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Editorial inquiries should be addressed to Prof. Dr. Tayyab Afghani, Department of Orbit and Oculoplastics, Al-Shifa Trust Eye Hospital, Jhelum Road Rawalpindi, Pakistan.
Tel: 0092 51 5487821-25, Fax: 0092 51 5487827; Email: aqrcpio@yahoo.com ;
Website: www.asjoalshifaeye.org

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Risk Factors for Posterior Capsular Opacification after Cataract Surgery in Dera Ismail Khan, Pakistan

Muhammad Kamran Khalid¹, Muhammad Shoaib Khan¹, Maria Shafiq¹, Muhammad Irfanullah Kakar¹

Abstract:

Objectives: To determine Demographic (Gender, Age, Address, and Place of surgery) and Clinical (Laterality, Procedure of surgery and Type of IOL) variables as risk factors for development of PCO in our location.

Materials & Methods: This was a cross-sectional comparative study conducted at the department of Ophthalmology, Gomal Medical College, Dera Ismail Khan, Pakistan from January 2021 to March 2021. The sample consisted of consecutive patients of Nd:YAG laser procedures during this period at Eye Unit, DHQ Teaching Hospital Dera Ismail Khan, Pakistan. A total of 160 patients with PCO undergoing Nd:YAG laser procedures were included in the study during this period. Demographic (Gender, Age, Address, and Place of surgery) and Clinical (Laterality, Procedure of surgery and Type of IOL) variables were compared with development of PCO (Duration from surgery) using Chi-square test and p-value <0.05 was taken statistically significant.

Results: Among the demographic variables, age of the patients <15 years was statistically significant (p<0.05) risk factor for the development of early PCO (<12 months), whereas gender, urban or rural address and place of surgery in public or private setup were not statistically significant risk factors for development of early PCO (p>0.05). Whereas among the clinical variables, ECCE procedure of surgery and PMMA type of IOL were statistically significant (p<0.05) risk factors for the development of early PCO (<12 months), and laterality i.e. right or left eye was not a statistically significant risk factors for development of early PCO (p>0.05).

Conclusion: Age of the patient <15 years, ECCE procedure of surgery and PMMA type of IOL are significant risk factors for development of early PCO in our setup. *Al-Shifa Journal of Ophthalmology 2023; 19(1): 14-19. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

1. *Gomal Medical College, Dera Ismail Khan*

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Correspondence to:

Muhammad Kamran Khalid
Gomal Medical College, D I Khan
drkamrankhalid786@gmail.com

Introduction:

Cataract surgery is the most commonly performed ocular surgery as cataract is the most common treatable cause of blindness globally. Conventional extra-capsular cataract extraction (ECCE) with implantation of rigid polymethyl-methacrylate (PMMA) intraocular lens (IOL) has largely been replaced by phacoemulsification and implantation of foldable IOL which gives better visual results. Posterior capsular opacification (PCO) is one of the most common complication after cataract surgery which has been reported to occur in 20%--40% of post-cataract surgery patients over a period of 2--5 years¹.

Formation of PCO has been described to occur due to the proliferation of residual lens epithelial cells (LEC) in the capsular bag after cataract surgery. LECs may undergo transformation from epithelial to mesenchymal type cells under the influence of cytokines, growth factors and extra cellular matrix proteins that leads to the formation of PCO.² Clinically it may take two forms i.e., capsular fibrosis type and pearls type and both can lead to significant visual compromise.

Neodymium: Yatrium-Aluminum-Garnet (Nd:YAG) laser has long been used to treat PCO effectively after cataract surgery. The cumulative incidence of Nd:YAG laser capsulotomy was 10.6%, 14.8%, 21.2% and 28.6% postoperatively after 1, 2, 3 and 4 years respectively³. Although a relatively simple and non-invasive procedure, Nd:YAG laser capsulotomy is not without complications. Mild intraocular inflammation, transient increase in IOP, IOL pitting, corneal injury, vitreous prolapse, IOL dislocation, cystoid macular edema and retinal detachment are among the common reported complications.^{4,5,6} Therefore a lot of effort has been made to prevent the formation of PCO including modifications in IOL materials and design, surgical techniques and pharmacological measures⁷.

A significant effort has also been made to determine the risk factors for the development of PCO including general conditions of the patient, ocular conditions, surgical techniques and type of IOLs. The aim of our study is to determine risk factors for the development of PCO in our location.

Materials & Methods:

This was a cross-sectional comparative study conducted at the department of Ophthalmology, Gomal Medical College, Dera Ismail Khan, Pakistan from January 2021 to March 2021. The sample consisted of consecutive patients of Nd: YAG laser procedures during this period at the Eye Unit, DHQ Teaching Hospital Dera Ismail Khan, Pakistan. Proper approval from the

ethical committee of Gomal Medical College, Dera Ismail Khan was taken before starting the study. Nd: YAG laser procedures were performed with slit-lamp delivery system SuperQ, Ellex, Australia, under topical anesthesia using an Oculus YAG capsulotomy contact lens. The energy level was titrated from case to case to get the desired effect. The sampling technique was consecutive, non-probability technique. A total of 160 patients Nd: YAG laser procedures were included in the study during this period. All patients in whom Nd: YAG laser treatment was not possible due to any reason were excluded. Descriptive statistics were used including frequencies and percentages for categorical data and Mean +/- SD for quantitative data, using SPSS version 20. On the basis of duration from surgery, patients were divided into those presenting within 12 months after surgery (Early PCO) and those presenting after 12 months (Late PCO). Demographic (Gender, Age, Address, and Place of surgery) and Clinical (Laterality, Procedure of surgery and Type of IOL) variables were compared with development of PCO (Duration from surgery) using Chi-square test and p-value <0.05 was taken statistically significant.

Results:

A total of 160 patients with PCO undergoing Nd: YAG laser procedure were included in the study. Out of these 92 (57.5%) were female and 68 (42.5%) were male. 27 (16.9%) were <15 years of age and 133 (83.1%) were >15 years of age. Patients coming urban area of DIKhan were 35 (21.9%) and 125 (78.1%) were from rural areas. Cataract surgery was performed in public setup in 92 (57.5%) patients and 68 (42.5%) were operated in private setup. Nd: YAG laser procedure was performed in right eye in 90(56.3%) and in left eye in 70(43.8%). Frequency distribution of Procedure of surgery, Type of IOL and Duration from surgery is shown in Tables 1.

Table No.1: Procedure of surgery

Procedure	Frequency	Percent
ECCE	42	26.3%
Phaco	118	73.8%
Total	160	100%

Type of IOL	Frequency	Percent
PMMA	34	21.3%
Hydrophilic	126	78.8%
Total	160	100%

Duration	Frequency	Percent
Early PCO(<12 months)	35	21.9%
Late PCO(>12 months)	125	78.1%
Total	160	100%

Comparison between the demographic variables (Gender, Age, Address, and Place of surgery) and Development of PCO is shown in Table No 2.

Table No.2: Development of PCO

Gender	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
Female	19	73	0.189	0.663
	16	52		
Male	16	52		

Age	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
<15 years	18	9	38.132	0.000
	17	116		
>15 years	17	116		

Address	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
Urban	7	28	0.092	0.761
	28	97		
Rural	28	97		

Place of surgery	Development of PCO		Chi-Square	p-value
	Early PCO	Late PCO		
Public setup	21	71	0.115	0.735
	14	54		
Private setup	14	54		

This is evident from the above tables that age of the patients <15 years is statistically significant ($p < 0.05$) risk factor for the development of early PCO (<12 months), whereas gender, urban or rural address and place of surgery in public or private setup are not statistically significant risk factors for development of early PCO ($p > 0.05$).

Comparison between the clinical variables (Laterality, Procedure of surgery and Type of IOL) and Development of PCO is shown in Table No. 8—10.

Table No.3: Development of PCO

Laterality	Development of PCO		Chi-Square	p-value
Right	Early PCO	Late PCO	1.073	0.300
	17	73		
Left	18	52		

Procedure	Development of PCO		Chi-Square	p-value
ECCE	Early PCO	Late PCO	4.375	0.036
	14	28		
Phaco	21	97		

Type of IOL	Development of PCO		Chi-Square	p-value
PMMA	Early PCO	Late PCO	9.412	0.002
	14	20		
Hydrophilic	21	105		

It is evident from the above tables that ECCE procedure of surgery and PMMA type of IOL are statistically significant ($p < 0.05$) risk factors for the development of early PCO (<12 months), whereas laterality i.e., right or left eye were not statistically significant risk factors for development of early PCO ($p > 0.05$).

Discussion:

Young age has been reported in a number of studies as a highly significant risk factor for the development of PCO as is also evident from our study⁸. A presumptive explanation may be a larger number of residual LECs in younger patients after cataract surgery and relatively raised levels of cytokines in aqueous humour of young patients leading to active growth of LECs and ultimate PCO⁹.

Many studies have reported phacoemulsification as a mean of reducing

post-operative PCO as compared to ECCE⁸ which is also supported by our study (Table No.3). The reason being less residual LECs in phacoemulsification because of better removal of LECs from the under surface of anterior capsule after capsulorhexis, less damage to the blood- aqueous barrier and less iris pigment dispersion in phacoemulsification as compared to ECCE. Davidson et al have suggested that almost 100% removal of LECs is necessary to prevent formation of PCO¹⁰ which practically looks impossible. The formation of larger incision, more iris manipulation during manual expression of cataract and resulting inflammation has been blamed for early formation of PCO in ECCE cases specially diabetic patients¹¹.

Several studies have reported increased incidence of PCO with PMMA IOLs as compared to both silicone and acrylic IOLs.^{12,13} This is in accordance with our

study (Table No.3) where we have compared PMMA IOLs with acrylic IOLs for the development of early PCO. It has been presumed that due to bulky size of acrylic IOL, it mechanically resists the proliferation of LECs over the capsular surface, supporting the “no space no cells” theory¹⁴. Other studies have reported even more superiority of hydrophobic over hydrophilic acrylic IOLs⁸ in prevention of PCO but such comparison is not done in our study. A number of other factors including IOL design, optic edge design and overall length of the IOL^{15,16} have also been evaluated as risk factors for development of PCO in different studies but these are not included in our study.

Aasuri et al has reported clinically significant PCO in 72% (12) with PMMA IOLs as compared to 21% (4) with acrylic IOLs in pediatric population ($p=0.002$)¹⁷. Our study has shown age <15 years as a significant risk factor (Table-5) for the development of early PCO irrespective of IOL used so if PMMA IOLs are used in children, it may further increase the risk of development of PCO in children. Certain other factors including hardness of lens nucleus, vitreous loss and diabetes have also been reported as significant risk factors for PCO⁸ but these are not evaluated in our study.

Conclusions:

Age of the patient <15 years, conventional ECCE and PMMA type of IOL are significant risk factors for development of early PCO in our setup. Proper addressing of such risk factors in patients undergoing cataract surgery is crucial for delay or prevention of PCO in such patients.

Limitations:

One limitation of this study is that inherently multiple surgeons were involved, each with their techniques to doing both ECCE and Phaco, with variable interop maneuvers which affect PCO, such as rhexis size and polishing techniques. A relatively smaller sample size and a cross-

sectional study design are the factors that are limiting the authenticity of our results. Prospective studies may evaluate such risk factors more precisely.

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Authors Contribution

Concept and Design: Muhammad Irfanullah Kakar
Data Collection / Assembly: Muhammad Kamran Khalid
Drafting: Muhammad Shoaib Khan
Statistical expertise: Maria Shafiq
Critical Revision: Muhammad Kamran Khalid