Restoring the Intermediate Segment

Approaches to traumatic iridodialysis and cyclodialysis.

BY WILLIAM ERIC SPONSEL, MB, ChB, MD

Ocular trauma frequently damages the cornea, lens, and retina. Standard methods of managing such injuries use ultrasonic, radiological, slit-lamp, and ophthalmoscopic imaging. Because damage to the intermediate segment of the eye (ie, the iris root, zonule, and ciliary body) is obscured from view, it is often ignored. The clinician's failure to detect and resolve anterior uveal injury can result in either profound hypotony that may lead to phthisis or ocular hypertension with axonal loss. Both conditions are painful and may cause blindness.

Before the advent of ultrasound biomicroscopy (UBM), the available methods for viewing the intermediate segment included gonioscopy and liquid immersion ultrasound. Hyphema, corneal edema, and a collapse of the anterior chamber preclude gonioscopy in many trauma cases. Immersion ultrasound provides insufficient detail to help direct and facilitate careful surgical exploration. Contradistinctively, preoperative UBM provides the surgeon with useful 3-D mapping information. A thoughtful application of UBM findings may lead to surgical success, even when one's expectations are appropriately guarded. With UBM, the precise placement of drainage sclerostomies over supraciliary effusion and hemorrhage is possible, as is identifying cyclodialysis zones that require resuturing of the scleral spur and reattachment of the ciliary body. Optical coherence tomography may ultimately provide similarly useful images, but its resolution diminishes in patients who have dark uveal pigmentation, thus limiting its clinical applicability.

In the following three patients, all of whom presented within a few weeks of each other at the South Texas Medical Center in San Antonio, my colleagues and I used a P45 Ultrasonic Workstation UBM (Paradigm Medical Industries, Inc., Salt Lake City, UT), courtesy of Erin Doe, MD, a glaucomatologist at the Brooke Army Medical Center in Fort Sam Houston, Texas. The UBM's 50-MHz VHF mode provides microscopic digital images that reveal hidden anatomy and pathology beneath the iris, sclera, and ciliary body.

CASE 1

Severe, Bilateral Trauma

A 54-year-old white male had been kicked in the face by a horse and suffered severe trauma to both eyes 10 years earlier. His right eye had been enucleated, and his left eye afforded such limited vision that he required a stick to walk. The patient's left eye had (1) extensive traumatic angle recession with posteriorly displaced reattachment of the iris root, (2) a large, circinate, supraciliary effusion beneath the ciliary body, (3) a cortical cataract lacking zonular support (zonulolysis) causing phacodonesis, (4) a prelenticular pupillary membrane, (5) cystoid maculopathy, and (6) chronic severe hypotony. These problems were accompanied by a prephthisical change of the globe's shape, corneal edema, and a recent onset of

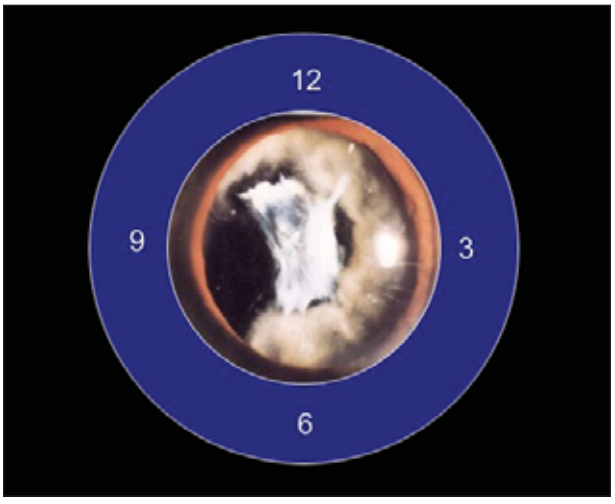

Figure 1. The patient's prephthisical eye had a calcified pupillary membrane, a large supraciliary fluid space, a grossly congested ciliary body, and a posterior reattachment of the scleral spur that was well behind the corneoscleral junction.

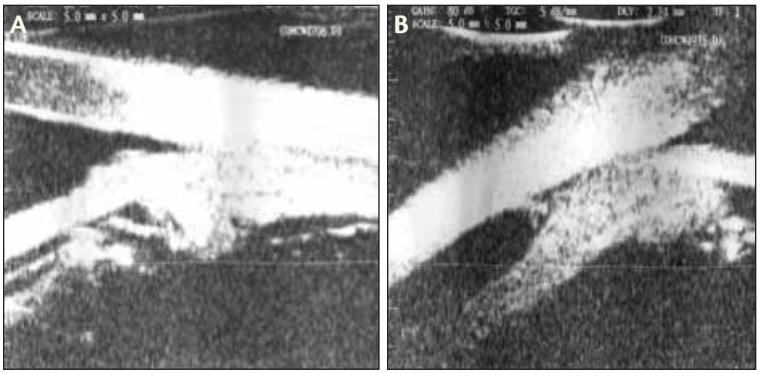

Figure 2. UBM reveals small cyclodialysis clefts at the 11- and 12-o'clock positions and a large accumulation of supraciliary fluid at the 4-o'clock position in a patient's left eye (A). A large area of fluid extended nasally to the 7-o'clock position, but there was little accumulation of fluid adjacent to the cyclodialysis cleft (B).

ocular pain. His BCVA vacillated between 20/400 OS and hand motions, with a refraction of -9.75 + 1.00 X 30. The patient's left eye was too soft to applanate, and UBM confirmed the presence of extensive broad but shallow effusions from the 9- to the 2-o'clock position with associated, massive, uveal swelling (Figure 1). An area of angle recession was evident from the 2- to the 5-o'clock position.

After detailed informed consent, the patient underwent elective reconstructive surgery. The removal of the fibrotic pupillary membrane before capsulorhexis revealed a widely dilated pupil as a result of the scarred posterior reattachment of the scleral spur. I used a clear corneal approach and carefully performed low-infusion phacoemulsification on the dense cataract. I left the peripheral posterior synechiae in place to stabilize the azonular capsule and performed manual I/A. I then gently inserted a foldable Acrysof MA60 lens (Alcon Laboratories, Inc., Fort Worth, TX) beneath the iris and anterior capsule, with its haptics bracing the capsular bag into the sulcus.

After securely positioning the IOL, I drained more than 2 mL of straw-colored supraciliary fluid through several strategically placed sclerostomies. Repeated replacement of the anterior chamber's fluid with BSS facilitated the drainage. The supraciliary fluid's drainage should continue after uveal tissue initially presents within the margins of each sclerostomy, because uveal swelling can account for a high proportion of the total fluid drained (Figure 2). After completing primary drainage, I grasped the retracted pupillary margin with two pairs of forceps, pulled the peripheral iris back into view, and re-established a central pupil. I then repeated the drainage and fluid replacement. Once all four drainage sites stopped yielding fluid during the anterior chamber's reformation, I determined that there was no immediate need to plicate the scleral spur to the corneoscleral junction, because hydrostatic pressure alone held the uveal tissue in place.

Using viscoelastic to reform the anterior chamber in this case would have posteriorly displaced the entire iris diaphragm and peeled off the re-applied uvea. I advised my assisting surgeon that, if our efforts were successful, this chronically hypotonous patient would resume making aqueous and, with little or no normal angle structure remaining, would soon need glaucoma surgery.

Three days postoperatively, the patient presented to the ER with an IOP of 60 mm Hg that rapidly responded to medication. He received an Ahmed Glaucoma Valve (New World Medical, Inc., Rancho Cucamonga, CA) approximately 3 months later, and he ultimately attained a visual acuity of >20/100 OS that allowed him to read large print and walk without assistance.

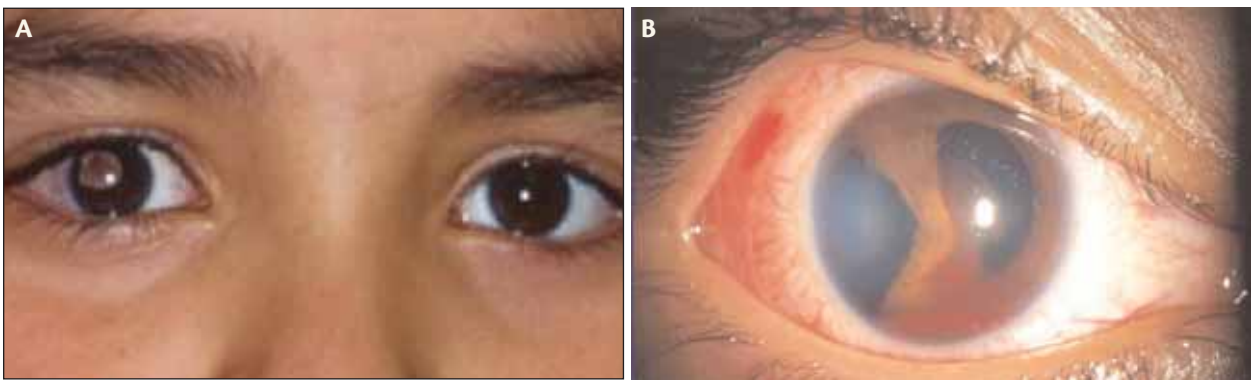

Figure 3. Before surgery, the patient had an afferent pupillary defect and an IOP of 0 mm Hg OD (A). His eye had extensive temporal irido- and cyclodialysis, zonulolysis, and hyphema (B).

CASE 2

Cyclodialysis Cleft With Supraciliary Fluid Pockets

An 81-year-old Hispanic male presented with a painful left eye. He had a history of corneal stromal edema. He had been scheduled for assessment in the cornea clinic with presumptive Fuch's dystrophy, but I was invited to assess his hypotony in the glaucoma clinic when he first arrived. His BCVA was 20/200 OS, and his IOP was <1 mm Hg OS. A thorough patient history and careful gonioscopy revealed that he had undergone bilateral cataract extraction 5 years earlier. Postoperatively, the patient's visual acuity remained 20/20 OD, but his left eye irregularly cycled through periods of relative clarity and total blurring. He demonstrated a mild, afferent pupillary defect in his hypotonous left eye, and a slit-lamp fundus examination revealed macular folds consistent with hypotony maculopathy. Gonioscopy confirmed pigmentary accumulation inferiorly and temporally and a small, single-clock-hour, nondisplaced cyclodialysis superiorly.

UBM revealed fluid extending downward to the 4- and 7-o'clock positions, on either side of the small cyclodialysis cleft. The scarred area at the 12-o'clock position contained little adjacent supraciliary fluid. I prescribed Cyclogyl 2% (Alcon Laboratories, Inc.) q.i.d. for his left eye instead of primary repair. Within 1 month, the patient's left eye had an IOP of 10 mm Hg, a clear cornea, and no residual macular folds. His visual acuity, which had previously vacillated between hand motions and 20/40 since cataract extraction, now measured 20/15 OS. UBM with cycloplegia showed an obstruction of the small cyclodialysis cleft with peripheral iris root and a spontaneous resorption of all the supraciliary fluid. Later, the patient was treated with surgical closure of the cyclodialysis cleft, which allowed the restoration of his normal pupillary function. He had no further ocular problems.

CASE 3

Hemi-Iridodialysis and Cyclodialysis

An 8-year-old Hispanic male had suffered an injury to his right eye from a BB gun 11 days before presenting. His IOP had been almost zero since the injury. The temporal iris was detached and scrolled nasally. The iris was encased in fibrin and vitreous, and the temporal zonule was destroyed (Figure 3). The lens appeared to be intact, but there was no evidence of macular function. His visual acuity was < 20/400 OD. The boy was in great pain and appeared at risk for recurrent bleeding.

UBM showed extensive cyclodialysis and supraciliary effusion with angle recession beyond the ends of the cyclodialysis. The patient was scheduled for surgical

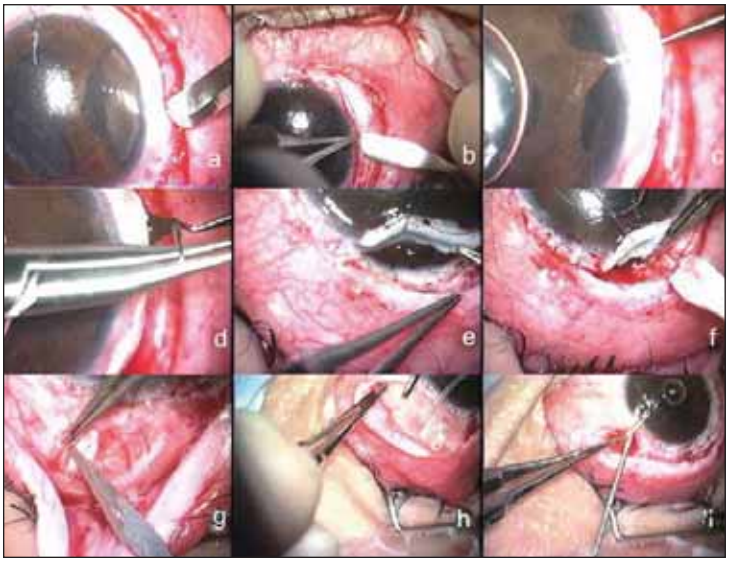

Figure 4. The surgeon creates a stepped incision (A) and a half-thickness planar corneoscleral ridge (B). He unscrolled the iris root (C and D) and attached the peripheral iris to the sclera with 10–0 nylon (E). After performing a manual vitrectomy (F), he created sclerostomies over the largest areas of supraciliary and pars plana/choroidal detachment (G). Finally, the surgeon implanted a tube shunt (H and I).

repair of the cyclodialysis and the iridodialysis with an anterior vitrectomy and transscleral drainage. Based on my experience in case 1, I tentatively scheduled optional implantation of an Ahmed Glaucoma Valve and a scleral graft.

After carefully performing the peritomy, I created a stepped incision posterior to the limbus (Figure 4A). I used a crescent blade to create a half-thickness planar corneoscleral ridge for the full extent of the wound (Figure 4B). Keeping the internal Descemet's openings below 2 clock hours at a time will avoid an expurgation of the ocular contents. After clearing overlying fibrin and vitreous and carefully instilling viscoelastic, I unscrolled the iris root (Figures 4C and D). I attached the peripheral iris to the anterior lip of the stepped incision with 10–0 nylon sutures (Figure 4E). After closing the central area, I carefully opened the adjacent area with a blade and performed another vitrectomy (Figure 4F).

After repairing the anterior and intermediate segments, I strategically placed sclerostomies (Figure 4G) overlying the largest areas of supraciliary and pars plana/choroidal detachment as shown on preoperative UBM. I completed a slow, repetitive transzonular fluid replacement with BSS using a 30-gauge cannula via an oblique 25-gauge paracentesis. This process continued as long as fluid exited through each sclerostomy. Finally, I placed the Ahmed Glaucoma Valve (Figures 4H and I) to avoid postoperative ocular hypertension and associated pain that could readily compromise my efforts.

The child rapidly recovered from the 6-hour procedure. He had a central oval pupil with normal sphincter function, a UCVA of 20/30 OD, full peripheral visual fields, and a consistent IOP of approximately 16 mm Hg without medication.

SUMMARY

The three cases presented herein illustrate the utility of UBM in the assessment of intermediate segment trauma. I now recognize that, in some cases, prophylactically placing a shunt may be prudent after the surgical repair of the trauma, because postoperative nausea or eye-rubbing could readily undo the meticulous repair. Large clefts must be repaired primarily. In smaller cyclodialyses, if the detached scleral spur remains aligned with its normal anatomic attachment site, pharmacologic cycloplegia may temporarily induce the cleft to reseal, allowing spontaneous resorption of massive quantities of circinate supraciliary fluid. Most importantly, the precise attachment of the scleral spur is key to the success of all repairs. If resutured too far anteriorly or posteriorly, the ciliary body will remain detached with persisting supraciliary fluid, and long-term hypotony and eventual phthisis are likely. Thorough supraciliary drainage facilitates initial repair and helps stabilize the repositioned uveal tissue. ❑

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1. Sponsel WE. Complex referral surgery for the glaucoma subspecialist: approaches to chronic iridodialysis, cyclodialysis, angle recession, and uveal prolapse. Paper presented at the Second International Congress on Glaucoma Surgery; February, 2003; Luxor, Egypt.