Original Article

Frequency of Raised Intraocular Pressure and its Correlations to the energy used following Neodymium YAG Laser Posterior Capsulotomy in Pseudophakes

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Abstract

Objective: To determine the frequency of raised intraocular pressure in pseudophakic undergoing Nd YAG laser posterior capsulotomy.
To compare the frequency of raised intraocular pressure in pseudophakic undergoing high and low energy Nd YAG laser posterior capsulotomy
Methods: This Descriptive case series included 140 patients with pseudophakic posterior capsular opacity. After dilating the pupils with tropicamide Nd YAG laser posterior capsulotomy was performed and the total amount of energy used was noted. The frequency of raised IOP in post-laser patients and comparison of frequencies of raised IOP undergoing high and low energy Nd YAG laser posterior capsulotomies (≤ 50 MJ labeled as low energy and > 50 MJ labeled as high energy) were calculated
Results: The mean age was 57.37 ±8.74. Mean pre laser IOP was 15.15 and post-laser IOP was 17.50. The rise in IOP was normal in 82.9% and raised in 17.1%. In lower energy group normal IOP was found in 35.7% and raised in 2.9%. In a higher energy group, normal IOP was found in 47.1%, and raised IOP was found to be 14.3%.
Conclusion: Higher the energy used during the Nd YAG laser posterior capsulotomy procedure, more is the chance of a rise in post-laser intraocular pressure as compared to those in which lesser energy was being used.
Keywords: Posterior capsular opacity, pseudophakic, Nd YAG laser posterior capsulotomy, intraocular pressure.

Introduction

Posterior capsular opacity (PCO), also known as secondary cataract, is the opacification of the posterior capsule of the lens after cataract extraction and implantation of posterior chamber intraocular lens (IOL). It is a common late complication of posterior chamber IOL implantation that usually occurs in uncomplicated cataract surgery[1, 2]. The opacification varies in intensity and can cause visual deterioration of varying degrees from mild to almost complete visual loss resulting in only light perception (PL+ve). Along with a decrease in visual acuity, it can also cause decreased contrast sensitivity, annoying glares, and monocular diplopia.[3,4]

Nd YAG laser (Neodymium-doped yttrium aluminum garnet; Nd: Y3Al5O12) posterior capsulotomy is the procedure of choice for posterior capsular opacification. It is an outpatient procedure performed in ophthalmologist's office under topical anesthesia with pupils dilated. The patient is asked to place his chin on chin rest and his head is fixed with the help of the head strap. The procedure is preferably performed in dim light. This is a noninvasive procedure in which the opacified posterior capsule is focused and laser fires are shot to burst the capsule. The Nd YAG laser uses a specific wavelength and the fires are shot in a circular pattern to create a circular hole that clears the visual pathway and causes a dramatic increase in visual acuity.[5,6]

The intraocular pressure (IOP) is the pressure inside the eyeball which is highly significant, as it can cause damage to the eyeball and in severe and complicated cases, can even cause total visual loss. The pathology behind the rise in intraocular pressure is defective drainage of aqueous humor resulting in high IOP. Various studies have shown Nd YAG laser posterior capsulotomy to have an association with a rise in intraocular pressure and some studies have also proved that higher the energy is used for posterior capsulotomy the more are the chances for higher IOP[5]. However the proper mechanism for this phenomenon is not being completely understood yet, it is said that higher energy causes more inflammatory cells to be released which along with broken posterior capsular particles cause changes in the trabecular meshwork and cause a blockage. These mechanisms cause alteration in aqueous drainage and a resultant increase in IOP occurs.[7,8,9]

Patients & Methods

A Descriptive case series study was being conducted at the Ophthalmology Department, Rawalpindi Medical University. The study was completed within 6 months from 21.02.15 to 21.08.15. The sample size was 140 eyes calculated using the WHO sample size calculator by non-probability consecutive sampling. Pseudophakic with posterior chamber IOLs of both genders between the age group of 20 years to 70 years with vision less than 6/12 due to PCO and pre YAG IOP between 10 and 20 mmHg were included. The consent was taken from the hospital ethical committee. An eye examination was done. Pre YAG IOP was checked, the total amount of energy used is noted. After 6 hours post-laser IOP was noted and the difference in IOP and its relation to the amount of energy used was being studied.

Results

In this study, the total number of 140 patients with unilateral pseudophakic posterior capsular opacities were enrolled. The mean age was 57.37 ± 8.74, Mean pre laser IOP was 15.15 ± 2.41, and mean post-laser IOP was found to be 17.50 ± 3.46. Out of 140 patients, 57 were females which were 40.7% of the total, and 83 were males which were 59.3% of the total. The post YAG rise in IOP was found to be Normal i.e. < 5mmHg in 116 out of 140 patients which were 82.9% of the total and raised i.e. ≥5mmHg 24 out of 140 patients which were 17.1% of the total. In group 1(the group in which <50 MJ of energy was used), the number of patients was 54 which was 38.6% and in group 2 (in which energy used was >50 MJ), the number of patients was 86 which was 61.4 % as shown in Table 1.

Mean Pre laser IOP in group 1 was 14.8148 ± 2.37 and mean post-laser IOP was 16.68 ± 3.214 and mean pre laser IOP in group 2 was 15.36 ± 2.42 and post-laser IOP was 18.01 ± 3.52 as shown in Table 2.

In group 1 of patients (lower energy group i.e. in which energy < 50 MJ was used) normal IOP i.e. less than 5 mmHg was found to be in 35.7% and raised i.e. ≥ 5mmHg in 2.9%. In group 2 patients (higher energy group i.e. in which energy >50 MJ was used) normal IOP was found to be in 47.1% and raised IOP was found to be in 14.3% as shown in Table 3.

Graphical representation of the frequency of IOP status and gender distribution is being shown in Figures 1 and 2 respectively.

Table 1: Energy groups

	Frequency	*Percent*	*Valid percent*	*Cumulative Percent*
Valid <50 low	54	38.6	38.6	38.6
>50 high	86	61.4	61.4	100.0
Total	140	100.0	100.0	

Table 2: Paired samples statistics

	Mean	*N*	*Std. Deviation*	*Std Error Mean*
Pair Pre group 1	14.814	54	2.371	0.322
1 Post group 1	16.685	54	3.214	0.437
Pair Pre group 2	15.360	86	2.420	0.261
2 Post group 2	18.011	86	3.526	0.380

Table 3: Energy groups * IOP Status Cross tabulation

		IOP Status		
		Normal	**Raised**	**Total**
Energy groups	<50 low Count	50	4	54
	%within Energy groups	92.6%	7.4%	100.0 %
	% within IOP status	43.1%	16.7%	38.6%
	% of Total	35.7%	2.9%	38.6%
	>50 high Count	66	20	86
	% within Energy groups	76.7%	23.3%	100.0 %
	% within IOP status	56.9%	83.3%	61.4%
	% of Total	47.1%	14.3%	61.4%
Total				
	Count	116	24	140
	% within Energy groups	82.9%	17.1%	100.0 %
	% within IOP status	100.0%	100.0%	100.0 %
	% of Total	82.9%	17.1%	100.0 %

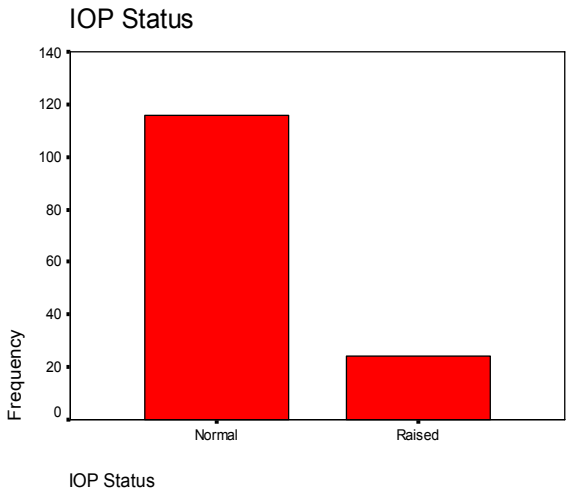
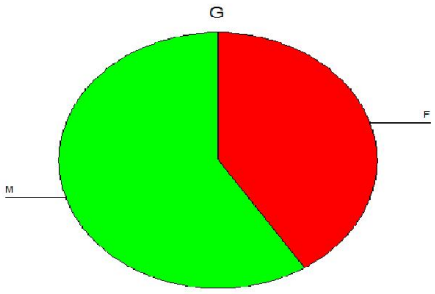


Figure 1: IOP Status



G-Gender, M-Male & F-Female

Figure 2: Gender Frequency Pie Chart

Discussion

Posterior capsular opacity (PCO) is the most common complication of uncomplicated cataract surgery. Various studies have shown that surgical techniques, IOL designs, patient's age, and previous ocular inflammation play their roles in PCO formation. Nd Yag laser posterior capsulotomy is the only most effective and non-invasive procedure being most commonly used, to get rid of PCO in the visual axis[10,11]. Nd Yag laser posterior capsulotomy dramatically increases visual acuity if no other cause of decrease vision is present[12,13]. However as already discussed, Nd Yag laser-like any other procedure has its complications but still, it is the overall best and most effective treatment of PCO.[14,15]

Transient and more rarely long term rise in intraocular pressure after YAG capsulotomy has been noticed all over the world. Various researches are being performed the world over and studies are still going on. In 1985 Solomovic and Parrish performed a study on 66 patients and found the post-laser rise in IOP in 55% of patients [16]. Simsek and his colleagues, 1998, did a study in which they divided patients into four groups, three were given anti-glaucoma medication before YAG and the fourth group was left untreated. In the untreated group, post-laser rise in IOP was noted after 1 and 3 hours and it was noticed that IOP rise was 3.90 ± 5.35 and 5.95 ± 5.32, respectively.[17] Flohr's study also revealed a similar type of results.[18]

In recent years many studies were being performed that also came up with the same results. In 2004, Barnes and colleagues performed their study on glaucomatous patients and showed significant IOP rise in most of the patients.[21] In, 2008, in China, Cai P proved through his studies that anti-glaucoma drugs given before Nd YAG laser posterior capsulotomy prevents IOP rise in most of the patients.[9]

Researches are also being going on to find out the exact etiology of IOP rise after Nd Yag Laser posterior capsulotomy. It is being said that the liberated particles of the posterior capsule result in clogging up the anterior chamber angle that effects aqueous drainage and causes IOP to rise.

In all the studies and discussion mentioned above, IOP rise after YAG is considered but the total amount of energy used is not being considered. There are relatively fewer studies done in which the total amount of energy used in Nd YAG laser posterior capsulotomy and its association with the IOP rise is considered.

In 2008, a study performed in Karachi at PNS Shifa hospital by Muhammad Waseem and Haseeb Ahmed considered the total amount of energy used and the associated rise in IOP and found that out of 148 patients, IOP rise occurred in 53 (35.81%) patients. In high energy category, IOP rise occurred in 60 % of patients as compared to low energy category in which it occurred in only 28.32%.[5]

The results of my study proved the association of post YAG IOP rise to the total amount of energy used. Higher the energy used more are the chances of elevation of IOP. IOP rise in low energy group occurred in 2.9 % whereas in high energy group it occurred in 14.3 % of individuals.

The mechanism of more rise in IOP when higher energy is used remains unclear. Various explanations and mechanisms are being given until now. The most probable mechanism would be that higher energy used causes the liberation of more particles of the posterior capsule during the procedure that results in clogging the anterior chamber angle and resultant defective drainage and rise in IOP. It is also being hypothesized that higher energy causes the production of more acoustic shock waves that cause the release of an increased number of inflammatory mediators that alter the trabecular meshwork and aqueous dynamics.

Though the accurate comparison of various studies regarding post YAG IOP rise is difficult, as PCO thickness, patient's susceptibility to IOP elevation, physician's expertise while performing YAG, and size of capsulotomy are important factors affecting the post YAG rise in IOP. But our study and the other studies discussed above are sufficient enough to prove that IOP elevation is certainly associated with the amount of energy used.

Conclusion

We conclude from our study that a rise in intraocular pressure is frequently associated with Nd YAG laser posterior capsulotomy procedure and IOP elevation is higher if the total amount of energy used is more as compared to those in which lesser amount of energy is being used. Because even a transient rise in intraocular pressure can cause significant damage to the eye, we must be very careful in performing the procedure and minimum possible energy should be used. Follow up should also be done to check IOP and if found elevated should be treated timely.

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