INTRODUCTION

Posterior capsular opacification (PCO) is a frequent complication of cataract surgery with posterior chamber intraocular lens implantation. It varies from 7% to 31%, by 2 years postoperatively. Standard treatment of PCO consists of making an opening in the central part of posterior capsule. Nd: YAG laser posterior capsulotomy is the treatment of choice for the PCO. This procedure is non-invasive, relatively safer, less time consuming and free from infections but has been associated with complications, like raised intraocular pressure (42.85%), IOL pitting, cystoid macular oedema (4.1%) and retinal detachment (2.5%).

Raised intraocular pressure (IOP) remains one of the frequent complications of Nd: YAG laser capsulotomy. It is usually acute but transient. It can partly be controlled by timolol-pretreatment but after 4 hours, the difference is no more significant, whether pre-treated or not. Silverstone observed higher pressures associated with performing large capsulotomies that required high energy levels. The mechanism for the increased IOP is believed to be a decrease in outflow, secondary to the shock wave or entrapment of capsular fragments and debris in the filtration angle. The correlation of the total amount of laser energy used to the rise in IOP following Nd: YAG capsulotomy was rarely evaluated quantitatively in most of the local and international studies. It may be an important factor leading to raised IOP after laser capsulotomy. Therefore, it was decided to conduct study on this important but less attended aspect.

The objectives of this study were to determine the frequency of ‘raised intraocular pressure’ after Nd: YAG laser posterior capsulotomy and to determine the association of the energy used with the ‘raised’ versus normal intraocular pressure after laser capsulotomy.

ABSTRACT

Objective: To determine the frequency of raised intraocular pressure (IOP) after Nd: YAG laser posterior capsulotomy and its association with the energy used with raised versus normal intraocular pressure in pseudophakes.

Study Design: Comparative, cross-sectional study.

Place and Duration of Study: Ophthalmology Department, PNS Shifa Hospital, Karachi, from August 2008 to February 2009.

Methodology: Pseudophakes having poor vision due to posterior capsular opacification (PCO) in an otherwise normal looking eye and intraocular pressure between 10-20 mmHg were included in the study. Patients with diabetic retinopathy, corneal diseases, inflammatory eye diseases, posterior segment surgery, glaucoma, trabeculectomy, maculopathy and any systemic disease were excluded from the study. Particulars of the eligible patients and pre-laser intraocular pressure were entered in specially designed proforma. Nd: YAG laser posterior capsulotomy was done. Laser energy used was noted and then their post-laser intraocular pressure was checked after 4 hours. Unpaired t-test was used for comparison of means of IOP and energy levels. Chi-square test was applied to compare the proportions of patients with raised and the normal IOP with YAG laser energy used during posterior capsulotomy.

Results: Raised intraocular pressure (IOP ≥ 5 mmHg from the baseline) after Nd: YAG laser posterior capsulotomy was noted in both the ‘low energy’ and the ‘high energy’ groups but it was more common in the ‘high energy’ group (p < 0.001, r=0.512).

Conclusion: Higher YAG laser energy has significantly higher chances of raising IOP. Hence, it was recommended that each patient undergoing Nd: YAG laser capsulotomy should receive minimum possible laser energy and must be followed up for raised intraocular pressure.

METHODOLOGY

The study was conducted in the Ophthalmology Department, PNS Shifa Hospital, Karachi, from August 2008 to February 2009. A non-probability, purposive sampling technique was used.

An increase in IOP of ≥ 5 mmHg from the baseline (pre-laser capsulotomy) 4 hours after Nd: YAG laser posterior capsulotomy were termed as having ‘raised IOP’. Energy used in this procedure was termed as ‘low energy’ if it was less than 50 mJ and ‘high energy’ if it was > 50 mJ.

Pseudophakes with posterior chamber IOLs having poor vision due to PCO in otherwise normal looking eye were included in the study, aged 40 years and above. All were having IOP between 10 and 20 mmHg. Informed consent was taken from patients undergoing Nd: YAG laser posterior capsulotomy. Patients with diabetic retinopathy, corneal diseases, inflammatory eye diseases, posterior segment surgery, glaucoma, trabeculectomy, macular oedema/maculopathy and any systemic disease were excluded from the study. All patients were treated with Nd: YAG laser by the same consultant ophthalmologist with same technique.

Name, age, gender, address and contact number of all the selected patients having PCO, were entered in the especially designed proforma. Before performing Nd: YAG laser posterior capsulotomy, all patients underwent a thorough ophthalmic evaluation including the best corrected visual acuity, slit lamp examination, IOP measurement by Goldmann Applanation tonometer, and detailed fundus examination to rule out any pre-existing pathology. The measurement of pre-laser IOP was noted, as viewed on the control display panel of Nd: YAG laser machine, by one single consultant ophthalmologist, using minimum possible pulses of Nd: YAG laser, with energy level of 1.0-1.3 mJ/pulse. The total amount of energy used in YAG laser capsulotomy procedure was noted, as viewed on the control display panel of Nd: YAG laser machine, and was recorded in the proforma. The IOP was measured 4 hours following the procedure and entered in the proforma.

Data analysis was done using SPSS version 10. Quantitative data like age, pre- and post-IOP and laser energy levels were presented by mean ± SD. Energy used in Nd: YAG laser posterior capsulotomy was categorized in the ‘low energy’ and the ‘high energy’ categories. Unpaired t-test was used for comparison of above mentioned quantitative variables between low and high energy categories. Qualitative response variables like sex, raised and normal IOP were presented by frequencies and percentages. Chi-square test was applied to compare proportions of patients having raised normal IOP with ‘low’ and ‘high’ energy used during Nd: YAG laser posterior capsulotomy. Correlation between ‘raised IOP’ and energy used was determined by correlation co-efficient and presented in scatter diagram. P-value ≤ 0.05 was considered as statistically significant result.

RESULTS

Out of 148 cases, 14 (9.45%) patients were aged between 40-50 years and 134 (90.55%) were more than 50 years. The mean age was 61.20±8.61 years, (minimum 41 years, maximum 80 years) in the ‘low energy’ category whereas in the ‘high energy’ category, mean age was 65.74±9.05 years (minimum 45 years, maximum 80 years, p=0.386. There were 77 (52.03%) males and 71 (47.97%) females. The two categories were similar in gender distribution (p=0.760). Mean pre-laser IOP in ‘low energy’ category was 14.46±1.83 mmHg (minimum 10 mmHg, maximum 18 mmHg) while in ‘high energy’ category, it was 13.91±1.60 mmHg (minimum 10 mmHg, maximum 16 mmHg). Both the categories had similar pre-laser IOP (p=0.114). Mean post-laser IOP in ‘low energy’ category was 18.29±2.17 mmHg (minimum 12 mmHg, maximum 24 mmHg) while in ‘high energy’ category mean post-laser IOP was 19.11±2.58 mmHg (minimum 16 mmHg, maximum 24 mmHg). Both the categories were similar in post-laser IOP (p=0.063). ‘Low energy’ cases were 113 (76.35%) and ‘high energy’ cases were 35 (23.65%). The mean energy used in ‘low energy’ category was 36.46±6.42 mJ, whereas in the ‘high energy’ category mean energy used was 56.84±2.65 mJ which was a statistically significant (p < 0.001, Table I).

### Table I: Pre- and post-laser IOP, energy used, rise in IOP values versus category of energy (group statistics).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Category of energy used</th>
<th>Significance</th>
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<tbody>
<tr>
<td></td>
<td>High &gt; 50 (n=35)</td>
<td>Low ≤ 50 (n=113)</td>
</tr>
<tr>
<td>Pre-laser IOP</td>
<td>13.91±1.60</td>
<td>14.46±1.83</td>
</tr>
<tr>
<td>Post-laser IOP</td>
<td>19.11±2.57</td>
<td>18.29±2.17</td>
</tr>
<tr>
<td>Energy used</td>
<td>56.84±2.65</td>
<td>36.46±6.42</td>
</tr>
<tr>
<td>IOP values</td>
<td>5.51±1.58</td>
<td>3.83±1.84</td>
</tr>
</tbody>
</table>

Key: Values given in column 2 and 3 are Mean ± SD.

The mean rise in IOP value was 3.83±1.84 mmHg in ‘low energy’ category (minimum 2 mmHg, maximum 8 mmHg); whereas in ‘high energy’ category, the mean rise in IOP value was 5.51±1.58 mmHg (minimum 2 mmHg, maximum 8 mmHg), which was statistically significant (p < 0.001, Table I).

Raised IOP was noted in 53 (35.81%) cases while IOP remained normal in 95 (64.19%) cases. In ‘low energy’
group, 'raised IOP' was noted in 32 (28.32%) cases as compared to 81 (71.68%) cases in which IOP remained normal; while in 'high energy' group, raised IOP was noted in 21 (60.00%) cases as compared to 14 (40.00%) cases in which IOP remained normal. Chi-square test showed p-value of 0.001 and hence it was statistically significant.

A significantly positive/direct correlation was found between IOP and the energy used as depicted in the Figure 1.

DISCUSSION

Durham and Gills performed 3000 Nd: YAG laser posterior capsulotomies. An IOP of 25 mmHg or elevation of 8 mmHg above the baseline value was set as the criteria. Elevation of IOP was noted in 6% patients with no history of glaucoma at 2 hours as compared to 16.9% patients with history of glaucoma. In 66 patients, Slomovic and Parrish found that 55% of patients had significantly raised IOP following YAG laser therapy. In another study, 3 groups were given different anti-glaucoma medicines while 4th group was given no medicine. In the untreated group, IOP was found to be raised significantly at 1 hour (3.90±5.35) and 3 hours (5.95±5.32) following Nd: YAG laser procedure. This aspect seems to be similar to the present study except that the patients were fewer, duration of IOP check-up was different and the energy level was not considered a key factor. Flohr showed similar pattern of IOP rise as in this study. Ladas and colleagues studied 210 patients of Nd: YAG laser capsulotomy. One group was given topical 2% dorzolamide, second oral acetazolamide and third one received no medicines prior to capsulotomy. Latter group experienced IOP higher than 30 mmHg in 15.7% cases after capsulotomy. There have been many other more or less similar studies in recent years. It may be mentioned that none of the studies cited above considered the total amount of energy delivered in the YAG laser posterior capsulotomy. In this study, ‘raised IOP’ was found in 53 patients (35.81%). Out of 35 patients of ‘high energy’ category, ‘raised IOP’ was noted in 60% patients in comparison with raised IOP in 28.32% patients of ‘low energy’ category.

The results of this study showed that frequency of ‘raised IOP’ was certainly associated with the high amount of laser energy delivered to the eyes and must be expected to be greater in patients who receive excessive amount of YAG laser energy. However, it might occur in other patients in which ‘low energy’ was delivered even without any other obvious pre-existing intraocular pathology. Studies by Holweger and Marefat showed the results that no relationship existed between total YAG laser energy used and the rise in IOP. However, Channel and Beckman showed that higher IOP was associated with larger capsulotomies and increased laser energy used during YAG procedures. This substantiates results of the present study. Though the mechanism(s) remained undetermined, the possible mechanisms would be: the more the energy used during the procedure, the more particles liberated from posterior capsular breakdown, resulted in the clogging of angle of anterior chamber and lead to the raised IOP. Additionally, the acoustic shock waves released inflammatory mediators that altered the trabecular meshwork and the aqueous dynamics and resulted in an IOP rise.

It was difficult to compare different studies due to different techniques of cataract surgery and different intraocular lens implant materials, their designs and the thickness of PCO. However, the present results have sufficient grounds to suggest that energy level of Nd: YAG laser was certainly one of the key factors in the elevation the IOP.

CONCLUSION

Raised IOP was a frequent complication of Nd: YAG laser posterior capsulotomy which occurred as an isolated complication in an otherwise normal procedure and could not be neglected. Most of the times, it is depended upon the amount of laser energy delivered to the eye during the procedure. The higher the energy used, the greater the frequency of raised IOP following capsulotomy. Hence, it is recommended that each patient undergoing Nd: YAG laser capsulotomy should receive minimum possible laser energy and must be followed up for raised intraocular pressure.

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REFERENCES


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