



ORIGINAL ARTICLE

Clin Exp Ocul Trauma Infect. 2021;3(2),28-34

**Anatomical Outcomes After Traumatic Giant Retinal Tear (Grt)
Associated Retinal Detachments Repair**

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Abstract**Purpose**

To analyze the surgical outcomes of giant retinal tear (GRT) associated retinal detachments and their association with extent of giant retinal tear (GRT), grade of proliferative vitreoretinopathy (PVR) and type of surgical procedure performed.

Materials And Methods

A retrospective case analysis of 150 eyes, conducted at Lahore General Hospital's ophthalmology department from 2003 and 2018. The research included patients who underwent different types of surgical repairs for GRT associated detachments. The data was divided into four groups based on the type of surgical procedures performed and the time period. In all the groups the patient's demographic profile was recorded along with extent of GRT, grade of proliferative vitreoretinopathy and the surgical procedure employed for correction. The follow up period of the patients extended from 5 months to 7 years.

Results

The data included 150 patients out of which 95 were males and 55 females who were followed up after the surgery from 1 year to 7 years post-operatively. Out of 150 eyes, 39 (26%) eyes had the extent of giant retinal tear equal to or greater than 180 degrees and 111 (74%) eyes had extent of giant retinal tear less than 180 degrees. Amongst the patients 48 (32%)

eyes were phakic, 75 (50%) were pseudophakic and 27 (18%) were aphakic.

Five eyes (3.33%) had a proliferative vitreoretinopathy grade A, 34 (22.67%) eyes had proliferative vitreoretinopathy grade B while proliferative vitreoretinopathy grade C was noted in 111 (74%) eyes.

In total out of 150 eyes operated in 113 (75.33%) eyes primary surgical repair was successful while 37 (24.67%) eyes had recurrent retinal detachment. These 37 cases had surgical revision procedure performed. 145 (96.67%) eyes had anatomically attached retinas on follow-ups.

Conclusion

Primary and revision GRT associated retinal detachments with varying grades of PVR achieved high success rates of retinal attachments after undergoing surgical correction with various methods of surgical treatment.

Keywords: Proliferative vitreoretinopathy, Giant retinal tear (GRT), Pars plana vitrectomy, Silicone oil.

Introduction

A retinal tear is a neurosensory break in the retinal tissue. A giant retinal tear is a full thickness retinal break that extends three clock hours or more around the retina circumferentially. Giant retinal tears are common cause of detachment amongst the world population. In a survey by the British giant retinal

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tear epidemiology eye study, it was found that there was a 0.094 to 0.114% incidence rate per 100,000 people. (1) It was also found that proliferative vitreoretinopathy (PVR) occurred in 40 to 50 percent of cases that complicated GRT treatment. (2)

Giant retinal tear associated detachments occur in patients after trauma, in high myopia, posterior segment inflammations, retinoschisis, hereditary vitreoretinopathies and syndromes like Marfan, Stickler and Wagner. They can occur after cataract surgery and are frequent in aphakic patients. In some studies, aphakic GRT was observed in 3 to 35 percent of cases. However, in pseudophakia, GRT was found to be less prevalent in one study, it ranged only from 1% to 18% of cases. (3-5)

Patients with GRT can suffer from complexities and normally the visual symptoms show up immediately. Patients present with GRT associated detachments normally within 10 days of observing symptoms. (6, 7) However patients may also report later in many cases depending on the circumstances. The time lag can lead to increase in associated complications that can affect visual outcomes. Similarly surgical and anatomical outcomes depend on associated grades of vitreoretinopathies. The surgical procedures varied according to the complexity of cases. (8)

There is no consensus on the best techniques for treating GRT associated detachments amongst the surgeons. This has led to many techniques being used in retinal surgeries worldwide with varying success rates. Some of the techniques being used include fluid-air exchange done with patient pronation, unfolding retinal tears with rapid head movements, surgical operation by a surgeon operating in supine position. To achieve retinal fixation during operation many adjuvants have been used such as adhesives, micro incarceration, retinal tracks, sodium hyaluronate, sutures and screws. These methods have now evolved and the use of silicon oil tamponade with pars plana vitrectomy is the modern procedure of choice. (9,10) The surgical outcomes of giant retinal tear (GRT) associated retinal detachment based on the extent of giant retinal tear (GRT), the grade of proliferative vitreoretinopathy (PVR) and the surgical procedure was analyzed in this research.

Materials and Methods

A retroactive case study was conducted at Lahore General Hospital vitreo-retinal department between the years 2003 and 2018. The patients were divided into four groups.

A retrospective case analysis of 150 eyes, conducted at Lahore General Hospital's ophthalmology department from 2003 and

2018. The research included patients who underwent different types of surgical repairs for GRT associated detachments. The data was divided into four groups based on the type of surgical procedures performed and the time period.

Patients who underwent encirclement with 20-gauge pars plana vitrectomy and 1000 centistokes silicone oil for surgical repair between 2003 and 2008 were classified as Group A. This included 36 (24%) eyes out of the total. In 10 (27.78%) eyes the extent of giant retinal tear was equal to or greater than 180 degrees and in 26 (72.22%) eyes the extent of giant retinal tear was less than 180 degrees.

Patients operated between 2009 and 2013 were classified into Group B and C differing in the surgical technique employed for repair during this time period. Those who underwent encirclement with 23-gauge pars plana vitrectomy and 5000 centistokes silicone oil for surgical repair were classified as Group B. This included 39 (26%) eyes and the extent of GRT was less than 180 degrees in all 39 (26%) eyes.

Patients who underwent correction with 23-gauge pars plana vitrectomy and 5000 centistokes silicone oil for surgical repair were classified as Group C. It included 13 (8.67%) eyes and the extent of GRT was equal to or greater than 180 degrees in all eyes operated.

Patients who underwent surgical repair with 23-gauge pars plana vitrectomy and 5000 centistokes silicone oil between the year 2014 to 2018 were classified as Group D. It included 62 (41.33%) eyes, 16 (25.81%) eyes had extent of giant retinal tear equal or greater than 180 degrees and 46 (74.19%) eyes had extent of giant retinal tear less than 180 degrees.

In all the groups the patient's demographic profile was recorded along with extent of GRT, grade of proliferative vitreoretinopathy and the surgical procedure employed for correction. The follow up period of the patients extended from 5 months to 7 years.

Results

150 patients who underwent GRT associated retinal detachment surgeries were included in this retrospective case analysis. There were 95 males and 55 female patients. Left eyes were affected in 111 (74%) cases while the right eyes were involved in 39 (26%) cases. Patient's ages ranged from 7 years to 60 years with a mean age of 35.03 years. Patients were followed up postoperatively from a minimum of 5 months to a maximum of 7 years.

There were 48 (32%) phakic eyes, 75 (50%) pseudo-phakic and 27 (18%) were aphakic. The extent of GRT was equal to or greater than 180 degrees in 39 (26%) eyes and 111 (74%) eyes had less than 180 degrees of tear. Grade A proliferative vitreoretinopathy (PVR) was present in five eyes (3.33%), 34 (22.67%) patients had a grade B PVR while grade C PVR was noted in 111

Table 1: The Surgical Outcomes of Giant Retinal Tear In 150 Eyes In A Time Period Between the Year 2003-2018

Variables	Eyes	Percentage
Male	95	63.33%
Female	55	36.67%
The extent of GRT equal to or greater than 180 degree	39	26%
The extent of GRT less than 180 degree	111	74%
Phakic	48	32%
Pseudo Phakic	75	50%
Aphakic	27	18%
Proliferative Vitreoretinopathy Grade A	05	3.33%
Proliferative Vitreoretinopathy Grade B	34	22.67%
Proliferative Vitreoretinopathy Grade C	111	74%
Procedure	Encirclement, 20-gauge pars plana vitrectomy, and 1000 centistokes Silicone Oil Encirclement, 23-gauge pars plana vitrectomy and 5000 centistokes Silicone Oil 23-gauge pars plana vitrectomy and 5000 centistokes Silicone Oil	
Primary Success Rate	113	75.33%
Failure Rate	37	24.67%
Secondary Success Rate	32	86.49%

* PVR: Proliferative Vitreoretinopathy Grade.

* > 180-degree GRT: Extent of GRT equal or greater than 180 degree.

* < 180-degree GRT Extent of GRT less than 180 degree.

(74%) eyes as shown in table 1.

In Group A, patients underwent encirclement with 20-gauge pars plana vitrectomy and 1000 centistokes silicone oil tamponade. There were 36 (24%) eyes in total, 20 (55.56%) males and 16 (44.44%) females. There were 16 (44.44%) phakic, 10 (27.78%) pseudo-phakic and 10 (27.78%) aphakic eyes.

The extent of GRT was equal to or greater than 180 degrees in 10 (27.78%) eyes and extent of GRT was less than 180 degrees in 26 (72.22%) eyes. They were operated between year 2003 to 2008. Primary success was achieved in 20 (55.56%) eyes while 16 (44.44%) eyes had re-detachment for which they had repeated surgery with attached retina in 12 (75%) eyes while 4

(25%) remained unsuccessful. Primary success was achieved in the eyes with the extent of GRT less than 180 degrees, proliferative vitreoretinopathy grade C and those who were in phakic. The failure rate was higher in eyes with the extent of GRT equal to or greater than 180 degrees, proliferative vitre-

Table 2: The Surgical Outcomes of Giant Retinal Tear In 36 Eyes In A Time Period Between the Year 2003-2008

Variables	Eyes	Percentage
Eyes	36	24%
Male	20	55.56%
Female	16	44.44%
The extent of GRT equal to or greater than 180 degree	10	27.78%
The extent of GRT less than 180 degree	26	72.22%
Phakic	16	44.44%
Pseudo Phakic	10	27.78%
Aphakic	10	27.78%
Procedure	Encirclement, 20-gauge pars plana vitrectomy, and 1000 centistokes Silicone Oil	
Primary Success Rate	20	55.56%
PVR A	01	05%
PVR B	07	35%
PVR C	12	60%
Phakic	13	65%
Pseudo Phakic	07	35%
Aphakic	00	00
> 180-degree GRT	08	40%
< 180-degree GRT	12	60%
Failure Rate	16	44.44%
PVR A	01	6.25%
PVR B	02	12.5%
PVR C	13	81.25%
Phakic	03	18.75%
Pseudo Phakic	10	62.5%
Aphakic	10	62.5%
> 180-degree GRT	16	37.5%
< 180-degree GRT		
Secondary Success Rate	12	75%
Secondary Failure Rate	04	25%

* PVR: Proliferative Vitreoretinopathy Grade.

* > 180-degree GRT: Extent of GRT equal or greater than 180 degree.

* < 180-degree GRT Extent of GRT less than 180 degree.

retinopathy grade C and in aphakic eyes as shown in table 2.

Patients operated between 2009 and 2013 were divided into two groups B and C based on the surgical procedure performed. Group B patients underwent encirclement, 23-gauge pars plana vitrectomy and 5000 centistokes silicone oil tamponade. In this group B there were 27 (69.23%) males and 12 (30.77%) females. This included 12 (30.77%) phakic, 18 (46.15%) pseudo-phakic and 09 (23.08%) aphakic eyes. Amongst these patients 39 (26%) eyes had extent of GRT less than 180 degrees. The retina was attached in 30 (76.92%) eyes after primary surgery while 9 (23.08%) eyes had second surgery with 8 (88.89%) attached while 1 (11.11%) persistent detached retina. Most of the successful eyes were pseudophakic with prolifer-

ative vitreoretinopathy grade C. Most of the failed cases were aphakic with proliferative vitreoretinopathy grade C as shown Table 3: The Surgical Outcomes of Giant Retinal Tear In 39 Eyes In A Time Period Between the Year 2009-2013

Table 4: The Surgical Outcomes of Giant Retinal Tear In 13 Patients In A Time Period Between the Year 2009-2013

Variables	Eyes	Percentage
Eyes	52	34.67%
Male	36	23%
Female	16	30.77%
The extent of GRT equal to or greater than 180 degree	--	--
The extent of GRT less than 180 degree	39	75%
Phakic	12	30.77%
Pseudo Phakic	18	46.15%
Aphakic	09	23.08%
Procedure	Encirclement, 23-gauge pars plana vitrectomy, and 5000 centistokes Silicone Oil	
Primary Success Rate	30	76.92%
PVR A	01	3.33%
PVR B	12	40%
PVR C	17	56.67%
Phakic	11	36.67%
Pseudo Phakic	16	53.33%
Aphakic	03	10%
> 180-degree GRT	--	--
< 180-degree GRT	30	100%
Failure Rate	9	23.08%
PVR A	0	--
PVR B	09	100%
PVR C	01	11.11%
Phakic	02	22.22%
Pseudo Phakic	06	66.67%
Aphakic	--	--
> 180-degree GRT	09	100%
< 180-degree GRT	08	88.89%
Secondary Success Rate	08	88.89%
Secondary Failure Rate	01	11.11%

Variables	Eyes	Percentage
Eyes	52	34.67%
Male	36	69.23%
Female	13	30.77%
The extent of GRT equal to or greater than 180 degree	--	25%
The extent of GRT less than 180 degree	00	--
Phakic	00	--
Pseudo Phakic	09	69.23%
Aphakic	04	30.77%
Procedure	23-gauge pars plana vitrectomy and 5000 centistokes Silicone Oil	
Primary Success Rate	07	53.85%
PVR A	00	--
PVR B	03	42.85%
PVR C	04	57.14%
Phakic	00	--
Pseudo Phakic	07	100%
Aphakic	00	--
> 180-degree GRT	07	100%
< 180-degree GRT	--	--
Failure Rate	06	46.15%
PVR A	00	--
PVR B	01	16.67%
PVR C	05	83.33%
Phakic	00	--
Pseudo Phakic	02	33.33%
Aphakic	04	66.67%
> 180-degree GRT	06	100%
< 180-degree GRT	--	--
Secondary Success Rate	06	100%
Secondary Failure Rate	--	--

- * PVR: Proliferative Vitreoretinopathy Grade.
- * > 180-degree GRT: Extent of GRT equal or greater than 180 degree.
- * < 180-degree GRT Extent of GRT less than 180 degree.

- * PVR: Proliferative Vitreoretinopathy Grade.
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- * < 180-degree GRT Extent of GRT less than 180 degree.

in table 3.

Group C patients underwent 23-gauge pars plana vitrectomy and 5000 centistokes silicone oil tamponade. In this group there were 10 (76.92%) males and 03 (23.07%) females. There were 9 (69.23%) pseudo-phakic and 4 (30.77%) aphakic eyes operated. Out of the eyes operated 13 (8.67%) eyes had extent of GRT equal to or greater than 180 degrees. The retina was flattened operatively in 7 (53.85%) out of 13 (25%) eyes. Revision surgery was successful in all the 6 (100%) eyes. The primary success was noted in most of the eyes with proliferative vitreoretinopathy grade C with pseudo-phakic. The failure rate was higher in eyes with proliferative vitreoretinopathy grade C and in aphakic eyes as shown in table 4.

Patients in Group D underwent 23-gauge pars plana vitrectomy with 5000 centistokes silicone oil tamponade. There were 62 (41.33%) eyes, 39 (62.90%) males and 23 (37.10%) females. Amongst them 20 (32.26%) were phakic. Primary surgery was successful in 56 (90.32%) eyes out of the 62 (41.33%) eyes operated. Remaining 6 (9.68%) eyes had revision surgery with a 100% success rate. The successful surgeries had extent of GRT less than 180 degrees and were pseudophakic with proliferative vitreoretinopathy grade C. Most of the failed cases with the extent of GRT equal or greater than 180 degrees with phakic lens status and proliferative vitreoretinopathy grade C as shown in table 5.

The retina was attached in 113 (75.33%) eyes out of 150 eyes after the first surgery while 37 (24.67%) had recurrent retinal detachment and needed repeat surgical procedure. The retina was re-attached in 32 (86.49%) eyes with one further surgery. Five eyes (13.51%) had persistent retinal detachment even af-

ter repeat surgery. At the last follow-up, 145 (96.67%) eyes had anatomically attached retinas. The success rate increased to 96.67% from 75.33% with repeat surgery.

Table 5 The Surgical Outcomes of Giant Retinal Tear In 62 Eyes In A Time Period Between the Year 2014-2018

Variables	Eyes	Percentage
Eyes	62	41.33%
Male	39	62.90%
Female	23	37.10%
The extent of GRT equal to or greater than 180 degree	16	25.81%
The extent of GRT less than 180 degree	46	74.19%
Phakic	20	32.26%
Pseudo Phakic	38	61.29%
Aphakic	04	6.45%
Procedure	23-gauge pars plana vitrectomy and 5000 centistokes Silicone Oil	
Primary Success Rate	56	90.32%
PVR A	02	3.57%
PVR B	08	14.29%
PVR C	46	82.14%
Phakic	16	28.57%
Pseudo Phakic	36	64.29%
Aphakic	04	7.14%
> 180-degree GRT	17	30.36%
< 180-degree GRT	39	69.64%
Failure Rate	06	9.68%
PVR A	00	--
PVR B	00	--
PVR C	06	100%
Phakic	04	66.67%
Pseudo Phakic	02	33.33%
Aphakic	00	--
> 180-degree GRT	05	83.33%
< 180-degree GRT	01	16.67%
Secondary Success Rate	06	100%
Secondary Failure Rate	--	--

* PVR: Proliferative Vitreoretinopathy Grade.

*> 180-degree GRT: Extent of GRT equal or greater than 180 degree.

* < 180-degree GRT Extent of GRT less than 180 degree.

Discussion

We analyzed the outcomes of GRT associated retinal detachment surgeries performed in the vitreo-retinal department of our hospital. We aimed to analyze the various factors that contributed in the success of the surgical procedures. Our success rate with primary surgery was 75.33%, however with revision surgeries of the failed cases we were able to attain 96.67% success in re-attaching the retina detached. Our results were comparable to other studies. In a study by YK Ghosh et al achieved a success rate of 65.51% with the primary surgery. Their success rate increased to 86.20% with revision of the failed cases. (11)

Retinal detachments caused by GRT pose a challenging situation to the vitreoretinal surgeons. In our study most of the cases of GRT associated detachments had PVR grade C and B with grade C associated with majority of revision surgeries.

These tears become more and more complex and difficult to treat if left unattended for a long time. The severity of time-related complexities of GRT was highlighted by Schepens et al, for the first time. In addition GRT associated detachments are accompanied and complicated by proliferative vitreoretinopathy and the incident of PVR ranges from 40 to 50 percent in these detachments. Kertes et al highlighted factors causing poor postoperative visual acuity in detachments and these included macular detachments, hypotony, higher grades of proliferative vitreoretinopathy and GRT above 180 degrees. (12, 13)

Proliferative vitreoretinopathy was the cause behind many of post-operative re-detachments in our study and the re-detachments were observed to occur within a few days to weeks of the primary surgery. Glaser, in his research found that eyes with GRT above 180 degrees with grade D1 proliferative vitreoretinopathy or even worse had a 50% rate of proliferative recurrence. These D1 grade cases were treated with intraoperative perfluorocarbon liquid-fluid oil and supplementary scleral encirclement.

In our study over the course of time we progressed from 20G to a 23G vitrectomy system and encirclement was gradually replaced by vitrectomy alone with better anatomical outcomes. Before the introduction of Pars Plana Vitrectomy, GRT was usually treated with scleral buckling and intraocular tamponade with the common use of silicon oil or intravitreal air. Such type of treatment in the past yielded only 51 to 65 percent success. GRT was treated more successfully with scleral buckling as it prevents reopening and limits the extension of tears. (14, 15)

Soon with the advent and use of 3-port pars plana vitrectomy introduced a new improved technique that resolved retinal detachments issues especially related to GRT. This method also helped in treating GRT associated detachments with proliferative vitreoretinopathy through including retinectomises. The success rate of the pars plana procedure is normally greater than other methods.16 Research shows that micro-incision surgery with 23G PPV and Silicone oil tamponade can obtain similar results to a 20-gauge pars plana vitrectomy. (17)

Patients who underwent treatment in the earlier years of our study had encirclement as part of the surgical plan especially when employing 20G vitrectomy system. The value of scleral buckling is not without controversy though. In a study by Verstraeten et al included 34 patients with GRT who were treated with vitrectomy, scleral buckling, endolaser, gas tamponade, and intraoperative perfluorocarbon liquids. Despite scleral

buckling two patients required revision surgery. (18)Similarly in their study by Scott et al also highlighted the association between scleral buckling and recurrent retinal detachments.

Opposing the use of scleral buckling, Johnson et al presented a case against using scleral buckling in the case of GRT associated detachments. He highlighted that without proliferative vitreoretinopathy, the use of scleral buckling can cause potential complications like anterior retinal folds, tear fish mouthing, choroidal hemorrhage that could lead to tear slippage. (19)

Similarly Kreiger and Freeman highlighted that with meticulous base trimming followed by deep scleral indentation could be more successful. Their procedure demonstrated that suitable dissection of vitreous base and perfect repositioning of GRT using a suitable tamponade can have better results. (20, 21)

However, the controversial use of scleral buckling remains an open and wide debate among surgeons. In a research of 30 patients in favor of scleral buckling proved that the absence of scleral encirclement was a potential risk for re-detachments. (22)There are advocates of both approaches.

In our study 75 cases among the 150 cases underwent pars plana vitrectomy with scleral buckling. Of these 75 patients, 25 cases had recurrent retinal detachments. The other 75 cases without scleral buckling, 12 patients had recurrent retinal detachments. So the use of scleral buckling remains questionable in the success of GRT detachments.

Using a logistic regression analysis showed that silicon oil internal tamponade was the only substantial predictive factor for the anatomical success rate of the primary procedure. Additionally, the use of silicone oil comes with other benefits such as better visualization of fundus details; it increases the visual facilitation of instruments in and around the oil bubble. Al-Khairi in his research showed that using oil tamponade showed a recurrent rate of 12.5 percent while gas tamponade showed 32.1 percent. (23)

The analysis of our data showed that with a combined approach of scleral encirclement and PPV with silicone oil in GRT associated detachments with grades A, B and C PVR produced high retinal re-attachments rates. Similarly with small gauge systems even without encirclement that retinal attachments was high with GRT associated detachments. Cases undergoing revision surgeries also attained high re-attachment rates. (24, 25)

Conclusion

Primary and revision GRT associated retinal detachments with varying grades of PVR achieved high success rates of retinal attachments after undergoing surgical correction with various methods of surgical treatment. This 15 year study has concluded that with the advances in the surgical techniques and gadgets the results of retinal re-attachments improved. This huge audit of scleral buckling and combined vitrectomy techniques for retinal detachments is unique in its way depending upon the number of patients and years to conduct the study.

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