Challenges in Lens Extraction: EYES WITH PRIMARY ANGLE-CLOSURE GLAUCOMA

Eyes that develop primary angle-closure glaucoma (PACG) are functionally and anatomically different from those encountered in routine cataract surgery. They have flatter corneas, shorter axial lengths, shallower anterior chambers, and thicker and relatively anteriorly positioned lenses. These factors combine to pose unique challenges in cataract surgery that may be organized according to those involving preoperative considerations, surgical management, and postoperative surveillance.

PREOPERATIVE CONSIDERATIONS

Determine the etiology. Of first importance is to determine the underlying etiology of angle narrowing, as the approach to cataract surgery will differ depending on the pathology. A narrow anterior segment in PACG is most often secondary to pupillary block. In turn, this may be associated with congenital problems such as nanophthalmos, in which the axial length is less than 19.5 mm (or greater than 2 standard deviations shorter than normal).

Examinations. Angle-closure glaucoma suspects should be examined carefully for any peripheral anterior synechiae (PAS) and/or posterior synechiae (PS). Examination should include careful gonioscopy in all cases and may also include the use of ultrasound biomicroscopy to further characterize the anterior segment configuration.

If any element of pupillary block is present, preoperative laser peripheral iridotomy (LPI) should be performed, as this may dramatically deepen the anterior chamber. If there is little change following LPI, a diagnosis of plateau iris configuration should be entertained. This may be confirmed by anterior segment ultrasound. If plateau iris is present, one can also consider preoperative argon laser peripheral iridoplasty or adjunctive endocyclophotocoagulation to open the anterior chamber angle and improve IOP control.

Lens extraction. The timing of lens extraction in patients with PACG is an area of debate among glaucoma specialists, with some advocating early cataract removal in an effort to change the angle configuration and alter the course of disease. A full discussion of this topic is beyond the scope of this article, but it would seem prudent to consider discussing with patients the advantage of earlier surgery to avoid any phacomorphic component of the PACG, especially in patients who retain very narrow angles and poor control of IOP despite the above interventions.

Informed consent. Regardless of timing, informed consent in patients with PACG should include education regarding reasonable expectations (especially in patients with amblyopia).

Cataract surgery can dramatically improve quality of life for these patients.

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or glaucomatous visual field loss), an increased risk of complications, and the need for a fluid intraoperative plan. This discussion and consent should be inclusive and tailored to the individual.

**SURGICAL MANAGEMENT**

**Anesthesia.** To decrease the risk of precipitating acute angle closure, we do not dilate the pupils preoperatively in patients with PACG, and instead we use intracameral preservative-free lidocaine with epinephrine. We favor topical anesthesia in general, but, if a retrobulbar block would otherwise be indicated, we prefer a peribulbar block in these patients. This strategy avoids any additional risk for positive posterior pressure.

**Incision.** Once the case begins, the shallow and crowded anterior chamber common in these patients often presents the greatest challenge. Clear corneal incisions should be fashioned long enough and anterior enough to discourage iris prolapse.

**Creating space.** The next step is to create sufficient space for safe intraocular maneuvers and lens disassembly. In patients with very shallow anterior chambers, one may consider administering intravenous mannitol 15 to 30 minutes before surgery to dehydrate the vitreous and create space (20%, 1–2 mL/kg). If the anterior chamber remains extremely shallow, a limited dry pars plana vitrectomy may be a good option. After a small conjunctival peritomy is fashioned, a 23-gauge microvitreoretinal blade is used to create a sclerostomy 3.5 mm behind the limbus (although this distance may have to be adjusted for very short eyes). The vitrector is then directed toward the center of the vitreous cavity. A brief vitrectomy, lasting only seconds, can transform a seemingly impossibly shallow anterior chamber into one that is nearly normal.

**Pupil dilation.** Pupillary dilation may be inadequate at this stage, secondary to existing inflammation, synechiae formation, or chronic use of miotics. If PS or PAS are present, they must be dissected. This can often be accomplished gently with the ophthalmic viscosurgical device (OVD) cannula. However, it is important to realize that PS are often not just at the pupillary margin, but rather extend peripherally along the lens capsule, in which case a cyclodialysis spatula may be helpful. Pupil expansion devices may then be inserted if required. We often use a Malyugin Ring (MicroSurgical Technology); however, in a crowded anterior segment, iris hooks may be easier to maneuver into position and less traumatic to the corneal endothelium.

**Capsulorrhexis.** In eyes in which the crystalline lens is still positioned anteriorly, control of capsulorrhexis creation may be difficult, as maneuverability may be limited and the tear will tend to extend radially. Helpful tools in this step include a highly retentive OVD such as Healon5 (Abbott Medical Optics) and microinstrumentation from ASICO or MicroSurgical Technology. Frequent regrasping of the rhexis margin and directing the tear inward can help to complete the maneuver. Hydrodissection should be performed in a slow and controlled fashion to avoid forcing the iris toward the incisions.

**Nucleus removal.** With proper preparation, once the capsulorrhexis is in place and the lens is mobilized, the remainder of the case may become more routine, with space increasing as the procedure goes on. These eyes are good candidates for prechopping, in which the nucleus can be broken into quadrants with no flow in the eye. One should be mindful of the corneal endothelium, with a low threshold...
for instilling additional OVD throughout surgery. We favor a Kelman curved tip to direct the ultrasound energy posteriorly, and we perform as much debulking, nuclear disassembly, and phacoemulsification within the bag as safely possible.

IOL choices. Short eyes can make preoperative biometry less accurate, and new methods of intraoperative aberrometry may prove helpful in selecting an appropriate IOL. With any lens with a power higher than 30.00 D, we recommend using a larger B cartridge to avoid stress fractures of the lens optic as it passes through the injector.

At times, giving the patient full correction may require an overall IOL power of 35.00 D or higher. If this power cannot be supplied in a single lens, one may consider placing an IOL with most of the required lens power in the capsular bag and a lower-powered supplementary IOL in the sulcus. Placing more than one IOL in the capsular bag is discouraged, as this can lead to significant interlenticular fibrosis that often requires explantation.

Intraoperative gonioscopy. After cataract surgery is complete, gonioscopy may be used to identify any areas of residual PAS. These can then be released manually with micrograspers (ASICO or MicroSurgical Technology) or with viscodissection.

POSTOPERATIVE SURVEILLANCE

Despite an uneventful cataract extraction, patients with PACG remain at increased risk for aqueous misdirection or malignant glaucoma postoperatively. Because transient anterior chamber shallowing is theorized to precipitate aqueous misdirection in some cases, one must make every effort to avoid anterior chamber shallowing and IOP fluctuations during cataract surgery. These efforts may include frequent use of a cohesive OVD throughout the case and minimizing instrument exit and reentry as much as possible.

One may also use low-flow settings, slowly raising the bottle height and decreasing the aspiration flow rate to minimize fluctuations in anterior chamber pressure. At the completion of the case, one must ensure watertight closure (and consider suturing) of all wounds and paracenteses to avoid chamber shallowing secondary to wound leak.

Even with the above precautions, patients should be educated regarding the symptoms of aqueous misdirection (see Symptoms of Aqueous Misdirection) and told to present immediately if any symptoms occur. Initial treatment in the event of aqueous misdirection includes topical and oral aqueous suppressants and vigorous cycloplegia.

In patients who have experienced aqueous misdirection in the fellow eye, one may consider performing a prophylactic iridoozonulohyaloidotomy (IZH) at the completion of cataract surgery in the second eye (see Steps for IZH).

The PACG patient with a previous trabeculectomy who undergoes cataract surgery also deserves careful monitoring. A modern cataract surgery with clear corneal incisions is less likely than cataract surgery with a scleral tunnel incision to induce bleb failure, but multiple studies have shown that the IOP in patients with a functioning trabeculectomy is increased by up to 3 mm Hg after cataract surgery. Chen et al identified iris manipulation, age less than 50 years, preoperative IOP greater than 10 mm Hg, and cataract surgery less than 6 months after trabeculectomy as risk factors for decreased bleb function after cataract extraction. These patients should be observed closely so that increased topical steroids, antiglaucoma medications, and/or 5-fluorouracil injections may be initiated at the earliest sign of failure, inflammation, or scarring of the functioning bleb.

CONCLUSION

Cataract surgery in patients with PACG presents unique challenges to the ophthalmic surgeon, but meeting these challenges can dramatically improve quality of life for these patients. In some cases it may even improve the angle configuration, stabilize IOP, and lessen or obviate the need for escalation of glaucoma therapy.


Suggested Further Reading:

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