

Posterior Capsule Opacification after Cataract Surgery and its Determinants

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Abstract

Purpose: A review of posterior capsule opacification (PCO) after cataract surgery and some affecting factors

Methods: A cross-sectional study was designed to study cataract patients who underwent cataract surgery between 2003 and 2006 in Farabi Eye Hospital, Tehran, Iran. Random sampling was done. Those with a history of uveitis, intraocular surgery, and eye trauma were excluded from the study. The patients were then invited for follow-up visits and study of the results. Postsurgical PCO percentage was calculated, and its association with variables like sex, age, history of cataract surgery, type of surgery, and type of lens was studied.

Results: The incidence of PCO in patients was 14.2% (11.3 to 17.0 CI=95%) with an incidence of 8.7% and 19.9% in males and females, respectively (P<0.001). PCO was not significantly correlated with age. The incidence of PCO in those who had undergone cataract surgery at least one year ago was 10.9% while it was 22.7% in those who had received surgery at least 4 years ago (P=0.005). PCO incidence in those with and without partial opacity was 31% and 13.2%, respectively (P=0.011). The highest and lowest incidence of PCO belonged to those who were operated on with small incision cataract surgery (SICS) and phacoemulsification techniques, respectively (P=0.009). The incidence of PCO was 24.2% and 12% in cases in whom PMMA and foldable lenses were used, respectively (P=0.002). Of those with PCO after cataract surgery, 31.6% (21.5 to 41.8 CI=95%) needed Nd:YAG laser capsulotomy.

Conclusion: In our study, the incidence of PCO after cataract surgery was relatively low with a higher incidence in females. Preoperative corneal opacity, surgical technique and the lens type can be factors affecting the incidence of PCO.

Keywords: Cataract Surgery, Posterior Capsule Opacification, Farabi Eye Hospital

Iranian Journal of Ophthalmology 2012;24(2):3-8 © 2012 by the Iranian Society of Ophthalmology

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Received: November 11, 2011

Accepted: May 10, 2012

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Introduction

Posterior capsule opacification (PCO) is one of the most important and common complications after cataract surgery^{1,2} and based on various studies, it may happen in 20% of the cases within a year after cataract surgery. Its incidence has been reported to reach as high as 50% five years after surgery.^{3,4} Despite advances in cataract surgery techniques worldwide, this postoperative cataract surgery complication is still observed. Although phacoemulsification technique has lowered the incidence of PCO to some extent, the type of the lens is considered to be one of the risk factors. Some researchers have proposed that the complication is related to some other complications such as RP, pseudoexfoliation, glaucoma, and even myopia.^{2,4,5}

According to some studies, the growth of the epithelial cells of young people is more than elderly; hence, age is also believed to be factor in the incidence of PCO.^{4,5} Vision impairment caused by PCO has made it a reason for patients' postsurgical dissatisfaction. Although the chance of the incidence of PCO after cataract surgery increases over time, fortunately, its simple and easy treatment by Nd:YAG capsulotomy can relieve patients' concerns.^{6,7}

A few studies have investigated the incidence of PCO after cataract surgery in Iran, therefore, we intend to study the incidence of PCO after cataract surgery in patients admitted to Farabi Eye Hospital in Tehran, which is one of the largest ophthalmology centers in Iran.

Methods

In cross-sectional study, age-related cataract patients who underwent cataract surgery between 2003 and 2006 in Farabi Eye Hospital, Tehran, were considered as the target population. Sampling was done using FOX PRO 6.2 database under the Clipper 5.2 programming language that was available in the archives of the hospital. Using the code of ICD H25, random sampling was done among patients who had received cataract surgery between 2003 and 2006. After choosing the selected files, those with a history of uveitis, intraocular surgery, and eye trauma were excluded from the study and were replaced by other cases. Those files without information

on the contact telephone number were also excluded. The data of the selected cases was recorded before surgery. The patients were contacted via their phone numbers and were invited for ophthalmology examinations. To include cases in the study, visual acuity and refraction measurements, slit-lamp examination, intraocular pressure (IOP) measurement, indirect ophthalmoscopy, and keratometry were performed. PCO was measured by retroillumination at slit exam by the ophthalmologist, and recorded in patient's file.

Statistical analysis

In this study, the incidence of PCO was reported as a percentage with a 95% confidence interval. Logistic regression was used to assess the relationship between PCO and studied variables.

Results

The incidence of PCO was studied in 558 eyes that had received cataract surgery. Of them, 272 (48.7%) belonged to female patients and 286 (51.3%) belonged to male patients with a mean age of 67.0 ± 8.9 (47 to 88) years. In general, the follow-up period after surgery was 32.8 ± 15.8 months.

Phacoemulsification, extracapsular, and small incision cataract surgery (SICS) techniques were used in 74.7%, 10.6%, and 14.7% of the cases, respectively.

The results of the postsurgical studies showed that the incidence of PCO was 14.2% (11.3 to 17.0, CI=95%). Table 1 shows the incidence of PCO after cataract surgery according to age and sex. The incidence of PCO in males and females was 8.7% and 19.9%, respectively. The incidence of PCO in females was 2.6 folds more than males ($P < 0.001$). PCO was not significantly correlated with age and as shown in Table 1, except for the age group of 55 to 65 with a high PCO incidence of 19.7%, the incidence of PCO in other age groups was close to each other ($P = 0.148$). The same was true for the relationship between the incidence of PCO and sex.

Our results showed that the incidence of PCO increased with time as the incidence PCO was 10.9% and 22.7% at least 1 and 4 years after their cataract surgery, respectively

($P=0.005$). In this study, 21.6% of the cataract patients had diabetes. The incidence of PCO did not show a significant difference between diabetic and non-diabetic individuals (16% vs. 13.5%, $P=0.400$). The same was true about the relationship between the incidence of PCO and age and sex. Other systemic and organic diseases such as hypertension, hyperlipidemia, and the history of heart diseases were not significantly correlated with PCO. Other eye diseases such as PEX ($P=0.215$), glaucoma ($P=0.340$), and age-related maculopathy ($P=0.787$) also were not significantly correlated with PCO. However, the incidence of PCO was significantly higher in individuals who had already undergone corneal opacity surgery as the incidence of PCO in individuals with and without corneal opacity was 31% and 13.2%, respectively ($P=0.011$).

Figure 1 shows the information regarding the incidence of PCO in cataract surgery techniques. As shown, the highest and the lowest incidence of PCO was seen in SICS and phacoemulsification techniques, respectively ($P=0.009$).

The incidence of PCO in hydrophil lenses, and hydrophobe lenses was 12.2%, and 10.4%,

respectively. χ^2 test did not show a significant relationship between them ($P=0.680$).

According to our study, the type of lens was significantly correlated with the incidence of PCO as it was 24.2% and 12% in PMMA and foldable lenses, respectively ($P=0.002$). Of cases with PCO after cataract surgery, 31.6% (21.5 to 41.8 CI=95%) underwent Nd:YAG laser capsulotomy. Uncorrected visual acuity (UCVA) of patients with and without PCO was 0.58 ± 0.41 and 0.34 ± 0.41 logMAR, respectively. However, those with PCO who underwent Nd:YAG laser capsulotomy had a UCVA of 0.3 ± 0.29 logMAR. ANOVA showed a significant difference in the vision of the three groups ($P<0.001$). Mean corrected vision of the patients without PCO, those with PCO, and those with PCO who underwent Nd:YAG laser capsulotomy, was 0.19, 0.45, and 0.17 logMAR, respectively ($P<0.001$). Table 2 shows the distribution of the patients' corrected vision after surgery in 3 groups. As it is shown, the distribution of corrected vision was best in those with a history of YAG ($P<0.001$).

Table 1. The incidence of posterior capsule opacification after cataract surgery

	Male	Female	Total
47-55	8.1 (-0.7-16.9)	20 (5.6-34.4)	13.4 (5.3-21.6)
55-65	13.4 (5.2-21.7)	25 (15.5-34.5)	19.7 (13.3-26.2)
65-75	6.1 (2-10.2)	18.3 (10.8-25.8)	11.4 (7.4-15.5)
>75	10 (1.6-18.4)	15.5 (6.2-24.9)	13 (6.6-19.3)
Total	8.7 (5.5-12)	19.9 (15.1-24.6)	14.2 (11.3-17)

Table 2. Corrected and uncorrected visual acuity of the patients after surgery based on logMAR

	UCVA logMAR		BSCVA logMAR	
Without PCO	0.34	0.41	0.19	0.34
Non-treated PCO	0.58	0.41	0.45	0.48
PCO+YAG capsulotomy	0.30	0.29	0.17	0.21

PCO: Posterior capsule opacification
 UCVA: Uncorrected visual acuity
 BSCVA: Best spectacle corrected visual acuity

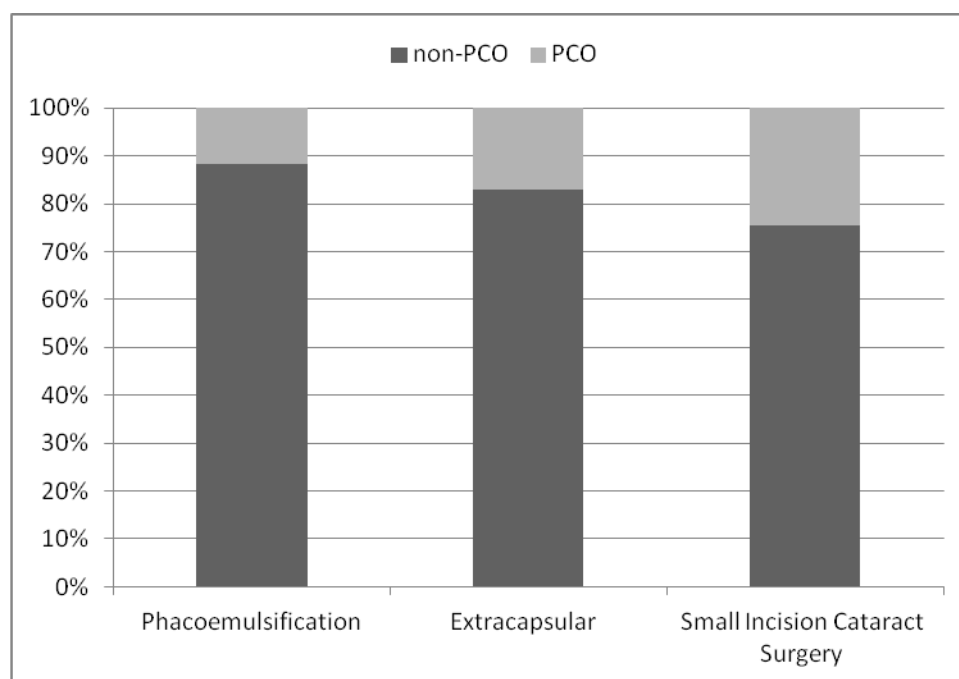


Figure 1. The incidence of posterior capsule opacification in different cataract surgery techniques

Discussion

Previous reports have shown that PCO is the most common complication after cataract surgery. Several studies have reviewed the importance and possible causes of the complication; however, their relatively high diversity and conflict of the results led us to conduct a research on the incidence of PCO in an Iranian population sample.

PCO was observed in 14.2% of cases and as it was shown, its incidence increased from 10.9% to 22.7% over time. Other studies have reported a range from 1% to 99% for the incidence of PCO.^{1,3,4,8,9} Apart from the main and the physiologic factors, some other factors can also cause this vast range. One of the most important ones is the time of the PCO study after cataract surgery. Based on our study as well as some other ones; the incidence of PCO increases with time. The time of the study after surgery is one of the main reasons for the different incidence rates in different studies. Some studies reported a 20% to 50% PCO incidence 5 years after cataract surgery. PCO incidence in our study was 22.7 per cent 4 years after surgery. Comparison between our results and other studies showed that the incidence of PCO in Iran is lower.^{3,4} Another reason can be the

filing system we used for data collection and also other factors such as the surgical technique and the type of lens which is further explained in the following parts.

Our study did not show a significant relationship between age and the incidence of PCO. As shown in Table 1, except for the age group of 55 to 65, other age groups were similar to each other regarding the incidence of PCO after cataract surgery. Other studies reported different results on the relationship between age and PCO incidence. Most studies have emphasized the relationship between age and the incidence of PCO and have shown that being young at the time of surgery is one of the risk factors.⁴ Majima reported that the growth rate of the epithelial cells is more progressive in the young people¹⁰; therefore, a reason why we did not observe any relationship between age and the incidence of PCO was the age range of the cases with a minimum of 47 years.

There was no relationship between PCO and systemic diseases in our study. However, we expected to see a significant relationship between diabetes as one of the systemic diseases and the incidence of PCO; however, there was no such relationship between the

two although some other studies have reported such a relationship between diabetes and the incidence of PCO. In a study specifically conducted on the relationship between diabetes and PCO,¹¹ Ebihara reported that the results of the incidence of PCO 6 to 12 months after cataract surgery were significantly lower in non-diabetic individuals. However, there are some other studies reporting the opposite. Zaczek reported that the incidence of PCO was lower in diabetic patients. He believed that damage to the epithelial cells of the lens in hyperglycemia and less proliferation of epithelial cells were responsible for the lower incidence of PCO in diabetic patients.¹² In summary, based on existing studies, diabetes lowers the incidence of PCO.

As mentioned earlier, PCO did not show a significant relationship with other eye disorders such as glaucoma and PEX. Although documenting the relationship between these factors according to our study is relatively difficult and requires special studies with acceptable methodology, review of other studies conducted in this area besides our findings can strengthen or weaken the results. Kuchle reported that the incidence PCO in PEX cases was significantly higher. He believed that PEX made the surgical conditions more difficult and therefore increased the incidence of PCO.¹³ Moreover, it seems that removing the lens and subsequent cleaning the posterior capsule material in the presence of loose zonules and a non-stretched pupil is harder, thus ground is prepared for the remaining cells to cause PCO. PCO did not have a significant relationship with glaucoma in our study. However, some other studies have reported such a relationship which is in contrast to our results.^{14,15} It should also be mentioned that most studies have reviewed the relationship between PCO and glaucoma in combined glaucoma and cataract surgeries. A possible reason why we did not observe any relationship between PCO and glaucoma can be the fact that our patients had only undergone cataract surgery while in the studies, the surgery was combined and that is

why they reported a higher incidence rate for PCO. As mentioned earlier, preoperative corneal opacity increases the incidence of PCO. Although previous studies did not examine this relationship and it is pathologically hard to determine this relationship, we believe that it is likely that in patients with corneal opacity, the visual field of the surgeon is restricted which subsequently makes the removal of the lens residues difficult and increases the Incidence of PCO.

As a new technique of cataract surgery, phaco method had the lowest PCO incidence. Previous studies have also confirmed this finding, but it seems that the most important factor is the type of the lens that is used in various surgical techniques. As we reported, the incidence of PCO in those with PMMA lenses was twice higher comparing those with foldable lenses.^{9,16,17} Round-edged PMMA lenses make it easier for epithelial cells to progress under the lens. Moreover, the lens material also plays an important role in the incidence of PCO. Numerous studies have shown the relationship between the type of the lens and PCO. Today, because of the vertical design of the lens borders, the incidence of PCO due to the lens structure is minimal. In a review article, Buehl studied the impact of various intraocular lenses on PCO. He not only reported the relationship between the lens type and PCO, but also studies the effect of the lens on PCO grade.¹⁶ The present study has also some limitations. With regard to the fact that capsulorhexis and removal of cortical material can influence the incidence of PCO, lack of these indexes in the present study is a limit, which should be considered.

Conclusion

The incidence of PCO after cataract surgery in this study was relatively low. However, it showed a higher incidence in females. Our study showed that preoperative corneal opacity, surgical technique and the type of the lens could affect the incidence of PCO and found that the incidence of PCO increased with time after cataract surgery.

References

1. Dewey S. Posterior capsule opacification. *Curr Opin Ophthalmol* 2006;17(1):45-53.
2. Nekolová J, Pozlerová J, Jirásková N, et al. Comparison of posterior capsule opacification after two different surgical methods of cataract extraction. *Am J Ophthalmol* 2008;145(3):493-8.
3. Schaumberg DA, Dana MR, Christen WG, Glynn RJ. A systematic overview of the incidence of posterior capsule opacification. *Ophthalmology* 1998;105(7):1213-21.
4. Tetz MR, Nimsgern C. Posterior capsule opacification. Part 2: Clinical findings. *J Cataract Refract Surg* 1999;25(12):1662-74.
5. Powe NR, Schein OD, Gieser SC, et al. Synthesis of the literature on visual acuity and complications following cataract extraction with intraocular lens implantation. Cataract Patient Outcome Research Team. *Arch Ophthalmol* 1994;112(2):239-52.
6. Elgohary MA, Dowler JG. Incidence and risk factors of Nd:YAG capsulotomy after phacoemulsification in non-diabetic and diabetic patients. *Clin Experiment Ophthalmol* 2006;34(6):526-34.
7. Stordahl PB, Drolsum L. A comparison of Nd:YAG capsulotomy rate in two different intraocular lenses: AcrySof and Stabibag. *Acta Ophthalmol Scand* 2003;81(4):326-30.
8. Wormstone IM, Wang L, Liu CS. Posterior capsule opacification. *Exp Eye Res* 2009;88(2):257-69.
9. Yamada K, Nagamoto T, Yozawa H, et al. Effect of intraocular lens design on posterior capsule opacification after continuous curvilinear capsulorhexis. *J Cataract Refract Surg* 1995;21(6):697-700.
10. Majima K, Kojima Y, Ouhashi F. Cell biological analysis with respect to cause of fibrous opacification of the anterior capsule after cataract extraction. *Ophthalmologica* 1998;212(6):364-8.
11. Ebihara Y, Kato S, Oshika T, et al. Posterior capsule opacification after cataract surgery in patients with diabetes mellitus. *J Cataract Refract Surg* 2006;32(7):1184-7.
12. Zaczek A, Zetterström C. Posterior capsule opacification after phacoemulsification in patients with diabetes mellitus. *J Cataract Refract Surg* 1999;25(2):233-7.
13. Küchle M, Naumann GO. Pseudoexfoliation and posterior capsular opacification. *Am J Ophthalmol* 2001;131(6):820.
14. Shin DH, Kim YY, Ren J, et al. Decrease of capsular opacification with adjunctive mitomycin C in combined glaucoma and cataract surgery. *Ophthalmology* 1998;105(7):1222-6.
15. Apple DJ, Solomon KD, Tetz MR, et al. Posterior capsule opacification. *Surv Ophthalmol* 1992;37(2):73-116.
16. Buehl W, Findl O. Effect of intraocular lens design on posterior capsule opacification. *J Cataract Refract Surg* 2008;34(11):1976-85.
17. Oner FH, Gunenc U, Ferliel ST. Posterior capsule opacification after phacoemulsification: foldable acrylic versus poly(methyl methacrylate) intraocular lenses. *J Cataract Refract Surg* 2000;26(5):722-6.