

Original Research Article

Safety and efficacy of Nd:YAG laser capsulotomy in management of posterior capsular opacification

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ABSTRACT

Background: At present, the only effective treatment of posterior capsular opacification (PCO), which is the most common complication of modern cataract surgery, is Neodymium-Yttrium Aluminum Garnet (Nd:YAG) laser capsulotomy. There are few complications associated with this easy and quick laser capsulotomy. The current study was conducted in a tertiary hospital of Odisha with an objective to find the safety and efficacy of Nd:YAG laser capsulotomy in the management of defective vision due to posterior capsular opacity.

Methods: The study was conducted among the patients attending the Ophthalmology out patient department of a tertiary hospital in Odisha with defective vision due to posterior capsular opacity after cataract surgery. Nd:YAG laser capsulotomy was carried out in all patients with significant PCO. Visual acuity and intraocular pressure were recorded before and after the procedure. The cases were carefully followed up and looked for any complication and visual acuity was assessed during follow up visits.

Results: In the study 184 participants were included. Visual improvement was observed in 97.8% participants. Visual acuity improved to 6/6 in 21.73 %, 6/9 in 36.41 % cases, 6/12 in 15.21 % cases. Raised IOP was recorded among 46% of participant after 4 hrs of laser capsulotomy which was later observed among 12% of participants on follow up visit at 1 week. The most common complication recorded was transient rise of IOP (46.3%) followed by aqueous flare (28.8%).

Conclusions: Nd:YAG laser capsulotomy is a noninvasive, effective, relatively safe procedure for PCO with good visual outcome.

Keywords: Intra ocular pressure, Nd:YAG laser, Posterior capsular opacity, Visual acuity

INTRODUCTION

Cataract is the major cause of blindness in India accounting for 62.6% amongst all the causes for blindness.¹ Posterior capsular opacification (PCO) with an incidence of 20%-50% is one of the most common complications of modern cataract surgery.² At present, the only effective treatment for PCO is Neodymium-Yttrium Aluminum Garnet (Nd:YAG) laser capsulotomy,

which is nothing but clearing the visual axis by creating a central opening in the opacified posterior capsule.^{2,3} The Nd:YAG laser has a wavelength of 1064 nm that can disrupt the ocular tissues. The Nd:YAG laser is a cold laser acts by photo disruption of the unwanted tissue by shock waves and clears the optical axis. The increase in Intra Ocular Pressure (IOP) after Nd:YAG capsulotomy is due to reduced outflow facility which is because of trabecular meshwork blockage by the capsular debris,

vitreous particles floating in the anterior chamber.^{4,6} Improvement in visual acuity after Nd:YAG laser capsulotomy in patients having significant PCO has been well documented in different studies.⁷⁻⁹ Complications of this easy and quick procedure are retinal detachment, damage to the Intra Ocular Lens (IOL), cystoid macular edema, increased IOP, iris hemorrhage, corneal edema, IOL subluxation and exacerbation of localized endophthalmitis.^{2,3,10,11} Keeping all the facts in mind the current study was conducted to evaluate the safety and efficacy of Nd:YAG laser capsulotomy in the management of PCO in patients attending a tertiary health institution of Odisha.

METHODS

The present study was a hospital based descriptive study, which was conducted in a tertiary teaching hospital of Odisha among patients attending the outpatient department of Ophthalmology from October 2011 to September 2013. Patients with significant PCO, history of good immediate postoperative (cataract) visual acuity and absence of any corneal /retinal (organic) pathology were included in the study. History of any systemic or topical medication and any significant systemic illness was recorded. A complete ophthalmic history was collected which includes history of any pre-existing glaucoma, optic atrophy, corneal opacity, retinal pathology, amblyopia, corneal dystrophy/degeneration or any other ocular conditions. The study participants were included in the present study based on the above inclusion and exclusion criteria.

Ethical approval for the study was obtained from the Institute Ethics Committee of the tertiary teaching hospital of Odisha. Informed consent was obtained from each study participants after explaining the objective of the study and a copy of the participant information sheet was given to all participants.

The participants for the study were recruited from 10/2011 to 09/2013. Each patient was evaluated before undergoing laser capsulotomy to confirm that the visual loss was only due to PCO and not due to any other pathology or systemic illness. The following tests were done in each case prior to posterior capsulotomy: best corrected visual acuity, intraocular pressure recording, slit lamp examination for evaluation of red reflex and anterior segment pathology and fundus examination. As the single and most reliable technique for assessing capsular opacity is direct ophthalmoscopy, the same was used in the present study. Ultrasound B scan where posterior segment view was obscured by dense PCO was also done.

Neodymium-Yttrium Aluminum Garnet (Nd:YAG) laser capsulotomy was done as per the clinical indication for PCO in the affected one eye of the study participants after complete evaluation and informed consent. Minimal energy (1mj) was used for the procedure. Laser shots

were placed across the tension lines. The usual strategy was to create cruciate openings beginning at 12 o’ clock periphery with progress towards 6 o’ clock position. The posterior capsule cut across 3 o’ clock and 9 o’ clock position. Intra ocular pressure was recorded after 4 hrs and 1 week of capsulotomy. The patients were advised the following treatment: topical Timolol maleate 0.5% B.D for 1 week, tropical antibiotic and steroid eye drops QID for 1 week, oral acetazolamide tablets 250 mg QID for 5 days only when IOP was not controlled with above medication. The patients were followed up at 1 week, 1 month, 3 months and 6 months of laser capsulotomy. During the follow up visits the laser capsulotomy eyes were carefully examined for iritis, hyphaema, aqueous flare, vitritis, rise in intra ocular pressure, retinal detachment and cystoid macular oedema.

RESULTS

In the present study 184 participants were included based on the inclusion and exclusion criteria. As per indication the Nd:YAG laser capsulotomy was done and the subjects were followed up as per the protocol. Among the 184 participants, 100 (54%) were male and 84 (46%) were female. Most (55%) of the participants were belonged to 41-60 years of age. On assessment of pre laser visual acuity (VA) it was found that most (51%) of them had VA of 6/60 to 6/36 followed by hand movement- counting fingers (HM-CF) at 5 mts (36%). VA of 6/24 to 6/12 was recorded in 13% of participants (Table 1).

Table 1: Pre laser visual acuity.

Pre laser VA	Number of cases	Percentage
HM- CF 5mts	66	36
6/60 - 6/36	94	51
6/24 - 6/12	24	13

Table 2: Early post Nd:YAG laser capsulotomy complications.

Complications	Number of cases	Percentage
No complications	3	1.6
Aqueous flare	53	28.8
Bleeding from iris	7	3.8
Vitritis	24	13
Rise in IOP (transient)	85	46.3
Pitting of IOL	12	6.5

The most common early post Nd:YAG laser capsulotomy complication recorded was transient rise of IOP (46.3%) followed by aqueous flare which was found in 28.8% participants. The other complications recorded among the participants were vitritis, pitting of IOL and bleeding from iris among 13%, 6.5% and 3.8% participants

respectively. In 3 patients no early, postoperative complications were found (Table 2).

There was no change in IOP at 4hrs of posterior laser capsulotomy among 94 participants (51%). An increase of 1-2 mm Hg of IOP was recorded among 36% of study participants followed by an increase in 3-4mm Hg IOP in 9% of participants. In 5 cases the IOP was lower by 1mm Hg at 4hrs of capsulotomy. After 1 week of capsulotomy the IOP of 65% of participants were found normal and in 23% of participants the IOP was recorded 1mm Hg lower than the normal. Among 10% of participants 1-2mm Hg raised IOP was recorded (Table 3).

Visual acuity was assessed during the post laser capsulotomy follow up visits of the participants. Visual improvement was observed in 175 (97.8%) participants out of 179 participants whose visual acuity was assessed during follow up visits. In case of one participant there was no visual improvement and in five participants the

visual acuity could not be assessed due to unavoidable reasons. Visual acuity improved to 6/6 in 40 (21.73%) cases, 6/9 in 67 (36.41%) cases, 6/12 in 29 (15.21%) cases (Table 4).

Table 3: Change in IOP after 4 hours and 1 week of Nd:YAG laser capsulotomy.

Change of IOP	After 4 hrs		After 1 week	
	Number	Percentage	Number	Percentage
No change	94	51	119	65
1-2mmHg	66	36	19	10
3-4mmHg	17	9	4	2
>5mmHg	2	1	0	0
-1mmHg	5	3	42	23

Table 4: Visual improvement after Nd:YAG laser posterior capsulotomy.

Pre laser VA	Post laser VA								Total
	6/6	6/9	6/12	6/18	6/24	6/36	6/60	Lost to follow up	
HM- CF 5mts	0	6	22	7	9	13	4	5	66
6/60 – 6/36	20	57	7	6	0	4	0	0	94
6/24 – 6/12	20	4	0	0	0	0	0	0	24

DISCUSSION

Posterior capsular opacity is one of the major complications of cataract surgery with or without implantation of intraocular lens. The use of Nd:YAG laser which is entirely non-invasive procedure has simplified the treatment of PCO.

Various studies have examined the relationship between Nd:YAG laser posterior capsulotomy and development of retinal detachment. In a study by Rosa et al, showed an incidence retinal detachment in post laser patients as 0.08%.¹² Keates et al, reported the incidence as 0.89%.¹³ In the present study there was no case of retinal detachment recorded. This could be because of the absence of risk factors in cases selected for Nd:YAG laser capsulotomy. The development of cystoid macular edema after Nd:YAG laser posterior capsulotomy has been demonstrated in many studies. The main diagnostic tools are evaluation with 78D lens and fundus fluorescein angiography. The incidence of cystoid macular edema according to Winslow et al, was 0.55% and they attributed this occurrence to vitreous instability secondary to Hyaluronic acid and prostaglandin diffusion through the compromised posterior capsule. Jampol hypothesized that UV-A light may generate free radicals, facilitating

prostaglandin production and including inflammation and ultimately cystoid macular edema.^{14,15}

Post Nd:YAG laser capsulotomy, IOL pitting was noted among 19.8% cases in Hassan et al, study and 11.7% in Haris et al, study.^{16,17} In the present study pitting of IOL was seen in 12 cases (6.52%) because of uncooperativeness of patients. Bleeding from iris occurred in 7 cases (3.8%). Gore et al. reported that 33.5% of patients had iritis after Nd:YAG laser capsulotomy manifested as cells and flare in the anterior chamber on slit lamp examination.¹⁸ Vitritis was seen in 24 patients (13%) and aqueous flare occurred in 85 (28.8%) cases. Other rare complications like corneal stromal scarring, macular holes, endophthalmitis did not occur among participants in this study.

The IOP rise after Nd:YAG laser posterior capsulotomy may be absent or transient. In the present study the raised IOP was recorded among 46% of participant after 4 hrs of laser capsulotomy which was later observed among 12% of participants on follow up visit at 1 week. On subsequent follow up visits the IOP was found normal. Rathod et al, in their study found that during the first 3 hours after procedure IOP rose from baseline but was not affected till 6 weeks post laser capsulotomy.¹⁹ In another study by Jayne et al, recorded maximum increased IOP

within 1.5-4 hours of Nd:YAG laser capsulotomy which returned to baseline within 24 hours.²⁰ They also observed that rise in IOP was more pronounced in patients with glaucoma and in those who experienced a higher rise of IOP within hours of capsulotomy. Similar observations were also reported by few other studies.^{21,22} Acute IOP elevation following capsulotomy is common among patients who do not receive prophylactic treatment and may occur in 15 to 36% of cases.²³⁻²⁸ When prophylactic treatment is prescribed, however, an IOP spike above 5 mm Hg is seen in only 2 to 8.5% of cases.²³

When the visual acuity was assessed during follow up visits of the participants, visual improvement was observed in 175 (97.8%) participants out of 179 participants. In various studies the rate of improvement of visual acuity was recorded as more than 90%.²⁹⁻³² In a study by Keates et al, found visual improvement in 87.8% cases and compared with a surgically treated group in which 68.4% of cases experienced improved vision at the end of 6 months follow-up.¹³ In present study, visual acuity improved to 6/6 in 40 (21.73%) cases, 6/9 in 67 (36.41%) cases, 6/12 in 28 (15.21%) cases, 6/18 in 13 (7%) cases, 6/24 in 9 (4.89%) cases, 6/36 in 17 (9.23%) cases, 6/60 in 4 (2.17%) cases. In one case visual acuity was not improved due to glaucomatous optic atrophy which could be found only after capsulotomy. In the current study the better visual outcome may be related to good cases selection for the laser procedure and subsequent lower complications as compared to earlier studies. Because of high astigmatism most of the cases the visual acuity could not be improved to 6/6.

CONCLUSION

Posterior Capsular Opacification (PCO) is one of the most common visually disabling consequence of modern cataract surgery. At present, the most effective treatment of PCO is Nd:YAG laser capsulotomy which is entirely a non-invasive procedure. Improvement in visual acuity with Nd:YAG laser capsulotomy in patients with PCO has been shown in the present study. Though Nd:YAG capsulotomy is a safe procedure, few complications are associated with this procedure. Post Nd:YAG capsulotomy rise in IOP are minimal and transient.

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