EFFECT OF TOPICAL BRIMONIDINE 0.15% VERSUS TIMOLOL 0.5% TO PREVENT INTRAOCULAR PRESSURE ELEVATION AFTER Nd-YAG LASER CAPSULOTOMY

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ABSTRACT

BACKGROUND

Posterior capsular opacification (PCO) is the most common long term complication of modern extra capsular cataract surgery techniques including phacoemulsification. The treatment of choice for clinically significant posterior capsule opacification is Neodymium: Yttrium-Aluminium-Garnet (Nd:YAG) laser posterior capsulotomy. Increased IOP is a well-known complication of Nd:YAG laser posterior capsulotomy Effective prophylaxis could prevent the possible optic nerve damage or visual field loss in susceptible patients.

MATERIALS AND METHODS

This prospective randomized study was conducted for one year in the Department of Ophthalmology Christian Medical College and Hospital, Ludhiana. All patients undergoing laser capsulotomy during this period were randomly distributed into two groups – A or B. Group A received 1 drop of Brimonidine 0.15%, Group B received 1 drop of 0.5% Timolol, one hour prior to presentation. Nd:YAG laser Capsulotomy was done. IOP was measured using an applanation tonometer after 1 hr, 2 hrs, 3 hrs and 4 hrs. after completion of procedure. The data was collected as per protocol and statistically analysed using t-test, Chi-square test and Z test.

RESULTS

There were 30 patients in each group. The baseline IOP was 15.10 ± 2.66 mmHg for group A and 16 ± 2.18 mmHg for group B ($p = 0.11$) (t test). There was no statistically significant reduction between the two groups in the mean IOP changes at 1, 2 or 3 hrs after Nd:YAG capsulotomy. The mean reduction in IOP after 4 hrs. for group was -1.83 mmHg and for group B was -1.53 mmHg. The difference was statistically significant ($p < 0.05$).

CONCLUSION

Brimonidine 0.15% was found to have an efficacy comparable to that of Timolol 0.5% in preventing post Nd:YAG capsulotomy IOP spikes.

KEYWORDS

Posterior Capsular Opacification, Nd:YAG Laser, Intraocular Pressure, Prophylaxis, Brimonidine, Timolol.

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BACKGROUND

Posterior capsular opacification (PCO) is the most common long term complication of modern extracapsular cataract surgery techniques including phacoemulsification. It is the most common cause of non-refractive decreased postoperative vision.[1] The main mechanism of postoperative PCO is proliferation and migration of lens epithelial cells onto the posterior capsule. Equatorial epithelial cells undergo fibrous metaplasia, causing fibrosis of posterior capsule.[2] Migration of these cells centrally towards the visual axis, and their subsequent opacification, can have significant impact on vision, including a marked decrease in visual acuity, as well as impaired contrast sensitivity, glare disability and monocular diplopia.[1,3]

Factors important in preventing PCO include surgery related factors and intraocular lens IOL related factors. Surgery related factors that help in prevention of PCO are meticulous cortical clean up, "In the bag" IOL fixation and capsulorhexis slightly smaller than the diameter of the IOL. Lens related factors for PCO prevention include bio compatible IOL, good contact between the IOL optic and the posterior capsule and IOL optic geometry that possesses a square, truncated, or sharp edge. This prevents migration of proliferative material from the equatorial region on to the

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posterior capsule[4] Studies have reported that the prevalence of PCO and its impact on visual acuity progress with time.[1,3] Eradication of PCO thus becomes an important goal of modern ophthalmology.

In the past, invasive surgical posterior capsulotomy was the primary treatment of posterior capsular opacification and it is still performed where Nd:YAG laser facility is not available or in cases with very dense or fibrotic membrane particularly in children.[5] The treatment of choice for clinically significant posterior capsular opacification is Neodymium: Yttrium-Aluminium-Garnet (Nd:YAG) laser posterior capsulotomy. It is an effective modality in the management of posterior capsular opacification.[6] Nd:YAG laser is a solid state laser that delivers pulses in the near infrared (1064 nanometers).[7] This laser is a cold laser and cuts intraocular tissue non-invasively.

Increased IOP is a well-known complication of Nd:YAG laser posterior capsulotomy.[8,9,10] It is usually transient occurring within 4 hours after the laser procedure and lasting for less than 24 hours.[9,10] This is most commonly seen in eyes with a history of glaucoma, or with initial intraocular pressure greater than 20 mmHg.

Several mechanisms have been described to explain the acute IOP rise. Increase in IOP following laser capsulotomy may be related to size of capsulotomy, debris created and amount of energy delivered to the eye. Blockage of the trabecular meshwork with capsular remnants, inflammatory debris and high molecular weight soluble lens proteins has been described. Another explanation for increase in IOP after capsulotomy is that energy delivered to the eye creates a shock wave that disturbs the ciliary body or causes a neurohumoral increase in IOP.[7]

The reported incidence of IOP elevation after Nd: YAG laser capsulotomy varies from 39% to 77%. The maximum IOP increase commonly occurs between 1.5 and 4 hours and usually returns to base line within 24 hour after treatment.[11]

Steinert et al reported an incidence of glaucoma developing in 1% to 6% of patients after capsulotomy.[12]

Considering the high incidence of IOP rise with laser capsulotomy, prophylaxis for post laser IOP elevation has become a standard procedure and is done routinely.

Aim- To compare the effect of topical Brimonidine 0.15% vs Timolol 0.5% as prophylactic agents for control of Intraocular pressure rise following Nd:YAG laser Capsulotomy.

MATERIALS AND METHODS

This prospective randomized study was conducted in the Department of Ophthalmology, Christian Medical College and Hospital, Ludhiana for one year. All patients undergoing laser capsulotomy during this period were randomly distributed into two groups A or B.

An informed consent was taken from all subjects enrolled in the study. All patients underwent a baseline evaluation including relevant history and ocular examination. Distant visual acuity (uncorrected and best corrected) was recorded by Snellen chart. Anterior segment examination was done with a slit lamp and grade of posterior capsular opacification was recorded using the following grading system.[7]

Grade	Posterior Capsule Opacification
0	Clear capsule
1	Low density peripheral involvement of ¼ of the total capsule area
2	Medium density peripheral involvement of ½ of the total capsule area
3	High density total involvement of the capsule area
4	High density peripheral and central involvement of the capsule area

Table 1. Posterior Capsule Opacification

Gonioscopy was done using Goldman single mirror lens, fundus examination was done with 90 diopter lens for all patients. IOP was measured by Goldmann's applanation tonometer.

Exclusion Criteria for the Study-

1. History of previous ocular laser treatment.
2. History and findings suggestive of glaucoma.
3. Active ocular inflammation or infection.
4. History of prolonged steroid administration.
5. History of uveitis.
6. Patients on antiglaucoma drugs or any systemic hypotensive agents.
7. History of any ocular pathology which could influence the IOP.
8. History of allergy to Timolol or Brimonidine.
9. Pregnancy and nursing mothers.

All patients included in the study underwent a baseline IOP measurement 1 hour prior to the procedure following which patients in group A received 1 drop of Brimonidine 0.15% and patients in group B received 1 drop of Timolol 0.5% 1 hour prior to the procedure. Pupils were semi-dilated using 1-2 drops of a combination of tropicamide 0.8% and phenylephrine 2.5%. Topical xylocaine 4% was used anaesthetize the eye prior to the procedure.

Nd:YAG laser capsulotomy was done with Visulas yag III (Carl Zeiss) laser using the Abraham capsulotomy lens with the beam retro focused. Single pulse mode was used with the lowest energy to create an opening of size 3-4 mm in the central part of the opacified capsule. IOP was measured using an applanation tonometer after 1 hr, 2 hrs, 3 hrs and 4hrs of completion of procedure. All patients were instructed to use predacetate 1% eye drops QID for 7 days after the procedure. Follow up was done after 24 hrs, 48 hrs, 4 and 7 days of the procedure. At each follow up, history of any adverse effects was taken, examination included visual acuity by Snellen chart, anterior segment examination and IOP measurement by applanation tonometer. All IOP recordings were done by a single investigator who was masked to the prophylactic drug used.

The data was collected as per protocol and statistical analysis was done using unpaired t-test, paired t-test, chi-square test and Z test. Statistical significance was determined by a p value <0.05.

RESULTS AND ANALYSIS

This prospective study included a total of 60 patients who fulfilled the inclusion criteria. Group A included 30 patients who were given topical Brimonidine 0.15% and group B included 30 patients who were given topical timolol 0.5%, prophylactically 1 hour before Nd:YAG capsulotomy to prevent post procedure rise in IOP. The age of the patients in group A ranged between 39-80 years with a mean of 60.57 years and in group B ranged between 30-83 years with a mean of 62.57 years.

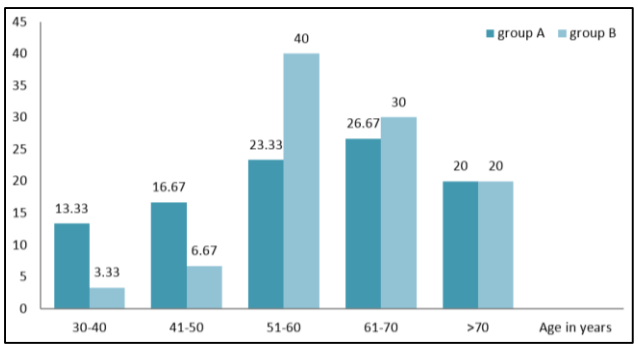

Figure 1. Age Distribution

IOP in the Two Groups at 4th Hour- The maximum reduction was seen at 4th hour in both the groups and it was also observed that group A had the better reduction in IOP (1.83 mmHg) from the baseline as compared to group B (1.53 mmHg) the difference being statistically significant (p= 0.05).

IOP Variation at 4th Hour Table

	Group A	Group B	P Value
Base line IOP (mmHg)	15.10	16	0.11
IOP Mean (mmhg)	13.27	14.47	0.05
IOP Change over baseline	-1.83	-1.53	0.05

Table 2. IOP Variation at 4th Hour Table

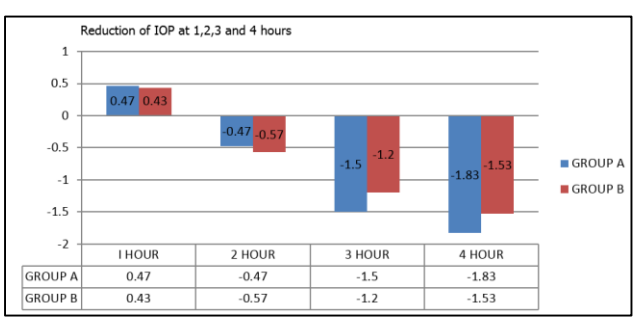

Figure 2. Reduction of IOP at 1, 2, 3 and 4 Hours

DISCUSSION

Posterior capsular opacification (PCO) is one of the most common visually disabling complications of cataract surgery. Nd:YAG laser capsulotomy is the mainstay of treatment for PCO.[1] Although safe and non-invasive, Nd:YAG capsulotomy can lead to complications like transient IOP elevation, uveitis, IOL damage, subluxation of IOL and even cystoid macular edema.[2]

The most common complication of posterior capsulotomy is increased IOP.[2] The sudden increase in pressure may have harmful effect, especially if the optic nerve is already severely compromised. The frequent occurrence of transient IOP rise and the unpredictability of the degree of rise is a major issue.[3]

It has been reported that IOP elevation generally reaches its peak within the first three hours after laser treatment.[5] Various hypotensive agents have been tried prophylactically in an attempt to decrease the incidence and severity of IOP rise after Nd:YAG laser posterior capsulotomy with varying degree of success.[4]

Brimonidine is a selective alpha 2 adrenergic agonist which lowers IOP by decreasing the aqueous humour production and increasing the uveoscleral outflow. It has its peak of action at 3-4 hours. Timolol is a non-selective beta blocker, that decreases IOP by decreasing aqueous production.[7] It's onset of action occurs after 10-20 minutes of instillation and lasts for atleast 24 hours with peak action at 2-3 hours.

In our study, the mean age of the patients included in the brimonidine group was 60.57 years and in the timolol group was 62.57 years. Majority of the patients were found to have grade 2 PCO in both the groups. At baseline evaluation, mean IOP in group A was 15.10 mmHg and in group B it was 16 mmHg. The difference between the two groups was not statistically significant (p=0.11).

In the brimonidine group, slight rise in the mean IOP at the end of 1st hour was observed but when this value was compared to the baseline mean IOP the difference was not statistically significant. After 2 hours the mean IOP was lesser than the baseline IOP of the group. The IOP reduction obtained at 3 hours was statistically significant. The maximum IOP reduction was obtained at 4 hours after laser procedure and the difference when compared from the baseline was statistically significant. Chen et al also observed a fall in mean IOP from baseline in the brimonidine group from 1st hour till 24 hours and reported point of maximum IOP fall to be 24 hours after laser procedure.

In the timolol group also, a slight increase in the mean IOP was observed at the end of 1st hour but when this value was compared to the baseline the difference was not statistically significant. After 2 hours the mean IOP was lesser than the baseline IOP of the group. The maximum reduction in IOP reading was obtained after 4 hours of the procedure and the difference was statistically significant when compared from baseline (p=0.04).

When two groups were compared for their IOP lowering efficacy it was observed that after the end of 2nd hour, a mean reduction of 0.47 mmHg in the brimonidine group and 0.57 mmHg in the timolol group was seen after laser capsulotomy. Although a slightly better reduction was seen in the timolol group but it was not statistically significant (p=0.14). At the end of 3rd hour 1.5 mmHg reduction of IOP in the brimonidine group and 1.2 mmHg reduction in the timolol group was observed. The difference between the two

groups was again statistically not significant. At the 4th hour, reduction in IOP in the brimonidine group was 1.83 mmHg and it was 1.53 mmHg in the timolol group. This was the maximum reduction seen in the both the groups and it was also observed that brimonidine had a better reduction in IOP from the baseline compared to timolol. The difference between the two groups as statistically significant (p=0.05).

CONCLUSION

This study demonstrated that both topical brimonidine and timolol given prophylactically as a single dose administration 1 hour before Nd:YAG laser capsulotomy were effective in preventing IOP elevation after capsulotomy. Moreover considering that both the drugs have a similar safety profile, topical brimonidine 0.15% may be considered to have better IOP lowering effect after Nd:YAG laser capsulotomy as compared to timolol 0.5%.

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