

BRIMONIDINE EFFICACY ON INTRAOCULAR PRESSURE CONTROL FOLLOWING ND: YAG LASER CAPSULOTOMY

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ABSTRACT

Objective: To determine the efficacy of 0.2% brimonidine eye drops on control of intraocular pressure following Neodymium: Yttrium-Aluminum-Garnet (Nd: YAG) laser posterior capsulotomy.

Study Design: Quasi experimental study.

Place and Duration of Study: Study was conducted in department of Ophthalmology, Combined Military Hospital Peshawar of six months duration from Oct 2013 to Mar 2014.

Material and Methods: A total of 182 patients were included in this study. One drop of 0.2% brimonidine one hour prior to laser treatment was instilled in the eyes of patients. Cornea was anaesthetized with topical 0.5% proparacaine hydrochloride. "Ocular instruments ® Abraham Capsulotomy YAG contact lens" was used along with Q-switched Zeiss VISULAS YAG III (Nd: YAG) laser system to make a hole of 3-4mm in the posterior capsule using minimum amount of total laser energy. Data were analyzed using SPSS version 15.0. Mean and standard deviation was calculated for numeric variables like age and intraocular pressure at different occasions. Frequency and percentage was calculated for categoric variable i.e. gender. Efficacy was stratified among age and gender to see effect modifiers.

Results: The mean age of participants was 63.3 ± 7.7 years. Out of 182 patients, 109 (59.9%) were male while remaining 73 patients (40.1%) were female. Brimonidine 0.2% eye drops proved effective in 162 patients (89.0%). Stratification of age and sex with regard to efficacy of 0.2% brimonidine eye drops was carried out.

Conclusion: The use of 0.2% brimonidine has been proven effective to counteract the IOP increase following Nd: YAG laser capsulotomy in this study.

Keywords: Brimonidine, Capsular opacification, Nd: YAG laser, Posterior capsule of lens.

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INTRODUCTION

The most common cause of preventable blindness worldwide after refractive error is cataract (33%)¹. Cataract extraction is the most common treatment modality. Despite advances in cataract extraction surgery, posterior capsule opacification (PCO) is still a common post-operative complication of cataract surgery. It may arise in months or years after surgery and causes decreased visual acuity of patients, making it necessary to perform a posterior capsulotomy for an improvement in visual quality^{2,3}. Neodymium: Yttrium Aluminum Garnet (Nd:YAG) Laser posterior capsulotomy is associate with rise in

IOP of 10 mmHg or more in 67%¹ of the patients. Recent studies indicate that the material and design of intraocular lenses e.g polymethylmethacrylate (PMMA), silicone and hydrophilic acrylic lenses induce further clouding than hydrophobic acrylic lenses. It has also been observed that the lenses implanted in the ciliary sulcus induce more rise in intraocular tension than the lenses implanted in the capsular bag^{4,5}. PCO is caused by residual lens epithelial cells (LECs) which are inevitably left behind after surgery and is essentially a wound healing response of the lens to surgery. With time the residual LECs proliferate to form Elschnig's pearls or undergo metaplasia to myofibroblasts. These can migrate to obscure the visual axis or cause fibrosis of the capsule. The management options for PCO include Neodymium: Yttrium Aluminum Garnet

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(Nd:YAG) laser capsulotomy and pars plana surgical capsulotomy⁶. Nd:YAG laser is a photo-disruptive laser which causes disruption of tissue by producing extreme heat of about 10,000°C along with an acoustic shockwave¹. A non-invasive and effective method of dealing with PCO is Nd:YAG laser capsulotomy⁶. but Nd:YAG laser has its own problems like corneal haze, uveitis, hyphema, lens pits, and retinal detachment and the most consistent complication is the post-capsulotomy rise in intraocular pressure (IOP). Rise in IOP is probably caused by clogging of the trabeculum with debris⁷. IOP rises after capsulotomy, which decreases gradually until reaching near normal in a week^{8,9}. Rise in IOP is directly proportional to the amount of energy used for posterior capsulotomy¹⁰.

Various drugs and drug combinations have been investigated to prevent the acute rise in IOP following laser capsulotomy. Drug brimonidine is α 2-adrenergic receptor agonist. It has dual mechanism of action, firstly it decreases the aqueous humor formation and secondly it increases the uveoscleral outflow¹¹. The neodymium yttrium aluminum garnet (Nd: YAG) laser is solid type of laser, causes disruption of tissues by ionization mode of action. It has 1064 nm wave length, with infrared radiation. It is a powerful continuous waves (CW) laser which is usually Q switched when used to treat the eye conditions. It is commonly used to clear the visual axis by disruption of posterior capsule following cataract surgery or iridotomy in narrow angle glaucoma and to cut vitreous bands¹⁴.

All lasers have more or less complications despite their useful benefits. Nd: YAG laser when used for posterior capsulotomy can cause following complications including mild anterior uveitis, transient rise of intraocular pressure, damage to corneal endothelium, cystoids macular edema (when used before 6 months of surgery), retinal detachments (especially in myopes) and macular hemorrhage. The retinal detachment is more commonly seen in myopes, but the incidences of retinal detachments, holes or tears

increases if capsulotomy is done with Nd:Yag laser within one year of cataract surgery¹⁵.

In reported literature, one study conducted in Brazil shows the mean rise of IOP was 2%² when beta-adrenergic blocker was used after Nd: YAG capsulotomy, while another study conducted in India shows IOP rise was 3.3%⁷, 7.35%¹² (in Turkey) and 31.7%¹³ (in USA). There are significant controversies in previous studies so the rationale of our study is to get the clear outcome of brimonidine use on intraocular pressure control following Nd: YAG laser capsulotomy. There are no similar local studies available, so this study will provide local statistics and may contribute to enhance better patient management and outcomes.

MATERIAL AND METHODS

This quasi experimental study was performed in the department of Ophthalmology, Combined Military Hospital, Peshawar. Study period was from October 2013 to March 2014. Approval from hospital ethical committee of concerned hospital and written informed consents from the subjects were obtained. Sample size was 182, sampling technique was non-probability consecutive and size was calculated using WHO sample size calculator. Patients who developed PCO within 6 month after cataract surgery were included in the study, their age was 18 year and above. Patients with IOP above 21 mmHg with or without anti-glaucoma medication, patient using medication that alter IOP were excluded from study. Patients of glaucoma, hypertension, diabetes mellitus or with history of ocular trauma, uveitis, retinal detachment or angle anomalies were also excluded.

Patients with PCO presenting to eye department, CMH Peshawar were selected. After explaining the procedure and possible complications, informed-written consent was taken. The data were collected using a proforma. Age, gender, involved eye and date of cataract surgery were obtained in history. IOP measurement and detailed slit-lamp examination was

carried out prior to commencement of the study in order to detect and exclude conditions like angle anomalies, glaucoma, vitreous hemorrhage, retinal detachment and previous surgical treatment of glaucoma.

One drop of 0.2% brimonidine one hour prior to laser treatment was instilled in the eyes of patients. Cornea was anaesthetized with topical 0.5% proparacaine hydrochloride. "Ocular instruments ® Abraham Capsulotomy YAG contact lens" was used along with Q-switched Zeiss VISULAS YAG III (Nd: YAG) laser system to make a hole of 3-4 mm in the posterior capsule

Applanation Tonometer as per following protocol:

- 1st measurement - Baseline IOP at presentation/before the treatment.
- 2nd measurement - 24 hours after the laser capsulotomy.

On ethical grounds, any patient from any group who developed a rise in IOP >30 mmHg was immediately treated with additional anti-glaucoma drugs.

Data were analyzed using SPSS version 16.0. Mean and standard deviation was calculated

Table-I: Efficacy of topical brimonidine on intraocular pressure control following neodymium: yttrium-aluminum-garnet laser capsulotomy.

		Intra ocular pressure (IOP)			
		n	Normal n(%)	Raised p(%)	p-value
Total		182	162 (89.01)	20 (10.99)	<0.001
Brimonidine	Given	182	162 (89.01)	20 (10.99)	<0.001
	Not Given	100	33 (33.00)	67 (67.00)	
Gender	Male	109	97 (88.99)	12 (11.01)	0.992
	Females	73	65 (89.04)	08 (10.96)	

Table-II: Stratification of age with regard to efficacy.

Age (Years)	Total	Percentage (%)	Efficacy of 0.2% brimonidine eye drops		p-value
			Yes	No	
45-55	29	15.93	25	4	0.900
56-64	77	42.30	70	7	
65-74	58	31.86	51	7	
>75	18	09.89	16	2	
Total	182	100	162	20	

using minimum amount of total laser energy. All the capsulotomies were performed by single eye surgeon in order to avoid bias. Following the laser capsulotomy, all patients were advised combination of tobramycin and prednisolone topical eye drops along with pressure lowering drug so as to control inflammation and infection.

Brimonidine 0.2% eye drops was instilled once soon after the laser capsulotomy and then 12 hourly for 7 days. Intraocular pressure of all patients at all intervals was measured by principal investigation using same Goldmann

for numeric variables like age and intraocular pressure at different occasions. Frequency and percentage was calculated for categoric variable i.e. gender. Efficacy was stratified among age and gender to see effect modifiers. Chi-square test was applied and p-value for each variable was calculated. A p-value of <0.05 was taken as statistically significant.

RESULTS

A total of 182 patients were included in this study. Mean age of the patients was 63.3±7.7 years. Out of 182 patients, 109 (59.9%) were male while remaining 73 patients (40.1%) were female.

Compared to the already accepted 67% incidence of raised IOP after Nd: YAG Laser Posterior Capsulotomy, 0.2% brimonidine eye drops proved effective in 162 patients (89.01%) to maintain normal IOP after laser procedure. While in other 20 (10.99%) patients IOP was raised after the procedure. Efficacy of brimonidine was found significant in reducing IOP after Nd: YAG laser capsulotomy (p -value <0.001) (table-I). The study also showed that there was no significant difference in efficacy of drug on gender or age of the patients. Stratification of age with regard to efficacy of 0.2% brimonidine eye drops was

Visually significant posterior capsule opacifications (PCO) is the most common late complication of uncomplicated cataract surgery. PCO may impair contrast sensitivity or can cause glare or monocular diplopia. Certain acrylic intraocular lenses (IOL) may be associated with lower rates of PCO than polymethylmethacrylate (PMMA) and silicon lenses. The incidence of PCO ranges from 10% in some studies to 50% in others after operated cataract extraction. Elschning's pearls is most common type of PCO which is due to proliferation of the lens epithelial cell layer at the equator of the lens capsule near the site of opposition of the anterior capsule with the

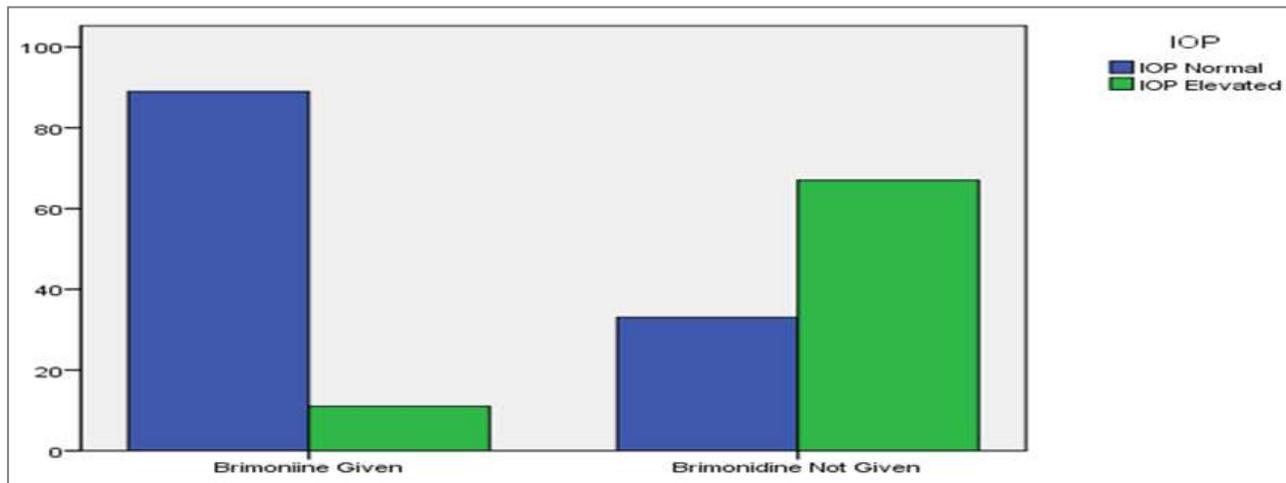


Figure: Brimonidine efficacy on IOP control following Nd:YAG laser capsulotomy.

carried out (table-II & figure).

DISCUSSION

In reported literature, one study conducted in Brazil shows the mean rise of IOP was 2%² when beta-adrenergic blocker was used after Nd: YAG capsulotomy, while another study conducted in India shows IOP rise was 3.3%⁷, 7.35%¹² (in Turkey) and 31.7%¹³ (in USA). In comparison to other studies our study reflected that brimonidine is very much effective in controlling rise in IOP following Nd: YAG laser capsulotomy. Laser is an acronym for light amplification by the stimulated emission of radiation. The laser light is coherent (all photons have same wavelength) and collimated (waves of light are parallel)¹⁶.

posterior capsule¹⁷.

In present study, the efficacy of 0.2% brimonidine eye drops on control of intraocular pressure following Nd:YAG laser posterior capsulotomy was observed to be 89.0%. In a study by Gartaganis et al¹⁸ a significant mean percent reduction in IOP was found after 0.2% brimonidine instillation 1 hour pre-capsulotomy and immediately post capsulotomy, 80% of the subjects showed a decrease in IOP after instilling 0.2% brimonidine (1 hour pre capsulotomy). No such decrease was observed in control. Post capsulotomy a statistically significant decrease in IOP ranging between 1-10 mmHg was found in 73.3% of the treatment group. Yeom et al¹⁹ had also documented similar observations where IOP decreased from the baseline in the group who

were instilled with brimonidine, decreases in IOP from baseline ranged from 2.3 to 2.7 mmHg in the brimonidine 0.2% group whereas the vehicle group exhibited a rise in IOP. IOP elevations of less than 5 mmHg occurred in 22.9% of patients in the brimonidine 0.2% group. Present study also provide substantial evidence in favor of brimonidine for prevention of acute rise in IOP after Nd:YAG laser posterior capsulotomy among Pakistani patients. Our study has further strengthened the efficacy in addition to providing local statistics for brimonidine use before and after laser therapy for PCOs.

The limitation of this study is that it was a single center study, hence long term outcomes needs to be explored by multi-center randomized control trails.

CONCLUSION

The use of 0.2% brimonidine has been proven effective to counteract the increase in IOP following Nd: YAG laser capsulotomy in this study.

CONFLICT OF INTEREST

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

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