

Ab Interno Trabeculotomy

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AND ROBERT N. WEINREB, MD

CASE PRESENTATION

A 79-year-old white male was first examined in January 2001 and diagnosed with advanced primary open-angle glaucoma. His medical history included anticoagulation for chronic atrial fibrillation. The patient began topical ocular hypotensive treatment followed by argon laser trabeculoplasty, but his IOP remained high. In October 2002, he underwent uncomplicated phacoemulsification with a lens implant combined with trabeculectomy. His IOP was well controlled for 2 years but then increased. The patient underwent another trabeculectomy in November 2004. One year later, his IOP increased again. In July 2006, the patient developed progressive changes to his optic disc and visual field despite maximum tolerated medical therapy.

Comments on the Treatment Options

SM: This patient is on maximum tolerated medical therapy, and he presents with an IOP above the target as well as progressive optic nerve and visual field changes. My surgical options for this patient include another trabeculectomy, the implantation of a glaucoma drainage device, or an *ab interno* trabeculotomy. Given that the patient is anticoagulated, drainage device surgery would pose a significant risk of hemorrhage. Also, the chances of success with a trabeculectomy are lower, due to his history of two previous failures. Therefore, an *ab interno* trabeculotomy using the Trabectome (NeoMedix Corporation, Tustin, CA) is my preference.^{1,2}

FAM: In this patient, a substantial decrease in the IOP is necessary to avoid further disease progression. How would this influence your choice of the surgical procedure?

RNW: Trabeculectomy often results in a significant reduction of the IOP. In a patient who has a history of two failed trabeculectomies, however, the chances of the procedure's success are small. A drainage device may have a better chance of success. In a patient with a bleeding tendency, however, as pointed out by Dr. Mosaed, the risks of hemorrhage and failure are increased. With *ab*



(All figures courtesy of NeoMedix Corporation.)

Figure 1. Key features of the Trabectome's handpiece include I/A ports, the electrocautery element, and an insulating shoe.

interno trabeculotomy, an IOP in the single digits is rarely achieved, because it cannot decrease below the episcleral venous pressure. Nevertheless, the procedure has the advantages of no conjunctival manipulation and only a small chance of hemorrhage. If additional lowering of the IOP is required after *ab interno* trabeculotomy, one could add topical medication.

Dr. Mosaed, would you describe the *ab interno* trabeculotomy procedure using the Trabectome?

SM: The device cauterizes and removes a portion of the trabecular meshwork and the inner wall of the Schlemm's canal (Figures 1 to 3). The procedure is performed under direct gonioscopic view, and the surgeon usually ablates from 60° to 180° of the trabecular meshwork. *Ab interno* trabeculotomy essentially re-establishes aqueous drainage in eyes that have a diminished outflow facility. It should reduce some of the risks associated with trabeculectomy or aqueous drainage devices such as hypotony, a flat anterior chamber, or bleb-related infections.

RNW: Is there a difference from conventional goniotomy?

SM: One of the reasons why conventional goniotomy does not work well in adults is that the surgeon simply makes a cut on the trabecular meshwork without excis-

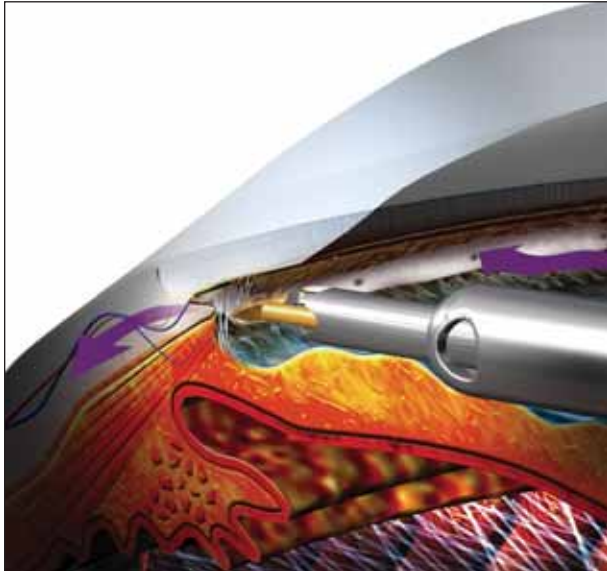


Figure 2. In this schematic representation, the trabecular meshwork and inner wall of Schlemm's canal are ablated to allow the direct flow of aqueous through the aqueous collector channels (arrows).

ing or cauterizing the tissues. The cut ends of the trabecular meshwork tend to fold back into their original position and scar together. With the Trabectome, the surgeon ablates (excises) the tissue, thus cauterizing the cut ends so they are less likely to reapproximate and close.

RNW: What are your current indications for using the Trabectome?

SM: Only approximately 150 patients have undergone the procedure in the US at the time of this writing. The indications and contraindications for *ab interno* trabeculotomy with the device have therefore been changing as surgeons acquire more experience. My current indications include patients with IOPs above their target on maximum tolerated medical therapy, those with progressive optic nerve and/or visual field loss despite maximum tolerated medical therapy, or those in whom conventional surgery to reduce their IOP has been unsuccessful.

The relative contraindications for the procedure include opaque corneas or extensive peripheral anterior synechiae, which impair the surgeon's access to or visualization of the angle structures. I also usually do not recommend this procedure for patients whose IOPs are in the low teens but require further reduction. My colleagues and I have found that the procedure is more effective for patients who start off with higher levels of IOP.

RNW: Have you performed this procedure as an alternative to medical therapy?



Figure 3. In this intraoperative view, the Trabectome's handpiece is engaged in the trabecular meshwork. A small cleft of ablation forms behind the trailing end of the handpiece.

SM: Yes, the procedure should be considered in patients who cannot tolerate topical medication or who are poorly compliant.

RNW: Can the procedure be performed in phakic patients?

SM: The Trabectome may be used in phakic patients and also as part of a combined procedure with phacoemulsification and IOL implantation.

FAM: Is there any correlation between the degree of ablation and the reduction of IOP?

SM: We have not yet evaluated this correlation, but we hope to in the future.

RNW: What are the potential complications of this procedure?

SM: A small hyphema, perhaps from a reflux of blood from Schlemm's canal, occurs in the majority of cases. It usually resolves spontaneously in a few days. There is also a potential risk of infection (because a clear corneal incision is needed for access to the angle structures) and of corneal abrasion from the gonioscopes.

AB: Is there a risk of an IOP spike in the postoperative period? If so, is it correlated to the amount of ablation?

SM: I have seen IOP spikes in only a few cases. One of the patients had to undergo conventional trabeculectomy to lower his IOP.

FAM: What is the success rate of the procedure in terms of lowering IOP?

SM: My colleagues and I have an 80% early success rate, defined as an IOP of less than 21 mm Hg or a 30% reduction from the preoperative IOP, with or without the simultaneous use of IOP-lowering medications. Fifty percent of our patients required no concomitant treatment after the procedure.

"Additional evaluation is needed to better delineate the appropriate indications for [*ab interno* trabeculotomy], specific surgical technique, and postoperative management."

CONCLUSION

As noted by Dr. Mosaed, *ab interno* trabeculotomy with the Trabectome is generally safe and can effectively reduce IOP in many, but not all, patients. Additional evaluation is needed to better delineate the appropriate indications for the procedure, specific surgical technique, and postoperative management. □

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1. Francis BA, See RF, Rao NA, et al. *Ab interno* trabeculectomy: development of a novel device (Trabectome) and surgery for open-angle glaucoma. *J Glaucoma*. 2006;15:68-73.
2. Minckler DS, Baerveldt G, Alfaro MR, Francis BA. Clinical results with the Trabectome for treatment of open-angle glaucoma. *Ophthalmology*. 2005;112:962-967.

CONTACT US

If there is a subject that you would like to see addressed in this column, please send your suggestion via e-mail to gtletters@bmctoday.com.

ALPHAGAN® P

(brimonidine tartrate ophthalmic solution) 0.1% and 0.15%
Sterile



INDICATIONS AND USAGE

ALPHAGAN® P is indicated for the lowering of intraocular pressure in patients with open-angle glaucoma or ocular hypertension.

CONTRAINDICATIONS

ALPHAGAN® P is contraindicated in patients with hypersensitivity to brimonidine tartrate or any component of this medication. It is also contraindicated in patients receiving monoamine oxidase (MAO) inhibitor therapy.

PRECAUTIONS

General:

Although brimonidine tartrate ophthalmic solution had minimal effect on the blood pressure of patients in clinical studies, caution should be exercised in treating patients with severe cardiovascular disease.

ALPHAGAN® P has not been studied in patients with hepatic or renal impairment; caution should be used in treating such patients.

ALPHAGAN® P should be used with caution in patients with depression, cerebral or coronary insufficiency, Raynaud's phenomenon, orthostatic hypotension, or thromboangiitis obliterans. Patients prescribed IOP-lowering medication should be routinely monitored for IOP.

Information for Patients:

As with other drugs in this class, **ALPHAGAN® P** may cause fatigue and/or drowsiness in some patients. Patients who engage in hazardous activities should be cautioned of the potential for a decrease in mental alertness.

Drug Interactions:

Although specific drug interaction studies have not been conducted with **ALPHAGAN® P**, the possibility of an additive or potentiating effect with CNS depressants (alcohol, barbiturates, opiates, sedatives, or anesthetics) should be considered. Alpha-agonists, as a class, may reduce pulse and blood pressure. Caution in using concomitant drugs such as anti-hypertensives and/or cardiac glycosides is advised.

Tricyclic antidepressants have been reported to blunt the hypotensive effect of systemic clonidine. It is not known whether the concurrent use of these agents with **ALPHAGAN® P** in humans can lead to resulting interference with the IOP lowering effect. No data on the level of circulating catecholamines after **ALPHAGAN® P** administration are available. Caution, however, is advised in patients taking tricyclic antidepressants which can affect the metabolism and uptake of circulating amines.

Carcinogenesis, Mutagenesis, and Impairment of Fertility:

No compound-related carcinogenic effects were observed in either mice or rats following a 21-month and 24-month study, respectively. In these studies, dietary administration of brimonidine tartrate at doses up to 2.5 mg/kg/day in mice and 1.0 mg/kg/day in rats achieved 150 and 120 times or 90 and 80 times, respectively, the plasma drug concentration (C_{max}) estimated in humans treated with one drop of **ALPHAGAN® P** 0.1% or 0.15% into both eyes 3 times per day.

Brimonidine tartrate was not mutagenic or cytogenic in a series of *in vitro* and *in vivo* studies including the Ames test, chromosomal aberration assay in Chinese Hamster Ovary (CHO) cells, a host-mediated assay and cytogenic studies in mice, and dominant lethal assay.

Pregnancy:

Teratogenic effects: Pregnancy Category B.

Reproductive studies performed in rats and rabbits with oral doses of 0.66 mg base/kg revealed no evidence of impaired fertility or harm to the fetus due to **ALPHAGAN® P**. Dosing at this level produced an exposure in rats and rabbits that is 190 and 100 times or 120 and 60 times higher, respectively, than the exposure seen in humans following multiple ophthalmic doses of **ALPHAGAN® P** 0.1% or 0.15%.

There are no adequate and well-controlled studies in pregnant women. In animal studies, brimonidine crossed the placenta and entered into the fetal circulation to a limited extent. **ALPHAGAN® P** should be used during pregnancy only if the potential benefit to the mother justifies the potential risk to the fetus.

Nursing Mothers:

It is not known whether this drug is excreted in human milk; although in animal studies brimonidine tartrate was excreted in breast milk. A decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother.

Pediatric Use:

In a well-controlled clinical study conducted in pediatric glaucoma patients (ages 2 to 7 years) the most commonly observed adverse events with brimonidine tartrate ophthalmic solution 0.2% dosed three times daily were somnolence (50%-83% in patients ages 2 to 6 years) and decreased alertness. In pediatric patients 7 years of age or older (>20kg), somnolence appears to occur less frequently (25%). Approximately 16% of patients on brimonidine tartrate ophthalmic solution discontinued from the study due to somnolence.

The safety and effectiveness of brimonidine tartrate ophthalmic solution have not been studied in pediatric patients below the age of 2 years. Brimonidine tartrate ophthalmic solution is not recommended for use in pediatric patients under the age of 2 years. (Also refer to Adverse Reactions section.)

Geriatric Use:

No overall differences in safety or effectiveness have been observed between elderly and other adult patients.

ADVERSE REACTIONS

Adverse events occurring in approximately 10-20% of the subjects receiving brimonidine ophthalmic solution (0.1-0.2%) included: allergic conjunctivitis, conjunctival hyperemia, and eye pruritus. Adverse events occurring in approximately 5-9% included: burning sensation, conjunctival folliculosis, hypertension, ocular allergic reaction, oral dryness, and visual disturbance.

Adverse events occurring in approximately 1-4% of the subjects receiving brimonidine ophthalmic solution (0.1-0.2%) included: allergic reaction, asthenia, blepharitis, blepharoconjunctivitis, blurred vision, bronchitis, cataract, conjunctival edema, conjunctival hemorrhage, conjunctivitis, cough, dizziness, dyspepsia, dyspnea, epiphora, eye discharge, eye dryness, eye irritation, eye pain, eyelid edema, eyelid erythema, fatigue, flu syndrome, follicular conjunctivitis, foreign body sensation, gastrointestinal disorder, headache, hypercholesterolemia, hypotension, infection (primarily colds and respiratory infections), insomnia, keratitis, lid disorder, pharyngitis, photophobia, rash, rhinitis, sinus infection, sinusitis, somnolence, stinging, superficial punctate keratopathy, tearing, visual field defect, vitreous detachment, vitreous disorder, vitreous floaters, and worsened visual acuity.

The following events were reported in less than 1% of subjects: corneal erosion, hordeolum, nasal dryness, and taste perversion.

The following events have been identified during post-marketing use of brimonidine tartrate ophthalmic solutions in clinical practice. Because they are reported voluntarily from a population of unknown size, estimates of frequency cannot be made. The events, which have been chosen for inclusion due to either their seriousness, frequency of reporting, possible causal connection to brimonidine tartrate ophthalmic solutions, or a combination of these factors, include: bradycardia; depression; iritis; keratoconjunctivitis sicca; miosis; nausea; skin reactions (including erythema, eyelid pruritus, rash, and vasodilation) and tachycardia. Apnea; bradycardia; hypotension; hypothermia; hypotonia; and somnolence have been reported in infants receiving brimonidine tartrate ophthalmic solutions.

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(brimonidine tartrate ophthalmic solution) 0.1%

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