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SYSTEMIC EFFECTS OF INTRAOCULAR ADRENALINE DURING PHACOEMULSIFICATION AND INTRAOCULAR LENS IMPLANTATION SURGERY

Medical Science

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ABSTRACT

Adequate mydriasis is crucial for cataract surgery. To perform a safe operation the pupil needs not only to be dilated preoperatively but preferably needs to remain dilated throughout the procedure. Intraocular Adrenaline is routinely being used as a mydriatic in irrigating eye solutions during phacoemulsification and intraocular lens implantation. This study aimed at assessing the systemic side effects of intraocular adrenaline.

Material and Method: This study was conducted at a tertiary care centre of central India. Sixty cataract patients both male and females aged between 50-70 years were voluntarily enrolled who underwent phacoemulsification and intraocular lens implantation surgery. All patients belonged to ASA physical status 1and 2.

Thirty patients were hypertensive on treatment, well controlled. The other thirty were normotensive. Intraoperatively vital parameters like Heart rate, Blood pressure and Respiratory rate were monitored by standard multipara monitors and Pre & Post operative blood sugar levels were analysed biochemically by Hexokinase method.

Data was analyzed using the IBM SPSS for Windows software package. T-tests were used to determine statistically significant pairwise differences.

Conclusion: There were no significant differences between the two groups. The rise in vital parameters which subsided with progress of surgery was most likely neurogenic response to surgery.

KEYWORDS

Intraocular Adrenaline

INTRODUCTION:

Adequate mydriasis is crucial for cataract surgery. To perform a safe operation the pupil needs not only to be dilated preoperatively but preferably needs to remain dilated throughout the procedure. Pupillary constriction during cataract surgery may increase the risk for complications, including iris damage, incomplete cortex removal, posterior capsule rupture, vitreous loss and dislocation of the lens material.

Mydriasis for cataract surgery is usually achieved preoperatively by topical mydriatics, such as cyclopentolate, tropicamide and phenylephrine. Intraocular Adrenaline is an alternative to the topical mydriatics for cataract surgery.

Adrenaline is a substance with dual effects; to contract the dilator musculature by its α receptor actions and relax the sphincter by a β effect, resulting in mydriasis. It is usually used at a low concentration in the irrigating solution to maintain mydriasis.

However, adrenaline may also stimulate receptors in cardiovascular tissues, resulting in systemic side effects, such as elevation of heart rate & blood pressure. These effects are particularly perilous in high-risk groups such as patients with hypertension or cardiovascular diseases. This study aimed at assessing the systemic side effects of intraocular adrenaline by observing vital parameters like Heart rate, Blood pressure & respiratory rates and by biochemical analysis of pre & post operative blood sugar levels.

MATERIAL AND METHODS:

This prospective study enrolled 60 cataract patients scheduled for phacoemulsification and IOL implantation at a tertiary care centre of central India. Both male and females aged between 50-70 years, ASA physical status 1 & 2 were randomly enrolled after written informed consent. Thirty patients were hypertensive on treatment, well controlled. The other thirty were normotensive. Intraoperative vitals were monitored. For systemic effect of adrenalin; Heart rate, blood pressure and respiratory rate were recorded. Pre & post operative blood sugar levels were analysed biochemically. Intraocular adrenaline was composed of 1 mL of 1:10,000 Dilution adrenalin with Sodium bisulfate preservative. Irrigating solution with 0.4 mL of adrenaline hydrochloride 0.01% in 500 mL balanced salt solution was used.

Inclusion Criteria: Physiological status ASA 1 and 2
Exclusion Criteria: History of Diabetes

Heart rate, Blood Pressure and Respiratory rate were assessed with standard multipara moniters (BPL Excello Eco) on the right upper arm of patients during surgery. Pre and Post operative blood sugar were sent to biochemistry lab and evaluated on Roche Cobas C311 by hexokinase method.

Statistical Analysis

Data was collected on standardized forms and was analyzed using the IBM SPSS for Windows software package. Comparison between the two independent populations was done using the independent *t*-test. Paired *t*-test was used to analyze two-paired data. Student paired t-tests were used to determine statistically significant pairwise differences. The level of significance was $P<0.05$.

RESULTS

Out of total 60 subjects, 30 were hypertensive on treatment, well controlled. The other 30 were normotensive. In the hypertensive group, there were 15 male and 15 female patients. The age distribution of the participants in hypertensive group was normal, with average age being 65.68 ± 4.25 years. In the normotensive group, there were again 15 males and 15 females. The age distribution of participants was normal, with average age being 66.20 ± 3.90 years. The difference in age between the 2 groups was not significant.

Table No.1-Demographic characteristics of participants

Variable	Well controlled Hypertensive	Normotensive
Age in years (Mean ± SD)	65.68±4.25	66.20±3.90
Gender Male(N)	15	15
Female(N)	15	15

There were no statistically significance differences between the mean systolic blood pressure and the mean diastolic blood pressure in two groups, which support the matching of the two groups.

The mean systolic blood pressure in the hypertensive group was 138.3 ± 15.5 mmHg preoperative and became 140.2 ± 20.0 mmHg after intraocular injection of adrenaline but returned to normal

postoperatively 135.5±5.5. Whereas in the normotensive group, preoperative systolic blood pressure mean was 132.8±18.5 mmHg and became 135.6±10.5 mmHg after intraocular adrenaline and beginning of operation but again returned to normal postoperatively 130.6±6.6, which was not statistically different in the two groups.

Table No.2- Systolic Blood Pressure in mmHg

	Pre operative Systolic Blood Pressure	Post operative Systolic Blood Pressure	p-value
Well controlled Hypertensive	138.3±15.5	135.5±5.5	0.3
Normotensive	132.8±18.5	130.6±6.6	0.5

The mean diastolic blood pressure was 88.5 ± 6.2 mmHg preoperatively and became 90.2±4.0 mmHg in the hypertensive group but returned to normal postoperatively 88.0±5.5, whereas in the normotensive group, preoperative mean diastolic blood pressure was 85.4±6.5 mmHg and became 90.33±5.4 mmHg but again returned to normal postoperatively 83.5±3.5, which was not statistically significant.

Table No.3- Diastolic Blood Pressure in mmHg

	Pre operative Systolic Blood Pressure	Post operative Systolic Blood Pressure	p-value
Well controlled Hypertensive	88.5±6.2	88.0±5.5	0.7
Normotensive	85.4±6.5	83.5±3.5	0.16

In our study, the mean of preoperative pulse rate was 70.2±9.6 bpm in hypertensive group and was 68.0±5.5 in normotensive group. The mean of pulse rate post intraocular adrenaline was 75.5±4.8 bpm in hypertensive group and 74.5±4.0 in normotensive group. Postoperatively mean pulse rate was 68.1±8.5 in hypertensive group and 67.0±3.5. Thus showing non-significant difference in heart rate between both the groups as well as before and after intraocular adrenaline.

Table No.4- Mean Pulse Rate beats per minute

	Pre operative Pulse	Post operative Pulse	p-value
Well controlled Hypertensive	70.2±9.6	68.1±8.5	0.37
Normotensive	68.0±5.5	67.0±3.5	0.4

Significant increases in heart rate and systolic & diastolic blood pressure occurred in both groups preoperatively and intraoperatively, especially in systolic blood pressure. But the difference was not significant between groups.

Pre-operative mean respiratory rate was 13.3 ± 2.4. Respiratory rates increased initially with start of surgery to 15.6±3.8 and then settled to baseline (12.6 ± 2.1). Here also, the difference was not significant in both the groups.

Preoperative fasting blood sugar level mean was 118.5±7.5 mg/dl and postoperative mean level was 121.4 ± 6.4 in the hypertensive group. Preoperative fasting blood sugar level mean was 115.5±5.5 mg/dl and postoperative mean level was 116.4 ± 4.0 in the normotensive group, which is not statistically different.

Post operative blood sugar level increased in both the groups but the difference was again not significant.

Table No.5- Mean Blood Sugar Levels in mg/dl

	Pre operative	Post operative	p-value
Well controlled Hypertensive	118.5±7.5	121.4±6.4	0.11
Normotensive	115.5±5.5	116.4±4.0	0.47

DISCUSSION

Cataract extraction is, in the majority of cases, a safe and effective procedure, but maintenance of mydriasis can contribute to the ease with which surgery can be performed. A small pupil during surgery may increase the risk for damage to the iris, incomplete clearance of soft lens matter, or, more importantly, rupture of the posterior capsule.

Mydriasis for cataract surgery is usually achieved preoperatively by topical mydriatics, such as cyclopentolate, tropicamide, and phenylephrine. Intraocular Adrenaline is an alternative to the topical mydriatic modalities for cataract surgery. Adrenaline must be tried before mechanical pupil dilation methods because the latter have disadvantages, including iris trauma and sphincter rupture. In addition, mechanical dilation has financial ramifications, time consuming, and requires creation of additional incisions.

To maintain mydriasis during surgery, some surgeons use adrenaline either in the intraocular irrigation fluid, or as a bolus injection into the anterior chamber.

There were concerns about elevation of blood pressure and other vital parameters by use of intraocular adrenaline. In this study, the change in cardiovascular system after intraocular injection of adrenaline was not significantly different between the two groups. The rise in vital parameters which subsided with progress of surgery was most likely neurogenic response to surgery. Surgically induced neurogenic hypertension should be responsible for the intraoperative increase in blood pressure and heart rate in both groups. Consecutively, postoperative changes recovered to baseline a day after surgery in both the groups.

Similar results were found in earlier studies and comparable with that of Salima *et al*., who mentioned that the mean of preoperative blood pressure increased significantly after injection of local anesthesia. At the beginning of the surgery, blood pressure values dropped down to preoperative values. Intraoperative and postoperative blood pressure after intraocular injection of adrenaline remained constant.

Björn Lundberg in Umeå university mentioned that the lower dose and the intraocular distribution of adrenaline may reduce the risk for cardiovascular side effects in certain groups of patients.

It was found in this study that intraocular adrenaline injection did not significantly affect systolic and diastolic blood pressure in hypertensive patients as well as in normal patients.

In conclusion, intraocular adrenaline hydrochloride appears not to cause any significant systemic side effects and can be a good alternative to topical mydriatics for phacoemulsification and IOL implantation.

The limitation of this study is that the relatively small sample size may reduce the statistical power of the outcomes. Further studies of a larger number of subjects and longer follow-up periods are warranted.

Funding and Conflict of Interests

This study is purely voluntary and there is no conflict of interests regarding the publication of this paper.

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