THE STUDY OF COMPLICATIONS OF ND: YAG LASER CAPSULOTOMY

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Abstract-
Objective- To study the complications of ND:YAG Laser capsulotomy.
Participants- Patients between age group of 08 to 80 who is having significant posterior capsular opacification leading to decreased visual acuity from early post operative days.
Material and Method- 200 patients with PCO were studied for post ND:YAG laser complications. The patient who is not having any organic cause of decreased vision and who have completed at least three months after cataract surgery were selected. ND:YAG laser procedure was performed and their visual acuity improvement along with complications associated with this procedure were studied.
Results- The procedure is absolutely safe if strict selection (inclusion/exclusion) criteria is followed. Most of complications are transient which can be managed by proper medication. Complications like retinal detachment or cystoid macular edema are multifactorial and can not always be only due to laser capsulotomy alone. Endophthalmitis is rare complication but highly unpredictable which can not be ruled out but be well treated with newer generation intravitreal drugs or vitrectomy surgery. Most of the patients 86% were significantly benifited by improved visual acuity.
Keywords- ND: YAG Laser Capsulotomy, cystoid macular edema, Endophthalmitis, Optic atrophy, Amblyopia, Corneal dystrophy-degeneration, iriti’s.
Abbreviations- PCO ( Posterior capsular opacification), IOL (Intraocular lens)

Introduction
Posterior capsular opacification (PCO) also called as after cataract is a nagging post surgical complication following phacoemulsification or non phacoemulsification cataract surgery with posterior chamber intraocular lens implantation. The term posterior capsular opacification is actually a misnomer. It is not the capsule which opacifies, rather an opaque membrane develops as retained cells proliferate and migrate on the posterior capsular surface. Though there are many factors suggested to reduce posterior capsular opacification. The incidence of posterior capsular opacification still exists considerably. And till today ND:YAG laser capsulotomy has been the ultimate choice to get rid of it. The nd:yg lasing medium is a man made crystal of Neodymium doped yttrium-Aluminium-Garnet is a photodisruptor not a photocoagulator like argon or krypton laser[1]. Laser has range of applications in ophthalmology in anterior & posterior segment on various parts[2]. In laser machines, emitted photons are trapped in highly polished mirrors forcing them to travel back & forth in the cavity. When a photon passes close to an excited particle, the particle will be stimulated to emit a photon that is identical in wavelength, phase and spatial coherence to the first. This amplifi-
cation continues, increasing the number of active photons[3,4].
The laser power setting is between 1 to 2.5 mj/pulse or if mode is
locked then between 3to 5 mj/pulse. The capsulotomy is performed
by series of punctures in cruciate pattern with first puncture aimed
at visual axis. An opening about 3mm is usually adequate but
larger might be needed for peripheral retinal visualization and its
treatment [5].

Aims and Objective
1. To study the intra & postoperative complications of ND: YAG
laser posterior capsulotomy.
2. To study incidence of complications.
3. To study the visual improvement (outcome).

Materials and Method
Inclusion Criteria
1. Significant PCO.
2. Good immediate post (cataract) operative visual acuity.
3. No corneal /retinal (organic) pathology.

Exclusion Criteria
1. less than 3 months post cataract surgery.
2. Amblyopia.
3. Optic atrophy.

In this study 200 patients with significant posterior capsular opaci-
fication were treated with ND:YAG laser and followed up from period
of June 2010 to December 2011. The criteria for selection of patient was significant posterior capsu-
lar opacification causing decrease in visual acuity. No attempt has
been made to limit the study to specific age group or gender.
In all patients a complete ophthalmic history including history of
timing of cataract surgery, history of any preexisting glaucoma,
retinal pathology, amblyopia, opticatrophy, cornealopacity, Corne-
al dystrophy-degeneration or any other ocular condition was rec-
corded. History of any topical or systemic medication and other
significant systemic illness was also recorded.
Visual acuity for distant and near was recorded before and after
the procedure. Anterior segment examination and intraocular pres-
sure measuring on applanation tonometry was done with slit lamp.
Direct and indirect ophthalmoscopy was performed to rule out any
pre existing macular or retinal pathology. After recording all find-
ings laser capsulotomy was performed in all suitable patients.
Following procedure was performed for performing YAG laser
capsulotomy in the present study.
The purpose, procedure and possible complications were ex-
plained to every patient and their relatives in best possible lan-
guage. Written informed consent was taken in each case.

Capsule was examined for wrinkles and tension lines, because if
shots were fired across tension lines it might lead to larger and
uncontrolled opening per pulse.
For accurate focusing, the intersection of the He-Ne beam where
the two red spots becomes one that spot was used. It locates the
focal point of laser energy. For energy settings we began with less
energy 1mj at monoburst and increased in steps as required until
tissue breakdown was achieved. Successive shots were fired to
make opening ‘X’ or ‘A’ shaped. If the membrane did not open
focal point was shifted slightly forward.
Usually 3 mm opening was made which was adequate for good
visual acuity. Following the procedure all patients were routinely
given topical antibiotic-steroid combination drops and topical an-
tiglaucoma drops. Patients were followed up on day one, day sev-
en, day fourteen, one month then after six months interval. On
each follow up patients were examined for visual acuity for distant
and near. Intraocular pressure measured, slit lamp examination
and fundoscopy was done. Rise of intra ocular pressure was not-
ed and labeled as immediate rise, if the rise of IOP (intra ocular
pressure) was for hours and returned to normal at end of seven
days and Persistent rise if sustained high IOP was measured on
subsequent follow up.

Results
Out of 200 patients number of male patients were 123 meaning
61.5% and female 77 meaning 38.5%.13 patients had to undergo
repeated YAG due to inadequate opening. 10 out of which were
below 20 years of age because of thicker PCO in younger age
group is very common.

A. Age Distribution

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>08-30</td>
<td>13</td>
</tr>
<tr>
<td>31-40</td>
<td>73</td>
</tr>
<tr>
<td>41-50</td>
<td>89</td>
</tr>
<tr>
<td>51-60</td>
<td>15</td>
</tr>
<tr>
<td>61-70</td>
<td>30</td>
</tr>
<tr>
<td>71-80</td>
<td>07</td>
</tr>
</tbody>
</table>

B. Sex Distribution

<table>
<thead>
<tr>
<th>Total Cases</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>61.5%</td>
<td>38.5%</td>
</tr>
</tbody>
</table>

C. Pre YAG Vision

<table>
<thead>
<tr>
<th>Pre YAG Vision</th>
<th>No. of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/12</td>
<td>56</td>
<td>28%</td>
</tr>
<tr>
<td>6/18</td>
<td>67</td>
<td>33.5%</td>
</tr>
<tr>
<td>6/24</td>
<td>49</td>
<td>24.5%</td>
</tr>
<tr>
<td>6/36</td>
<td>17</td>
<td>8.5%</td>
</tr>
<tr>
<td>6/60</td>
<td>9</td>
<td>4.5%</td>
</tr>
<tr>
<td>Finger Counting</td>
<td>2</td>
<td>1%</td>
</tr>
</tbody>
</table>

For all patients initially energy was kept at 1mj and gradually in-
creased in step till desired result was obtained. Burst was kept
monoburst. Majority of patients had adequate opening with shots
between 6 to 12. Very few patients required more than 12 shots.
Post YAG Vision

<table>
<thead>
<tr>
<th>Vision</th>
<th>No. of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/18-6/6</td>
<td>183</td>
<td>91.5%</td>
</tr>
<tr>
<td>6.24 OR LESS</td>
<td>17</td>
<td>8.5%</td>
</tr>
</tbody>
</table>

Complications

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Complications</th>
<th>No. of Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Corneal injury</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>2.</td>
<td>Iritis</td>
<td>67</td>
<td>33.5%</td>
</tr>
<tr>
<td>3.</td>
<td>Hypehama</td>
<td>3</td>
<td>1.5%</td>
</tr>
<tr>
<td>4.</td>
<td>IOL related</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a)Pitting</td>
<td>9</td>
<td>4.5%</td>
</tr>
<tr>
<td></td>
<td>b)Cracks</td>
<td>3</td>
<td>1.5%</td>
</tr>
<tr>
<td></td>
<td>c)Decentration</td>
<td>3</td>
<td>1.5%</td>
</tr>
<tr>
<td>5.</td>
<td>IOP rise</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a)Immediate</td>
<td>79</td>
<td>39.5%</td>
</tr>
<tr>
<td></td>
<td>b)Persistent</td>
<td>7</td>
<td>3.5%</td>
</tr>
<tr>
<td>6.</td>
<td>Cystoid macular edema</td>
<td>8</td>
<td>4%</td>
</tr>
<tr>
<td>7.</td>
<td>Retinal damage</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td>8.</td>
<td>Endophthalmitis</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Discussion

Since the advent of YAG in 1981 its application ranged remarkably. Its acceptance in the management in PCO was well appreciated in surgeons as well as patients due to the non surgical and non invasive approach as against needling which was mainstay in PCO management prior to YAG [6]. Complications seen during procedure are discussed below

In complications related to IOL (Intraocular lens) i.e. pitting, cracks or decentration none of the IOL’S were glass or silicon. All were made up of polymethylmethacrylate (PMMA). More pitting was seen in cases of dense PCO with more number of shots in uncooperative patients. Such was more observed in pediatric age group or with intraocular lenses having deposits or scratches due to surgery.

There was no decrease or disturbance in visual acuity with only pitting of IOL but 1.5% who had cracks in IOL failed to improve more than 6/18. It was observed that using monoburst and avoiding multiple burst modes and by using minimum energy we could reduce IOL damage. Use of contact lens stabilizes the eye, increases convergence and divergence angle which lowers the retinal side effects and improves laser beam effect. Optics acts as a heat sink and facilitates accurate focusing and magnification [7]. Pitting of IOL can also be reduced by deep focusing technique where optical break down occurs in the anterior vitreous and the shock wave radiate forward and ruptures the capsule.

Postcapsulotomy intraocular pressure elevation is a common but transient complication following this procedure. In most cases IOP returned to pretreatment level within 10days. 3.5% had persistent rise of IOP on subsequent follow up, so topical pressure reducing agent were continued for longer time. Antiglaucoma medication was reduced gradually and finally omitted. One patient with preexisting glaucoma had exacerbation, mean IOP before capsulotomy was 23 mm hg and mean IOP during first week of post laser was 30 mm hg. After 6 months the mean IOP was 28. Patient whose IOP was uncontrolled had to undergo trabeculectomy surgery. It was observed that having rise in IOP in absence of PCIOL and use of higher total energy is related to posterior trapping of capsular debris [8]. The acute pressure rise is caused by impaired aqueous outflow and rapid onset suggests that the reduced outflow mostly due to capsular debris, acute inflammatory cells, heavy molecular weight protein or a combination of these mechanisms [9, 10]. The IOP rise was correlated with previously high IOP. Higher the pretreatment IOP leads to greater the chance of high pressure rise. Therefore glaucoma patients were at higher risk of developing pressure elevation. Also the presence of PCIOL may result in less incidence of transient IOP rise but it does not necessarily protect against the onset of persistent IOP elevation [11].

Four percent (4%) of patients had cystoids macular edema and were treated with topical anti-inflammatory drugs for 21 days. Visual acuity improved slightly but failed to improve more than 6/18. This is more seen in patients who had greater inflammatory reaction in their cataract operation. One of this patient had preexisting diabetic retinopathy. The development of retinal complication remains more in a patient who had greater inflammatory reaction to surgery [12].

In this study none of the patients had retinal complications like tear, hole or detachment. Thirty three point five percent (33.5%) of patient had iritis after YAG capsulotomy manifested as cells and flare in the anterior chamber on slit lamp examination. They were given topical steroid and reaction had subsided leaving no delayed complication. Corneal injury was seen in one percent 1% of patient and hyphema seen in 1.5% cases. The damage to cornea or iris can occur due to misfiring of shots. In cornea it causes stromal haze but clears within 3 days. Hyphema also gets resolved within 3 to 7 days depending on size without any treatment and complications.

Conclusion

There are many methods tried for prevention of PCO but YAG laser capsulotomy remains the most common and safe procedure. When correctly done with proper patient selection and thorough fundus examination and at least after three months after cataract surgery. It is very economical, convenient, fast and non invasive OPD procedure with immediate results which is easily mastered by surgeons as well as patients due to the non surgical and non invasive approach as against needling which was mainstay in PCO management prior to YAG [6]. Its acceptance in the management in PCO was well appreciated it carries a low but finite risk of complications. These complications are rare and rarely sight threatening. Therefore we should be alert of development of cystoids macular edema, retinal detachment. Persistent rise in IOP during follow up of patients with ND: YAG laser posterior capsulotomy.

References


Bioinfo Publications
The Study of Complications of ND: YAG Laser Capsulotomy


