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A study of incidence of posterior capsular of opacification after cataract surgery based on square edge polymethyl methacrylate intra ocular lens

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Abstract

Introduction: Cataract is one of the most common and established surgical procedure in Opththalmology in the world with the posterior capsular opacification (PCO) as a very common complication, which may be present in long term. This study was done to find the incidence of the posterior capsular opacification after cataract surgery and implantation of 360 square edge PMMA posterior chamber IOL among the patients attending our tertiary care hospital.
Materials and Methods: The cataract surgery was done with a careful implantation of a square edged single piece PMMA IOL within the capsular bag seeing that peripheral 1mm of the anterior capsular rim covers the optic edge of the IOL. On the 1st postoperative day, the cases were examined under slit lamp for any postoperative complications. The next visits were conducted at day 7, 1 month, 3 months, 6months and 8 months. The best-corrected visual acuity was tested using Snellen chart, both aided and unaided.
Results: Out of 50 patients included in the study, 21 (42%) were females and 29 (58%) were males. The most common age group of all the patients was 61-70 years wherein 58.6% of the males and 42.9% of the females were present. Of the total 50 eyes operated for cataract, 90% of the patients had no posterior capsular opacification, while 4% had fibrous membrane type of PCO and 6% had Elsching's Pearl type of PCO.
Conclusion: The square edged PMMA IOL is quite effective in reducing the formation of posterior capsular opacification after the cataract surgery

Keywords: Posterior capsular opacification, Intraocular lens, square edged IOL, cataract

Introduction

Cataract is one of the most common and established surgical procedure in Ophthalmology in the world. This involves the extra capsular extraction of the opaque lens fibers followed by the implantation of the intraocular lens (IOL) thereby restoring a good vision. However, the "secondary cataract" or the posterior capsular opacification (PCO) as a very common complication, which may be present in long term [1]. The time duration between the cataract surgery and the development of PCO may vary from as less as three months to four years after the cataract surgery. The causes of PCO is not single but multifactorial [2]. The resultant

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of PCO is halo effect, contrast sensitivity, reduced quality of vision, lack of binocular vision [3]. Apart from impairing the quality of life of the patient, it also affects the fundus and impedes the ophthalmic examinations like optical coherence tomography [4].

Lens epithelial cells are left behind during the surgeries in the capsular bag and are the main causes of PCO. This results in the proliferation, migration collagen deposition, epithelial to mesenchymal transition and lens fibre regeneration of LEC. These left over LEC migrate over the posterior capsule and undergo EMT and fibre regeneration [5-7]. The two types of PCO are fibrous type and pearl type. The fibrous type is due to the migration and proliferation of LEC, undergoing EMT thereby resulting in fibrous metaplasia leading to visual loss. The pearl type is due to LECs which are located at the equatorial region and causing regeneration of the lenticular fibres forming Elschnig pearls and Soemmering ring [5].

The first IOL implantation surgery was done in 1950 by Sir Harold Ridley and since then, the technology has come a long way reducing the incidence of PCO although the problem is not completely eliminated [8]. It has been estimated that an incidence of postoperative PCO is 11.8% in one year and 20.7% in 3 years and around 28% in 5 years. This is more so a bigger problem among the children undergoing cataract surgery, where the problem is seen in almost all of them [9, 10].

Although the achievements of the modern surgery in this field has been gradual, there has been a considerable decrease in the incidence of PCO with improvement in the surgical techniques and modification of the IOLs. This study was done to find the incidence of the posterior capsular opacification after cataract surgery and implantation of 360 square edge PMMA posterior chamber IOL among the patients attending our tertiary care hospital.

Materials and Methods

50 eyes of 50 patients with Senile cataract-irrespective of grade & type, between the ages of 40-80 years who underwent cataract surgery were including in this prospective study which was conducted by the department of Ophthalmology at Mallareddy medical college for women during the period two years I.e Jan 2019 -Feb 2021.

All patients with Cardiac & serious illness, Glaucoma, patients with Pseudoexfoliation, traumatic cataract, uveitis & complicated cataract, posterior segment pathology with diabetic retinopathy were excluded from the study.

Complete history was taken from all patients for systemic illness like hypertension, diabetes, cardiac status etc. Detailed ocular examination was done with slit lamp biomicroscopy. Intraocular pressure was measured with applanation tonometry and best-corrected visual acuity measured with snellen E chart. A-scan biometry was done for all patients and IOL with accurate dioptric power implanted.

A local anesthesia (peribulbar) was given to all the patients with a combination of a short acting 2% lignocaine (3.5cc) mixed with 1; 200000 adrenaline and 75 unit's hyaluronidase and long acting 0.75% bupivacaine solution (2cc). Topical anesthesia was not used. Scleral incision of 6mm was made and a sclerocorneal tunnel upto 1mm was made into the corneal lamellae. Anterior chamber was filled with viscoelastic and a continuous curvilinear capsulorhexis of 5mm was done with cystotome with 26-G needle to keep the capsular rhexis central. Anterior chamber entered with sharp keratome in the plane of tunnel. Thorough and proper hydro dissection (1.5cc of ringer lactate solution) was done in 3quadrants by tenting up the capsular rim until a fluid wave was seen in the capsular bag followed by hydrodelineation.

The nucleus was brought into the anterior chamber and the chamber filled with viscoelastic material. Nucleus expressed with wire-vectis without traumatizing the iris. A thorough and extensive cortical cleanup was made with the Simcoe cannula by tenting up the anterior capsular rim. The capsular bag is then filled with viscoelastic and the careful implantation of

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the square edged single piece PMMA IOL within the capsular bag was done seeing that peripheral 1mm of the anterior capsular rim covers the optic edge of the IOL.
A good aspiration of the viscoelastic material was done from anterior chamber and capsular bag and behind the IOL also, so as not to leave any amount of viscoelastic within the eye. Anterior chamber was well formed. Air bubble was injected into anterior chamber. A subconjunctival injection of dexamethasone and gentamicin 0.5cc was given and the eye closed with pad and bandage.
On the 1st postoperative day, the cases were examined under slit lamp for any postoperative complications. The next visits were conducted at day 7, 1 month, 3 months, 6months and 8 months. The best-corrected visual acuity was tested using Snellen chart, both aided and unaided.
At all visits except first post-operative day, the IOL transparency, relations of the capsulorhexis margin, the IOL optic and centration of the IOL were evaluated under adequate pupillary dilatation. The PCO was assessed by the following grading system.
No PCO-No evidence of PCO seen before and after pupil dilatation to a minimum of 6mm. (With a direct ophthalmoscopy a clear view of optic disc, vessels, and nerve fiber layer).
Grade I: PCO seen only with pupil dilated to a minimum of 6mm. (With a direct Ophthalmoscopy, a clear view of optic disc, vessels and nerve fiber layer).
Grade II: PCO in central axis, detectable with an undilated pupil. (With a direct Ophthalmoscopy, mild obscuration of fundus details. Optic disc seen but not nerve fiber layer).
Grade III: PCO in the central visual axis with an undilated pupil. (On direct Ophthalmoscopy, there is marked obscuration of fundus details, even margins of optic disc is not seen clearly).
All the patients were followed up for at one year.

Results

Out of 50 patients included in the study, 21 (42%) were females and 29 (58%) were males (Fig: 1)

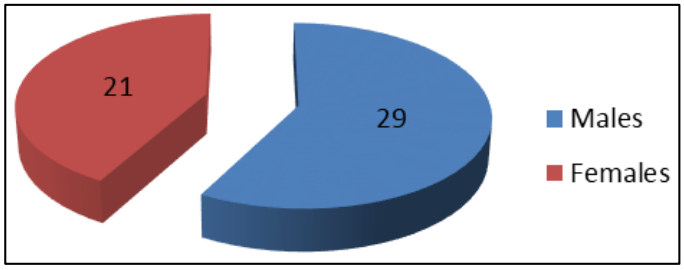

Fig 1: Age wise distribution of the patients

The age groups of the patients was from 40-80 years. The most common age group of all the patients was 61-70 years wherein 17 (58.6%) of the males and 9 (42.9%) of the females were present. 15 (30%) of the total patients belonged to 51 to 60 years age group, out of which 7 were males and 8 were females. Incidentally, patients between 71 to 80 years were only 3 (6%) of the total patients with the cataract surgery (Table: 1).

Table 1: Division of the patients based on age group

Age	Males	Females	Total
40-50	3 (10.3%)	3 (14.3%)	6 (12%)

51-60	7 (24.1%)	8 (38.1%)	15 (30%)
61-70	17 (58.6%)	9 (42.9%)	26 (52%)
71-80	2 (6.9%)	1 (4.8%)	3 (6%)
Total	29 (100%)	21 (100%)	50 (100%)

The most common type of cataract in our study was mature senile cataract, which was seen in 14 (28%) of the patients. 10 patients (20%) had immature senile cataract with nuclear sclerosis grade II, 5 (10%) were with immature senile cataract with nuclear sclerosis grade IV, 6 (12%) were with immature senile cataract with nuclear sclerosis grade III, 7 (14%) were with immature senile cataract with nuclear sclerosis grade V and 4 (8%) were with only immature senile cataract with no nuclear sclerosis (Fig: 2).

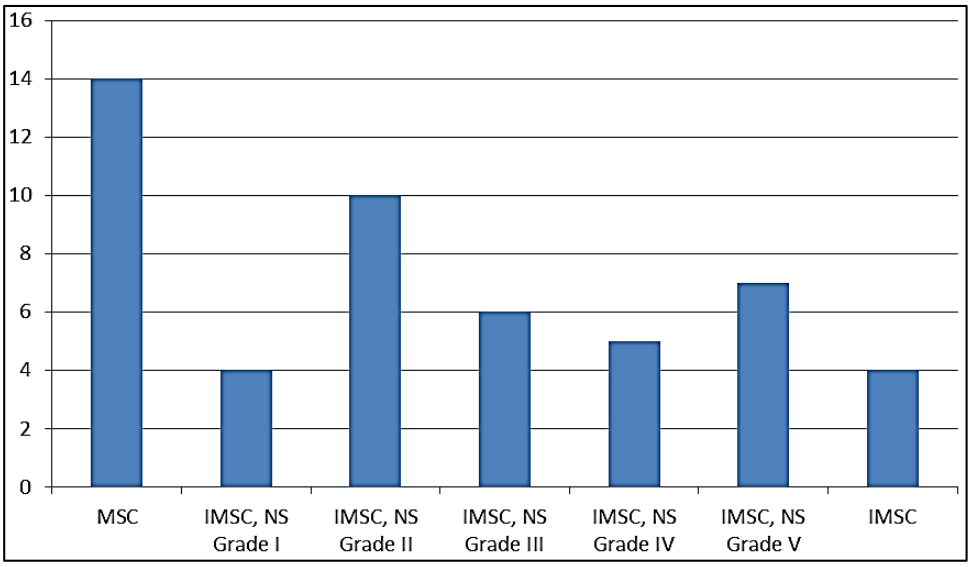

Fig 2: Grade of Cataract

Post-operative course was uneventful in 41 patients (82%). 2 patient (4%) had mild iritis while 7 (14%) patients had corneal edema at first post-operative day which was resolved in the next week with topical medications (Fig: 3).

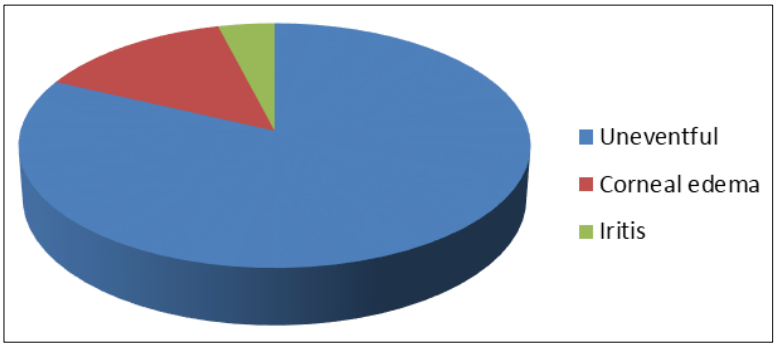

Fig 3: Post-operative events

Of the total 50 eyes operated for cataract, 45 (90%) of the patients had no posterior capsular opacification, while 2 (4%) had fibrous membrane type of PCO and 3 (6%) has Elsching's Pearl type of PCO (Table: 2).

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Table 2: Type of PCO

Incidence of PCO at followup	Number (Percentage)
No PCO	45 (90%)
Fibrous membrane type	2 (4%)
Elsching's Pearl type	3 (6%)

The final BCVA was achieved in 41 (82%) of the patients while 9 (18%) of them had macular pathology. Out of these cases, 5 had posterior capsular opacification. All the cases of Posterior capsular opacification were treated with Nd-YAG Laser therapy and all the patients recovered to 6/6 final visual acuity.

Table: 3: Pre and Post-operative Visual acuity

Pre-OP VA	Post-OP VA	Number (%)
6/60	6/6	4 (8%)
CF 2mts	6/6	25 (50%)
HM+	6/6	7 (14%)
PL+	6/6	5 (12%)
CF 3 mts	6/9	9 (18%)

All the patient in this study were treated with square edged intraocular lens and the BCVA of 6/6 was seen in 46 (92%) of the cases. PCO was seen in 5 (10%) patients.

Discussion

Posterior capsule opacification is a very common complication among the patients undergoing cataract surgeries. Not only does it affect the vision of the patient but also has economic implications [11]. It is mainly caused due to the proliferation and the migration of Lens Epithelial Cells (LECs), macrophages and fibroblasts on the posterior capsule.

The most common age group in our study to have PCO was 40-60 years of age. Out of the 5 cases of PCO, 3 were between 40-50 years and 2 were between 50-60 years. Younger age group is a known risk factor for PCO as there are more LECs on the anterior capsule in the younger age group, which results in a strong cellular proliferation [12]. It has been reported that the patients who were <40 years of age had 3 times more rate of incidence of PCO formation than those above 60 years of age [13]. A study by Sundelin *et al.* reported that younger patients were more at risk of PCO formation compared to the elderly [14].

The incidence of PCO in our study was 10% after the cataract was treated with square edged IOL. In a study by Schaumberg *et al.*, 11.8% was the incidence of PCO after 2 year while it was 28.5% after 5 years of surgery [10]. Oshika *et al.* compared the incidence of PCO in IOLs inserted during cataract surgery and found that the lowest rate was found among the patients treated with acrylic IOLs with a sharp optic edge [15]. The inhibiting effect of the IOLs was observed due to the truncated edges of the IOLs rather than that of the characteristic shape of the lens [16]. A study by Mootha *et al.* and Alio *et al.* have observed the incidence of PCO ranged from 11% to 40.7% in patients with silicone IOL implants at 6 weeks to around 3 months [17, 18]. An overall incidence of PCO of 5.71% was observed in a study by Joshi *et al.* [19].

A study by Hayashi *et al.* have reported that PCO formation was greater among patients undergoing implantation with PMMA lens complared to those who were implanted with soft acrylic IOLs [20]. In our study, we observed only 10% of the patients with PCO after undergoing implantation with square edged PMMA IOL. Moderately sized Capsulorhexis

which overlaps the IOL optic is said to be beneficial in reducing the incidence of PCO especially when square edged IOLs are used [21]. Maddula *et al.* have observed that the modification of round edged IOls to square shaped IOLs are one of the reason for the decresed incidence of the PCO in patients undergoing cataract surgeries [22]. With a complete encompassment of 3600 around the IOL optic is necessary to provide an effecitive barrier [23]. Nishi *et al.* have demonstrated IOLs with a sharp edge to be effective against the development of PCO [16, 24]. This sharp bend reduces the migration of the LEC toward the posterior capsule [16].

In a study by Ebihara *et al.*, the incidence of the formation of PCO was far higher among the patients with diabetes mellitus rather than those without DM [25].

Clinical trials were conducted to identify other methods of inhibiting PCO. These include the use of distilled water as reported by Rekas *et al.* and Maloof *et al.* [26, 27]. Irrigation with distilled water in the posterior capsule is said to wash away as many LECs as possible mechanically thereby limiting their proliferation and migration preventing the secondary cataract formation. Effect of hydrogen peroxide was compared to that of distilled water by D'Antin *et al.* and it was observed that the patients treated with hydrogen peroxide showed growth retardation which was similar to the patients treated with distilled water [28]. Another study by Joshi and Hussain showed that when treated with 0.6% tryptophan blue, the patients showed a lower rate of PCO formation rather than in the control group [29]. In yet another study by Joshi *et al.*, it was observed that patients who had the IOL rotated by 360^0 had a better result against the formation of PCO [30].

Conclusion

The incidence of PCO in the present study was 10% which was further reduced to nil after treatment with ND-Yag with full visual acuity. The square edged PMMA IOL is quite effective in reducing the formation of posterior capsular opacification after the cataract surgery. This method can be considered for patients undergoing cataract surgery instead of plane or rounded PMMA IOLs.

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