Transscleral Neodymium:YAG Laser Cyclophotocoagulation for End-Stage Glaucoma, Refractory Glaucoma, and Painful Blind Eyes

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ABSTRACT

We used transscleral Neodymium:YAG laser cyclophotocoagulation (TSYLCC) to treat 47 patients (47 eyes) with end-stage, refractory, or absolute glaucoma. The mean pretreatment intraocular pressure (IOP), 40.5 ± 10.8 mm Hg, decreased a mean of 13 ± 8 months following treatment to 15.6 ± 10.6 mm Hg, a statistically significant change ($P < .05$). Our overall rate of success (final IOP ≤ 25 mm Hg, with or without medications) was 79% (37 eyes). Early complications included pain (11 eyes) and inflammation (13 eyes); late complications included hypotony (7 eyes), high IOP (5 eyes), and decreased visual acuity (4 eyes). TSYLCC seems to be a safe, effective, and convenient outpatient procedure.

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The authors thank Monzer Jabak, Research Coordinator at the King Khaled Eye Specialist Hospital, for his assistance.

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Eyes with intractable glaucoma, or those that are blind and painful because of longstanding glaucoma, often pose challenging therapeutic problems. For blind eyes, retrobulbar alcohol injection usually alleviates the pain and symptoms, but only temporarily, and may have to be repeated periodically. In the case of seeing eyes, it is usually preferable to resort to a filtering procedure, especially now that wound healing modulators have improved the success rate.[1,2] An artificial drainage device may be implanted, but when this is not feasible or if the device fails, cyclocryotherapy remains the only reasonable option. However, cyclocryotherapy is not without complications.[3-6]

Transscleral Neodymium:YAG (Nd:YAG) laser cyclophotocoagulation (TSYLCC) recently has gained popularity as a cyclodestructive procedure for intractable glaucoma. Beckman and coworkers,[7,8] who, in the early 1970s, first described using transscleral ruby laser cyclophotocoagulation to lower intraocular pressure (IOP), have since conducted further research using the Nd:YAG laser. With the advent of the Nd:YAG laser, the procedure has become even more popular.

The aim of our study was to evaluate the efficacy of this treatment modality in 47 eyes of 47 patients with end-stage, intractable glaucoma, and painful blind eyes. We evaluated our results in terms of IOP control, preservation of vision, and complications.

MATERIALS AND METHODS

The charts of 47 patients seen at the King Khaled Eye Specialist Hospital were reviewed retrospectively. The age range was 27 to 80 years (mean, 53 ± 11

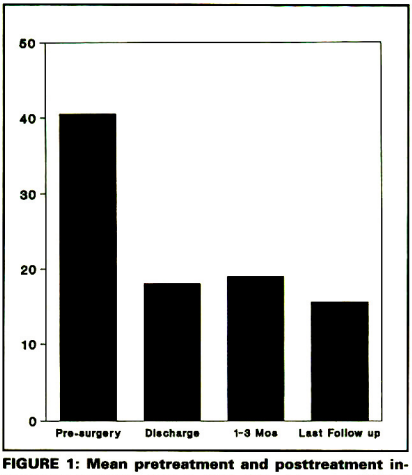

FIGURE 1: Mean pretreatment and posttreatment intraocular pressure. The overall rate of success (IOP ≤ 25 mm Hg, with or without medication at the last follow-up examination) was 79% (37 eyes).

years). All patients had been diagnosed with uncontrolled glaucoma or painful blind eyes. In addition to demographic and medical information, details of the treatment sessions were carefully reviewed and recorded. All patients in the study had uncontrolled IOP on maximum tolerated antiglaucoma medications. Thirty-nine eyes (83%) had non-neovascular secondary glaucoma; eight (17%), neovascular glaucoma. Thirty-seven eyes (78.7%) had had previous ocular surgery; 10 (21.3%) had not. Nine eyes (19.2%) had no perception of light and only four (8.5%) had a visual acuity of 20/200 or better. Thirty-six (77%) had three quadrants of ciliary body treated. Forty-four (94%) had only one treatment session. All patients had a minimum follow up of 5 months (range, 5 to 37 months; mean, 13 ± 8 months).

Informed consent was obtained from all patients. The procedure was performed under retrobulbar anesthesia consisting of a mixture of 2 cc of 2% lidocaine and 3 cc of 0.5% bupivacaine, together with 25 units of hyaluronidase. Anesthesia was administered in the minor operating room, and each patient was monitored closely for at least 10 to 15 minutes. No premedications were used. The patient was placed before the laser machine (Microruptor II, Lasag, Thun, Switzerland) with eyelids separated by a wire speculum.

Defocusing of the machine was set to the maximum (position 9); laser treatment was placed at 2 to 3 mm from the limbus, resulting in a range of 9 to 39 spots (mean, 28.4 ± 5.9 spots), with a range of energy of 3 to 9 J (6.2 ± 1.1 J). Following treatment, all patients received topical steroids and atropine eye drops, along with antiglaucoma medications, including timolol and dipivefrin eyedrops, as well as oral acetazolamide. Analgesics were prescribed as needed.

Antiglaucoma medications were titrated according to the patient's response during subsequent follow-up visits. The earlier-treated patients remained in the hospital and had daily follow up for 1 week; the later ones were seen as outpatients. However, all of the patients were seen at least once during the first week. Thereafter, all of them were examined over a period of at least 5 months to evaluate the effect of treatment on IOP control, visual acuity, and to determine whether there were any complications. The treatment's rate of success (defined as a postlaser IOP of ≤ 25 mm Hg with or without medications) was correlated with several variables, such as the position of the laser spots, the total power used, the number of quadrants treated, the age of the patient, the preoperative IOP level, any previous surgery, the type of glaucoma, and any complications.

RESULTS

Intraocular Pressure

The mean pretreatment IOP was 40.5 ± 10.8 mm Hg; the mean posttreatment IOP was 15.6 ± 10.6 mm Hg. The decrease in IOP following laser treatment was statistically significant ($P < .05$) (Fig 1).

Preservation of Vision in Seeing Eyes

Visual acuity decreased in four (8%) of the eyes following laser treatment. We defined "significant visual loss," in eyes with good vision, as the loss of two or more Snellen lines; in eyes with poor vision (counts fingers or hand movements), a change from 20/400 to counts fingers, from counts fingers to hand movements, from hand movements to light perception, or from light perception to no light perception. Three (6%) of the eyes ended up with no light perception (from a pretreatment level of light perception in two eyes and hand movements in one); one eye ended up with counts fingers at 4 feet, from 20/125 pretreatment. Hence, vision was significantly reduced in only one eye (2%).

Complications

Tables 1 and 2 list early and late postoperative complications. Of the five patients who had increased IOP, only two (4%) ended with an IOP higher than their pretreatment level; the other three patients had higher pretreatment levels, but the decrease in IOP was not significant.

TABLE 1
Early Postoperative Complications

Complications	Eyes	Percent
Cells and flare	7	15
Hypopyon	3	6
Fibrin clot	2	4
Hyphema	1	2
No complications	34	73

TABLE 2
Late Postoperative Complications

Complications	Eyes	Percent
Hypotony (IOP < 5 mm Hg)	7	15
High IOP	5	11
Decreased visual acuity	4	9
No complications	31	65

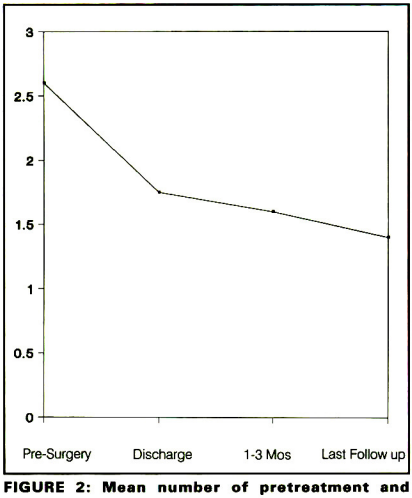

FIGURE 2: Mean number of pretreatment and posttreatment anti-glaucoma medications.

Anti-Glaucoma Medications

The change in the number of medications used is shown in Figure 2. Twenty-four patients (51%) were able to use fewer antiglaucoma medications after treatment. The mean number of pretreatment drugs was 2.64, compared with a posttreatment mean of 1.35.

There was no significant correlation between the success of treatment and any of the following parameters: laser placement, type of glaucoma, total power used, number of quadrants treated, age, or preoperative IOP. There was a significant negative correlation ($P = .02$) between the number of previous ocular operations and success, but none was found between success and the type of surgery (cutting or laser).

There was no significant correlation between postoperative complications and any of the following: type of glaucoma, number of quadrants treated, power used, or previous glaucoma surgery.

DISCUSSION

The Nd:YAG laser in its free-running or thermal mode has opened new avenues in the management of various types of intractable glaucoma. Several authors have described its effectiveness in lowering IOP, in both animal and human eyes.[9-12] In 1986, Fankhauser and his coworkers studied the effect of TSYLCC on 16 autopsy eyes in an effort to find an effective treatment strategy.[13]

The mechanism of IOP lowering is believed to be related to the efficacy of the Nd:YAG laser in penetrating the ocular walls. In 1987, Devenyi and coworkers found that this procedure decreased IOP in normal rabbit eyes.[11] Also, in 1987, Devenyi and coworkers, studying 24 patients with different types of intractable glaucoma, in whom more conventional forms of therapy had failed, reported a rate of success (IOP < 25 mm Hg) of 62.5% using TSYLCC.[12] In 1988, Hampton and Shields made recommendations regarding the treatment strategy for the laser position, angle of application, defocusing, and pulse energy, based on histological studies conducted on human autopsy eyes.[14] In the same year, two other clinical trials supported the efficacy of TSYLCC, suggesting apparent advantages over other cyclodestructive procedures.[15,16] In 1989, Trope and Ma evaluated midterm effects of TSYLCC in 28 glaucomatous eyes with poorly controlled IOP.[17] Their rate of success (IOP < 25 mm Hg) was 71.5%. In 1989, Maus and Katz reported three cases of choroidal detachment, flat anterior chamber, and hypotony in a series of 750 patients treated by TSYLCC.[18]

CONCLUSION

Our study of 47 patients demonstrates the safety, effectiveness, and convenience of using TSYLCC to lower IOP in eyes with end-stage or refractory glaucoma that previously had failed to respond to more conventional treatment. The procedure also has proved to be safe and effective and probably less expensive as an outpatient procedure for blind painful eyes. In addition, previously operated eyes seem to respond

better to it. Finally, TSYLCC may prove useful for treating eyes with better visual acuity which do not respond to conventional modalities. More controlled comparative studies with other cyclodestructive procedures are required.

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