FREQUENCY OF INTRA OCULAR PRESSURE CHANGE AFTER LOW ENERGY AND HIGH ENERGY ND: YAG LASER POSTERIOR CAPSULOTOMY

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ABSTRACT

Objective: To compare frequency of rise in Intra Ocular Pressure (IOP) in patients undergoing low energy and high energy Nd: YAG laser posterior capsulotomy.

Study Design: Comparative, cross-sectional study.

Place and Duration of Study: Armed Forces Institute of Ophthalmology (AFIO), Rawalpindi from January 2013 to August 2013.

Material and Methods: One hundred and twenty patients fulfilling the inclusion criteria were enrolled in the study. Base line IOP was measured with the help of Goldman applanation tonometer. After dilating pupil, Nd: YAG laser posterior capsulotomy was performed, using minimum possible pulses of Nd: YAG laser. The total amount of energy used in the procedure was recorded. IOP was measured 4 hours after the procedure. Post laser frequency of change in IOP (5 mm of Hg from baseline) was calculated in low energy and high energy groups. Chi square test was applied to compare the frequency of raised IOP in both groups.

Results: Raised IOP was noted in 33 (27.50%) cases and this was more common in high energy group occurring in 22 (46.8 %) as compared to low energy group 11 (15.1 %).The *p*-value was found to be <0.05 and was statistically significant.

Conclusion: The results suggested that high energy levels used during Nd: YAG laser posterior capsulotomy had significantly more chances of raised IOP.

Keywords: High energy, Intraocular pressure, Low energy, Nd: YAG laser Posterior capsulotomy.

INTRODUCTION

Posterior capsular opacification (PCO) is a frequent complication of cataract surgery with posterior chamber intraocular lens (PC IOL) implantation[1]. It varies from 7% to 31%, by two years post operatively[2]. Standard treatment of PCO consists of making an opening in the central part of posterior lens capsule[3] Nd: YAG laser posterior capsulotomy is the treatment of choice for PCO. This procedure is effective, non-invasive, relatively safe and less time consuming[4]. Although rare, but Nd: YAG laser capsulotomies may be associated with many complications, the most common being raised IOP after the procedure. Nd YAG laser capsulotomy resulted in rise in IOP in 27% of cases[5]. It is also observed that higher the laser energy, more are the chances of IOP rise[6]. This rise in IOP may be significantly high and may threaten the vision[7].

Association of amount of laser energy with rise in IOP has rarely been researched in local population so the objective of the study was to determine the frequency of raised IOP and its association with the amount of Nd YAG laser energy used for the procedure.

MATERIAL AND METHODS

This comparative cross sectional study was conducted at Armed Forces Institute of Ophthalmology, Rawalpindi from January 2013 to August 2013. Approval from the hospital

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ethical committee was obtained and informed consent was taken from the participants.

Inclusion criteria were age more than 40 years, any gender, posterior capsular opacification, pre procedure IOP between 15–21 mm of Hg.

Patients with history of glaucoma, trabeculectomy, corneal diseases (like keratoconus, corneal dystrophies etc) and posterior segment surgery (like macular hole and retinal detachment), were excluded from the study.

One hundred twenty patients having posterior capsular opacification diagnosed on slit lamp examination were included in this study by using non-probability purposive sampling.

The data were collected using a predefined proforma. Samples were selected from all the patients who underwent Nd: YAG laser capsulotomy. All the confounding variables were recognized during the study and were excluded through exclusion criteria.

One drop of proparacaine hydrochloride was used for topical anesthesia. Base line IOP was measured by Goldman applanation tonometer. Pupil was dilated with 1% tropicamide eye drops.

An opening of 3-4 mm was made in the posterior capsule, using minimum possible pulses of Nd: YAG laser with the help of Abraham capsulotomy lens. Total amount of energy used during the procedure was recorded, as viewed on the control display panel of Nd: YAG laser delivery system.

Two groups were made, low energy group, when energy used was less than 50 mJ and high energy group, when energy used was more than 50 mJ.

IOP was measured 4 hours following the procedure and was considered raised if more than 5 mm of Hg above baseline.

Age and gender status of the patients was also noted.

Data were analyzed by using SPSS version 13.0. Quantitative data like age, IOP, IOP in low and high energy Nd:YAG laser levels were presented by mean ± SD. Qualitative variables like gender, frequency and percentage of raised IOP and IOP in low and high energy Nd:YAG laser groups were also presented. Chi-square test was used to compare frequency of raised IOP in low and high energy groups.

Table-I: Pre and post-laser IOP, rise in IOP values versus category of energy.

Outcome	Category of energy used		Significance *p*-value
	High >50 (n=47)	Low <50 (n=73)	
Pre-laser IOP	16.57 ± 1.65	17.18 ± 1.65	0.053
Post-laser IOP	21.62 ± 4.36	19.21 ± 3.21	0.001
Energy used	63.91 ± 9.60	44.04 ± 3.67	<0.001

Table-II: IOP raised or not raised energy cross tabulation.

	IOP raised or not		Total
	Raised	Not raised	
Energy			
High energy	22	25	47
Low energy	11	62	73
Total	33	87	120

RESULTS

Out of 120 cases, 64 (53.3%) were male and 56 (46.3%) were female. There were 28 (59.6%) males and 19 (40.4%) females in high energy group and 36 (49.3%) males and 37 (50.7%) females in low energy group.

Mean age ± SD was 57.88 ± 6.01 years (Range 45–74 years). Mean age in high energy group was 57.34 ± 6.20 years (Range 45-70 years), and in low

energy group was 58.22 ± 5.90 years (Range 46-74 years).

Both the high energy and low energy groups had similar mean pre laser IOP (p=0.053). Mean post laser IOP in high energy group was 21.62 ± 4.36 mm of Hg and in low energy group it was 19.21 ± 3.21 mm of Hg (p=0.001)

Out of total 120 patients raised IOP was noted in 33 (27.5%) cases and IOP remained normal in 87 (72.5%) cases. In low energy group, raised IOP was noted in 11 out of 73 (15.1%) cases where as In high energy group, raised IOP was noted in 22 out of 47(46.8%) cases.

Chi square test was applied that showed p-value<0.05 (p-value >0.001). This showed a higher frequency of raised IOP after high energy Nd: YAG laser posterior capsulotomy that is statistically significant.

DISCUSSION

PCO has a profound impact on the patient's life by causing social and economic burden. It also affects the daily routine life by reducing visual acuity and increasing the glare. Various surgical techniques have been devised to delay the incidence of PCO but still there are no conclusive results to halt the development of PCO.

Since the advent of Nd: YAG laser in 1981, its applications have ranged remarkably in various medical fields. It is widely accepted in the management of PCO among the surgeons as well as the patients, due to its non invasive approach and being outdoor procedure[8].

Although it is the most effective treatment modality for the management of PCO, still it is not without complications. One of the important complications is raised IOP. Transient rise of IOP after Nd: YAG laser capsulotomy has been reported and well documented in literature and is 0.5–3 %[9]. These studies lack energy calculation and published results in general at all energy levels. Immediate rise of IOP after the procedure is due to absence of posterior chamber IOL and use of high energy Nd: YAG laser that resulted in prolapsed vitreous.

Raised IOP should be anticipated and managed accordingly with Goldman applanation tonometer which is a gold standard diagnostic tool[10].

Various studies have proved that IOP was raised after the Nd: YAG laser posterior capsulotomy. Slomovic and Parrish found that 55% of patients had significantly raised IOP following YAG lasertherapy[11]. Flohr showed similar pattern of IOP rise that is similar to the results as depicted in our study[12].

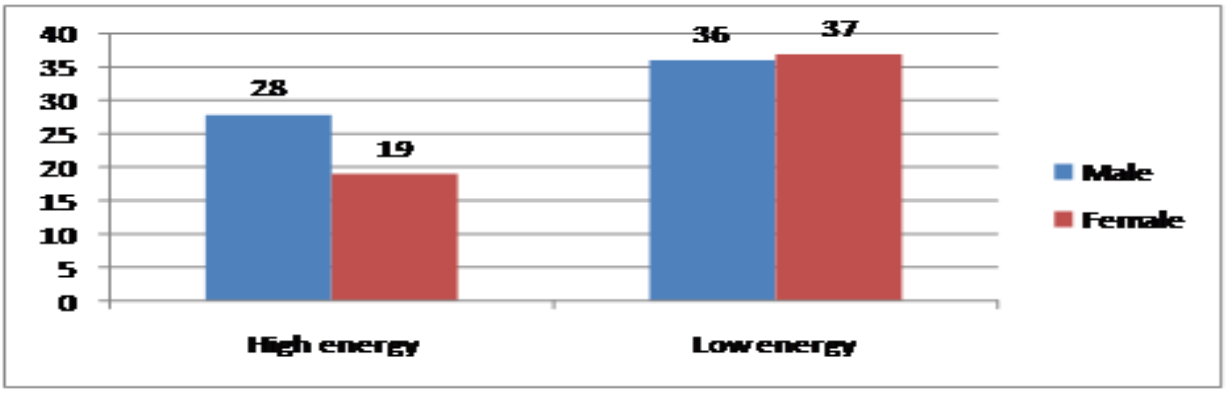

Figure: Gender distribution in high and low energy groups.

Ladas and colleagues studied 210 patients who underwent Nd: YAG laser capsulotomy. One group was giventopical 2% dorzolamide, second was given oral acetazolamide and the third group received no medicines prior to capsulotomy. Latter group experienced IOP higher than 30 mmHg in 15.7% cases after laser

capsulotomy[13]. In this study the percentage of raised IOP is slightly less than the other studies that are mentioned previously.

In our setup Waseem MA demonstrated elevation in IOP in 53 out of 148 (35.81%) cases[6]. Burq MA's study showed that raised IOP occurred in 48 out of 104 (46.2%) cases after Nd: YAG laser capsulotomy[7]. The results are almost similar in both studies.

In comparison to the above mentioned studies, our study showed the rise in IOP in 33 out of total 120 (27.5%) cases and IOP remained normal in 87 (72.5%) cases being slightly less in percentage than the previously mentioned studies.

Our study also showed the relationship of raised IOP with the amount of energy delivered during Nd: YAG laser posterior capsulotomy and found a positive relationship. Channel and Beckman also showed that raised IOP was associated with increased laser energy used during Nd: YAG laser capsulotomy[14]. In our population, a study by Waseem MA showed raised IOP in 21 out of 35 (60%) patients in high energy group as compared to raised IOP in 32 out of 113 (28.32%) patients in low energy group. In our study raised IOP was noted in 22 (46.8%) cases in high energy group as compared to 11 (15.1%) cases in low energy group. Both studies showed a strong positive association between the high amount of energy used and frequency of raised IOP.

Another important aspect that should be kept in mind is the habit of late presentation in our population due to socio-economic reasons. This leads to thick posterior capsules with marked reduction in visual acuity and profound glare at presentation. Thick posterior capsules require higher amount of laser energy as compared to thin capsule when patient present early. In these cases technique of ND: YAG laser capsulotomy is important that can reduce the amount of laser energy required for the procedure.

Although our study showed that frequency of raised IOP is strongly associated with high energy Nd: YAG laser posterior capsulotomy but it could not determine the exact mechanism of this relationship. It may be due to the acoustic shock wave generated by high energy laser triggering the release of inflammatory mediators that can alter the aqueous and trabecular dynamics resulting in raised IOP. Moreover this study could not compare the results of different studies due to different surgical techniques used to delay the incidence of PCO formation, including IOL material and design.

CONCLUSION

The results suggested that high energy levels used during Nd: YAG laser posterior capsulotomy had significantly more chances of raised IOP.

It is recommended that each patient undergoing Nd: YAG laser capsulotomy should receive minimum amount of energy and patient should be followed up for rise in IOP and managed accordingly.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

1. Florian TA, Gerd UA, Are lens implant modifications the best way to prevent posterior capsule opacification?.Br J Ophthalmol. 2014; 98: 850-1.
2. Auffarth G, Brezin A, Caporossi A, Lafuma A, Mendicute J, Berdeaux G, et al. Comparison of Nd: YAG capsulotomy rates following phacoemulsification with implantation of PMMA, silicone or acrylic intraocular lenses in four European countries. Ophthalmic Epidemiol 2004; 11: 319-29.
3. Ram J, Kumar S, Sukhija J, Severia S. Nd:YAG laser capsulotomy rates following implantation of square-edged intraocular lenses: polymethyl methacrylate versus silicone versus acrylic. Can J Ophthalmol. 2009; 44: 160–4.
4. Hossain MI, Hossain MA, Hossain MJ. Visual outcome after Nd:YAG laser Capsulotomy. J Armed Forces Med Coll Bangladesh. 2009; 5: 29-31.
5. Raza A. Complications after Nd YAG Posterior Capsulotomy. J Rawal Med Coll. 2007; 11: 27-9.
6. Waseem M, Khan HA. Association of raised intraocular pressure and its correlation to the energy used with raised versus normal intraocular pressure following Nd: YAG laser posterior capsulotomy in pseudophakes. J Coll Physicians Surg Pak. 2010; 20: 524-7.

7. Burq MA, Taqui AM. Frequency of retinal detachment and other complications after neodymium:Yag laser capsulotomy. J Pak Med Assoc. 2008; 58: 550-2.
8. Mohan LG.Visual benefits of Nd YAG laser capsulotomy study in south eastern Rajasthan. Int J Biol Med Res. 2012; 3(4): 2507-14.
9. Ficker LA, Steele AD. Complications of Nd YAG laser posterior capsulotomy. Trans OphthalmolSoc U.K 1985; 104: 529 – 32.
10. Troost A, Yun SH, Specht K, Krummenauer F, Schwenn O. Transpelpebral tonometry: reliability and comparison with Goldmannapplanation tonometry and palpation in healthy volunteers. Br J Ophthalmol. 2005; 89(3): 280-3.
11. Slomovic AR, Parrish II RK. Acute elevations of intraocular pressure following Nd:YAG laser posterior capsulotomy. Ophthalmology. 1985; 92: 973-6.
12. Flohr MJ, Robin AL, Kelley JS. Early complications following Q-switched neodymium:YAG laser posterior capsulotomy. Ophthalmology. 1985; 92: 360-3.
13. Ladas ID, Baltatzis S, Panagiotidis D, Zafirakis P, Kokolakis SN, Theodossiadis GP. Topical 2.0% dorzolamide vs. oral acetazolamide for prevention of intraocular pressure rise after neodymium: YAG laser posterior capsulotomy. Arch Ophthalmol.1997; 115:1241-4.
14. Channell MM, Beckman H. Intraocular pressure changes after Nd: YAG laser posterior capsulotomy. Arch Ophthalmol 1984; 102: 1024-6.

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