Brinzolamide 1% versus apraclonidine 0.5% to prevent intraocular pressure elevation after neodymium:YAG laser posterior capsulotomy

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PURPOSE: To compare the efficacy of brinzolamide 1% with that of apraclonidine 0.5% in preventing intraocular pressure (IOP) rise after neodymium:YAG (Nd:YAG) laser posterior capsulotomy.

SETTING: Department of Ophthalmology, Akdeniz University, Antalya, Turkey.

METHODS: One hundred fifteen patients who had Nd:YAG laser posterior capsulotomy for posterior capsule opacification were prospectively randomized to receive brinzolamide 1% (57 patients) or apraclonidine 0.5% (58 patients) approximately 1 hour before laser surgery. A masked observer measured IOP by Goldmann applanation tonometry before treatment and after treatment at 1, 2, and 3 hours and 7 days.

RESULTS: The mean IOP changes from baseline were not statistically different between the study groups at 1, 2, and 3 hours and 7 days ($P = .109$, $P = .764$, $P = .275$, and $P = .879$, respectively). The incidence of IOP elevation of 5 mm Hg or higher was 12.2% (7 of 57 eyes) in the brinzolamide group and 10.3% (6 of 58 eyes) in the apraclonidine group ($P = .743$); IOP elevations of 10 mm Hg and greater occurred in 3.5% (2 of 57 eyes) and 1.7% (1 of 58 eyes) ($P = .618$), respectively. There were no IOP elevations greater than 20 mm Hg in either group.

CONCLUSION: Brinzolamide 1% and apraclonidine 0.5% given prophylactically before Nd:YAG laser capsulotomy were effective in preventing IOP spikes after treatment.

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Intraocular pressure (IOP) elevation after laser treatment is a common and potentially serious complication after anterior segment laser surgery. Studies show the incidence of IOP elevation of 5 mm Hg or greater after neodymium:YAG (Nd:YAG) laser posterior capsulotomy varies from 20% to 95%.[1–5]

Many drugs are used for prophylaxis of IOP spikes after Nd:YAG laser posterior capsulotomy. Apraclonidine hydrochloride 0.5% and brimonidine tartrate 0.2% or 0.15%, which are α-adrenergic agonists, are the current standard prophylaxis for these spikes.[6,7] Brinzolamide, the newest topical carbonic anhydrase inhibitor (CAI), lowers IOP by suppressing aqueous humor secretion.[8,9] It is effective in the short- and long-term treatment of patients with glaucoma or ocular hypertension and in reducing IOP after phacoemulsification cataract surgery.[10–13]

To our knowledge, there are no published reports of the effectiveness of brinzolamide in preventing IOP elevation after laser treatment. This study examined the IOP-lowering effects of brinzolamide 1% and apraclonidine 0.5% for prophylaxis of IOP elevation after Nd:YAG laser posterior capsulotomy.

PATIENTS AND METHODS

This prospective randomized double-masked clinical trial enrolled 115 patients having Nd:YAG laser posterior capsulotomy

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at the Akdeniz University Medical Facility between June and December 2005. Patients were prospectively randomized to receive brinzolamide 1% (n = 57) or apraclonidine 0.5% (n = 58) approximately 1 hour before laser surgery. The research followed the tenets of the Declaration of Helsinki, and all patients gave verbal informed consent after they received an explanation of the nature and possible consequences of the procedure.

Patients in the study were older than 21 years with visually significant posterior capsule opacification (PCO). One eye of each patient was enrolled. Exclusion criteria included a history of glaucoma, known allergy to CAIs or α adrenergic agonists, severe cardiovascular disease, intraocular surgery except cataract operation, and an IOP greater than 21 mm Hg before the procedure. Women of childbearing potential were also excluded.

All patients had complete baseline eye examinations including best corrected Snellen visual acuity, slitlamp biomicroscopy, and fundus examination. The baseline IOP was measured by Goldmann applanation tonometry approximately 3 hours before the laser procedure.

The eyes were dilated with topical tropicamide 1%. Both groups received the study drugs 1 hour before the laser treatment. All procedures were performed by the same surgeon (M.Ü.) who was masked to treatment assignment. Laser spots were applied until the capsule was opened to approximately 4.0 mm in diameter. The total amount of the laser power and the number of applications were recorded. Patients were prescribed dexamethasone 0.1% 4 times a day for 1 week.

Postoperative measurements were recorded at 1, 2, and 3 hours and 7 days and were done by the same physician who measured the IOP before surgery. Two measurements were taken each time, and the mean value was recorded. An IOP rise of 5 mm Hg or more was considered a clinically significant change; IOP elevations of 10 mm Hg or greater were also recorded.

Results are presented as means ± SD. The Student *t* test or chi-square analysis was used for data comparison between the study groups. A *P* value less than 0.05 was considered significant. Sample-size calculations revealed this study had a 99% power to detect a 4 mm Hg difference in IOP between the 2 groups.

RESULTS

Table 1 shows the demographic data of the patients. There were no statistically significant differences between groups.

The mean amount of energy used for Nd:YAG capsulotomies was 43.2 ± 17.3 mJ in the brinzolamide group and 39.6 ± 20.3 mJ in the apraclonidine group. The difference between groups was not statistically significant ($P = .297$).

Table 1. Demographic data.

Parameter	Brinzolamide Group	Apraclonidine Group
Number of patients	57	58
Sex		
Male, n (%)	35 (61)	32 (55)
Female, n (%)	22 (39)	26 (45)
Age (y)		
Mean ± SD	61.8 ± 9.2	60.3 ± 12
Range	32–80	42–90

Seven patients (12.2%) in the brinzolamide group and 6 (10.3%) in the apraclonidine group had IOP elevations of 5 mm Hg or higher on at least 1 postoperative IOP measurement throughout the study; this was not statistically significant ($P = .743$). Intraocular pressures elevations of 10 mm Hg or greater occurred in 2 eyes (3.5%) in the brinzolamide group and 1 eye (1.7%) in the apraclonidine group. The difference was not statistically significant ($P = .618$). No eye had an IOP elevation higher than 20 mm Hg.

Table 2 shows eyes with significant IOP elevation at any follow-up measurement. The number of eyes with an IOP elevation greater than 5 mm Hg at 1, 2, and 3 hours and 7 days were not statistically different ($P = .728$, $P = 1.0$, $P = 1.0$, and $P = .496$, respectively). The difference in the number of eyes having an IOP rise higher than 10 mm Hg at 1, 2, and 3 hours was also not statistically significant ($P = .496$, $P = .496$, and $P = 1.0$, respectively).

Table 3 shows the mean IOP levels before the procedure and at each follow-up examination and the mean IOP changes from baseline. The mean IOP changes from baseline were not statistically different between the study groups at 1, 2, and 3 hours and 7 days.

DISCUSSION

Posterior capsule opacification can be effectively treated with an Nd:YAG laser capsulotomy. However, this procedure can result in significant morbidity from postoperative complications. These include transient immediate postoperative IOP elevation, new onset of glaucoma, worsening of preexisting glaucoma, IOL damage, iris damage, hyphema, cystoid macular edema, and retinal detachment.[2,14]

This study compared the effectiveness of brinzolamide 1% with that of apraclonidine 0.5% in preventing post-laser IOP spikes. To our knowledge, there are no published reports of the effectiveness of brinzolamide in anterior segment laser procedures.

Apraclonidine and brimonidine are the current drugs of choice for prophylaxis of post-laser IOP elevations.[6,7,15] Carbonic anhydrase inhibitors are also effective and safe for the prevention of post-laser IOP spikes. Topical dorzolamide and oral acetazolamide, given prophylactically as

Table 2. Number of patients with significant IOP rise over time.

	IOP Rise ≥5 mm Hg				IOP Rise ≥10 mm Hg			
Group	1 H	2 H	3 H	1 Wk	1 H	2 H	3 H	1 Wk
Brinzolamide (n = 57)	6	4	2	1	1	1	1	0
Apraclonidine (n = 58)	5	5	2	0	0	0	1	0

IOP = intraocular pressure

Table 3. Mean IOP levels and mean IOP changes over time.

Parameter	Brinzolamide (n = 57)	Apraclonidine (n = 58)	*P* Value
Mean IOP levels (mm Hg)			
Baseline	15.3 ± 2.0	16.1 ± 2.1	.068
After laser	15.2 ± 3.9	15 ± 3.2	.714
1 h	14.4 ± 3.3	15 ± 3.1	.348
2 h	14.4 ± 2.9	15.7 ± 2.9	.021
3 h	15.4 ± 2.1	16.2 ± 2.1	.058
7 d			
Mean IOP change			
1 h	−0.1 ± 3.4	−1.1 ± 3.1	.109
2 h	−0.9 ± 3.3	−1.1 ± 2.8	.764
3 h	−0.9 ± 2.7	−0.4 ± 2.5	.275
7 d	0.1 ± 1.3	0.1 ± 1.2	.879

a single administration before Nd:YAG laser posterior capsulotomy, have good efficacy and safety in preventing IOP elevation.[16,17] A study[18] comparing the efficacy of topical dorzolamide with that of apraclonidine in preventing IOP spikes after Nd:YAG laser posterior capsulotomy found similar results with both drugs.

Brinzolamide, the newest topical CAI, exhibits selectivity, high affinity, and potent inhibitory activity for the carbonic anhydrase type II (CA II) isoenzyme, which is involved in aqueous humor secretion. These characteristics, along with good ocular bioavailability, make brinzolamide maximally effective in lowering IOP by locally inhibiting CA II in the ciliary processes and suppressing aqueous humor secretion. It begins to act 30 minutes after administration, shows peak effect at 2 hours, and lasts for 6 to 8 hours.[8,9] Its effectiveness equals that of dorzolamide 2.0%, and it produces less ocular discomfort on instillation. It is effective in the short- and long-term treatment of patients with glaucoma or ocular hypertension and in reducing IOP after phacoemulsification cataract surgery.[10–13]

Apraclonidine reduces IOP by reducing aqueous production and increasing uveoscleral outflow.[19] However, the uveoscleral outflow effect occurs only with prolonged treatment. Topical CAIs offer distinct advantages over α-agonists because they do not affect the pupil and accommodation and have almost no central nervous system side effects. In addition, they likely pose fewer problems than β-blockers in patients with compromised cardiac or pulmonary function.[10]

Because the rise in IOP tends to maximize approximately 3 hours after laser treatment, we instilled the study drugs 1 hour before the procedure to coincide with the time of potential maximum IOP rise and then evaluated IOP elevations for the first 3 hours.[2,3,20–22] We did not include a placebo group because the efficacy of treatment versus no treatment is well established.

There was no statistically significant difference in mean IOP change at any follow-up visit. The number of eyes with an IOP increase higher than 5 mm Hg or higher than 10 mm Hg was also not significant at any examination.

Although more patients in the brinzolamide group (n = 70 than in the apraclonidine group (n = 6) had an IOP elevation of 5 mm Hg or higher, the difference was not statistically significant throughout the study. The number of patients who had an IOP elevation of 10 mm Hg or more was also higher in the brinzolamide group (2 versus 1), but it was not statistically significant. In addition, no patient had an IOP elevation of 20 mm Hg or greater at any post-laser measurement.

The incidence of IOP spikes of 5 mm Hg or higher in apraclonidine-treated patients having Nd:YAG laser posterior capsulotomy is reported to be between 6% and 13% in other studies.[18,23–25] In the current study, 10.3% of patients receiving apraclonidine had IOP elevations of 5 mm Hg or greater, indicating our results are comparable to those in previous reports.

Brinzolamide 1% and apraclonidine 0.5% given prophylactically as a single-dose administration 1 hour before laser treatment were effective in preventing IOP spikes after laser treatments, and brinzolamide 1% prophylaxis was at least as effective as apraclonidine 0.5% prophylaxis. However, instillation of brinzolamide 1% or apraclonidine 0.5% did not completely prevent post-laser IOP spikes. Postoperative IOP monitoring is indicated in all patients having Nd:YAG laser posterior capsulotomy.

Brinzolamide is a new drug, and larger prospective studies should be done to better define the differences in efficacy between brinzolamide and apraclonidine for Nd:YAG laser posterior capsulotomy.

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