Managing Vitreous Loss During Cataract Surgery

The goal is to prevent retinal detachment.

BY STEVE CHARLES, MD

Because vitreous is virtually invisible, I recommend using preservative-free triamcinolone acetate (Triesence; Alcon) to enhance visualization during anterior vitrectomy. Many surgeons still use cellulose sponges for anterior vitrectomy and to test for vitreous in the anterior chamber, within the wound, or on the iris. Leading vitreoretinal specialists have universally recommended against this practice for 3 decades, because it causes marked and instantaneous vitreoretinal traction. Traction on the anterior vitreous is particularly dangerous because of its proximity to the strong, permanent vitreoretinal adherence at the peripheral base, and because the peripheral retina has approximately 1/100th the tensile strength of the posterior retina. The sponge produces traction by wicking and also when the vitreous is lifted for cutting. Sweeping with a spatula produces vitreoretinal traction, because one end of the collagen fibers is mechanically fixed in the wound, while the other end remains adherent to a structurally weak retina at the vitreous base. The surgeon should use a vitreous cutter to shear any posterior connection to vitreous in the wound. In some instances, viscoelastic is recommended to relocate vitreous from the phaco wound into the anterior chamber.

REDUCING VITREORETINAL TRACTION

Vitreous cutters section the vitreous collagen fibers by shearing as the inner needle moves past a port in the outer needle. High cutting rates (preferably at least 1,500 cpm) reduce vitreoretinal traction by decreasing the travel of collagen fibers before the shearing takes place. The smaller the average cut fiber length, the less vitreoretinal traction. Port-based flow limiting, created by the cutter's interrupting flow through the port, reduces pulse flow (which is the amount of fluid that moves through the cutter's port with each open-closed cycle). Less pulse flow equals less pulsatile vitreoretinal traction. Port-based flow limiting is analogous to the anterior chamber stability produced by high-vacuum, low-flow phacoemulsification. The lowest effective suction levels and flow rates are safer, because they produce less vitreoretinal traction from uncut collagen fibers traveling through the cutter. The surgeon should slowly increase the suction or flow rate until the removal of vitreous starts, while always using the highest cutting rate available. One should hold the cutter stationary or advance it into the vitreous while applying suction to reduce traction; it is unsafe to withdraw the probe while the foot pedal is in position 3 with vacuum engaged. The cutter's tip should always be in view.

> "The lowest effective suction levels and flow rates are safer, because they produce less vitreoretinal traction from uncut collagen fibers traveling through the cutter."

Separating infusion and the cutter is essential to reduce turbulence as well as the wound's size; an infusion sleeve should never be used. The ophthalmologist should place the cutter through the pars plana or a sideport incision while maintaining infusion through a sideport incision, never through the phaco wound. A

pars plana approach causes the vitreous to move posteriorly without sweeping the wound, but a two-port (sideport) approach can be used.

For a pars plana approach, surgeons should use a microvitreoretinal blade to make the incision. After creation of a small fornix-based flap away from the 3- and 9-o'clock positions to avoid ciliary nerves and vessels, minimal cautery should be applied as needed, and a caliper is used to construct the sclerotomy 3.5 mm posterior to the limbus. The IOP should be normalized in advance through the sideport and the microvitreoretinal blade advanced until it can be visualized in the pupil. After completing the vitrectomy, the incision should be closed with an absorbable suture.

POSTERIOR VITRECTOMY

When capsular rupture and posterior dislocation of lenticular material occur, the surgeon's primary goal should be to prevent acute vitreoretinal traction. Retinal breaks resulting in retinal detachment are largely preventable with the proper technique. Charles Kelman, MD, recommended posterior-assisted levitation to support the nucleus after capsular rupture, but it is a potentially dangerous technique that displaces the anterior vitreous causing acute vitreoretinal traction. A phaco probe should never be used to remove lenticular material posterior to a capsular rupture, because ultrasonic energy emulsifies hyaluronan but not collagen fibers. Similarly, both irrigation to "float up" the nucleus or using a lens loop to retrieve lenticular material cause acute, unacceptable vitreoretinal traction.

Postponing the posterior vitrectomy and removing dislocated lenticular material for a few days will allow the cornea to clear, the pupil to dilate fully, and the wound to become more watertight. To prevent vitreoretinal traction, the surgeon must perform a pars plana vitrectomy before using the fragmenter to remove lenticular material. Temporarily oversewing the wound with 9–0 or 10–0 nylon will prevent leaks and iris prolapse.

Lenticular material will not damage the retina, and the concept of allowing vitreous to support lenticular material during fragmentation is dangerous. Endoillumination, high-speed cutting (5,000-7,500 cpm), a fundus contact lens, and significant training and experience with pars plana vitrectomy are necessary to safely perform these cases. All vitreous should be removed before the lens material is lifted away from the retina with the fragmenter by means of linear suction. Linear ultrasound is then engaged by the pedal's sidekick function to emulsify the lenticular material. If the fragmenter needle drills into the nucleus, the surgeon can use the endoilluminator to push off the nucleus or use it bimanually to crush the nucleus into the port or chop it. Continuous ultrasound and simultaneous continuous aspiration to prevent scleral thermal damage are the best approach. Perfluorodecalin can be used to float a very dense nucleus into the anterior chamber after posterior vitrectomy.

CONCLUSION

The goal of vitrectomy for a dropped nucleus after cataract surgery is to prevent intra- as well as postoperative vitreoretinal traction leading to a retinal detachment. ■

Steve Charles, MD, is a clinical professor of ophthalmology at the University of Tennessee Department of Ophthalmology Hamilton Eye Institute, and he is in practice at the Charles Retina Institute in Memphis. He is a consultant to Alcon. Dr. Charles may be reached at (901) 767-4499; scharles@att.net.