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Visual and anatomical outcomes of primary retinectomy for diabetic tractional retinal detachment

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Abstract

Purpose Uncontrolled proliferative diabetic retinopathy (PDR) can cause fibrovascular growth and retinal traction, leading to tractional retinal detachment (TRD). The role of primary retinectomy in diabetic TRD remains unclear, as most studies focus on rhegmatogenous retinal detachment (RRD) with PVR. This study aims to investigate the impact of retinectomy on anatomical and visual outcomes in patients undergoing pars plana vitrectomy (PPV) for diabetic TRD.

Method Patients who underwent primary retinectomy during PPV for diabetic TRD were retrospectively evaluated. Best corrected visual acuity (BCVA) before surgery and at the final follow-up, retinectomy characteristics, and final retinal attachment status were documented. TRD score, the quadrant and extent of the retinectomy, presence of macular displacement at final follow-up, and postoperative complications were evaluated. The relationship between the quadrants and extent of the retinectomy and visual acuity was also assessed.

Result Thirty-eight eyes of 38 patients with mean age 60.55 ± 10.00 years were included. Mean follow-up was 23.53 ± 27.40 months. The most common locations of the retinectomy sites were extended posterior to the equator (39.5%), around the equatorial zone (34.2%), and peripheral retina (26.3%). The mean BCVA improved from 1.71 ± 0.53 logMAR to 1.48 ± 0.74 logMAR at the final follow-up. At the final visit 65.8% of patients experienced improved or maintained BCVA. Temporal retinectomy showed worse visual outcomes in the Chi-square test but not in binary logistic regression analysis. Furthermore, 26 (68.4%) eyes were attached without tamponade, 10 (26.3%) were attached under silicone oil and 2 (5.6%) remained detached under silicone oil.

Conclusion These findings suggest that retinectomy, when deemed necessary in eyes with diabetic TRD, may not lead to poor functional and anatomical outcomes, contrary to some previous assumptions.

Keywords Proliferative diabetic retinopathy, Retinectomy, Tractional retinal detachment

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Introduction

Diabetic retinopathy (DR), one of the most common microangiopathic complications of diabetes mellitus (DM), is a leading cause of vision loss worldwide [1]. According to early reports from the Diabetic Retinopathy Study, risk factors for vision loss include vitreous hemorrhage, neovascularization, optic disc involvement, and severe angiogenesis [2].

Chronic hyperglycemia induces pathological changes in the retina and vitreous, which can progress to tractional retinal detachment (TRD) [3]. It activates metabolic pathways leading to capillary closure, ischemia, and breakdown of the vascular basement membrane [4]. Hyperglycemia also disrupts free radical clearance, increases microvascular osmolarity, and elevates nitric oxide levels—contributing to neurotoxicity and promoting angiogenesis [1]. Nitric oxide further stimulates protein kinase C, which activates vascular growth factors. In response to hypoxia, basement membranes thicken, and factors such as vascular endothelial growth factor (VEGF) promote neovascularization [4]. VEGF and other angiogenic mediators have been identified in the retina and vitreous of TRD cases [5].

Hyperglycemia alters the cross-linking of type II collagen, accelerating vitreous liquefaction and syneresis. This may result in axial and tangential traction, further promoting neovascularization [3]. New vessels often grow into and anchor within the cortical vitreous, where high levels of fibronectin support fibrous proliferation [5]. A shift in the balance between proangiogenic and profibrotic factors contributes to the contraction of neovascular vitreoretinal adhesions, leading to retinal detachment [6, 7].

Vitreoretinal adhesion plays a key role in the development of retinal neovascularization [8]. Posterior vitreous detachment (PVD), defined as the separation of the posterior vitreous cortex from the inner limiting membrane, occurs due to weakened adhesion between these layers [9]. PVD has been associated with the progression of proliferative diabetic retinopathy (PDR) and is considered a prognostic factor for visual outcomes in diabetic vitrectomy [9]. Moreover, the presence or absence of PVD is recognized as a contributing factor in the development of TRD in eyes with diabetic retinopathy [8, 10].

Fibrovascular tissues and contractile structures formed in uncontrolled PDR may cause anteroposterior and tangential tractions on the thinned ischemic retinal tissue and may develop detachment of the neurosensory retina and intraocular hemorrhage [11, 12]. TRD is a potential complication of progressive PDR, and there remains ongoing discussion regarding the optimal timing of surgery and appropriate surgical techniques [12, 13]. The overall aims of TRD surgery include removal of vitreous opacities, release of vitreoretinal traction, successful reattachment of the retina, and prevention of recurrent neovascularization. Delaying surgery may increase the risk of widespread traction and irreversible visual impairment.

Retinectomy involves removing portions of the retina to relieve persistent traction that prevents the neurosensory retina from re-attaching. Retinectomy has gained prominence in the management of rhegmatogenous retinal detachment (RRD) complicated by anterior retinal shortening and advanced proliferative vitreoretinopathy (PVR) [14–19]. Several studies have suggested that retinectomy may serve as an alternative approach to reduce intraocular pressure in cases with neovascular glaucoma [20, 21]. The indications for retinotomy and retinectomy have progressively expanded, now encompassing various complex and previously inoperable cases. However, retinectomy is a technically demanding procedure that requires surgical expertise and may be associated with several complications, including intraoperative hemorrhage, subretinal perfluorocarbon retention, hypotony, anterior retinal neovascularization, and recurrent PVR [22]. Although it has been suggested that extensive retinectomies should be avoided in patients with diabetic TRD [13, 14], this recommendation is not yet supported by robust clinical evidence.

One of the fundamental tenets of vitreoretinal surgery is to preserve the integrity of the retina and to resort to retinectomy only when absolutely necessary. The necessity of retinectomy, its location, timing, and its impact on anatomical and functional success in cases of RRD, particularly in the presence of PVR, has been extensively discussed [15–19]. However, the effects of retinectomy performed during the initial surgery on functional and anatomical outcomes in cases of diabetic TRD have not been adequately investigated. In this article, we present the compiled results of patients who underwent pars plana vitrectomy (PPV) and primary retinectomy (PR) due to diabetic TRD in three tertiary referral centers.

Methods

This retrospective, observational, multicenter cross-sectional study was conducted to evaluate consecutively treated patients undergoing PR for diabetic TRD in eyes without prior vitrectomy. This study adhered to the principles outlined in the Declaration of Helsinki and was reviewed by the Local Ethics Committee of Kocaeli University. Electronic health records of patients who underwent PR for diabetic TRD at participating medical centers between 2012 and 2023 were retrospectively scrutinized.

Inclusion and exclusion criteria

Inclusion criteria were retinectomies performed in eyes with diabetic TRD and not previously vitrectomized, in which the retinectomy was performed as a primary adjunct procedure during the first vitrectomy. Eyes operated on with a retinectomy after a previous vitrectomy were excluded, that is non-primary retinectomies. The decision and timing of surgery were based on the presence of tractional retinal detachment threatening or involving the macula, broad nasal detachment extending close to the optic disc, or extensive peripheral retinal detachment where laser photocoagulation could not be adequately applied, particularly in cases accompanied by recurrent vitreous hemorrhage.

The recorded characteristics encompassed patient demographics, diabetes type (1 or 2), laterality, pre- and post-operative best-corrected visual acuity (BCVA), intraocular pressure (IOP) at the last follow-up, TRD complexity score, pre-operative lens status, preoperative pan-retinal photocoagulation, preoperative retinal tear or hole, intraocular tamponade status, retinectomy area, retinectomy width, necessity of re-vitrectomy, presence of retinectomy in repeat surgery, postoperative macular displacement, postoperative complications, and the attainment of anatomical reattachment Postoperative macular displacement was independently assessed by three masked observers (EOT, HSK, FBK) at different time points using optical coherence tomography infrared images; in cases where OCT images were not obtainable, surgical videos were used for evaluation. Anatomical success was defined as an attached retina after primary retinectomy with or without intraocular silicone oil tamponade. The primary outcome was anatomical success, while the secondary outcome was determined as visual acuity improvement.

The TRD score was determined using the complexity scoring (CS) system established by Zarbin and his study group [13, 23, 24]. This system assessed the following parameters: (1) the number of quadrants of fibrovascular proliferation (FVP), ranging from 1 to 4 quadrants, with each involved quadrant corresponding to a 1-point increase in the CS; (2) the location of FVP—either anterior to the equator (0 points), posterior to the equator (0 points), or both anterior and posterior (1 point); (3) TRD, 1 point); (4) traction-rhegmatogenous retinal detachment (TRRD, 2 points); and (5) the presence or absence of a posterior vitreous detachment (no PVD, 1 point). TRD scoring and detailed surgical data were obtained by retrospectively reviewing the operation notes and surgical video records of all patients.

The reasons for reoperation were identified as tractional preretinal membranes and fibrosis, retinal detachment under silicone oil—particularly in the inferior quadrant—and posterior pole membranes posing a risk of macular traction.

Surgical technique

All subjects underwent a standard three-port 23-gauge or 25-gauge pars plana vitrectomy (PPV). In cases where the lens obstructed intraoperative fundus visualization or impeded adequate membrane removal, phacoemulsification was performed. A core vitrectomy was executed, followed by meticulous vitreous trimming up to the vitreous base over 360°, typically employing scleral indentation, preceded by triamcinolone injection.

The precise removal of all epiretinal and PVR membranes, following staining with membrane blue (DORC, Zuidland, The Netherlands), was performed using intraocular vitreoretinal forceps. Dissection was initiated from the posterior membranes and extended anteriorly up to the equator. The decision to peel the internal limiting membrane (ILM) at the posterior pole was left to the discretion of individual surgeons.

Post-membrane peeling, residual anterior traction and retinal detachment were evaluated. PR was performed in cases where anterior retinal wrinkling was present and posterior hyaloid detachment could not be achieved anterior to the equator due to strong adhesions, preventing complete vitreous removal. PR was also indicated in cases with large horizontal retinal tears that occurred during separation of the posterior hyaloid or traction release, and when retinal reattachment was not possible due to persistent tractions or intrinsic fibrosis.

Endodiathermy was applied to the retinal edge at the retinectomy site, and the primary retinectomy was performed using a vitreous cutter. Particular care was taken to remove the non-functional anterior retinal flap in the periphery to reduce ischemia, neovascularization, and reproliferation. Intraoperative elevation of intraocular pressure was used when necessary to achieve hemostasis and reduce bleeding from the PR margins. Any subretinal membranes were meticulously dissected when present.

Following completion of PR, retinal flattening was achieved via intravitreal injection of perfluorocarbon liquid over the posterior pole. Continuous laser retinopexy along the retinectomy margin and tight panretinal photocoagulation were applied in all cases. The perfluorocarbon liquid (Teknomek®, Istanbul, Turkey) was then exchanged for air, followed by silicone oil tamponade using either 1300 or 5700 centistoke oil (Teknomek®, Istanbul, Turkey), depending on surgeon preference.

Surgical techniques such as segmentation, delamination, en bloc resection, and viscodissection were employed according to the individual surgeon's intraoperative preference.

A schematic representation of the distribution of retinectomy areas is presented in Fig. 1. The surgical maneuvers performed during the operation are shown in Fig. 2.

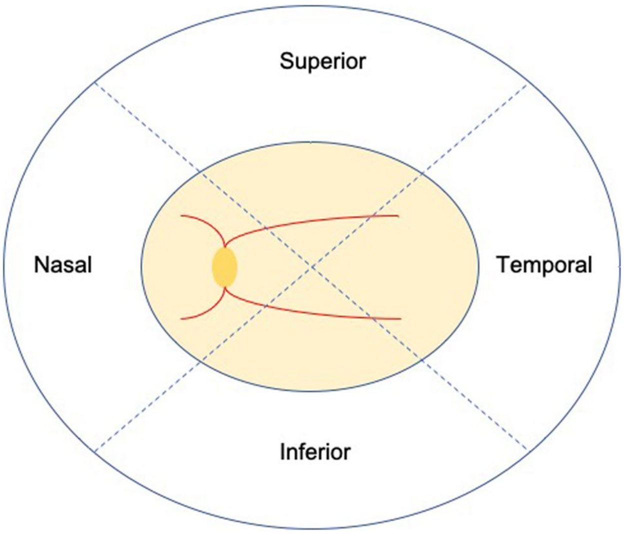

Fig. 1 Retinectomy quadrants were categorized as nasal, temporal, superior, or inferior. If a single quadrant accounted for at least 70% of the retinectomy area, it was classified under that quadrant. In cases involving multiple quadrants, each involved quadrant was recorded separately

Table 1 Baseline and demographic characteristics of the patients

	Mean ± SD (min-max)
Age	60.55 ± 10.00 (32–77)
Follow-up time (months)	23.53 ± 27.40 (0.37-124.17)
Preoperative BCVA (logMAR)	1.71 ± 0.53 (0.3–2.3)
Preoperative IOP (mmHg)	14.39 ± 4.17 (7–25)
Preoperative TRD Score	4.76 ± 1.53 (2–8)
	n (%)
Gender (Female: Male)	15:23
Preoperative Lens (Phakic: Pseudophakic)	26:12
Presence of PRP	4 (10.5)
DM Type (type 1: type 2)	8:30
Presence of retinal tear	15 (39.5)

Abbreviations: BCVA: best corrected visual acuity; DM: diabetes mellitus; IOP: intraocular pressure; PRP: panretinal photocoagulation

Statistical analysis

Statistical tests were performed via a statistical analysis program (SPSS, version 21.0; Chicago, IL, USA). The threshold for statistical significance was a p-value of < 0.05 Firstly, the assumption of normality in the data was evaluated using the Kolmogorov-Smirnov test and histogram plots. Subsequently, dependent and independent nonparametric continuous variables were analyzed using the Wilcoxon test and the Mann-Whitney U test, respectively. Categorical variables were assessed using the Pearson Chi-Square test or Fisher's Exact test, while the McNemar test was applied for dichotomous repeated measures. Continuous data are presented as mean ± standard deviation (SD), whereas categorical data are summarized as counts (percentages), unless stated otherwise.

Binary logistic regression analysis was used to evaluate factors associated with the preservation of visual acuity and anatomical success. BCVA obtained in Snellen fractions was converted to the logarithm of the minimum angle of resolution (logMAR) for statistical analysis.

Results

Thirty-eight eyes of 38 patients from three tertiary referral centers were included. Of the cohort, 39.5% ($n = 15$) were female, and the mean age was 60.55 ± 10.00 years. The mean follow-up period was 23.53 ± 27.40 months. Baseline and demographic characteristics are summarized in Table 1.

Retinectomy location varied: 39.5% ($n = 15$) extended posterior to the equator, 34.2% ($n = 13$) were around the equatorial zone, and 26.3% ($n = 10$) involved the peripheral retina. The inferior quadrant was the most frequently targeted area (63.2%), followed by the nasal (47.4%), superior (44.7%), and temporal (34.2%) quadrants. Combined phacoemulsification was performed in 42.1% ($n = 16$) of patients. Silicone oil was used as the intraocular tamponade in all cases.

Re-vitrectomy was required in 47.4% ($n = 18$), and among these, repeat retinectomy was performed in 35.29% ($n = 6$), followed by silicone oil tamponade. In one patient, after silicone oil removal, an epiretinal membrane was peeled and C3F8 gas used as tamponade. In

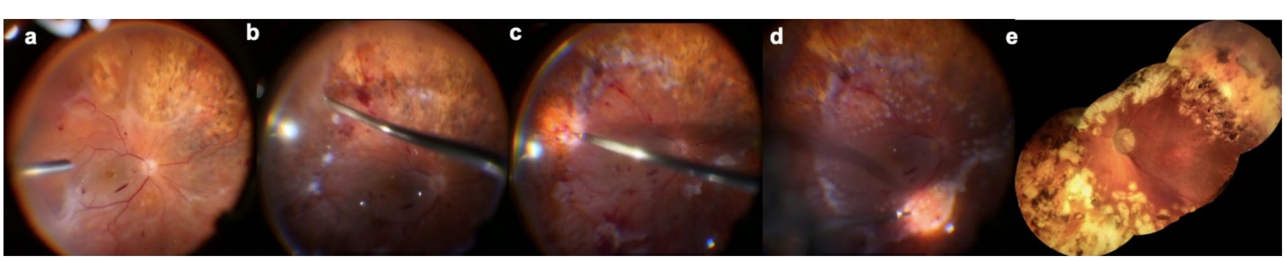

Fig. 2 Surgical images of a 56-year-old female patient who underwent primary retinectomy due to diabetic TRD and intraocular hemorrhage. Fundus image after completion of core vitrectomy and peripheral vitreous removal shows nearly 360-degree preretinal membranes and intrinsic retinal shortening (**a**). After removal of preretinal membranes, persistent intrinsic retinal shortening is observed, and perfluorodecalin is injected. Retinectomy margins are marked with endo-cautery and the retinectomy is performed using a cutter, followed by removal of the residual anterior retina (**b**). Endolaser photocoagulation is applied to the retinectomy margins and the peripheral retina beyond the arcades (**c**, **d**). Following silicone oil removal, the final fundus image at the last follow-up is presented, with the patient's visual acuity recorded as 20/200. (**e**)

others, ILM and/or membranes at the posterior pole were peeled, and additional endolaser was applied to areas of vascular proliferation when necessary.

At final follow-up, mean BCVA improved to 1.48 ± 0.74 logMAR (range: 0.2 to 3.0). Vision was preserved or improved in 65.8% (n = 25) of patients. Retina remained attached without tamponade in 68.4% (n = 26), under silicone oil in 26.3% (n = 10), and was detached under oil in 5.4% (n = 2).

At the last visit, 7.89% (n = 3) had developed severe PVR, 7.89% (n = 3) had glaucoma, 2.63% (n = 1) had hypotony, and 2.63% (n = 1) developed late endophthalmitis. Perioperative and postoperative characteristics are summarized in Table 2.

An additional analysis was performed to evaluate the procedures performed before, during and after surgery and their relationship with vision preservation and retinal anatomical success. This analysis showed that if the retinectomy involved the temporal quadrant, the patient's final visual acuity became worse than the initial value. Retinectomy performed in other quadrants did not appear to exert a negative effect on preserving final vision (Table 3). Although the anatomical success was higher in cases without temporal retinectomy than in cases with temporal retinectomy, no significant difference was detected. We found no relationship between anatomical success and surgical interventions (Table 4). To further assess the independent effect of temporal retinectomy, we performed binary logistic regression analyses, adjusting for potential confounders including age, intraoperative ILM peeling, and macular displacement (Table 5). In the multivariate analysis, temporal retinectomy was not significantly associated with preservation of visual acuity (OR = 0.251, 95% CI: 0.047–1.328, p = 0.104) or anatomical success (OR = 0.324, 95% CI: 0.062–1.677, p = 0.179).

Discussion

TRD secondary to PDR remains one of the most challenging indications for vitreoretinal surgery. Management of TRD, particularly in cases resistant to standard membrane peeling techniques, often requires complex surgical decision-making. In the current study, we aimed to investigate and report the results of patients with PPV and PR due to diabetic TRD. The major findings were; (1) 68% eyes had attached retina without tamponade and 66% eyes had improved or stabilized BCVA at the final follow-up; (2) The most common zone for retinectomy was the posterior to equatorial zone.

TRD due to PDR is the second most common vitrectomy indication after vitreous hemorrhage in PDR. Vitreoretinal surgical procedures continue to be the first option considered, especially in TRDs involving or threatening the macula [14, 22]. Our study cohort consisted of patients who underwent PPV and PR due to diabetic

Table 2 Peroperative and postoperative patient characteristics

Postoperative BCVA, (logMAR) (mean ± SD) (min-max)		1.48 ± 0.74 (0.2-3.0)
Postoperative protected or improved BCVA, % (n)		65.8 (25)
Retinectomy area, % (n)	Posterior to the equator	39.5 (15)
	Around the equator	34.2 (13)
	Peripheral retina	26.3 (10)
Retinectomy quadrant, (%)	Inferior	63.2
	Nasal	47.4
	Superior	44.7
	Temporal	34.2
Phacoemulsification and IOL implantation during surgery, % (n)		42.1 (16)
Re-vitrectomy, % (n)		47.4 (18)
Retinectomy in secondary surgery, % (n)		35.29 (6)
Anatomical success, % (n)	Silicone tamponade +	26.3 (10)
	Silicone tamponade -	68.4 (26)
Postoperative complication, % (n)	PVR	36.8 (14)
	Glaucoma	7.89 (3)
	Hypotonia	2.63 (1)
	Endophthalmitis	2.63 (1)

Abbreviations: BCVA: best corrected visual acuity; IOL: intraocular lens; PVR: proliferative vitreoretinopathy

Table 3 Analyses of relationship between protection of visual acuity and surgical interventions

		VA not improved	VA improved	*p* value*
Preoperative anti-VEGF	*Not performed*	2	6	0.432
	Performed	11	19	
TRD score ≤ 4	*>4*	8	13	0.428
	≤4	5	12	
ILM peeling	*Not performed*	7	8	0.191
	Performed	6	17	
Retinectomy width	*<90°*	7	10	0.415
	>90°	6	15	
Retinectomy area	*Posterior to the equator*	3	12	0.314
	Around the equator	6	7	
	Peripheral retina	4	6	
Inferior retinectomy	*Not performed*	3	11	0.205
	Performed	10	14	
Nasal retinectomy	*Not performed*	8	12	0.428
	Performed	5	13	
Superior retinectomy	*Not performed*	9	16	0.747
	Performed	4	9	
Temporal retinectomy	*Not performed*	4	17	***0.029***
	Performed	9	8	
Postoperative macular displacement	*Yes*	5	4	0.127
	No	8	21	

Chi-square test

Abbreviations: Anti-VEGF: anti-vascular endothelial growth factor; ILM: internal limitant membrane; TRD: tractional retinal detachment; VA: visual acuity

Table 4 Analyses of relationship between retinal attachment without tamponade and surgical interventions

		Retina not attached	Retina attached	p*
Preoperative anti-VEGF	*Not performed*	1	7	0.191
	Performed	11	19	
TRD score ≤ 4	*>4*	6	14	0.825
	≤4	6	12	
ILM peeling	*Not performed*	6	9	0.367
	Performed	6	17	
Retinectomy width	*<90°*	6	15	0.658
	>90°	6	11	
Retinectomy area	*Posterior to the equator*	4	11	0.793
	Around the equator	5	8	
	Peripheral retina	3	7	
Inferior retinectomy	*Not performed*	4	10	0.761
	Performed	8	16	
Nasal retinectomy	*Not performed*	5	15	0.358
	Performed	7	11	
Superior retinectomy	*Not performed*	8	17	0.938
	Performed	4	9	
Temporal retinectomy	*Not performed*	4	17	0.067
	Performed	8	9	
Postoperative macular displacement	*Yes*	4	5	0.289
	No	8	21	

Chi-square test

Abbreviations: Anti-VEGF: anti-vascular endothelial growth factor; ILM: internal limitan membrane; TRD: tractional retinal detachment

TRD. While retinectomy may frequently be performed in RRD, especially in cases with PVR, it is not often performed by surgeons in cases of diabetic TRD. There are many studies showing the anatomical and functional results of retinotomy and/or retinectomy, the majority of which consist of eyes with PVR due to RRD. Ramamurthy et al. reviewed retinotomy and retinectomy studies and reported that anatomical success after retinectomies varied from 72 to 96% and final BCVA improved to at least 20/400 level in 27–60% cases [22]. Grigoropoulos et al. evaluated 304 eyes with retinectomy due to various complex retinal detachments, and found 72% anatomical success with at least one surgery and 69% visual gain [14]. However, in this study, the authors did not provide details about the visual gains or anatomical consequences of different types of detachment. Ouiram et al. showed that in their study group of eyes treated with vitrectomy and inferior retinectomy due to recurrent RRD complicated by proliferative vitreoretinopathy, anatomical success was achieved in 93% of the eyes and visual improvement or preservation was achieved in 70% [25]. In the present study, 68.4% of patients had attached retina without tamponade and 26.3% of them had attached retina under silicone oil. In addition, we evaluated visual acuity gain as maintaining current BCVA or increasing visual BCVA, and we found that 65.8% of the patients achieved visual acuity gain and/or preservation. Thus, our results suggest that PR may provide similar success as reported in rhegmatogenous retinal detachment series, both anatomically and functionally, in TRD due to PDR.

In the present study, we recorded the location of the retinectomy area and found that the posterior to the equatorial zone and the equatorial zone were two of the most frequently operated retinal regions for retinectomy. To the best of our knowledge, this is the first study to investigate retinectomy regions in terms of outcome in patients with diabetic TRD. Hocaoglu et al. evaluated 126 cases with PVR due to RRD and they found that equatorial and peripheral zones were frequent zones for retinectomy [26]. In patients with a threat to the macula with TRD, tight posterior vitreous adhesion and epiretinal membranes in posterior regions may complicate posterior vitreous separation during surgery and cause iatrogenic tears. In addition, removal of subretinal membranes close to the posterior zone may be required during retinectomy for re-attaching the retina. So, these findings may explain why eyes with diabetic TRD need more retinectomies in the posterior and equatorial zones than the peripheral zone.

There are some studies that have evaluated factors that may be associated with visual outcomes after retinectomy [14, 27]. Many of these studies included eyes with PVR due to RRD and they showed that larger retinectomy sizes were associated with worse post-operative visual outcomes [14, 28–31]. Grigoropoulos et al. assessed the relationship between some conditions and good visual acuity (better than 6/24) and they found a significant association between good visual acuity between tamponade duration, removal of silicone oil, total extent of retinectomy and preoperative visual acuity [14]. However, these authors did not evaluate retinectomy location and visual outcome [14]. Morse et al. revealed an association

Table 5 Binary logistic regression analysis of factors associated with visual acuity preservation and anatomical success

	Visual Acuity Preservation			Anatomical Success		
	Odds Ratio	Confidence Interval	p	Odds Ratio	Confidence Interval	p
Age	0.998	0.927–1.073	0.951	0.964	0.891–1.044	0.369
ILM peeling	1.352	0.265–6.902	0.104	1.071	0.211–5.428	0.934
Temporal retinectomy	0.251	0.047–1.328	0.717	0.324	0.062–1.677	0.179
Macular displacement	0.324	0.062–1.703	0.183	0.552	0.104–2.927	0.485

between 360° retinectomy or retinectomy involving one entire temporal quadrant and reduced BCVA at the six months visit but not at the final visit [28]. We also assessed the correlation between vision preservation and/or improvements and surgical interventions. In our study group, no association was found between the extent of retinectomy and poor visual outcomes in univariate analysis. However, eyes with temporal retinectomy showed a relationship with poorer postoperative visual outcomes. Nevertheless, in multivariate analyses, when potential confounding factors such as age, intraoperative ILM peeling, and macular displacement were included, temporal retinectomy was not significantly associated with worse visual prognosis. This is likely due to the limited sample size. Despite this, closer monitoring of membranes and retinal shortening in the temporal retina during preoperative follow-up may be advisable in diabetic TRD patients, and earlier surgical intervention in these eyes may help to prevent visual deterioration.

Postoperative hypotony is a significant complication after retinectomy, with reported rates ranging from 3 to 22% in large series [14, 25–27, 30, 32–38]. The proposed mechanisms include increased fluid absorption through exposed retinal pigment epithelium (RPE) and tractional forces from retained anterior flaps leading to episcleral membranes, ciliary body detachment, and recurrent PVR. Kolomeyer et al. reported hypotony in 17% of eyes (7/41) undergoing 360° retinectomy for complex RD, despite the use of silicone oil tamponade, which was thought to reduce hypotony risk [37]. Grigoropoulos et al. found a significant association between hypotony and silicone oil removal, but no link to the extent of retinectomy [14]. In a series of 42 eyes with anterior grade C PVR, Hocaoğlu et al. observed chronic hypotony in 8%, despite silicone oil use [26]. However, these studies were conducted in eyes with PVR-associated RRD, which differs from the patient population in our study. In our study, postoperative hypotony was observed in only one case, in which silicone oil was not removed. We believe that larger-scale studies in patients with diabetic TRD will yield more definitive insights into the incidence of postoperative hypotony.

Preoperative intravitreal anti-VEGF has been explored to enhance surgical safety in PDR-related TRD [39]. Initial reports, such as that by Chen and Park, demonstrated reduced neovascularization and intraoperative hemorrhage following intravitreal bevacizumab (IVB) administration [40]. Subsequent studies, including those by Rizzo et al. and Yeoh et al., observed decreased surgical complexity, bleeding, and iatrogenic injury [41, 42]. The IBeTra study quantitatively confirmed reduced intraoperative bleeding with IVB [43]. Moreover, IVB may lower early postoperative vitreous hemorrhage rates and reoperation risk. In our study, no significant association was found between preoperative anti-VEGF use and visual outcomes or surgical complexity, possibly due to limited sample size.

The Diabetic Retinopathy Vitrectomy Study (DRVS) provided pivotal insights into the role of vitrectomy in eyes with severe PDR [44]. Since then, substantial advancements have been made in imaging technologies, surgical techniques, and intraocular tamponade agents, significantly improving the management of these complex cases. Silicone oil is widely used in the management of complex retinal detachments requiring extended tamponade, particularly in cases of advanced PDR with associated TRD and PVR. Compared to intraocular gas, silicone oil offers prolonged intraocular stability and has been associated with improved anatomical outcomes in challenging cases [13]. Several studies have demonstrated variable success rates with silicone oil in PDR-related retinal detachments. Lean et al. reported a 31% reattachment rate in 13 eyes with severe diabetic TRD, while Yeo et al. observed a 70% reattachment rate in a series of 23 eyes [45, 46]. Lucke et al. documented a 73% reattachment rate in a larger cohort of 106 patients [47]. Azen et al., in a prospective study of 359 eyes, reported a complete retinal reattachment rate of 57% and macular reattachment in 74% of cases [48]. In a multicenter series by Scott et al., involving 132 eyes with various etiologies including PDR, the reattachment rate following initial or repeat surgery ranged between 48% and 50% [49]. In our study, all cases involved advanced diabetic TRD with concurrent PVR, requiring retinectomy. Given the severity and complexity of the pathology, silicone oil tamponade was employed in all eyes. At the final follow-up, 68% of eyes demonstrated complete retinal reattachment without tamponade, while 26.3% remained attached under silicone oil.

Our study was retrospective in design and lacked a control group, which limits the ability to draw causal inferences. In addition, the relatively small sample size reduced the statistical power for subgroup analyses, particularly for comparing surgical gauge systems (23G vs. 25G). Surgeries were performed by three different surgeons with varying levels of surgical experience, which may have introduced some variability in outcomes. However, our study shows that the visual and anatomical results of retinectomy surgery, which is not performed frequently in eyes with diabetic TRD, are similar to the results of retinectomies due to other retinal detachments and provides information to surgeons about visual prognosis.

In conclusion, along with advances in the vitrectomy technologies, anatomical and functional outcomes of eyes with diabetic TRD have steadily improved. However, it should be kept in mind that a good result can be obtained with retinectomy in cases complicated by dense membranes and retinal shortening, as demonstrated by our findings.

Author contributions
Concept and design; LK, EOT, Supervision; LK, Data collection &/or processing; EOT, LK, HSK, FBK, SAS, IT, Analysis and/or interpretation; EOT, LK, HSK, FBK, SAS, IT, Literature search; EOT, HSK, FBK, SAS, IT, Writing; EOT, HSK, IT Critical review; EOT, LK, HSK, FBK, SAS, IT. All authors critically revised the manuscript, approved the final version to be published, and agreed to be accountable for all aspects of the work.

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Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethical approval
This investigation complied with the principles outlined in the Declaration of Helsinki. The local ethics committee approved the study (Number: GOKAEK-2024/07.06). Written informed consent was obtained from all participants before participating.

Competing interests
The authors declare no competing interests.

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