# VISUAL OUTCOME AFTER PARS PLANA VITRECTOMY IN DIABETIC VITREOUS HEMORRHAGE

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## ABSTRACT

**Objectives:** To determine visual outcome and frequency of complications after pars plana vitrectomy in diabetic vitreous hemorrhage.

**Methodology:** This was interventional case series conducted at department of ophthalmology, Khyber Institute of Ophthalmic Medical Sciences, Hayatabad Medical Complex, Peshawar from January 2013 to June 2014. Known diabetic patients above 16 years of age, having vitreous hemorrhage were included. Standard three ports pars plana vitrectomy (PPV) with membrane peeling, endolaser and without endotamponade by single study surgeon was done in all patients. Best corrected visual acuity was noted pre operatively and on 1st day, 2nd week and 8th week post operatively. P- value <0.05 was considered statistically significant. Post-operative complications and visual improvement were noted at final visit.

**Results:** Total of 50 patients having diabetic vitreous hemorrhage were included in the study. Mean age was 41.4 years. Male patients were 66%. Clear lens was present in 46% patients and cortical lens vacuoles in 36% patients. Fresh vitreous hemorrhage was present in 80%. Baseline and final post-operative best corrected visual acuity logarithm minimal angle of resolution was 1.01± 0.17 and 0.74± 0.25 respectively. The difference in pre and post-operative best corrected visual acuity logarithm minimal angle of resolution was 0.045 which was statistically significant. There were no post-operative complications in 82% patients. Visual improvement was observed in 82%.

**Conclusion:** Most patients with diabetic vitreous hemorrhage regain or retain useful vision after PPV. Many patients may suffer late complications like recurrent vitreous hemorrhage and retinal detachment after successful initial surgery requiring secondary intervention.

**Key Words:** Diabetic retinopathy, Vitreous hemorrhage, Pars plana vitrectomy

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## INTRODUCTION

Diabetic retinopathy (DR) is a common and devastating complication of diabetes mellitus (DM) and one of the commonest causes of legal blindness and visual impairment in the western world[1, 2]. Worldwide diabetes is fourth on the list of reasons for blindness after cataract, glaucoma and trachoma[3]. Diabetic retinopathy is increasing in severity and prevalence globally and in particular in under developed countries[4]. Since chronicity of diabetes and its control, directly influences the development of DR, long term complications are seen more frequently as improved diabetes management has resulted in increased lifetime of diabetic patients[5]. About 97% of Type 1DM and 80% of Type 2 DM who have DM for 15 years or more will show signs of retinopathy[6]. Proliferative diabetic retinopathy (PDR) is present in about 40% of Type 1 DM and 5% of Type 2 DM patients[7]. The overall incidence of PDR is 16.2 per 10,000 persons/ year[8].

Vitreous haemorrhage (VH), tractional retinal detachment (TRD), combined retinal detachment, macular edema, macular detachment and macular ischemia are the commonest complications of PDR[9]. Ocular non-surgical treatment includes intravitreal injections of steroids, antivascular endothelial growth factor (anti- VEGF) and laser photocoagulation. Despite adequate laser and diabetes control retinopathy may progress and up to 5% of patients with PDR require surgical treatment[10].

Vitreous hemorrhage (VH) is the commonest complication of PDR. Depending upon the severity of hemorrhage, it can cause significant reduction in vision and make the examination and treatment more difficult[11]. Fresh vitreous hemorrhage in Type 2 DM can be treated conservatively in the hope of spontaneous resolution so

that laser treatment can be administered [12]. Chronic and persistent non-clearing VH (older than 3 months) is an indication of pars plana vitrectomy (PPV) and endolaser photocoagulation[13]. The correct timing for surgery is also influenced by the visual loss , the contralateral eye, spontaneous resolution predicted time, risk of further vitreous hemorrhage, previous photocoagulation to control retinal ischemia, the presence of TRD with macular involvement, neovascular glaucoma, and patients who require rapid visual recovery (e.g. professions requiring good stereopsis) [14]. According to the diabetic retinopathy vitrectomy study (DRVS) in patients with type 1DM early surgery is clearly beneficial because of early and more severe prolifarative retinopathy[14, 15]. This study also reported good visual acuity results of around 20/40 or better in 25% of patients undergoing early vitrectomy as compared to 15% of patients treated conventionally[16].

Currently, PPV is the commonly used therapy for PDR. In patients with advanced disease PPV improves anatomic features and visual acuity (VA). Although, visual improvement or stabilization occurs in majority of cases after PPV but the procedure entails a risk of intraoperative and post-operative complications[17]. These complications range from mild self resolving to severe resulting in poor visual outcome. Post-operative complications including recurrent vitreous hemorrhage (VH), persistent and/or recurrent retinal detachment whether, tractional, rhegmatogenous or combined TRD/RRD, cataract, iris neovascularization (INV) and neovascular glaucoma (NVG) are common and often lead to serious long-term visual impairment. Resultant visual acuity (VA) is the most relevant evidence of successful surgery for surgeon as well as the patient[18]. Recent evidence suggest better outcome in VA when compared with the earlier studies, which be due to improved diabetes control and its systemic co-morbidities, better surgical techniques, early diagnosis and management and surgeons experience and confidence[9].

The rationale of this study was the notion that pars plana vitrectomy improves visual acuity in patients with diabetic vitreous hemorrhage. Therefore we conducted this study to determine visual outcome after pars plana vitrectomy in diabetic vitreous hemorrhage and to determine the frequency of complications after pars plana vitrectomy in diabetic vitreous hemorrhage.

## METHODOLOGY

This study was interventional case series conducted at Ophthalmology Department, Khyber Institute of Ophthalmic Medical Sciences, Hayatabad Medical Complex, Peshawar. Study duration was one and half year from January 2013 to June 2014.

Fifty consecutive patients with diabetic vitreous hemorrhage were included in the study by non-probability purposive sampling. Patients above 16 years, both male and female, previously diagnosed patients of diabetes mellitus both type 1 and type 2, having vitreous hemorrhage were included in the study. Exclusion criteria included patients having diabetic vitreous hemorrhage with either tractional, rhegmatogenous or combined retinal detachment, patients with iatrogenic retinal tear and use of tamponade per-operatively during pars plana vitrectomy, previous pars plana vitrectomy, vitreous hemorrhage due to other ocular co-morbidities like retinal vein occlusion (central or branch), retinal vasculitis and patients who could not complete the follow up.

Patients diagnosed as having diabetic vitreous hemorrhage and advised to undergo PPV in outpatient department (OPD) of Ophthalmology unit Hayatabad Medical Complex Peshawar were included in the study after fulfilling inclusion and exclusion criteria. Approval of ethical committee and written informed consent was taken from all patients. After admission detailed pre-operative assessment was carried out on all patients which included best corrected visual acuity testing by Snellen acuity test, detailed Slit lamp (Topcon SL3F, Japan) examination of anterior segment, iris and lens, followed by dilated posterior segment examination using double aspherical fundus lens +78D/+90D (Volk, USA) and/ or by binocular indirect ophthalmoscope (Keeler, Germany) with +20D (Volk, USA) lens. Intraocular pressure(IOP) was measured by Goldmann applanation tonometer (Haag Streit, Switzerland) and gonioscopy was done using Goldmann indirect goniolens (Volk, USA). B-Scan (ocular ultrasonography) was done using Quantal Medical Compact-II B-Scan when fundus view was hazy. Laboratory investigations like blood sugar level (fasting and random), glycosylated haemoglobin level (Hb A1C), virology screening (HBs Ag, Anti-HCV) were carried out. Radiological investigations like chest X-ray, electrocardiograpyh (ECG) and echocardiogram were done. Surgery was performed both under local and general anaesthesia by the single study vitreo-retinal surgeon. All eyes underwent standard 3-port pars plana vitrectomy using 20-gauge (20G) instrumentation with a bimanual technique and using Binocular Indirect Operating Microscope system (BIOM). Vitrectomy included removal of the posterior and peripheral vitreous body, induction of the posterior vitreous detachment and peeling of the fibrovascular membranes if present from the retinal surface. Endolaser panretinal photocoagulation with up to 1000 laser coagulation spots was applied to all eyes included in the study. The number of intra-operative endolaser spots applied varied according to eye status e.g.; presence of pre-operative laser, lens status and the visibility of peripheral retina during surgery. In some patients in whom fundus view was hazy due to cataract, phacoemulsification with implantation of foldable posterior chamber intraocular lens was done along with

PPV. In all patients no endotamponade was used. At the end of surgery, vitreous cavity was filled with filtered air in all patients. Best corrected visual acuity was measured using Snellen acuity test in meters which was then converted to logarithm of minimal angle of resolution (Log MAR) using visual acuity converter software. Anterior and posterior segment examination was carried out on 1st day, 2nd week and 8th week post operatively. Final best corrected visual acuity in Log MAR and complications were recorded on the 8th week post operatively. Visual improvement and/or worsening were defined as ≥ 2 lines deviation from baseline BCVA on Snellen acuity test. Visual stability was defined as < 2 lines deviation from baseline BCVA on Snellen acuity test.

Statistical analysis was performed using a commercially available computer software system (SPSS, version 20). The data presented as mean, standard deviation, frequencies and percentages. Paired samples T- test was performed when preoperative and postoperative data was compared. A p-value of <0.05 was considered statistically significant.

## RESULTS

Total of fifty patients were included in the study. Mean age was 41.4 years and age range was from 17–70 years. Male patients were 66% and female were 34%. Type 1 DM was present in 30% while type 2 DM was present in 70 % patients. Duration of diabetes was 5- 10 years in 18%, 11- 15 years in 60% and 16- 20 years in 22% patients.

Baseline non-surgical treatment and clinical findings are shown in Table 1 and 2 respectively.

In our study 86% patients had pars plana vitrectomy while 14% had combined phacoemulsification with pars plana vitrectomy.

Baseline and final BCVA in Log MAR is shown in Table 3.

Pre-operative and final post-operative mean BCVA Log MAR was 1.01±0.17 and 0.74±0.25 respectively. The difference in pre and post op BCVA was 0.045 which was statistically significant (p< 0.05).

Post-operative complications at final follow up are shown in Table 4.

Visual improvement was observed in 82%, stable vision in 10% and worsening in 8% patients.

**Table 1: Baseline non- surgical treatment**

| Treatment | History | | Total |
|---|---|---|---|
| Medical Treatment | Diet + Oral | | 6 (12%) |
| | Oral | | 17 (34%) |
| | Oral+ Insulin | | 9 (18%) |
| | Insulin | | 18 (36%) |
| Argon Laser | Previous Laser | Yes | 35 (70%) |
| | | No | 15 (30%) |
| | Laterality (n= 35) | Right eye | 4 (8%) |
| | | Left eye | 1 (2%) |
| | | Both eyes | 30 (60%) |
| | Sessions (n= 35) | Single | 10 (20%) |
| | | Multiple | 25 (50%) |
| Intravitreal Injection | Previous Injection | Yes | 43 (86%) |
| | | No | 7 (14%) |
| | Number of Injections (n= 43) | One | 7 (14%) |
| | | Two | 16 (32%) |
| | | >2 | 20 (40%) |

**Table 2: Baseline clinical findings**

| Structure | Status | Total |
|---|---|---|
| Lens | Clear Lens | 23 (46%) |
| | Cortical Vacuoles | 18 (36%) |
| | Mature Cataract | 2 (4%) |
| | Aphakia | 1 (2%) |
| | Pseudophakia | 6 (12%) |
| Vitreous | Fresh Hemorrhage | 40 (80%) |
| | Old Hemorrhage | 8 (16%) |
| | No View | 2 (4%) |
| Retina | PDR without Laser Scars | 14 (28%) |
| | PDR with Laser Scars | 23 (46%) |
| | No View | 13 (26%) |
| Macula | Edema | 6 (12%) |
| | No Edema | 31 (62%) |
| | No View | 13 (26%) |

**Table 3: Baseline and final Log MAR BCVA**

| BCVA Log MAR (Snellen) | Pre- Operative n (%) | Final Post Operative n (%) |
|---|---|---|
| 0.30 (6/12) | 0 (0%) | 3 (6%) |
| 0.48 (6/18) | 0 (0%) | 6 (12%) |
| 0.60 (6/24) | 5 (10%) | 13 (26%) |
| 0.78 (6/36) | 3 (6%) | 18 (36%) |
| 1.00 (6/60) | 12 (24%) | 4 (8%) |
| 1.08 (5/60) | 20 (40%) | 1 (2%) |
| 1.18 (4/60) | 9 (18%) | 2 (4%) |
| 1.30 (3/60) | 1 (2%) | 2 (4%) |
| 1.48 (2/60) | 0 (0%) | 1 (2%) |
| Total | 50 (100%) | 50 (100%) |

**Table 4: Post-operative complications and gender distribution**

| Complications | Gendre | | Total |
|---|---|---|---|
| | Male | Female | |
| No Complications | 27 | 14 | 41 (82%) |
| Recurrent Vitreous Hemorrhage | 2 | 2 | 4 (8%) |
| Retinal Detachment | 3 | 1 | 4 (8%) |
| Endophthalmitis | 1 | 0 | 1 (2%) |
| Total | 33 | 17 | 50 (100%) |

## DISCUSSION

As the lifespan of diabetic patients has increased with the widespread use of antidiabetic medications, ocular and systemic microvascular complications of diabetes are more commonly encountered by the health care individuals. In type1 DM, the frequency of PDR increases up to 41% when the duration of diabetes exceeds 15 years. In type 2 DM, on the other hand, the rate of PDR is 3% when the duration of the disease exceeds 10 years [5]. In our study 30% of patients are type 1 DM while 70% are type 2 DM and 60% of our patients have 11-15 years duration of diabetes mellitus. A study by Guzey et al reported type 1 DM in 17.3%, type 2 DM in 82.6% and mean duration of diabetes was 19.4± 4.9 and 15.3± 7.4 years respectively[19]. Qamar et al reported type 1 DM in 14.6%, type 2 DM in 85.3% and mean duration of diabetes was 14 years and 11 years respectively[20].

Although panretinal photocoagulation (PRP) is considered the first line treatment for PDR, anti-proliferative drugs (anti-VEGF) are slowly finding their place in the management[12]. The objective of preoperative laser photocoagulation and anti- VEGF agents alone or in combination is to facilitate control of the vascular proliferative process[13]. In our study, 70% patients have laser photocoagulation, 85.7% have bilateral PRP and 50% have multiple PRP sessions. Pre-operative PRP was reported in 60% by Mason et al[6], 72% by Ünver et al [8] and 47.6% by Qamar et al[20]. Anti-VEGF agents reduce the time required for vitreous clear-up and decrease the need for vitrectomy [21]. In our study 86% of patients have previous anti- VEGF injection and 40% have multiple injections.

PPV is a commonly accepted method of treatment when vitreous hemorrhage fails to clear despite laser photocoagulation and anti- VEGF agents. The outcome of PPV in eyes where prior intensive laser photocoagulation and Anti- VEGF agents have been applied are more satisfactory[22]. Despite the intensive photocoagulation applied pre-operatively, the proliferations are observed to continue in 70% of our cases. At this stage, PPV and additional intraoperative endolaser photocoagulation are necessary.

The common post- vitrectomy complications are recurrent vitreous hemorrhage, retinal detachment, cataract and rubeosis iridis. Post vitrectomy recurrent vitreous hemorrhage is the most important indication for reoperation,which generally appears in the early days after the first operation. The rate of post-vitrectomy vitreous hemorrhage has been reported to vary between 3.3% and 69.2%, the source of hemorrhage can be fibrovascular ingrowth at sclerotomy site or anterior hyaloid proliferations[23, 24]. In our study, recurrent vitreous hemorrhage is present in 8% of patients. Studies of Mason et al[6], Guzey et al [19] and Brown et al[23] reported recurrent vitreous hemorrhage in 19%, 9.7% and 51% respectively. Improved results in our study are due to preoperative laser photocoagulation and anti- VEGF agents, meticulous vitreous removal as possible and additional intra-operative endolaser photocoagulation.

One of the most severe complications of PPV is post-operative retinal detachment. The retinal detachment appearing in 8% of our cases can be caused by iatrogenic retinal tear, atrophic retinal tear, late contractions of vitreous incarceration and peripheral traction due to anterior hyaloid proliferation. Post vitrectomy retinal detachment as 5.5%, 10.1%, 11% and 13.2% was reported by Guzey et al[19], Gupta et al[9], Mason et al[6] and Ünver et al[8] respectively.

Post vitrectomy endophthalmitis has been reported to vary between 1.6% and 5.35%[25] being 2% in our study. Studies of Eifrig et al[25], Guzey et al[19] reported 0.039% and 1.39% while Mason et al [6] reported no case of post vitrectomy endophthalmitis.

The existence of cataract before and after surgery in proliferative diabetic retinopathy is another important factor affecting the visual outcome. Pre-operative lenticular opacities not only affect the per-operative retinal visibility but also cause difficulty in removing the anterior vitreous from its base[26]. Combined phaco- vitrectomy procedure give clear surgical view in patients with hazy media due to cataract[27]. In our study, combined phaco-vitrectomy is done in 14% cases. Combined phaco-vitrectomy in patients having diabetic vitreous hemorrhage was reported in two different studies by Gupta et al and study of Demetriades et al as 30.34%, 14.05% and 28% cases respectively[9,28, 29]. In phakic eyes in which PPV is done, cataract may develop at a rate of 20-35% post operatively[9]. In our study post-operative cataract was not noted. Two different studies of Gupta et al[9, 29], Mason et al[6] and Guzey et al[19] reported post-operative cataract formation in 20.5%, 22.6%, 15% and 9.7% respectively. This difference is because many of our patients are either young with clear lens or very old having prior cataract surgery and also due to short follow up period of our study during which cataract is not noted.

Visual outcome after successful PPV in diabetic vitreous hemorrhage depends on the macular function. Surgery for vitreous hemorrhage without macular detachment produces, in most cases, good visual acuity. In our study 80% cases has final Log MAR BCVA > 1.00. Gupta et al[29] reported final visual acuity of Log MAR ≥ 0.3 in 65% cases. Another study by Gupta et al[9] reported final visual acuity of Log MAR ≤ 0.3 in 50.9% cases. In our study mean pre & post- operative Log MAR BCVA is 1.016 and 0.74 respectively. Gupta et al[9] reported mean pre & post- operative Log MAR BCVA as 1.56 and 0.66 respectively. This difference is due to small sample size and short follow up in our study. Overall, these results

show an improvement from diabetic retinopathy vitrectomy study (DRVS) where 25% achieved final BCVA ≤ 0.3 Log MAR after PPV for vitreous hemorrhage. Due to early diagnosis and earlier intervention pre-operative visual acuity improved with time and this correlates with improved post-operative visual results. Patients with poor pre-operative visual acuity although achieve greater improvement in log MAR but still has worse final post-operative visual acuity[30]. The early vitrectomy study (EVS)[15] suggested that the results of surgery were better with earlier vitrectomy. As with time the surgical methods has changed significantly since the EVS and there can be a justification for repeating that study with modern methods. Due to improvement in vitreoretinal surgery, the outcome after diabetic vitrectomy continues to improve. With the use of adjunctive pharmacotherapy further progress is going to be witnessed in this field.

## CONCLUSION

Visual results after PPV in diabetic vitreous hemorrhage show that most patients regain or retain useful vision. A significant proportion of patients may develop late complications like recurrent vitreous hemorrhage and retinal detachment after successful PPV requiring secondary intervention.

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## CONTRIBUTORS

AI conceived the idea, planned the study, and drafted the manuscript. OKO and MTK helped acquisition of data and did statistical analysis. SJ drafted the manuscript and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.