

A Study of Outcome of Cataract Surgery in Patients with Pre-operative Ocular Co-morbidities

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Abstract: *Purpose* - To determine pattern of ocular co – morbidities & their influence on post operative visual outcome in patients subjected to cataract surgery. *Method* - Study was observational & prospective. Patients having cataract with local co-morbidities were subjected to MSICS, after detailed ocular examination and investigations. Necessary intra – op modifications pertaining to ocular co-morbidities were done. Patients were followed up on 1st, 7th & 30th Post op days and BCVA was recorded. *Results* – 42 eyes of 42 patients were included in study. 59.52% of the subjects were male and 40.47% were females. ARMD was the most common co – morbidity (28.5%), followed by Pseudo-exfoliation (23.80%). 11.9% of the patients had Diabetic retinopathy (DR), 9.52% of the patients had glaucoma and CNVM. 9.52% patients were found to have RD. Corneal disease was present in 7.14% of patients. 4.76% of patients had pterygium. There was improvement in BCVA post operatively in patients having ARMD, PXF, DR & Pterygium. But in patients with Corneal disease, Glaucoma, RD and CNVM, the improvement in BCVA was less evident. Presence of ocular co- morbidities pre operatively in patients subjected to MSICS has adverse effect on post operative outcome of the surgery. *Conclusion* - Identification of pre existing ocular co – morbidities in patients undergoing cataract surgery by necessary investigations in order to control the co – morbidities and to customise surgical plan, will help in improving outcome of cataract surgery along with quality of life in patients.

Keywords: Age Related Macular Degeneration (ARMD), Psuedoexfoliation (PXF), CNVM (Choroidal Neovascular Membrane), Topography, Specular Microscopy, Best Corrected Visual Acuity (BCVA), Retinal Detachment (RD)

1. Introduction

Globally, cataract is the major cause of blindness accounting for 51% of total blindness and there are regional variations, with America having the lowest prevalence and the highest being in South-East Asia [1]. Cataract surgery is one of the most commonly performed ophthalmic surgeries. Under expert hands cataract surgery yields 100% results, when not associated with ocular co- morbidities. In patients having pre- operative co-morbidities, the outcome of the cataract surgery is not satisfactory even under expert hands. Studies have shown wide variability in terms of post-operative visual outcomes following cataract surgery.

The World Health Organization (WHO) recommends that poor visual acuity (V/A < 6/60) or borderline visual acuity

(V/A <6/18–6/60) following cataract surgery should not exceed more than 5% each after best available correction [1].

Many studies reported that 30–40% of eyes undergoing cataract surgery have a postoperative Best corrected visual acuity (BCVA) less than 6/60, which does not meet the individual's daily visual requirement in developing countries [1].

One of the reasons given for such poor visual outcomes have been pre-existing ocular co-morbidities. Reported prevalence of ocular co-morbidities in patients undergoing cataract surgery is from 26-49%. Various studies show that Age related macular degeneration (ARMD), Diabetic retinopathy (DR), Glaucoma, refractive errors, Pseudoexfoliation (PXF) and such others are the most frequently associated ocular co-morbidities. Deep set eyes also pose as an intra op challenge during cataract surgery [2].

Furthermore, the studies have shown a significant association of pre existing ocular co- morbidity with poor post op visual outcomes. This warrants a need for early diagnosis and treatment of the same to achieve favourable surgical outcome. Also there is a need for devising a case based protocol to improve the surgical outcome and minimise the morbidity.

This study was undertaken to determine the pattern of ocular co – morbidities in patients subjected to cataract surgery and also to study the influence of pre – existing co – morbidities on the post- operative visual outcome.

2. Methods

The study was carried out in our ophthalmology OPD from June 2021 to December 2021. The study was conducted in accordance with the ethical standards of declaration of Helsinki. Patients having pre-existing ocular co-morbidity along with cataract and who underwent cataract surgery was considered as the inclusion criteria. Patients not willing to give consent to participate in the study & Pediatric cataracts were considered as exclusion criteria for the study. The study was an observational, prospective study.

Informed written consent of the subject to participate in the study was taken. Detailed medical and ocular history were taken. The examination included Best corrected visual acuity (BCVA) measurement with Snellen's visual acuity chart. Intra ocular pressure (IOP) was measured for all the cases using non contact tonometer (TOPCON, U.S). Anterior segment evaluation using slit lamp (TOPCON, U.S) was done to grade the cataract and also to note the pre operative ocular co- morbidity if any. Dilated Posterior segment examination using indirect ophthalmoscope after dilating the pupils by "tropicamide (0.8%) + phenylephrine (5%)" eyedrops was done. The existing ocular co-morbidity was noted and additional specific investigations pertaining to the pre-existing co-morbidity like Optical coherence tomography (OCT) in cases of suspected ARMD, DR & CNVM. B scan in case of RD, Glaucoma OCT, Specular microscopy, applanation tonometry in cases of Glaucoma suspects, Specular microscopy in case of corneal diseases were performed. Photo documentation (Refer to Figure 1 & Figure 3) of the co-morbidity was done pre-operatively wherever possible, using slit-lamp photography and fundus photography. A scan was done in each case to calculate the axial length and thereby the IOL power. All the patients were subjected to manual small incision cataract surgery with rigid PCIOL under local anaesthesia, after physician fitness in every case. All the surgeries were done by the same experienced surgeon. Certain modifications in the surgery with respect to the co-morbidity like, temporal incision in case of glaucoma patients, stretch pupiloplasty, iris hooks & usage of adrenaline intracamerally in case of PXF small pupil cases (refer to Figure 1) were carried out. Intra-operative complications if any, were noted. Post – operatively the patient was started on topical antibiotic with steroid (1% Prednisolone & 0.5% moxifloxacin), topical cycloplegic agents like 2% homatropine and topical 5% sodium chloride

preparation. Also additional topical drugs like anti-glaucoma drugs wherever required were advised. Detailed ocular examination was done on 1st, 7th and 30th post op days and the outcome was assessed in the form of BCVA. Anterior and posterior segment evaluation along with analysis of the post operative complications was done.



Figure 1. Small pupil with PXF.

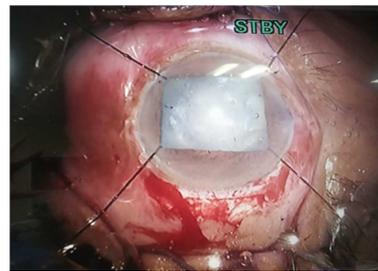


Figure 2. Iris hooks used intra operatively for a case of small pupil in a cataract surgery.



Figure 3. Macular grade corneal scar with cataractous lens – Pre operative.



Figure 4. Figure 3 post operative.

3. Results

The study included 25 (59.52%) male subjects, 17 (40.47%) female subjects.

There was 1 subject (2.3%) in the 40 – 49 yrs age group, 3 subjects (7.14%) in 50 – 59 yrs age group, 21 subjects (50%) in 60 – 69 yrs age group, which was the highest number of subjects in a particular age group.

There were 12 subjects (28.57) in the 70 – 79 yr age group, while there were 5 subjects (11.90) above the age of 80 yrs.(Refer to table 1).

The cataract grade distribution among the subjects was as follows, 9 patients (21.42%) had NS 1 grade, 20 (47.61%) of them had NS 2 grade, 6 (14.28%) of the patients had NS 3 grade, 2 (4.76%) patients had NS 4 grade and 5 (11.90%) of them had mature cataract.(Refer to table 2).

Thirty seven (88.09%) of the patients had nuclear cataract, 28 (66.66%) of them had cortical cataract. 19 (45.23%) patients were found to have posterior subcapsular cataract (PSC), while 5 (11.90%) of them had mature cataract (Refer to table 3).

Among the ocular co – morbidities seen in the operated patients for cataract surgery, ARMD was the most commonly present co – morbidity (28.5%), with Pseudo-exfoliation being the next common co – morbidity (23.80). 11.9% of the patients were found to have DR, 9.52% of the patients had glaucoma and CNVM. Also 9.52 patients were found to have RD. Corneal disease was present in 7.14% of the patients. 4.76% of the patients had pterygium (Refer to table 4).

The distribution of BCVA among patients with different co – morbidities pre operatively is illustrated in table 5 (Refer to table 5).

The distribution of BCVA among patients with different co – morbidities post operatively is illustrated in table 6 (Refer to table 6).

On Comparison of tables 5 & 6, there is improvement in the BCVA of post operative patients having ARMD, PXF, DR & Pterygium. But in patients with Corneal disease, Glaucoma, RD and CNVM, the improvement in BCVA is less evident.

Comparison of the Pre – op & Post op BCVA among the study population is illustrated in table 7 (Refer to table 7).

Comparison of the pre op and post op mean BCVA in LogMAR with respect to the associated co- morbidity is given in table 8 (Refer to table 8).

The additional investigations done pre operatively and intra op modifications in the cataract surgery according to the co morbidity are explained in table 9 (Refer to table 9).

(Figure 1) shows small pupil with PXF for which investigations like - Specular microscopy, Glaucoma OCT were done and intra op modifications like - Intracameral adrenaline / Stretch pupiloplasty / sphincterotomy/(Figure 3) Iris hooks were made use of.

Figure 3 & Figure 4 are photo documentation of corneal scar of macular grade with cataract pre operatively and the same patient after cataract surgery. There was no particular intra operative modification in this case.

Table 1. Distribution of patients according to gender and age (n=42).

| Age (in years) | Male | Female | Percentage (%) | |
|----------------|------|--------|----------------|--------|
| 40-49 | 0 | 1 | 0 | 2.3 |
| 50-59 | 2 | 1 | 4.76 | 2.3 |
| 60-69 | 12 | 9 | 28.57 | 21.42 |
| 70-79 | 8 | 4 | 19.04 | 9.52 |
| >80 | 3 | 2 | 7.14 | 4.76 |
| TOTAL NO. | 25 | 17 | 59.52% | 40.47% |

Table 2. Distribution of patients according to grading of cataract (n = 42).

| Grade | No. of patients | Percentage (%) |
|-------------|-----------------|----------------|
| NS 1 | 9 | 21.42 |
| NS 2 | 20 | 47.61 |
| NS 3 | 6 | 14.28 |
| NS 4 | 2 | 4.76 |
| MATURE | 5 | 11.90 |
| HYPERMATURE | 0 | 0 |

Table 3. Distribution of patients according to type of cataract (n = 42).

| Type of cataract | No. of Patients | Percentage (%) |
|-----------------------|-----------------|----------------|
| Nuclear | 37 | 88.09 |
| Cortical | 28 | 66.66 |
| Posterior subcapsular | 19 | 45.23 |
| Posterior polar | 0 | 0 |
| Mature | 5 | 11.90 |
| Hyperature | 0 | 0 |

Table 4. Distribution of Pre operative ocular co – morbidities in cataract surgery operated patients (n=42).

| Ocular co-morbidity | No. of patients | % of patients |
|----------------------|-----------------|---------------|
| ARMD | 12 | 28.5 |
| PXF | 10 | 23.80 |
| Diabetic retinopathy | 5 | 11.9 |
| Glaucoma | 4 | 9.52 |
| Retinal detachment | 4 | 9.52 |
| CNVM | 4 | 9.52 |
| Corneal disease | 3 | 7.14 |
| Pterygium | 2 | 4.76 |

Table 5. Pre operative Best corrected visual acuity in various ocular co – morbidities.

| OCULAR CO - MORBIDITY | No. of patients with BCVA < 6/60 | No. of patients with BCVA 6/60 – 6/24 | No. of patients with BCVA 6/18 – 6/6 |
|-----------------------|----------------------------------|---------------------------------------|--------------------------------------|
| ARMD | 2 | 6 | 4 |
| Diabetic retinopathy | 0 | 3 | 2 |
| PXF | 1 | 4 | 5 |
| Glaucoma | 2 | 1 | 0 |
| Corneal disease | 1 | 2 | 1 |
| Retinal detachment | 4 | 0 | 0 |
| CNVM | 0 | 4 | 0 |
| Pterygium | 1 | 0 | 1 |

Table 6. Post operative Best corrected Visual acuity in patients with various ocular co – morbidities n = 42.

| OCULAR CO – MORBIDITY | No. of patients with BCVA < 6/60 | No. of patients with BCVA 6/60 – 6/24 | No. of patients with BCVA 6/18 – 6/6 |
|-----------------------|----------------------------------|---------------------------------------|--------------------------------------|
| ARMD | 0 | 0 | 12 |
| Diabetic retinopathy | 0 | 4 | 1 |
| PXF | 0 | 1 | 9 |
| Corneal disease | 0 | 2 | 1 |
| Glaucoma | 1 | 2 | 1 |
| Retinal detachment | 4 | 0 | 0 |
| CNVM | 0 | 2 | 2 |
| Pterygium | 0 | 0 | 2 |

Table 7. Comparison of Pre & Post op BCVA.

| | Pre operative BCVA | Post operative BCVA |
|-------------|--------------------|---------------------|
| < 6/60 | 11 | 5 |
| 6/60 – 6/24 | 20 | 11 |
| 6/18 – 6/6 | 13 | 28 |

Table 8. Comparison of pre & post op BCVA in each co – morbidity studied.

| Co - morbidity | Pre – op mean BCVA (LogMAR) | Post – op mean BCVA (LogMAR) |
|----------------------|-----------------------------|------------------------------|
| CNVM | 0.85 | 0.55 |
| RD | 2.51 | 2.4 |
| Glaucoma | 1.45 | 1.22 |
| Corneal disease | 1.8 | 0.6 |
| Diabetic Retinopathy | 0.72 | 0.16 |
| PXF | 0.86 | 0.19 |
| ARMD | 0.96 | 0.10 |
| Pterygium | 1.75 | 0.10 |

Table 9. Additional investigations done pre operatively and intra op modifications according to the co morbidity.

| Co Morbidity | Additional investigations pre operatively | Intra operative modifications |
|----------------------|---|--|
| CNVM | OCT – Macula, Fundus photograph | - |
| RD | Ascan in silicon oil mode | - |
| Glaucoma | Applanation tonometry, Glaucoma OCT, Angle OCT, Specular microscopy | Peripheral iridectomy |
| Corneal disease | AS OCT, Specular microscopy, photodocumentation | - |
| Diabetic Retinopathy | Fundus photograph, OCT -Macula, B Scan | Intravitreal Anti – VEGF |
| PXF | Photodocumentation, Specular microscopy, Glaucoma OCT | Intracameral adrenaline / Stretch pupiloplasty, sphincterotomy, Iris hooks |
| ARMD | OCT – Macula, Fundus photograph | - |
| Pterygium | Keratometry & corneal topography | Pterygium excision with sliding autograft |

4. Discussion

Several studies show that the existence of an ocular co-morbidity in the eye to be operated for cataract is related to a poor self assessed functional outcome [3]. Assessment of cataract surgery outcomes and factors associated with it is important for improvising cataract management. The aim of this study was to determine the visual outcome in such patients with ocular co-morbidities and to analyse factors associated with poor post operative visual outcome.

This study was an observational and prospective study, conducted in a tertiary care teaching hospital in western Maharashtra for a period of 6 months i.e from June 2021 to December 2021. The study included 42 eyes of 42 patients.

It was observed that 59.52% of the subjects were male and 40.47% of them were females. The mean age was found to be 67.09 yrs. in our study, while in study conducted by Markos, Tamrat LT & Asferaw MA [1] it was found to be 64.16 yrs.

All of the 42 patients underwent manual small incision cataract surgery by a single surgeon.

It was noted that of the 42 patients, 5 patients (11.90%) had mature cataract, while majority of the patients had grade 2 nuclear sclerosis i.e 20 patients (47.61%). 37 patients in total had nuclear sclerosis, 28 patients (66.66%) had cortical cataract and 19 patients (45.23%) had posterior polar cataract.

The ocular co-morbidities that were come across in this study were Age related macular degeneration (ARMD) (28.50%), Pseudoexfoliation (23.80%), Diabetic retinopathy (DR) (11.90%), Glaucoma (9.52%), Retinal detachment (RD) (9.52%), Choroidal neovascular membrane (CNVM) (9.52%), Corneal diseases including Band shaped keratopathy & spheroidal degeneration were seen in 7.14%. Pterygium was noted in 4.76% of patients.

Our study showed ARMD to be the most prevalent ocular co-morbidity being 28.05% of the study population. In study conducted by Lundström M, Brege KG, Florén I, Lundh B, Stenevi U & Thorburn W [3] 13.7% AMD was noted, 4.10% in Markos CM, Tamrat LT, Asferaw MA [1], 5.1% in Riley AF, Malik TY, Grupcheva CN, Fisk MJ, Craig JP, McGhee CN [4] and 7.6% in a study conducted in West Africa by Murray

NL, Murray TN [5]. Careful pre operative evaluation was done in every case, performing necessary investigations like Optical coherence tomography (OCT) & Fundus photograph. The pre op mean BCVA was 0.96 LogMAR and post op mean BCVA of 0.11 LogMAR as opposed to post op mean BCVA of 0.4 LogMAR in study conducted by) Lundström M, Brege KG, Florén I, Lundh B, Stenevi U, Thorburn [3].

PXF was found in 23.08% of the cases in our study. In the study conducted by Markos CM, Tamrat LT, Asferaw MA [1]. PXF was seen in 32.2% cases, while 2.23% PXF cases were seen in a study conducted by Arthur D K, Kalaiselvi G [6]. As PXF was associated with small pupil size in 7 out of 10 cases, intra operatively use of intracameral adrenaline was used in all 7 cases, iris hooks (refer to Figure 1 & Figure 2) were used in 2 cases & stretch pupiloplasty was done in 3 cases to manage small pupil. Necessary additional investigations like specular microscopy, glaucoma oct along with photodocumentation of the PXF was done. Mean pre op BCVA was 0.86 LogMAR, while post op mean BCVA was 0.19 LogMAR in our study in cases having PXF. In a study conducted by Singh VM, Yerramneni R, Madia T, Prashanthi S, Vaddavalli PK, Reddy JC [7] mean post op BCVA in cases with PXF was found to be 0.15 LogMAR.

Diabetic retinopathy was found in 11.90% of cases in our study. 3.35% cases were seen in Arthur D K, Kalaiselvi G [6], 7.6% in Riley AF, Malik TY, Grupcheva CN, Fisk MJ, Craig JP, McGhee CN [4] (Auckland study), 3% in Stolk-Vos AC, Visser MS, Klijn S, Timman R, Lansink P, Nuijts R et al [8]. Pre operatively OCT, Fundus photograph & Bscan were done. There were 4 NPDR and one PDR patient. In all the cases Inj Bevacizumab was given Intra vitreally along with cataract surgery. In the PDR case PRP was also done pre operatively. Pre op mean BCVA was 0.72 LogMAR, while post op mean BCVA was 0.16 LogMAR. In a study by) Ridderskär, L., Montan, P., Kugelberg, M., Nilsson, I., Lundström, M., Behndig, A et al [9] the mean post op BCVA was 0.15 LogMAR, 0.50 LogMAR in a study by Krepler, K., Biowski R., Schrey, S, Jandrasits K, Wedrich A [10].

Primary open angle glaucoma was found in 9.52% of cases. In a study by Riley AF, Malik TY, Grupcheva CN, Fisk MJ, Craig JP, McGhee CN [4], 9.2%, 5.7% in a study by Markos CM, Tamrat LT, Asferaw MA [1], 11% by Stolk-Vos AC, Visser MS, Klijn S, Timman R, Lansink P, Nuijts R et al [8] had Glaucoma pre operatively. In these patients IOP measurement was done by Applanation tonometry followed by usage of topical anti glaucoma drugs including Travoprost, Brimonidine & Timolol. Additionally intravenous mannitol infusion was given in 2 cases where IOP control was unable to be achieved pre operatively with topical anti glaucoma drugs. Necessary investigations like Specular microscopy, Glaucoma OCT were done. Post operatively anti glaucoma medications were continued for IOP control. Post operatively Perimetry, Glaucoma OCT and regular IOP checks were done. Pre op mean BCVA was 1.45 LogMAR, while post op mean BCVA was 1.22 LogMAR. In a study by Lin Fu, the mean post op BCVA was 0.26 LogMAR in patients having Glaucoma.

Retinal detachment was seen in 9.52% cases, all of them treated with PPV with silicon oil internal tamponade. Four percent cases had previous RD in study by Stolk-Vos AC, Visser MS, Klijn S, Timman R, Lansink P, Nuijts R et al [8] while 0.6% in study by Riley AF, Malik TY, Grupcheva CN, Fisk MJ, Craig JP, McGhee CN [4]. Certain pre op assessment modifications like A-scan in silicon oil mode in patients with silicon oil filled globe were done. Mean pre op BCVA was 2.51 LogMAR, while mean post op BCVA was 2.4 LogMAR.

There were 9.52% cases with CNVM pre operatively, 3 of them diagnosed as Classic CNVM while one was occult CNVM. The mean pre op BCVA was 0.85 LogMAR, mean post op BCVA was 0.55 LogMAR. Necessary pre op investigations like OCT, Fundus photograph were done. There haven't been enough studies on pre op co- morbidity as CNVM.

Pterygium as an ocular co- morbidity was seen in 2 patients (4.76%) in our study population. In a study conducted by Patel Mitali G, Darshankumar K Mahyavanshi, Sunil Nayak, Aayushi Patel, Brijal Patel, Harsh Darji. [11], pterygium was seen in 3.07% patients. Both of the pterygia in our study were grade 2 nasal progressive pterygium. Their pre op mean BCVA was 1.75 LogMAR. Pre operatively keratometry and topography was done to measure the corneal astigmatism. In cases where Keratometric values were not recordable due to pterygium, K1/K2 values of the fellow eye were used for IOL power calculation. Pterygium excision with sliding autograft was done along with cataract surgery in these cases.

Corneal disease including Band shaped keratopathy, Corneal scarring & spheroidal degeneration were seen in 7.14% patients in our study. In a study by Riley AF, Malik TY, Grupcheva CN, Fisk MJ, Craig JP, McGhee CN [4], 1.8% cases had corneal disease, while 3.5% cases in the study by Markos CM, Tamrat LT, Asferaw MA. Pre operatively AS OCT in necessary cases, photodocumentation and specular microscopy were performed. Corneal haze in such conditions impedes visibility posing a challenge to the surgeon thereby affecting the post op outcome [12]. Mean pre op BCVA was found to be 1.8 LogMAR, while post op mean BCVA was 0.6 LogMAR in our study. In a study by Ho YJ, Sun CC, Chen HC [12] 0.9 LogMAR was found to be the post op BCVA.

Here we infer that presence of ocular co- morbidities pre operatively in patients subjected to manual small incision cataract surgery has an adverse effect on the post operative outcome of the surgery. Detecting the local co-morbidity using necessary additional investigations and modifying the intra -operative course accordingly helps in improving the outcome of cataract surgery [13, 14].

Merits of the study were detection of the associated ocular co-morbidities in patients undergoing cataract surgery in order to individualise the pre op assessment, modify the intra operative surgical plan and post operative care in order to improve the outcome of the cataract surgery. Also very few studies have documented the association of CNVM as a pre

existing ocular co -morbidity in patients undergoing cataract surgery.

Small study population including a limited number of co – morbidities is one of the main set back of the study. Also, there is no comparison with phacoemulsification surgery in our study.

5. Conclusion

Identification of pre existing ocular co – morbidities in patients undergoing cataract surgery by necessary investigations and adequate control of those co – morbidities, along with customisation of surgical plan according to the co – morbidity, will help improve the outcome of cataract surgery and thereby quality of life for these patients [15]. Also SICS with PCIOL implantation can be an alternative to phacoemulsification with foldable IOL in patients with pre operative ocular co-morbidities, specifically in patients with corneal diseases as phacoemulsification surgery can cause increased endothelial damage. Also phacoemulsification surgery requires more expertise and is more expensive.

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