CLINICAL STUDY OF VISUAL OUTCOME AND COMPLICATIONS FOLLOWING NEODYMIUM: YTTRIUM-ALUMINIUM-GARNET (ND: YAG) LASER POSTERIOR CAPSULOTOMY FOR POSTERIOR CAPSULAR OPACIFICATION

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ABSTRACT

BACKGROUND

The present study of “visual outcome and complication following Nd: YAG laser posterior capsulotomy” was conducted in Silchar Medical College and Hospital, over a period of one year from September, 2014 to August, 2015.

MATERIALS AND METHODS

The study was conducted at Silchar Medical College and Hospital, Silchar from September, 2014 to August, 2015. Visual outcome and complications following Nd: YAG laser capsulotomy for posterior capsular opacification was studied in 100 eyes of 100 patients.

RESULTS

Improvement in visual acuity was found to be excellent in this present study. Significant improvement in visual acuity was seen in 82 cases (82%) with 6/18 vision or more. Out of these, visual acuity of 6/6 was seen in 40 cases (40%). Rest of the cases could not be improved to 6/6 because of high astigmatism. Incidence of various complications found after Nd: YAG laser posterior capsulotomy were, immediate raised intraocular pressure in 30 cases (30%), mild anterior uveitis in 19 cases (19%), intraocular lens pitting in 12 cases (12%), anterior hyaloid membrane rupture in 8 cases (8%).

CONCLUSION

Nd: YAG laser posterior capsulotomy is a very economical, convenient, fast and non-invasive OPD procedure for posterior capsular opacification with immediate results. Although safe, Nd: YAG laser capsulotomy carries risks. However, these can be minimised when correctly done with proper patient selection, thorough fundus examination and at least three months after the cataract surgery.

KEYWORDS

Nd: YAG Laser, Posterior Capsulotomy, PCO.

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BACKGROUND

Cataract is the chief cause of avoidable blindness in the world.¹ Extracapsular cataract extraction (ECCE) or phacoemulsification with posterior chamber intraocular lens implant (PCIOL) is the most frequent surgical technique.² However, posterior capsular opacification (PCO), which is also termed secondary cataract, is a common long-term complication of modern cataract surgery.³ Advantages in surgical techniques, intraocular lens materials and designs have reduced the PCO rate, but it is still a significant problem. The current treatment of choice for PCO is Neodymium-doped Yttrium-Aluminium-Garnet (labelled as Nd: YAG) laser capsulotomy, which is an effective, safe, non-invasive procedure that does not require patient hospitalisation.^{4,5} However, Nd: YAG laser posterior capsulotomy can be associated with significant complications. The purpose of the study is to evaluate the visual outcome and the complications following Nd: YAG laser posterior capsulotomy.

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Aims and Objectives

This Study Aims to Find Out

1. The visual outcome following Nd: YAG laser posterior capsulotomy.
2. The different complications following Nd: YAG laser posterior capsulotomy.
3. The incidence of the complications.

MATERIALS AND METHODS

Source of Data

Nd: YAG laser capsulotomy was carried out in 100 eyes of 100 patients. The materials for the present study will be drawn from the patients attending outpatient department of Ophthalmology at SMCH, Silchar from September, 2014 to August, 2015. The criterion for selection of patient was significant posterior capsular opacification causing decrease in visual acuity. Approval for the study was obtained from the institution's ethical review board.

Inclusion Criteria

1. Decrease in vision by at least $\leq 6/9$ on Snellen's chart.
2. Posterior capsular opacification at least 3 months after cataract surgery.

Exclusion Criteria

1. Age less than 15 years.
2. Eyes with subluxated lens.

3. Eyes with aphakia.
4. Cases with post-op complications like endophthalmitis.
5. Uncooperative patients with pre-existing corneal scars, irregularities or oedema that interfere with target visualisation.
6. PCO associated with pre-existing cystoid macular oedema or other fundus pathology that likely to reduce the visual acuity.
7. Patients with pre-existing raised intraocular pressure.

Detailed clinical examination, visual acuity testing with Snellen's chart, slit-lamp examination, measurement of IOP with Goldman applanation tonometer, fundus examination and B scan ultrasound were done. Random blood sugar was done as routine investigation to all patients. Finally, informed consents were taken before doing the procedure. Nidek YC 1800 Q and Abraham lens were used for the procedure.

Topical proparacaine hydrochloride ophthalmic solution 5% was used as anaesthetic and 2% hypromellose gel used in the contact lens as coupling media. Minimal energy level (0.5–1 mJ) was used initially and may increase gradually up to 2.5 mJ. An opening of 3–4 mm was produced in the posterior capsule. Intraocular pressure was examined on the same day at 1 hour and 4 hours following the procedure. All patients were routinely given topical antibiotic-steroid combination drops. The patients were discharged on the same day. Patients were followed up after 1 week, 2 weeks and then at 1 month. On each followup visit, patients were examined for visual acuity, intraocular pressure, corneal burn, inflammation of iris, hyphaema, intraocular lens pitting and posterior segment for anterior hyaloid membrane rupture, cystoid macular oedema, endophthalmitis and retinal detachment. The patients were given topical timolol maleate 0.5% eye drops twice daily if the post laser IOP is >21 mmHg 1 week after the procedure.

RESULTS

In the present study, 100 eyes of 100 patients with pseudophakia and posterior capsular opacification undergoing Nd: YAG laser capsulotomy in the Department of Ophthalmology was evaluated. The observations done during the study are as follows.

Male and female distribution was 0.61. The age ranged from 25 to 85 years. Mean age was 64.9 years, an incidental finding as cases were selected on random basis. Fundus was visible in 91 cases and hazy in 9 cases due to presence of thick PCO.

Visual Acuity	Number of Patients	
	Pre Laser	Post Laser
6/6	0	40
6/9-6/24	34	48
6/36-6/60	36	7
5/60-1/60	21	0
FC-HM	9	0
Visual Outcome		

5 Cases Lost to Follow

Pre YAG visual acuity in 9 patients were hand movement to finger counting, whereas 1/60 – 5/60 in 21, 6/60 to 6/24 in 55, 6/18 to 6/9 in 15 patients. Visual acuity improved to 6/6 in 40 patients, 6/18 to 6/9 in 42 and 6/60 to 6/24 in 13 patients.

Figure 1. Line Diagram showing Visual Outcome following Nd: YAG Laser Capsulotomy

Pre-Laser Visual Acuity	Post Laser Visual Acuity								Lost To Followup
	6/6	6/9	6/12	6/18	6/24	6/36	6/60	<6/60	
<6/60	3	7	9	1	4	2	3	0	1
6/60	5	7	2	0	0	2	0	0	2
6/36	8	6	2	0	2	0	0	0	2
6/24	12	1	2	3	0	0	0	0	0
6/18	6	1	0	0	0	0	0	0	0
6/12	5	1	0	0	0	0	0	0	0
6/9	1	0	0	0	0	0	0	0	0
Pattern of Visual Outcome									

Pre-laser visual acuity improved from <6/60 to 6/6 in 3 cases, 6/9 in 7 cases, 6/12 in 9 cases, 6/18 in 1 case, 6/24 in 4 cases, 6/36 in 2 cases, 6/60 in 3 cases. 1 case lost to followup.

Pre-laser visual acuity improved from 6/60 to 6/6 in 5 cases, 6/9 in 7 cases, 6/12 in 2 cases, 6/36 in 2 cases. 2 cases lost to followup.

Pre-laser visual acuity improved from 6/36 to 6/6 in 8 cases, 6/9 in 6 cases, 6/12 in 2 cases, 6/24 in 2 cases. 2 cases lost to followup.

Pre-laser visual acuity improved from 6/24 to 6/6 in 12 cases, 6/9 in 1 case, 6/12 in 2 cases, 6/18 in 3 cases; from 6/18 to 6/6 in 6 cases, 6/9 in 1 case; from 6/12 to 6/6 in 5 cases and 6/9 in 1 case; from 6/9 to 6/6 in 1 case.

Figure 2. Histogram showing Pattern of Visual Outcome after Nd: YAG Laser Posterior Capsulotomy

Complications	Number of Patients	%
Corneal Burn	0	0
IRITIS	19	19
Hyphaema	0	0
IOL Pitting	12	12
Anterior Hyaloid Membrane Rupture	8	8
Raised IOP	30	30

CME	0	0
Endophthalmitis	0	0
RD	0	0
No Complication	25	25
Lost to Followup	5	5
Post YAG Laser Complications		

The patients were evaluated for any complications following Nd: YAG laser posterior capsulotomy and it was found that raised intraocular pressure was the most common complication following the procedure which was seen in 30 (30%) patients, second most common was the presence of iritis in 19 cases (19%) followed by intraocular lens pitting in 12 cases (12%) and rupture of anterior hyaloid membrane in 8 cases (08%). None of the patients showed corneal burn, hyphaema, cystoid macular oedema, endophthalmitis or retinal detachment within 1 month followup period. 24 patients showed no complications, whereas 5 patients lost to follow up.

Figure 3. Bar Diagram showing Complications following Nd: YAG Laser Posterior Capsulotomy

Duration	Number of Patients	
	Raised IOP	Unchanged
1 Hour	30	70
4 Hour	28	72
1 Week	7	88
2 Weeks	1	94
1 Month	0	95
Intraocular Pressure Changes		

5 Patients Lost to followup

The rise in intraocular pressure was seen in 30% cases (30 cases) 1 hour after and in 28% cases (28%) 4 hours after Nd: YAG laser capsulotomy, which on treatment returns to pre-laser value in 21% cases after 1 week. 7% cases (7 cases) showed raised IOP even after continued medication for 1 week. After 2 weeks, only 1 case showed raised IOP. But, none of these 7 cases showed persistent rise in intraocular pressure at 1 month followup.

Intraocular Pressure (mmHg)	Number of Patients				
	1 Hour	4 Hours	1 Weeks	2 Weeks	1 Month
Unchanged	70	72	88	94	95
1-2	27	26	5	1	0
3-4	1	0	1	0	0
5<	2	2	1	0	0
Pattern of Changes in IOP					

Out of 100 cases, 70 cases showed no change in intraocular pressure, 27 cases showed increase in intraocular pressure by 1-2 mmHg, 1 case showed rise by 3-4 mmHg and 2 cases showed rise by more than 5 mmHg. At the end of 1 week, intraocular pressure was found to be pre-laser value in 88 cases, while 5 cases showed rise in IOP by 1-2 mmHg. Rise in IOP by 3-4 mmHg and more than 5 mmHg was seen in one case each. At the end of 2 weeks, only 1 case showed high IOP, which returned to pre-laser level after 1 month. 5 cases lost to followup.

Figure 4. Histogram showing Pattern of Change in Intraocular Pressure after 1 Hour, 4 Hours, 1 Week, 2 Weeks and 1 Month

	Number of Patients	Percentage
With Iritis	19	19
No Iritis	81	81
Incidence of Iritis		

Iritis was the second most common complication found in the present study, with 19 % cases (19 cases).

Figure 5. Pie Diagram showing Incidence of Iritis immediately after YAG Laser Capsulotomy

	Number of Patients	Percentage
Cases with Pitting of IOL	12	12
No Pitting	88	88
Incidence of IOL Pitting		

Post YAG laser IOL pitting was seen in 12 % cases (12 cases).

Figure 6. Pie Diagram showing Incidence of Post Laser IOL Pitting

Anterior Hyaloid Membrane Rupture

	Number of Patients	Percentage
With AHMR	8	8
No AHMR	92	92

Incidence of Anterior Hyaloid Membrane Rupture

Anterior hyaloid membrane rupture was seen in 8% cases (8 cases).

Figure 7. Pie Diagram showing Incidence of Post Laser Anterior Hyaloid Membrane Rupture

Figure 8. Posterior Capsular Opacification

Figure 9. Post Laser

Figure 10. IOL Pitting

DISCUSSION

Cataract surgery is currently the most common and well-established ophthalmic surgical procedure in the world. This procedure involves the extra capsular extraction of the natural opaque lens fibres and implantation of an intraocular lens (IOL), which restores good vision.¹ Posterior capsular opacification is the most common late complication of uncomplicated cataract surgery with or without intraocular lens implantation.²

In this study, the main aim is to evaluate the visual outcome and complications following Nd: YAG laser capsulotomy in 100 eyes of 100 patients. Visual acuity improved to 6/18 or better in 82 cases (82%). None of the cases had visual acuity less than 6/60 after the treatment. Out of 100 eyes of 100 cases, 5 cases lost to followup. Hence, in the present study, improvement in visual acuity was excellent. This was most probably due to high skill, proper patient selection, correct method, good machine and

exclusion of any abnormality that might reduce post-laser visual acuity. Although, because of high astigmatism most of the cases could not be improved to 6/6.

In this present study, incidence of various complications after Nd: YAG laser posterior capsulotomy were, raised intraocular pressure in 30 cases (30%), mild anterior uveitis in 19 cases (19%), intraocular lens pitting in 12 cases (12%), anterior hyaloid membrane rupture in 8 cases (8%). None of the cases showed corneal damage, hyphaema, cystoid macular oedema, endophthalmitis or retinal detachment.

The rise of intraocular pressure was most probably because of presence of cells and flare in the anterior chamber blocking the trabecular meshwork. Most of the cases returned to pre-laser state since all the cases were given topical steroid drops.

In the present study, 19 patients (19%) had iritis after YAG laser capsulotomy manifested as cells and flare in anterior chamber on slit-lamp examination. They were given topical steroid and reaction had subsided leaving no delayed complication.

In the present study, intraocular lens pitting was seen in 12% cases (12 cases). This was seen in cases of thick PCO with more number of shots. However, there was no decrease or disturbance in visual acuity with only pitting of IOL.

Anterior hyaloid membrane rupture was seen in 8 cases (08%) due to inadvertent shots over anterior vitreous face.

None of the cases showed corneal burn or hyphaema. This was most probably because of high skill with proper focusing and exclusion of uncooperative patients. Cystoid macular oedema, endophthalmitis and retinal detachment were not seen in this present study as less number of shots was used as far as possible; moreover, cases with pre-laser fundus pathology or cases with predisposing factors were excluded from this study. These are contradictory to some studies done earlier.

CONCLUSION

The posterior capsule opacification is a very common late complication after cataract surgery worldwide and it can be managed safely as an outdoor procedure by Nd: YAG laser

posterior capsulotomy improving the visual acuity. It may however require augmentation with optical correction. It is very economical, convenient, fast and non-invasive OPD procedure with immediate results. Although safe, Nd: YAG laser capsulotomy carries risks.

Proper selection of patient is important to reduce these complications. High skill, proper focusing, less number of shots, postponing by at least 3 months after cataract surgery can reduce the incidence of complications. It should be done with caution in patients with increase in axial length, peripheral retinal degeneration and retinal detachment in other eye as these patients are at increased risk of developing retinal detachment. These can also be minimised by minimising energy and number of precisely focused shots.

Hence, Nd: YAG laser capsulotomy remains the most common and safe procedure for the management of PCO when correctly done with proper patient selection, thorough fundus examination and at least three months after the cataract surgery.

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