Original Article

Outcomes of Pars Plana Vitrectomy for Diabetic Tractional Retinal Detachment in a Tertiary Care Hospital of Peshawar

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ABSTRACT

Purpose: To determine the visual outcomes of Pars Plana Vitrectomy (PPV) in eyes with diabetic tractional retinal detachment (TRD) in a tertiary care center of Peshawar.

Study Design: Interventional case series.

Place and Duration of Study: Department of Ophthalmology, Hayatabad Medical Complex (HMC), Peshawar for 06 months duration.

Methods: Total of 39 patients diagnosed with TRD secondary to Proliferative Diabetic Retinopathy(PDR)were enrolled. All patients underwent standard 23-gauge vitrectomy. Snellen chart was used to evaluate the preoperative and postoperative Best-Corrected Visual Acuity (BCVA).

Results: The average age of patients was 55.2 ± 8.4 years, with all cases having type II diabetes and a mean disease duration of 11.2 ± 3.8 years. Preoperatively, only 3% patients had BCVA of 6/24 or better, whereas postoperatively, 39% achieved this visual acuity. A significant visual improvement was observed in 72% of patients, with 10% reaching 6/18 and 3% achieving 6/12. On log-MAR scale, the visual acuity improved from 1.33±0.38 before vitrectomy to 0.97±0.41 after Vitrectomy ($p < 0.0001$).

Conclusion: In this prospective case series, most patients demonstrated meaningful postoperative visual gain, with a substantial increase in the proportion achieving functional vision. The significant improvement in LogMAR visual acuity highlights the role of timely PPV in eyes with TRD secondary to proliferative diabetic retinopathy, even in patients with long-standing type II diabetes.

Keywords: Pars Plana vitrectomy, Diabetes, Proliferative Diabetic Retinopathy, Retina.

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INTRODUCTION

Diabetic retinopathy (DR) is a primary cause of visual impairment, with approximately 93 million affected individuals worldwide.[1] Tractional Retinal Detachment (TRD) represents a severe manifestations of DR. The contracting fibrovascular membranes promote progressive distortion and detachment of the retina due to their tractional force.[2] The development of these membranes is induced by the ischemic and hyperglycemic environment through the release of angiogenic factors, primarily the Vascular Endothelial Growth Factors (VEGF).[3] Despite improvement in the management of diabetes, including better glycemic control, diabetic eye screening programs, and treatment modalities for PDR (Proliferative Diabetic Retinopathy), including PRP (Pan-Retinal Photocoagulation), complications such as TRD continue to occur, especially in lower and middle-income countries.[4]

Vitrectomy remains the primary surgical intervention for the treatment of TRD, as it allows the

removal of the vitreous and fibrovascular membranes, thereby decreasing tractional forces on the retina.[5] The last two decades have seen considerable evolution in the technology and methods of performing vitrectomy, with the introduction of small-gauge instrumentation, new tamponade agents, and other intraoperative adjuncts.[6] The integration of anti-VEGF therapy, both pre operatively and intraoperatively, has further revolutionized surgical outcomes by reducing intraoperative bleeding and fibrovascular proliferation.[7,8] Indeed, many series have demonstrated that attachment rates of over 90% have been achieved even without tamponade.[9]

Post-vitrectomy visual outcomes have been correlated to several factors, including grade of proliferative vitreoretinopathy, previous surgeries, time since detachment and visual acuity before surgery.[10,11] Significant improvement in visual outcomes were reported after 27-gauge vitrectomy for TRD, where percentage of severe visual impairment declined from 81.0% preoperatively to 56.9% at 6 months postoperatively.[12] This prospective case series was designed to evaluate the visual outcomes of vitrectomy for management of TRD in diabetic patients in a tertiary care hospital of Peshawar with different demographic data.

METHODS

This prospective case series was conducted at the Department of Ophthalmology, Hayatabad Medical Complex (HMC), Peshawar for a duration of 06 months. Ethical approval for the present study was granted by the IREC (Institutional Research and Ethical Committee) of Hayatabad Medical Complex, **(Reference No. 2343)**. Consequent upon eligibility, assessment and agreement to participate (by signing a written consent), patients were enrolled in this study. All eligible patients presenting during the study period were included consecutively, and therefore a priori sample size estimation was not determined. This study enrolled diabetic patients of age ≥ 18 years and with concurrent TRD. Moreover, the enrollment criteria also included patients' consent for participation and in follow-up assessments. Patients with non-diabetic retinal detachment, such as rhegmatogenous retinal detachment (RRD), Non-diabetic proliferative retinopathy with TRD, history of vitrectomy, concurrent ocular pathologies, such as AMD and corneal opacities were excluded.

All patients received pre-operative anti-VEGF injections. The same consultant/ surgeon (TS) performed surgical interventions. Silicone Oil was used as tamponade in all cases. Data including demographic parameters and clinical variables were recorded on a predesigned questionnaire. Demographic data included: patients' name, age, gender, affected eye (left or right), and type of diabetes. Moreover, the clinical data consisted of disease duration, risk factors (e.g., diabetic control), comorbidities including vitreous hemorrhage, history of ocular surgeries and hypertension. Finally, preoperative and postoperative Best Corrected Visual Acuity (BCVA) was quantified and converted to Log-MAR for an objective one-to-one comparison.

Statistical analysis was conducted using SPSS. Continuous data variables such as age and BCVA values were expressed in terms of mean and standard deviations. Categorical data variables such as gender, comorbidities, effected eye side, and type of diabetes were expressed in the form of frequencies and percentages. Comparative analyses of pre- and post-operative BCVA values were conducted using paired t-test, while that of categorical data using chi-square test, with significance level at p-value < 0.05.

RESULTS

In this study, 39 patients with TRD underwent vitrectomy. The predesigned questionnaire consisted of three major sections, pertaining to the patient demographics, clinical variables and vitrectomy procedure. The summary of the demographic variables

Table 1: *Demographic data of patients included in this study (n = 39).*

Demographic and Clinical Variable		n (%)
Gender	Male	22 (56.4)
	Female	17 (43.6)
Age (Years)	31-40	02 (5)
	41-50	08 (21)
	51-60	21 (54)
	61-70	05 (13)
	> 70	03 (7)
Diabetes	Type I	0 (0)
	Type II	39 (100)
Diabetes duration (Years)	≤ 05	05 (13)
	06-10	16 (41)
	11-15	14 (36)
	> 15	04 (10)
Laterality	Right	26 (67)
	Left	13 (23)

n: number of patients, %: percentage, <: less than, >: greater than, ≤: less than or equal to

is presented in Table 1. The average age of the patients was 56.38 ± 11.43 years. The median age was 55 years, while the range was 31-89 years. The mean duration of diabetes was 10.37 ± 3.90 years. The patients had Type 2 diabetes mellitus. Early presentation of the patients to ophthalmology clinics and early intervention illustrated favorable treatment outcomes.

Table 2 illustrates the summary of the clinical variables. It was noted that the TRD duration prior to surgery was highly variable. Specifically, the mean TRD duration was 35.67 ± 18.26 months. Other co-morbidities were also frequently observed among the patients. Specifically, there were 12 (31 %) patients with concurrent hypertension. Seventy-two percent of patients had a history of previous ocular surgery (Table 2).

Table 2: *Summary of clinical variables (n = 39).*

Clinical Variables		n (%)
Duration of TRD (months)	≤ 12	05 (13)
	13-24	05 (13)
	25-36	09 (23)
	37-48	04 (10)
	49-60	08 (20)
	> 60	01 (3)
Vitreous hemorrhage	No	36 (92)
	Yes	03 (8)
Hypertension	No	27 (69)
	Yes	12 (31)
Prior ocular surgeries	AS	04 (10)
	PPK+YLC	05 (13)
	PPK+PCO	02 (5)
	PPK+PCO+YLC	11 (28)
	No surgery	10 (25)

PRK: photo-refractive keratectomy, PCO: posterior capsule opacification, YLC: YAG laser capsulotomy, AS: Aphakic surgery, n: number, %: percentage, >: greater than, ≤: less than or equal to

The pre- and post- vitrectomy visual acuity is given in Table 3. Snellen's chart-based analyses demonstrated that patients in preoperative settings had severe visual impairments, with 33% of patients had a BCVA of 6/60. Only 3% of patients had a BCVA equal to or better than 6/24 preoperatively, while a considerable number had vision at the level of counting fingers (CF) or hand movements (HM), with one patient (3%) had only light perception (PL +ve).

It is evident that the visual outcomes had significantly improved after vitrectomy. Twenty-six percent of patients achieved visual acuity of 6/24, while 10% achieved visual acuity of 6/18. Moreover, visual acuity of 18% patients improved to 3/60, while a few patients (3%) achieved 6/12 vision. Visual recovery may remain limited, likely due to chronicity of TRD, despite the anatomical repair. This may also be governed by the pre-existing macular damage.

Table 3: *Summary of pre- and post-vitrectomy visual acuity.*

Visual Acuity	Pre-vitrectomy (%)	Post-vitrectomy (%)
6/60	13 (33)	08 (20)
6/36	03 (7)	02 (5)
6/24	01 (3)	10 (26)
6/18		04 (10)
6/12		01 (3)
1/60	07 (18)	02 (5)
2/60	06 (15)	03 (8)
3/60	05 (13)	07 (18)
4/60		
5/60		01 (3)
6/60		01 (3)
PL+ve	01 (3)	
HM	03 (8)	

%: percentage, PL: perception of light, HM: hand movement

The postoperative complications are given in Table 4. While most patients (77%) remained uneventful during the postoperative course, a complication rate of (23%) was observed after vitrectomy. To stratify the complications, the most consistently observed complication was elevated intra-ocular pressure (IOP), noted in 03 (8%) patients. However, the IOP was transient and resolved at subsequent follow-up. Moreover, the iatrogenic retinal breaks were observed in 02 (5 %) cases, which were treated with laser therapy. Early onset of cataract occurred in 01 (3 %) patients. In addition, a star fold pattern and retinal detachment was identified postoperatively in 01 (3%) patient each. The lower complication rate indicates the favorable safety profile of vitrectomy in TRD cases in this setup of Peshawar.

Table 4: *Clinical complications associated with vitrectomy.*

Complications	Number (Percentage)
Increased IOP	03 (8)
Retinal Breaks	02 (5)
Early cataract	01 (3)
Localized fibrosis	01 (3)
Retinal detachment	01 (3)

For an objective statistical comparison, the values of visual acuity were converted from Snellen's chart to

the corresponding Log-MAR scale. The mean BCVA values before and after vitrectomy were 1.33±0.38 (range: 0.6-1.8) and 0.97±0.41 (range: 0.3-1.8), while the corresponding median values were 1.3 and 1, respectively. This improvement in BCVA values was statistically significant as evidenced by a p value less than 0.0001 using the paired t test.

DISCUSSION

TRD is a severe complication of PDR and often results in significant visual impairment. This study assessed visual outcomes after PPV in patients with TRD, emphasizing how surgical intervention influences their visual acuity. The results indicated that vitrectomy was associated with significant improvement in vision in a large proportion of patients with TRD. Preoperatively, the majority had severe visual impairment, and only 3% had a BCVA of 6/24 or better, whereas postoperatively, 39% patients achieved a BCVA of 6/24 or better. Of these eyes, 10% regained 6/18 and 3% reached 6/12. This represents a significant improvement in functional outcome. These results imply that earlier surgical intervention could optimize the visual outcome for patients with TRD. However, 8% of patients had postoperative vision at HM or worse, which can be due to chronicity of retinal detachment, and macular involvement. Postoperative complications are additional factors that may affect full recovery of vision despite successful anatomical retinal reattachment.[13]

Results of the current study are in accordance with the literature on anatomical and visual outcomes after vitrectomy in diabetic eyes. A meta-analysis of 38 studies encompassing 3,839 eyes reported a retinal reattachment failure rate of 5.9% following a single surgical procedure, with a mean final visual acuity of 0.94 LogMAR, corresponding to approximately 6/53 on the Snellen scale.[14] In the current study, postoperative visual acuity was comparatively better as 39% achieved 6/24 or better vision. Another study in 69 eyes reported a primary reattachment rate in 98.6% of the patients with significant improvement in Log-MAR visual acuity from a mean of 1.84 preoperatively to 0.93 postoperatively.[15] These are comparable to our results, further establishing vitrectomy as the standard of care for diabetic TRD. In another large, single-center retrospective study of patients with advanced diabetic tractional retinal detachment, vitrectomy achieved excellent anatomical outcome and improved or stabilized vision in 80.1% of eyes. Smaller gauge vitrectomy systems were found to have similar outcomes to 20-gauge instrumentation.[16] The probable reason for variable results could be due to a difference in surgical skills, availability of equipment, selection of patients, and the duration of TRD prior to surgery.[17,18] In the developing world, like Pakistan, suboptimal availability of vitreoretinal services, late referrals, and poor diabetic control might be the reason for less promising visual outcomes compared to international standards.[19]

Overall, complications arising in our series were 23%, of which the most common issues, elevated IOP (8%), was managed conservatively. The other significant complication is localized fibrosis (5%) that can be related to fibrovascular proliferation and incomplete removal of epiretinal membranes, which have hindered final visual recovery.[20] Frequency of early cataract formation was observed in 3% cases. Pars plana vitrectomy accelerates cataract progression by increasing intraocular oxygen levels and changes in the lens capsule. Despite these complications, 77% of the patients had an uneventful postoperative course. However, advanced surgical techniques like intraoperative OCT-guided membrane dissection may reduce risks of complications. Of the utmost importance is the early detection of the disease, timely intervention, and better systemic diabetic control for optimizing the surgical outcome. Multicenter studies enrolling larger patient cohorts and longer follow-up duration can be recommended to further refine the surgical strategies to improve the visual prognosis in TRD patients.

In conclusion, this study demonstrates real life data from a tertiary care center of low to middle income countries with most patients showing a proportional visual improvement. However, postoperative visual recovery remains variable.

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Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(Reference No. 2343).**

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Authors Designation and Contribution

Muhammad Arshad Raza; Trainee Medical Officer: Concepts, Design, Literature search, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.

Tariq Shahnaam; Concepts, Design, Literature search, Manuscript preparation.

Sanaullah Jan; Concepts, Design, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.