Original Article

Surgical Outcomes of Vitrectomy in Patients with Complications of Diabetic Retinopathy at A Tertiary Care Center

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ABSTRACT

OBJECTIVE: Surgical outcomes of vitrectomy in patients with complications of diabetic retinopathy in a tertiary care center.

METHODOLOGY: In this prospective, observational, interventional study, the fifty eyes underwent pars plan vitrectomy (PPV) for complications of proliferative diabetic retinopathy (PDR) from January to September 2019. The visual success for patients who underwent PPV was determined by the estimation of best-corrected visual acuity (BCVA) and central macular thickness (CMT) during the follow-up period. Statistical package for social science (SPSS) version 20 was used for data analysis.

RESULTS: In this study, 86% of eyes achieved BCVA of better than 20/200. The common complication was an iatrogenic break (20%) during a surgical procedure; other complications include increase intraocular pressure (20%), hypotony (12%), and postoperative vitreous hemorrhage (14%). The use of intraoperative anti-VGGF was found to reduce intra-operative and recurrent vitreous hemorrhage with good visual outcomes.

CONCLUSION: Despite medical advances in the management of patients with diabetes, mixed-gauge vitrectomy remains essential for visual rehabilitation of selected patients with non-clearing VH and tractional complications of PDR, and the use of AVEGF pre and postoperative enhance our ability to achieve the good visual outcome

KEYWORDS: Vitrectomy, Intravitreal anti-VEGF, PDR complications, 23 G, 25 G, 27 G.

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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder which in turn leads to various macrovascular and microvascular complications. One of the most important consequences of such changes is diabetic retinopathy (DR)[1]. It was estimated that in 2017 there are 451 million people with diabetes worldwide. These figures were expected to increase to 693 million by 2045[2]. According to the National diabetic survey of Pakistan (NDSP) 2016-17, 26.3% population of Pakistan is suffering from diabetes mellitus[3]. With the increase in the prevalence of DM in Asia, DR is becoming a leading cause of acquired blindness in Pakistan[4]. As per available data, the prevalence of DR was estimated to be around 145 million, out of which around 45 million people suffered from vision-threatening DR. Around 35% of this population had diabetic retinopathy, 7% of which were affected by proliferative diabetic retinopathy[5]. Amongst these patients with Proliferative diabetic retinopathy, persistent vitreous hemorrhage (VH), tractional retinal detachment (TRD) involving the macula, combined tractional and rhegmatogenous retinal detachment (TRRD), vitreomacular traction (VMT), and progressive fibrovascular proliferation were common indications for vitrectomy[6]. Persistent vitreous hemorrhage is one of the most common indications for vitrectomy[7].

Small gauge transconjunctival pars plana vitrectomy (23G, 25G) is the standard of care for surgical management of retinal problems[7]. Nowadays advanced surgical techniques have improved the outcome of complicated proliferative diabetic retinopathy[7]. Studies have shown that the surgical outcomes of diabetic vitrectomy improved significantly with the preoperative use of anti-vascular endothelial growth factor (anti-VEGF) and intraoperative use of endolaser and microincision vitrectomy surgery. Studies also report that PPV with the removal of ILM achieves better visual acuity and reduced foveal thickness as compared to grid laser photocoagulation alone in the treatment of diabetic macular edema[8].

It is important to highlight those patients with complicated PDR need to be monitored continuously for foveal involvement as this progressive disease may involve the fovea over time, warranting PPV. Surgical outcomes are better in patients with recently reduced vision and poorer in subjects with longstanding macular heterotopia. Since the advancements in surgical techniques, more and more patients with complicated PDR are undergoing early vitrectomy for a better visual outcome and stabilization

of disease. The purpose of this study is to evaluate the visual outcomes of patients with complicated PDR undergoing PPV in a tertiary care hospital in Pakistan.

METHODOLOGY

This study was a prospective observational study and was conducted at civil hospital Karachi-Pakistan, from January to September 2019. The study was approved by the ethical review board of the hospital (ethical approval letter number and date). During this period all the patients who underwent PPV for complications of PDR such as non-resolvable vitreous hemorrhage, tractional retinal detachment threatened to the macula and anterior hyaloid fibrovascular proliferation were included in the study. All the patients who underwent PPV had a complete pre-operative ophthalmological assessment. BCVA was recorded and a complete slit-lamp examination was performed, intraocular pressure was always recorded. Dilated fundus examination was performed with a 90 D lens. After this, OCT of the macula was performed in all patients to record the central macular thickness (CMT) and tractional membrane on the macula. The patients were then treated with 23 G pars plana vitrectomy (PPV). Anti-vascular endothelial growth factor agents were used in addition to laser as an adjunct to PPV to reduce the risk of neovascularization, intraoperative bleed, and to reduce or to improve macular edema.

The high-speed cutting technique with a new viewing system was used during PPV. To dissect fibrovascular tissue and to relieve tractions we used a microsurgical instrument.

For the hemostasis, we used endodiathermy as well as a high-pressure infusion line. Both intraocular gases; Sulphur hexafluoride (SF6), perflouropropane (C3F8), and also silicone oil was used for endotamponade.

Patients were seen on the first day after surgery and after one month followed by visits after six months. On every visit, a complete ophthalmic examination was performed with recording of BCVA, intraocular pressure, and dilated fundoscopy. OCT of the macula was performed to record CMT preoperatively and then at one, two- and six-months intervals postoperatively.

Statistical package for social science (SPSS) version 20 was used for data analysis. Data were presented as mean ± standard deviation (SD) for continuous variables. Frequencies and percentages (%) were calculated for categorical variables. Student's t-test and Chi-squared test

were applied for comparing independent variables where applicable. Values for $P< 0.05$ were considered statistically significant.

RESULTS

Out of these fifty eyes, 23(46%) were right eyes and 27(54%) were left eyes. 29 (58%) study patients were males and 21(42%) were female with a mean age of 49.43±6.2 years. The mean duration of diabetes mellitus was 13.1±4.60 years. 7(14%) eyes with vitreous hemorrhage without TRD and 25(50%) eyes having nonresolvable vitreous hemorrhage with TRD were treated by PPV. 13% to 26% cases of refractory macular edema with epiretinal membrane also underwent small gauge vitrectomy (Table I).

TABLE I: BASELINE AND INDICATIONS FOR PARS PLANA VITRECTOMY IN PATIENTS WITH PROLIFERATIVE DIABETIC RETINOPATHY

Parameters		n (%)
No of eyes		50
Gender	Male	29 (58%)
	Female	21(42%)
Laterality	OD	23(46%)
	OS	27(54%)
Duration of Type II Diabetes		13.1±4.60
Age (years)		49.43±6.2
Lens status		
Phakic		8(16%)
Pseudophakic		42(84%)
Indications for PPV		
Non-resolvable vitreous hemorrhage with no TRD		7(14%)
Non-resolvable vitreous hemorrhage with TRD Threatening macula		25(50%)
Refractory macular edema with epiretinal membrane		13(26 %)
Combined TRD with rhegmatogenous retinal detachment		5(10%)

Data presented as n= numbers, (%)= percentage, OD=right eye. OS=left eye

The majority of the cases had 23 G vitrectomy (47eyes-94%) whereas the remaining eyes underwent 25G PPV. For intraocular tamponade, silicone oil was the most commonly used agent and it was used in 30 (60%) eyes and sulfur hexafluoride (SF6) was used in 12(24%) eyes, and perflouropropane (C3F8) was used in 1(2 %) eye (Table II).

Complications during Vitrectomy

The intraoperative complication encountered was iatrogenic retinal breaks found in 20% of cases. The intraoperative silicone oil was associated with postoperative raised intraocular pressure in 20% of cases that required anti-glaucoma topical drops to control. During follow-up, vitreous hemorrhage, hypotony and neovascular glaucoma were found in 7 (14%), 6 (12%), and 6 (12%) eyes respectively.

Rubeosis iridis, cataracts, and retinal detachment, and endophthalmitis were seen in 4 (8%), 3 (6%), 3 (6%), and 1 (2%) eyes, respectively (Table III).

TABLE II: PRE AND INTRAOPERATIVE SURGICAL MANAGEMENT OF PDR

Preoperative management	Percentage (%)	Number (n)
Pan retinal photocoagulation		
Yes	76%	38
No	24%	12
IVI of Bevacizumab (1.25 mg)		
Given	64%	32
Not Given	36%	18
Intraoperative management		
Vitrectomy gauge		
23G	94%	47
25G	6%	3
Endotamponade		
SF6	24%	12
C3F8	6%	3
Silicon oil	60%	30
Air	10%	5

TABLE III:
INTRA AND POST-OPERATIVE COMPLICATIONS

Complications	n (%)
Iatrogenic retinal breaks	10(20%)
High Intraocular pressure	10(20%)
Postoperative vitreous hemorrhage	7(14%)
Hypotony	6(12%)
Neovascular Glaucoma	6(12%)
Rubeosis Iridis	4(8%)
Cataract	3(6%)
Retinal Detachment	3(6%)
Endophthalmitis	1(2%)

Data presented as n = number, (%) = percentage

Visual outcome

Overall, 43 eyes (86%) achieved 20/200 or better visual outcomes. Out of these, 40 eyes (80%) got 20/40 or better vision. The patients with VH achieved better log MAR VA as compared to patients with TRD. (p=0.005). (Table IV).

The BCVA significantly increased from preoperative 0.19±0.095 log MAR to 0.61±0.210 log MAR six months postoperatively whereas the CMT significantly decreased from preoperative 553.21±64.67µm to six months' post-operative 211.16±72.34 µm. Significant improvement in Early Treatment of Diabetic Retinopathy was observed at postoperative 1st, 3rd, and 6th months (p≤ 0.05) (Table V).

TABLE IV: PRE- AND POST-OPERATIVE COMPARISON OF VISUAL OUTCOME

Visual outcome (log MAR)	Preoperative n (%)	Postoperative n (%)	P-value
Overall			
≤ 0.30	2(4%)	40(80%)	P<0.042
>0.30 to ≤ 1.00	13(26%)	3(6%)	
>1.00	35(70%)	7(14%)	
Vitreous hemorrhage			
≤ 0.30	0(0%)	19(38%)	P=0.005
>0.30 to ≤ 1.00	17(34%)	26(52%)	
>1.00	33(66%)	5(10%)	
Tractional retinal detachment			
≤ 0.30	1(2%)	21(42%)	0.06
>0.30 to ≤ 1.00	14(28%)	18(36%)	
>1.00	35(70%)	11(22%)	

n= numbers, (%) = percentage, Log MAR converted Visual acuity 0.30=20/40; 1.0=20/200

DISCUSSION

Since the last century small gauge (G) transconjunctival pars plana vitrectomies like; 23G, 25G, or 27G are the popular choice for patients with complicated retinal diseases. Surgical management of retinal complications is a big challenge to vitreoretinal surgeons[9]. Some favorable factors like brief duration of detachment without macular involvement, presence of previously good PRP, and absence of neovascularization were always helpful to predict the good visual outcome after pars plana vitrectomy[10,11].

TABLE V: OUTCOME CHANGES IN BCVA, AND CMT

Outcomes	Pre-operative	Post-operative (1th month)	Post-operative (2nd month)	Post-operative (6th month)	P value
BCVA	0.19±0.095	0.41±0.1	0.73±0.12	0.61±0.21	<0.002
CMT	553.21±64.67	248.8±25.3	275.8±43.39	211.16±72.34	<0.01

±= SD, BCVA= Best-corrected visual acuity, CMT= Central macular thickness

But anatomical success does not always lead to a good visual outcome because of dense fibrous tissue, vitreomacular adhesion, iatrogenic tears, long duration of macular edema, and severe ischemic maculopathy[12,13].

Pre-operative use of intravitreal anti-VEGF injection always helps to prevent intra and post-operative complications of vitrectomy[14-17]. In our study, more satisfactory visual outcomes were achieved through a micro incisional vitrectomy system with the use of AVEGF.

Several studies have been published during the last decade on this subject and all showed continuing improvement in visual outcome[18,19]. Different studies stated good visual outcomes in patients who underwent PPV for repairing of traction alone or with VH in complicated DR.[4,20] Results of our study are very favorable as compared to other studies, with lower rates of complications such as iatrogenic retinal breaks, hypotony followed by postoperative vitreous hemorrhage, and raised IOP[9].

In our study, 36% of eyes with TRD and 52% eyes with VH achieved final vision >0.30 to ≤1.00 and >0.30 to ≤1.00 log MAR respectively. This result is similar to a study by Sokol JT et al[21] who reported 27.6% eyes with TRD and 50.9% with VH achieving final VA of ≥0.3 logs MAR. Sokol JT et al[21] also reported significant improvement in mean visual outcome from 1.84±0.61 to 0.93±0.66 in 95.7% of eyes. Little differences in results of our series are due to the small sample size of our study and a short period of follow-up. Most common complications during and after vitrectomy for PDR include; corneal epithelial defects, formation of a cataract, neovascular glaucoma, elevated IOP, recurrent vitreous bleeding, iatrogenic retinal breaks & rhegmatogenous retinal detachment[17,22]. The development of these complications can be minimized by meticulous surgical technique and cautious postoperative follow-up.

Post vitrectomy rate of cataracts in eyes of phakic patients with PDR is approximately 20 to 35% [10]. In our study, it was about 6%. Different studies of Gupta B et al[9] and Mason III JO et al[22] & Guzey M 2001[23] reported post-operative cataract formation in 20.5%, 22.6%, 15%, and 9.7% cases respectively. The incidence of neovascular glaucoma (NVG) is approximately 3% [5]. In our study it was about 12%, it usually occurs due to severe ischemia and/or inadequate endo laser photocoagulation[4]. Post vitrectomy recurrent vitreous hemorrhage is the most important indication for reoperation. Vitreous hemorrhage after PPV has been reported in 7–63% of patients[9]. Guzey M 2001[23] & Kamura Y 2013[24] reported recurrent vitreous hemorrhage in 6% and 9.7% respectively. In our study, it was about 14%. This may be due to anterior fibrovascular proliferation near the vitreous base. These results can be improved by doing preoperative laser photocoagulation and use of intra-operative anti-VEGF agents and also good intraoperative endo-laser photocoagulation.

One of the most serious complications of PPV is postoperative RD that is usually caused by missed iatrogenic retinal tear, atrophic retinal tear, late contractions of vitreous incarceration, and peripheral traction due to anterior hyaloid proliferation. Iatrogenic retinal breaks occurred at a rate of 8.1% in a series of patients who underwent small gauge vitrectomy for complicated PDR[25]. In our study, iatrogenic retinal tears were about 20%, but due to good endo-photocoagulation, we have only 6% cases of post vitrectomy RD. In studies by Guzey M 2001[23], Gupta B et al[9] and Mason III JO et al[22] and post vitrectomy retinal detachment was seen in 5.5%, 10.1%, and 11% respectively. Post vitrectomy endophthalmitis has been reported to vary between 1.6% and 5.35%[26,27]. In our study it was around 2%. Guzey M 2001[23] reported 0.039% and 1.39% while Mason III JO et al[22], reported no case of post vitrectomy endophthalmitis.

CONCLUSION

Despite medical advances in the management of patients with diabetes, mixed-gauge vitrectomy remains essential for visual rehabilitation of selected patients with non-clearing VH and tractional complications of PDR, and the use of AVEGF pre and postoperative enhance our ability to achieve the good visual outcome

Ethical Permission: Baqai Medical University Hospital Karachi IRB letter No. BIDE/IRB/ SSULTAN/09/23/19/0231, Dated; 23-9-2019.

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AUTHORS CONTRIBUTIONS

Sultan S: Concept, Study design, data gathering and analysis, manuscript final review.
Shakeel A: Concept, Study design, manuscript writing, final review.
Khanzada MA: Manuscript writing, final proofreading
Zaman Y: Manuscript writing, edited and reviews the final manuscript
Kamil Z: Data analysis, Data analysis, edited and reviews the final manuscript.
Waris N: Data interpretation edited and reviews the final manuscript.

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