

INCIDENCE OF POSTERIOR CAPSULAR OPACIFICATION WITH FOLDABLE ACRYLIC AND PMMA INTRAOCULAR LENS IMPLANTATION

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ABSTRACT

BACKGROUND

Posterior Capsular Opacification (PCO) is the commonest complication of cataract surgery today. There are considerable medical, social and economic adverse effects. The important factors to be considered for PCO among others are the IOL composition and design. The cost of any implant must be considered in developing countries like India. As compared to PMMA lens, a more expensive IOL must have significant advantages.

MATERIALS AND METHODS

This study included 140 subjects of which 70 patients (group A) had PMMA lens implant and the remaining 70 (group B) had a foldable acrylic lens implant. Time elapsed since surgery and PCO were graded in both the study groups.

RESULTS

This study shows that an important contributing factor for the development of PCO is the IOL material. PMMA lens implantation has demonstrated visually significant, early and higher number of PCO formation as compared to the acrylic group.

CONCLUSION

PCO develops earlier in patients with PMMA IOL implantation and is visually significant when compared to the acrylic IOL patients.

KEYWORDS

Phacoemulsification, Posterior Capsular Opacification, Intraocular Lens, Hydrophobic IOL, Polymethyl Methacrylate IOL.

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BACKGROUND

In the modern day, cataract surgery Posterior Capsular Opacification (PCO) is the commonest long-term complication and probably the commonest cause of non-refractive decreased postoperative vision.¹

PCO has important social, medical and economic adverse effects and there is a considerable interest in its prevention.² A number of variables including patient characteristics such as age and type of cataract, surgical variables such as capsulotomy type and size, Intraocular Lens (IOL) designs, placement and surgical technique have received attention in literature as possible factors involved in modulating PCO development.¹

In the manufacture of IOLs, Polymethyl Methacrylate (PMMA) has been conventionally used and considered as the gold standard till the advent of foldable lenses. With increased acceptance of phacoemulsification, foldable IOLs gained popularity as the standard procedure for cataract removal.³ Foldable intraocular lenses have allowed micro-incision surgery, typically involving smaller, self-sealing incisions with no sutures. As compared to rigid PMMA IOLs, foldable IOLs of a standard make are more expensive. To be cost-effective, the foldable IOLs must have distinct advantages.⁴ Visually significant PCO occurred in 7.1% patients with hydrophobic acrylic lens implantation as compared to 19.3% after PMMA lens implantation as reported by Auffarth et al.⁵

Foldable hydrophobic IOLs are the standard for implantation after phacoemulsification in the western world and is now being used increasingly in India as well. Cost of any implant is a consideration in developing countries like India. An expensive IOL must have significant advantages over the PMMA lens.

This study was designed for comparison of the incidence of posterior capsular opacification in patients with polymethyl methacrylate IOL and foldable acrylic IOL implantation after phacoemulsification.

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Aim of the Study

Comparison of the incidence of posterior capsular opacification in patients with polymethyl methacrylate IOL and foldable acrylic IOL implantation after phacoemulsification.

MATERIALS AND METHODS

The study included 140 subjects of which 70 patients were in group A and 70 in group B. Group A comprised of patients who had undergone phacoemulsification surgery with single piece PMMA intraocular lens implantation and group B of those with single piece hydrophobic acrylic intraocular lens implantation.

This study comprised of a prospective and a retrospective arm to analyse the extent of PCO and its impact on vision after phacoemulsification with foldable acrylic and PMMA IOLs. The retrospective arm comprised of patients who underwent uneventful phacoemulsification surgery at the base hospital between January to December 2012 with either a foldable acrylic or PMMA intraocular lens implantation.

The patients who underwent uneventful phacoemulsification surgery at the base between January to December 2013 with either foldable acrylic or PMMA intraocular lens formed the prospective arm of the study. Detailed ocular history including history of distorted vision, glare and duration of decreased vision was noted, if present. The type of surgery done, intraocular lens implanted and date of surgery was recorded from the patient’s medical records. Ocular examination included recording uncorrected visual acuity, both for near and distance of the enrolled subjects using Snellen’s chart. Best-corrected visual acuity was recorded through refraction done on subjects. Posterior capsular opacification was evaluated after mydriasis was achieved by topical tropicamide (1%).

The grading system used to record the extent of PCO is given in Table 1.⁶

Grade	Posterior Capsular Opacification
0	Clear capsule
1	Low-density peripheral involvement of quarter of the total capsule area
2	Medium-density peripheral involvement of half of the total capsule area
3	High-density total peripheral involvement of capsule area
4	High-density peripheral and central involvement of the capsule area

Table 1. Grading System Used to Record the Extent of PCO

Statistical Analysis- Collection of data was done as per the protocol and analysis was done using relevant statistical methods including Chi-square test, ‘t’ tests, Chi-square trend with SPSS for windows (version 21.0). Statistical significance was determined by a ‘p’ value ≤0.05.

RESULTS AND ANALYSIS

Age Distribution- The age of the patients in group A ranged between 41-80 years with mean age being 63.71 years and in group B ranged between 42-85 years with a mean age of 65.11 years. There was no statistically significant difference between the mean age of both groups (p=0.20).

Time Elapsed since Surgery- The average time elapsed since surgery in group A was 22.31 months (3-36 months). Average time elapsed since surgery for group B was 18.86 months (3-36 months). There was no statistically significant difference found between both the groups (p=0.06).

Development of PCO- 78.57% (55/70) in group A and 42.86% (30/70) in group B developed posterior capsular opacification. The difference between the two groups were found to be statistically significant (p=0.005) as shown in Table 2.

	Group A		Group B	
	No.	%	No.	%
Development PCO	55	78.57	30	42.86
No PCO	15	21.43	40	57.14
Total	70		70	

Table 2. Difference Between Development of PCO in Group A and Group B

Grade of PCO- The distribution of subjects according to grade of PCO as shown in Table 3.

Grade of PCO	Group A		Group B	
	No.	%	No.	%
0	15	21.43	40	57.14
1	20	28.57	19	27.14
2	18	25.71	5	7.14
3	14	20.00	5	7.14
4	3	4.29	1	1.43

Table 3. Distribution of Subjects According to Grade of PCO

The distribution of subjects with grade 1 PCO was found to be similar in both the groups with 28.57% (20/70) and 27.14% (19/70) in groups A and B, respectively. 54.28% (38/70) subjects in group A developed mild (grade 1 and 2) PCO compared to 34.28% (24/70) in group B. Severe form of PCO (grade 3 and 4) was more in group A (24.29%) as compared to group B (8.57%). Therefore, the distribution of PCO was statistically significant in between the two groups (p=0.00067).

Relation of PCO with Time Elapsed since Cataract Surgery- Majority of the patients developed PCO beyond 31 months in acrylic group and after 21 months in PMMA group. This comparison showed statistically significant difference in both the groups (p=0.001).

DISCUSSION

PCO is one of the commonest complication of cataract surgery today. The time period between cataract surgery and PCO varies widely ranging from 3 months to 4 years. Such patients develop blurred vision and glare like in cataract before the extraction.

The only way to treat PCO is Nd:YAG capsulotomy. It is relatively safe, but can lead to problems like IOL damage, IOP elevation, subluxation of IOL, uveitis, cystoid macular oedema and even retinal detachment. It is also a costly procedure, which poses a burden on the healthcare system. After cataract extraction with IOL implantation, the PCO varies significantly depending on the IOL design, optic material and surgical technique. Gold standard material used as IOL is PMMA. Its qualities include being biocompatible, inert and cost effective. Disadvantages include a higher rate of PCO and more astigmatism. Being a rigid IOL, it requires a large wound incision for implantation within the bag.

Cataract surgery has evolved over the time with phacoemulsification giving advantage of in the bag implantation of foldable IOL. In order to be cost effective, the foldable IOLs must have other advantages over the PMMA lens.

In this study, 78.57% (55/70) in group A and 42.86% (30/70) in group B developed PCO. The difference in both the groups was statistically significant ($p=0.05$). It has been reported that the incidence of PCO is about 10 to 50% within 2 years of cataract surgery.² Oner et al in their two years study found the PCO rate was 8.7% in acrylic and 24.7% in PMMA groups.⁷

In another study by Hennig et al, PCO rate was 23.3% in acrylic and 36.1% in PMMA groups at the end of one year.⁸ Hazra et al found that there was no difference in PCO formation between the rigid and foldable lens designs.⁹ According to Takkar et al, significant PCO is associated with PMMA IOLs.¹⁰

The hydrophobic nature of the acrylic lens contributes to the high capsular biocompatibility, which also explains the low PCO rate of this IOL as compared to hydrophilic acrylic IOLs.¹¹ Many experimental studies have shown that acrylic material shows strong adhesion between the posterior capsule and the acrylic optic. Nagata et al reported a mean adhesiveness of 2.76 GW for hydrophobic acrylic making it three times higher adhesive than PMMA (0.81 GW) with the lens capsule.¹² The role of IOL materials and its influence on the lens epithelial cells was shown by Hollick et al. Also, at the end of their two-year study, they found presence of lens epithelial cells on the posterior capsule of patients with acrylic IOLs to be much lower as compared to PMMA ($P=0.001$), which corroborates with the clinical finding of less PCO rate in the patients with acrylic IOL.² The difference in the PCO grade between the two groups was statistically significant ($p=0.00067$). Most of the patients in PMMA group were equally divided between grade 1 (28.57%), grade 2 (25.71%) and grade 3 (20.0%) PCO, whereas in the acrylic group majority were grade 1 PCO (27.14%). Grade 4 PCO was seen in 3 patients (4.29%) in PMMA and 1 patient (1.43%) in acrylic group.

The probability of developing PCO increased in the PMMA group as the duration of time elapsed since surgery increased and was found to be significant beyond 21 months of surgery ($p=0.001$). Similarly in the acrylic group, the probability of developing PCO increased beyond 31 months after phacoemulsification ($p=0.001$).

SUMMARY AND CONCLUSION

This study shows IOL material plays an important role in the development of PCO. According to this study, both the PMMA and acrylic IOLs develop PCO, but the difference is in between the time over, which it develops and how visually significant it is.

In contrast to the acrylic group, PMMA showed higher number of PCO formation. Visually significant PCO was seen more in PMMA and it developed earlier as compared to the acrylic group.

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