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Original Research Article

# A Prospective Study to Assess the Impact on Intraocular Pressure (IOP) after Phacoemulsification (PE) with Posterior Chamber Intraocular Lens (PCIOL) Implantation and its Relation with Ocular Biometric Parameters

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**Abstract**

**Aim:** The aim of the present study was to assess the impact on intraocular pressure (IOP) after Phacoemulsification (PE) with Posterior Chamber Intraocular Lens (PCIOL) implantation and its relation with ocular biometric parameters.

**Methods:** A prospective observational study was done in the Department of Opthalmology, IGIMS, Patna, India. The study population included 150 eyes of 150 patients having age-related cataracts with normal IOP (11-21mmHg). They have undergone eventless PE with PCIOL implantation surgery

**Results:** The mean pre-operative and post- operative IOP was 12.46±1.96 and 11.55±1.66 mmHg, respectively. The mean pre-operative and post-operative ACD was 3.32±0.26 and 3.67±0.26 mm, respectively. The average axial length before surgery was 23.55±0.72 mm, which was unchanged after surgery. The average IOP of the non-treated fellow eye was 13.6±2.6 mmHg, and after one month was 13.2± 2.4 mm Hg. The average CCT was 548.62±24 µm both pre-operatively and post-operatively. After doing the paired t-test, the post-operative IOP reduction was significantly associated with pre-operative IOP, $p<0.001$ and ACD<0.001. The average IOP reduction after one month was 1.92±0.64 mmHg.

**Conclusion:** IOP is significantly reduced after PE with IOL implantation surgery in normal eyes having age-related cataracts. In addition to preoperative IOP, ACD is significantly associated with postoperative IOP reduction. The preoperative IOP is proportional to post-operative IOP reduction, and the more the increase in preoperative IOP, the decrease in post-operative IOP is more.

**Keywords:** Intraocular pressure, Phacoemulsification, IOL implantation, Ocular biometric parameter



## Introduction

Glaucoma and cataract are frequently encountered in the same patient, their prevalence increasing with age. [1] An increasing number of patients who present to the ophthalmologist with symptoms of cataract or glaucoma are diagnosed with both conditions. [2] Although it is an increasingly common situation, the management of combined cataract and glaucoma is still a subject of debate.

Primary open angle glaucoma (POAG) is one of the most common forms of glaucoma in adults. Nowadays, phacoemulsification represents the gold standard for cataract surgery. The surgical technique assumes small clear corneal incisions and foldable intraocular lenses, which greatly reduce the operating time. [3] Several studies report that cataract surgery lowers intraocular pressure (IOP) in normal and glaucomatous eyes [4-6] and some authors consider it a part of glaucoma management as well.

It is a well-established fact that modern phacoemulsification surgery alters several ocular parameters, such as the anterior chamber depth (ACD) and angle (ACA), as well as the intraocular pressure (IOP). Furthermore, research has demonstrated that certain of these parameters are intertwined with one another; the ACA and its structures play a pivotal role in IOP regulation. [7-10] Phacoemulsification surgery, which results in the implantation of an intraocular lens inside the capsular bag (PCIOL), leads to the modification of these anterior chambers structures, leading to the modification of the IOP. [11]

Nevertheless, for POAG patients, the effect of cataract surgery on IOP and the number of medications remains unclear. In a meta-analysis for the American Academy of Ophthalmology, Chen et al. showed a modest 13% average decrease in IOP in patients with POAG after phacoemulsification alone. [12] However, studies evaluating IOP after phacoemulsification in POAG eyes showed substantial variability of results with IOP reduction ranging from − 7% [13] to − 22%. [14] Similarly, the number of glaucoma medications varied from + 7% [15] to − 59% [16] after cataract surgery.

The aim of the present study was to assess the impact on intraocular pressure (IOP) after Phacoemulsification (PE) with Posterior Chamber Intraocular Lens (PCIOL) implantation and its relation with ocular biometric parameters.

## Materials and Methods

A prospective observational study was done in the Department of Opthalmology, IGIMS, Patna, India. The study population included 150 eyes of 150 patients having age-related cataracts with normal IOP (11-21mmHg). They have undergone eventless PE with PCIOL implantation surgery The patient was selected purposively, and informed written consent was taken. Exclusion criteria include a patient having pediatric cataract, glaucomatous eyes, complicated cataract, systemic disease, retinal disease, traumatic cataract and per operative complications. A brief history of the patient, including medical, surgical, ophthalmic, family and drug history, were taken. All patients were gone through a detailed slit lamp examination, including dilated fundoscopic examination. Best Corrected Visual Acuity (BCVA) was examined the day before surgery and one month after surgery by Snellen chart and LogMAR chart. GAT measured preoperative and post-operative IOP in the morning between 10-12am with proper maintenance of sterilization. Optical Coherence Biometer measured ACD and axial length; Pachymeter measured CCT. The Patients were not allowed to use any topical medication before surgery except the dilating drop. After surgery, each patient was treated with topical 0.5% Moxifloxacin, 1% Prednisolone acetate and 0.1% nepafenac eye drop for six weeks.

## Surgical Procedure

Pre-operative pupillary dilatation was made by Tropicamide 1% and Phenylephrine, 2.5% combination, drop every 15 minutes interval for 45 minutes in the operated eye. The peribulbar block was given using 3 ml of 0.5% Bupivacaine and 5 ml of 2% Lignocaine mixed with 150 IU of Hyaluronidase. With all aseptic precaution, a side-port incision was given first 45 degrees from the main incision. Trypan blue were inserted and kept for 30 seconds, and washed thoroughly. Hydroxy Propyl Methyl Cellulose 2% (HPMC) were given to form the A/C. A temporal clear corneal two planner incision was provided by a 2.8 mm keratome at 9 o'clock position for the Right eyes and at 3 o'clock position for the left eyes. A controlled circular continuous curvilinear capsulorhexis of about 4.5-5 mm was done with the help of cystotome and /or capsulorhexis/forceps. Proper hydro dissection and gentle nucleus rotation were done. Then/sculpting and nucleus management was done by the modified stop and chop method. The cortical matter was aspirated by a bimanual cannula. Foldable in bag IOL implantation was done for all the cases. The OVD was cleared with the bimanual method by placing the irrigation cannula behind the IOL in a very low parameter. Then stromal hydration was done to seal the wounds, and intra-cameral ceftazidime, 1 mg in 0.1ml, were given as prophylaxis. Incisions left sutureless. All surgeries were done with an INTREPID Micro-coaxial system using the Infinity Vision System by one skilled surgeon using the same quality lens and same procedure.

IOP was measured at the same time in the non-treated fellow eye. The patient follow-up was done on the 1st POD and one month after surgery for all the cases. All data were analyzed by a statistical software package (SPSS 18.0). Changes of a score at different time points (preoperative, 1st POD, one month after surgery) were analyzed by ANOVA with Bonferroni corrections. A p-value of <0.05 was considered statistically significant. The results were given in numbers and percentages for qualitative variables and mean and standard deviation for quantitative variables. Paired t-test was used to determine the changes in different preoperative and post-operative biometric parameters.

## Results

**Table 1: Comparison of ocular biometrics before and one month after PE with IOL implantation surgery**

| Ocular parameters | Preoperative Mean±SD | Postoperative Mean±SD | p value |
|---|---|---|---|
| Age, years | 61.87±4.02 | 62.78±4.03 | 0.925 |
| BCVA Snellen Chart | 6/60-6/36 (75%) | 6/9-6/6 (70%) | 0.507 |
| BCVA in LogMAR chart | 1-0.78 (74%) | 0.18-0 (69%) | 0.790 |
| IOP, mmHg (Treated eye) | 12.46±1.96 | 11.55±1.66 | <0.001 |
| IOP, mmHg(Non-treated fellow eye) | 13.2±2.4 | 13.6±2.6 | 0.789 |
| ACD, mm | 3.32±0.26 | 3.67±0.26 | <0.001 |
| AL, mm | 23.55±0.72 | 23.59±0.76 | 0.840 |
| CCT, $\mu$m | 548.62±24 | 550.64±26 | 0.928 |

The mean pre-operative and post- operative IOP was 12.46±1.96 and 11.55±1.66 mmHg, respectively. The mean pre-operative and post-operative ACD was 3.32±0.26 and 3.67±0.26 mm, respectively. The average axial length before surgery was 23.55±0.72 mm, which was unchanged after surgery. The average IOP of the non-treated fellow eye was 13.6±2.6 mmHg, and after one month was 13.2± 2.4 mm Hg. The average CCT was 548.62±24 µm both pre-operatively and post-operatively. After doing the paired t-test, the post-operative IOP reduction was significantly associated with pre-operative IOP, $p<0.001$ and ACD<0.001.

**Table 2: Postoperative IOP change after Phacoemulsification with PCIOL implantation surgery in normal eyes**

| No of Eyes | Preoperative IOP (Mean±SD) | Postoperative IOP (Mean±SD) | Change at one month |
|---|---|---|---|
| 425 | 13.47±1.94 | 11.58±1.68 | 1.92±0.64 |

The average IOP reduction after one month was 1.92±0.64 mmHg.

## Discussion

Cataract surgery is one of the oldest surgical procedures in ophthalmic history, first documented in the fifth century BC. [17] This surgery has gone through different revolutions like couching, Intra Capsular Cataract Extraction(ICCE), Extra Capsular Cataract Extraction(ECCE) and Phacoemulsification introduced by Dr. Charles Kelman [18] in 1967. Different studies publicized that cataract surgery has IOP lowering effect in normotensive and glaucomatous eyes. [19-21] It is an effective procedure to control the IOP and help to decrease the number of antiglaucoma drugs. [20,22]

Recent studies show that PE with PCIOL implantation surgery reduces the IOP and it is proportional to the presurgical IOP. [23-25] The mean pre-operative and post- operative IOP was 12.46±1.96 and 11.55±1.66 mmHg, respectively. The mean pre-operative and post-operative ACD was 3.32±0.26 and 3.67±0.26 mm, respectively. The average axial length before surgery was 23.55±0.72 mm, which was unchanged after surgery. The average IOP of the non-treated fellow eye was 13.6±2.6 mmHg, and after one month was 13.2± 2.4 mm Hg. Several hypotheses have been proposed to explain the Effect of IOP reduction after cataract surgery. [26,27]

Many studies have tried to find out a relationship between pre-operative ocular biometrics with post-operative IOP change. [28,29] Issa et al [30] reported that post-operative IOP could be presumed by the relationship between preoperative IOP and ACD before surgery. The average CCT was 548.62±24 µm both pre-operatively and post-operatively. After doing the paired t-test, the post-operative IOP reduction was significantly associated with pre-operative IOP, $p<0.001$ and ACD<0.001. The average IOP reduction after one month was 1.92±0.64 mmHg. Poley BJ et al [30] also showed that Phacoemulsification with PCIOL implantation has a long term effect on post-operative IOP in normotensive and ocular hypertensive eyes. Yang et al [32] reported that the preoperative IOP, lens thickness, ACD, angle opening distance and anterior chamber area were strongly associated with postoperative IOP change. But AL and CCT have no association with post-operative IOP change. In this study, we also observed that CCT and AL are not associated but, preoperative IOP and ACD is strongly associated with post-operative IOP change.

Preoperative IOP was measured the day before surgery when the pupil was constricted. So, dilating drop has no effect on IOP measurement. We have also analyzed the IOP in the untreated fellow eye at the same time. It helps us to find out if there is any probability error in IOP measurement before and after surgery in treated eyes. In spite of the factors that may influence the IOP like time of IOP estimation, globe pressure, season, weather, a medication used or not etc., there was no clinically and statistically significant difference found between preoperative and post-operative IOP values in untreated fellow eyes after one month. This result gives strong evidence that no significant measurement error occurred in the estimation of IOP in treated eyes.

## Conclusion

IOP is significantly reduced after PE with IOL implantation surgery in normal eyes having age-related cataracts. In addition to preoperative IOP, ACD is significantly associated with postoperative IOP reduction. The preoperative IOP is proportional to post-operative IOP reduction, and the more the increase in preoperative IOP, the decrease in post-operative IOP is more.

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