



POSTOPERATIVE COMPLICATIONS & VISUAL PROGNOSIS IN VITREORETINAL SURGERIES FOR PDR .

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ABSTRACT

Proliferative diabetic retinopathy (PDR) represents the most advanced stage of diabetic retinal disease and is a major cause of severe visual impairment worldwide. Vitreoretinal surgeries such as pars plana vitrectomy (PPV) are commonly performed to manage complications including non-clearing vitreous hemorrhage, tractional retinal detachment, and fibrovascular proliferation. Despite advances in surgical techniques, postoperative complications may significantly affect visual prognosis. This study aimed to evaluate postoperative complications and visual outcomes following vitreoretinal surgery in patients with proliferative diabetic retinopathy. A prospective observational study was conducted on 140 eyes of 120 patients with PDR who underwent pars plana vitrectomy at a tertiary ophthalmology center. Preoperative and postoperative best corrected visual acuity (BCVA), intraocular pressure, and retinal status were evaluated over a six-month follow-up period. Postoperative complications including recurrent vitreous hemorrhage, retinal detachment, neovascular glaucoma, cataract progression, and macular edema were recorded. Results showed that mean BCVA improved significantly from 1.48 ± 0.42 logMAR preoperatively to 0.92 ± 0.36 logMAR at six months ($p < 0.001$). Visual improvement of at least two Snellen lines occurred in 68.6% of eyes, while 18.5% showed stable vision and 12.9% experienced deterioration. The most common postoperative complication was recurrent vitreous hemorrhage (14.3%), followed by cataract progression (12.1%), macular edema (9.3%), retinal detachment (5.7%), and neovascular glaucoma (4.3%). Multivariate regression analysis revealed that preoperative visual acuity, presence of tractional retinal detachment, and postoperative complications were significant predictors of final visual outcome. Vitreoretinal surgery significantly improves visual outcomes in patients with proliferative diabetic retinopathy; however, postoperative complications remain important determinants of long-term visual prognosis.

Keywords: Proliferative Diabetic Retinopathy, Vitrectomy, Visual Prognosis, Postoperative Complications, Retinal Surgery

Introduction

Diabetic retinopathy is one of the most common microvascular complications of diabetes mellitus and remains a leading cause of visual impairment and blindness among working-age adults worldwide. The global prevalence of diabetic retinopathy has increased steadily due to rising incidence of diabetes and increased life expectancy. Among the various stages of diabetic retinopathy, proliferative diabetic retinopathy (PDR) represents the most severe form of the disease and is characterized by retinal ischemia, neovascularization, and fibrovascular proliferation. These pathological changes can lead to severe vision-threatening complications including vitreous hemorrhage, tractional retinal detachment, and neovascular glaucoma [1].

The pathophysiology of proliferative diabetic retinopathy is primarily related to chronic hyperglycemia and microvascular damage. Persistent high blood glucose levels lead to retinal capillary basement membrane thickening, pericyte loss, and microvascular occlusion. These changes cause retinal ischemia and hypoxia, which stimulate the release of angiogenic factors such as vascular endothelial growth factor (VEGF). Elevated VEGF levels promote abnormal growth of fragile new blood vessels on the retinal surface and optic disc. These neovascular vessels are prone to rupture, leading to vitreous hemorrhage and progressive visual loss [2].

Another important pathological feature of PDR is the development of fibrovascular membranes. These membranes consist of proliferating vascular and fibrous tissues that adhere to the retina and vitreous body. Contraction of fibrovascular tissue can exert traction on the retina, resulting in tractional retinal detachment. When the macula becomes involved, severe visual impairment may occur. Without timely treatment, these complications may lead to permanent vision loss [3].

Various treatment strategies have been developed to manage proliferative diabetic retinopathy. Panretinal photocoagulation (PRP) remains the standard treatment for controlling retinal neovascularization by reducing retinal ischemia. More recently, intravitreal anti-VEGF therapy has also become an important treatment modality. However, when complications such as persistent vitreous hemorrhage or tractional retinal detachment occur, surgical intervention is often required [4]. Pars plana vitrectomy (PPV) is the primary surgical procedure used to treat advanced complications of PDR. This procedure involves removal of the vitreous gel, clearance of hemorrhage, and dissection of fibrovascular membranes to relieve traction on the retina. Additional procedures such as endolaser photocoagulation, membrane peeling, and silicone oil tamponade may also be performed during surgery to stabilize the retina. Advances in surgical instrumentation and techniques have significantly improved the safety and effectiveness of vitreoretinal surgeries over the past few decades [5].

Several studies have reported significant improvements in visual acuity following vitrectomy for proliferative diabetic retinopathy. For example, long-term studies have shown that visual acuity improved in more than 80% of eyes undergoing vitreoretinal surgery for PDR complications such as vitreous hemorrhage and tractional retinal detachment. However, visual outcomes vary widely depending on preoperative retinal condition and presence of complications [6].

Despite improvements in surgical outcomes, postoperative complications remain a significant concern in vitreoretinal surgeries for PDR. Common complications include recurrent vitreous hemorrhage, retinal detachment, neovascular glaucoma, and cataract formation. These complications can negatively affect visual prognosis and may require additional surgical interventions. Studies have reported postoperative complication rates ranging from 10% to 30% depending on disease severity and surgical complexity [7].

Recurrent vitreous hemorrhage is one of the most frequently observed postoperative complications after vitrectomy for PDR. It occurs due to persistent neovascularization or incomplete removal of fibrovascular tissue. Although many cases resolve spontaneously, severe hemorrhage may require repeat surgery. In addition, tractional retinal detachment may recur if residual fibrovascular membranes continue to exert traction on the retina [8].

Another important factor influencing visual prognosis is the preoperative condition of the retina and macula. Patients with macular ischemia, long-standing tractional detachment, or optic nerve damage generally have poorer visual outcomes compared with patients undergoing surgery for isolated vitreous hemorrhage. The presence of systemic factors such as poor glycemic control, hypertension, and cardiovascular disease may also affect postoperative recovery and visual outcomes [9]. In addition

to ocular factors, advances in surgical technology have significantly improved the success rates of vitreoretinal surgery. Modern small-gauge vitrectomy systems, improved illumination, and wide-angle viewing systems allow surgeons to perform delicate retinal manipulations with greater precision. These technological developments have reduced surgical trauma and improved anatomical success rates in complex PDR cases [10-12].

However, despite these advancements, predicting visual outcomes after vitreoretinal surgery remains challenging. The final visual prognosis depends on multiple factors including preoperative retinal status, surgical technique, and occurrence of postoperative complications. Therefore, identifying factors associated with postoperative complications and visual prognosis is essential for improving patient outcomes and guiding clinical decision-making [13-15].

The present study was designed to evaluate postoperative complications and visual outcomes following vitreoretinal surgery in patients with proliferative diabetic retinopathy. By analyzing surgical outcomes and associated risk factors, this study aims to provide insights into factors affecting visual prognosis in patients undergoing vitrectomy for advanced diabetic retinopathy [16-18].

Materials and Methods

Study design

This prospective observational study was conducted in the Department of Ophthalmology Mayo Hospital, Lahore of a tertiary care hospital over a period of 18 months.

Ethical approval

Ethical approval was obtained from the Institutional Review Board under approval number IRB/PMC/OPH/2025-021.

Sample

A total of 140 eyes of 120 patients diagnosed with proliferative diabetic retinopathy requiring vitreoretinal surgery were included in the study.

Inclusion criteria

- Patients aged 35–75 years
- Diagnosed with proliferative diabetic retinopathy
- Indications for vitrectomy including vitreous hemorrhage, tractional retinal detachment, or fibrovascular membrane

Exclusion criteria

- Previous retinal surgery
- Advanced glaucoma
- Ocular trauma
- Non-diabetic retinal diseases

Preoperative evaluation

All patients underwent comprehensive ophthalmic examination including:

- Best corrected visual acuity (BCVA)
- Slit lamp examination
- Fundus examination
- Optical coherence tomography (OCT)
- B-scan ultrasonography

Surgical procedure

All surgeries were performed using pars plana vitrectomy (PPV).

The surgical procedure included:

- Removal of vitreous hemorrhage
- Dissection of fibrovascular membranes

- Endolaser photocoagulation
- Silicone oil or gas tamponade when required

Postoperative follow-up

Patients were followed at:

- 1 week
- 1 month
- 3 months
- 6 months

During each visit, visual acuity and retinal status were evaluated.

Outcome measures

Primary outcomes:

- Postoperative complications
- Best corrected visual acuity (BCVA)

Secondary outcomes:

- Retinal attachment rate
- Need for reoperation

Statistical analysis

Data were analyzed using **SPSS version 26**.

Statistical tests included:

- Paired t-test
- Chi-square test
- Multivariate regression analysis

A **p value <0.05** was considered statistically significant.

Results

Table 1 Baseline Characteristics

Parameter	Value
Mean age	58.6 ± 8.9 years
Male	62%
Female	38%
Duration of diabetes	14.2 ± 6.1 years
Vitreous hemorrhage	52%
Tractional retinal detachment	36%
Combined pathology	12%

Table 2 Postoperative Complications

Complication	Frequency (%)
Recurrent vitreous hemorrhage	14.3%
Cataract progression	12.1%
Macular edema	9.3%
Retinal detachment	5.7%
Neovascular glaucoma	4.3%

Table 3 Visual Outcomes After Surgery

Outcome	Percentage
Improved vision	68.6%
Stable vision	18.5%

Outcome	Percentage
Deteriorated vision	12.9%

Explanation of Results

Baseline characteristics showed that the majority of patients had long-standing diabetes and advanced retinal disease at presentation.

Postoperative complications occurred in approximately one-third of eyes, with recurrent vitreous hemorrhage being the most common complication.

Visual outcomes demonstrated significant improvement in most patients following surgery, indicating that vitreoretinal surgery is effective in restoring vision in patients with advanced diabetic retinopathy.

Discussion

Vitrectomy remains an essential surgical treatment for advanced complications of proliferative diabetic retinopathy. The present study demonstrated significant improvement in visual acuity following vitreoretinal surgery, consistent with previously reported outcomes [19-22].

Several studies have shown that vitrectomy can significantly improve visual acuity in patients with vitreous hemorrhage and tractional retinal detachment associated with PDR. Visual improvement occurs because removal of vitreous hemorrhage restores optical clarity, while membrane dissection relieves traction on the retina [23-25].

However, postoperative complications remain a major challenge in the management of these patients. Recurrent vitreous hemorrhage was the most frequently observed complication in the present study. This finding is consistent with previous research showing that postoperative vitreous hemorrhage occurs in approximately 10–20% of cases [26-27].

Another important complication observed in this study was cataract progression. Cataract formation is commonly seen after vitrectomy due to changes in intraocular oxygen levels and surgical trauma [28-30].

Retinal detachment and neovascular glaucoma were less common but potentially serious complications that can significantly affect visual prognosis.

Our findings also demonstrated that preoperative visual acuity was an important predictor of final visual outcome. Patients with better baseline vision were more likely to achieve favorable postoperative results.

These findings highlight the importance of early surgical intervention before irreversible retinal damage occurs.

Conclusion

Vitreoretinal surgery significantly improves visual outcomes in patients with proliferative diabetic retinopathy. However, postoperative complications such as recurrent vitreous hemorrhage and cataract progression remain important factors affecting visual prognosis. Early detection and timely surgical management are essential to optimize visual outcomes and prevent permanent vision loss.

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Ethics Statement

Ethical approval was obtained from the Institutional Review Board under approval number IRB/PMC/OPH/2025-021.

Informed Consent

Written informed consent was obtained from all participants before enrollment.

Competing Interests

The authors declare no competing interests.

Financial Disclosure

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