Surgical Technique

New Ab Interno Technique for Removal of Iris-Embedded EX-PRESS Shunt and Chronic Eye Pain Caused by Shunt Malpositioning

Davinder S. Grover, MD, MPH; Melissa A. Fellman, MD; Ronald L. Fellman, MD

The EX-PRESS shunt (Alcon Laboratory) is a stainless steel implant designed to shunt aqueous from the anterior chamber to the subconjunctival space. The device is placed under a scleral flap, with the lumen ideally positioned parallel to the iris. A properly positioned EX-PRESS shunt creates a controlled communication between the anterior chamber and the bleb. Several shunt-specific complications have been described elsewhere, including blockage, extrusion or exposure, and anterior dislocation. In addition to these complications, malpositioning of the shunt can occur but, to our knowledge, has never been reported as a source of debilitating chronic eye pain requiring shunt removal.

We describe a new technique for gonioscopy-assisted ab interno removal of an EX-PRESS shunt. We also report findings in a patient with severe eye pain due to indentation and chafing of the superior iris stroma caused by an iris-embedded shunt. The patient’s eye pain resolved completely after successful ab interno removal of the malpositioned shunt. In a second patient, the ab interno technique was used to remove a nonfunctioning shunt during another glaucoma procedure.

Report of Cases

Patient 1
A 71-year-old woman with an unremarkable general medical history and an ocular history of primary open angle glaucoma, had undergone bilateral EX-PRESS shunt placement in 2011, performed by a glaucoma specialist. Six months later, she came to our tertiary glaucoma practice with extreme pain in her right eye and no pain in her left eye. She reported that the pain had started the day after shunt implantation, but only in her right eye.

At examination, her best-corrected visual acuity was 20/25 OU, and her intraocular pressure (IOP) was 10 mm Hg in both eyes with Goldmann applanation; low, diffuse, healthy-appearing blebs were noted in both eyes (Figure 1C). The patient was taking no ocular medication. Slitlamp examination of her right eye showed that the internal tip of the EX-PRESS shunt was embedded in the iris, and careful gonioscopic examination confirmed this finding. Figure 1 demonstrates the preoperative gonioscopic findings. Iris movement caused a deep groove in the iris stroma from contact with the shunt (apparent only after shunt removal). The patient also had cataracts that were not visually significant.

Figure 1. Preoperative Clinical Photographs in Patient 1

![Gonioscopic photographs of the right eye demonstrating the malpositioned EX-PRESS shunt embedded in the iris stroma before (A) and after (B) dilation. C, Preoperative external photograph of the bleb in the affected (right) eye; the bleb appears diffuse and elevated with healthy-appearing conjunctiva. D, Preoperative gonioscopic photograph of the patient’s left eye demonstrating a properly positioned EX-PRESS shunt.](http://jamaophthalmology.com)
Trace anterior chamber inflammation was seen in the right eye but not the left.

After an unsuccessful 3-week trial of cyclopentolate treatment (atropine sulfate ophthalmic solution 1% twice daily), topical ketorolac tromethamine ophthalmic solution, and prednisolone acetate 1%, we concluded that the patient’s eye pain was probably caused by the shunt’s touching a sensory nerve in the iris stroma. Given the healthy-appearing blebs, we were reluctant to remove the shunt using the previously described approaches. We therefore developed a minimally invasive ab interno method for EX-PRESS shunt removal.

After removal of the malpositioned shunt, the patient’s pain completely resolved. She was treated with antibiotic drops for 1 week and topical steroid drops for 2 months. Since her operation, there has been no morphologic change in the bleb in her right eye (Figure 2B) and no change in IOP. At the 10-month postoperative visit, the patient’s visual acuity was 20/25 OU, she had no anterior chamber inflammation, her IOP was 12 mm Hg in both eyes, her blebs appeared healthy, and she was taking no ocular medications. Figure 2 demonstrates the postoperative gonioscopic findings.

Patient 2
An 82-year-old woman came to us with uncontrolled primary open angle glaucoma despite maximal tolerated medical treatment and 2 prior laser trabeculoplasty treatments. At initial examination of her affected (right) eye, her visual acuity was 20/25, and her IOP was 22 mm Hg; her treatment included combined dorzolamide-timolol, latanoprost, brimonidine, and acetazolamide. She had a history of cataract surgery. She underwent uncomplicated EX-PRESS shunt placement in her right eye with mitomycin C treatment. A tenon cyst subsequently developed that was refractory to 2 sessions of bleb needling with mitomycin C. Her IOP was 24 mm Hg with maximal medical therapy. An ab interno trabeculotomy was performed, and the patient’s shunt was removed at the same time via the ab interno approach described above. The bleb was not manipulated during this procedure. The rationale for removing the shunt was to avoid the risk of future erosion, given that the shunt no longer served a purpose. At 3 months after operation, the patient’s IOP was 15 mm Hg with a prostaglandin analogue and combined dorzolamide-timolol treatment. Her visual acuity was 20/20, her tenon cyst was still present, and her examination findings were otherwise stable.

Technique
For the EX-PRESS shunt removal procedure, 2 corneal paracenteses were created, positioned at roughly 4 clock-hours nasally and temporally from the shunt. Sodium hyaluronate (Healon GV; Abbott Laboratories) was injected into the anterior chamber. The shunt position was visualized by using a gonioprism. A 25-gauge microvitrectoretinal blade was inserted through a paracentesis track and used to incise the scleral and corneal tissue on the nasal and temporal aspects of the shunt insertion site (Figure 3A). Once the tissue adjacent to the shunt insertion was dissected, the microvitrectoretinal blade was used to cannulate the distal lumen of the shunt (Figure 3B). Its tip was then directed posteriorly to deliver the anterior lip of the shunt into the anterior chamber (Figure 3C and D). Care was taken to maintain control of the shunt within the eye with the microsurgical forceps (Figure 3E and F). The temporal paracentesis was enlarged, and the shunt was removed without difficulty through the clear corneal wound.

An alternative method for delivering the EX-PRESS shunt into the anterior chamber is to grasp the lumen with microsurgical forceps and pull the shunt toward the pupil (technique shown in Video). Any device that allows visualization of the angle structures can be used for the ab interno technique (a 4-mirrored gonioprism, a Swan-Jacobs gonioprism, or even an endocyclophotocoagulation probe camera). After shunt removal, the internal sclerostomy is enlarged with microsurgical scissors to prevent failure of the bleb and closure of the sclerostomy; this was particularly important for preserving bleb function in our first patient.

Discussion
The EX-PRESS shunt is increasing in popularity as a glaucoma surgical procedure, and there will be a concomitant increase in complications associated with this device. This shunt can be malpositioned, blocked by intraocular debris, or eroded. Disturbing the conjunctival bleb associated with an EX-PRESS shunt can lead to bleb failure and possibly to additional invasive glaucoma procedures.

We describe a new ab interno approach for removal of the EX-PRESS shunt, which clearly offers many advantages over an external approach. In addition to sparing the conjunctiva, the ab interno removal is more efficient and less traumatic than an external approach.

Figure 2. Postoperative Clinical Photographs of the Affected (Right) Eye in Patient 1

A, Gonioscopic photograph demonstrating the postoperative appearance of the angle. The sclerostomy is patent and the iris stroma is indented, marking the former location of the shunt.

B, Postoperative external photograph of the bleb.
approach. Surgeons who are proficient in gonioscopy-assisted angle surgery should not have difficulty with this new approach.

In addition, we now understand that the internal malpositioning of the EX-PRESS shunt may cause debilitating chronic eye pain when the steel tube is deeply embedded in the iris, especially in phakic patients, in whom the iris tends to vault forward. The ability to remove the shunt via an atraumatic ab interno approach is especially useful when it is internally malpositioned with a functioning bleb. More important, we have also found the technique useful for removing the device when it is internally malpositioned with a functioning bleb. More important, we have also found the technique useful for removing the device when the bleb has failed and the surgeon has decided on another surgical method of IOP reduction. It seems reasonable to remove a nonfunctioning intraocular metallic foreign body, because it serves no purpose. When doing so is possible and safe, we remove EX-PRESS shunts if they have failed and the patient requires an additional operation. Until recently, however, we used an external approach to remove the shunt, which was more invasive than our new approach and involved both conjunctival and scleral flap dissection. Although the EX-PRESS shunt has been shown to be safe with a low likelihood of erosion,1-4 long-term data on its safety for 10 to 15 years is not yet available. If necessary, the minimally invasive approach we describe can be used to safely remove shunts at high risk for erosion.

In conclusion, we report a new conjunctiva-sparing ab interno technique to remove a malpositioned or malfunctioning EX-PRESS shunt. We also describe a symptom of debilitating chronic eye pain in patients with this shunt, caused by impalement of the iris.

ARTICLE INFORMATION
Author Affiliations: Glaucoma Associates of Texas, Dallas (Grover, R.L. Fellman); University of Texas Medical School at Houston (M.A. Fellman).
Corresponding Author: Davinder S. Grover, MD, MPH, Glaucoma Associates of Texas, 10740 North Central Expressway, Ste 300, Dallas, TX 75231 (dgrover@glaucomaassociates.com).
Submitted for Publication: January 2, 2013; final revision received February 9, 2013; accepted February 25, 2013.
Published Online: August 1, 2013. doi:10.1001/jamaophthalmol.2013.4274.
Author Contributions: Dr Grover and Ms Fellman had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Grover, R. L. Fellman. Acquisition of data: Grover. Analysis and interpretation of data: All authors. Drafting of the manuscript: Grover, M. A. Fellman. Critical revision of the manuscript for important intellectual content: Grover, R. L. Fellman. Administrative, technical, and material support: Grover, M. A. Fellman. Study supervision: R. L. Fellman.

Conflict of Interest Disclosures: None reported.

REFERENCES