ORIGINAL ARTICLE

Change in intraocular pressure at different energy levels of yag laser capsulotomy

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Abstract

Purpose: To evaluate and determine rise in intraocular pressure after Nd-YAG laser posterior capsulotomy in cases of posterior capsular opacification, causing decrease in vision.

Aim and Objectives: To prevent patients undergoing ocular laser procedures from glaucomtous damage of eye due to rise in IOP.

Study Design: Prospective-experimental study.

Place and duration of study: Sindh Government Qatar Hospital, Karachi, from December 2018 March 2019.

Material and Methods: Patients of both gender with Posterior Capsular Opacification (PCO) were selected who underwent un-eventful cataract surgery. Patients with history of previously glaucoma or ocular hypertension disease or intravitreal injections given for any cause were excluded. Complete ocular examination was performed. After pupilary dilatation, YAG laser capsulotomy was done. IOP was measured with Goldmann Applanation Tonometer after instilling a topical anesthetic agent. Post-YAG IOP was again measured at 1-hour, 4-hour and after 24-hours means the next day. Data was analyzed using SPSS version 25. Paired T-tests were used to assess the significance of any change in IOP.

Results: 150-patients were inducted into the study and grouped according to energy used. Group-1 up-to 25 milli joules (m.j.), group-2, 25 to 100 m.j. and group-3 greater than 100m.j. IOP > 6 mmhg compared to IOP before laser, was considered significant and between 1 to 6 mmhg, difference was labeled as moderate change. There was no change in IOP in 48(32%) cases, moderate rise in 51(34%) cases and significant increase in 51(34%) cases. Significant rise was noted at 4 hours in 21 patients of group 2 and 15 patients in group 3. After 24 hours, 21 patients of group 2 and 9 of group 3 showed significant rise in IOP.

Conclusion: Increase in IOP is related to amount of energy. Higher the amount of energy used, higher the risk of IOP elevation.

Keywords: Posterior capsulotomy (PCO), Yag laser, Intraoccular pressure (IOP)

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Introduction:

Posterior Capsular Opacification (PCO) is a main cause of decreased vision after successful cataract surgery in recent years. As it affect the vision and involve visual axis,[1] it becomes problem for the patients. Younger age is a significant risk factor for posterior capsular opacification.[2] Posterior capsular opacification causing visual disturbances is most commonly treated in adults by Neodymium: Ytrrium Alumunium Garnet (Nd:Yag) laser capsulotomy.[3] Though the procedure is safe and effective, some physiological and anatomical changes do occur. The laser works by its photo disruptive propery and there may be intraocular lense (IOL) pitting, anterior uveitis, vitritis, cystoid macular oedema and even retinal detachment.[4] Rise of intraoccular pressure is a relatively commoner finding as depicted by numerous national and international studies, both old and recent ones[5,6] deserves monitor-

ing and is usually manageable by medical treatment.[7,8] We conducted this study to establish the relationship of total energy used and the rise in intraoccular pressure by comparing the relative frequency of raised intraoccular pressure with laser energy > 120 milli joules (mj) in pseudophakic cases, having PCO. We also determined the post YAG time interval in which this rise of intraoccular pressure affects the patient population maximally. Explanations for the rise in intraocular pressure following Nd:YAG laser capsulotomy include the deposition of debris in the trabecular mesh work, trabeculitis as a consequence of the radiating "shock waves", neurovascular mechanisms, pupillary block and inflammatory swelling of the ciliary body or iris root associated with angle closure.[9] The aim of this study was to examine the influence of Nd:YAG laser capsulotomy on intraoccular pressure.

Material and Methods:

Type of study: The study was a prospective, descriptive study.

Site of study: This study was performed after written informed consent was obtained from the patients in Sindh Government Qatar Hospital. All the results of the study were enrolled on a proforma prepared by the author, prior to study.

Ethics: The local ethical committee of Sindh Government Qatar Hospital approved the research protocol.

Inclusion criteria includes all pseudophakic cases of adult age having PCO, confirmed by consultant in Eye Department of the hospital, were enrolled for the study. Complete ocular examination of each patient was done especially the recording of IOP by goldmann applanation tonometer (standard instrument for measuring IOP) as a base line, for comparison with the post laser IOPs and according to inclusion and exclusion criteria of the study. Energy used in each case in mill joules (mj) was recorded at the end of each procedure and the patients were reviewed at 1-hour, 4-hours and 24-hours (next day) for IOP recording. Those cases showing IOP of more than 20 mmHg after 24 hours were started medical treatment to avoid the optic nerve damage. All patients were advised topical prednisolone acetate 1% q.i.d and betaxolol (0.25%) b.i.d for a week's time. The patients were finally given advice for routine follow up visits. Only those cases that had undergone uncomplicated cataract surgery with posterior chamber intraocular lens (PC IOL) at Eye Department of Sindh Government Qatar Hospital were included in the study.

The exclusion criteria included complications during the cataract surgery like retained lense matter in anterior chamber or remains of visco elastic which can increase intraoccular pressure. Diagnosed cases of glaucoma and ocular hypertension, those with corneal opacities, uveitis, optic neuropathy and those who had under gone any other Ophthalmic surgeries like trabeculectomy and intravitreal avastin injection (may increase IOP) prior to Nd:YAG laser posterior capsulotomy treatment, were also excluded from the study.

Duration of study: All the patients under went Nd:YAG laser capsulotomy from December 15, 2018 to March 14, 2019 at Eye Department of the Hospital.

Total number of patients: There were 21 eyes in group-I and 99 eyes in group-II and 30 in group-III.

Each capsulotomy was performed by a single surgeon in a single session with a Nd:YAG laser. All patients underwent a complete ocular examination on all visits, including best corrected visual acuity, refraction (auto-refraction followed by subjective refraction), slit lamp bio-microscopy and IOP measurement. Visual acuity was measured in a darkened room using Snellen chart. Objective refraction was done using an auto refracto-meter of good condition. Patients were grouped according to the amount of energy they received during the procedure i.e. "group 1": up to 25 mj, "group 2": 25 to 100 mj and "group 3": >100 mj. and the change of IOP in each patient of each group was also cat-

Table 1: IOP response in each group before and after laser

Groups of energy	Total patients	No change in IOP	Rise up to 6mmhg	Rise greater than 6mmhg
Upto 25 mj	21(14%)	9	9 (42.85%)	3(14.28%)
From 25 to 100mj	99(66%)	33	33(33.33%)	33(33.33%)
Greater than 100mj	30(20%)	6	9(30%)	15(50%)
Total	150(100%)	48	51(34%)	51(34%)

Table 2: Significant rise in different groups

	Group 1 (21 pts)	Group2 (99 pts)	Group 3 (30pts)	Total (50)
Significant rise of IOP in patients	3	33	15	51
Percentage	14.28%	33.33%	50%	*34%*

Table 3: IOP rise in relation to time interval

IOP	Rise at 1 hr	Rise at 4 hr	Rise at 24 hr
No of patients	51	51	90
Percentage	34%	34%	*60%*

Table 4: Descriptive analysis

	Iop Before Laser	IoP at 1 hr after laser	IoP at 4 hrs after laser	IoP at 24 hrs after laser
Mean	12.1200	22.8800	19.6800	16.5200
N	50	50	50	50
Std. Deviation	1.36487	17.94850	12.25151	7.68577
Minimum	10.00	10.00	10.00	10.00
Maximum	14.00	70.00	58.00	40.00

Table 5: ANOVA analysis

Energy Used	Sum of Squares	df	Mean Square	F	Sig.
Between groups	40147.862	2	20073.931	79.638	.000
Within groups	11847.018	47	*252.064*		
Total	51994.880	49			

egorized into "no change", "a rise of 1-6mm of Hg, moderate change" and "significant change (>6mm of Hg)". Percentage of the patient population showing a significant rise of intra-occular pressure was calculated in each group and the relationship between the amount of laser energy and post laser intra-occular pressure surge was calculated.

Results:

A total of 150 patients were included in the study. Average pre laser intra-occular pressure was 12.12mm of Hg. At 1-hour it was 22.80mg, at 4-hour it was 19.68mmhg and at 24-hour it was 16.52mm of Hg. Minimum intra-occular pressure before laser was 10mm of Hg. Maximum intra-occular pressure at 1-hour after laser was 70mm of Hg. Maximum intra-occular pressure at 4-hour after laser was 58mm of Hg. Maximum intra-occular pressure at 24-hour after laser was 40 mm of Hg. Average energy used in each case was 16.68 mj. There were 21(14%) patients in group 1, 99(66%) patients in group 2 and 30(20%) patients in group 3. There was no change in intra-occular pressure in 48(32%) patients. Some rise of intra-occular pressure in 51(34%) patients. Significant rise of intra-occular pressure was noted 51(34%) cases. Some rise of intra-occular pressure was noted at 1 hour in 9 patients in group 1, 24 patients in group 2 and 9 patients in group 3. Significant rise of intra-occular pressure at 1 hour was noted in 3 patient in group 1, 24 patients in group 2 and 15 patients in group 3. At 4 hours, some rise of intra-occular pressure was noted in 3 patient in group 1, 18 patients in group-2 and 9 patients in group-3. Significant rise of intra-occular pressure was noted at 4 hour in 21 patients in group 2 and 15 patients in group 3. There was no patient in group 1 for significant rise. At 24 hours, some rise of intra-occular pressure was noted in 3 patient in group-1, 9 patients in group-2 and 9 patients in group-3. Significant rise of intra-occular pressure was noted at 24 hours in 21 patients in group 2 and 9 patients in group 3. There was no patient in group 1 at 24 hours.

Discussion:

Earlier studies addressing total Laser energy applied and the intra-occular pressure rise, vary widely in their results due to lack of standardization of parameters. Thus 30, 50, 80 and 200 m.joules have been used as a cut off value for low and high energy levels.[9,10] Others have taken average of the m.joules used in low and high energy groups.[11] Still others consider per shot energy (2.5m.j vs. 3.5m.j) instead of total energy per case, as the parameter for energy grouping in cases of posterior capsulotomy.[12]

We grouped our patients into "1, Low energy group" where the total energy used was up to 25 mj, "2, intermediate energy group" if it was between 25 to 100 mj and "3, high energy" if the energy used was more than 100 mj. Intra-occular pressure changes in each case of every group were recorded after 1, 4 and 24 hours. Thus we found a proportionate increased frequency of significant rise of intra-occular pressure with higher energy consuming groups as compared to the lower ones. Excluding the studies considering long term effects of this procedure, those studying acute / immediate effects did it at differing hours e.g. 1, 2, 3, 4, 5, 24 hours post YAG capsulotomy.[14,15]

We recorded intra-occular pressures of every patient in each group of energy level at 1, 4 and 24 hours- post laser application and found that 51 patients shows significant rise of intra-occular pressure.

Number of patients showing the transient rise of intra-occular pressure after YAG laser capsulotomy also varies much in literature again due to lack of standardization.[16-19] Of the various older studies considering use of m.joules in relation to rise of intra-occular pressure, study of Richter CU et al, is worth mentioning i.e. while using ≥ 200mj they noticed a rise of >10mmof Hg in their 67% of cases, 38% of which were having >40mm of Hg rise of intra-occular pressure.[10] It was a very high rate of alarmingly high intra-occular pressure probably arising from the use of so high energy in this procedure. In another study conducted by Bhargava R, et al rise of intra-occular pressure was seen in12.6% of the patients in which average energy used was 57.8mj (±26.8mj) in contrast to an average use of 42.3±26.6mj and no case of raised intra-occular pressure post YAG laser capsulotomy.[16] Percentage of patient population showing rise of intra-occular pressure >30mm of Hg was 41% in the study of 66 cases of Slomovic AR et al, while 14% of them were having intra-occular pressure more than 40mm of Hg.[20] In a study of 500 cases conducted by Shaikh MA et al, pressure rise of up to 6mm of Hg was seen in 48.6% of cases while another 6.2% were showing a rise of 6-10mm of Hg.[6]

In our study, 51 out of 150 eyes (34%) showed some rise of IOP (table 1) and 51 eyes showed significant rise (34%). Out of these 51 eyes with significant rise of intra-occular pressure, it was 3/21 (14.28%) in group 1 energy level, 33/99 (33.33%) in group 2 and 15/30 (50%) in group 3 energy levels (table no 2) showing a proportionately rising rate of significant intra-occular pressure rise with higher energy use as compared to lower energy levels. Intra-occular pressure rise at 1 hour was in 51 cases out of 150 (34%) and 51 at 4 hours (34%). Intra-occular pressure at 24 hours was persistently elevated and was seen in 90 cases (60%), out of 150, showing rise according to etiology, discussed above. We believe that our results are more scientific and reliable in terms of amount of energy use, intra-occular pressure rise and time of these intra-occular pressure elevations. Further research may help to evaluate more about long terms effect of yag laser energy on Intra-occular pressure of pseudophakic eyes.

Conclusion:
Increase in intra-occular pressure is common after yag laser capsulotomy. It is related to amount of energy used. Higher the amount of energy used, more will be the risk of intra-occular pressure elevation.

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Role and contribution of authors:
Iftikhar Ahmed, collected the data, references and wrote the article.

Rashid Alvi, collected the data, and helped in introduction writing.

Asghar Ali Shaikh, collected the data, references and helped in introduction and discussion writing and also critically review the artcle and advised useful changes.

Maazallah, collected the data, references and helped in introduction writing.

Ismail Khan, collected the data, references and did the interpretation of data and helped in compiling the results.

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