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Visual Outcome in Nd: YAG Laser Capsulotomy in Posterior Capsular Opacity

Ophthalmology

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ABSTRACT

Introduction: Study aimed to see the visual outcome after Nd-YAG laser Capsulotomy in posterior capsular opacity at M.L.B. Medical college Jhansi uttar pradesh and to study Correlation between PCO and visual acuity before and after Nd:YAG laser posterior capsulotomy.

Material and Methods: Nd: YAG laser capsulotomy was carried out in 160 eyes of 160 patients. It was a hospital based prospective study on outpatient basis who underwent extra capsular cataract extraction with PCIOL implantation elsewhere diagnosed PCO by red reflex evaluation by retinoscopy. PCO followed ECCE with PCIOL implantation with decreased BCVA of two or more lines.

Results: Out of 160 patients (160 eyes) overall visual outcome after Nd-YAG laser capsulotomy is 95%.There sex predilection was not present among the patients who developed PCO and were treated with Nd YAG laser. Males were 88 and females were 72. Most patients 72.5% were in the 41- 80 years age range. A large proportion of these patients 70% had the diagnosis of PCO between 3-12 months post-surgery. Majority of the patients, 75% presented with visual acuity of <3/60 before the laser procedure while this reduced to 5% post laser procedure.

Conclusion: Nd: YAG laser capsulotomy is a safe and effective method to treat PCO. It is non-invasive and avoids all the complications associated with surgical capsulotomy and local anaesthesia.

KEYWORDS

Visual Outcome, Nd: YAG, Laser Capsulotomy, Posterior Capsular Opacity

INTRODUCTION:

Posterior capsular opacification, referred to as 'secondary cataract' or 'after cataract', develops over the clear posterior capsule a few months to a few years after an uneventful cataract surgery.Posterior capsule opacification (PCO) and posterior chamber intraocular lens (PC IOL) decentration still remain two major complications of successful extracapsular cataract surgery (ECCE) or phacoemulsification1-6.Posterior capsular opacification is caused mainly by remnant lens epithelial cell proliferation and migration, epithelial-mesenchymal transition, collagen deposition, and lens fiber generation. All of these processes are influenced by cytokines, growth factors, and extracellular matrix proteins.

Posterior capsular opacification development is age dependent, with a low incidence in older patients but high rates in young patients,especially children and infants.7-10 Advances in surgical techniques, intraocular lens materials, and designs have reduced the PCO rate, but it is still a significant problem. At present, the only effective treatment of PCO is Nd:YAG laser capsulotomy, which involves clearing the visual axis by creating a central opening in the opacified posterior capsule.7,11 Although this procedure is easy and quick, carries vision-related complications and risks and puts a significant financial burden on the health care system.

MATERIALAND METHODS:

The study includes 160 eyes of 160 patients attending outpatient department at M.L.B. Medical college Jhansi uttar pradesh, during the period from april 2017 to march 2018 who underwent extra capsular cataract extraction with PCIOL in our hospital or elsewhere diagnosed PCO by detailed eye examination. And patients treated with LASER capsulotomy were followed up over a period of 6 months and final visual outcome is evaluated. Inclusion criteria: 1.Patients having significant PCO and complaining of gradual diminution of vision after a certain period of appreciably good vision following successful cataract extraction surgery with IOL implantation were included in the study.2. Both male and female patients were included in the study.

3. The age group of the patients to be studied was >14years. Exclusion criteria: Patients classified in the fallowing groups were not included in the study group: 1. Patients with complaints of diminution of vision without gaining good vision following cataract surgery were excluded from the study.2. Patients with decreased visual acuity due to any ocular or systemic pathology. 3. Patients with posterior segment disorder .After a detailed explanation of the procedure benefits and risks, informed consents were obtained from all the patients. Methods: All patients went through a baseline ophthalmologic examination before laser capsulotomy including measurements of best-corrected visual acuity (BCVA), Goldmann applanation tonometry and fundus examination. This study is based on PCO on 160 eyes of 160 patients. They previously underwent an uneventful extra capsular cataract surgery (ECCE) or phacoemulsification procedure together with IOL implantation.

These IOLs were made of hydrophobic acrylic material and polymethylmethacrylate (PMMA) . This technique was conducted when an eye lost two or more decimal line of BCVA or when the patients complained of blurred vision.Before starting the procedure, one drop of 4% xylocaine was instilled into the conjunctival cul-de sac. The pupils were fully dilated and the aim was to create a capsulotomy of about 4 mm in size. A central cruciate pattern in an upward-downward direction was used. The aiming beam was focused slightly posterior to the posterior capsule.

The optical center of the IOL was matched with the center of the opening. The starting initial energy level (0.3-10 mJ), number of pulses used to create capsulotomy and summated laser energy was noted in each case.Single pulse mode Nd:YAG laser was used at the minimal amount of energy necessary to obtain breakdown and rupture the capsule and vitreous strand. The energy needed for this procedure was between 0.8 and 1.2 mJ/pulse.

The initial energy of 0.8 mJ/pulse was consumed and then it maintained or increased its initial value depending on the degree of breaking of the capsule and mean total energy levels were 74±21 mJ. No difference was given to the initial energy levels according to PCO types. A number of laser shots in the posterior capsule, which were aimed at posterior 150 µm from a datum point were conducted along an imaginary line. This line extended 0.5 mm inside from optic margin or along anterior continuous curvilinear capsulorhexis (CCC) and into circular en bloc pattern.

After circular application of laser, vitreous strands which were attached with fragment were cut with the laser. When the procedure was performed, the circular fragment was completely separated from vitreous, and then quickly sunk in intravitreal space. As rise in IOP was perhaps the most common side effect of Nd:YAG laser capsulotomy, all patients had one drop of brimonidine tartrate/timolol malate ophthalmic solution both before and immediately after and this eye drop two times a day during post treatment 2day. In addition, all patients had 0.1% fluorometholone eye drop four times daily for

1week. The patients were checked the retinal problems through dilated funduscopic examination on the following 1st week and 6th month. Also, almost all patients were followed up every 6month. Procedural outcome was determined based on the values of BCVA, which were measured before and after the procedure.

STATISTICALANALYSIS

Descriptive statistics like mean and percentages were used to interpret the results.

Table 1: age wise PCO formation (n=160)

Age	Number of cases	Percentage
14-21 yrs	8	5%
21-40 yrs	24	15%
41-60 yrs	48	30%
61-80 yrs	68	42.5%
>80 yrs	12	7.5%
Total	160	100%

Table 2:Gender ratio of cases (n=160)

	Number of cases	percentage
Male	88	55%
Female	72	45%
Total	160	100%

Table 3: Types of posterior capsular opacification (n=160)

Types of pco	number of cases	percentage
Fibrous	32	20%
Elsching's Pearls	100	62.5%
Mixed	28	17.5%
Total	160	100%

Table-4: Grading of posteriorcapsularopacity

Grade	Fundusdetails	No. of cases
Grade- 1	Opacification limited to periphery, the central part is clear	22
Grade- 2	Diffuse opacity appreciated with slit lamp – mild obscuration of fundus details	48
Grade- 3	Opacity of posterior capsule with marked obscuration of fundus details	54
Grade- 4	Total thick opacity with no fundal glow	36

Table-5: Energy required in different types of PCO (n=160)

Cumulative laser energy in mj.	Elschnig pearl	Fibrous and mixed	Total number of cases	Percentage		
	number of cases	Percentage	number of cases	Percentage		
<50	15	9.4%	2	1.3%	17	10.7%
51-60	20	12.5%	0	0%	20	12.5%
61-70	28	17.5%	6	3.7%	34	21.2%
71-80	20	12.5%	8	5%	28	17.5%
81-90	17	10.6%	26	16.3%	43	26.9%
91-100	--	--	12	7.5%	12	7.5%
>100	--	--	6	3.7%	6	3.7%
Total	100	62.5%	60	37.5%	160	100%

Table-6: Visual improvement after Nd: YAG laser posterior capsulotomy (n=160)

Pre ual las acu er ity vis	Post laser visual acuity							
	6/6	6/9	6/12	6/18	6/24	6/36	6/60	Cf 5 mts – hm
CF 5 mts – HM	0	4	20	6	8	9	5	8
6/36 – 6/60	20	44	10	10	0	0	0	0
6/18 – 6/24	12	4	0	0	0	0	0	0

RESULTS:

After a short term study of 12 months the following observations were made, 160 patients were identified having posterior capsular opacity diagnosed by red reflex evaluation by retinoscopy, slit lamp examination, direct and indirect. These Cases were divided according to age/sex wise and also according to duration between cataract extraction and development of PCO. PCO was graded based on view of fundus details and Nd: yag laser capsulotomy done for all the cases. Pre-laser and post-laser visual acuity recorded, compared and analyzed. Safety, efficacy and Post-laser complications of Nd: yag laser were recorded, followed and treated. Table-2 shows M:F ratio of 1.3:1 . PCO may occur equally in both males and females. Most of the patients about 72.5% were in the 41-80years age range. This is perhaps the age at which patients with age related cataract present to the Ophthalmologist due to visual incapacitation. Elschnig's Pearl type of PCO was the most common type (62.5%) than Fibrous type (20%) and Mixed type (17.5%). PCO was graded based on Fundus details seen by direct or indirect ophthalmoscopy where Severe PCO (Grade-4) diagnosed were about 22.5%, moderate (Grade 2 and 3) were 63.75% and mild (Grade-1) were13.75%. The total cumulative energy (energy per pulse in mj x number of pulses) required to perform adequate capsulotomy ranged from 25 to 125 mj. The mean total cumulative energy delivered for elsching pearl type PCO was 62.5 ± 15 mj while for fibrous and mixed type PCO it was 82.5 ± 20 mj. maximum patients required less then 100 mj & in those who required more than 100 mj risk of rise in Intra ocular pressure was more. A large proportion of these patients about 70% had the diagnosis of PCO between 3-12 months post-surgery, 15% diagnosed 12 months after surgery and 15% developed PCO within 3 months after surgery. Shows improvement in visual acuity was excellent in this study. Visual acuity improved to 6/6 in 32 cases, 6/9 in 52 cases, 6/12 in 30 cases, 6/18 in 16 cases, 6/24 in 8 cases, 6/36 in 9 cases, 6/60 in 5 cases. Overall, 95% of the patients studied had visual improvement. However, 5% of the patients did not have visual improvement.

DISCUSSION:

The study was carried out in 160 eyes of 160 patient which was a hospital based prospective study on outpatient basis who underwent extra capsular cataract extraction with PCIOL implantation, diagnosed PCO by red reflex evaluation by retinoscopy. These patients were followed up for a period of 6 months. Chief complaints of all the cases was diminished vision which varied from hand movements to 6/18. Before undergoing laser capsulotomy each patient was evaluated to confirm that the visual loss was only after Cataract. Nd-YAG laser capsuloyomy therapy presents the advantage of a non-invasive, effective, out patient procedure, relatively safe technique to manage intact posterior capsule that opacify post operatively.. Polak M Zarnowski. T Zogorski Z12, have included 25 & 26 eyes respectively and visual outcome was 89%, 95% and in our present study it was 95%. Study conducted by Hasan, et al13, Wilkins et al14, Panezai MN15, Shawani MA and Hameed K, Hayashi, K., Hayashi, H., et al.16, Wang, J,et al.17 Yilmag S., et al.,18 Stark W.J.19 had similar results as that of our study.

Incidence of PCO: foldable Intra ocular lenses were associated with much lower Posterior capsular opacification rate compared to rigid once . According to Meta analysis by Schaumberg et al20, the incidence of PCO in adults is 10% 1 years after surgery, 20% 2 years after surgery and greater than 25% 3 to 5 years after surgery.

Sex ratio in PCO: There was no significant sex predilection among the patients who developed PCO.

Cataract is the leading cause of blindness worldwide, equal among male and female, therefore when routine cataract surgery are performed, complications such as PCO can also occur in equal proportions. In our study, males were 88 and females were 72 with a Male to Female ratio of 1.3:1.

This probably reflects that female population less commonly undergo surgery for cataract or present to hospital for their reduced vision after surgery.

Age distribution of PCO: 72.5% of patients were in 41-80 years age group. This is perhaps the age at which patients with age related

cataract present to the Ophthalmologist.

Duration between surgery and PCO: A large proportion of these patients about 70% had the diagnosis of PCO between 3-12 months post-surgery, 15% diagnosed 12 months after surgery and 15% developed PCO within 3months after surgery. This may be that people who had received visual restoration after initial cataract surgery would have become so dependent on the good vision and so would be visually disabled when PCO sets in, hence the early presentation.

Types of PCO: Elschnig's Pearl type of PCO is the most common type (62.5%) than Fibrous type (20%) and Mixed type (17.5%). PCO has been graded based on the Fundus details seen by direct or indirect ophthalmoscopy where Severe PCO (Grade-4) diagnosed were about 22.5%, moderate (Grade 2 and 3) were 63.75% and mild (Grade-1) were 13.75%.Elschnig pearl type Posterior Capsular Opacification was common (62.5%) then fibrous and Mixed type (37.5%).

Total cumulative energy for capsulotomy: The total cumulative energy (energy per pulse in mj x number of pulses) required to perform adequate capsulotomy ranged from 25 to 125 mj. The mean total cumulative energy delivered for elsching pearl type Posterior Capsular Opacification was 62.5 ± 15 mj while for fibrous and mixed type Posterior Capsular Opacification it was 82.5 ±20 mj. The mean total energy delivered was 72.5 ± 15 mj but maximum patients required less then 100 mj for capsulotomy & in those who required more than 100 mj risk of rise in Intra ocular pressure was more. Maximum studies used energy per pulse ranging from 0.8-3.2 mj but the number of pulses was high.. In another study by Richter et al.21 they found that maximum patients required less then 200 mj for capsulotomy & in those who required more than 200 mj risk of rise in Intra ocular pressure was more. Complications of Nd: YAG

Complications may include the following:

- Transient intraocular pressure elevation
- Post laser iritis
- Retinal tears and detachments
- Macular edema and macular hole
- Corneal edema
- Intraocular lens dislocation into the vitreous
- Pitting of the intraocular lens
- Hyphaema

The incidence of intraocular pressure elevations are significantly reduced when patients are pretreated with apraclonidine. Intraocular pressure can be checked 30-60 minutes postoperatively, although that is surgeon dependent. Iritis can be present after the capsulotomy, but it is usually self-limited. It can be treated with a weeklong course of topical steroids (1% prednisone acetate or 0.5% loteprednol, 4 times daily).

Table7: Other complication of Nd: YAG laser capsulotomy

Complications	No. of cases
Post laser iritis	2
Glare	4
Pitting over Intraocular lens	3
Vitreous floaters	1
Macular edema	-
Retinal detachment	-
Macular hole	-

CONCLUSION:

Nd: YAG laser capsulotomy is a safe and effective method to treat PCO. It is non-invasive and avoids all the complications associated with surgical capsulotomy and local anaesthesia.

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