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Preoperative factors associated with visual outcome after surgery for giant retinal tear–associated retinal detachment: a retrospective case series

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Abstract

Background

Giant retinal tear (GRT)–associated rhegmatogenous retinal detachment (RRD) can usually be repaired anatomically, but the visual outcome often remains poor. This study aimed to identify the factors associated with the final visual outcome after surgery for GRT-associated RRD and to report anatomical results and complications in a tertiary center.

Methods

This retrospective consecutive case series included eyes undergoing surgery for GRT-associated RRD between January 2015 and December 2025. Demographic, clinical, and surgical variables were collected. The primary outcome was final best-corrected visual acuity (BCVA, logMAR). Secondary outcomes included single-surgery and final anatomical success, change in BCVA, and complications. Associations with final BCVA were assessed using univariable analyses and multivariable linear regression.

Results

Seventy-eight eyes of 76 patients were included (mean age, 47.8 ± 15.2 years; 81.6% male). The macula was detached in 58 eyes (74.4%), and preoperative proliferative vitreoretinopathy (PVR) grade C or higher was present in 21 (26.9%). Single-surgery anatomical success was achieved in 61 eyes (78.2%) and final attachment in 74 (94.9%). Mean BCVA improved from 1.71 ± 0.72 to 0.94 ± 0.68 logMAR ($p < 0.001$); 45 eyes (57.7%) achieved 20/200 or better. In multivariable analysis, macular detachment ($B = 0.42$, $p = 0.005$), worse preoperative BCVA ($B = 0.31$, $p = 0.002$), PVR grade ≥ C ($B = 0.34$, $p = 0.011$), and tear extent > 180° ($B = 0.28$, $p = 0.038$) were independently associated with worse final BCVA (adjusted $R^2=0.43$).

Conclusions

Anatomical reattachment was achieved in most eyes, but functional outcomes remained limited in a substantial proportion. Macular detachment, worse presenting BCVA, advanced PVR, and tear extent > 180° were independently associated with final visual acuity. These findings reinforce the importance of early diagnosis and identify eyes with extensive tears or advanced PVR as having an unfavorable visual prognosis.

Background

A giant retinal tear (GRT) is a full-thickness retinal break extending circumferentially 90° or more, usually accompanied by posterior vitreous detachment and by rolling or inversion of the posterior flap.[1, 2]

GRTs account for a small fraction of all rhegmatogenous retinal detachments (RRD) but affect a comparatively young and predominantly male population, and they are associated with high myopia, ocular trauma, previous intraocular surgery and hereditary vitreoretinopathies such as Stickler and Marfan syndromes.[1, 3, 4]

The surgical management of GRT-associated RRD has evolved considerably over the past decades. Scleral buckling alone, once used in selected cases, has largely been replaced by pars plana vitrectomy (PPV), which allows direct manipulation of the posterior flap and removal of vitreous traction, with or without a supplementary encircling buckle.[5] The introduction of perfluorocarbon liquid (PFCL) for unfolding and stabilizing the posterior flap, together with wide-angle viewing systems and small-gauge instrumentation, has raised single-surgery anatomical success to between 65% and 100% and final reattachment rates above 90% in contemporary series. [1, 3, 6, 7] Two technical questions remain open: whether an encircling scleral buckle adds value to PPV, and whether silicone oil or gas is the better tamponade. Neither, however, addresses the problem that matters most to patients, namely that a substantial proportion of anatomically successful eyes still end with poor central vision.[8, 9]

Several baseline variables have been proposed as prognostic factors for the functional result: macular detachment at presentation, presenting visual acuity, the circumferential extent of the tear, proliferative vitreoretinopathy (PVR), trauma and the delay before surgery. Reported associations are inconsistent across series that differ in size, case mix and referral pattern.[3, 6] An additional analytical difficulty is that these variables are interdependent: an eye with a detached macula almost by definition presents with poor acuity, and extensive tears are more often accompanied by PVR. Univariable comparisons alone may thus be misleading.

We analyzed a consecutive series of eyes undergoing surgery for GRT-associated RRD at a high-volume tertiary eye hospital. The primary aim was to identify, using a multivariable approach, the baseline factors independently associated with final visual acuity. Secondary aims were to report the anatomical outcomes and complications of the same cohort and, as an exploratory assessment, the findings in the fellow eye.

Methods

Study design and ethics

This retrospective, single-center, consecutive case series was conducted at the Retina Unit of the University of Health Sciences, Beyoğlu Eye Training and Research Hospital, Istanbul, Türkiye. The study was approved by the Non-Interventional Clinical Research Ethics Committee of Taksim Training and Research Hospital, Istanbul, Türkiye (decision no. 125, 24 February 2026) and adhered to the tenets of the Declaration of Helsinki. Owing to the retrospective design of the study, the requirement for informed consent was waived by the ethics committee; all patients had given written consent for their surgical

procedure as part of routine clinical care, and patient data were anonymized before analysis. The study is reported in accordance with the STROBE statement for observational studies.

Patients

The records of all consecutive patients operated for GRT-associated RRD between January 2015 and December 2025 were reviewed. A GRT was defined as a full-thickness circumferential retinal break of 90° or more.[1] Eyes with retinal dialysis, with a break smaller than 90°, with tractional or exudative detachment, with previous vitreoretinal surgery in the study eye, or with a follow-up shorter than 6 months were excluded. Both eyes of the 2 patients with bilateral disease were included and all analyses were performed on a per-eye basis.

Recorded variables were age at surgery, sex, laterality, presumed etiology (ocular trauma, high myopia defined as a spherical equivalent of ≤ − 6.0 diopters or an axial length ≥ 26.0 mm, previous intraocular surgery, hereditary vitreoretinopathy, idiopathic), the interval between the onset of symptoms and surgery, the circumferential extent of the tear in degrees, the presence of inferior extension of the tear, the number of detached quadrants, macular status (attached or detached), lens status, preoperative PVR grade according to the updated Retina Society classification[10], surgical technique, PFCL use, tamponade agent, the timing of silicone oil removal, preoperative and final best-corrected visual acuity (BCVA), the number of vitreoretinal procedures, intraoperative and postoperative complications, and the status of the fellow eye. For the fellow eye, the following were recorded at presentation and at every follow-up visit: the presence of lattice degeneration or asymptomatic retinal breaks, a previous or simultaneous GRT, a previous rhegmatogenous retinal detachment or vitreoretinal surgery, the performance and timing of prophylactic laser retinopexy, and the occurrence of a new retinal detachment during follow-up. Prophylactic 360° laser retinopexy was offered to fellow eyes with lattice degeneration, asymptomatic breaks, high myopia or a suspected hereditary vitreoretinopathy.

Surgical technique

All procedures were performed by experienced vitreoretinal surgeons. A 360° encircling silicone band (No. 41, 3.5 mm) was placed at the beginning of surgery at the surgeon’s discretion; it was generally preferred in eyes with inferior extension of the tear, PVR of grade C or higher, or in phakic patients younger than 40 years, whereas the remaining eyes were usually treated with PPV alone. Standard 23 or 25-gauge three-port PPV was performed with a wide-angle viewing system. After core vitrectomy, the vitreous base was shaved with scleral indentation, with particular attention to the anterior and posterior edges of the tear. PFCL was injected to unfold and stabilize the posterior flap and to reattach the retina, followed by two to three confluent rows of endolaser photocoagulation along the posterior edge of the tear, extended anteriorly to the ora serrata at both ends of the tear, and 360° peripheral endolaser, and by a direct PFCL–silicone oil or PFCL–air–gas exchange. Tamponade was selected at the surgeon’s discretion: silicone oil was preferred in eyes with PVR or tears exceeding 180°, and in monocular patients

or those unable to posture, whereas gas was used in the remaining eyes. Combined phacoemulsification with intraocular lens implantation was performed when lens opacity precluded adequate visualization. Postoperatively, patients were instructed to maintain face-down positioning for up to 14 days, adjusted according to the tamponade agent and the location of the tear. Silicone oil was removed once the retina had remained attached for at least 3 months without signs of active PVR. The main surgical steps in a representative case are shown in Fig. 2.

Outcome measures

The primary outcome measure was the final BCVA in logMAR units at the last visit and its association with the baseline variables. Secondary outcome measures were single-surgery anatomical success, defined as complete retinal attachment after a single vitreoretinal procedure excluding planned silicone oil removal; final anatomical success, defined as complete retinal attachment at the last visit, with or without silicone oil in situ; the change in BCVA; and intraoperative and postoperative complications.

BCVA was measured with Snellen charts and converted to logMAR for analysis. Counting fingers, hand motions and light perception were assigned logMAR values of 1.9, 2.3 and 2.7, respectively, in accordance with published conversion scales.[11] A change of ≥ 0.2 logMAR (two lines) was regarded as clinically meaningful, and a final BCVA of 1.0 logMAR (20/200) or better was defined as a favorable functional outcome. For descriptive purposes, BCVA was also grouped into four categories: 20/40 or better, 20/50 to 20/200, worse than 20/200 to counting fingers, and hand motions or light perception.

Statistical analysis

Analyses were performed with IBM SPSS Statistics, version 26.0, IBM Corp., Armonk, NY, USA. The normality of continuous variables was assessed with the Shapiro–Wilk test. Continuous variables are presented as mean ± standard deviation (range) or as median (interquartile range) and categorical variables as number (percentage). Preoperative and final BCVA were compared with the Wilcoxon signed-rank test.

The association between the final BCVA and continuous variables was examined with the Spearman rank correlation, and its association with categorical variables with the Mann–Whitney U or Kruskal–Wallis test. The four variables considered clinically relevant a priori (macular status, preoperative BCVA, tear extent > 180° and PVR grade C or higher) were entered simultaneously into a multivariable linear regression model with the final BCVA (logMAR) as the dependent variable; no data-driven variable selection was performed, in order to limit overfitting given the sample size. Unstandardized regression coefficients (B) with 95% confidence intervals are reported. Collinearity was assessed with the variance inflation factor (VIF), and values above 2.5 were regarded as indicating relevant collinearity. Model assumptions were checked by inspection of the residuals for normality and homoscedasticity. A logistic regression model restricted to macular status and PVR grade C or higher was fitted for the binary outcome of a final BCVA of 20/200 or better, in order to keep the number of predictors proportionate to

the number of events. Analyses were performed on eyes with complete data (complete-case analysis). Because the encircling band was not allocated at random but at the surgeon's discretion, guided by these features, the two surgical groups were compared descriptively. A two-sided p value below 0.05 was considered statistically significant.

Results

Baseline characteristics

Seventy-eight eyes of 76 patients were included; 2 patients had bilateral disease. The mean age at surgery was 47.8 ± 15.2 years (range, 12–78) and 62 of the 76 patients (81.6%) were male. The presumed etiology was ocular trauma in 18 eyes (23.1%), high myopia in 12 (15.4%), previous intraocular surgery in 9 (11.5%), hereditary vitreoretinopathy in 3 (3.8%) and idiopathic in 36 (46.2%). The median interval between the onset of symptoms and surgery was 9 days (interquartile range, 4–21).

The tear extended 90–120° in 34 eyes (43.6%), 121–180° in 28 (35.9%) and more than 180° in 16 (20.5%). The macula was detached in 58 eyes (74.4%), and PVR of grade C or higher was present at presentation in 21 eyes (26.9%). Forty-seven eyes (60.3%) were phakic, 27 (34.6%) pseudophakic and 4 (5.1%) aphakic. The mean preoperative BCVA was 1.71 ± 0.72 logMAR, and the mean follow-up was 28.4 ± 19.6 months (median, 24; range, 6–96). Baseline characteristics are summarized in Table 1.

Table 1
Baseline demographic and clinical characteristics (78 eyes of 76 patients)

Characteristic	Value
Age at surgery, years, mean ± SD (range)	47.8 ± 15.2 (12–78)
Sex, male, n (%) (patients)	62 (81.6)
Bilateral involvement, n patients	2
Laterality, right / left, n	40 / 38
Etiology, n (%)	
Ocular trauma	18 (23.1)
High myopia	12 (15.4)
Previous intraocular surgery	9 (11.5)
Hereditary vitreoretinopathy	3 (3.8)
Idiopathic	36 (46.2)
Symptom onset to surgery, days, median (IQR)	9 (4–21)
Tear extent, n (%)	
90–120°	34 (43.6)
121–180°	28 (35.9)
>180°	16 (20.5)
Inferior extension of the tear, n (%)	29 (37.2)
Macula detached, n (%)	58 (74.4)
Detached quadrants, median (range)	3 (1–4)
PVR grade ≥ C, n (%)	21 (26.9)
Lens status, phakic / pseudophakic / aphakic, n (%)	47 (60.3) / 27 (34.6) / 4 (5.1)
Preoperative BCVA, logMAR, mean ± SD	1.71 ± 0.72
Macula-on / macula-off eyes	0.61 ± 0.44 / 2.09 ± 0.51
Fellow eye at presentation (patients with unilateral GRT, n = 74)	
Normal	44 (59.5)
Lattice degeneration or asymptomatic break	19 (25.7)

BCVA: best-corrected visual acuity; IQR: interquartile range; PVR: proliferative vitreoretinopathy; SD: standard deviation.

Characteristic	Value
Previous rhegmatogenous retinal detachment	8 (10.8)
Previous giant retinal tear	3 (4.1)
Prophylactic laser retinopexy in the fellow eye, n (%)	29 (39.2)
Follow-up, months, mean ± SD (median, range)	28.4 ± 19.6 (24, 6–96)
BCVA: best-corrected visual acuity; IQR: interquartile range; PVR: proliferative vitreoretinopathy; SD: standard deviation.	

Surgical characteristics

PPV alone was performed in 54 eyes (69.2%) and PPV combined with an encircling scleral buckle in 24 (30.8%); no eye was treated with scleral buckling alone. PFCL was used in 71 eyes (91.0%) and a relaxing retinectomy was required in 7 (9.0%). Tamponade consisted of silicone oil in 56 eyes (71.8%; 5000 cSt in 51 and 1000 cSt in 5), C3F8 in 15 (19.2%) and SF6 in 7 (9.0%). Combined phacoemulsification was performed in 19 of the 47 phakic eyes (40.4%). Silicone oil was removed in 48 of the 56 oil-filled eyes (85.7%) after a median of 4.5 months (Table 2).

Table 2
Surgical characteristics

Variable	n (%)
Pars plana vitrectomy alone	54 (69.2)
Pars plana vitrectomy + encircling scleral buckle	24 (30.8)
Perfluorocarbon liquid use	71 (91.0)
Relaxing retinectomy	7 (9.0)
Tamponade: silicone oil (5000 cSt / 1000 cSt)	56 (71.8) (51 / 5)
Tamponade: C3F8 / SF6	15 (19.2) / 7 (9.0)
Combined phacoemulsification + IOL (of phakic eyes)	19 (40.4)
Silicone oil removed (of oil-filled eyes)	48 (85.7)
Time to silicone oil removal, months, median (range)	4.5 (3–12)
Vitreoretinal procedures per eye, mean (range)	1.4 (1–4)
IOL: intraocular lens.	

Anatomical outcomes

Single-surgery anatomical success was achieved in 61 of the 78 eyes (78.2%) and final anatomical success in 74 eyes (94.9%); silicone oil remained in situ at the last visit in 8 of these eyes. Redetachment occurred in 17 eyes (21.8%) after a median of 2.5 months, and the underlying cause was PVR in 12 of them (70.6%), an inadequately treated or new peripheral break in 4 (23.5%) and reopening of the tear in 1 (5.9%). The mean number of vitreoretinal procedures per eye was 1.4 (range, 1–4), excluding silicone oil removal.

Single-surgery success was lower in eyes with PVR grade C or higher (57.1% vs. 86.0%; p = 0.008) and in eyes with a tear larger than 180° (62.5% vs. 82.3%; p = 0.043), and did not differ between traumatic and non-traumatic eyes (72.2% vs. 80.0%; p = 0.489).

Comparison of the two surgical techniques

Because the encircling band was added at the surgeon's discretion and preferentially in higher-risk eyes, the two surgical groups differed at baseline (Table 3). Eyes treated with PPV and a buckle more often had an inferior extension of the tear (62.5% vs. 25.9%; p < 0.001), PVR of grade C or higher (41.7% vs. 20.4%; p = 0.048) and were more often phakic patients younger than 40 years (37.5% vs. 11.1%; p = 0.005); they were also younger (42.2 ± 15.1 vs. 50.3 ± 14.6 years; p = 0.024). The proportion of macula-off eyes (70.8% vs. 75.9%; p = 0.633) and of tears larger than 180° (29.2% vs. 16.7%; p = 0.203) did not differ significantly.

Table 3
Comparison of PPV alone and PPV combined with an encircling scleral buckle

Variable	PPV (n = 54) / PPV + SB (n = 24)	p
Age, years, mean ± SD	50.3 ± 14.6 / 42.2 ± 15.1	0.024
Indications for buckling		
Inferior extension of the tear, n (%)	14 (25.9) / 15 (62.5)	< 0.001
PVR grade ≥ C, n (%)	11 (20.4) / 10 (41.7)	0.048
Phakic and younger than 40 years, n (%)	6 (11.1) / 9 (37.5)	0.005
Tear > 180°, n (%)	9 (16.7) / 7 (29.2)	0.203
Macula detached, n (%)	41 (75.9) / 17 (70.8)	0.633
Preoperative BCVA, logMAR, mean ± SD	1.73 ± 0.70 / 1.66 ± 0.77	0.694
Silicone oil tamponade, n (%)	37 (68.5) / 19 (79.2)	0.331
Single-surgery anatomical success, n (%)	42 (77.8) / 19 (79.2)	0.887
Final anatomical success, n (%)	51 (94.4) / 23 (95.8)	0.812
Final BCVA, logMAR, mean ± SD	0.92 ± 0.67 / 0.98 ± 0.71	0.718

BCVA: best-corrected visual acuity; CI: confidence interval; OR: odds ratio; PPV: pars plana vitrectomy; PVR: proliferative vitreoretinopathy; SB: scleral buckle; SD: standard deviation. Because the buckle was not allocated at random, the groups are not comparable at baseline and the comparison is descriptive.

Despite this unfavorable baseline profile, single-surgery anatomical success was similar in the two groups (79.2% vs. 77.8%; p = 0.887), as were final anatomical success (95.8% vs. 94.4%; p = 0.812) and final BCVA (0.98 ± 0.71 vs. 0.92 ± 0.67 logMAR; p = 0.718).

Functional outcomes

The mean BCVA improved from 1.71 ± 0.72 logMAR preoperatively to 0.94 ± 0.68 logMAR at the final visit (p < 0.001). A gain of ≥ 0.2 logMAR was recorded in 58 eyes (74.4%), BCVA was unchanged in 12 (15.4%) and decreased by ≥ 0.2 logMAR in 8 (10.3%). A final BCVA of 20/200 or better was achieved in 45 eyes (57.7%) and of 20/40 or better in 16 eyes (20.5%). The distribution of preoperative and postoperative BCVA by category is shown in Fig. 1a, and the outcomes are summarized in Table 4.

Table 4
Anatomical and functional outcomes

Outcome	Value	p
Single-surgery anatomical success, n (%)	61 (78.2)	–
Final anatomical success, n (%)	74 (94.9)	–
Redetachment, n (%)	17 (21.8)	–
Cause: PVR / new or missed break / tear reopening	12 / 4 / 1	–
Preoperative BCVA, logMAR, mean ± SD	1.71 ± 0.72	< 0.001*
Final BCVA, logMAR, mean ± SD	0.94 ± 0.68	
BCVA gain ≥ 0.2 logMAR, n (%)	58 (74.4)	–
No meaningful change, n (%)	12 (15.4)	–
BCVA loss ≥ 0.2 logMAR, n (%)	8 (10.3)	–
Final BCVA 20/200 or better (≤ 1.0 logMAR), n (%)	45 (57.7)	–
Final BCVA 20/40 or better (≤ 0.3 logMAR), n (%)	16 (20.5)	–

BCVA: best-corrected visual acuity; PVR: proliferative vitreoretinopathy. * Wilcoxon signed-rank test, preoperative versus final BCVA.

Factors associated with the final visual acuity

In univariable analysis, the final BCVA correlated with the preoperative BCVA (rho = 0.52, p < 0.001) and, more weakly, with the interval between symptom onset and surgery (rho = 0.26, p = 0.021), but not with age (rho = 0.11, p = 0.337) or with the duration of follow-up (rho = − 0.09, p = 0.434).

Eyes with a detached macula had a worse final BCVA than eyes with an attached macula (1.12 ± 0.66 vs. 0.42 ± 0.41 logMAR; p < 0.001), as did eyes with PVR grade C or higher (1.32 ± 0.71 vs. 0.80 ± 0.60 logMAR; p < 0.001) and eyes with a tear larger than 180° (1.24 ± 0.70 vs. 0.86 ± 0.65 logMAR; p = 0.014). The final BCVA did not differ significantly according to etiology (traumatic 1.05 ± 0.69 vs. non-traumatic 0.91 ± 0.68 logMAR; p = 0.402), lens status (p = 0.216), surgical technique (PPV 0.92 ± 0.67 vs. PPV with buckle 0.98 ± 0.71 logMAR; p = 0.718) or tamponade agent (silicone oil 1.02 ± 0.70 vs. gas 0.74 ± 0.58 logMAR; p = 0.094). Eyes that required more than one procedure ended with a worse final BCVA than eyes attached after a single surgery (1.29 ± 0.72 vs. 0.84 ± 0.63 logMAR; p = 0.011).

In the multivariable linear regression model, macular detachment (B = 0.42; 95% confidence interval [CI], 0.13–0.71; p = 0.005), preoperative BCVA (B = 0.31; 95% CI, 0.12–0.50; p = 0.002), PVR grade C or higher (B = 0.34; 95% CI, 0.08–0.60; p = 0.011) and a tear larger than 180° (B = 0.28; 95% CI, 0.02–0.54; p = 0.038) were independently associated with a worse final BCVA; the model explained 46% of the variance (adjusted R^2=0.43; p < 0.001), and no variance inflation factor exceeded 2.4. In the logistic model for a

final BCVA of 20/200 or better, an attached macula (odds ratio [OR] = 4.81; 95% CI, 1.43–16.18; p = 0.011) and the absence of PVR grade C or higher (OR = 3.57; 95% CI, 1.18–10.79; p = 0.024) were independent predictors. The analyses are presented in Table 5, and the multivariable model is illustrated in Fig. 1b.

Table 5
Factors associated with the final best-corrected visual acuity (logMAR)

Variable	Final BCVA / coefficient	p
Univariable analysis		
Preoperative BCVA (Spearman rho)	0.52	< 0.001
Symptom onset to surgery (Spearman rho)	0.26	0.021
Age (Spearman rho)	0.11	0.337
Follow-up duration (Spearman rho)	−0.09	0.434
Macula off vs. on, mean logMAR	1.12 vs. 0.42	< 0.001
PVR ≥ C vs. <C, mean logMAR	1.32 vs. 0.80	< 0.001
Tear > 180° vs. ≤180°, mean logMAR	1.24 vs. 0.86	0.014
Trauma vs. non-trauma, mean logMAR	1.05 vs. 0.91	0.402
PPV vs. PPV + buckle, mean logMAR	0.92 vs. 0.98	0.718
Silicone oil vs. gas, mean logMAR	1.02 vs. 0.74	0.094
>1 procedure vs. single surgery, mean logMAR	1.29 vs. 0.84	0.011
Multivariable linear regression (n = 78)	R^2=0.46; adjusted R^2=0.43	< 0.001
Macular detachment (B, 95% CI)	0.42 (0.13–0.71)	0.005
Preoperative BCVA (B, 95% CI)	0.31 (0.12–0.50)	0.002
PVR ≥ C (B, 95% CI)	0.34 (0.08–0.60)	0.011
Tear > 180° (B, 95% CI)	0.28 (0.02–0.54)	0.038
Logistic regression, final BCVA 20/200 or better (n = 78)		
Attached macula (OR, 95% CI)	4.81 (1.43–16.18)	0.011
Absence of PVR ≥ C (OR, 95% CI)	3.57 (1.18–10.79)	0.024

BCVA: best-corrected visual acuity; CI: confidence interval; OR: odds ratio; PPV: pars plana vitrectomy; PVR: proliferative vitreoretinopathy. Spearman rank correlation for continuous variables; Mann–Whitney U test for two-group comparisons.

Fellow eye

Excluding the 2 patients with bilateral GRT, both of whose eyes were study eyes, the fellow eye of the remaining 74 patients was normal at presentation in 44 (59.5%), showed lattice degeneration or asymptomatic retinal breaks in 19 (25.7%), had a history of rhegmatogenous retinal detachment in 8 (10.8%) and had been affected by a previous GRT in 3 (4.1%). Prophylactic laser retinopexy was performed in the fellow eye of 29 patients (39.2%), at a median of 1 month (range, 0–6) after the index surgery.

During follow-up, a new rhegmatogenous retinal detachment developed in the fellow eye of 4 patients (5.4%), after a median of 14 months (range, 3–42); the break was a GRT in 2 of them (2.7% of the cohort). Detachment occurred in 1 of the 29 eyes that had received prophylactic laser (3.4%) and in 3 of the 45 that had not (6.7%), a difference that was not statistically significant in this small sample (p = 1.000). All 4 eyes were reoperated and the retina was attached at the last visit.

Complications

Cataract progression requiring surgery occurred in 22 of the 28 eyes that remained phakic after the primary procedure (78.6%) and elevated intraocular pressure requiring topical therapy in 14 eyes (17.9%), of which 3 (3.8%) required glaucoma surgery. Silicone oil emulsification or migration into the anterior chamber was observed in 6 of the 56 oil-filled eyes (10.7%), epiretinal membrane formation in 9 (11.5%), hypotony maculopathy in 3 (3.8%), retained or subretinal PFCL in 2 (2.6%) and unexplained visual loss after silicone oil removal in 4 of the 48 eyes in which oil was removed (8.3%). No case of endophthalmitis or suprachoroidal hemorrhage was recorded (Table 6).

Table 6
Intraoperative and postoperative complications

Complication	**n (%)**
Cataract progression requiring surgery (of eyes remaining phakic, n = 28)	22 (78.6)
Elevated intraocular pressure requiring medication	14 (17.9)
Requiring glaucoma surgery	3 (3.8)
Epiretinal membrane	9 (11.5)
Silicone oil emulsification / anterior chamber migration (of oil-filled eyes, n = 56)	6 (10.7)
Unexplained visual loss after silicone oil removal (of eyes with oil removed, n = 48)	4 (8.3)
Hypotony maculopathy	3 (3.8)
Retained or subretinal perfluorocarbon liquid	2 (2.6)
Endophthalmitis	0 (0)
Suprachoroidal hemorrhage	0 (0)

Discussion

In this consecutive series of 78 eyes operated for GRT-associated RRD, the retina was finally attached in 94.9% of eyes, yet only 57.7% achieved 20/200 or better. Macular status and presenting visual acuity were the strongest predictors of the final visual acuity, with additional independent contributions from PVR grade C or higher and from a tear extending beyond 180°. Together these four variables explained 46% of the variance in the final BCVA.

Our anatomical results are consistent with the contemporary literature. Single-surgery success rates between 65% and 100% and final reattachment rates above 90% have been reported in series of comparable size,[1, 6, 12–14] and Choovuthayakorn et al.[3] reported single-surgery success of 57.5% in non-traumatic and 69.2% in traumatic eyes, with final success of 97.1% and 100%, respectively. The demographic profile of our cohort — a mean age of 47.8 years, 81.6% male and 23.1% traumatic — also closely resembles that series (mean age 52.6 years, 88.3% male, 21.6% traumatic).[3] In a previous series of 45 eyes from Türkiye treated with vitrectomy and silicone oil without adjuvant scleral buckling, Hocaoglu et al. reported a final anatomical success of 98%.[15] PVR was the leading cause of redetachment in our eyes (70.6% of failures), as it is in most published series, which reinforces the view that the principal biological obstacle in GRT surgery is not the initial reattachment but the proliferative response that follows it.[8, 12, 16]

The finding that macular status and preoperative BCVA dominate the functional outcome is expected, but two aspects of our analysis deserve emphasis. First, these two variables are strongly interdependent, and reporting them separately without a multivariable model risks double-counting the same prognostic information; in our model both retained independent significance, with acceptable collinearity, which suggests that the depth of visual loss at presentation carries information beyond the binary macular status — plausibly the height and duration of foveal detachment. Second, PVR grade and tear extent remained independently associated with the final BCVA even though they are usually discussed in terms of anatomical risk. A tear larger than 180° was associated both with lower single-surgery success (62.5% vs. 82.3%) and with a worse final BCVA, and eyes requiring more than one operation ended with substantially worse acuity (1.29 vs. 0.84 logMAR), which indicates that the functional cost of extensive disease is mediated at least in part through repeat surgery and its consequences.[17]

The delay between symptom onset and surgery correlated weakly with the final BCVA in univariable analysis but did not survive adjustment, most likely because its effect operates through macular detachment rather than independently of it. A comparable dependence of the visual result on the interval to surgery has been reported for macula-off rhegmatogenous detachment in general.[18, 19] This is nonetheless the variable most amenable to intervention: while surgical technique is already close to its practical ceiling in experienced hands, the interval from symptom to operating room depends on referral pathways and on the availability of urgent vitreoretinal surgery.

Regarding technique, single-surgery success did not differ significantly between PPV alone and PPV combined with an encircling buckle (77.8% vs. 79.2%), in agreement with the international multicenter study of 200 eyes by Ong et al.[8] which found comparable results in adults and an advantage for the

combined procedure only in children, in whom hereditary vitreoretinopathies such as Stickler syndrome predispose to giant tears and complicated detachments.[20] This equality, however, should not be read as equivalence of the two techniques, because the buckle was not allocated at random: it was preferentially added to eyes with inferior extension of the tear, PVR grade C or higher, or phakic patients younger than 40 years — precisely the features that predict failure. Buckled eyes accordingly started with a worse risk profile (inferior extension 62.5% vs. 25.9%; PVR ≥ C 41.7% vs. 20.4%; phakic and younger than 40 years 37.5% vs. 11.1%) and still achieved the same single-surgery and final anatomical success. This pattern is compatible with a benefit of buckling in this selected group, but confounding by indication cannot be excluded and our data cannot demonstrate it; a randomized comparison restricted to eyes meeting these three criteria would be the appropriate test. With respect to tamponade, gas-filled eyes had a slightly better final BCVA than oil-filled eyes (0.74 vs. 1.02 logMAR) without reaching significance, a pattern that echoes the findings of Barth et al.[9], who reported fewer redetachments with silicone oil but better final acuity with gas in macula-on GRT detachments, together with a high rate of unexplained visual loss in oil-filled eyes.[21] In our series, unexplained visual loss after oil removal occurred in 4 of 48 eyes (8.3%), a complication that has been linked to the oil tamponade itself rather than to its removal.[22] Because tamponade was selected according to case severity, this difference should not be interpreted as a treatment effect.

The complication profile of our cohort is unremarkable for this type of surgery, dominated by cataract progression in eyes that remained phakic (78.6%) and by elevated intraocular pressure (17.9%). The fellow eye deserves particular attention in this disease. In our cohort it was already abnormal at presentation in 40.5% of patients — lattice degeneration or asymptomatic breaks in 25.7%, a previous detachment in 10.8% and a previous GRT in 4.1% — and a new detachment developed during follow-up in 5.4%, half of which were themselves giant tears. These figures are consistent with the bilateral tendency of the disease and justify a dilated peripheral examination of the fellow eye in every GRT patient, at presentation and at each subsequent visit. Whether prophylactic treatment should follow that examination is less clear. Prophylactic laser retinopexy was performed in 39.2% of our patients, and although fellow-eye detachment was numerically less frequent in treated than in untreated eyes (3.4% vs. 6.7%), the difference was not significant and the comparison is confounded by indication, since treatment was offered to the eyes judged to be at higher risk. A Cochrane review reached the same impasse at a higher level of evidence, finding no randomized trial on which to base a recommendation.[23] Our data therefore support vigilance and informed discussion with the patient rather than a blanket policy, and they add one practical observation: the detachments that did occur appeared after a median of 14 months, so follow-up of the fellow eye needs to extend well beyond the first postoperative year.

This study has the limitations inherent to a retrospective single-center series. Selection and information bias cannot be excluded, and missing data were handled by complete-case analysis. Visual acuity was recorded with Snellen charts and low-vision levels were converted with a published scale, which introduces imprecision at the lower end of the range.[11] PVR was graded by the operating surgeon at the time of surgery rather than by a masked reader, and surgery was performed by several surgeons over a 11-year period during which techniques and instrumentation evolved. Neither the encircling band nor

the tamponade agent was allocated at random, so comparisons between techniques remain subject to confounding by indication. Although our cohort is larger than most single-center series reported from Türkiye, the number of eyes and events limited the number of predictors that could be modeled and the precision of the estimates, as reflected in the width of the confidence intervals; in addition, macular status and preoperative BCVA are closely related, which complicates the separation of their individual contributions. Finally, macular optical coherence tomography was not available at every visit for every eye, so the microstructural correlates of visual recovery — ellipsoid zone integrity, persistent subretinal fluid and epiretinal membrane — which are established predictors of the visual result after detachment surgery[24], could not be analyzed; these are the natural subject of a prospective extension of this work.

Conclusions

In this cohort of eyes undergoing surgery for GRT-associated RRD, final retinal attachment was achieved in 94.9%, but 42.3% of eyes remained worse than 20/200. Macular detachment, worse preoperative BCVA, PVR grade C or higher, and tear extent > 180° were independently associated with poorer final visual acuity. These findings highlight the importance of early diagnosis and careful prognostic assessment, particularly in eyes with extensive tears or advanced PVR. The observed associations should be validated in larger prospective cohorts incorporating standardized follow-up and macular imaging.

Abbreviations

BCVA
Best-corrected visual acuity
C3F8
Perfluoropropane
CF
Counting fingers
CI
Confidence interval
cSt
Centistokes
GRT
Giant retinal tear
HM
Hand motions
IOL
Intraocular lens
IQR
Interquartile range
logMAR

Logarithm of the minimum angle of resolution
LP
Light perception
OCT
Optical coherence tomography
OR
Odds ratio
PFCL
Perfluorocarbon liquid
PPV
Pars plana vitrectomy
PVR
Proliferative vitreoretinopathy
RRD
Rhegmatogenous retinal detachment
SB
Scleral buckle
SD
Standard deviation
SF6
Sulfur hexafluoride
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
VIF
Variance inflation factor

Declarations

Ethics approval and consent to participate

The study was approved by the Non-Interventional Clinical Research Ethics Committee of Taksim Training and Research Hospital, Istanbul, Türkiye (decision no. 125, 24 February 2026) and was conducted in accordance with the Declaration of Helsinki. Owing to the retrospective design, the requirement for informed consent to participate was waived by the ethics committee.

Consent for publication

Written informed consent for publication of the intraoperative images shown in Figure 2 was obtained from the patient.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AK conceived and designed the study, analysed the data and drafted the manuscript; MA, MŞ, SGÇ, ŞÖ and CA collected the data; HÖA supervised the study and critically revised the manuscript. All authors read and approved the final manuscript.

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Figures

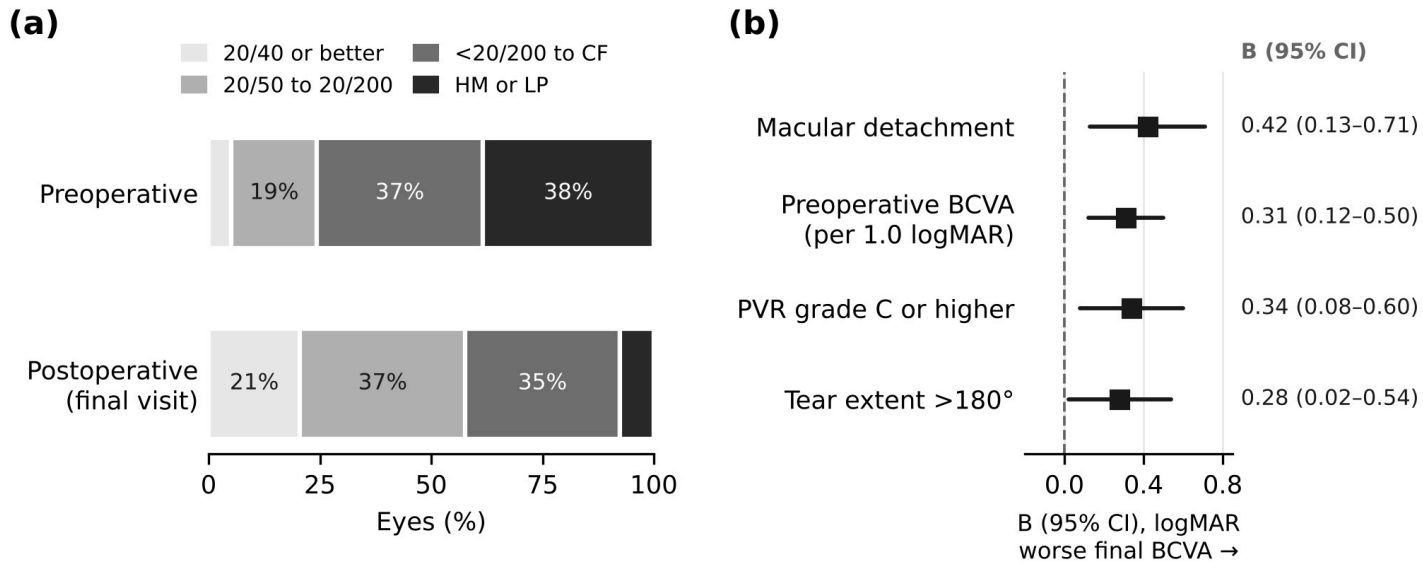

Figure 1

Visual outcome and factors associated with the final best-corrected visual acuity (BCVA) in 78 eyes. (a) Distribution of preoperative and postoperative (final visit) BCVA by category. (b) Multivariable linear regression for the final BCVA (logMAR); squares indicate unstandardized coefficients (B) and horizontal lines their 95% confidence intervals. Positive values indicate a worse final BCVA. CF: counting fingers; HM: hand motions; LP: light perception; PVR: proliferative vitreoretinopathy.

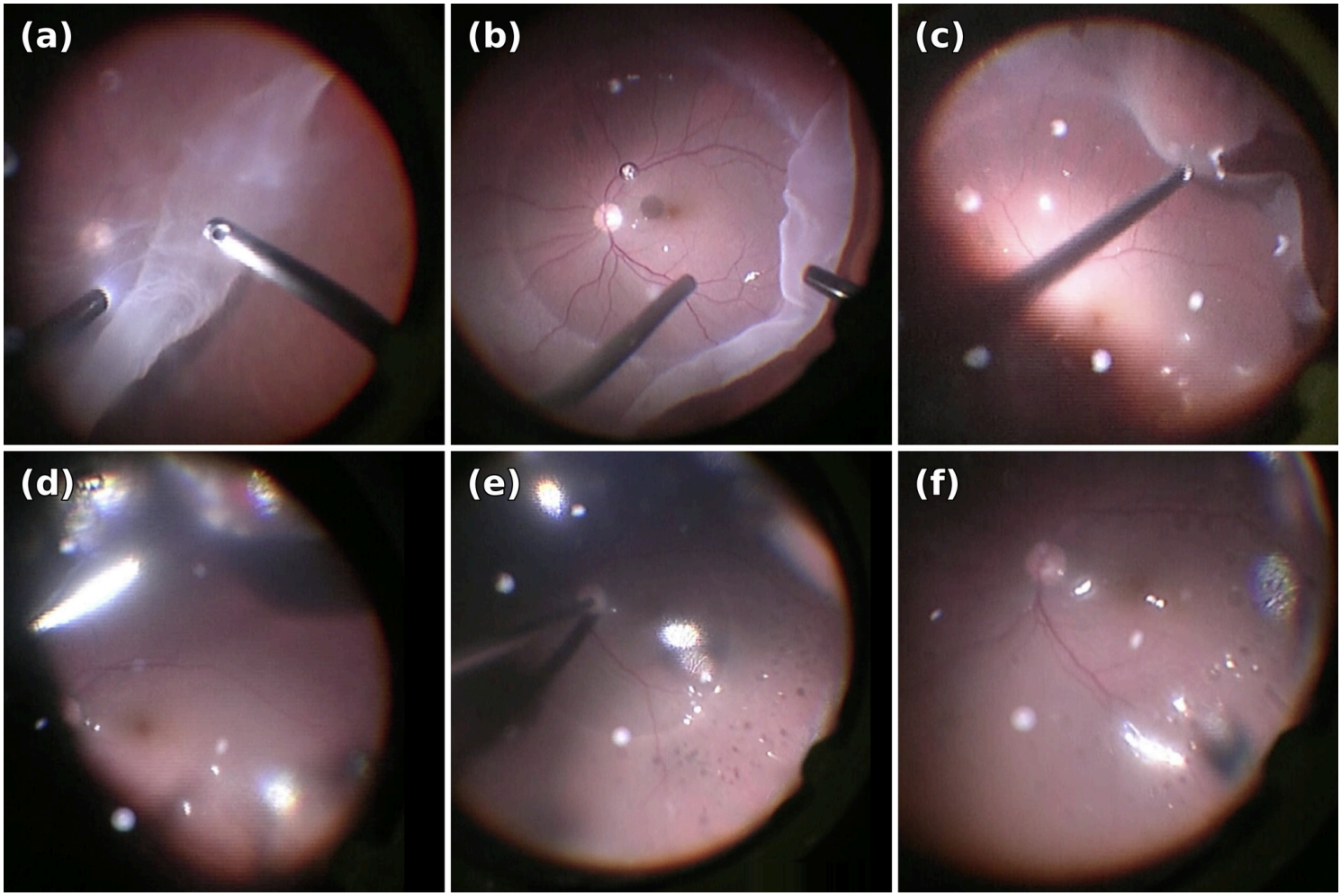

Figure 2

Intraoperative views of a representative case of giant retinal tear–associated rhegmatogenous retinal detachment. (a) Giant retinal tear with a folded posterior flap; (b) injection of perfluorocarbon liquid (PFCL) to unfold and flatten the posterior flap; (c) shaving of the vitreous base; (d) endolaser photocoagulation along the edge of the tear under PFCL; (e) direct PFCL–silicone oil exchange; (f) attached retina under silicone oil at the end of surgery.