Original Article

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Comparative Evaluation of Intraocular Pressure after Various Intravenous Inducing Agents

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Abstract

Background: General anaesthesia has effects on various systems including intraocular pressure (IOP). Anaesthetic drugs also lead to changes in IOP. Though rare, IOP measurement is important as acute glaucoma is a major cause of blindness postoperatively. *Aims:* Present study was undertaken to compare the changes in IOP with inducing agents Thiopentone, Propofol & Ketamin with and without Midazolam. *Material & Methods*: We measured IOP after giving three inducing agents, Thiopentone, Propofol & Ketamin individually and then compared along with same inducing agent with Midazolam. The patients were randomly divided in six groups each of 35. First three groups received three inducing agents individually and other three groups received same inducing agent with Midazolam. *Results & Conclusion:* After administration of inducing agent there is fall in IOP. With addition of Midazolam there is more fall in IOP which is desirable to counteract the increase in IOP caused due to Suxamethonium & endotracheal intubation.

Keywords: Intraocular Pressure; Thiopentone; Propofol; Ketamin; Midazolam.

Introduction

The choice of anaesthesia technique depends on pre-anaesthetic status of patient, type of surgical procedure and also the experience of anaesthesiologist. Whenever there is failure of regional technique, general anaesthesia is the ultimate answer. So consideration of general anaesthesia is must in each and every patient. General anaesthesia has effects on various systems including changes in intraocular pressure (IOP).

The drugs used in anaesthesia and also various maneuvers that are performed perioperatively leads to changes in IOP. Suxamethonium, inhalational agents & endotracheal intubation increase intraocular pressure was noted by Cunningham et al [15] (1986) and Meistelman C [14] (1993). The management of anaesthesia for ophthalmic surgery requires control of IOP before, during and after the procedure.

In non-ophthalmic surgery also consideration of IOP is important; because acute glaucoma is one of the causes of post-operative visual loss. Though rare, it is dreadful complication in peri operative period [1]. Gartner and Billet [2] described acute angle closure glaucoma in 4 of 3437 patients (0.1%).

Considering importance of IOP in ophthalmic and non ophthalmic surgeries, present study was undertaken to compare the changes in intraocular

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pressure after various intravenous inducing agents with or without premedication.

Material & Methods

This was prospective randomized, comparative double blind study. After approval by Institutional Ethics Committee and written informed consent by the patients, 210 patients of either sex belonging to ASA physical status grade I and the age groups of 20 to 50 years scheduled for various non-ophthalmic procedures of general surgery, ENT and orthopedic specialty undergoing general anaesthesia were studied. The patient with open eye injury, pre-existing raised IOP, intracranial tumors, facio-maxillary injury, hypertension, hypotension and patients with respiratory disease were excluded from the study. After thorough pre-anaesthesia evaluation and routine investigations, these patients were posted for routine surgery under general anaesthesia.

These 210 patients were randomly divided into two main groups of 105 each with three subgroups having 35 patients in it according to the type of intravenous inducing agents and premedication Midazolam.

These groups were done as-

Group Ia - IV Thiopentone 5 mg/kg

Group Ib - IV Ketamin 2 mg/kg

Group Ic - IV Propofol 2 mg/kg

Group IIa - IV Thiopentone + Midazolam 2 mg

Group IIb - IV Ketamin + Midazolam 2 mg

Group IIa - IV Propofol + Midazolam 2 mg.

Intraocular pressure (IOP) was measured with Schiotz's Applanation Tonometer after instillation of 2% Lignocaine in both eyes.

After taking patient in the operation theater, monitors like ECG, Pulseoxymeter, NIBP and $ETCO_2$ were applied. Baseline pulse rate, blood pressure and SpO_2 were recorded.

After induction with one of the above IV induction agent, Inj. Suxamethonium 1.5 to 2 mg/kg was administered and after laryngoscopy, trachea was intubated with appropriate size endotracheal tube. Anaesthesia was maintained on mixture of O_2, N_2O, isoflurane and Inj. Vecuronium as muscle relaxant. At the end of surgery, the patients were reversed with Inj. Glycopyrollate 10mcg/kg and Inj. Neostigmin 0.05mg/kg and extubation was done.

Intraocular pressure (IOP) was measured in all these patients – preoperatively, before induction of anaesthesia, immediately after administration of inducing agent, 2 min after endotracheal intubation, 5 min after intubation and postoperatively in recovery room.

The data from the study were analyzed using statistics software. Quantitative parameters were compared using t - test and qualitative tests were analyzed using chi-square test.

Results

The demographic parameters like age, sex were comparable among all the groups (Table 1 & 2). The distribution of operative procedures was similar in all groups.

Intraocular Pressure (IOP)

Thiopentone group (Ia) - There was small increase in IOP immediately after induction, there was small decrease in IOP at 2min., at 5 min and also there was decrease in post-operative period as compared to preoperative readings. The difference was statistically not significant.

Ketamin group (Ib) - There was significant increase in IOP immediately after induction, there was small rise in IOP at 2min., and insignificant decrease at 5 min after induction when compared with preoperative reading. The difference was statistically not significant.

There was significant decrease in IOP in post-operative period as compared to preoperative readings. The difference was statistically not significant.

Propofol group (Ic) - There was significant decrease in IOP immediately after induction, as compared to preoperative reading which continued upto 2 min. post induction. This difference was statistically significant. There was insignificant decrease in IOP, at 5 min as compared to preoperative readings; but there was significant difference in IOP in postoperative period.

Thiopentone + Midaz (Group IIa)

There was significant decrease in IOP immediately after induction as compared to pre-operative reading which maintained till 2 min after induction. At 5 min after induction, there was insignificant decrease in IOP with similar findings observed in post-operative

period as compared to pre-operative findings.

Thio + Ketamin (Group IIb)

There was significant decrease in IOP immediately after induction and at 2 min after induction, as compared to pre-operative reading.

At 5 min after induction, there was insignificant difference as compared to pre-operative reading. Similar observations were seen in post-operative period.

Propofol +Midazolam (IIc)

There was lightly significant decrease in IOP immediately after induction as compared to pre-operative readings which continued till 2 min after induction.

At 5 min after induction, there was insignificant decrease in IOP as compared to pre-operative readings. Similar findings were noted in post-operative period.

Comparison between the Subgroups

The mean pre-operative IOP was comparable statistically in all six groups.

There was no statistically significant difference observed in mean-pre-operative IOP in all six groups.

Immediately after induction of anaesthesia, there was significant decrease in plain propofol group and in all groups where Midazolam was given in combination.

At 2 min, IOP was almost similar in all subgroups of I and II but there was significant decrease in IOP at 2min, as compared to their respective pre-operative readings.

In group Ia and Ic and all groups with Midazolam, there was significant decrease in IOP at 5 min as compared to pre-operative readings. There was insignificant increase in Ketamin group at 5 min after induction.

Table 1: Age distribution in various groups

Age range in years	Group I			Group II		
	IA	IB	IC	IIA	IIB	IIC
15-24	10	12	12	13	15	16
25-34	08	08	05	06	07	06
35-44	12	10	14	10	08	06
>45	05	05	04	06	05	07

Table 2: Sex distribution in various groups

	Group I			Group II		
	IA	IB	IC	IIA	IIB	IIC
Male	22	12	16	12	16	20
Female	13	23	19	23	19	15

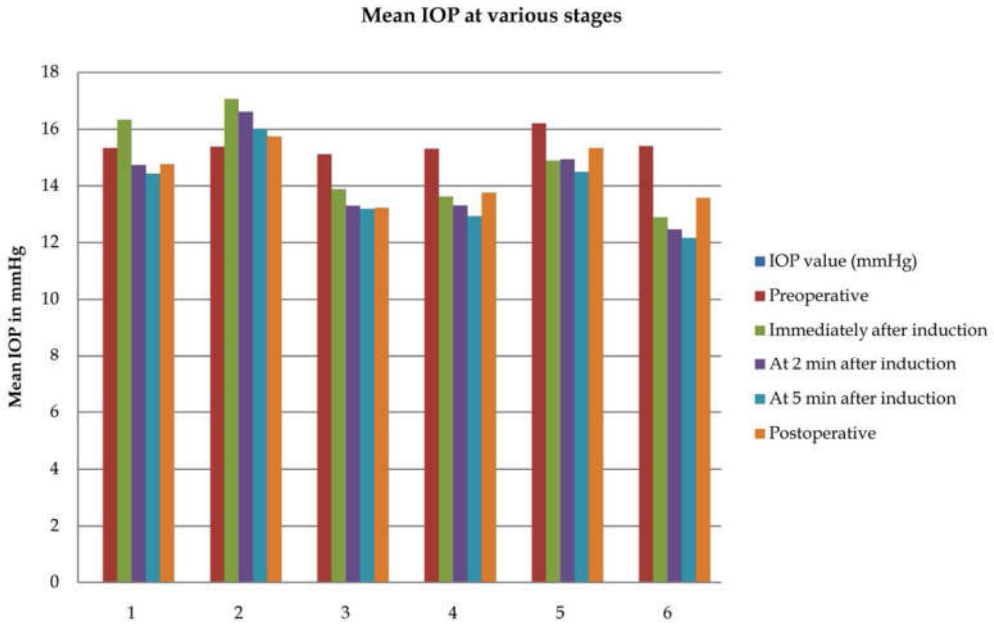

Fig. 1:

Table 3: Mean IOP at various stages

IOP value (mmHg)	IA	IB	IC	IIA	IIB	IIC
Preoperative	15.34 ± 1.60	15.39 ± 1.51	15.12 ± 1.54	15.31 ± 1.52	16.21 ± 2.38	15.41 ± 2.00
Immediately after induction	16.34 ± 1.30	17.07 ± 1.36	13.88 ± 1.35	13.62 ± 1.59	14.9 ± 2.17	12.9 ± 1.92
At 2 min after induction	14.74 ± 0.8	16.62 ± 1.32	13.3 ± 1.02	13.31 ± 1.49	14.94 ± 2.27	12.47 ± 1.86
At 5 min after induction	14.44 ± 0.80	16.01 ± 1.15	13.19 ± 0.94	12.93 ± 1.29	14.5 ± 1.93	12.17 ± 1.61
Postoperative	14.77 ± 1.04	15.75 ± 1.19	13.23 ± 0.83	13.76 ± 1.07	15.34 ± 1.86	13.58 ± 1.46

Discussion

Intraocular pressure remains major concern in a patient with general anaesthesia, particularly in pediatric and geriatrics and with closed or open eye injuries. If these pressure changes are not taken into account, it may lead to vitreous loss, retinal detachment and even blindness.

Normal range of intraocular pressure in healthy eyes is 12 to20 mmHg with diurnal variation of 2 to 3 mmHg and positional changes of 1 to 6 mmHg.

The important determinants of IOP are changes in choroidal blood volume, central venous pressure, extra ocular muscle tone and aqueous humor dynamics which depend on balance between its production and elimination through Fontana's spaces and Schlemm's canal.

Various peri operative events like coughing, bucking, emesis and changes of position also affect IOP. The role of various anaesthetic drugs also play significant role in IOP changes. So this study was undertaken to study the effect of different IV induction agents and its combination with Midazolam.

Preoperatively mean IOP was ranging from 15 to 20 mmHg, almost comparable and there was no major difference in any group. This observation correlates with the studies done earlier by Mirakhur et al [3] (1988), Joshi C [4] (1975), Halsted SM [5] (2012) and Hany A Mowafi et al [6] (2013).

After induction of anaesthesia there was significant decrease in IOP immediately after induction as compared to pre-operative readings in propofol group and in all groups receiving Midazolam along with IV induction agent. There was small increase in IOP in ketamin group.

N W B Crathorne et al [7] (1959), M H Albrak [8] (1975), Joshi C [4] (1975), A and Sugata et al [9] (2012) have also noted decrease in IOP after propofol and Midazolam combination compared with other inducing agents. Some of them observed increase in IOP after ketamin induction. Induction with thiopentone and propofol causes decrease in venous return, cardiac output, cerebral blood flow and decrease in intracranial pressure sometimes resulting in decrease in IOP.

Propofol induction is followed with direct myocardial depression leads to more fall in IOP. Ketamin induction increases vascular resistance, thereby increases blood pressure, increase cardiac output and also increase in intracranial pressure causing increase in IOP.

Midazolam is short acting benzodiazepine which potentiates actions of thiopentone and propofol. It alleviates anxiety and decreases sympathetic stimulation. So when used in combination with ketamin, Midazolam decreases cardiovascular effects of ketamin reducing intracranial pressure and IOP. There was small increase in IOP in thiopentone and propofol groups at 2min and 5 min after induction and postoperatively when compared with preoperative readings. Here decreasing action with thiopentone and propofol is counterbalanced by increase in IOP Suxamethonium hence IOP remains somewhat unchanged. These observations are similar to studies done by Martin Peuler [10] (1975), Mirakhur et al [3] (1988), Shyamlal K Badrinath [11] and Kery Frey et al [12] (1999).

Increase in IOP is counterbalanced by action of Midazolam. After administration of Suxamethonium increase in IOP is almost completely counterbalanced in combination group of Midazolam with propofol. In ketamin and Midazolam groups, after Suxamethonium there was insignificant increase in IOP as compared to individual ketamin group. This shows that Midazolam can be used effectively with ketamin to minimize the changes in IOP during general anaesthesia.

Conclusion

The rise in IOP after Ketamin induction is countered by adding Midazolam. After administration of inducing agent there is fall in IOP. With addition of Midazolam there is more fall in IOP which is desirable to counteract the increase in IOP caused due to Suxamethonium & endotracheal intubation.

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