

Research Article

Incidence of Retinal Detachment after Neodymium: Yttrium Aluminum Garnet (Nd: YAG) Laser Capsulotomy following Cataract surgery

Sharjeel Sultan¹, Abdul Rasheed Khokar², Nisar A. Siyal³, Nazish Waris⁴

¹Assistant Professor Ophthalmology Unit-II, Dow University of Health Sciences Civil Hospital Karachi-Pakistan;

²Professor and Head of Ophthalmology Unit-II, Dow University of Health Sciences, Civil Hospital Karachi-Pakistan;

³Associate Professor Ophthalmology Unit-II, Dow University of Health Sciences, Civil Hospital Karachi-Pakistan; ⁴Baqai Institute of Diabetology and Endocrinology, Baqai Medical University, Karachi-Pakistan

Abstract

Background/Aim: To evaluate the incidence of retinal detachment (RD) after doing Neodymium: Yttrium Aluminum Garnet (Nd: YAG) laser capsulotomy following cataract surgery.

Method: This retrospective observational study was conducted at Civil hospital Karachi-Pakistan from January 2017 to January 2018. Patients visited to outpatient department (OPD) or admitted to ward, who referred for laser treatment (Nd: YAG) after cataract surgery were included in this study. Baseline characteristics for intraocular pressure (IOP), best corrected visual acuity (BCVA) and spherical equivalent (SE) diopter were noted for each patient. Treatment results after Nd: YAG laser, primary RD of right and left eyes and complications in successful cases were also noted. Statistical package for social science (SPSS) version 20 was used for data analysis. Values for $p < 0.05$ were statistically significant.

Results: Total of 104 eyes, 59(56.7%) right eyes and 45(43.3%) left eyes of 89 patients are included. Most patients were females 51(57.3%) with mean age of 51.43 ± 7.2 years. In most of the patients, after cataract surgery to laser treatment, time interval varied between 1-2 years 52(50%) and 2-3 years 25(24.0%). Patients succeeded at first attempt treatment after Nd: YAG laser were 86(82.7%), and at second attempt were 11(10.6%). Complications in successful cases both after 1st and 2nd attempts were intraocular lens (IOL) pitting in 5(4.81%) and transient IOP elevation in 4(3.84%) eyes. Primary RD was observed in 4(3.84%) eyes, 1(0.96%) in right eyes and 3(2.88%) in left eyes.

Conclusion: Incidence of RD after Nd: YAG laser capsulotomy was observed 3.8% following cataract surgery. Minimal complications were observed using Nd: YAG laser capsulotomy. It concludes that to manage intact posterior capsular opacity, Nd: YAG laser therapy is a noninvasive, effective and relatively safe technique. However, the RD incidence after Nd: YAG laser was higher in this part of the world need special consideration for its management.

Received | 13-01-2019: Accepted | 27-09-2019

Corresponding Author | Dr. Sharjeel Sultan, Assistant Professor Ophthalmology Unit-II, Dow University of Health Sciences, Civil Hospital Karachi-Pakistan. **Email:** sharj35@yahoo.com

Keywords | Neodymium: Yttrium Aluminum Garnet laser; retinal detachment; intraocular lens; intraocular pressure; incidence

Introduction

The Neodymium: Yttrium Aluminum Garnet (Nd: YAG) is non-invasive technique of laser posterior capsulotomy, effective, relatively safe opening of

opacified posterior capsule, and has become the standard of care.¹ About Nd: YAG laser treatment, it is commonly believed that it initiates structural changes in the anterior vitreous, resulting in vitreous liquefaction, posterior vitreous detachment and, if any

abnormal vitreoretinal attachments exist, in retinal breaks and detachment.²

The rare complication of Nd: YAG is retinal detachment (RD) following cataract surgery, but remains as an infrequent, vision-threatening complication.³ The main symptoms of RD over time are flashing lights and sudden increase in the amounts of floaters. The associated risk factors of RD are young age, surgical complications and long axial lengths following uneventful cataract surgery.⁴ The cumulative risk of RD was reported about 2.3 times higher after cataract surgery.⁵ Other complications of Nd: YAG include raised intraocular pressure (IOP) which can occur in up to 30% of cases, cystoid macular edema, glaucoma, intra-ocular lens (IOL) damage or dislocation or exacerbation of endophthalmitis, iritis, lens pitting and uveitis.⁵ Myopia is one of the strong risk factors for RD following Nd: YAG laser capsulotomy. Higher prevalence and most severity of myopia was observed in Asian populations than white populations, it indicates the burden of RD was more in Pakistan.^{6,7}

In selected compliant patients and repeated attempts, Nd: YAG laser posterior capsulotomy can be successfully performed in a pediatric population without serious complications. However, for managing recurrent posterior capsular opacity, laser treatment is also a good option. By doing this, for at least 5 years restored visual acuity can be maintained.⁸ Moreover, the exact phenomena of RD after Nd: YAG laser is still not known. But, in younger patients, the use of cataract surgery was increasing and therefore to know the risk in a contemporary clinical environment is important. Therefore, the aim of our study is to observe the incidence of RD after doing Nd: YAG laser capsulotomy with complications following cataract surgery.

Method

This retrospective observational study was conducted at Civil hospital Karachi-Pakistan from January 2017 to January 2018. Patients visited to outpatient department (OPD) or admitted to any other ward or referred from other hospitals for treatment of Nd: YAG laser after cataract surgery were included in this study. The indication for treatment of Nd: YAG laser were strictly after cataract surgery. Patients of this

study were excluded with trauma history, uveitis, glaucoma, or other substantial ophthalmic diseases, proliferative diabetic retinopathy (PDR), eyes having previous RD history and with vitreoretinal surgeries undergone previously. Exclusion criteria also involve, patients who had undergone with intraocular surgery within 3 months, sulcus or fixated IOL having part of the posterior capsule intact and patients who had undergone combined cataract surgery and pars plana vitrectomy using intraocular tamponades with silicon oil which can affect refractive power. Prior to treatment, it was confirmed that vision was decreased due to the posterior capsular opacification only after cataract surgery for each patient.

Non-probability sampling was used for patient's selection. For capsulotomy in each case, similar device of Nd: YAG laser was used. By consultant ophthalmologists, Nd: YAG laser capsulotomies for all patients were done. Patients of this study received a thorough slit lamp biomicroscopic examination before and after Nd: YAG laser capsulotomy of anterior and posterior segments. Baseline characteristics includes age, gender, laterality and time from cataract surgery to laser treatment were noted for each patient. Prior to Nd: YAG laser treatment, best corrected visual acuity (BCVA- log MAR), IOP (mmHg) and spherical equivalent (SE) were noted, patients were followed up for 1 week and 1-month after Nd: YAG laser.

Outcomes of Nd: YAG laser treatment complications in successful cases such as IOL-pitting, transient IOP elevation were also noted. Failure of YAG laser treatment was considered on adequate size of capsulotomy (4 to 4.5mm) approximately.⁹ Primary failure occurs because the pupil was well dilated and laser applied was decentered and the complaint did not restore so the blurring of vision contrast was still there and patients were still complaining blurring of vision. After examination, it was noted without dilation of pupil that the laser applied was off-center still the capsule was thick in the paracentral area of the pupil and patients have blurring in dim light fluid night vision. After primary laser failure, next treatment was given within two to three weeks.

Statistical Analysis

Statistical package for social science (SPSS) version

20 was used for data analysis. Data was presented as mean \pm standard deviation (SD) for continuous variables. Frequencies and percentages (%) were calculated for categorical variables. Paired t-test was applied for comparing independent variables where applicable. Values for $p < 0.05$ were statistically significant.

Results

In our study, overall incidence of RD afterward Nd: YAG laser capsulotomy was observed 3.8% following cataract surgery.

Table 1 shows the patients baseline and demographics characteristics. The study comprised total 104 eyes, 59(56.7%) right eyes and 45(43.3%) left eyes of 89 patients. Most of the patients were females 51(57.3%) as compare to males 38(42.6%). Patients with less than 40 years were 26(29.2%) and ≥ 40 years were 63(70.8%), with mean age of 51.43 ± 7.2 years. Diminished vision varied from hand movements to 6/18 was the main complaints of all the cases.

Outcomes of Nd: YAG laser treatment and RD following cataract surgery are shown in table 2. In most of the patients, after cataract surgery to laser treatment, time interval varied between 1-2 years 52(50%) and 2-3 years 25(24.0%). Patients succeeded at first attempt treatment after Nd: YAG laser were 86(82.7%), and at second attempt were 11(10.6%). Failure of ND: YAG laser treatment were 7(6.7%). Complications in successful cases (both after 1st and 2nd attempt) were IOL pitting in 5(4.81%) and transient IOP elevation in 4(3.84%) patients.

Figure 1 shows the primary Retinal Detachments (RD) of Right and Left eyes. Primary RD was observed in 4(3.84%) eyes, 1(0.96%) in right eyes and 3(2.88%) in left eyes.

Table 3 shows the BCVA, IOP, and SE changes after Nd: YAG laser capsulotomy following cataract surgery. Mean pre-laser treatment BCVA was 0.48 ± 0.32 , after 1 week was 0.15 ± 0.09 and after 1 month was 0.14 ± 0.12 ($p < 0.05$). On the other hand, mean pre-laser treatment IOP and SE were 15.9 ± 1.8 and -0.29 ± 0.23 , after 1 week was 15.1 ± 2.5 and -0.32 ± 0.58 , and after 1 month was 15.3 ± 1.5 and -0.37 ± 0.25 ($p < 0.05$), respectively.

Table 4 shows the comparison of RD incidence after Nd: YAG laser capsulotomy following cataract surgery.

Table 1: Patients Demographics Characteristics

Characteristics	Results
No. of eyes	104
Gender	
Males	38(42.6%)
Females	51(57.3%)
Laterality	
Right eye	59(56.7%)
Left eye	45(43.3%)
Age of patients (years)	
<40 years	26(29.2%)
≥ 40 years	63(70.8%)
Mean age of patients (years)	51.43 ± 7.2

Data presented as mean \pm SD or n (%)

Table 2: Outcomes of Nd: YAG Laser Treatment and Retinal Detachment following Cataract Surgery

Characteristics	No. of eyes n (%)
Duration between cataract surgery to laser treatment	
3 months – 6 months	6(5.8%)
6 months -1 year	16(15.4%)
1-2 years	52(50%)
2-3 years	25(24%)
>3 years	5(4.8%)
Treatment results after Nd: YAG laser	
Success at first attempt	86(82.7%)
Success at second attempt	11(10.6%)
Failure	7(6.76%)
Complications in successful cases (both after 1 st and 2 nd attempt)	
IOL pitting	5(4.81%)
Transient IOP elevation	4(3.84%)

Data presented as n (%)

Primary RD of eyes

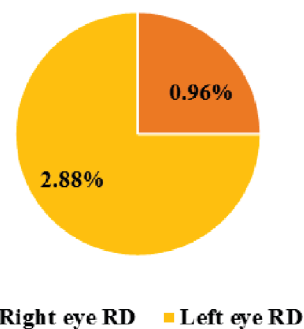


Figure 1: Primary Retinal Detachments (RD) of Right and Left Eyes

Table 3: Changes in VA, IOP, and SE after Nd: YAG laser Capsulotomy following Cataract Surgery

Characteristics	Pre-operative	1 Week Post laser	1 Month Post laser
BCVA (log MAR)	0.48±0.32	*0.15±0.09	*0.14±0.12
IOP (mmHg)	15.9±1.8	15.1±2.5	15.3±1.5
SE (diopter)	-0.29±0.23	-0.32±0.58	*-0.37±0.25

Data presented as mean ± SD

*P-value <0.05 considered as significant

Table 4: Comparison of Incidence of Retinal Detachment after Nd: YAG Laser Capsulotomy following Cataract Surgery with other Studies

Study	Study design	Frequency of RD
Burq MA (2008) ⁵	Prospective	1.9%
Raza A (2007) ¹⁰	Prospective	2.0%
Present study	Retrospective	3.8%

Data presented as (%)

Discussion

In this study, incidence of RD after Nd: YAG laser capsulotomy was observed 3.8% following cataract surgery, is higher as compared to Raza et al and Burq MA et al study.^{7,10} Number of studies were observed on Nd: YAG laser posterior capsulotomy and RD development. But, in Pakistan, scarcity of literature on the matter was found as compare to neighboring developing countries.

The increasing prevalence of RD after Nd: YAG laser treatment was lower in this study as compare to other parts of the world. Incidence of RD after Nd: YAG laser capsulotomy by Bath PE et al., Keates RH et al., and Jahn CE et al was reported 0.08%, 0.89% and 0.5%, respectively.¹¹⁻¹³ Wesolosky JD found 0.60% occurrence of RD after Nd: YAG capsulotomy at some instances.⁷ Incidence of RD in our people is presumed to be more common because in Asia-Pacific, East Asia and Southeast Asia regions, the prevalence and severity of myopia is reported to be higher in Holden BA et al study.¹⁴ In this study, visual loss was evaluated for each patient after cataract surgery and it was confirmed before undergoing Nd: YAG laser treatment. Most of the patients in our study succeeded at first attempt (82.7%) without any major complications but the percentage was lower as compare to Choi SH et al study.⁸ In our study, failure by Nd: YAG laser treatment were due to the capsule thickness that gradually increases with growth during aging and affect the choice of surgery similar to Wu S et al or it may be due to human handling error.¹⁵ The latter has the benefit of being a noninvasive office-based procedure that does not require high levels

skills which is often neglected in the course of procedure and thus leads to failure. Because, it is uncertain that itself laser application causes RD or rupturing the posterior capsule, it is considered a secondary complication.⁷

In our study, frequency of Nd: YAG laser treatment was higher for females as compare to males similar to other studies.^{4,16} After doing Nd: YAG laser capsulotomy, male gender, presence of lattice degenerations, RD history in fellow eye, rupturing of posterior capsular during surgery in Poulsen CD et al and Daien V et al study were reported as the associated risk factors for RD development.^{17,18} Similarly, RD risk after cataract surgery was increased for young age group.¹⁹ Most of the patients of our study, were ≥40 years of age with 1-2 years and 2-3 years duration between cataract surgery to laser treatment indicates that RD is common in older than younger in Pakistan. The BCVA and SE were significantly improved in our study similar to Choi SH et al,⁸ while, IOP remained same. No serious complications were observed in successful cases (both after 1st and 2nd attempt) following Nd-YAG laser capsulotomy, like cystoid macular edema, iridocyclitis, except transient elevation of IOP 3.84% and IOL pitting 2.88%, which was lower as compare to other studies.²⁰⁻²² However, Monteiro T et al reported that no clinically significant impact for pupil diameter was found on biometric measurements and IOL calculation.²³ Shetty NK et al reported that short- and long-term IOP elevations can be caused by Nd: YAG laser capsulotomy, but, for this IOP rise, the underlying mechanism remains unclear after Nd: YAG laser capsulotomy.²⁴

As, Nd: YAG laser capsulotomy complications are rare, require careful follow up. Capsulotomy size is important as patients subjected to lower amounts of laser energy prevent complications of RD and IOP rise and cystoid macular edema (CME).⁵ Nd: YAG laser should ideally be performed at-least after three months of cataract surgery to prevent complications. Decline in RD incidence is possible if complete anterior and posterior segment examination performed prior to cataract surgery and before going for a Nd: YAG laser capsulotomy. Increase in axial length, peripheral degenerations and patients having RD in other eye, should be taken with caution.

The present study has some limitations. Due to short-time follow-up period and retrospective data, other complications related to RD are missing need further large longitudinal prospective study in Pakistan. Capsulotomy size area was not measured accurately, as associated a large capsulotomy size with increased posterior movement of IOL is the other limitation of our study. Due to very thick capsules, pre-operative

results for spherical equivalent (SE) of few eyes were not available is also the limitation of our study. This study was conducted at one institution, other prospectively multi-center studies are required with longer follow up periods to collect more clinical records of cases for additional complications and true occurrence of RD.

Conclusion

Incidence of RD after Nd: YAG laser capsulotomy was observed 3.8% following cataract surgery. Minimal complications were observed using Nd: YAG laser capsulotomy. It concludes that to manage intact posterior capsular opacity, Nd: YAG laser therapy is a noninvasive, effective and relatively safe technique. However, the RD incidence after Nd: YAG laser was higher in this part of the world need special consideration for its management.

References

1. Khanzada MA, Jatoi SM, Narsani AK, Dabir SA, Gul S. Is the Nd: YAG laser a safe procedure for posterior capsulotomy. *Pak J Ophthalmol*. 2008;24(2):73-8.
2. Steel D. Retinal detachment. *BMJ clinical evidence*. 2014;2014.
3. Grzybowski A, Kanclerz P. Does Nd: YAG Capsulotomy Increase the Risk of Retinal Detachment? *Asia Pac J Ophthalmol*. 2018;7(5):339-44.
4. Olsen T, Jeppesen P. The incidence of retinal detachment after cataract surgery. *Open Ophthalmol J*. 2012;6(1):79-82.
5. Karahan E, Er D, Kaynak S. An overview of Nd: YAG laser capsulotomy. *Med Hypothesis Discov Innov Ophthalmol*. 2014;3(2):45-50.
6. Wesolosky JD, Tennant M, Rudnisky CJ. Rate of retinal tear and detachment after neodymium: YAG capsulotomy. *J Cataract Refract Surg*. 2017; 43(7): 923-8.
7. Burq MA, Taqui AM. Frequency of retinal detachment and other complications after neodymium: Yag laser capsulotomy. *J Pak Med Assoc*. 2008; 58(10): 550-552.
8. Choi SH, Kim YD, Yu YS, Kim MK, Choi HJ. Long-Term Outcome of Nd: YAG Laser Posterior Capsulotomy in Children: Procedural Strategies and Visual Outcome. *Am J Ophthalmol*. 2019; 197(1): 121-7.
9. Karahan E, Tuncer I, Zengin M. The Effect of ND: YAG Laser Posterior Capsulotomy Size on Refraction, Intraocular Pressure, and Macular Thickness. *J Ophthalmol*. 2014; 2014:1-5.
10. Raza A. Complications after Nd: Yag posterior capsulotomy. *J Rawalpindi Medic Coll*. 2007; 11(1): 27-30.
11. Bath PE, Hoffer KJ, Aron-Rosa D, Dang Y. Glare disability secondary to YAG laser intraocular lens damage. *J Cataract Refract Surg*. 1987;13(3):309-313.
12. Keates RH, Steinert RF, Puliafito CA, Maxwell SK. Longterm follow-up of Nd:YAG laser posterior capsulotomy. *J Am Intraocul Implant Soc*. 1984; 10(2): 164-168.
13. Jahn CE, Richter J, Jahn AH, Kremer G, Kron M. Pseudophakic retinal detachment after uneventful phacoemulsification and subsequent neodymium: YAG capsulotomy for capsule opacification. *J Cataract Refract Surg*. 2003; 29:925-9.
14. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. *Ophthalmol*. 2016;123(5):1036-42.
15. Wu S, Tong N, Pan L, Jiang X, Li Y, Guo M, et al. Retrospective Analyses of Potential Risk Factors for Posterior Capsule Opacification after Cataract Surgery. *J ophthalmol*. 2018; 2018:1-7.
16. Bond-Taylor M, Jakobsson G, Zetterberg M. Posterior vitreous detachment—prevalence of and risk factors for retinal tears. *Clinic ophthalmol (Auckland, NZ)*. 2017; 11(1):1689.
17. Poulsen CD, Peto T, Grauslund J, Green A. Epidemiologic characteristics of retinal detachment surgery at a specialized unit in Denmark. *Acta ophthalmologica*. 2016;94(6):548-55.
18. Daien V, Le Pape A, Heve D, Carriere I, Villain M. Incidence, risk factors, and impact of age on retinal detachment after cataract surgery in France: a national population study. *Ophthalmol*. 2015; 122(11): 2179-85.
19. Laube T, Brockmann C, Lehmann N, Bornfeld N. Pseudophakic retinal detachment in young-aged patients. *PloS one*. 2017;12(8):1-19.
20. Khan B, Alam M, Shah MA, Bashir B, Iqbal A, Alam A. Complications of Nd: YAG laser capsulotomy. *Pak J Ophthalmol*. 2014;30(3):133-6.
21. Minello AA, Prata Junior JA, Mello PA. Efficacy of topic ocular hipotensive agents after posterior capsulotomy. *Arq Bras Oftalmol*. 2008;71(5):706-10.
22. Lin J-C, Katz LJ, Spaeth GL, Klancnik JM Jr. Intraocular pressure control after Nd : YAG laser posterior capsulotomy in eyes with glaucoma. *Br J Ophthalmol*. 2008;92(3):337-339.
23. Monteiro T, Soares A, Leite RD, Franqueira N, Faria-Correia F, Vaz F. Comparative study of induced changes in effective lens position and refraction after Nd: YAG laser capsulotomy according to intraocular lens design. *Clin ophthalmol (Auckland, NZ)*. 2018;12(1):533-537.
24. Shetty NK, Sridhar S. Study of Variation in Intraocular Pressure Spike (IOP) Following Nd-YAG Laser Capsulotomy. *J Clin Diagn Res*. 2016;10(12):9-12.