ORIGINAL RESEARCH

Latanoprost for the prevention of ocular hypertension after neodymium:yttrium-aluminum-garnet laser posterior capsulotomy

C. F. Chung,[1] MRCS (Ed), Jimmy S. M. Lai,[1] FRCOphth, Dennis S. C. Lam,[2] FRCOphth

[1] *Department of Ophthalmology, United Christian Hospital, Hong Kong, China.*

[2] *Department of Ophthalmology & Visual Sciences, The Chinese University of Hong Kong, Hong Kong Eye Hospital, Hong Kong, China.*

Correspondence and reprint requests:

Jimmy S. M. Lai, Department of Ophthalmology, United Christian Hospital, Hip Wo Street Kwun Tong, Kowloon, Hong Kong, China.

Acknowledgment

This paper was presented at the Hong Kong Ophthalmological Symposium in 2000 and the 18th Congress of the Asia-Pacific Academy of Ophthalmology in 2001.

The authors have no financial and proprietary interests in the products mentioned and no financial support was given for this study.

Abstract

Aim: To evaluate the efficacy of latanoprost for the prevention of ocular hypertension after neodymium:yttrium-aluminum-garnet laser posterior capsulotomy.

Methods: Fifty six eyes of 56 consecutive patients receiving neodymium:yttrium-aluminum-garnet laser capsulotomy for posterior capsule opacification were randomized to group 1, who received 1 drop of latanoprost 0.005%, or to group 2, who received 1 drop of normal saline, 1 hour before the laser treatment. Intraocular pressures were taken before instillation of the eye drop, and at 1 hour and 2 hours after the laser procedure. Student's *t*-test was used to analyze the differences in intraocular pressures between the 2 groups.

Results: There were no statistically significant changes in the mean intraocular pressures of the 2 groups at 1 and 2 hours after neodymium:yttrium-aluminum-garnet laser capsulotomy compared with the baseline. There was no statistically significant difference in the mean intraocular pressures between the 2 groups at the same time intervals.

Conclusions: A single application of latanoprost given 1 hour before neodymium:yttrium-aluminum-garnet laser posterior capsulotomy did not produce a statistically significant intraocular pressure lowering effect during the first 2 hours after the laser procedure when compared with a control group.

Key words: *Intraocular pressure, Laser surgery*

Introduction

Posterior capsule opacification (PCO) frequently occurs after cataract extraction and posterior chamber intraocular lens (PCIOL) implantation and can cause deterioration of visual acuity. Neodymium:yttrium-aluminum-garnet (Nd:YAG) laser posterior capsulotomy is the standard treatment for PCO to restore vision.[1] It has been reported that the intraocular pressure (IOP) may rise significantly within 3 hours after Nd:YAG capsulotomy.[2-5] Apraclonidine,

pilocarpine, and timolol have been studied for the prevention of such IOP spikes.[6-10] The prophylactic effect of apraclonidine for IOP spikes after laser procedures may become insignificant for patients already receiving long-term apraclonidine treatment.[3] Besides, apraclonidine is associated with adverse effects including mild ocular inflammation, corneal edema, eyelid retraction, blepharospasm, and irregular heart rate.[7]

Latanoprost is an effective IOP lowering agent for primary open angle glaucoma and ocular hypertension.[11-16] Latanoprost is a prostaglandin (PG) analogue — PG $F_{2\alpha}$.[17] The main mechanism of action is to increase aqueous outflow through the uveoscleral route.[18] The onset of action occurs approximately 4 hours after application, with a peak effect at 8 to 12 hours.[11,19] Latanoprost has minimal systemic side effects and its ocular side effects are relatively mild. These include local irritation, dry eye and foreign body sensation, iris hyperpigmentation, conjunctival hyperemia, iritis, lacrimation, itching, and cystoid macular edema (CME).[14-16,20-22] Due to the minimal adverse effect profile, latanoprost is theoretically a safe pharmacological agent for prophylactic use against post-laser IOP spikes.

A double blind randomized controlled trial was conducted to investigate the IOP-lowering effect and safety of prophylactic latanoprost for the prevention of ocular hypertension after Nd:YAG laser posterior capsulotomy.

Materials and methods

Consecutive patients with PCO after uncomplicated cataract extraction and PCIOL implantation requiring Nd:YAG capsulotomy were enrolled. Patients with single eye, pregnancy, history of ocular hypertension, glaucoma, uveitis, long-term steroid use, or intraoperative complications of vitreous loss were excluded. If the intraocular lens was cracked during Nd:YAG capsulotomy, these patients would also be excluded.

The study was approved by the ethics committee of the United Christian Hospital. Informed consent was obtained from all patients. Prior to laser capsulotomy, the visual acuity and the IOP were measured. The anterior segment and the fundi were examined. Patients were randomly assigned to either group 1, to receive latanoprost, or group 2 as a control. Patients in group 1 received 1 drop of latanoprost 0.005% and patients in group 2 received 1 drop of normal saline 1 hour before laser treatment, with 15 minutes leeway. Patients who received the medications longer than 1 hour and 15 minutes before laser treatment were excluded. The surgeons were blinded to the assigned treatment.

The eye was anesthetized with 1 drop of topical benoxinate 0.4%. No mydriatic was given for pupil dilatation. The opacified posterior capsule was perforated using Nd:YAG laser (Alcon 3000LE, Irvine, USA). The total amount of laser energy used was recorded. IOP readings before instillation of the eye drop and at 1 and 2 hours after laser treatment were taken by investigators blinded to the assigned treatment.

The patients were followed up 1 week after the laser capsulotomy to check the visual acuity. If fundal examination revealed clinical CME, fluorescein angiography was arranged to confirm the finding.

The changes in IOP readings were analyzed using Student's *t*-test. Pearson's correlation was employed for analysis of correlation between laser energy and mean changes in IOPs.

Results

Fifty six eyes of 56 consecutive Chinese patients were recruited. Patients were randomized to receive latanoprost (29 patients) or saline (27 patients). **Table 1** shows the patients' demographic data, the mean YAG laser energies, and the mean IOPs of the 2 groups at different time intervals. The mean IOPs between the 2 groups before and at 1 and 2 hours after Nd:YAG capsulotomy did not show any statistically significant differences.

One hour after capsulotomy, the mean change in IOPs from baseline was -0.6 and +1.0 mm Hg for groups 1 and 2, respectively. The difference in the IOP changes was not statistically significant. After 2 hours, the mean change in IOPs for the latanoprost and control groups was +0.5 and +0.3 mm Hg, respectively, — a non-significant difference (**Figure 1**).

Four patients had a rise in IOP of >5 mm Hg after laser capsulotomy. One patient (3.4%) was receiving latanoprost and 3 (11.1%) were in the control group. One of the 3 patients in the control group had an increase in IOP to 27 mm Hg 2 hours after the capsulotomy. This patient was treated with systemic acetazolamide.

The mean laser energies used for the treatment and control groups were 14.4 ± 11.9 mJ and 19.3 ± 17.5 mJ, respectively. There was no significant difference in the laser energy used for the 2 groups.

Pearson's correlation was used to look for any correlation between the laser energy and the mean changes in IOP for

Table 1. Patients' demographic data and their intraocular pressures at different time intervals.

Characteristic	Group 1 (latanoprost)	Group 2 (control)	p Value
Number of eyes	29	27	
Mean age + SD (years)	70.6 ± 8.7	71.0 ± 9.2	
Men:women	10:19	11:16	
Mean laser energy (mJ)	14.4 ± 11.9	19.3 ± 17.5	0.22
Intraocular pressure (mm Hg)			
Pre-laser	11.7 ± 3.6	11.8 ± 2.5	0.95
Post-laser 1 hour	11.2 ± 4.5	12.8 ± 4.2	0.17
Post-laser 2 hours	11.5 ± 5.2	13.6 ± 4.3	0.14

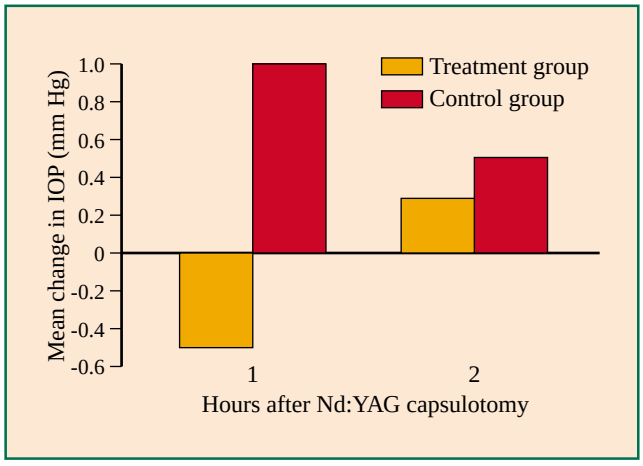

Figure 1. Mean changes in intraocular pressures (IOPs) of patients in the treatment and control groups 1 and 2 hours after neodymium:yttrium-aluminum-garnet (Nd:YAG) laser posterior capsulotomy laser capsulotomy.

patients in both the treatment and the control groups 1 and 2 hours after capsulotomy. No correlation was found as the p values for the correlation coefficients were greater than 0.05.

One patient (male, 68 years) in the control group developed CME, confirmed by fluorescein angiography 1 week after capsulotomy. This patient had diabetic retinopathy treated with panretinal photocoagulation more than 1 year before the capsulotomy. This was the same patient who had an IOP spike requiring systemic acetazolamide. This patient's visual acuity was 0.1 before and after laser capsulotomy.

Discussion

IOP may rise significantly within 3 hours after Nd:YAG posterior capsulotomy.[2-5] Ocular hypertension may be due to obstruction of the trabecular meshwork by lens capsule particulate debris and inflammatory cells or due to shock-wave damage to the trabecular endothelial cells.[5] Since latanoprost increases aqueous outflow through the uveoscleral route, it may prevent the IOP spike after Nd:YAG capsulotomy. In this study, latanoprost was given 1 hour before laser surgery so that its onset of action might coincide with the post-laser IOP spike. However, latanoprost did not show any significant IOP lowering effect compared with the control group. Single application of latanoprost has also been found to be ineffective for the prevention of ocular hypertension after phacoemulsification and intraocular lens implantation.[23] The explanation may be similar for both situations since the uveoscleral outflow enhancement by prostaglandins requires remodeling of the ciliary muscle and this effect may only occur with long-term administration of latanoprost.[24,25]

This study did not identify any contributing factor for the post-laser IOP spike. The 4 patients (1 in the latanoprost group and 3 in the control group) who had post-laser IOP spikes of 5 mm Hg greater than the pre-laser level did not require significantly higher Nd:YAG laser energy. The laser energy used for the patient in the latanoprost group was 20 mJ, while the mean energy for this group was 14.4 ± 11.9 mJ, and the energy level for the 3 patients in the control group ranged from 18 to 30 mJ, while the mean energy for this group was 19.3 ± 17.5 mJ. Analysis using Pearson's correlation failed to show a positive correlation between the laser energy and the mean changes in IOP in both groups 1 and 2 hours after capsulotomy.

Nd:YAG posterior capsulotomy has been shown to cause CME in 3% of patients.[1] Latanoprost has also been reported to be related to CME.[20,22] In this study, none of the patients in the latanoprost-treated group developed CME. The only patient who developed CME was in the control group. This patient also had diabetic retinopathy, which could be the cause of the CME. Moreover, since the incidence of laser capsulotomy- and latanoprost-induced CME is rare and the sample size in this study was small, no conclusion as to the cause of the CME may be reached.

Conclusion

A single drop of latanoprost given 1 hour before Nd:YAG posterior capsulotomy had no significant IOP lowering effect in the immediate post-laser period.

References

1. *Slomovic AR, Parrish RK. Neodymium:YAG laser posterior capsulotomy: visual acuity outcome and intraocular pressure elevation. Can J Ophthalmol 1985;20:101-104.*
2. *Slomovic AR, Parrish II RK. Acute elevations of intraocular pressure following Nd:YAG laser posterior capsulotomy. Ophthalmology 1985;92:973-976.*
3. *Ren J, Shin DH, Chung HS, et al. Efficacy of apraclonidine 1% versus pilocarpine 4% for prophylaxis of intraocular pressure spike after argon laser trabeculoplasty. Ophthalmology 1999;106:1135-1139.*
4. *Flohr MJ, Robin AL, Kelley JS. Early complications following Q-switched neodymium:YAG laser posterior capsulotomy. Ophthalmology 1985;92:360-363.*
5. *Ritcher CU, Arzeno G, Pappas HR, Steinert RF, Puliafito C, Epstein DL. Intraocular pressure elevation following Nd:YAG laser posterior capsulotomy. Ophthalmology 1985;92:636-640.*
6. *Pollack IP, Brown RH, Crandall AS, Robin AL, Stewart RH, White GL. Effectiveness of apraclonidine in preventing the rise in intraocular pressure after neodymium:YAG posterior capsulotomy. Trans Am Ophthalmol Soc 1988;86:461-472.*
7. *Silverstone DE, Brint SF, Olander KW, et al. Prophylactic use of apraclonidine for intraocular pressure increase after Nd:YAG capsulotomies. Am J Ophthalmol 1992;113:401-405.*
8. *Brown SVL, Thomas JV, Belcher CD III, Simmons RJ. Effects of pilocarpine in treatment of intraocular pressure elevation following neodymium-YAG laser posterior capsulotomy. Ophthalmology 1985;92:354-359.*
9. *Richter CU, Arzeno G, Pappas HR, Arrigg CA, Wasson P, Roger FS. Prevention of intraocular pressure elevation following Nd:YAG laser posterior capsulotomy. Arch*

Ophthalmol 1985;103:912-915.
10. *Migliori ME, Beckman H, Channell MM. Intraocular pressure changes after Neodymium-YAG laser capsulotomy in eyes pretreated with timolol. Arch Ophthalmol 1987;105: 473-475.*
11. *Vetrugno M, Cantatore F, Gigante G, Cartia L. Latanoprost 0.005% in POAG: effects on IOP and ocular blood flow. Acta Ophthalmologica Scandinavica Supplement 1998;227: 40-41.*
12. *Racz P, Ruzsonyi MR, Nagy ZT, Bito LZ. Maintained intraocular pressure reduction with once-a-day application of a new prostaglandin F2 alpha analogue (PHXA41). An in-hospital, placebo controlled study. Arch Ophthalmol 1993; 111:657-661.*
13. *Alm A, Villumsen J, Tornquist P, et al. Intraocular pressure-reducing effects of PhXA41 in patients with increased pressure. A one-month study. Ophthalmology 1993;100:312-316.*
14. *Alm A, Stjernschantz J. The Scandinavian Latanoprost Study Group. Effects on intraocular pressure and side effects of 0.005% latanoprost applied once daily, evening or morning. Ophthalmology 1995;102:1743-1752.*
15. *Watson P, Stjernschantz J. The Latanoprost Study Group. A six-month, randomized, double-masked study comparing latanoprost with timolol in open-angle glaucoma and ocular hypertension. Ophthalmology 1996;103:126-137.*
16. *Mishima HK, Masuda K, Kitazawa Y, Azuma I, Araie M. A comparison of latanoprost and timolol in primary open-angle glaucoma and ocular hypertension: a 12-week study. Arch Ophthalmol 1996;114:929-932.*
17. *Stjernschantz J, Alm A. Latanoprost as a new horizon in the medical management of glaucoma. Curr Opin Ophthalmol 1996;7:11-17.*
18. *Toris CB, Camras CB, Yablonski ME. Effects of PhXA41, a new prostaglandin F_{2a} analogue on aqueous humor dynamics in human eyes. Ophthalmology 1993;100:1297-1304.*
19. *Dirlink Q, Alm A. Prostaglandin F2 alpha — isopropylester eye drops: effects in normal human eyes. Br J Ophthalmol 1989;73:419-426.*
20. *Moroi SE, Gottfredsdottir MS, Schteirgart MT, et al. Cystoid macular oedema associated with latanoprost therapy in a case series of patients with glaucoma and ocular hypertension. Ophthalmology 1999;106:1024-1029.*
21. *Camras CB, the United States Latanoprost Study group. Comparison of latanoprost and timolol in patients with ocular hypertension and glaucoma. Ophthalmology 1996;103: 138-147.*
22. *Heier, JS, Steinert RF, Frederick AR. Cystoid macular oedema associated with latanoprost use. Arch Ophthalmol 1998;116: 680-682.*
23. *Lai JS, Loo A, Tham CC, Ho SY, Lam DS. Preoperative latanoprost to prevent ocular hypertension after phacoemulsification and intraocular lens implantation. J Cataract Refract Surg 2001;27:1792-1795.*
24. *Ocklind A. Effect of latanoprost on the extrcellular matrix of the ciliary muscle. A study on cultured cells and tissue sctions. Exp Eye Res 1998;67:179-191.*
25. *Lindsey JD, Kashiwagi K, Kashiwagi F, Weinreb RN. Prostaglandins alter extracellular matrix adjacent to human ciliary muscle cells in vitro. Invest Ophthalmol Vis Sci 1997; 38:2214-2223.*