GIANT RETINAL TEAR

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All about the Eye

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GIANT RETINAL TREATMENT

1. How do you classify giant retinal breaks? Describe its etiology, pre-operative evaluation and principles of management. (2+2+2+4) D2011
2. Write clinical features and management of retinal detachment with giant retinal tear in a 22 year Old boy with Marfan's Syndrome 3+7 J2013

Definition

- A giant retinal tear (GRT) is defined as full-thickness circumferential tear/retinal break of more than 90 degrees (3 clock hours) of the retina associated with vitreous detachment.

Characteristics

(1) They rapidly lead to extensive retinal detachment,
(2) Posterior flap has a tendency to roll over, fold or invert,
(3) They have increased risk of proliferative vitreoretinopathy,
(4) They require meticulous surgery to prevent complications,
(5) They have several ocular and systemic associations,
(6) Fellow eye involvement occurs frequently, and
(7) Detachments occur frequently in these cases.

Classification

- Scott classified GRTs into three types based on their location with emphasis on pathophysiology and required management:
  1. **Equatorial GRTs** are most common and have posterior extensions , give posterior flaps extra mobility and have tendency to invert or fold
  2. **Equatorial with posterior extensions**
  3. **Oral type** is least common.

- Schepens classified GRTs on the basis of etiology into
  1. Idiopathic
  2. Traumatic
  3. lattice-related
  4. Iatrogenic types. Iatrogenic GRTs are known to occur after heavy diathermy or photocoagulation, pars plana vitrectomy (PPV), and refractive surgeries.

- Based on the configuration, GRTs may be classified as—
  (1) GRT without detachment
  (2) GRT with detachment with (a) at posterior flap, (b) rolled posterior flap (c) inverted posterior flap
  (3) GRT with detachment with associated posterior extensions (radial rips) at or within the tear margin.

Etiology, risk factors & associations

<table>
<tr><td>Idiopathic 70%</td><td rowspan="2">Ocular conditions
1. Ocular trauma 20%
➢ Closed globe trauma
➢ Open globe trauma
2. High myopia
3. Chorioretinal degeneration 10%
4. Aphakia
5. Pseudophakia
6. Hereditary vitreoretinopathies
7. Buphthalmos (rare)
8. Microspherophakia (rare)</td></tr>
<tr><td>Systemic conditions
1. Marfan's syndrome
2. Stickler syndrome
3. Wagner syndrome
4. Ehrler Danlos syndrome</td></tr>
<tr><td colspan="2">Iatrogenic/ post intra-ocular surgery
1. Cataract surgery- as a complication of attempted removal of intravitreal nuclear fragment during cataract surgery by the anterior segment surgeon using the limbal approach deep vitrectomy.
2. 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,</td></tr>
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3. **Vitrectomy** - the use of blunt instrumentation and invariable tractional forces exerted during from plana vitreous surgery
4. **Refractive Surgery**

Pathogenesis

1. Giant retinal tears occur from liquefaction of the central vitreous associated with peripheral vitreous condensation with concomitant traction in the region of the vitreous base.
2. The neurosensory retina tears circumferentially in the area of the posterior vitreous base.
3. The vitreous gel remains attached to the anterior flap of retina, and the torn posterior retina moves freely and can fold upon itself.

- Giant retinal tear occurs due to dynamic vitreous traction at areas of retinal abnormality such as WWOP.
- These areas have dense vitreous condensation and these increase in extent and density over time.
- The posterior border of WWOP is well defined with thick inelastic vitreous attachment.
- In such eyes, central vitreous liquefies early leaving a shrunken gel anteriorly and thin layer of vitreous cortex posteriorly.
- This gel contains dense bands attached anteriorly.
- PVD usually stops at this border leading to focal vitreoretinal adhesion and traction is subsequently the causes of neurosensory retinal tear.
- The anteriorly directed vitreous traction then "rips" the abnormal retina circumferentially.
- Thus, the pathogenesis of GRT is similar to that of a smaller tear with difference only in the area of retinal abnormality.
- Giant retinal tears are characterized by intense ocular inflammation due to blood retinal barrier breakdown.
- Large RPE surface predispose to greater release of RPE cells which undergo transdifferentiation into myofibroblasts.
- Initially, the posterior flap is freely mobile but as PVR sets in; it becomes stiff and begins to roll.
- If left untreated, the size of GRTs increases with subsequent extension of the RD.

Differential diagnosis

Giant Retinal Tear	Giant retinal dialysis
GRT is full-thickness circumferential tear/retinal break of more than 90 degrees (3 clock hours)	GRD is retinal disinsertion from the ora serrata with 90 degrees or more of circumferential extent and vitreous remain attached to the posterior margin of the break
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 and intrinsic retinal elasticity.	Vitreous bridges the dialysis gap and is attached to the posterior margin of the dialysis therefore the retina is not very mobile. Posterior vitreous detachment is absent, This prevents the posterior margin in GRD from inverting
Giant tear requires highly specialized techniques especially for unfolding the inverted retinal flap	Dialyses can often be repaired with peripheral cryotherapy, laser or a scleral buckle
Outcomes are not as good as GRD	Good prognosis

Clinical diagnosis

1. Presenting visual acuity depends on status of macula and configuration of GRT flap in relation to macula.
2. Macula-off RDs usually have a visual acuity between counting fingers (CF) and light perception (LP).
3. If GRT flap covers the macula, poor vision is the norm.
4. Tobacco dusting in vitreous cavity is present in all cases.
5. Vitreous hemorrhage may also result if tear involves the retinal vessels.
6. Most GRTs have less than 180 degree circumferential extent.
7. Location of GRT varies with inferotemporal and superonasal quadrants being commonly involved in traumatic cases.
8. GRTs have associated RRD in about 44% to 92% cases.
9. The posterior flap may invert over the optic disc or the macula, thereby the full extent of the associated RD may not be ascertained.
10. Posterior tears or radial rips may exacerbate the inversion of flap.
11. PVR (40-50% of GRT) occurs quickly and frequently because of large area of RPE being exposed and increased liberation of RPE cells into vitreous cavity. It is more common in traumatic and long-standing detachments
12. Fundus of the fellow eye should be examined thoroughly to look for any predisposing lesion and features of high myopia.
13. Hypotony develops quickly due to increased uveoscleral outflow.

Diagnostic procedures

1. B scan ultrasonography
   i. USG B scan of the posterior segment helps in determining the location and extent in cases with vitreous hemorrhage.
   ii. Also it can help to differentiate between GRT and GRD.
   iii. A classical **"double linear echo"** sign is seen in GRT with two high-amplitude linear echoes, one extending from the optic disc and other usually lying almost parallel to it (inverted posterior flap).
   iv. PVD and inverted posterior flap can be seen, which helps in differentiating it from GRD.
2. Axial length of the other eye should be done to determine if high myopia is the cause.
3. Systemic examination should be done for relevant associated syndromes**.**

Preoperative Evaluation

- Careful IDO of both eyes should be done

1. Size of the tear, 2. Mobility of the posterior flap, 3. Radial extension if any,	4. Amount of vitreous liquefaction, 5. Abnormal areas of vitreous condensation 6. And the extent of proliferative vitreoretinopathy (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.

Management

- Management of GRTs includes

Procedure	Indication
1. Use of laser photocoagulation	Laser is effective when the retina is attached. The edge of the tear is treated with two to four rows of photocoagulation, with emphasis to the radial edges of the tear, treating anteriorly up to the ora serrata.
2. Scleral buckle	Scleral buckle is effective if the edge of the tear is not inverted, and is a good option in children to preserve the lens and limit positioning issues. Support of the edges of the tear is important, as is thorough cryotherapy or photocoagulation of the tear edges
3. Primary vitrectomy with perfluorocarbon liquids (PFCL)	Primary vitrectomy with intraoperative use of PFCL liquids and gas or silicone oil tamponade is necessary to unroll and reposition a folded retina
4. Vitrectomy with scleral buckle	if PVR is present, vitrectomy with a scleral buckle can be used
5. Combined phaco/vitrectomy	if a significant cataract is present, combined phaco/vitrectomy is warranted.

Surgery

- Prior to the advent of pars plana vitrectomy (PPV), numerous strategies were adopted for management of GRT associated RRD like **binocular occlusion, retinal incarceration, retinal tacks, trans-scleral suturing and scleral buckling.**
- With introduction of PPV, flap manipulation and complete vitrectomy became possible under direct wide-field visualization.
- 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.

A. Vitrectomy

1. Pars plana vitrectomy has a higher success rate than previously attempted surgeries and is the treatment of choice for GRT.
2. Conventional 20-G vitrectomy with PFCL use has been reported to have up to 94% final attachment rates in GRT associated RD. 29, 30 25-gauges PPV can achieve excellent attachment rates in eyes with GRT associated retinal detachment.
3. Smaller-gauge vitrectomy has evolved over time and has several advantages compared to conventional 20-G surgery including
   i. lesser retinal mobility,
   ii. lesser vitreous traction,
   iii. easy manipulation of tissues and PVR management,
   iv. other than improved wound anatomy
   v. and reduced postoperative pain and inflammation.
4. A thorough vitrectomy of the vitreous base around its entire circumference is mandatory in the management of a giant tear.
5. It is important to remove the condensed vitreous gel attached to the anterior edge of giant tear.
6. Meticulous removal of the peripheral gel permits 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 decreases the occurrence of anterior PVR.

7. Optimal visualization of the vitreous base is vital for its dissection.
8. This is aided by maximal papillary dilatation pharmacologically, or with help of iris retractors, scleral indentation with cotton tipped applicator by the assistant or by using wide angle viewing system (panoramic viewing).
9. Epiretinal membranes and proliferative tissue especially near the posterior edge of the giant tear should be removed thoroughly with the help of intravitreal forceps and vitrectomy cutter.

B. Lensectomy/ Lens aspiration

1. The main indications for lens removal in giant tears are **cataract, lens subluxation and the presence of anterior proliferative vitreoretinopathy.**
2. Controversy remains as for need for clear lens extraction in fresh giant tears.
3. 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.
4. 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.
5. Many eyes with giant tears are highly myopic have large axial length and have broader pars plana region.
6. This anatomic variation allows adequate shaving of the vitreous base with less risk of lens touch.
7. The clears lens should be removed when it impedes adequate peripheral vitreous dissection.

C. Role of PFCL

1. The introduction of perfluorocarbon liquid (PFCL) supplanted all previous techniques for unrolling and repositioning inverted giant retinal tears.
2. PCFLs having a high specific gravity with relatively low viscosity allow for precise, controlled and accurate repositioning of the retina with minimal manipulation
3. Once the retina is mobilized by membrane peeling, the inverted retinal flap is unfolded to expose the optic disc and posterior pole and liquid perfluoro-octane is slowly injected over; the optic disc.
4. 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.

D. Endophotocoagulation/cryotherapy

1. With the retina fully attached under PFCL eight to ten rows of endophotocoagulation of 200-500 micron spot size are applied to the posterior edge and anterior retinal flap and at least five rows are placed in the fundus periphery not involved in giant tear.
2. Cryotherapy can also be used to treat the GRT edges up to the ora, especially if it is very anterior.

E. Gas -Fluid exchange

1. The perfluorocarbon liquids can then be directly exchanged with gas or silicone oil.
2. 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 may also be done.
3. A flute needle (Janowitz) with a soft silicone tip is positioned at the edge of the giant break as air-enters the vitreous cavity.
4. The anterior retina is flattened as the bubble descends towards the perfluorocarbon meniscus.
5. Fluid should be aspirated at the edge of the break, at the air/perfluorocarbon interface, to prevent posterior slippage of retina.
6. Slippage may occur when persistent subretinal fluid is trapped posteriorly by descending air bubble causing the retina to slide.
7. It's important to maintain adequate intraocular pressure during PFCL air exchange to prevent posterior slippage of retina.

F. PFCL-Oil exchange

1. Alternatively a direct silicone oil perfluorocarbon exchange can be done to decrease the chances of slippage of retina.
2. Both PFCL and silicone oil being hydrophobic extrudes fluid at the PFCL-oil interface.
3. Presence of fluid at the PFCL–air interface at the area of tear allows entry of fluid into sub retinal space and cause tear slippage.
4. A silicone oil infusion pump should be used during the exchange.
5. With panoramic viewing, aspiration of PFCL liquid should be started at the edge of the giant tear using a silicone tipped blunt needle.

6. 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.
7. The aspirating tip is then placed just below the anterior surface of the PFCL as the oil continues to fill the vitreous cavity.

G. Role of encircling element

1. The use of encircling scleral band in GRT is controversial.
2. Some studies have reported higher redetachment rates with encirclage due to redundant retinal folds, fish-mouthing and increased posterior retinal slippage.
3. While others report a lack of encircling element to be associated with a higher rate of redetachment.

- **Management of the other eye**

1. While GRTs are fairly rare, about 12.8% of patients develop bilateral GRTs.
2. Therefore, it is important to watch and manage the other eye to prevent bilateral GRTs.
3. Characteristics that suggest a high risk for GRT include myopia over six diopters, white without pressure, and vitreous condensation.
4. It is suggested that peripheral pathology should be treated with laser.
5. The use of a prophylactic buckle remains controversial.

- **Complications**

1. The major complications associated with micro-incisional surgery for GRTs include retinal slippage during PFCL removal,
2. Retinal folds associated with slippage, SB, or high myopia;
3. Residual PFCL;
4. Formation of a new tear and extension of the existing tear due to proliferative vitreoretinopathy (PVR).
5. Cataract progression
6. Recurrent RD with PVR.

- **Causes of re-detachment 45% include:**

1. Anterior traction and re-proliferation at the corners of the tear
2. Missed breaks away from the tear,
3. The presence of concomitant macular holes, and the occurrence of PVR.
4. Re-detachment due to PVR is more common in eyes with old detachments, blood, pre-existing membranes and pre-existing PVR.