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Comparative Evaluation of Complication Rate Following ND YAG Laser Capsulotomy for Posterior Capsular Opacification in Patients with and Without Ocular Comorbidities

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ABSTRACT: OBJECTIVE-To evaluate the complication rate and visual outcomes following Nd:YAG laser posterior capsulotomy for posterior capsular opacification (PCO) in patients with and without ocular comorbidities.

METHODS-

This prospective, interventional, comparative, and observational study included 80 eyes undergoing Nd:YAG laser capsulotomy for PCO in a tertiary care center. Patients were divided into two groups: Group A comprised 40 eyes without ocular comorbidities, and Group B included 40 eyes with ocular comorbidities. Visual outcomes and post-procedure complications were assessed and compared between the groups

RESULTS-

The mean age of patients in Group A was 61.65 ± 8.85 years, while in Group B it was 63 ± 10.46 years. Among the total 80 patients, 38 (47.5%) were male and 42 (52.5%) were female. In Group B, ocular comorbidities included moderate nonproliferative diabetic retinopathy (NPDR) (n = 14; 35%), subluxated intraocular lens (IOL) (n = 10; 25%), and other conditions. A transient rise in intraocular pressure (IOP) of >5 mmHg from baseline was observed in one patient in each group on the first post-procedure day; both responded well to a 7-day course of topical antiglaucoma medication. IOL pitting was noted in one patient per group. No other complications related to the Nd:YAG procedure were observed.

CONCLUSION-

Nd:YAG laser posterior capsulotomy is a safe and effective procedure for treating PCO, even in the presence of ocular comorbidities. The visual outcomes were excellent across both groups. While a transient rise in IOP was noted in a small number of cases, it was well-managed with medical therapy, and no long-term IOP elevation was observed.

Key words: Intraocular lens, neodymium-doped yttrium aluminum garnet laser, phacoemulsification, posterior capsular opacification

I. INTRODUCTION

Conventional extracapsular cataract surgery, manual small-incision cataract surgery, and phacoemulsification are the three most widely used forms of cataract surgery in the world. Posterior capsular opacification (PCO) or secondary cataract is the most common long-term complication of modern cataract surgery. Moreover, it is the common determining factor for visual outcomes following phacoemulsification. PCO is caused by proliferation, migration, and the epithelial–mesenchymal transition of lens epithelial cells (LECs) present in the equatorial area of the capsular bag. PCO remains a major problem and a cause of diminution of vision after cataract surgery, despite advancements in this field. PCO is associated with social and economic repercussions. It results in reduced contrast sensitivity and visual acuity. Surgical capsulotomy and(Nd:YAG) Neodymium yttrium aluminum garnet laser capsulotomies are the treatment modalities available for PCO. The noninvasive nature and excellent results of Nd: YAG laser posterior capsulotomy have made it the preferred treatment for PCO. Although PCO is safe and effective, it is associated with various complications such as an increase in intraocular pressure (IOP), pitting of the IOL, IOL dislocation, cystoid macular edema, iris hemorrhage, uveitis, and retinal complications. The present study included patients with and without comorbidities and compared the visual outcomes and complications of Nd: YAG capsulotomy, such as post-vitrectomized eyes, operated case of retinal surgery, operated cases of traumatic cataract, post-uveitic eyes (having old signs of uveitis, no episode of uveitis since the last 1 year)subluxated IOL(<2clockhoursof subluxation), age- related macular degeneration.

II. METHODS

Sample Size

The required sample size was calculated to detect a difference of 5 mmHg in intraocular pressure (IOP) between pre- and post-procedure measurements, with a significance level (α) of 0.05

and a power of 80%. Accounting for a 20% potential dropout rate, the final sample size was rounded up to 40 patients in each group.

Study Design and Patient Selection

This was a prospective, interventional, comparative, and observational study conducted from December 2023 to June 2025 in a tertiary care center. The study received approval from the hospital's Institutional Ethics Committee. Informed written consent was obtained from all participants.

Patients with visually significant posterior capsular opacification (PCO) who were scheduled for Nd:YAG laser capsulotomy were included. Participants were divided into two groupsGroup A (n = 40): Patients undergoing Nd:YAG capsulotomy without any ocular comorbidities and group B (n = 40): Patients undergoing Nd:YAG capsulotomy with ocular comorbidities, include Post-vitrectomized eyes, Eyes with a history of retinal surgeryOperated cases of traumatic cataract,Post-uveitic eyes (no active uveitis in the past year; residual signs only)Eyes with subluxated intraocular lens (IOL) <2 clock hours and Age-related macular degeneration.

Exclusion criteria included:

- Thin PCO not affecting visual acuity
- Absence of records of prior ocular surgery
- Known cases of glaucoma

Clinical Examination

All patients underwent Best-corrected visual acuity (BCVA) using Snellen chartSlit-lamp biomicroscopy Intraocular pressure (IOP) measurement using a hand-held applanation tonometer Dilated fundus examination using indirect ophthalmoscopy and a 90D lensOptical coherence tomography (OCT) of the macula.
Grading of Posterior Capsular Opacification

PCO was graded clinically as follows:

- Grade 0: No visible opacification
- Grade 1: Minimal wrinkling of the posterior capsule with a fine layer of lens epithelial cells (LECs)
- Grade 2: Mild honeycomb pattern with dense fibrosis
- Grade 3: Classic Elschnig pearls with a thick layer of LECs
- Grade 4: Severe opacity with a darkening effect

Nd:YAG Laser Capsulotomy Procedure was performed using an Appasamy Nd:YAG laser system by a single experienced surgeon on an outpatient basis.Pupillary dilation was achieved using tropicamide 0.5% and phenylephrine 10% eye drops.A Q-switched Nd:YAG laser was used with Abraham's lens for focusing.The initial laser energy was set at 0.3 mJ and adjusted based on the thickness of the posterior capsule.A central cruciate capsulotomy of 4–4.5 mm was aimed for, centered on the visual axis.The laser focus was kept slightly posterior to the capsule to avoid IOL damage.

All patients were prescribed topical 1% prednisolone acetate, instilled every 3 hours and tapered over 2–3 weeks. No antiglaucoma medications were used routinely unless clinically indicated.

Parameters Studied

Parameters assessed in both groups includedTotal laser energy usedVisual outcome(BCVA), Intraocular pressure (IOP), Central macular thickness (CMT) via OCT

Also studied parameters were Incidence of complications, such as:Cystoid macular edema ,Retinal complications, IOL dislocation, IOL pitting, Uveitis, Iris hemorrhage.

Patients were followed up on Day 1, Day 7, 1 month, Every 3 months thereafter, up to 1 year. At each follow-up visit, the following were recorded: BCVA, slit-lamp findings, IOP, OCT findings, and dilated fundus examination.

III. STATISTICAL ANALYSIS

Demographic data were presented as mean ± standard deviation (SD).Sex distribution was reported as frequency and percentage.BCVA was converted to logMAR units for statistical analysis.Independent t-tests were used to compare:BCVAEnergy requirementsIOPCentral macular thickness (CMT). ANOVA was used to compare energy requirements across different PCO grades.Chi-square test was used to compare categorical outcomes such as visual improvement and complication rates between groups.
All statistical analyses were performed using SPSS version 26.0 (IBM Corp., Chicago, USA). A p-value < 0.05 was considered statistically significant.

IV. RESULTS

A total of 80 eyes were included and equally divided into two groups, with 40 eyes in each. The mean age of patients in Group A was 61.65 ± 8.85 years and in Group B was 63 ± 10.46 years. Most patients in both groups were within the 51–70 years age range. The gender distribution in Group A was equal (20 males and 20 females),

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whereas Group B included 18 males (45%) and 22 females (55%).

The energy distribution of 2 groups are shown in **table 1.** The mean total energy used during Nd:YAG capsulotomy was 46.95 ± 25.92 mJ in Group A (range: 12–120 mJ) and 42.62 ± 21.85 mJ in Group B (range: 16–120 mJ). The difference between the two groups was not statistically significant (P = 0.422).

Groups	No. of patients	Mean ± SD (mJ)	Independent sample t	P value
A	40	46.9500 ± 25.92489	0.807	0.422
B	40	42.6250 ± 21.85229		

Table 1: Comparison of energy requirements between the two group P>0.05 not significant.

When analyzed according to posterior capsular opacification (PCO) grade, the average energy required was 22.30 mJ for Grade 2, 41.62 mJ for Grade 3, and 79.52 mJ for Grade 4 PCO, showing a statistically significant correlation between higher PCO grade and increased energy requirement (P < 0.001).Laser energy requirements and its correlation with PCO grade are shown in **fig 2**.

Table 2: Distribution of patients in group B according to various ocular comorbidities

Ocular comorbidity in group B	No. of patients	Percentage
ARMD	6	15
Mild NPDR	2	5
Moderate NPDR	14	35
Post-uveitic	5	12.5
Retinitis pigmentosa	3	7.5
Subluxated IOL	6	15
Operated traumatic cataract	4	10

The distribution of eyes according to various comorbid conditions is presented in **table2.** Among the study participants, 35% (n = 14) had ocular comorbidities, including moderate non-proliferative diabetic retinopathy, age-related macular degeneration (ARMD), subluxated intraocular lenses (IOLs), post-uveitic eyes, and other retinal pathologies.

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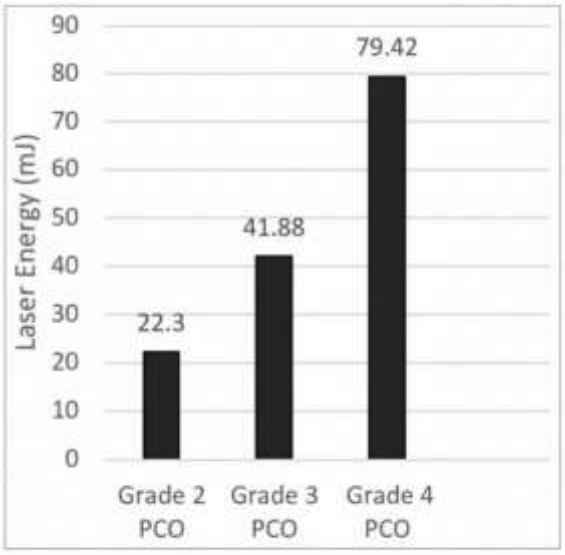

Figure 2: Bar diagram showing energy requirement in various grades of posterior capsular opacification

No major intraoperative or postoperative complications were observed in either group. IOL pitting was detected in two eyes (5%) in each group. The results of IOP comparision between the 2 groups are depicted in **fig 3 and 4**. A transient rise in intraocular pressure (IOP > 5 mmHg from baseline) occurred in one eye (2.5%) per group on the first postoperative day and was effectively managed with topical beta-blockers for seven days. No long-term IOP elevation or other complications, such as anterior uveitis, retinal detachment, or cystoid macular edema (CME), were reported during the one-year follow-up. No long term anti glaucoma medications were required in both patient groups.

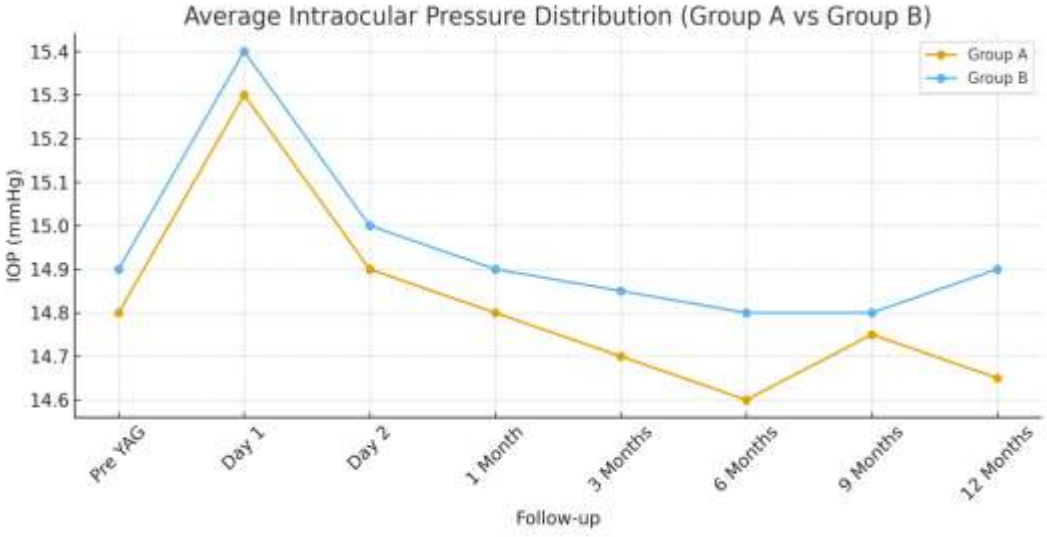

Fig 3Graph showing average intraocular pressure distribution in group A and group B at pre-YAG and post-YAG follow-ups

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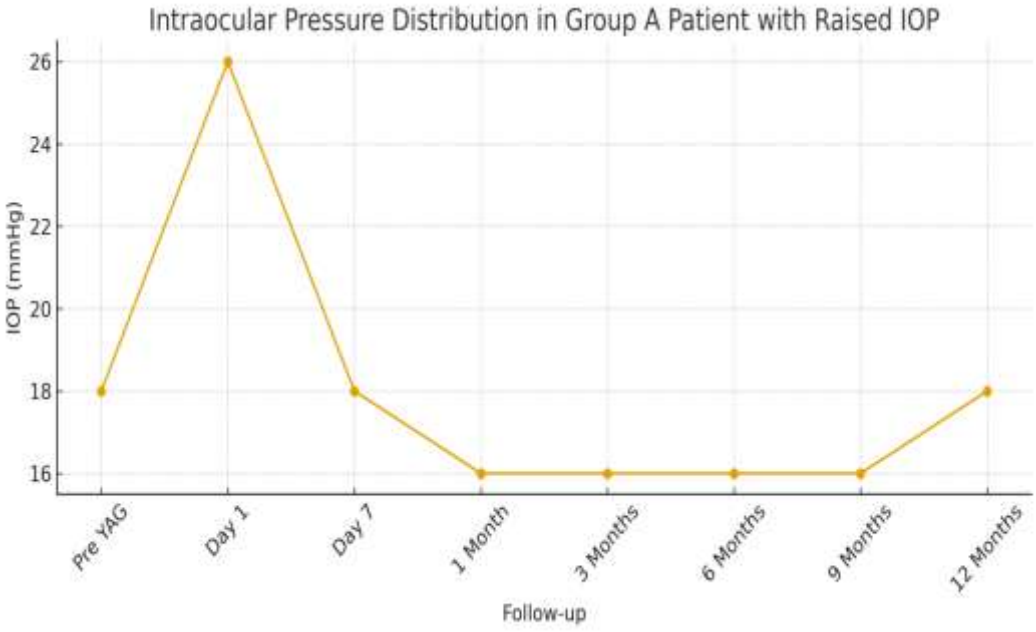

Fig 4 Graph showing intraocular pressure distribution in a patient in group A who had raised IOP as a complication at various follow-ups. IOP = intraocular pressure

Both groups demonstrated significant improvement in best-corrected visual acuity (BCVA) following Nd:YAG capsulotomy. On day 1 post-procedure, 70% of patients in Group A and 37.5% in Group B had logMAR BCVA between 0.3 and 1. A statistically significant difference in visual outcomes was observed between the two groups (P = 0.013), with Group A exhibiting superior postoperative BCVA. BCVA improvement remained stable throughout the 12-month follow-up period.

The mean central macular thickness (CMT) before Nd:YAG capsulotomy was 244 ± 40 µm in Group A and 266 ± 59 µm in Group B. On the seventh postoperative day, the mean CMT increased slightly to 250 ± 50 µm and 270 ± 59 µm in Groups A and B, respectively, but the difference was not statistically significant (P = 0.221).

V. DISCUSSION

Posterior capsular opacification (PCO) remains the most frequent delayed complication following cataract surgery and the leading cause of postoperative visual deterioration. It results primarily from proliferation and epithelial–mesenchymal transition of residual lens epithelial cells (LECs) on the posterior capsule. Although numerous preventive techniques—such as improved cortical cleanup, posterior capsule polishing, square-edged and hydrophobic IOL designs, and pharmacologic strategies—have reduced its incidence, PCO persists as a common challenge in pseudophakic eyes.

Nd:YAG laser posterior capsulotomy is widely accepted as the standard non-invasive management for visually significant PCO. The current study compared energy requirements, visual outcomes, and complication profiles of Nd:YAG capsulotomy in patients with and without ocular comorbidities.

In the present study, the mean energy used was comparable between both groups and aligned with findings by **Bhargava et al.**, who reported mean energy levels of approximately 44 mJ for in-the-bag IOL fixation. A significant correlation was observed between PCO grade and total laser energy delivered, confirming that denser, fibrotic capsules require greater laser power for complete opening.

No significant association between total laser energy and complication rate was observed. IOL pitting occurred in 5% of eyes, consistent with earlier studies (Khanzada et al., Soni et al.). Pitting is attributed to inaccurate laser focus or higher total energy and is more common with polymethyl methacrylate (PMMA) lenses. Transient IOP elevation occurred in 2.5% of eyes, lower than reported rates in previous studies (Hood et al., Soni et al.), possibly due to careful energy titration and postoperative monitoring. No long-term IOP elevation or CME was detected, similar to observations by **Tariq et al.** and **Ge et al.**

Visual outcomes in both groups showed marked improvement, with significantly better

BCVA in the non-comorbid group (Group A). The reduced visual gain in Group B likely reflects the influence of pre-existing retinal or optic nerve pathology rather than the laser procedure itself.

The study also found no significant postoperative changes in central macular thickness, reinforcing the safety of Nd:YAG capsulotomy concerning macular health. These findings agree with previous research demonstrating stable macular parameters post-procedure.

VI. CONCLUSION

Nd:YAG laser posterior capsulotomy is a safe and effective procedure for the management of posterior capsular opacification (PCO). The visual outcomes following the procedure were excellent, even in patients with pre-existing ocular comorbidities, indicating that the treatment can be safely applied across a broad patient population. Although a transient rise in intraocular pressure (IOP) was observed in a few cases, it responded well to medical management, and no patient experienced a sustained or long-term increase in IOP.

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Conflicts of interest There are no conflicts of interest.

REFERENCES

[1]. Spalton DJ. Posterior capsular opacification after cataract surgery. Eye 1999;13:489-92.
[2]. Pandey SK, Apple DJ, Werner L, Maloof AJ, Milverton EJ. Posterior capsule opacification: A review of the aetiopathogenesis, experimental and clinical studies and factors for prevention. Indian J Ophthalmol 2004;52:99-112.
[3]. Awasthi N, Guo S, Wagner BJ. Posterior capsular opacification: A problem reduced but not yet eradicated. Arch Ophthalmol 2009;127:555-62. Apple DJ, Solomon KD, Tetz MR, Assia EI, Holland EY, Legler UF, et al. Posterior capsule opacification. Survey of ophthalmology 1992;37:73-116
[4]. Apple DJ, Peng Q, Visessook N, Werner L, Pandey SK, Escobar-Gomez M, et al. Surgical prevention of posterior capsule opacification: Part 1: Progress in eliminating this complication of cataract surgery. J Cataract Refract Surg 2000;26:180-7.
[5]. Özkurt YB, Taşkıran A, Erdogan N, Kandemir B, Doğan ÖK. Effect of heparin in the intraocular irrigating solution on postoperative inflammation in the pediatric cataract surgery. Clin Ophthalmol (Auckland, NZ) 2009;3:363.
[6]. Sharma P, Panwar M. Trypan blue injection into the capsular bag during phacoemulsification: initial postoperative posterior capsule opacification results. J Cataract Refract Surg 2013;39:699-704.
[7]. Joshi RS, Hussain MS. Long-term results of trypan blue dye irrigation in the capsular bag to prevent posterior capsule opacification: A randomized trial. Indian J Ophthalmol 2017;65:1440-4.
[8]. Ram J, Pandey SK, Apple DJ, Werner L, Brar GS, Singh R, et al. Effect of in-the-bag intraocular lens fixation on the prevention of posterior capsule opacification. J Cataract Refract Surg 2001;27:1039-46. 12. Hollick EJ, Spalton DJ, Ursell PG, Pande MV, Barman SA, Boyce JF, et al. The effect of polymethylmethacrylate, silicone, and polyacrylic intraocular lenses on posterior capsular opacification 3 years after cataract surgery. Ophthalmology 1999;106:49-55.
[9]. Kugelberg M, Wejde G, Jayaram H, Zetterström C. Posterior capsule opacification after implantation of a hydrophilic or a hydrophobic acrylic intraocular lens: One-year follow-up. J Cataract Refract Surg 2006;32:1627–31.
[10]. Beltrame G, Salvetat ML, Chizzolini M, Driussi GB, Busatto P, Di Giorgio G, et al. Posterior capsule opacification and Nd:YAG capsulotomy rates after implantation of silicone, hydrogel and soft acrylic intraocular lenses: A two-year follow-up study. Eur J Ophthalmol 2002;12:388-94.
[11]. Bhargava R, Kumar P, Phogat H, Chaudhary KP. Neodymium-yttrium aluminium garnet laser capsulotomy energy levels for posterior capsule opacification. J Ophthalmic Vis Res 2015;10:37-42.
[12]. Bhargava R, Kumar P, Prakash A, Chaudhary KP. Estimation of mean ND:Yag laser capsulotomy energy levels for membranous and fibrous posterior capsular opacification. Nepal J Ophthalmol 2012;4:108–13.
[13]. Minello AA, Prata Junior JA, Mello PA. Efficacy of topic ocular hipotensive agents after posterior capsulotomy. Arq Bras Oftalmol 2008;71:706–10.

[14]. Sesar A, Petric I, Sesar I, Lacmnovic-Loncar V, Jurisi D, Tomi Z, et al. Intraocular pressure after ND:YAG laser capsulotomy in pseudophakic patients with glaucoma. Acta Med Croatica 2006;60:109–12.
[15]. Slomovic AR, Parrish RK 2nd. Acute elevations of intraocular pressure following Nd:YAG laser posterior capsulotomy. Ophthalmology 1985;92:973-6.
[16]. Ge J, Wand M, Chiang R, Paranhos A, Shields MB. Long-term effect of Nd: YAG laser posterior capsulotomy on intraocular pressure. Arch Ophthalmol 2000;118:1334-7.