Vitrectomy for Repair of Retinal Detachment

Meticulous attention to technique and illumination helps make the surgery more effective.

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Most retinal surgeons approach vitrectomy surgery for rhegmatogenous retinal detachment in a similar fashion. Each of us, however, finds a few pearls or tricks that facilitate safe, effective, and expeditious completion of surgery for our patients. This article describes the techniques I use during vitrectomy surgery for repair of rhegmatogenous retinal detachment without proliferative vitreoretinopathy (PVR).

INSTRUMENTATION

I use a BIOM wide-angle viewing system (Insight Instruments, Stuart, FL) with a Carl Zeiss Meditec (Jena, Germany) microscope and the Accurus Surgical System (Alcon Laboratories, Inc., Fort Worth, TX). On the Accurus machine I use only the 3-D vitrectomy setting with the following parameters: cut rate, 2,500-1,500; suction rate, 30-290 mm Hg. Cut rate and suction are adjusted with the foot pedal, and the 3-D setting is not changed throughout the case.

For infusion solution, BSS Plus (Alcon Laboratories, Inc.) is combined with 3 cc of 50% dextrose and 0.3 cc of 1:1000 epinephrine. The same solution is used for all cases to make instructions simple for the circulating nurse and avoid any mistakes in preparation of the infusion solution.

My instrumentation is mostly 20-gauge, except the chandelier light (Dutch Ophthalmic USA, Kingston, NH), which is 27-gauge. I have considered switching to smaller-gauge instrumentation for retinal detachments; however, I have not done so for reasons that are discussed below.

ENTRY

Over time, my conjunctival peritomies for vitrectomy surgery have become smaller and smaller. Generally a 2.5-clock-hour peritomy is made on the temporal side and a 1-clock-hour peritomy on the superonasal side. Cautery is not used during the peritomy, and usually there is no problem with bleeding.

The sclerotomies are placed 3.5 mm posterior to the limbus in phakic patients and 3 mm posterior to the limbus in pseudophakic or aphakic patients (anterior pars plana). A 20-gauge sclerotomy is placed for the infusion at about 1 clock hour inferior to the horizontal meridian. A 5-0 nylon suture is used to tie down the infusion cannula, and the infusion is opened only after clear visualization of the tip. The superotemporal sclerotomy is placed about 1 clock hour superior to the horizontal meridian. The superonasal sclerotomy is placed 1 to 2 clock hours superior to the horizontal meridian, based on the height of the patient’s nose and depth of...
the orbit. Plugs are used when there are no instruments in the sclerotomies.

A chandelier light is used for all vitrectomies performed for retina detachments. Currently I use the 27-gauge dual chandelier made by Dutch Ophthalmic. It is self-sealing and provides two chandelier lights (Figure 1). They are generally inserted at 6:30 and 9:00 o’clock for right eyes and 3:00 and 5:30 o’clock for left eyes.

Inserting the light directly inferiorly makes inferior tilting difficult. A 27-gauge needle attached to a tuberculin syringe is used to make the sclerotomies for the chandelier. One may need to go in and out with the needle two to three times to achieve an optimal opening. The inferotemporal insertion is transconjunctival, and the temporal insertion is transscleral. To maximize illumination, the chandelier cord is taped to the drape so that the tip of the chandelier is perpendicular to the sclera. The length of the tip can be adjusted and usually 4 mm of the tip is inserted into the eye.

VITRECTOMY

The surgical procedure begins with a core vitrectomy. After making sure the posterior vitreous is detached, midperipheral vitrectomy is performed. Thorough shaving of the peripheral vitreous follows with scleral depression. Reduced suction and increased cut rate (with the pedal pressed one-third to one-half of the way down) is used for peripheral vitrectomy to avoid peripheral tears, and minimal suction is used in close proximity to the detached retina.

Peripheral shaving: One of the sclerotomies is plugged, and peripheral vitreous shaving is performed on the side of the plugged sclerotomy. The sclera is depressed with the free hand. I usually use the narrow tip of the scleral depressor rather than the broader tip because it can be moved more readily around the globe without tearing the conjunctiva.

The light of the chandelier is used for illumination. In my experience, retroillumination provides the best visualization of the peripheral vitreous in the areas further away from the chandelier light (nasally and superiorly). One may want to start shaving near one of the chandeliers to get a better idea of the location of the vitreous base and its posterior insertion. Sometimes, especially in myopic patients, vitreous base insertion can be quite posterior. Generally, the vitreous base insertion starts close to the edge of the most posterior break; however, in myopic patients, the vitreous base insertion can occasionally be quite posterior.

A meticulous peripheral vitreous shaving is performed, with a lot of patience. In pseudophakic or aphakic patients, this stage of surgery is easier than in phakic patients. There are a few tips that make peripheral vitreous shaving easier in phakic patients.

One is lowering the intraocular pressure (IOP) to 10 to 20 mm Hg (based on scleral rigidity) during vitreous shaving, which makes scleral indentation easier. With the resistance reduced, the surgeon is able to depress the globe further inward, so that the peripheral vitreous and vitreous base shaving can be performed with the shaft of the vitreous cutter perpendicular to the surface of the retina. In phakic patients, this facilitates peripheral vitreous shaving without touching the lens. It is also more comfortable for patients under monitored anesthesia care.

Mild suction and high cut rate are used at this stage. For less bullous detachments, one may use more suction and a higher cut rate immediately above the depressed area because indentation prevents suction of the retina into the vitrectomy port. However, this must be done very carefully to avoid iatrogenic breaks. Further, one needs to be careful not to depress the retina into the chandelier light or infusion cannula. To avoid this, one may indent more posteriorly and with less indentation.

After completion of vitreous shaving in one half of the eye (180°), a plug is placed in the opposite sclerotomy, and the other half of the eye is done in the same way. The chandelier light provides the necessary illumination so that the surgeon can perform scleral depression.

When vitreous shaving is completed, the peripheral...

Figure 1. The dual chandelier light pipes are inserted on either side of the infusion port.
The retina is examined for retinal breaks with scleral depression for 360°. This is the most important part of the surgery. During the peripheral shaving one may make a mental note of the location of breaks that are visualized. All of the breaks are then marked with sharp-tipped endodiathermy. Tears are converted to round holes with the vitreous cutter to minimize future traction.

If there is no PVR and no peeling, generally no scleral buckle is used, regardless of the number or location of the breaks: no PVR, no scleral buckle. However, there is an exception to this rule; in patients with pathologic myopia and in younger patients a scleral buckle is placed (#42 band and #70 sleeve) to supplement the vitrectomy surgery.

Depending on the location of retinal breaks and size of the retinal detachment, perfluorocarbon liquid (PFCL) (Perfluoron; Alcon Laboratories, Inc.) may be used. Otherwise one may proceed directly to air.

With a posterior break or a small detachment generally no PFCL is used. With large detachments and peripheral breaks PFCL may be used. PFCL is injected above the optic nerve head. Attention is paid to apply minimal pressure during the injection because the shear force of the PFCL can induce retinal breaks. The flow of the PFCL should always be away from the break, so that no PFCL gains access to the subretinal space.

On rare occasions when the retinal detachment is associated with a macular hole, it is important that the flow of the PFCL is towards the nasal retina, away from the macula. For instance, in a right eye with retinal detachment and macular hole, PFCL should be injected with the right hand, so that the flow is toward the nasal retina. Conversely, in the left eye, the PFCL should be injected with the left hand to direct the flow of the PFCL away from the macular hole and prevent it from getting under the macula/retina.

In eyes with a chronic detachment or with a very small retinal break, the force of the PFCL may not be sufficient to push the subretinal fluid out through the break, and the fluid may become entrapped under the anterior retina. In these cases, after the eye is filled halfway with PFCL, if one perceives that the fluid is trapped anteriorly under the retina, a soft-tipped cannula can be used to actively aspirate the subretinal fluid through the peripheral break. If the break is closed, one may open the break with the soft-tipped cannula and aspirate the fluid. This helps to ensure that the retina is completely attached under the PFCL (unless there are membranes).

In cases in which PFCL is not used, air-fluid exchange is performed and subretinal fluid is drained through the retinal break.

Whether with PFCL or air, at this point the retina is generally completely attached. Laser treatment is applied using a curved, lighted laser probe from Alcon or Lumenis (Santa Clara, CA), depending on the surgical facility where the operation is performed.

Laser is applied around the breaks, and then three or four rows of laser are applied posterior to the ora serrata for 360°. Similar to the vitreous shaving procedure, during laser application one of the sclerotomies is plugged, and scleral depression is performed by the surgeon with the hand that is not holding the laser probe.

The peripheral burns do not have to be confluent; they can be spaced one to two burn widths apart. The most posterior row of burns should preferably be posterior to the vitreous base insertion. Otherwise the vitreous can still exert traction posterior to the lasered area and cause redetachment.

The combination of the curved, lighted laser probe and scleral depression allows laser treatment all the way to the ora with excellent illumination in phakic, pseudophakic, and aphakic patients. The chandelier light further facilitates visualization.

After laser application, if PFCL is used, a fluid-air exchange is performed. Using the soft-tipped cannula, first the residual saline fluid above the PFCL is aspirated. Next, the PFCL at the posterior edge of the most anterior break is removed. If the break is far anterior, scleral depression maybe necessary for visualization, and again the illumination from the chandelier light is helpful. Next, the same procedure is repeated at the next more
posteriorly located break, and so on. Any residual sub-retinal fluid is removed through the breaks. When the PFCL level has passed posterior to the most posterior break, the soft-tipped cannula is moved over the optic nerve head, and the rest of the PFCL is removed.

When all the visible PFCL has been removed, the soft-tipped cannula is rinsed with BSS Plus in a beaker filled with saline. This empties the line of residual PFCL bubbles and prevents the heavier-than-water PFCL from dripping back into the eye when the cannula is reinserted into the eye to remove the residual fluid.

While the line is being rinsed, 10 to 15 drops of balanced saline solution are injected on the surface of the retina. The eye is gently shaken (not stirred) a few times, so that the remaining PFCL bubbles mix with the saline, and the mixture is aspirated with the soft-tipped cannula.

At this point, the peripheral retina and the retinal breaks are reexamined under air to ensure that all the breaks have been surrounded and there are no gaps.

CLOSURE

The chandelier lights are removed. The 20-gauge sclerotomies are closed with 7-0 vicryl sutures. Three perpendicular passes are made through each sclerotomy.

After the closure of the sclerotomies, the gas is diluted. We generally use 14% C3F8 gas for retinal detachment surgery. To avoid any mistakes during the dilution process, the scrub nurse hands the gas syringe without a needle so that the surgeon knows that the gas must be diluted prior to injection. The scrub nurse also observes the dilution process. The room air used for dilution is not filtered. An air-gas exchange with 14% C3F8 gas is performed using a chimney technique. In this procedure, a 30-gauge needle is used to inject the gas and a 27-gauge needle, attached to a TB syringe without a plunger, is inserted on the opposite side of the globe to function as a chimney. With these two needles inserted, the assistant or scrub nurse injects the gas into the eye, and the air comes out of the 27-gauge needle connected to the TB syringe. The gas is injected until there is about 5 cc left. The IOP is measured with a Barraquer tonometer, with an IOP between 10 and 15 mm Hg desired.

The conjunctiva is closed with interrupted 6-0 plain catgut sutures, and subconjunctival cefazolin and dexamethasone are injected. An exception to this is if the patient has allergies to cefazolin, in which case no antibiotic is injected. The subconjunctival injection is performed in a bimanual fashion to avoid accidental entrance into the globe due to patient movement as we are reaching the end of the case.

If gas was used, the patient is given prophylactic IOP-lowering drops. The patient is also given erythromycin antibiotic ointment and homatropine-atropine eye drops.

The eye is patched and covered with a shield. Regardless of the location of the breaks, patients are instructed to maintain face-down positioning for 1 week.

Patients are examined on postoperative day 1, and if everything looks fine they are seen again at 1 week. After 1 week, the homatropine and antibiotic ointment are discontinued, and the steroid eye drops are tapered based on the degree of inflammation. If the IOP is elevated, the patient is instructed to take IOP-lowering drops.

CONCLUSIONS

The procedures described above are used for patients with rhegmatogenous retinal detachment without PVR or other complicating factors. As noted at the outset, most retinal surgeons probably perform similar variations on most of these procedures. The few points I have highlighted are techniques that have made the surgery more effective in my hands.

I mentioned above that I have considered using smaller-gauge instrumentation for retinal detachment repair but have so far resisted making the switch. The main reason for my hesitation has to do with the curved, lighted laser probe that I use for detachment surgeries. This has not been available in smaller gauges the past; however, it is now becoming available, and I may transition to 23-gauge instrumentation as a result.

These pointers are offered for the consideration of other surgeons. I would be interested to hear from surgeons who use similar techniques or who find these pearls helpful in their own practice.

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