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Original Research Article

Determinants of posterior capsular opacity after cataract surgery: a cross-sectional study

Pratima Sahu[1], Amit Kumar Mishra[2]*

[1]Department of Ophthalmology, [2]Department of Community Medicine, Pondicherry Institute of Medical Sciences, Puducherry, India

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***Correspondence:**
Dr. Amit Kumar Mishra,
E-mail: dramitvss@gmail.com

ABSTRACT

Background: Posterior capsular opacification (PCO) which is also known as "after cataract" or "secondary cataract", is the most common complication of cataract surgery, with an incidence of 20-50%. The current study was conducted in a tertiary hospital of Odisha with an objective to find out the determinants of PCO among patients with defective vision attending the outdoor patient department of Ophthalmology.
Methods: A hospital based descriptive study was conducted among the patients attending the ophthalmology out patient department of a tertiary hospital of Odisha. The detail history regarding the type of surgical procedure used for cataract extraction and the type of Intra Ocular Lens (IOL) implanted, duration of post-operative period was collected from the available documents and ophthalmic examination of the participants.
Results: In the present study, 184 participants were included and examined. Fifty percent of the participants had undergone conventional extra capsular cataract extraction procedure. In 86.95% participants, the IOL used was Poly Methyl Methacrylate lens (PMMA). In 26.08% of the participants the development of PCO was within 12 to 36 months of cataract surgery. The average duration of PCO development recorded for participants <20 years was 3 months.
Conclusions: Most of the participants included in the study with PCO had undergone conventional ECCE surgery, implanted PMMA lens, IOL with round edge and had a duration of 12-36 months between cataract surgery and PCO development. The average duration of PCO development is less among younger participants which gradually increases with increase in age.

Keywords: Cataract, IOL, Lens, PMMA, Posterior capsular opacification

INTRODUCTION

Cataract is the main cause of curable blindness worldwide. Burden of blindness due to senile cataract is high in Indian population. There is a need to undertake quality cataract surgery for Indian population, both rural and urban to reduce the burden of this curable blindness. It is universally accepted that Extra Capsular Cataract Extraction (ECCE) with posterior chamber Intra Ocular Lens (IOL) is superior to Intra Capsular Cataract Extraction (ICCE) and free of major complications. As ECCE is always associated with some breakdown of the blood-aqueous barrier, inflammatory cells, erythrocytes, and many other inflammatory mediators may be released into the aqueous humor. The severity of this inflammatory response may be exacerbated by the IOL. In most cases, however, this inflammatory response is clinically insignificant. Posterior capsular opacification

(PCO) which is also known as "after cataract (AC)" or "secondary cataract", is the most common complication of these modern cataract surgery, with an incidence of 20% to 50%.[1] The AC can be opacification of posterior lens capsule, Elschnig‟s pearls or Soemmerring‟s ring.

Few studies had been done on posterior capsular opacification development and age of the patients and it was found that PCO development rate is very high among young patients (children and infants).[1-4] Taking the material of IOL into account, Hydrophilic acrylic material is more biocompatible, IOLs made of this material have been shown to support LEC adhesion, migration, and proliferation and leads to PCO development, the rate of development is high compared with an IOL made of PMMA or hydrophobic acrylic materials.[5-10] Lower rates of PCO development are also observed in new generation silicon lenses with square posterior edge. After cataract is most often managed by an opening in to the posterior capsule either by surgical or by Nd:YAG laser posterior capsulotomy. At present, the most widely practiced procedure for the management of symptomatic PCO is Nd:YAG laser capsulotomy. Limited published literature is available on determinants of PCO in Odisha. The current study was conducted in a tertiary hospital of Odisha with an objective to find out the determinants of PCO among patients with defective vision attending the outdoor patient department of Ophthalmology.

METHODS

A hospital based descriptive study was conducted among the patients attending the ophthalmology out patient department of a tertiary teaching hospital of Odisha. Ethical approval for the study was obtained from the Institute Ethics Committee of a tertiary teaching hospital in Odisha. Patients who had reported to the outpatient department of Ophthalmology for defective vision were screened during the study period from October 2011 to September 2013. Patients with significant PCO, history of good immediate post (cataract) operative visual acuity and absence of any corneal/retinal (organic) pathology were included in the study. Participants were included irrespective of their age. In all patients a complete ophthalmic history including history of any pre-existing glaucoma, retinal pathology, amblyopia, optic atrophy, corneal opacity, corneal dystrophy/degeneration or any other ocular condition was recorded. History of any topical or systemic medication and other significant systemic illness was also recorded. The participants were excluded if any of the above exclusion criteria were met. The detail history regarding the type of surgical procedure used for cataract extraction and the type of IOL implanted, duration of post-operative period were collected from the available documents and ophthalmic examination of the participants during their visits.

Informed consent was obtained from each study participants after explaining the objective of the study and a copy of the participant information sheet was given to all participants. Visual acuity was checked by Snellen's chart. Then slit lamp examination and dilated fundus examination were done. After the collection of the data relevant to the study, appropriate advice was given to the study participants. During the study if any of the participants were found with any other health related issues, the participants were referred to the concerned department for treatment and follow up.

RESULTS

In the present study, 184 participants were included within the study period based on the inclusion and exclusion criteria. Out of the total 184 patients, 100 (54%) participants were male and 84 (46 %) participants were female, the male to female sex ratio was 1.19. Most of the study participants (54.34%) were aged 41-60 years followed by >60 years (33.6%). Six (3.26%) participants were below the age of 20 years (Table 1).

Table 1: Age and gender distribution of study participants.

Variable		Number (n=184)	Percentage
Age (years)	<20	6	3.26
	21- 40	16	8.29
	41- 60	100	54.34
	>60	62	34.69
Gender	Male	100	54
	Female	84	46

The posterior capsule opacification among the study participants was graded as mild, moderate and severe depending upon the visibility of fundus by direct and indirect ophthalmoscopy. Half of the study participants had PCO of moderate grade followed by mild, 26%. Severe grade of posterior capsular opacity was recorded in 23.4% of study participants (Table 2).

Table 2: Grading of posterior capsular opacity of study participants.

Grade	Criteria	Number	%
Mild	Fundus seen in direct ophthalmoscope	48	26
Moderate	Fundus seen in indirect ophthalmoscope	93	50.6
Severe	No fundus view or details hazily seen	43	23.4

In the present study it was found that, half (50%) of the study PCO participants had undergone conventional Extra Capsular Cataract Extraction (ECCE) procedure followed by Small Incision Cataract Surgery (36.95%) and phacoemulsification (13.04%) surgery. In 86.95% participants, the IOL used in cataract surgery reported was Poly Methyl Methacrylate (PMMA) IOL and in 13.04% participants IOL lens was Acrylic lenses.

Regarding the intra ocular lens optic design, it was round edge in 63.58% participants and square edge in 36.42% participants, recorded by slit lamp examination. In most (26.08%) of the participants the duration between cataract surgery and development of PCO was reported as 12 to 36 months followed by 6 to 12 months (21.73%). In 4.34% cases the PCO was developed within a month of cataract surgery. A duration of less than 1 year and 3 years (36 months) between cataract surgery and development of PCO was reported by 65.19% and 91.31% of participants respectively (Table 3).

Table 3: Determinants of posterior capsular opacity after cataract surgery.

Determinants		Number (n=184)	%
Type of surgery	SICS	68	36.95
	Conventional ECCE	92	50
	PHACO	24	13.04
IOL material	PMMA IOL	160	86.95
	Acrylic IOL	24	13.04
IOL optic design	Round edge	117	63.58
	Sharp/Square edge	67	36.42
Duration between cataract surgery and PCO development	<1 month	8	4.34
	1 - 3 month	37	20.1
	3 - 6 month	35	19.02
	6 - 12 month	40	21.73
	12 - 36 month	48	26.08
	36 - 60 month	16	8. 69

The average duration of cataract surgery and development of PCO was recorded as 24 months among the participants of 41 to 60 years age group (54.34% of total participants), which was the highest average duration recorded as compared to the average duration recorded in any other age group participants. The average duration recorded for participants <20 years was 3 months. For participants >60 years of age (33.69%), the average duration of PCO development after cataract surgery was recorded as 20 months (Table 4).

Table 4: Average duration of development of posterior capsule opacification after cataract surgery in different age group.

Age of study participants (yrs.)	No. of cases (n=184)	Average duration (months)
<20	6	3
21- 40	16	12
41- 60	100	24
>60	62	20

DISCUSSION

Posterior capsular opacity is a major complication of cataract surgery with or without intraocular lens implantation. Among the participants included in the study most of them had undergone conventional ECCE followed by SICS (36.95%) and phacoemulsification (13.04%). Cortical cleaving hydro-dissection of nucleus followed by its rotation during SICS and phacoemulsification results in removal of maximum lens fibres and epithelial cells at the equator of the capsular bag, thereby reducing the chances of PCO. Further, due to bimanual irrigation/aspiration technique used in phacoemulsification which enables a surgeon to remove equatorial lens cells and fibres thereby reducing the incidence of PCO formation. The above study findings are consistent with the reported PCO cases in Moulick et al study among 150 patients.[11]

In a comparative study by Moin et al, between Hydrophobic Acrylic and polymethyl methacrylate (PMMA) intraocular lenses on incidence of PCO after cataract surgery found that PCO development was 6.2% with hydrophobic Acrylic IOLs and it was 23.4% with PMMA lenses.[12] In the present study among the 184 participants, 13% had history of implantation of Acrylic IOL during cataract surgery which less than the PMMA IOL implantation (87%). Kugelberg M et al, reported in his study that patients with the hydrophilic acrylic IOL had a significantly greater percentage area and severity of PCO than those with the hydrophobic acrylic IOL one year after surgery.[13] Vasavada et al also, reported that PCO was significantly less with the hydrophobic acrylic IOL at three years period after cataract surgery.[14]

Nishi et al, in their study demonstrated that the PCO reducing effect of truncated sharp edge IOL design.[15] In the above experimental study, sharp-edge hydrophobic acrylic (AcrySof) IOL and standard round optic edge PMMA IOL were used. After three weeks of surgery, Nishi et al. revealed that the lens capsule wrapped tightly around the sharp optic edge and the migration of Lens Epithelial Cells (LECs) was inhibited at the site of sharp rectangular lens capsule bend. It was not the same in sharp capsular bend in PMMA IOL group with round optic edge and therefore LECs could freely migrate into the posterior capsule centre.

Findl et al, study showed that a sharp-edged optic lens inhibited lens epithelial cells growth and lowered the incidence of PCO and laser capsulotomy.[16] According to our study the proportion of PCO patients with intraocular lenses models with sharp-edge optic design (36.42%) was lower than patients with round-edge optic design lenses (63.58%).

The interval between surgery and PCO varies widely, ranging from three months to four years after the surgery. The incidence of PCO reported is generally based on follow-up time after cataract surgery. Schaumberg et al in a meta-analysis of PCO reported a postoperative PCO incidence of 11.8% at 1 year, 20.7% after 3 years, and 28.5% after 5 years following cataract surgery.[7] In the present study it was found that in patients of 20-40 years of age the average duration of cataract surgery and

development of PCO was 12 months and in participants under 20 years of age it was 3months, the younger the age the earlier will be the PCO development. Among the study participants, 65.19% developed PCO within one year and 91.3% developed the PCO within 3 years of cataract surgery.

Development of PCO significantly depends on the age of patients-there is an inverse correlation with age. Young age is a significant risk factor for PCO, and its occurrence is a virtual certainty in paediatric patients.[17-19] The younger is the patient, the more rapid is PCO development. Paediatric patients are reported to have a rapid development of PCO (almost 100%). In a review done by Pandey et al, younger age was mentioned as a potential risk factor for the development of PCO which was also observed in the present study (Table 4).[20] As the current study was a hospital-based study where participants were recruited after screening of outdoor patients with defective vision after cataract surgery in the department of Ophthalmology, only proportion was estimated for determinants and associations could not be estimated.

CONCLUSION

The current study showed that among the study participants with PCO, most of the participants had undergone conventional ECCE surgery, implanted PMMA IOL, IOL with round edge and had a duration of 12-36 months between cataract surgery and PCO development. The average duration of PCO development is less among younger participants which gradually increases with increase in age.

Recommendations

Longitudinal or interventional studies can be planned/conducted to understand the role of independent risk factors on posterior capsular opacification development after different types of cataract surgeries.

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