

Comparing Posterior Capsule Opacification Incidence: Rigid Polymethyl Methacrylate vs. Foldable Acrylic Intraocular Lenses in Cataract Surgery

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Abstract:

Objectives: This comparative study aimed to determine the incidence of posterior capsule opacification following cataract surgery using Acrylic foldable intraocular lenses versus Polymethyl methacrylate rigid intraocular lenses.

Methodology: This study, conducted at the Department of Ophthalmology in DHQ Teaching Hospital Kohat and the Eye Care Centre Kohat, spanned from January 2018 to December 2020. Two patient groups with age-related cataracts were carefully selected after obtaining informed consent. Group A (200 patients) underwent Phacoemulsification surgery with foldable acrylic intraocular lenses, while Group B (200 patients) underwent small incision manual cataract surgery with rigid polymethyl methacrylate intraocular lenses. Follow-up assessments occurred at intervals between 6 months and 2 years. In Group A, 132 patients (66%) completed follow-up, and in Group B, 119 patients (59.5%) completed follow-up, with subsequent assessment for Posterior Capsule Opacification (PCO).

Results: In Group A, 11 patients (8.33%) exhibited Posterior Capsule Opacification, whereas in Group B, 31 patients (26.05%) displayed this condition.

Conclusion: The incidence of Posterior Capsule Opacification was found to be significantly lower in patients who received foldable acrylic intraocular lenses compared to those with Polymethyl methacrylate intraocular lenses. *Al-Shifa Journal of Ophthalmology 2022; 18(4): 148-153.* © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.

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Introduction:

Opacification of the natural lens, leading to the development of cataracts and subsequent vision impairment or blindness, is a pressing global issue¹. In contemporary ophthalmology, cataract surgery is predominantly conducted through either Phacoemulsification or Small Incision Manual Cataract Surgery (SMICS), with the subsequent implantation of intraocular lenses serving as a vital rehabilitation measure². Among the postoperative complications associated with cataract surgery, Posterior Capsule Opacification (PCO) stands out as a significant concern, given its potential to deteriorate vision³. While various theories have been proposed to explain the underlying mechanisms of PCO, it is well-established that PCO primarily arises from the regenerative

activities and extracellular matrix production of residual lens epithelial cells^{4,5}. An alarming statistic reveals that PCO develops in approximately 50% of patients' eyes following cataract surgery⁶. The multifaceted repercussions of PCO, spanning social, medical, and economic domains, underscore the imperative need for its prevention. The development of PCO is influenced by numerous variables, including patient age, cataract type, surgical technique, intraocular lens material, size, design, and placement, along with other potential factors that have been extensively documented in the literature as contributing factors to PCO modulation^{7,8}.

Traditionally, cataract surgeries performed through conventional and SMICS techniques predominantly featured Polymethyl Methacrylate (PMMA) lenses. However, with the advent of Phacoemulsification, there has been a surge in the utilization of foldable acrylic lenses, gaining favor among surgeons. It is pertinent to note that PMMA lenses are associated with a higher incidence of PCO compared to their acrylic counterparts^{9,10}. In fact, one study reported a PCO occurrence rate of 19.3% in patients with PMMA lenses, as opposed to 7.1% in patients with acrylic lenses.

PCO typically manifests in two primary forms: regenerative and fibrotic. Regenerative PCO, which is more prevalent, is attributed to the proliferation and migration of epithelial cells from the lens equator, resulting in the posterior capsule's coverage. On the other hand, fibrotic PCO occurs due to the trans differentiation of anterior lens capsule cells into the posterior capsule, leading to opacification.

Notably, intraocular lenses with adhesive properties to the posterior capsule, such as acrylic lenses, exhibit a lower incidence of PCO compared to non-adhesive PMMA lenses^{11,12}. This study seeks to explore and delineate the incidence of PCO in patients who have received foldable acrylic intraocular lenses as opposed to rigid

PMMA lenses. By doing so, it aims to contribute valuable insights to the ongoing discourse on this critical issue.

Materials and Methods:

The study was conducted within the Eye Department at DHQ Teaching Hospital Kohat and the Eye Care Centre in Kohat, spanning the duration from January 2018 to December 2020. The study participants were carefully selected, consisting of a total of 400 patients afflicted with age-related cataracts, with an age range spanning from 50 to 77 years. Inclusive criteria for participant selection encompassed the presence of age-related cataracts, ensuring that the cataract surgery proceeded uneventfully.

To maintain the integrity of the study, specific exclusion criteria were meticulously applied. Patients with traumatic cataracts and those who experienced eventful surgeries were excluded from the study. Additionally, individuals in whom Posterior Capsule Opacification (PCO) was observed intraoperatively were also excluded from participation.

All participants underwent comprehensive assessments, and explicit informed consent was diligently obtained from each of them. To ensure accurate biometric data, biometry was systematically conducted for every patient. Subsequently, the participants were categorized into two distinct groups.

Group A encompassed 200 patients, constituting 93 males (46.5%) and 107 females (53.5%). These individuals underwent cataract surgery employing Phacoemulsification techniques, with the subsequent implantation of foldable acrylic intraocular lenses.

In contrast, Group B was composed of 200 patients, including 117 males (58.5%) and 83 females (41.5%), as outlined in Table I. For these patients, small manual incision cataract surgery techniques were employed, with the implantation of rigid Polymethyl Methacrylate (PMMA) intraocular lenses.

Following their respective surgeries, the patients were thoughtfully registered for post-operative follow-up, spanning a period extending from 6 months to 2 years. In Group A, 132 patients (66%) participated in the follow-up, with 72 males (54.5%) and 60 females (45.5%) completing the assessment. In Group B, 119 patients (59.5%) partook in the follow-up, comprising 62 males (52.10%) and 57 females (47.89%) (as shown in Table II). Subsequently, these patients were meticulously evaluated for the development of Posterior Capsule Opacification, a pivotal aspect of the study.

Results:

In this comparative study, we aimed to investigate the incidence of Posterior Capsule Opacification (PCO) in patients who underwent cataract surgery using different techniques and intraocular lenses (IOLs).

The study was conducted at the Eye Department of DHQ Teaching Hospital Kohat and the Eye Care Centre Kohat from January 2018 to December 2020. A total of 400 patients with age-related cataracts were included in the study, with ages ranging from 50 to 77 years.

The patients were divided into two groups: Group A and Group B. Group A consisted of 200 patients who underwent cataract surgery using the Phacoemulsification technique, and foldable acrylic IOLs were implanted. Of these patients, 93 were male (46.5%), and 107 were female (53.5%). In contrast, Group B included 200 patients who underwent small incision manual cataract surgery with the implantation of

rigid Polymethyl Methacrylate (PMMA) IOLs. This group consisted of 117 males (58.5%) and 83 females (41.5%).

All patients were registered for follow-up, which ranged from 6 months to 2 years after the surgery. In Group A, 132 patients (54.5% male and 45.5% female) completed the follow-up. In Group B, 119 patients (52.10% male and 47.89% female) completed the follow-up.

The primary focus of the study was to evaluate the development of PCO in these two groups. In Group A, 11 out of 132 patients (8.33%) developed PCO during the follow-up period. In Group B, which underwent small incision manual cataract surgery with PMMA IOLs, 31 out of 119 patients (26.05%) developed PCO.

These results indicate a significant difference in PCO incidence between the two groups. Patients in Group A, who underwent Phacoemulsification with foldable acrylic IOLs, showed a notably lower incidence of PCO compared to those in Group B, who received small incision manual cataract surgery with rigid PMMA IOLs.

In conclusion, the study suggests that the choice of surgical technique and IOL material can influence the incidence of PCO following cataract surgery. Specifically, foldable acrylic IOLs are associated with a lower risk of PCO compared to rigid PMMA lenses. However, it's essential to acknowledge the limitations of the study, including the sample size, and further research is needed to establish the statistical significance of these findings.

Table I. Gender distribution (400 Patients)

Groups	Total patients	Male	Female
A	200	93(46.5%)	107(53.5%)
B	200	117 (58.5%)	83(41.5%)

Table II. Patients completed Follow up

Group	Patients	Male	Female
A	132	72(54.5%)	60(45.5%)
B	119	62(52.10%)	57(57.89%)

Table III. Posterior capsular opacification

Group	Number of Patients	Patients with PCO	Percentage
A	132	11	8.33
B	119	31	26.05

Discussion:

Cataract surgery is the most commonly procedure going on in ocular field. For rehabilitation two types of IOL in the form of fordable acrylic and rigid PMMA are used. PCO is most common post-operative complication of cataract surgery and its developments starts usually after 3 to 6 months. PCO results in blurred vision and glare. For rehabilitation after cataract surgery intra ocular lenses are implanted. PCO depends upon IOL design, optic material and surgical technique. Mostly rigid PMMA IOL are used after cataract surgery which has high rate of PCO. With evolution of cataract surgery by phacoemulsification foldable acrylic IOL have been made with less incidence rate of PCO.

Our study has shown PCO in 8.33% patients with foldable acrylic IOL as compared to 26.05% in PMMA IOL. There are multiple national and international studies data focusing on this issue. Moin M, Raza K, Ahmad A have reported PCO incidence of 6.2 % in acrylic IOL versus 24.3% PMMA IOL¹³. Chupra S, Gar M, Bhatiya N, Bhatti A have illustrated in their study the PCO rate of 42.86 % in acrylic IOL while 78.75% in PMMA IOL¹⁴. Henning etal has reported PCO rate of 23.3 % in acrylic IOL while 36.1 % PMMA

IOL¹⁵. Material of IOL has great influence on epithelial cells. Hollick et al have reported the presence of epithelial cells on the posterior capsule of the patients with PMMA IOL was more than acrylic IOL.

The development of PCO has been affected by various factors not only the IOL material. Takkar etal have reported high incidence of PCO associated with PMMA IOL¹⁶. Hyashi H, Hayshi K, Nakao F, etal have reported high incidence of PCO at PMMA IOL than acrylic IOL. According to their study 2.7% of patients with acrylic IOL and 30.4% patients with PMMA IOL developed PCO¹⁷. Oshuka T etal have reported that high incidence of PCO in PMMA IOL is due to weak adhesion between IOL and posterior capsule as compared to acrylic IOL which has strong adhesion with posterior capsule¹⁸. Santos has also reported the poor adhesive quality of PMMA IOL with posterior capsule as compared to acrylic IOL¹⁹. Wilson, Ram and Aasusi have reported incidence rate of PCO more in PMMA IOL than acrylic IOL^{20,21,22}.

The variation in results may be due to many reasons like manufacturer quality, pre-existing ocular morbidity and surgical expertise. Best treatment for PCO is YAG Laser capsulotomy which is also associated with complications in form of IOL pit,

retinal detachment, macular oedema and raised intraocular pressure^{23,24}. To avoid YAG laser complications it is better to practice use foldable acrylic IOLs²³⁻²⁴.

Conclusion:

Based on the study results and the referenced literature, it is evident that Acrylic IOLs offer a significant advantage in preventing posterior capsule opacification (PCO), a common and troublesome postoperative complication of cataract surgery. PCO often requires treatment through YAG Laser capsulotomy, which, unfortunately, is associated with potential complications.

To mitigate these complications and ensure better postoperative outcomes for cataract patients, it is strongly recommended that the preference be given to the use of foldable acrylic IOLs. This choice not only reduces the incidence of PCO but also minimizes the need for subsequent interventions like YAG Laser capsulotomy. By adopting this approach, eye care professionals can enhance the overall quality of vision restoration and contribute to the well-being of their patients.

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