

# Early Post – Operative Intraocular Pressure Rise between Phacoemulsification and Phacotrabeculectomy in Primary Open Angle Glaucoma Patients: A Comparison

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## ABSTRACT

**Introduction:** Phacoemulsification with intraocular lens implantation and triple procedure (phacoemulsification with intraocular lens implantation with trabeculectomy) are associated with a significant intraocular pressure rise during the early post – operative period. The study was undertaken to compare the outcome with respect to early post – operative intraocular pressure rise between phacoemulsification and phacotrabeculectomy in primary open angle glaucoma patients with moderate optic nerve head damage and visually significant cataract.

**Material and Methods:** Out of 95 patients, 41 underwent phacoemulsification and 54 underwent phacotrabeculectomy. Intraocular pressure was measured 6 hours after surgery.

**Results:** The patients' age, sex ratio and ratio of right eye to left eye did not differ significantly between the two groups. In phacoemulsification group, pre - operative intraocular pressure was  $16.32 \pm 2.09$  mm Hg and intraocular pressure at 6 hours was  $16.41 \pm 3.52$  mm Hg. Change in intraocular pressure was statistically not significant ( $P = 0.863$ ). In phacotrabeculectomy group, pre - operative intraocular pressure was  $17.39 \pm 2.57$  mm Hg and intraocular pressure at 6 hours was  $16.07 \pm 4.11$  mm Hg. Change in intraocular pressure was statistically not significant ( $P = 0.053$ ). A total of 6 patients in phacoemulsification group and 2 patients in phacotrabeculectomy group had an intraocular pressure rise of  $\geq + 5$  mm Hg. Change in intraocular pressure at 6 hours between the two operative groups was statistically not significant ( $P = 0.268$ ).

**Conclusion:** We found no added advantage in doing a phacotrabeculectomy as against phacoemulsification with respect to early post - operative intraocular pressure spikes in primary open angle glaucoma patients with moderate glaucomatous damage and visually significant cataract.

**Keywords:** Phacoemulsification, Phacotrabeculectomy, Post – operative Intraocular Pressure Rise

additional irreversible glaucomatous optic nerve head damage and visual field loss during this period of intraocular pressure spike.

Krupin T, et al<sup>5</sup>, found that on post – operative day 1, intraocular pressure rise of  $\geq 10$  mm Hg was observed in 69% of patients who underwent only cataract surgery and in 14% who underwent combined surgery. They concluded that combined surgery reduced the frequency and magnitude of immediate post – operative intraocular pressure spikes but did not totally eliminate it.

A study by Hitoshi Yasutani, et al<sup>6</sup>, showed that the mean intraocular pressure in primary open angle glaucoma group was significantly higher than in control group, although no significant difference was found pre – operatively. They concluded that intraocular pressure shortly after surgery was significantly greater in eyes with primary open angle glaucoma than in non – glaucomatous eyes.

Hopkins JJ, et al<sup>7</sup>, found that 4 hours after surgery, 5.5% of patients undergoing combined surgery had intraocular pressure  $\geq 30$  mm Hg, compared to 22.7% of phacoemulsification patients. However, no significant difference in intraocular pressure was found between the groups at post – operative day 1 or day 7. These results suggested that triple surgery protected against early post – operative elevation of intraocular pressure. Paulsen, et al<sup>8</sup> showed that intraocular pressure decreased significantly in both groups (phacoemulsification and phacotrabeculectomy), but patients with combined procedure had fewer intraocular pressure elevations and significantly less medications.

The purpose of this study was to compare the intraocular pressure rise in the early post – operative period between phacoemulsification with intraocular lens implantation (Phaco – IOL) and phacoemulsification with intraocular lens implantation with trabeculectomy (Phaco – Trab) in patients with primary open angle glaucoma.

## INTRODUCTION

Although the management of cataract in patients with glaucoma has changed over the past two decades, the best approach to combined cataract and glaucoma remains controversial. In most cases, where glaucoma is medically controlled, most surgeons would prefer to do a cataract extraction with intraocular lens implantation alone. Triple procedure (cataract extraction with intraocular lens implantation with trabeculectomy) is the preferred choice of treatment in patients with cataract co – existing with medically uncontrolled glaucoma.

However, these procedures are associated with a significant intraocular pressure rise during the early post – operative period.<sup>1-4</sup> Although the pressure can usually be brought under control within the first few post – operative days, patients with advanced glaucomatous damage before surgery may suffer

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**How to cite this article:** M. Shiraz Ali, Rajiv Kumar Gupta. Early post – operative intraocular pressure rise between phacoemulsification and phacotrabeculectomy in primary open angle glaucoma patients: a comparison. International Journal of Contemporary Medical Research 2017;4(3):781-784.

## MATERIAL AND METHODS

It was a prospective, non – randomized study conducted at Regional Institute of Ophthalmology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India over a period of 2 years. This study was conducted according to the principles of Helsinki Declaration on research involving human subjects.<sup>9</sup> Our Institutional Ethics Committee approved the protocol for the study. Written informed consent was obtained from all subjects who participated in the study. Confidentiality was maintained.

### Inclusion Criteria

Patients with primary open angle glaucoma and with visually significant cataract and :

1. Age  $40 \geq$  years
2. In whom optic nerve head could be clinically visualized with a + 90 dioptre lens
3. Moderate optic nerve head damage (Cup : Disc ratio  $> 0.6$  but  $< 0.8$ , as ascertained by two glaucoma specialists)
4. Intraocular Pressure  $\leq 21$  mm Hg on medications
5. Intraocular Pressure  $> 21$  mm Hg, if untreated

### Exclusion Criteria

1. One – Eyed patients
2. Primary angle closure glaucoma
3. Secondary glaucomas
4. Juvenile glaucoma
5. Ocular trauma / Laser / Surgery within past 6 months
6. Advanced glaucoma (Cup : Disc ratio  $\geq 0.8$ )
7. Intolerance to any medication
8. Uncontrolled systemic diseases like diabetes mellitus, systemic hypertension and cardiac disease

95 adult patients were enrolled into the study. Patients who were on 1 medication and in whom intraocular pressure was  $\leq 21$  mm Hg prior to surgery were assigned to phacoemulsification with intraocular lens implantation (Phaco – IOL) alone. Patients on  $> 1$  medication and those who were untreated were assigned to phacoemulsification with intraocular lens implantation with trabeculectomy (Phaco – Trab). 41 patients underwent Phaco – IOL and 54 patients underwent Phaco – Trab.

All eyes were examined thoroughly 7 – 10 days before surgery. At this time, uncorrected and corrected Snellen visual acuity, slit – lamp anterior segment examination, Goldmann applanation tonometry, gonioscopy, visual field analysis and dilated fundus evaluation with + 90 dioptre lens and indirect ophthalmoscope were performed.

Patients continued their regular medications until surgery and no sedation was given before surgery. All to – be – operated eyes were started on moxifloxacin 0.5% eye drops 6 times on the day before surgery. The eyes were dilated with topical tropicamide 0.8% and phenylephrine 5% before surgery.

All surgeries were performed by a single surgeon.

### Surgical Technique

Both procedures, Phaco – IOL and Phaco – Trab were done using Alcon Laureate phacoemulsification system.

For both procedures, peribulbar block was given using lignocaine hydrochloride 2%, bupivacaine 0.5% and hyaluronidase 1500 IU.

### Phaco – IOL

A temporal clear corneal incision was made and anterior

chamber was entered with a 2.8 mm disposable angled keratome blade. 2 side – port incisions were made using super blade. After injection of hydroxypropylmethylcellulose 2% viscoelastic material into the anterior chamber, a capsulorrhexis of 4.5 – 5.0 mm diameter was made, followed by hydrodissection and hydrodelineation. A “Stop and Chop” technique was used for phacofragmentation. Residual cortex was removed using bimanual technique. Viscoelastic material was injected to extend the capsular bag. A 6 mm optic, 13 mm haptic, single piece foldable intraocular lens was implanted in the capsular bag using the same main incision. A meticulous viscoelastic material removal was performed using the bimanual technique. Anterior chamber was reformed by hydrating the side – ports. Subconjunctival injection of dexamethasone and gentamycin was given. Eye pad and bandage was applied after instillation of moxifloxacin 0.5% and povidone iodine 5% eye drops.

### Phaco – Trab

A 6 mm fornix – based conjunctival flap in superonasal or superotemporal quadrant was raised. Adequate cautery was done to achieve hemostasis. A  $4 \times 3$  mm triangular, partial thickness scleral flap was dissected. Polyvinyl alcohol sponges soaked in Mitomycin C (0.2 mg/ml) were placed under the conjunctival flap as well as under the scleral flap for 3 minutes. After removal of sponges, the treated area was thoroughly irrigated with 30 ml of balanced salt solution.

After this, the surgeon changed his position to perform phacoemulsification through clear corneal incision temporally. Rest of the steps of cataract surgery were similar to those as of in Phaco – IOL group till viscoelastic material removal.

The surgeon again changed his position to complete trabeculectomy superonasally or superotemporally. Anterior chamber was entered beneath the scleral flap with a 2.8 mm disposable angled keratome blade. By means of Kelly’s descemets membrane punch, a sclerostomy of  $3 \times 1$  mm was created. A peripheral iridectomy was done with vannis scissors. Scleral flap was closed with 3 fixed 10 – 0 nylon sutures; one for the apex of triangular flap and one on each side of the flap. Anterior chamber was reformed by hydrating the side – ports. Conjunctiva was closed with 2 wing 8 – 0 vicryl sutures. Subconjunctival injection of dexamethasone and gentamycin was given. Eye pad and bandage was applied after instillation of moxifloxacin 0.5% and povidone iodine 5% eye drops.

### Main Outcome Measure

Intraocular pressure was measured 6 hours post – operatively using a Goldmann applanation tonometer by a single observer in all patients. Average of 3 readings was taken. Same tonometer was used in all patients. This observer (Observer No. 1) was not masked to the type of surgery. However, to eliminate the bias in intraocular pressure measurements, a different observer (Observer No. 2) took the intraocular pressure readings after the knob of the tonometer had been adjusted (when there was proper overlap of fluorescent semicircles) by the Observer No. 1.

## STATISTICAL ANALYSIS

All the analysis were performed using SPSS (Version 12). For categorical variables, chi square test was used. Paired t – test (one – side) was used to compare pre – operative and post – operative intraocular pressure. Independent t – test, Mann

Whitney test (two – side) was used to compare the two operative procedures.  $P < 0.05$  was considered significant.

**RESULTS**

The 95 patients who were originally recruited and assigned to each group completed all scheduled examinations without dropouts and all data were collected.

All surgeries were uneventful.

**All Patients**

The mean age of patients was  $62.87 \pm 7.90$  years. There were 55 (57.89%) males and 40 (42.11%) females. Regarding laterality, 49 (51.58%) were right eyes and 46 (48.42%) left eyes.

**Phaco – IOL and Phaco – Trab Groups**

The mean age in the Phaco – IOL group was  $62.37 \pm 6.84$  years and in the Phaco – Trab group,  $63.26 \pm 8.67$  years.

The patients’ age, sex ratio and ratio of right eye to left eye did not differ significantly between the 2 groups [Table 1].

**Phaco – IOL Group**

The mean pre – operative intraocular pressure was  $16.32 \pm 2.09$  mm Hg and intraocular pressure at 6 hours was  $16.41 \pm 3.52$  mm Hg. The change in intraocular pressure was statistically not significant ( $P = 0.863$ ) [Table 2]. A total of 5 patients at 6 hours had an intraocular pressure rise of 5 mm Hg or more but less

than 10 mm Hg. Only 1 patient had an intraocular pressure rise of 10 mm Hg or more at 6 hours [Table 4].

**Phaco – Trab Group**

The mean pre – operative intraocular pressure was  $17.39 \pm 2.57$  mm Hg and intraocular pressure at 6 hours was  $16.07 \pm 4.11$  mm Hg. The change in intraocular pressure was statistically not significant ( $P = 0.053$ ) [Table 3]. None of the patients at 6 hours had an intraocular pressure rise between 5 and 10 mm Hg. However, 2 patients had an intraocular pressure rise of 10 mm Hg or more at 6 hours [Table 4].

**Comparison Between Phaco – IOL and Phaco – Trab Groups**

When both the operative procedures were compared, the change in intraocular pressure at 6 hours was found to be statistically not significant ( $P = 0.268$ ) [Table 5].

**DISCUSSION**

Transient IOP elevation often complicates cataract surgery in otherwise normal individuals.<sup>3</sup> These IOP elevations can occur in eyes with no history of prior glaucoma. Between 15% to 60% of non - glaucomatous eyes have intraocular pressure elevations during the first 24 hours after surgery. The maximum mean IOP elevations occurs between 3 and 24 hours after surgery. Whether to perform cataract surgery alone or combine it with trabeculectomy is an important clinical decision when treating patients who have primary open angle glaucoma with visually significant cataracts.

Hopkins JJ, et al<sup>7</sup> conducted a study to determine the efficacy of combined phacoemulsification and trabeculectomy in preventing early post – operative increase in intraocular pressure. They found that 4 hours after surgery, 5.5% of patients that had undergone combined surgery had intraocular pressure greater than 30 mm Hg, compared with 22.7% of phacoemulsification patients and they concluded that triple surgery protected against early post – operative elevation in intraocular pressure.

In contrast, in our study, 6 hours after surgery, only 1 patient (2.45%) in the Phaco – IOL group and 2 patients (3.70%) in the Phaco – Trab group had an intraocular pressure greater than 28 mm Hg.

A study by Paulsen et al<sup>8</sup> showed that intraocular pressure decreased significantly in both groups (phacoemulsification and phacotrabeculectomy), but patients with combined procedure had fewer early intraocular pressure elevations.

We also found similar results as noted by Paulsen et al.<sup>8</sup> 6 patients (14.63%) in Phaco – IOL group and 2 patients (3.70%) in Phaco – Trab group had intraocular pressure rise of  $\geq 5$  mm Hg.

In our study, in the Phaco - IOL group, the mean pre - operative intraocular was  $16.32 \pm 2.09$  mm Hg and intraocular pressure at 6 hours was  $16.41 \pm 3.52$  mm Hg. The increase in intraocular pressure was statistically not significant at 6 hours from the pre - operative intraocular pressure ( $P = 0.863$ ). In the Phaco - Trab group, the mean pre - operative intraocular pressure was  $17.39 \pm 2.57$  mm Hg and intraocular pressure at 6 hours was  $16.07 \pm 4.11$  mm Hg. The increase in intraocular pressure was statistically

Parameter	Phaco – IOL Group	Phaco – Trab Group	P Value
Mean Age (Years)	$62.37 \pm 6.84$	$63.26 \pm 8.67$	0.588
Sex Ratio (Male : Female)	25 : 16	30 : 24	0.596
Laterality (Right Eye : Left Eye)	22 : 19	29 : 25	0.997

**Table-1:** Baseline Characteristics

Time	No. of Eyes (n)	Mean $\pm$ SD IOP (mm Hg)	IOP Range (mm Hg)	p value
Pre – Op	41	$16.32 \pm 2.09$	10 – 21	0.863
At 6 Hours	41	$16.41 \pm 3.52$	10 – 28	

**Table-2:** Phaco – IOL Group

Time	No. of Eyes (n)	Mean $\pm$ SD IOP (mm Hg)	IOP Range (mm Hg)	P value
Pre – Op	54	$17.39 \pm 2.57$	10 – 23	0.053
At 6 Hours	54	$16.07 \pm 4.11$	10 – 29	

**Table-3:** Phaco – Trab Group

Rise in IOP (mm Hg)	Phaco – IOL Group (n)	Phaco – Trab Group (n)
$\geq + 5$ and $< + 10$	5	0
$\geq + 10$	1	2

**Table-4:** No. of Patients with Rise in IOP of  $\geq + 5$  mm Hg at 6 Hours

	Phaco – IOL Group (mm Hg)	Phaco – Trab Group (mm Hg)	Z Value	P Value
Change in IOP at 6 hours	51.35	45.45	- 1.108	0.268

**Table-5:** Change in IOP at 6 Hours (Mean Rank)

not significant at 6 hours from the pre - operative intraocular pressure ( $P = 0.053$ ). The change in intraocular pressure at 6 hours between the 2 operative groups was statistically not significant ( $P = 0.268$ ).

The results from our study suggested that there was no statistically significant elevation of intraocular pressure in eyes with moderate glaucomatous optic nerve head damage at 6 hours in eyes subjected to phacoemulsification with intraocular lens implantation alone, as compared to eyes that had trabeculectomy with phacoemulsification with intraocular lens implantation.

It is expected that in eyes with moderate optic nerve head damage, the resistance to aqueous outflow may only be moderate with ability to withstand any factors likely to increase intraocular pressure in the early post - operative period, thereby preventing any acute intraocular pressure spike in the early post - operative period.

Trabeculectomy combined with phacoemulsification also increases surgical time, cost of surgical procedure and also entail prolonged visual recovery. These patients also require frequent follow up visits for assessment of bleb function and possible suturolysis.<sup>10</sup>

Recent reports also suggest that prolonged intraocular pressure control is better with clear corneal phacoemulsification and intraocular lens implantation followed by trabeculectomy as a two - staged procedure separated by few weeks to months.<sup>11</sup>

## CONCLUSION

We found no added advantage in doing a triple procedure as against phacoemulsification with posterior chamber intraocular lens implantation only with respect to early post - operative intraocular pressure spikes. Hence, phacoemulsification with posterior chamber intraocular lens implantation is a feasible option as is triple procedure in patients with primary open angle glaucoma and with moderate glaucomatous optic nerve head damage and visually significant cataract.

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**Source of Support:** Nil; **Conflict of Interest:** None

**Submitted:** 03-03-2017; **Accepted:** 04-04-2017; **Published:** 15-04-2017