

**A CLINICAL STUDY OF INTRAOCULAR PRESSURE CHANGES WITH VECURONIUM BROMIDE AND PANCURONIUM BROMIDE**A. S. Nagaraja<sup>1</sup>, K. A. Nagesha<sup>2</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: BACKGROUND:** The maintenance of intraocular pressure forms the mainstay of anesthetic management of intraocular surgery. It is desirable to achieve a normal or reduced intraocular pressure before the eye is opened to avoid expulsive hemorrhage and ocular disruption at the time of incision. Therefore the ideal anesthetic technique for intraocular surgery should produce a moderate reduction in intraocular pressure, or maintain intraocular pressure at near normal values and avoid marked fluctuations during surgery (George et al, 1979). The use of suxamethonium is associated with significant rise in intraocular pressure with a peak increase between 2 and 4 minutes following administration and return to base line value after 6 minutes. The outcome of eye surgery, particularly when there is globe injury depends to a large extent on good control of intraocular pressure not only during maintenance, but also at induction of anesthesia. This is usually achieved by use of non-depolarizing muscle relaxant. Pancuronium when used in relatively larger doses is known to have a faster onset of action and also the block may be prolonged. Vecuronium is intermediate acting and free of cardiovascular and other side effects even when used in larger doses. **AIMS AND OBJECTIVES:** To study the effect of vecuronium bromide an intermediate acting nondepolarising muscle relaxant on intraocular pressure compared with pancuronium bromide, a long acting nondepolarising muscle relaxant. **MATERIALS AND METHODS: Study Design:** Comparative randomized study. **Sample Size:** 60 adult patients between 16-60 years subjected for elective non-ophthalmological surgical procedure. **Sampling Method:** Randomized double blind study. Study groups: **Group I:** 30 patients received pancuronium bromide 0.08 mg/Kg of body weight. **Group II:** 30 patients received vecuronium bromide 0.1 mg/Kg of body weight. **RESULTS:** The total number of patients studied is 60. 30 patients in Group I and 30 patients in Group II. I.O.P Changes: Fall of intraocular pressure in all 30 patients is seen in Group 2. Pulse rate changes: The mean resting pulse rate was  $81 \pm 6.7$  in Group I and  $81 \pm 6$  in Group II. After administration of pancuronium pulse rate was 22.22% more than resting value but after administration of vecuronium there was no change in pulse rate. The pulse rate gradually came down but remained 8.64% more than resting value 10 minutes following intubation in Group I when as it remained 2.47% more than the resting value in Group II. Systolic Blood Pressure Changes: In Group I the mean systolic blood pressure fell by 1.66% and in group II by 1.65% below the resting value. Diastolic Blood Pressure Changes: In Group I on induction with thiopentone, the mean diastolic blood pressure fell by 1.23% below the resting value and in group II by 1.65% below the resting value. **CONCLUSION:** Hence it is further concluded that pancuronium bromide is the relaxant of choice in patients for ocular surgery where there is need for prolonged anesthesia or when hypotension is undesirable and vecuronium bromide is good agent for short surgical procedures and in patients with cardiovascular diseases.

**KEYWORDS:** Intraocular Pressure Changes, Pancuronium, Vecuronium, Schiotz tonometer.

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**INTRODUCTION:** The maintenance of intraocular pressure forms the mainstay of anesthetic management of intraocular surgery. It is desirable to achieve a normal or reduced intraocular pressure before the eye is opened to avoid expulsive hemorrhage and ocular disruption at the time of incision.

Therefore the ideal anesthetic technique for intraocular surgery should produce a moderate reduction in intraocular pressure, or maintain intraocular pressure at near normal values and avoid marked fluctuations during surgery (George et al, 1979).

The mechanism of action of anesthetic agent in reducing the intraocular pressure may involve a direct effect on central diencephalic control centers, reduction of aqueous production, facilitation of aqueous drainage or relaxation of extra ocular muscle tone.

The use of suxamethonium is associated with significant rise in intraocular pressure with a peak increase between 2 and 4 minutes following administration and return to base line value after 6 minutes.

The outcome of eye surgery, particularly when there is globe injury depends to a large extent on good control of intraocular pressure not only during maintenance, but also at induction of anesthesia. This is usually achieved by use of non-depolarizing muscle relaxant.

Pancuronium when used in relatively larger doses is known to have a faster onset of action and also the block may be prolonged.

Vecuronium is intermediate acting and free of cardiovascular and other side effects even when used in larger doses.

Therefore this study was undertaken to evaluate the action of two nondepolarising muscle relaxant on intraocular pressure, pancuronium bromide a long-acting non-depolarizing muscle relaxant and vecuronium bromide, an intermediate acting muscle relaxant. The use of non-depolarizing muscle relaxant agent allows controlled ventilation with nitrous oxide and oxygen and this technique tends to maintain a stable intraocular pressure.

**AIMS AND OBJECTIVES:** To study the effect of vecuronium bromide an intermediate acting nondepolarising muscle relaxant on intraocular pressure compared with pancuronium bromide, a long acting nondepolarising muscle relaxant.

**METHODOLOGY:** Study design: Comparative randomized study.

**Sample size:** 60 adult patients between 16-60 years subjected for elective non-ophthalmological surgical procedure.

**Sampling method:** Randomized double blind study.

**Statistical analysis:**

- a. Students "t" test
- b. Chi square test
- c. Pearson's correlation co-efficiency
- d. Percentages.

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**Inclusion Criteria:** Adult patients of either sex, age range from 16-60 years subjected for elective non-ophthalmological surgical procedures belonged to ASA Grade I to Grade II physical status with informed consent from the patients.

**Exclusion Criteria:** Adult patients with cardiovascular, respiratory or metabolic diseases were excluded from the study.

**Study groups:**

Group I: 30 patients received pancuronium bromide 0.08 mg/Kg of body weight.

Group II: 30 patients received vecuronium bromide 0.1 mg/Kg of body weight.

After obtaining ethical committee clearance for the study, a thorough preoperative evaluation of the patient was done which included, history, general physical examination, systemic examination and laboratory investigations. A written informed consent from the patients was taken after explaining the procedure, advantage and its consequences in their own language.

All the patients were prepared for routine general anesthesia and were premedicated with Tab.diazepam 10 mg on the previous night and on the day of surgery 2 hours prior to surgery. On arrival of the patient in the operating room, basal intraocular pressure was measured; anesthesia was induced with a sleep dose of thiopentone. Adequacy of induction was confirmed by loss of eye-lash reflex and failure to respond to verbal communication.

Group I: Pancuronium bromide 0.08 mg/Kg was administered.

Group II: Vecuronium bromide 0.1 mg/Kg was administered.

The patient lungs were ventilated with 66% of Nitrous Oxide in oxygen using the Mapleson "A" circuit. The trachea was intubated three minutes after the administration of the muscle relaxant. The intraocular pressure was recorded with topical analgesia using Tonometer. In addition blood pressure and pulse rate also measured at the following events:-

After induction, before intubation, one minute after intubation, 2 minutes after intubation, 5 minutes after intubation and 10 minutes after intubation.

After all these readings were taken, the patient eyes were instilled with antibiotic drops. The patients were followed up for any eye complaints.

These patients underwent various surgeries. Intraocular pressure readings in this study were taken using 5.5 gm weight on Schiötz tonometer in all the patients. The readings were taken on both the eyes for each event.

These results were recorded from the Schiötz tonometer and converted according to the Friedenwald's chart. Pulse and blood pressure were recorded by cardiocap II-multimonitor. Mean values of pulse, blood pressure, and intraocular pressure readings in patients of respective groups was calculated and standard deviation was derived.

All the readings are tabulated and discussed.

Post-operative follow up was done and there were no untoward effects during this study and patients had no ophthalmological complaints.

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**RESULTS:** The total number of patients studied is 60. 30 patients in Group I and 30 patients in Group II.

### I.O.P Changes:

Events	Group I (MEAN ± SD) mmHg	Group II (MEAN ± SD) mmHg	t value	p value	Significance
Before Induction	16.7±2.08	16.1±1.71	-	-	-
After Induction	10.4±1.67	10.4±1.42	-	-	-
Before intubation	9.75±2	8.08±1.13	-	-	-
1min after intubation	13.7±1.51	12.6±1.2	3.0786	0.005	HS
2min after intubation	13.9±1.49	12.6±1.2	3.6607	0.005	HS
5min after intubation	14.8±1.53	13.7±1.24	3.0091	0.005	HS
10min after intubation	16.7±2.08	16.1±1.71	1.2004	0.05	NS

Table 1: showing intraocular pressure changes in Group I and Group 2.  
Fall of intraocular pressure in all 30 patients is seen in Group 2

**Pulse rate changes:** The mean resting pulse rate was  $81 \pm 6.7$  in Group I and  $81 \pm 6$  in Group II. After administration of pancuronium pulse rate was 22.22% more than resting value but after administration of vecuronium there was no change in pulse rate. The tachycardia following laryngoscopy and intubation was 2.98% above resting value in Group I patients and 14.8% above resting value in Group II patients. The pulse rate gradually came down but remained 8.64% more than resting value 10 minutes following intubation in Group I when as it remained 2.47% more than the resting value in Group II.

Events	Group I (MEAN ± SD) (in beats/min)	Group II (MEAN ± SD) (in beats/min)
Before Induction	$81 \pm 6.7$	$81 \pm 6$
After Induction	$83 \pm 8$	$82 \pm 7$
Before intubation	$87 \pm 12$	$81 \pm 9$
1min after intubation	$99 \pm 11$	$93 \pm 10$
2min after intubation	$98 \pm 9.5$	$91 \pm 8.6$
5min after intubation	$94 \pm 9.8$	$88 \pm 7.7$
10min after intubation	$88 \pm 11$	$83 \pm 7.1$

Table 2

**Systolic blood pressure changes:** In Group I the mean systolic blood pressure fell by 1.66% and in group II by 1.65% below the resting value. Following laryngoscopy and intubation there was 10.83% rise from resting value in group I and 8.26% rise from resting value in Group II.

An effort was made to correlate intraocular pressure and systolic blood pressure by applying Pearson's correlation co-efficient for the purpose of manual calculation, 10% of the sample was

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selected by random for the test. In Group I, it was observed that there is partial positive correlation before intraocular pressure and systolic blood pressure and in Group II there is positive correlation between intraocular pressure and systolic blood pressure. ( $r = + 1.20417$ ).

Events	Group I (MEAN $\pm$ SD) (in mm of Hg)	Group II (MEAN $\pm$ SD) (in mm of Hg)
Before Induction	120 $\pm$ 8.4	121 $\pm$ 8.6
After Induction	118 $\pm$ 7.6	119 $\pm$ 9.1
Before intubation	120 $\pm$ 7.7	119 $\pm$ 8.5
1min after intubation	133 $\pm$ 6.4	131 $\pm$ 9
2min after intubation	132 $\pm$ 7	130 $\pm$ 8.1
5min after intubation	131 $\pm$ 8.3	127 $\pm$ 8.4
10min after intubation	123 $\pm$ 9.1	122 $\pm$ 8

Table 3

**Diastolic blood pressure changes:** In Group I on induction with thiopentone, the mean diastolic blood pressure fell by 1.23% below the resting value and in group 2 no change was observed.

Following laryngoscopy and intubation in group II there was 20.99% rise in diastolic blood pressure above the resting value where as in group 2 mean diastolic blood pressure rose to 10% above the resting value.

Events	Group I (MEAN $\pm$ SD) (in mm of Hg)	Group II (MEAN $\pm$ SD) (in mm of Hg)
Before Induction	81 $\pm$ 7.5	80 $\pm$ 6.5
After Induction	80 $\pm$ 6.5	80 $\pm$ 7.1
Before intubation	81 $\pm$ 6	80 $\pm$ 7
1min after intubation	98 $\pm$ 4.6	88 $\pm$ 6.6
2min after intubation	97 $\pm$ 5.1	87 $\pm$ 6.1
5min after intubation	92 $\pm$ 6.2	85 $\pm$ 6.2
10min after intubation	84 $\pm$ 7.6	81 $\pm$ 6.3

Table 4

**Intubating Conditions:** In group I 76.66% had excellent intubating conditions and in Group II 86.66% had excellent intubatory conditions.

Groups	Excellent	Satisfactory	Fair
Group I	23 (76.66%)	5 (16.66%)	2 (6.66%)
Group II	26 (86.66%)	4 (13.33%)	0 (0.00%)

Table 5

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Grade	Criteria
Excellent	Good jaw relaxation, vocal cords open, no response to intubation
Satisfactory	Good jaw relaxation, vocal cords open, minimal reaction to intubation
Fair	Jaw relaxed, cords moving, intubation requiring firm pressure and accompanied by moderate bucking or coughing
Poor	Intubation impossible because of poor jaw or cord relaxation

Table 6

**COMPLICATIONS:** Following administration of pancuronium bromide or vecuronium bromide complications such as signs and symptoms of histamine release were not observed.

**DISCUSSION:** The maintenance of intraocular pressure forms the mainstay of anesthetic management of intraocular surgery. It is desirable to achieve a normal or reduce intraocular pressure before the eye is opened to avoid expulsive hemorrhage and ocular disruption at the time of incision.

The use of suxamethonium was shown to be associated with a rise in intraocular pressure. Therefore the study was undertaken to evaluate the action of the non-depolarizing muscle relaxants on intraocular pressure.

After induction of anesthesia with thiopentone in group I the fall in intraocular pressure averaged about 37.72% of resting value and in group 2 fall in 35-40% of resting value was observed. This compares well with the results of Mirakhur et al<sup>1</sup> (1988) who reported about 36% fall in I.O.P from resting value with a sleep dose of thiopentone given in a similar fashion as in our study.

The pulse rate following induction with thiopentone showed a small increase in both the group, which is not significant.

The systolic blood pressure following induction of thiopentone showed a fall in both the groups, which was not statistically significant whereas blood pressure showed a small decrease in Group I and no change in Group II. Mirakhur et al (1988) reported a significant fall in systolic arterial pressure in their study. In yet another study by Mirakhur et al<sup>2</sup> (1987) the fall in systemic arterial pressure following induction with thiopentone with fentanyl 1-2 µg/Kg whereas no narcotic was used in our study.

Following the administration of pancuronium bromide intraocular pressure measurements recorded after 3 minutes showed a mean value of  $9.75 \pm 2$ , which showed a fall of 41.62% below the resting values. Pancuronium bromide did not produce fall of intraocular pressure in 40% of the patient (i.e. 12 patients).

The fall in intraocular pressure following administration of pancuronium correlates well with the findings of Litwiller et al<sup>3</sup> (1975) who observed a fall of intraocular pressure to 70% of the control values after administration of a similar dose of pancuronium bromide. Whereas George et al<sup>4</sup> (1979) observed a fall in intraocular pressure after administration of pancuronium, which was statistically insignificant.

Whereas in their study Smith and Leano<sup>4</sup> (1973) observed a statistically significant fall in intraocular pressure occurring 3 minutes after the administration of pancuronium bromide 0.1 mg/kg. whereas Al-Albrak-Samuel<sup>5</sup> (1974) did not observe any change in intraocular pressure in their study with pancuronium. Litwiller et al concluded that the decrease in intraocular pressure

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must be a primary effect of pancuronium bromide and is not related to the duration of action of the drug as neuromuscular blockers.

Intraocular pressure recorded 3 minutes after administration of 0.1 mg/Kg vecuronium was associated with a fall in intraocular pressure which was 49.81% of the resting value. The drop in intraocular pressure was noted in all the 30 patients studied in this group.

Laryngoscopy and intubation produced a rise in intraocular pressure which was significant in comparison to the value immediately before it, but remained below the resting value. The intraocular pressure then gradually returned to resting value over a period of 10 minutes after intubation.

The findings of our study correlate with the findings of Mirakhur et al (1987) and Mirakhur et al (1988), Verbeek et al<sup>6</sup> (1994), Jantzen et al<sup>7</sup> (1986), Schniedu et al<sup>8</sup> (1986), Sia and Rashkovsky<sup>9</sup> (1981). All of the authors mentioned above have noted in their studies that administration of vecuronium produced a decrease in intraocular pressure. Fall in intraocular pressure may be related to the extraocular muscle relaxation. Tracheal intubation was associated with an increase in intraocular pressure which was significant in comparison to the values before intubation but was still below the baseline values.

Jantzen et al (1986) have stated that neuro-muscular blocking drugs reduce skeletal muscle tone leading to venous pooling. The resultant decrease in central venous pressure improves venous drainage from the choroid and increases the transcleral venous pressures gradient facilitating the outflow of aqueous humour.

In this study it can be concluded that vecuronium bromide produces a consistent and reliable fall in intraocular pressure but pancuronium bromide does not produce a consistent and reliable fall in intraocular pressure. The drop produced by the two drugs lasts for about 10 minutes.

Vecuronium bromide produces a stable cardiovascular system, whereas pancuronium bromide produces tachycardia and hypertension.

Vecuronium bromide produces good intubation condition too when given in equipotent dose as pancuronium bromide.

**CONCLUSION:** Hence it is further concluded that pancuronium bromide is the relaxant of choice in patients for ocular surgery where there is need for prolonged anesthesia or when hypotension is undesirable and vecuronium bromide is good agent for short surgical procedures and in patients with cardiovascular diseases.

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