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Characteristic of Posterior Capsular Opacification (PCO) in Dr. Mohammad Hoesin General Hospital: A Retrospective Study

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A B S T R A C T

Introduction: Posterior Capsular Opacity (PCO), also called "secondary cataract," is the most common complication after cataract surgery and occurs in 20-50% of patients within 2 – 5 after cataract surgery before. The current therapeutic option for PCO is using capsulotomy laser Nd:YAG (Neodymium: Yttriume-Auminume-Garnet) to break up opacities in the central or visual axis of the posterior capsule. **Methods:** This retrospective study was conducted in June 2022 with all patients in Lens Subdivision who were diagnosed with PCO in outpatient poly Dr. Mohammad Hoesin General Hospital Palembang from October 2021 – March 2022. Total sampling was obtained from the medical record of the patient. Each patient had previous cataract surgery with a range of 1 – 7 years before. **Results:** There are 15 samples in this study, with a total of 7 women (46.7%) and 8 men (53.3%). The mean age is 62.5 years, with the youngest age 14 years old and the oldest 73 years old. Seven patients (46.7%) are the most surgical history in the 3rd to 5th year. Each sample diagnosed with PCO was subjected to the Nd:YAG laser procedure with visual acuity before the procedure ranging from 1/~ to 6/15, and the best vision after the Nd:YAG laser procedure reached 6/6 vision. **Conclusion:** PCO commonly occurs after cataract surgery & occurred within 2 -5 years after cataract surgery. Therapeutic management can be using the Nd:YAG laser capsulotomy technique and surgical techniques to maintain visual function after cataract surgery.

1. Introduction

Posterior Capsular Opacity (PCO), also called "secondary cataract," is the most common complication after cataract surgery. PCO is a late postoperative complication of phacoemulsification and ECCE (extracapsular cataract extraction) in a large number of patients with hyper mature and long-term cataracts in developing countries.[1–3] In PCO, the posterior capsule has a secondary opacification due to the migration, proliferation, and differentiation of lens epithelial cells (LEC).[4] The diagnosis of this complication is based on history taking and ophthalmological examination. PCO can cause significant visual symptoms, especially when it involves the central visual axis.

PCO occurs in 20-50% of patients within 2 to 5 years after cataract surgery.[4] The fastest time for PCO to occur is 1 year after cataract surgery, while after 5 years, postoperative opacification can still occur.

The occurrence of decreased visual acuity after cataract extraction should prompt the examiner to look for signs of PCO. Patients may complain of decreased vision, blurring, glare, light sensitivity, impaired contrast sensitivity, halos around lights, or difficulty reading.[4] The main sign and symptom of PCO is a semi-opaque membrane with varying degrees of

opacity in the posterior capsule region. Another typical sign of PCO is Elschnig's pearl dan Soemmering rings.[4]

Advances in knowledge about the underlying pathophysiology have made modifications in surgical technique and intraocular lens design potential to reduce the incidence of PCO.[4] The most common procedure performed to improve visual acuity that provides insight into the fundus of an eye with PCO is laser capsulotomy. The current treatment for PCO is to use Nd:YAG capsulotomy laser (Neodymium: Yttriume-Auminume-Garnet). This procedure helps to break up opacities in the central or visual axis of the posterior capsule and has minor complications, such as increased intraocular pressure.[1,5] Laser capsulotomy is accepted as a standard and effective treatment for posterior capsule opacification.[6]

The cumulative incidence of Nd:YAG laser capsulotomy are 10.6%, 14.8%, 21.2% and 28.6% after 1, 2, 3, 4 years.[2] Nd:YAG capsulotomy laser is an effective treatment but can cause other complications, such as increased IOP, ocular inflammation, or macular edema.[5,7] Other options for the treatment of PCO are posterior capsulotomy surgery or capsulectomy, either primary (intraoperatively) or secondary.

2. Methods

This retrospective study was conducted in June 2022. Total sampling was obtained from medical records of a patient who was diagnosed with PCO in Dr. Mohammad Hoesin General Hospital Palembang from October 2021 until March 2022 (6 months).

A patient included in this study is all of the Patient Lens subdivisions from outpatient poly Dr. Mohammad Hoesin General Hospital Palembang. The parameters analyzed were patients' profile, age, gender, surgery history, and visions before and after Nd:YAG. Each patient has had previous cataract surgery with a range of 1 – 7 years before, with an average range of 4.5 years. Data processing using SPSS Statistic 20.

3. Results

There are 15 samples in this study. Total 7 women (46.7%) and 8 men (53.3%). The mean age is 62.5 years, with the youngest age 14 years old and the oldest 73 years old. The lowest history of previous surgery was in the 1st and 2nd years are 4 people (26.7%), 3 - 5 years are 7 people (46.7%), and a history of surgery >5 years are 4 people (26.7%) with the most surgical history is in the 5th year are 5 people (Table 1).

Each sample diagnosed with PCO underwent the Nd:YAG laser procedure with visual acuity before the procedure ranging from 1/~ to 6/15 and the best vision after the procedure. Nd:YAG laser reached 6/6 vision (Table 2).

Table 1. Patients characteristics.

Age (years)	**Total (n=15)**
10-15	1 (6.67%)
50-55	2 (13.3%)
56-60	2 (13.3%)
61-65	2 (13.3%)
66-70	2 (13.3%)
71-75	5 (33.3%)
75-80	1 (6.67%)
Gender	
Male	7 (46.7%)
Female	8 (53.3%)
Surgery history (years)	
1-2	4 (26.7%)
3-5	7 (46.7%)
>5	4 (26.7%)

Table 2. The vision before and after laser capsulotomy Nd:YAG

Vision before		Vision after	
OD	**OS**	**OD**	**OS**
6/30	-	6/7.5	-
6/60	-	6/9	-
-	2/60	-	6/6
6/60	-	6/12	-
-	5/60	-	6/9
6/60	-	6/6	
6/15	-	6/7.5	-
1/60	-	6/9	-
-	6/60	-	6/7.5
1/~	-	6/6	-
-	5/60	-	6/9
-	3/60	-	6/9
5/60	-	6/15	-
6/30	-	6/6	-
2/60	-	6/9	-

4. Discussion

Cataract surgery is one of the most common eye surgeries performed worldwide, which has been shown to have excellent results but still carries a risk of complications. Cataract, a clouding of the lens, is the most common cause of blindness in the world. It has a marked impact on the well-being and productivity of individuals and has a major economic impact on healthcare providers.[8]

The only means of treating cataracts is by surgical intervention. A modern cataract operation generates a capsular bag, which comprises a proportion of the anterior capsule and the entire posterior capsule. The bag remains in situ, partitions the aqueous and vitreous humors, and in the majority of cases, houses an intraocular lens (IOL).[8]

The production of a capsular bag following surgery permits a free passage of light along the visual axis through the transparent intraocular lens and thin acellular posterior capsule. Cataract surgery triggers a wound healing response in the lens, and the remaining lens epithelial cells proliferate and migrate along with the posterior capsule.[8]

PCO is a common cause of lack of visual acuity after cataract surgery which progresses smoothly in healthy eyes.[5] Intracapsular lens extraction technique in cataract surgery removes the entire lens, and the capsule is removed cause it does not leave a capsule for intraocular lens implantation.[2] PCO is caused by abnormal proliferation of anterior lens epithelial cells that migrate to the posterior capsule and disrupt the visual axis and reduce visual acuity.[4] PCO occurs when a cloudy layer of scar tissue forms behind a lens implant. This can cause blurred or blurred vision or seeing a lot of blinding light. PCO is quite common after cataract surgery, occurring in about 20% of patients.[3] Opacification of the capsule can lead to a secondary decrease in visual acuity when it obscures the visual axis, but also reduced contrast sensitivity and the emergence of visual symptoms such as halos.[9]

There are two commonly-described forms of PCO: fibrotic and regenerative. Fibrotic PCO follows classically defined fibrotic processes, namely hyperproliferation, matrix contraction, matrix deposition, and epithelial cell trans-differentiation to a myofibroblast phenotype. Regenerative PCO is defined by lens fiber cell differentiation events that give rise to Soemmerring's ring and Elschnig's pearls and become evident at a later stage than the fibrotic form. Both fibrotic and regenerative forms of PCO contribute to a reduction in visual quality in patients.[5,8,10]

Younger age is a significant risk factor for PCO. Postoperative capsular opacification is mainly caused by the migration and proliferation of residual lens epithelial cells (LECs) after cataract surgery and their differentiation into fibroblastic and lens fiber-like cells. It occurs more frequently and is more severe in young patients than in old as they exhibit increased numbers

of LECs and greater mitotic activity.[6] Young age at the time of surgery is one of the most important factors, whereas, at a young age, there is a tendency for higher epithelial cell growth.[11] Other potential risk factors include diabetes, uveitis, myotonic dystrophy, pigments retinitis, and traumatic cataract.[4]

Posterior capsular opacification (PCO) due to the proliferation and migration of lens epithelial cells (LECs) remains the most common long-term complication after cataract surgery, although advancements in surgical technology appear to have decreased its incidence. Results suggest that a sharp optic edge of the IOL and a firm capsule–IOL adhesion could inhibit LEC migration and PCO.[12]

The current study showed that the need for Nd:YAG capsulotomy to treat PCO was approximately two times higher for patients implanted with low-diopter IOLs compared to higher diopter IOLs. Although the overall incidence of PCO has decreased with advancements in modern cataract surgery, some patient groups are at higher risk.[12]

Neodymium-doped yttrium aluminum garnet (Nd: YAG) laser capsulotomy is a relatively non-invasive procedure that is used in the treatment of posterior capsular opacification. Nd:YAG is the effective treatment of PCO.[5] The procedure is quite fast, and the recovery of vision is fast if there are no other concomitant factors.[13,14] Laser capsulotomy is accepted as a standard and effective treatment for posterior capsule opacification.[15] YAG capsulotomy is a one-time procedure and rarely needs repetition.[16]

Since Nd:YAG introduction in 1980, it has become a standard treatment to improve visual acuity in pseudophakic outpatients with PCO. Laser capsulotomy uses a quick-pulsed Nd:YAG laser to apply a series of focal ablations in the posterior capsule and create a small circular opening in the visual axis.[17] This procedure is important to evaluate anterior and posterior chamber parameters before and after Nd:YAG laser capsulotomy because this treatment can cause complications, such as elevation of intraocular pressure (IOP), corneal injury, iris hemorrhage, uveitis, macular hole, anterior hyaloid surface injury, cystoid macular edema, retinal detachment, intraocular lens (IOL) injury, IOL dislocation, and changes in the refractive index.[18]

The indications for Nd:YAG laser capsulotomy is interfaced with daily activities, decreased vision, increased glare, and difficulty visualizing the fundus. Besides that, the relative contraindications are corneal scarring or edema that prevents a clear view during the procedure, placement of an intraocular glass lens during cataract surgery, and presence of iritis and macular edema in the retina.[17] This Nd:YAG laser capsulotomy performed due to PCO increases visual acuity while decreasing total and high-order aberrations and contributes to improved vision to a similar extent in patients implanted with both multifocal and monofocal IOLs.[19]

The laser Nd:YAG should be set somewhere from 1-3 mJ and can be Q-switched, mode-locked, or both. A Q-switched laser produces a series of single pulses that each last 12-20 nanoseconds, whereas a mode-locked laser produces a train of pulses that each last 25-30 picoseconds. These settings help deliver higher power. Methods of laser treatment are surgeon-dependent and may depend on the density of the opacity.[17]

Complications may include transient IOP elevation, and the incidence of intraocular pressure elevations is significantly reduced when patients are pretreated with apraclonidine. Intraocular pressure can be checked 30-60 minutes postoperatively, although that is surgeon-dependent. Other complications are iritis, retinal tears, and detachments, macular & corneal edema, IOL dislocation into the vitreous, and pitting of IOL.[17]

Ton Van et al. found a mean interval between cataract surgery and Nd:YAG laser capsulotomy of 32.17 months (2.6 years).[9] Recently, surgeons believed that all pediatric patients would develop PCO within two years after the surgery. The occurrence of PCO is determined by the age at the time of surgery, the presence or absence of other accompanying diseases, either diseases or other disorders of the eye, the presence of accompanying systemic disorders, the

operating technique, and the selection of the right type and material for LIO.[10]

Trivedi, et al., in his book, showed that PCO will occur 18 months to 2 years in children aged over 5 years post-surgery if PPC is not performed. Sawitri showed PCO occurred in 55.4% of children with the age group 5-9 years is more common than the age group above 9 years occurs for the first time between the 1st week to 36th week post-surgery, and most were found at 0-6 weeks postoperatively in 14 (34.1%) eyes.[10]

Opacification after cataract surgery in the first year of life is more common if there are eye abnormalities such as anterior segment dysgenesis, microcorneal or persistent fetal vasculature associated with rubella syndrome, toxoplasmosis, and pars planitis, and systemic disorders such as juvenile rheumatoid arthritis. The incidence of postoperative media opacification reaches 100% within 4 years if the posterior capsule is left intact.[20]

The management of PCO using laser capsulotomy which has side effects and the availability of laser facilities that are not owned by all eye health care makes the need to take steps to prevent the occurrence of posterior capsule opacification after cataract surgery.[11] Advances in surgical techniques and intraocular lens (IOL) construction have reduced the PCO rate.[15,21] Membranectomy surgery can be performed if laser therapy cannot be performed, such as in children who are uncooperative, unable to fixate and have nystagmus. The technique of membranectomy surgery can be done through the pars plana or limbus.[20]

5. Conclusion

Posterior Capsular Opacity (PCO), also called "secondary cataract," is the most common complication after cataract surgery and occurs in 20-50% of patients in 2 – 5 after cataract surgery before. The diagnosis of PCO was obtained with history taking and ophthalmologic assessment. Therapeutic management with laser capsulotomy Nd:YAG (Neodymium: Yttriume-Auminume-Garnet). Moreover, surgical techniques can also be used to maintain visual function after cataract surgery.

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