REVIEW ARTICLE

Giant Retinal Tears

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Giant retinal tear (GRT) is defined as peripheral break extending through 900 or more of the retinal circumference in which the vitreous gel is attached essentially to the anterior flap thereby allowing independent mobility of the posterior edge of tear. GRT needs to be differentiated from Giant dialysis, which is retinal disinsertion from the ora serrata with 90 degrees or more of circumferential extent. These conditions differ markedly in their vitreoretinal relationships and prognosis. In dialysis vitreous bridges the dialysis gap and is attached to the posterior margin of the dialysis and posterior vitreous detachment is absent thus preventing it from inversion. Conversely in giant tear vitreous remains strongly attached to the anterior margin of the tear and the posterior flap, without any vitreous adhesion is free to move and inverts towards disc due to gravity. Dialysis is generally amenable to buckling where as giant tear requires highly specialized techniques especially for unfolding the inverted retinal flap.

Schepens described three types of giant retinal tears: Idiopathic seen in 70%, traumatic in 20% and in 10% at the posterior edge of chorioretinal degeneration (1). Giant retinal tears (idiopathic or traumatic) occur more frequently in males. Myopia was a frequent finding, with approximately 40% of eyes in this series having more than 8 diopters of myopia. Fellow eyes of patients with giant tear are at considerable risk of retinal breaks, giant tears and retinal detachment. In a study of 226 patients with giant tears, 51 % developed retinal tears in the fellow eye including 13% who developed Giant tears (2).

The pathogenesis of idiopathic GRT is a liquefying process of the central gel forming a cavity while there is relentlessly progressive shrinkage of the remaining gel in. the vitreous base exerting traction on the base and the peripheral retina causing GRT. Posterior flap folds because it is not sustained by intact vitreous face. Radial extensions may occur generally at either end of the tear and if large in size may present difficulties in surgical repair.

Giant retinal tears resulting from blunt trauma occurs along the posterior border of vitreous base and may be associated with avulsion of vitreous base (3). Giant tears also occur along the posterior edge of large areas of chorioretinal scarring especially in eyes with acute retinal necrosis (4).

Giant retinal tears have been known to occur frequently in sticklers syndromes (5), marfan's syndrome and Ehler-Danlos syndrome. GRT have also been noted as a complication of attempted removal of intravitreal nuclear fragment during cataract surgery by the anterior segment surgeon using the limbal approach deep vitrectomy (6). They have also been described as a complication of pars plana vitreous surgery. This could be due to detachment of the residual peripheral vitreous after surgery combined with preexisting or surgically induced retinal pathology, the use of blunt instrumentation and invariable tract-ional forces exerted during from plana vitreous surgery (7).

Preoperative Evaluation

Careful indirect ophthalmoscopy of both eyes should be done and the size of the tear, mobility of the posterior flap, radial extension if any, amount of vitreous liquefaction, abnormal areas of vitreous condensation

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and the extent of proliferative viteoretinopathy (PVR) should be noted.Preoperatively, extension of a giant tear, possibly with creation of radial extensions may occur with violent head movement, and patients should not be subjected to extensive manipulation or physical activity.

Surgery

Since the advent of pars plana vitreous surgery giant tears have stimulated the development of many innovative approaches to unroll the flap of the tear and the results of surgery for GRT have steadily improved. The introduction of heavier water perfluorocarbon liquid (PFCL) by Chang *et al* supplanted all of the previous techniques (retinal sutures, tacks, prone fluid air exchange) for unrolling and repositioning inverted giant retinal tears (8). PCFLs have a higher specific gravity than water with relatively low viscosity and assume a liquid form at room temperature. The retinal flattening forces exerted by these compounds are significantly higher than those exerted by either air or silicone oil. PFCLs allow for precise, controlled and accurate repositioning of the retina with minimal manipulation. The surgical principles involved in the management include complete vitrectomy, unfolding of the retinal flap, sealing the tear with chorioretinal adhesion and providing long term intraocular tamponade.

Vitrectomy

Good results in the management of giant retinal tears greatly depend on removal of as much vitreous as possible. A thorough vitrectomy of the vitreous base around its entire circumference, extending close to the surface of pars plana and peripheral retina, is mandatory in the management of a giant tear. It is important to remove the condensed vitreous gel attached to the anterior edge of giant tear, otherwise this might be pushed posteriorly by air infusion and cause slippage of the posterior retinal flap after it has been unfolded.

Meticulous removal of the peripheral gel permits a more complete replacement of the vitreous volume by gas or silicon oil, decreases the likelihood of new breaks along the posterior insertion of the vitreous base, and diminished the occurrence of anterior PVR.

Optimal visualization of the vitreous base is vital for its dissection. This is aided by maximal pupillary dilatation either pharmacologically, or with help of iris retractors, scleral indentation with cotton topped application by the assistant or by using wide angle viewing system (panoramic viewing). Wide-angle viewing allows the surgeon to assess the overall, panfundoscopic vitreoretinal relationships and enhances visualization of mid peripheral and anterior vitreoretinal pathology. Thus it's an ideal surgical viewing system in cases of Giant Retinal Tears.

Lens Management

The main indications for lens removal in giant tears are cataract, lens subluxation and the presence of proliferative vitreoretinopathy. Controversy remains as for need for clear lens extraction in fresh giant tears. The advantages of lens removal are visualization of the edge of the tear during fluid-air exchange, and improved access to the region of the vitreous base. The use of wide angle viewing systems for giant tear surgery improves the ability to see the peripheral retina under air in phakic and pseudophakic eyes. Thus, lensectomy to increase fundus visualization is not necessary. Many eyes with giant tears are highly myopic have large axial length and have broader parsplana region. This anatomic variation allows adequate shaving of the vitreous base with less risk of lens touch. The clears lens should be removed when it impedes adequate peripheral vitreous dissection. It appears reasonable to conclude that the surgeon should not compromise the initial surgery for giant tear by diminishing other surgical goals to preserve the lens. Some surgeons recommend phacoemulsification and intraocular lens implantation because it makes possible optimal visualization for thorough debulking of the vitreous base and provides excellent visualization postoperatively for photocoagulation and avoids subsequent cataract surgery (9).

After vitrectomy attention should be turned to the epiretinal membranes especially near the posterior edge of the giant tear. Once the retina is mobilized by membrane peeling, the inverted retinal flap is unfolded

to expose the optic disc and posterior pole and liquid perfluoroactane is slowly injected over; the optic disc. Care is taken to prevent the injection of multiple bubbles by ensuring that the tip of injection needle is always within the PFCL bubble and the size of the bubble is gradually increased as subretinal and vitreous cavity fluid is displaced anteriorly and out of the eye. With the retina fully attached eight to ten rows of endophotocoaguloation of 200-500 micron spot size are applied to the posterior edge and anterior retinal flap and five rows are placed in the fundus periphery not involved in giant tear.

The perfluorocarbon liquids can then be directly exchanged with gas or silicone oil. A flute needle with a soft silicone tip is positioned at the edge of the giant break as air-enters the vitreous cavity. The anterior retina is flattened as the bubble descends towards the perfluorocarbon meniscus. Fluid should be aspirated at the edge of the break, at the air/perfluorocarbon interface, to prevent posterior slippage of retina. Slippage may occur when persistent subretinal fluid is trapped posteriorly by descending air bubble causing the retina to slide. It's important to maintain adequate intraocular pressure during PFCL air exchange to prevent posterior slippage of retina. A direct silicone oil perfluorocarbon exchange can be done to decrease the chances of slippage of retina if surgeon is not sure of tear edges being dry. Since PFCL silicone oil have; relatively similar surface tension, there is preferential attraction between the two interfaces. This characteristic reduces the problem of having an aqueous layer between the two interfaces.

A silicone oil infusion pump should be used during the exchange. With panoramic viewing, aspiration of perfluorocarbon liquid should be started at the edge of the giant tear using a silicone tipped blunt needle. As the silicone oil interface descends and covers; the edge of the tear, the liquid overcomes any residual intrinsic elastic forces that may result in posterior slippage. The aspirating tip is then placed just below the anterior surface of the PFCL as the oil continues to fill the vitreous. If the surgeon is sure of total vitreous base removal and drying of free retinal edges. Air-PFCL exchange followed by gas/silicon oil exchange is recommended.

Complications

Posterior slippage of a giant tear after successful reapproximation indicates residual fluid at the margin of the tear and of requires a repeat PFCL exchange with careful anterior drainage. Incidence of intraoperative slippage was noted in 49% to 10.7% of cases in two trials (10, 11). Postoperative slippage may also occur and was noted in 1.5% of cases. This can be managed by careful implementation of head positioning and by additional posterior coverage with postoperative laser.

Retention of PFCL bubble in vitreous cavity: Experimental studies have shown damaging retinal changes after 1 week with of perfluoro N-octane. Retinal damage, especially macular damage, may occur within 1-3 days of retention of a PFCL bubble. Hence, its almost total removal is prudent. Supine position in a patient with leftover PFCL bubble should be prohibited for fear of macular damage and also prone position need to be avoided in aphakia for fear of corneal damage. Removal of liquid PF -Octane from vitreous cavity is simplified by allowing the eye to remain air filled for approximately five minutes after removal of visible droplets. The high vapor pressure of this substance allows for evaporation from retinal surface and any PFCL entrapped elsewhere in the periphery gravitates to the posterior pole from where it can be easily removed. The most important postoperative complication in giant tear surgery is recurrent detachment principally due to development of proliferative vitreoretinopathy reported to occur in 49.4% and 31.5% of patients in two separate studeis (l0,11). Visually significant postoperative epimacular membranes developed in 7.4% and 15% of patients in these series and a frequent cause of reoperation after otherwise successful repair of giant tear.

Role of Scleral Buckling

Scleral buckling in the era of modern pars plana vitreous surgery and PFCL surgical techniques in cases of giant retinal tears without PVR is controversial. There is a general consensus in favor of buckling in giant tear cases with PVR. Scleral buckling along with vitreous surgery has traditionally been done to reduce the chances of redetachment. The proposed mechanisms are: it

reduces early and late traction ensuring GRT will remain closed and will not extend, supports areas where unrecognized retinal breaks develop after surgery away from GRT, counteracts later traction on peripheral retina from contracture of residual vitreous gel by epiretinal membrane. Buckling can complicate the closure of GRT by causing a gaping of retinal tissue, redundant retinal folds, fishmouthing and increased tendency of slippage of retina posteriorly. In a prospective randomized controlled trail conducted by us we used 3600 degree 9mm silicone band in 10 cases and none in 11 (12). In cases of GR T without PVR the success of primary surgery was 100% in scleral buckle group (SB) as compared to 37.5% in no scleral buckle group (NSB). Resurgeries were required in 8 out of 11 cases in NSB group whereas only one required re-surgery in SB group. The final visual acuity regained in SB group was better than NBS group as the re- surgeries done were less in this group. Buckle sutures and buckle should be placed at the beginning of the surgery but not tied. They should be tied after the PFCL- air exchange to reduce the chances of slippage of retina and ensure proper fill of silicone oil. The height of the buckle should be relatively low and broad to reduce the formation of radial folds as the circumferential dimension of the globe is shortened.

Giant tears without an inverted flap

These can be managed by conventional buckling surgery with cyrotherapy, low broad scleral buckle throughout the length of the retinal break and drainage beneath the elevated flap. Zone of cyrotherapy should extend beyond the edges of the tear to prevent recurrent detachment due to fluid passing posteriorly from beneath the anterior edge of the tear. Low buckling is preferred to decrease the anteroposterior opening of the break and for the same reason buckling effect should extend well posterior to the original posterior edge of the tear.

Management of fellow eyes

Idiopathic giant retinal tears have high incidence of retinal pathology in the fellow eye. Freeman (2) noted several high-risk characteristics in his study on fellow eyes of giant retinal tears: high myopia (>-10-00 diopters), increasing white with pressure, and increasing condensation of the vitreous base. The studies of fellow eyes indicate that increasing condensation of vitreous base and subsequent traction plays a major role in the pathogenesis of giant retinal tears. The main objective in management of high-risk fellow eyes is to relieve this vitreous traction. It is recommended that all the high-risk fellow eyes should have prophylactic scleral buckle. A prophylactic scleral buckle in phakic eye with an attached retinal is challenging and not without complication. 360 degree retinopexy, either in the form of cryopexy or laser photocoagulation may be considered but is not recommended for unrelieved traction might still cause giant tears along the posterior edge of photocoagulation or cryo. The role of preumatic retinopexy in the management of giant retinal tear requiring vitreoretinal surgery is controversial and we do not recommend it.

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