Cataract Update

Approaches to a posterior polar cataract

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Abstract

Posterior polar cataracts present special challenges to the cataract surgeon. These are often associated with weakness/dehiscence of the posterior capsule and thus have a higher rate of intraoperative posterior capsule rupture. The surgeon needs to adhere to special surgical strategies to minimize the risk of a posterior capsule rupture. These include, adhering to the principles of closed chamber technique, avoiding hydrodissection – instead performing 'inside-out' hydrodelineation and using modest to low phaco parameters and reducing these stepwise. This article provides important pearls on how to approach a posterior polar cataract.

Keywords: Posterior polar cataract, Surgical strategies, Inside-out delineation, Posterior capsule dehiscence

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Introduction

A posterior polar cataract is a dense white opacity that is situated on the central posterior capsule. It consists of characteristic concentric rings around the central opacity (bull’s eye, Fig. 1). A posterior polar cataract presents a special challenge to the phaco surgeon because of its predisposition to posterior capsular dehiscence during surgery.1,2 Osher et al.1 reported a 26% (8/31 eyes) incidence of posterior capsular rupture during surgery in eyes with a posterior polar cataract. Previously, we also reported a rupture rate of 36% (9/25 eyes)2 Hayashi et al.3 reported 7.1% (2/28 eyes), whereas Lee and Lee4 reported 11% (4/36 eyes).

Various strategies have been recommended to prevent posterior capsule rupture in posterior polar cataracts. Osher et al.1 recommended using slow-motion phacoemulsification with a low aspiration flow rate, a low level of vacuum, and infusion pressure. Fine et al.5 avoided overly pressurizing the anterior chamber with viscodissection to mobilize the epinucleus and cortex, Allen and Wood6 performed viscodissection, and Lee and Lee7 preferred a lambda technique with dry aspiration. We favor inside-out delineation.7 Combined with modern instrumentation, refined surgical strategies, a better understanding of phacodynamics, and cumulative surgical experience, this technique has enabled us to reduce the incidence of posterior capsular rupture to 8% (2/25 eyes).7

Timing of surgery is crucial. While it should be delayed as long as the patient is able to perform his routine activities, it must be balanced against the potential of a posterior capsule defect developing in an intact capsule, as well as the relative technical difficulty in performing phacoemulsification in advanced cataracts.

The following paradigms should govern the procedure.

Counseling

The patient should be informed of the possibility of the nucleus dropping intraoperatively due to a posterior capsular rupture, a relatively long operative time, secondary posterior segment intervention, and a delayed visual recovery. In addition, the surgeon should discuss Nd:YAG capsulotomy for residual plaque1–3 and emphasize the possibility of preexisting amblyopia, especially in cases of unilateral posterior polar cataract.3 Moreover, the possibility of a posterior polar cataract being an autosomal dominant condition is continually expanding, therefore, genetic counseling for the parents in addition to screening of family members is important.
Anesthesia

Topical or Peribulbar anesthesia works equally good. With increasing experience, one may use topical anesthesia in a selective manner. In case of topical anesthesia extra caution is necessary as the patient is able to move and squeeze his eye increasing the risk of forward bulging of the iris lens diaphragm. It is important to have a standby anesthetist, in case the patient requires any additional sedation.1

Surgical technique

It is important to adhere to the principles of closed chamber technique, namely, creating a valvular incision, injecting viscoelastic prior to retracting any instrument from the eye, performing bimanual irrigation/aspiration. This avoids any fluctuations in the anterior chamber and also prevents forward bulge of the posterior capsule.

The incision

In our technique, surgery is initiated with the creation of two paracentesis incisions with a 0.9 mm dual bevel knife (Alcon Laboratories, Fortworth, TX). This is followed by the injection of a dispersive viscoelastic, Viscoat® (Alcon Laboratories, Inc), with the cannula toward the cornea to coat the endothelium. As the next step, sodium hyaluronate (Provisc®) is injected in the anterior chamber to create space and facilitate further maneuvers. A temporal, clear corneal, single-plane, valvular incision of 2.2 mm is preferred in all cases.

The capsulorhexis

Ideally, the capsulorhexis should be no larger than 5 mm. A larger opening may not leave adequate support for a sulcus-fixated IOL if the posterior capsule is compromised.2,5

Hydro procedures

Cortical cleaving hydrodissection can lead to hydraulic rupture and should be avoided.1,2 It is logical instead to perform hydrodelineation to create a mechanical cushion of epinucleus.2–4,6,9,10 Fine et al.5 performed hydrodissection in multiple quadrants and gently injected tiny amounts of fluid such that the fluid wave could not extend across the posterior capsule. We employ inside-out delineation to precisely demarcate the central core of the nucleus.7

Inside-out delineation

With conventional hydrodelineation, the cannula penetrates the lenticular substance and thus causes the fluid to traverse from the outside inward. It is sometimes difficult to introduce the cannula within a firm nucleus, and the effort can rock and stress the capsular bag and zonules. The surgeon may also inadvertently inject fluid into the subcapsular plane and thereby conduct unwarranted hydrodissection. Inside-out delineation is easy to perform, provides excellent surgical control, reduces stress to the zonules, and precisely demarcates the central core of nucleus.

We sculpt a central trench using the slow-motion technique with the Infiniti Vision System (Alcon Laboratories, Inc.). For nuclear sclerosis of grade 3 or less (on a grading system from 1 to 5),11 our preset parameters are ultrasound energy of 30–60% (supraoptimal power), vacuum of 40 mm Hg, an aspiration flow rate of 14 mL/min, and a bottle height of 50–60 cm. We are careful not to mechanically rock the lens. Injecting a dispersive viscoelastic (Viscoat®) through the side-port incision before retracting the probe prevents the forward movement of the iris-lens diaphragm. We introduce a specially designed, right-angled cannula mounted on a 2-mL syringe filled with fluid through the main incision and place the tip adjacent to the right wall of the trench at an appropriate depth, depending on the density of the cataract. The tip then penetrates the central lenticular substance, and we inject fluid through the right wall of the trench (Fig. 2). The fluid traversing inside out produces delineation. A golden ring within the lens indicates successful delineation (Fig. 3). If the delineation is incomplete, one may inject fluid in the left wall of the trench with another right-angled cannula. The trench allows the surgeon to reach the central core of the nucleus and produce delineation at the desired depth. When the fluid reaches a desired depth, it will create an epinuclear bowl that will act as a mechanical cushion to protect the posterior capsule during subsequent maneuvers.
Nuclear removal

We avoid rotating the nucleus, because this maneuver can rupture the posterior capsule. All of our techniques are geared toward facilitating the removal of the nucleus while it is cushioned by the epinucleus. For nuclear sclerosis greater than +2, we use the technique of step-by-step chop in situ and lateral separation with 40–50% ultrasound, vacuum of 150–250 mm Hg, an aspiration flow rate of 16 mL/min, and a bottle height of 50–60 cm. The final aim is to create multiple fragments. These fragments are removed. For less dense nuclei, we emulsify the entire nucleus within the epinuclear shell. We use an aspiration flow rate of 14 mL/min and a vacuum level of 40–60 mm Hg. Traction of posterior lenticular fibers and posterior polar opacity during surgery are sufficient to break the weak posterior capsule. Thus, the slow-motion technique reduces turbulence in the anterior chamber. Similarly, injecting viscoelastic prior to removing the instrument prevents the anterior chamber from collapsing and the posterior chamber from bulging forward.

Epinuclear removal

First, we strip off the peripheral lower half of the epinucleus using 30% ultrasound, 80–100 mm Hg of vacuum, an aspiration flow rate of 14 mL/min and a vacuum level of 40–60 mm Hg. Traction of posterior lenticular fibers and posterior polar opacity during surgery are sufficient to break the weak posterior capsule. Thus, the slow-motion technique reduces turbulence in the anterior chamber. Similarly, injecting viscoelastic prior to removing the instrument prevents the anterior chamber from collapsing and the posterior chamber from bulging forward.

Pseudohole

At times, the classic appearance suggestive of a defect may be observed in the posterior cortex when the posterior capsule actually remains intact. This phenomenon is known as a pseudohole.

Cortical removal

Bimanual I/A using an aspiration flow rate of 18–20 mL/min and vacuum of 200–300 mm Hg optimizes surgical control, maintains the anterior chamber, and aids in the complete removal of the cortex. A more efficient way of cortex removal is to occlude it in the fornix and, as vacuum rises, pull it tangentially to detach it from the anterior capsule and finally aspirate it.

Polishing the posterior capsule

We avoid polishing the posterior capsule due to its fragility. The traction produced by polishing an excessively
adherent plaque could eventually rupture an otherwise normal posterior capsule. We prefer to perform an Nd:YAG posterior capsulotomy postoperatively when needed.

**Posterior capsular dehiscence**

If a defect is present in the posterior capsule, we inject Viscoat over the area of defect before withdrawing the phaco or I/A probe from the eye. If the vitreous face is intact, we aspirate the cortex with bimanual I/A. A posterior capsulorhexis may be performed if the rupture is confined to a small central area. In the case of a vitreous disturbance we perform a two port, limbal anterior vitrectomy using a cutting rate of 800 cuts/min, vacuum of 300 mm Hg, and an aspiration flow rate of 25 mL/min. Once the anterior chamber is free of vitreous, the remaining cortex is aspirated.

**IOL implantation**

In eyes with a posterior capsular defect, we implant the IOL in the bag only if we can create a posterior capsulorhexis. Our IOL of choice for in-the-bag implantation remains the single-piece AcrySof (Alcon, Fortworth, Texas). Its slow unfolding allows sufficient time to manipulate the IOL in the bag. If the posterior capsular defect is large, we will place a 3-piece hydrophobic acrylic lens over the anterior capsule in the ciliary sulcus. After implanting the IOL, we remove viscoelastic with two-port vitrectomy rather than I/A. Vitrectomy aspirates material in a piecemeal and gradual manner, and it reduces the chance of rapidly aspirating vitreous. We suture both, the main valvular incision as well as the paracentesis in eyes with a posterior capsular defect. We will periodically evaluate these eyes for retinal break, cystoid macular edema, and raised IOP.

**References**