

Repair of Retinal Detachment Associated With Giant Retinal Tear

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Retina Pearls is a column that appears regularly in Retina Today. The purpose of the column is to provide a forum for retinal specialists to share informative and exciting tips or pearls with regard to specific vitreoretinal surgical techniques, diagnostics, or therapeutics. This installment of Retina Pearls addresses the repair of retina detachment associated with giant retinal tear.



We extend an invitation to readers to submit surgical pearls for publication in Retina Pearls. Please send submissions for consideration to Ingrid U. Scott, MD, MPH (iscott@psu.edu) or Dean Elliott (deliott@doheny.org). We look forward to hearing from you.

- Ingrid U. Scott, MD, MPH; and Dean Elliott, MD

A giant retinal tear is defined as a retinal break that extends for greater than 90° (Figure 1). There is considerable variation in the preoperative features of retinal detachments caused by giant retinal tears. The severity of such a retinal detachment can vary from a 90° tear and no proliferation to a 360° tear and high-grade proliferative vitreoretinopathy (PVR).

Retinal detachments associated with giant retinal tears present several challenges for vitreoretinal surgeons. Typically, the vitreous is adherent to the anterior margin of the tear. Persistent shrinkage of the anterior vitreous can lead to extension of the tear. Without vitreous attachment to the posterior margin, the tear tends to roll, and radial tears can occur. During repair, the posterior margin is prone to slippage and may not readily unroll in the presence of proliferative tissue. PVR is common in these patients. Frequently, these types of detachments occur in the setting of trauma, which imposes its own extraordinary challenges in addition to increasing the risk of PVR.

This article presents some of the surgical techniques that I have found helpful in treating patients with retinal detachments associated with giant retinal tears. Due to

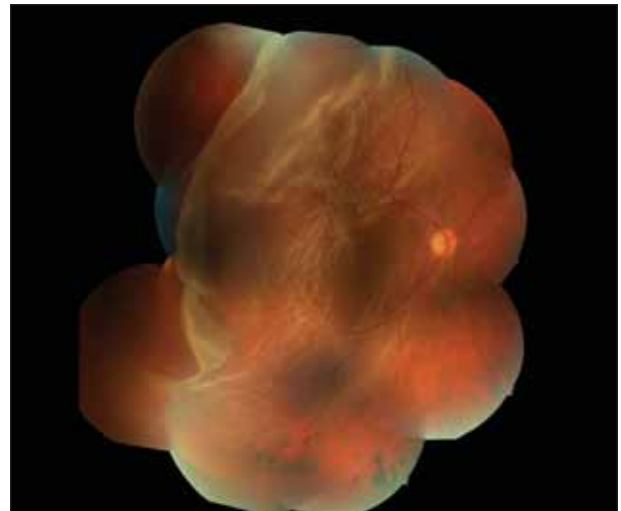


Figure 1. A giant retinal tear, defined as a retinal break that extends for greater than 90°.

the diverse characteristics of such retinal detachments and the numerous treatment strategies possible, each of my cases has been unique. Despite this, the same goal applies to each repair. That is to relieve the traction, unfold the retinal flap, and create a permanent adhesion.

PREOPERATIVE EVALUATION

In order to plan the most appropriate surgical approach, a good history is obtained and a thorough fundus examination with 360° scleral depression of both eyes is performed. I evaluate the extent of the retinal tear, the retinal detachment, and the PVR. I examine the vitreous attachments and the mobility of the posterior flap and look for the presence of additional tears and predisposing pathology such as lattice degeneration. If the patient has a history of trauma, I direct my attention toward other possible ocular or bodily injuries that can affect the surgery and postoperative recovery. I note the clarity of the cornea, aqueous, and lens; in addition I check the stability of the lens and the status of any lacerations.

It is important to examine the fellow eye in these patients because patients with a spontaneous giant retinal tear in one eye are at increased risk for developing a giant retinal tear in the fellow eye. In addition, predisposing connective tissue disorders can sometimes be uncovered in these patients.

PREOPERATIVE DECISIONS

Three important preoperative decisions are made regarding 1) the placement of a scleral buckle, 2) the necessity of a lensectomy, and 3) the type of vitreous substitute to be used.

The use of a scleral buckle for the repair of giant retinal tears without PVR is controversial. Some surgeons advocate vitrectomy alone, and some report success with pneumatic retinopexy for certain cases. A buckle can be used to support the extreme edges of a giant retinal tear, where recurrent traction could result in reopening or extension of the tear. An encircling element can also support the vitreous base of the attached retina where breaks and traction may develop. Disadvantages to placing a buckle include the possibility of redundant retinal folds, fishmouthing, distortion of the globe, an increased tendency for retinal slippage, longer procedure time, and increased patient discomfort.

In general, I choose to place a scleral buckle if the patient presents with high grade PVR or has a tear that extends into the inferior quadrants. I give special consideration to high myopes and try to avoid using a scleral buckle in the presence of scleral thinning. In each case, I usually use a No. 42 encircling element and a No. 72 sleeve.

In phakic patients I consider a lensectomy if there is significant anterior PVR, lens subluxation or a dense cataract. I have never had to remove an intraocular lens implant in a pseudophakic patient to repair a giant retinal tear.

For repairing retinal detachments with giant retinal

tears my vitreous substitute of choice is 14% to 16% perfluoropropane (C_3F_8). I consider silicone oil if an edge of the retinal tear falls between 5 and 7 o'clock, if the tear is greater than 270°, if the patient has to travel by air or to high altitudes, or if I am worried about the patient's compliance and ability to comply with postoperative positioning. I usually remove the silicone oil between 4 and 6 months following repair. One thousand centistoke oil is advantageous in this instance because its lower viscosity allows quicker infusion and removal. In cases with severe PVR, I consider a prolonged or permanent silicone oil tamponade. I prefer to use 5000 centistoke oil in this circumstance, with the hope of reducing the risk of emulsification and silicone oil toxicity.

SCLERAL BUCKLE

In combined buckle-vitrectomy cases, my first step is to create a 360° peritomy at the limbus. I place radial relaxing incisions in the superior temporal and inferior nasal quadrant. I find that positioning the relaxing incisions at these locations reduces the conjunctival scarring over the muscle insertions and that the buckle sleeve is easily covered with conjunctiva at the end of the case. The fascial connections between Tenon's capsule and the sclera are bluntly dissected with curved Stevens scissors in each quadrant. Each of the four rectus muscles is sequentially isolated with muscle hooks, bluntly stripped of its anterior-most connections to Tenon's capsule with a cotton-tipped applicator, then looped with a 2-0 silk traction suture using a fenestrated muscle hook. Each muscle is inspected to confirm that there are no muscle splits. Careful attention is directed toward making sure that there is no incarceration of the superior oblique tendon in the superior traction suture. The surface of the sclera is evaluated in each quadrant for evidence of possible thinning or anomalous vortex veins.

The encircling element, which has been soaked in a solution of 160 mg gentamicin in 30 mL balanced saline solution (BSS, Alcon Laboratories, Inc., Fort Worth, TX), is passed around the globe posterior to the muscle insertions. Closed Neugent utility forceps protect the posterior surface of the muscle as the band is threaded beneath the muscles. The band is secured in the superior nasal quadrant with a sleeve.

One horizontal 5-0 nylon mattress suture, with the anterior and posterior passes 6 mm apart and 5 mm in length, is placed in the center of each scleral quadrant to secure the buckle to the globe. The buckle is positioned to straddle the vitreous base. If the vitreous base is visible, the position on the sclera is identified using an O'Connor localizer while viewing with the indirect ophthalmoscope. The No. 42 band, however, is usually posi-

tioned so that the anterior suture is placed 2 mm posterior to the level of the muscle insertions. The sutures are tied and the buckle is adjusted to create a low to moderate indentation. I then move on to the creation of sclerotomies for the vitrectomy.

I find it is easier to place or modify the position of the scleral buckle prior to making sclerotomies. The globe is firmer for passing sutures, and the scleral indentation aids visualization of the anterior retina and vitreous during vitrectomy. Unfortunately, placing the buckle first enhances the risk of corneal decompensation that can affect visualization during the vitrectomy. The steps I take to reduce this possibility include: keeping the cornea well lubricated with 1% methylcellulose; taking care not to scrape the corneal epithelium against the lid speculum; rotating the globe within the orbit while shielding the cornea with the concave side of the Schepens retractor; and minimizing intraocular pressure (IOP) elevations by manipulating the globe only when necessary, using the minimal effective force on the traction sutures.

VITRECTOMY

If I am not placing a buckle, my procedure begins with a 3-clock-hour temporal and a 1-clock-hour superior nasal peritomy, followed by the creation of sclerotomies.

The position of each sclerotomy site is selected carefully. The infusion sclerotomy is usually placed in the inferior temporal quadrant, in a position where infusion flow is least likely to disrupt the retinal tear. The locations of the superotemporal and superonasal sclerotomies are based upon the depth of the orbit, the contour of the patient's nose, and the site of the retinal tear. I want to be sure that I have maximum access to the tear with the instruments. The sclerotomies are created 3.5 mm posterior to the limbus in phakic patients and 3 mm posterior to the limbus in aphakic and pseudophakic patients with a 20-gauge microvitrectoretinal blade. A semipermanent 6-0 Vicryl suture is used to secure the infusion cannula to the sclera. The infusion is only started once clear visualization of the infusion cannula tip within the vitreous cavity has been confirmed.

The infusion is always composed of BSS Plus (Alcon Laboratories, Inc.). In phakic diabetic patients it is supplemented with 3 mL of 50% dextrose.

I recently transitioned from the Accurus Surgical System (Alcon Laboratories, Inc.) to the Constellation Vision System (Alcon Laboratories, Inc.). Currently, I use 20-gauge instruments to repair retinal detachments secondary to giant retinal tears. Due to recent advancements in 23-gauge instrumentation and illumination products, I look forward to considering 23-gauge surgical techniques in future cases that do not require a scleral buckle.

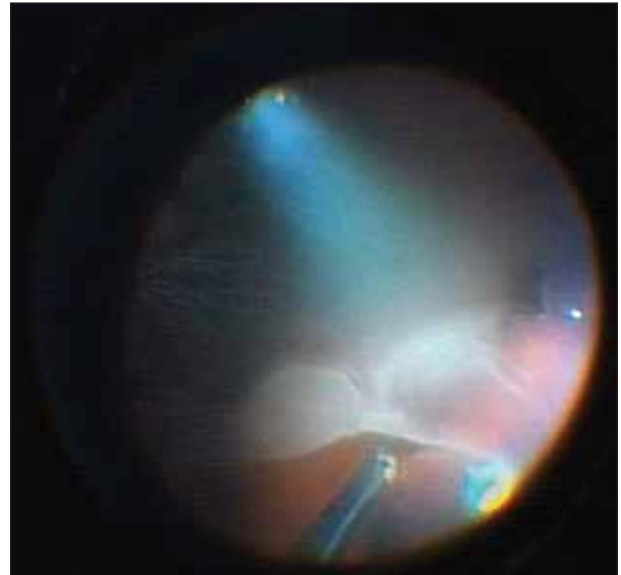


Figure 2. The anterior retinal flap of the giant retinal tear is excised with the vitreous cutter.

Visualization during vitrectomy is achieved with the BIOM (Insight Instruments, Stuart, FL) wide-angle viewing system and a xenon endoilluminator. I use a chandelier only in cases requiring bimanual membrane dissection or when there is no assistant available. To improve visualization during posterior membrane dissection I use a high magnification, flat fundus lens and angled prism lens mounted on a fixed scleral lens ring.

The cortical vitreous is removed using the 3-D core vitrectomy submode with a biased open (core) duty cycle. In this mode, the cut rate decreases and the vacuum increases with depression of the foot pedal. The cut rate is set between 5,000 and 3,500 cuts per minute (cpm), and the vacuum is set between 50 mm Hg and 300 mm Hg. I use a slower cut rate and higher suction for the core vitrectomy.

In the presence of a giant retinal tear, the detached retina can be extremely mobile. Techniques I use to prevent the retina from entering the vitreous cutter include pointing the port away from the mobile retina, shielding the mobile retina with the light pipe in pseudophakic or aphakic eyes, and decreasing the flow with depression of the foot pedal.

In giant retinal tears with PVR, the epiretinal membranes are stripped starting at the optic disc and moving up to and in the direction of the vitreous base using vitreoretinal picks and intraocular forceps. Occasionally subretinal membranes may be causing traction and may have need to be dissected.

In nearly all cases of retinal detachment associated with giant retinal tear, a meticulous anterior vitreous dis-

section is required. I pay particular attention to the vitreous attachments at the ends of the retinal tear. Visualization of the vitreous base is facilitated by the presence of an encircling element. Scleral depression may also be required but can be tricky with a preplaced scleral buckle. I find it helps to lower the IOP and to use the smallest tip of the depressor. To trim the vitreous base I switch to the vitrectomy shave mode. The parameters of this mode are proportional vacuum up to 250 mm Hg and a set cut rate of 5,000 cpm using a biased-closed (shave) duty cycle. The high cut speed and biased-closed duty cycle allow precise shaving of the anterior vitreous and can reduce the risk of traction on the peripheral retina. The anterior vitreous is removed by holding the port close to the retina at a 90° angle. It is important to maintain and advance the port within the vitreous.

I excise the anterior retinal flap if it can be done safely without damage to the retinal pigment epithelium, choroid, or lens (Figure 2). The edges of the retinal tear are then marked with intraocular endodiathermy (Figure 3).

I use perfluorocarbon liquid (PFCL; Perfluoron, Alcon Laboratories, Inc.) to displace the subretinal fluid, unroll the posterior margin of the retinal tear, and stabilize the macula during anterior membrane dissection.

The PFCL is injected from a syringe into the eye via a 23-gauge cannula. The stream of the PFCL is directed away from the giant retinal tear and toward the optic nerve. The PFCL is infused slowly while the eye is tilted in the direction opposite the tear. This reduces the chance of iatrogenic retinal breaks, retinal folds, loculated subretinal fluid, and subretinal PFCL.

As I am injecting the PFCL, I monitor the progress of the retinal flattening. In cases of PVR, additional proliferative tissues may be encountered as the level of PFCL advances. In these instances, the PFCL perfusion is halted and the membranes are delaminated from the retinal surface. The anterior dissection is usually aided by the posterior traction applied by the PFCL. If the edge of the tear does not uncurl readily and there is no PVR, it may be possible to smooth the tear into the right configuration using a silicone-tipped instrument. Manipulation of the retina can be performed under PFCL. Sometimes, however, it is necessary to remove a small quantity of PFCL so that the meniscus lies posterior to the uncured edge. Usually, as the PFCL is gently reinjected into the eye, the edge of the tear flattens out correctly. PVR may develop at the edge of the retinal tear, preventing it from uncurling. If the edge cannot be flattened despite thorough membrane dissection, a retinectomy may be necessary. Once the edge of the tear is flat, I fill the vitreous cavity with PFCL. I do not

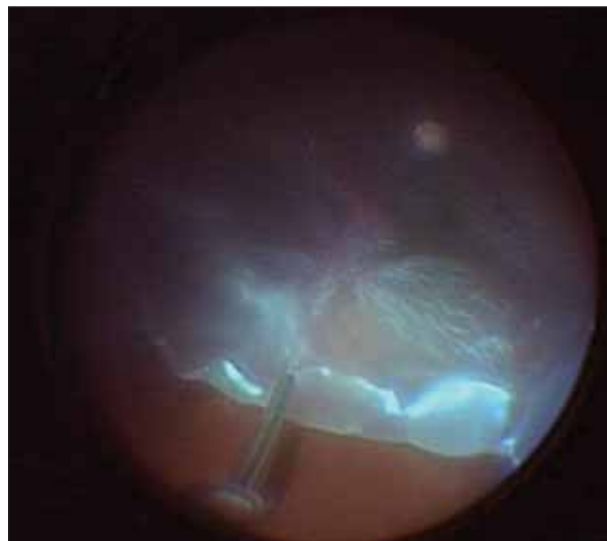


Figure 3. The edges of the retinal tear are marked with intraocular diathermy prior to infusion of perfluorocarbon liquid.

allow the tip of the infusion cannula to come in contact with the PFCL because this tends to stir up numerous small bubbles, which have the potential to migrate into the subretinal space.

PHOTOCOAGULATION

At this point I perform the endophotocoagulation. Three confluent rows of treatment are applied along the margin of the tear and around any additional retinal breaks. I am careful to include the extreme margin of retina at the tear and carry the laser treatment around the edges of the giant retinal tear up to the ora serrata. A tight scatter pattern of photocoagulation is applied between the posterior margin of the vitreous base and the ora for 2 clock hours on either side of the tear (Figure 4). In severe PVR, 360° of scatter endophotocoagulation is performed from the vitreous base to the ora.

I use a curved laser probe and scleral depression to decrease the need for indirect laser application in phakic patients. An illuminated endolaser probe or the chandelier will free up one hand for scleral depression. There is usually no need to depress in the area of the retinal tear. Caution is required to prevent the creation of a pathway for PFCL under the retina when the sclera is depressed at the edges of the tear. Sometimes it is necessary to add the anterior laser treatment under air.

If silicone oil tamponade is anticipated, I perform a peripheral iridectomy in aphakic patients, patients with anterior chamber lens implants and pseudophakic patients with an inadequate intraocular lens-capsular-iris diaphragm, prior to air-fluid exchange. The iridecto-



Figure 4. The laser treatment is applied to the margin of the giant retinal tear and in a scatter pattern between the posterior margin of the vitreous base and the ora on either side of the tear using the curved illuminated laser probe.

my is created at 6 o'clock, as peripherally as possible, with the vitreous cutter set to 200 cpm and the iris supported with diamond-dusted forceps.

AIR-FLUID EXCHANGE

An air-fluid exchange is performed using a silicone-tipped extrusion cannula. The eye is tilted in the opposite direction from the tear. The layer of BSS anterior to the PFCL level is aspirated. Any anterior flaps of retina are dried. Accumulation of subretinal fluid in this location can result in retinal slippage. The PFCL is then removed down to the level of the tear's posterior edge. The posterior edge is dried using gentle suction before the remaining PFCL is aspirated from the posterior vitreous cavity. The surface of the retina is flushed with a few drops of BSS prior to the final aspiration of fluid. While the extrusion needle is in the eye, continuous low aspiration helps to reduce the risk of PFCL in the cannula dripping back into the eye. If I encounter any retinal slippage, I can usually reposition the edge of retina more anterior with a silicone-tipped instrument. If there is considerable slippage, the retina must be flattened again and the air-fluid exchange repeated. If there is significant slippage of the posterior margin during the air-fluid exchange, I am more likely to consider silicone oil tamponade.

The next step of the procedure involves closing the sclerotomies and exchanging the air for either long-acting gas or oil.

GAS OR SILICONE OIL INFUSION

C_3F_8 gas diluted to 14% to 16% is flushed through the infusion while one of the superior sclerotomies is kept open with forceps. I use 14% C_3F_8 gas in smaller, superior giant retinal tears and 16% C_3F_8 in other cases.

Silicone oil is injected through a superior sclerotomy. The infusion of silicone oil is directed away from the giant retinal tear, while the eye is rolled slightly in a direction opposite the giant retinal tear. The IOP is carefully monitored and maintained at a normal level by decreasing the air infusion by increments of 5 mm Hg until there is no air infusion. The vitreous cavity is filled to the level of the lens-iris diaphragm.

CLOSURE

The sclerotomies are closed with 7-0 Vicryl sutures, and the infusion cannula is removed. IOP is adjusted to approximately 10 mm Hg. If silicone oil was used, the surface of the globe is irrigated well with BBS. If a buckle was placed, the ends are trimmed and the silk traction sutures are removed. The conjunctiva is closed using interrupted 7-0 Vicryl sutures. Subconjunctival dexamethasone (10 mg/1 cc) and cefazolin (100 mg/1 cc) are administered. I use subconjunctival vancomycin instead of cefazolin in patients who are allergic to penicillin.

The patient is asked to position prone or on the side opposite the tear for the first night. If gas is used, the patient is instructed to continue positioning on the side opposite the tear for 7 more days.

CONCLUSIONS

A number of variables are at play in the repair of retinal detachments associated with giant retinal tears. The techniques that I have described are used in patients without complicating factors other than PVR. There are few sound data to support the treatment strategies and techniques that I have described. My comments are based mainly on personal experience and limited evidence in the literature. I invite questions or comments from others who use similar strategies or have experience with other effective techniques when treating retinal detachments associated with giant retinal tears. ■

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