

PHOTOSCLEROSTOMY FOR FAILED FILTERS

FATHI EL SAYYAD, F. R. C. S. , AKEF EL-MAGHRABY, M. D., JORGE RODRIGUEZ, M. D.

**El Maghraby Specialist Hospital
Jeddah, Saudi Arabia**

The failure of filtering procedures may be due to several causes. Blockage of the sclerostomy by episcleral proliferation is not an uncommon cause for this. The use of the YAG laser applied to the internal portion of the sclerostomy by a gonioscopy lens has been used successfully to reopen 5 such cases which have remained patent. The author describes the technique and indications for the procedure.

The proliferation of episcleral tissue or an inadequate sclerostomy are frequent causes of failed filtering procedures second only to adhesions of tenon's and conjunctival tissues.

Various procedures have been reported to attempt the reopening of failed filters. These ranges from simple massage to reoperation.

We have used the YAG laser successfully in 5 cases to revive non-functioning filters.

CASE REPORTS

Case No. 1

A 32-year old woman with a history of chronic open angle glaucoma (Table 1) uncontrolled with medication in both eyes attended our institution on January 4, 1986. On initial examination, her visual acuity with myopic correction is 20/25 in the right eye and 20/28 in the left eye. She had an old standing divergent strabismus in the left eye. Her intraocular pressure was 45 mm Hg in both eyes. Slit lamp examination was unremarkable and gonioscopy showed both open angles. Both discs showed advanced cupping with very thin neural rim. Visual field examination showed small central fields in both eyes. She underwent right trabeculectomy on January 6, 1986 and left trabeculectomy on January 9, 1986.

Postoperative recovery was satisfactory with intraocular pressures of 12 mmHg in both eyes with no medications. She continued to have intraocular pressure in the teens with no medication until she was examined on August 26, 1986 at the time her intraocular pressure in the right eye was 40 mmHg and massaged down to 34 mmHg. Intraocular pressure in the left eye was 12 mmHg. She was instructed to use Timoptol 0.5% twice a day, Pilocarpine 1% 4 times a day; on the right eye, Diamox 250 mg 4 times a day and intermittent massage. She was reviewed again three days after and her intraocular pressure was down to 27 mmHg. However, it subsequently increased to 40 mmHg on this medication regimen. She was advised to have repeat surgery, but she refused.

TABLE 1

| PATIENT CHARACTERISTICS | | | |
|-------------------------|-----------------------------|-----|-------------------|
| PT. NO. | AGE | SEX | DIAGNOSIS |
| 1 | 32 | F | POAG - |
| 2 | 60 | M | POAG |
| 3 | 52 | M | POAG |
| 4 | 60 | F | PSXF ^o |
| 5 | 36 | M | POAG |
| - | PRIMARY OPEN ANGLE GLAUCOMA | | |
| ^o | EXFOLIATION GLAUCOMA | | |

This patient had very good initial control of IOP and her intraocular pressure in both eyes was in the low teens with good cystic blebs. However, the bleb in the right eye failed progressively a few months postop remaining cystic, but decreasing in size and becoming localized, the bleb would increase slight improvement with massage. Gonioscopy showed a thin non-pigmented membrane partially blocking the sclerostomy site of the right eye. On september 9, 1986, using a Q-switched Neodymium YAG laser through a 3-mirror Goldmann gonioscopy lens, five single shots of between 7 and 9 mJ (Table 2) were applied directly to the membrane under direct visualization in one session. Upon application of the laser, the membrane showed the appearance of vacuoles

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with small button holes in the center. The bleb immediately became more diffuse with decrease of intraocular pressure to 12 mmHg. The patient maintained low intraocular pressure with Timoptol 0.5% b. i. d. and Pilocarpine 3% q. i. d. and massage twice daily. Maintaining an average intraocular pressure of 15 with a good cystic bleb until she was examined again. On march 25, 1987, in the same treatment, her IOP was 27 mmHg massaged down to 20 mmHg. On gonioscopy, it was noted that there was an accumulation of fibrous episcleral tissue at the sclerostomy site that required another 5 applications of 7 mJ in one session. Her IOP decreased to 16 mmHg, massaged down to 9 mm.

TABLE 2

| PRE LASER GONIOSCOPY AND LASER PARAMETERS | | | |
|--|--------------------------|--------------|--------|
| PT. NO. | GONIOSCOPY | APPLICATIONS | ENERGY |
| 1 | NON-PIG. MEMBRANE | 5 | 7-9 MJ |
| 2 | THICK ANT. CAP. REMNANTS | 30 | 7 MJ |
| 3 | NON-PIG. MEMBRANE | 30 | 7 MJ |
| 4 | SCLERAL TISSUE | 4 | 5-7 MJ |
| 5 | INFLAMMATORY EXUDATE | 5 | 9.5 MJ |

She was last seen on September 5, 1987. Her intraocular pressure was 12 mmHg (Table 3). She is using Timoptol 0.5% twice a day, Pilocarpine 1% three times a day (Table 4) and massage twice daily. She still maintains a diffuse cystic bleb in the right eye. Her left eye continues to do well with an IOP of 17 mm at no medications.

Case No. 2

A 60-year old male Yemeni (Table 1) complained of decreased vision bilaterally. On initial examination, his visual acuity was CF 5m OD and hand movement OS. He had right immature cataract and left mature cataract. With intraocular pressure of 30 and 32 mmHg with open angles on gonioscopy. After an initial attempt to control IOP on medication, it became apparent that due to his idiosyncrasy, there would be no compliance. After agreeing to undergo surgery for cataract and glaucoma, he underwent trabeculectomy and

extracapsular cataract extraction with posterior chamber intraocular lens implant OU at different sittings. IOP in the right eye was 8 mmHg following surgery with a large diffuse bleb. IOP in the left eye was 36 mmHg after surgery with no obvious bleb. Digital massage decreased his IOP to 16 mmHg. However, the IOP returned to 36 mmHg within a few minutes. He was started on Timoptol .5% b. i. d. and Propine 1% b. i. d. with no significant reduction of his IOP. The trabeculectomy site was revised 2 months after the original filtering operation. However, the IOP was not reduced. He was put on Pilocarpine 1% and Timoptol .5% b. i. d., but his IOP remained at 30 mmHg. A consultation for the case was requested by the attending surgeon. Gonioscopy showed thick anterior lens capsule remnants with cortical matter incarcerated at the sclerostomy site. It was decided to attempt a YAG laser application to open the blocked sclerostomy site. Using the Goldmann lens with the Q-switched Nd: YAG laser at 7 mJ, 30 bursts (Table 2) were applied directly at the sclerostomy site. Immediately after the laser session, it was noticed that there was a definite diffuse moderately elevated bleb. Tension decreased to 14 mmHg (Table 3). Four months after this, his pressure continues to be at 20 mmHg with no medication (Table 4).

TABLE 3

| PRE & POST-OP LASER IOP | | |
|-------------------------|---------|----------|
| PT. NO. | PRE IOP | P.O. IOP |
| 1 | 40 | 12 |
| 2 | 30 | 14 |
| 3 | 36 | 14 |
| 4 | 32 | 11 |
| 5 | 30 | 8 |
| mmHg | | |

Case No. 3

A 52-year old Saudi, male, with known open angle glaucoma in both eyes (Table 1), uncontrolled with medication underwent bilateral trabeculectomy

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with IOP in the early teens with no medication. Two years after surgery, the IOP on his left eye was 24 mmHg. He was started on Timoptol .5% b. i. d. He disappeared for 3 months.

On his following examination, IOP was 36 mmHg in the left eye and not improving with digital massage on Timoptol .5% b. i. d. Gonioscopy showed the sclerostomy site partially blocked by a non-pigmented membrane. The bleb was shallow and localized. Nd:YAG laser was used with the same settings as in the previous case (Table 2) resulting in immediate decrease of IOP to 16 mmHg and elevation of the bleb. His IOP was 14 mmHg (Tables 3 & 4) with no medical treatment 3 months after laser, when he was lost for follow-up.

TABLE 4

| COMPARISON OF PRE & POST-OP MEDICATION | | |
|---|-------------|--------------|
| PT. NO. | PRE-OP MED. | POST-OP MED. |
| 1 | T, P, D | T, P |
| 2 | T, P | - |
| 3 | T | - |
| 4 | T | Pr |
| 5 | - | - |

T = TIMOPTOL; P = PILO; Pr = PROPINE; D = DIAMOX

Case No. 4

A 60-year old female (Table 1) with no previous history of glaucoma complaining of decreased vision in both eyes was examined on October 1, 1986.

Visual acuity was OD CF 2 meters and OS CF 20 cm that did not improve with refraction. Slit lamp examination showed spheroidal degeneration of both corneas with advanced pseudoexfoliation in both eyes with early nuclear cataract. The intraocular pressure was 62 mmHg in the right eye and 60 mmHg

in the left. Disc examination showed marked erosion of the superior and inferior rim of both discs with only a thin nasal rim remaining in both eyes.

Gonioscopic examination revealed open angles with 3+ pigmentation of the trabecular meshwork in both eyes. Visual fields showed advanced visual field loss with only a central island remaining in the right eye and a small temporal island in the left eye.

She was put on Timoptic .5% b. i. d. in both eyes, Pilocarpine 2% q. i. d. in both eyes. Diamox 250 mg q. i. d. PO. Intraocular pressure was reduced to OD 31 mmHg and OS 32 mmHg. In view of this, she was scheduled for trabeculectomy in both eyes at different sittings.

On October 9, 1986, she underwent trabeculectomy OS. On the first day postoperatively, her intraocular pressure was 30 mmHg which was brought down to 20 mm with massage. Intermittent massage was attempted in the following days with temporary reduction of IOP. A small bleb appeared after massage, but quickly disappeared. Gonioscopy showed a small area of episcleral tissue at the sclerostomy site, most probably left behind during surgery. The tissue seemed to function as a ball valve preventing adequate aqueous drainage. YAG laser photosclerostomy was performed on the fifth postop day requiring 4 shots of between 5 and 7 mJ applied directly to the episcleral tissue with a gonioscopy lens (Table 2). After the procedure, the intraocular pressure decreased (from 20 mm to 4 mm with gentle massage with the formation of a well defined persistent bleb. Two days later, she underwent right trabeculectomy with decrease of IOP. Intraocular pressure in the left eye has been maintained at 10-12 mm (Table 3) with a follow up of 6 months (Table 5). She is using Propine .1% bid (Table 4) with well-defined elevated blebs. Her vision is 20/200 best corrected in each eye. Visual fields were unobtainable due to poor cooperation.

Case No. 5

A 36-year old male, with a history of open-angle glaucoma in both eyes (Table 1). He underwent trabeculectomy six months previously at another hospital in both eyes. He was seen on November 30, 1987. His visual acuity was 20/70 in the right eye, improved to 20/20 with -2 and CF and the left eye improved to 20/70 with -1.75. Slit lamp examination showed a very flat bleb superior nasal in the right eye and well-formed cystic bleb in the left. He had very advanced cupping in both eyes with erosion of the inferior and superior rims. Visual fields showed marked nasal field loss in the right eye and marked visual loss in the left with central and temporal islands remaining. His intraocular pressure in the right eye was 30 mmHg and in the left was 12 mmHg. The surgeon was consulted and stated that he had a functioning bleb in the right eye with adequate control in

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pressure with late failure. Gonioscopy in the right eye showed very small patent internal sclerostomy with thin episcleral membrane closing most of it and regular trabecular band with open angle. The left eye showed patent sclerostomy with pigmentation of the trabecular meshwork. YAG photosclerostomy was performed on December 5, 1987 and this needed five applications of Q-switched Nd:YAG laser with five bursts per shot of 9.5 mJ (Table 2) with immediate reduction of intraocular pressure to 9 mmHg. He was discharged home on Maxidex three times a day. He was reviewed four days later on December 9, 1987. His intraocular pressure was 10 mmHg and went down to 4 mmHg on massage with more diffusion of the localized bleb. He was reviewed again on December 16, 1987 without using any treatment. His intraocular pressure was 8 mmHg (Tables 3 & 4) reduced to 6 mmHg with massage. His bleb showed more improvement with slight elevation and more diffusion.

TABLE 5

| INTERVAL BETWEEN FILTER & LASER TOTAL FOLLOW-UP | | |
|--|----------|---------------|
| PT. NO. | F&L TIME | POST LASER FU |
| 1 | 8/12 | 12/12 |
| 2 | 2/12 | 4/12 |
| 3 | 18/12 | 3/12 |
| 4 | 1/7 | 6/12 |
| 5 | 6/12 | 1/12 |

DISCUSSION

Trabecular Puncture and Goniotomy

Attempts to maintain patency of the trabecular openings were unsuccessful even with the use of five fluororacil and healon. But there is an evidence that laser punctures in the area of posterior trabecular meshwork near the sclera produces supraciliary cleft that remain patent.

In another study, high energy levels between 30 pulse of 52 mJ made of complete fistula anterior to the trabecular meshwork in the human eye before an enucleation.

In open-angle glaucoma, the Q-switched ruby laser of Grasnov and later, the Q-switched Neodymium laser of Frankhauser and coworkers have been able to achieve puncture from the anterior chamber into Schlemm's canal. Intraocular pressure rapidly falls to low normal level when such trabecular puncture is achieved. The uniform experience with it has been that pressure returns to pretreatment level several months after the laser trabecular puncture. Neodymium YAG laser may be carried out in cutting Parkin's membrane in case of congenital glaucoma. However, the laser is not usually situated in a suitable location for general anesthesia and corneal edema may limit the visualization and focusing necessary to achieve optical breakdown. Cases of juvenile glaucoma with abnormal membrane in the angle may also be carried out by Neodymium YAG laser goniotomy.

STAGE FILTERING SCLEROSTOMY

Webber and co-workers have reported a two-stage glaucoma filtering technique that offers a reduced incidence of flat chamber in their hands. At surgery, the sclerostomy is made with only partial thickness leaving only a thin wall residual barrier between the anterior chamber and the subconjunctival space. The day after surgery, the Neodymium YAG laser directed to a gonioscopy lens is fired at the sclerostomy side to complete the operation and to establish a filtering sclerostomy into the subconjunctival space. The rationale for these procedures at the day of the two-stage technique allows the conjunctiva to seal itself reducing the frequency of excess, filtration and subsequent loss of the chamber. This group uses a fornix base conjunctival flap rather than the more common limbus base conjunctival flap.

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Ticho and Zauberman reported a case in 1976 where the argon laser was used to treat a 50-year old woman, diagnosed to have an open-angle glaucoma and underwent a Scheie filtering procedure which failed after functioning for 10 days. The filtering site appeared to be occluded by uveal tissue. The argon laser was used to reopen the obstruction. Ticho and Ivry, in 1977 reported in a series of 11 patients treatment with argon laser for occluded filtering blebs. Success was reported in 5 of the 11 eyes with intraocular pressure below in 20 mmHg over 1 to 3-year follow-up period. Van Buskirk in 1982 reported 4 cases in which he attempted to reopen filtration site which were occluded internally by a pigmented membrane. Danielle Aron-Rosa reported one case of a 70-year old

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man with advance open-angle glaucoma. He used modelock pulsed neodymium YAG laser to cut away an opaque non-pigmented membrane that had occluded the trabeculectomy site. The intraocular pressure decreased immediately from 18 mmHg to 5 mmHg and diffuse conjunctival bleb formed. He had a follow-up of one month only.

In 1984, Praeger reported four eyes which underwent cicatricial closure of the filtering bleb within the 6 weeks postoperatively. They were treated by Neodymium YAG laser which resulted in a decrease in intraocular pressure for a minimum follow-up of 6 months.

In 1984, Allen Kohlker reported 3 patients with previously successful full thickness filtering procedures developed pigmented tissue in fistula site and uncontrolled intraocular pressure despite medical therapy. Argon therapy was applied through the conjunctiva to treat visible subconjunctival pigmented tissue within the side of the previous surgical filtration blebs. In all of the three cases, there was an immediate and significant decrease in intraocular pressure associated with re-establishment of the filtration bleb. Long term follow up showed well-controlled intraocular pressure without glaucoma medications. The average follow-up was 18 months for the first case, one year for the second, and five months for the third.

COMMENTS

The incidence of failed filtering procedures varies depending on the case, procedure, surgeon and other factors. The successful management of these cases will depend largely on the correct identification of the cause for the failure.

It has been demonstrated that limbal wounds heal as a result of fibrovascular growth from episcleral tissue. It is an old established observation that the organism will tend to close any vacuum created within itself, thus, the formation of fibrous membranes over a sclerostomy site is to a great extent a normal reaction of the organism trying to close the opening created by the surgeon.

Though fibroblast proliferation at the conjunctival or tenon's level has been described as the most frequent cause of filter failure, there are other mechanisms that must be taken into consideration in order to successfully manage these cases. Thus, gonioscopic examination is mandatory to establish the patency of the sclerostomy.

In all the cases in this series, it was determined that the obstruction was located at the sclerostomy site. The tissues encountered in these eyes were

non-pigmented and thus amenable to opening with the YAG laser, though if pigmented tissues are encountered, the Argon laser may be a viable alternative for their dissection.

CONCLUSIONS

We recommend the use of the YAG laser to reopen previously working filters that become occluded once gonioscopic shows that the obstruction lies at the sclerostomy site.

Experience with this procedure is too preliminary to use as a basis for generalization. About the frequency with which this approach will be indicated in selected cases, this technique may avoid further surgery to treat glaucoma. It should be restricted, however, to cases in which internal blockage of the sclerostomy is the basis for failure of the filter.

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