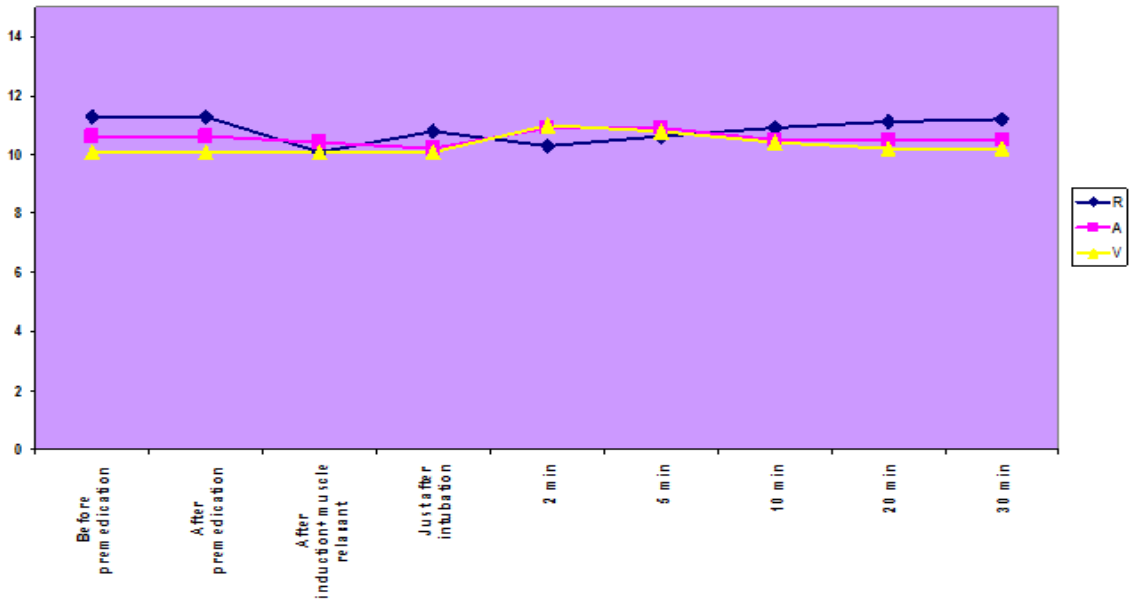

Fig. 5: Comparision of chanes in mean IOP using muscle relaxant

DISCUSSION

The maintenance of the intraocular pressure forms the mainstay of anaesthetic management of intraocular surgeries. Therefore this study was undertaken to evaluate the actions of different muscle relaxants on IOP. The mean IOP of 90 patients before premedication was 10.7 mmHg. The value lies in the normal range of IOP (10-21mmHg).

After premedication with glycopyrrolate and fentanyl there was no significant change in the IOP in all the groups. Thiopentone sodium produced insignificant change in the IOP by 0.01mm Hg. This may be due to depression of ocular centres in hypothalamus.

Succinylcholine, a depolarizing muscle relaxant is found to increase the intraocular pressure significantly according to Hofmann and Holzer [4] which has been confirmed by various workers. Murphy *et al.*[5]showed a significant fall of intraocular pressure with atracurium than pancuronium. Schneideret al. [6]demonstrated that neither atracurium nor vecuronium affected intraocular pressure. C.L. Chiu *et al.*[7] concluded that rocuronium reduced the intraocular pressure when used during rapid sequence induction of anaesthesia.

In Patients receiving rocuronium bromide, there was fall in IOP which reached baseline by 30 minutes and concurs with the studies conducted by SukanyaMithra[3].

In our study, IOP of patients receiving vecuronium remained at baseline upto intubation with insignificant

increase following intubation to reach baseline by 20 minutes.

Administration of Atracurim decreased the IOP by 0.2 mmHg followed by a further fall after intubation as noted by Schneider M J. it reached baseline by 20 minutes [8].

CONCLUSION

Rocuronium, vecuronium and Atracurium produce minimal effects on IOP. However, there is minimal though insignificant decrease in IOP with rocuronium. Rocuronium, by virtue of it's rapid onset is very useful in intraocular surgeries and repair of penetrating eye injuries in emergencies.

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