Phacodonesis and a Subluxated Crystalline Lens

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CASE PRESENTATION

A 67-year-old female presents for a cataract surgical evaluation. Her ocular history is significant for advanced proliferative diabetic retinopathy and open-angle glaucoma. She is status post scatter photocoagulation in both eyes, and a local retina specialist says the patient may eventually require pars plana vitrectomy. There is no rubeosis. The patient is being treated for glaucoma (0.9 cup-to-disc ratio and mild visual field loss), and her IOP is currently controlled on three topical medications.

An examination reveals a BCVA of 20/100 OD and 20/200 OS. Significant bilateral nuclear sclerosis with phacodonesis is present (Figure 1). After pupilary dilation, the inferior edge of the crystalline lens is visible for 180º (Figure 2). The patient has no obvious physical traits suggestive of Marfan’s or Weill-Marchesani syndrome, and she denies trauma.

How would you approach the cataract surgery?

Figure 1. In both eyes, a 3+ nuclear sclerotic lens appears to be superiorly subluxated. No vitreous prolapse is present.

Figure 2. Retroillumination images of the patient’s right (A) and left (B) crystalline lenses show their inferior edge for greater than 180º.

EHUD I. ASSIA, MD

The combination of advanced glaucoma and phacodonesis with lens subluxation suggests pseudoexfoliation (PXF) syndrome, which needs to be ruled out. Another potential cause is high myopia, in which significant phacodonesis is not uncommon. Cataract extraction is certainly indicated, not only to remove the opaque media but also because of the patient’s glaucoma. Anterior displacement of the unstable lens may play a role in the high IOP, and removal of the crystalline lens is often associated with decreased pressure.

Intracapsular cataract extraction and the implantation of either an ACIOL (angle or iris supported) or a suture-fixed PCIOL are valid options. My preference, however, would be to preserve the posterior capsule by fixing the lens capsule to the scleral wall. The Cionni Rings for Scleral Fixation and the Ahmed Capsular Tension Segments (CTS) (both from Morcher GmbH, Stuttgart, Germany; distributed in the United States by FCI Ophthalmics, Marshfield Hills, MA) were shown to be highly effective for fixation of the capsular bag to the scleral wall.

I have developed with Hanita Lenses (Kibbutz Hanita, Israel) an alternative device, the AssiAnchor (not available in the United States), which clips to the anterior capsule...
and is sutured to the scleral wall\textsuperscript{12} (Figure 3). After the lens is stabilized by the AssiAnchor, the surgeon performs phacoemulsification in the conventional manner. A capsular tension ring (CTR) may also be inserted to preserve the round contour of the capsular equator. My clinical experience (11 patients, 12 anchors) has been encouraging, and final follow-up (more than 2 years for four patients) revealed stable and central capsule-fixated IOLs in all eyes. This patient’s diabetic retinopathy should be well controlled prior to surgery to minimize postoperative macular edema.

\textbf{STEVEN DEWEY, MD}

The youth of this patient highlights the complexity of the case. Under most circumstances, I would recommend an ACIOL as a perfectly acceptable option for an eye with zonular laxity. I would not change this decision for mild glaucoma or well-controlled diabetes. The presented “gestalt” of this patient, however, suggests a high risk for worsening glaucomatous visual field loss and increasing diabetic ischemic disease, with rubeosis a significant possibility. These issues are relative contraindications for an angle-fixated ACIOL. The choice is therefore between an iris-fixated or a scleral-sutured PCIOL. I would defer the decision until after removing the cataract. The IOL would need to be acrylic with rounded edges at potential points of contact with uveal tissue. Due to potential problems with centration, the lens should be spherical or neutrally aspheric.

The specific technical aspect of the surgery is whether the capsule is capable of providing long-term assistance in the fixation of the IOL. As a general rule, I use a CTR at the start of a case only in the presence of significant phacoedonesis, but I do not use a CTR if the lens is relatively stable despite the apparent zonular defect. If the zonules prove more resilient and remain intact with a gentle phacoemulsification (large capsulorhexis with either a supra-capsular flip or, preferably, a well-controlled chop to preserve the zonules as much as possible), then the extent of the zonular abnormality can be assessed. If fewer than 3 to 4 clock hours are impaired, a CTR alone may be reasonable. More than 4 but fewer than 6 clock hours calls for scleral fixation in the region of zonular laxity, with a Cionni Ring for Sclera Fixation, a Henderson Capsular Tension Ring (Morcher GmbH; distributed in the United States by FCI Ophthalmics), or an Ahmed CTS. Otherwise, I would keep all incisions anterior to the limbus to preserve the conjunctiva.

If the zonules appeared pathologic and the lens seemed to be unstable as the case began, I would place retractors from the Mackool Cataract Support System (Duckworth & Kent Ltd., Hertfordshire, United Kingdom) as I performed the capsulorhexis. In this situation, the capsule would not likely help support the IOL, and iris-suture fixation would probably be the best option to minimize surgical trauma and spare the conjunctiva. Whether the capsule is useful or likely to be a nuisance could be decided at that point. I would carefully remove the ophthalmic viscosurgical device (OVD) at the end of the case.

My preference would be to pretreat this patient with Avastin or Lucentis (both from Genentech, Inc., South San Francisco, CA) and to administer intravitreal triamcinolone acetonide (only 1 mg) at the end of the case to minimize the impact of her diabetic condition.

\textbf{RICHARD J. MACKOOL, MD}

I would administer a peribulbar block and create a superior primary incision. Next, I would inject Viscoat (Alcon Laboratories, Inc., Fort Worth, TX) into the region of absent zonule, stain the anterior capsule with trypan blue, and completely fill the anterior chamber with additional viscoelastic. I would then perform the capsulorhexis and insert at least five retractors from the Mackool Cataract Support System before phacoemulsification. The retractors should be inserted at 45\textdegree{} intervals where the zonule is absent and at 90\textdegree{} intervals where there is evidence of possible zonular laxity. I would insert a standard CTR and then place an Ahmed CTS in the inferior capsular fornix and suture it to the sclera. If the superior zonule were not adequate, I would use two Ahmed CTS. After removing the Cataract Support System’s retractors, I would perform endoscopic cyclophotocoagulation (ECP) for at least 270\textdegree{} using the E2 Microprobe Laser and Endoscopy System.
CATARACT SURGERY COMPLEX CASE MANAGEMENT

There are several points of diagnostic interest in this case. First is the etiology of the lens subluxation. In the absence of any evidence of a systemic disease (including PFX), previous surgery, or trauma, one might assume simple ectopia lentis. Also intriguing is the patient’s potential acuity based on macular function, given her history of diabetic retinopathy. A potential acuity test would help set reasonable expectations on the part of the patient for cataract extraction. Posterior segment optical coherence tomography, perhaps already performed by the retina colleague mentioned, would help define the anatomical status of the macula. Finally, the severity of glaucoma and degree of its control would affect my surgical decisions. The number of medications and the presence of field loss suggest to me that adjunctive ECP at the time of cataract surgery might be indicated. The decision to perform ECP would depend on the target IOP and the likelihood of the patient’s ongoing adherence to medical therapy.

I would use my standard infection prophylaxis with a preparative topical fluoroquinolone antibiotic and my routine preoperative anti-inflammatory protocol with a preoperative topical fluoroquinolone antibiotic and mycophenolate mofetil beginning 3 days before surgery. Depending on the degree of phacodonesis, a Cionni preparation for a biaxial microincisional approach to phacofragmentation (more prophylactic) in the superior and inferior temporal quadrants in addition to routine preoperative anti-inflammatory protocol with a preoperative topical fluoroquinolone antibiotic and mycophenolate mofetil beginning 3 days before surgery.

There is no evidence of that the ophthalmic administration of VIGAMOX® has any effect on arthropathy in joints, even though oral administration of some quinolones has been shown to cause arthritis in immuno naive animals. Geriatric Use: Overall differences in safety and effectiveness have been observed between elderly and younger patients.

ADVERSE REACTIONS: The most frequently reported ocular adverse events were conjunctivitis, decreased visual acuity, dry eye, keratitis, ocular discomfort, ocular hyperemia, ocular pain, periorbital pain, subconjunctival hemorrhage, and tearing. These events occurred in approximately 1-4% of patients. Nonocular adverse events reported at a rate of 1-4% were fever, increased cough, infection, orbital edema, pharyngitis, rash, and rhinitis. Rx Only. Manufactured by Alcon Laboratories, Inc. Fort Worth, Texas 76104 USA. Licensed to sell only by Bayer Healthcare LLC. U.S. PAT. NO. 4,560,517, 5,678,092, 6,716,830 ©2003, 2004, 2006, Alcon, Inc

coemulsification of this dense nucleus without damage to the capsule. Cortical cleanup would be facilitated by gentle tangential aspiration and biaxial I/A (which would allow a direct approach to 360° of the capsule).

I would favor a three-piece, monofocal, hydrophobic acrylic, square-posterior-edge IOL in this case. This IOL would provide a defense against capsular contraction, a high-quality image, and resistance to posterior capsular opacification (as well as compatibility with silicone oil). The IOL's insertion would require a 2.8-mm temporal clear corneal incision. I would gladly perform limbal relaxing incisions if indicated for the correction of preexisting keratometric astigmatism (if with the rule, the inferior incision could be incorporated into the construction of the Hoffman pocket).

After the IOL's implantation, I would perform ECP on 270° of the ciliary epithelium, thoroughly aspirate all of the OVD, and use stromal hydration to seal the incisions. Depending on the IOP on the first day after surgery, I would have the patient continue using one or two of her glaucoma medications and then re-evaluate her in a couple of weeks.

An early follow-up visit with the retina specialist would be a good idea. The perioperative injection of a vascular endothelial growth factor inhibitor might be indicated to forestall the development of macular edema or the resurgence of neovascularization.

**DEVESH K. VARMA, MD, AND IQBAL IKE K. AHMED, MD**

Before approaching surgery, we would fully explore the systemic causes of the lens' subluxation, because they may present risks for anesthesia. PXF typically causes inferior subluxation, but in the context of underlying glaucoma, extend farther than the 180° visible in the retroillumination photographs.

PXF should also be considered, because this patient could be at risk of postoperative IOP spikes. The IOP might be slightly lower after cataract surgery alone, but because of her advanced cupping and need for three medications to maintain IOP control, the surgeon could consider a combined glaucoma-cataract procedure. In addition, given her advanced proliferative diabetic retinopathy, the patient would benefit from a preoperative retinal evaluation and treatment of any macular edema.

This patient likely has isolated ectopia lentis, a diffuse zonulopathy. Zonular loss may therefore...
central eyelet (Figure 5). The remaining iris hooks could then be removed.

With the capsule supported at its equator by the CTS, we would complete phacoemulsification using a zonule-friendly chopping technique, followed by cortical removal and implantation of a foldable acrylic lens. We would then release the iris hook and temporarily move the CTS to the central anterior chamber to facilitate suture fixation. We would create an inferior limbal peritomy and partial-thickness scleral groove. Next, we would expand the inferior sulcus with an OVD to prevent capsular trauma during the suturing of the CTS to the sclera. A 26-gauge needle on a viscoelastic syringe would be passed through the scleral groove into the sulcus and advanced centrally. A double-armed 9–0 Prolene suture with a CIF-4 needle (straightened with two needle drivers) (Ethicon Inc.) would be introduced through the temporal corneal incision, passed through the eyelet of the CTS, and docked into the lumen of the 26-gauge needle (Figure 6). The docked needle complex would be withdrawn through the scleral groove, and the process would be repeated with the second arm of the suture (without its passing through the eyelet of the CTS).

We would then place the CTS back in the capsular bag and tie the suture externally using a slipknot, with its tension adjusted to achieve a centered IOL (Figure 7). Using a Sinskey hook, we would bury the knot in the sclera. If needed, a second CTS could be implanted, 180° from the first segment. After withdrawing the OVD via a dry-aspiration technique, we would suture the incisions to avoid inadvertent shallowing of the anterior chamber and vitreous prolapse.

If the capsular bag became unusable, alternative strategies include iris or scleral suture fixation of a PCIOL, enclavation of the Artisan IOL (Ophtec BV, Groningen Netherlands), or an ACIOL.

Figure 7. The surgeon positions a CTS by adjusting tension on the suture.

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