ORIGINAL ARTICLE

Immediate Versus Delayed Vitrectomy for The Management of Vitreous Hemorrhage Due to Proliferative Diabetic Retinopathy

Vina Karina Apriyani[1], Grimaldi Ihsan[1], Rova Virgana[1], Iwan Sovani[1]
[1]Department of Ophthalmology, Faculty of Medicine Padjadjaran University, Cicendo Eye Hospital National Eye Center
Email: docvin.vk@gmail.com

ABSTRACT

Introduction: *Surgical approach in vitreous hemorrhage (VH) secondary to diabetic retinopathy remains the procedure of choice for non-clearing VH. However, the most appropriate timing of vitrectomy is yet to be defined. With improvements in surgical techniques, it is reasonable to operate on such patients that have no spontaneous improvement.*
Objective: *To compare the characteristics between groups of patients who underwent immediate and delayed vitrectomy for the management of vitreous hemorrhage due to proliferative diabetic retinopathy (PDR).*
Methods: *Retrospective review of 35 patients who underwent vitrectomy for VH secondary to PDR. Patients were excluded if they had prior vitrectomy, follow up < 1 month post-operatively, other retinal pathology, VH secondary to other causes, uveitis, or advanced glaucoma. Primary outcome was visual acuity in patients receiving immediate (< 30 days) versus delayed (> 30 days) vitrectomy. Secondary analyses included post-surgical complications.*
Results: *35 eyes were included, 13 eyes had immediate vitrectomy while 22 eyes had delayed vitrectomy. There was no difference between the groups in terms of age, gender, diabetes control, or diabetes duration. Pre-operative and final visual acuities were evaluated, including 7 days, 30-days and 3-months in both Groups. Complications within 3 months were dominantly seen in the delayed vitrectomy Group.*
Conclusion: *Immediate vitrectomy for VH due to PDR decreases time spent with vision loss, and decreases post-surgical complications. Modern vitrectomy surgery is safe and may be considered earlier in VH management.*

Keywords: *Diabetic Retinopathy, Vitreous Hemorrhage, Pars Plana Vitrectomy.*

INTRODUCTION

Vitreous hemorrhage (VH) secondary to proliferative diabetic retinopathy (PDR) is a cause of severe vision loss in diabetic patients. Vitrectomy for VH in diabetes, was last studied decades ago by the Diabetic Retinopathy Vitrectomy Study (DRVS) Research Group. Many changes have swept through the surgical retina field, including intraoperative endolaser photocoagulation; minimally invasive techniques; improved surgical illumination; modern vitrectomy machines; and improvements in intraoperative ophthalmic imaging.

Diabetic patient's ocular complications have become increasingly more frequent in the United States, as there has been a documented 133% increase in the incidence of diabetes mellitus from 1980 to 2011, with an overall cost of $245 billion to Medicare in 2012. Since 77.8% and 15.5% of patients with diabetes for more than 15 years will develop NPDR and PDR, respectively, it is imperative that standard treatment protocols are reviewed and revisited periodically.[2,3]

Vitrectomy surgery for common complications of PDR, specifically, VH and tractional retinal detachment (TRD), is safe and effective, as demonstrated by several retrospective reviews since the DRVS. Still, the most appropriate timing of vitrectomy for the treatment of diabetic complications is yet to be defined. This is unnecessary that patients spend months with low vision awaiting a procedure that is known to safely and effectively improve their vision.[4-7]

This retrospective case series compared two groups of patients with immediate and delayed vitrectomy for VH associated with PDR during the modern era of minimally invasive vitrectomy surgery.

MATERIAL AND METHODS

We retrospectively reviewed the medical records of patients affected by VH due to PDR who were subjected to PPV between February 2017-February 2018 at Vitreoretinal Unit Cicendo National Eye Hospital, Bandung, Indonesia. The diagnosis codes including PDR, VH which has been indicated for surgery, that the fundus examination was unclear. Patients were included if they underwent vitrectomy for non-clearing VH secondary to PDR.

Exclusion criteria included prior vitrectomy, retinal detachment, or other significant ophthalmic disease (advanced glaucoma, AMD, vasculitis, uveitis or other inflammatory disorders, or corneal disease). Patients were also excluded if there was less than 30 days of documented follow-up. Immediate vitrectomy was described as vitrectomy which was performed in less than 30 days, while delayed vitrectomy was described as vitrectomy which was performed for more than 30 days. The following preoperative variables were identified, age, gender, presenting and follow-up visual acuities, lens status, intraocular pressure (IOP), medical comorbidities, duration of diabetes, hemoglobin A1c (HbA1C) that was closest to date of surgery, and complication were recorded. The intraoperative information recorded included surgical time, spot amount of endolaser, and postoperative tamponade.

We evaluate the time from the initial visit until the vitrectomy surgery was performed. All patients were operated by five experienced vitreoretinal surgeons and postoperative follow-

ups were made at the Vitreoretinal Unit Cicendo Eye Hospital, Bandung, Indonesia. Data in this study was documented and analyzed using Microsoft Excel 2016.

RESULTS

After inclusion and exclusion criteria, 35 patients were identified. A total 35 eyes participated in the study. Table 1 showed the comparison of the characteristics of two groups that underwent immediate and delayed vitrectomy for non-clearing VH secondary to PDR. Other characteristics, including age, gender, diabetes duration, and diabetes control were similar between the groups. The mean age was 54.03 ± 8.16 years, 15 (42.85%) patients were female and 20 (57.14%) patients were male. 13 eyes constituted immediate vitrectomy Group and 22 eyes constituted delayed vitrectomy Group. The mean preoperative IOP (intraocular pressure) was 15 ± 3 for Group 1 and 13.8 ± 4.7 for Group 2. The preoperative lens status showed statistically significant between phakic and pseudophakic, with 32 eyes (91.42%) were phakic.

For duration of diabetes, we found that there were patients with newly diagnosis of diabetes or duration of diabetes less than 5 years in the two groups, and the amount was significant. The most common co-morbodity in both groups was hypertension with 25 patients (71.42%), followed by kidney failure with 10 patients (28.58%). The both groups were having the HbA1C more than 6.4% significantly.

Follow-up period was up to 3 months after vitrectomy. Table 2 showed the visual acuity at the initial visit, 1 week, 1 month, and 3 months after surgery. There was a significant difference in final visual acuity, when in the immediate vitrectomy Group showed good progression for visual acuity between initial visit and 3 months postoperative.

Table 1. Demographics and Patient Characteristics

Characteristics		Immediate PPV (13 patients)	Delayed PPV (22 patients)
Mean age		53.84 ± 9.09	54.13 ± 7.77
Gender, n (%)			
	Male	6 (46.15)	14 (63.63)
	Female	7 (53.84)	8 (36.36)
Entrance VA, n (%)			
	< 1/60	7 (53.84)	13 (59.09)
	1/60 - 5/60	4 (30.76)	9 (40.90)
	> 0.08	2 (15.38)	0 (0)
Mean preop IOP, mmHg		15 ± 3	13.8 ± 4.7
Eye, n (%)			
	right eye	9 (69.23)	14 (63.63)
	left eye	4 (30.77)	8 (36.37)
Lens status, n (%)			

	Phakic	12 (92.30)	20 (90.90)
	Pseudophakic	1 (7.70)	2 (9.09)
DM years			
	<5 years	6	5
	>5 years	5	8
	Unknown	2	9
Co-Morbidity			
	Hypertension	8	17
	Kidney Disease	5	5
HbA1C, n (%)			
	<6.4%	2 (7.69)	6 (27.27)
	>6.4%	11 (84.61)	16 (72.72)
	Unknown	2	9

We also recorded the intraoperative information, included the surgical time, endolaser spot, and postoperative tamponade, that showed in Table 3. The most frequent tamponade that have been used in immediate vitrectomy Group was fluid and sterile air with more than 40%, while the most popular tamponade in delayed vitrectomy Group was gas (40%).

In Table 4, we summarize the rebleeding status that occurs postoperatively. Six patients experienced rebleeding after 3 months follow-up in the delayed vitrectomy Group, whereas 1 patient had a rebleeding in the immediate vitrectomy Group.

Table 2. Visual Acuity at the Initial Visit, 1 Month, and 3 Months Follow Up

		Immediate (13)	Delayed (22)
Preop VA, n (%)	< 0.05	11 (84.61)	22 (100)
	> 0.05	2 (15.38)	0 (0)
1 mth, n (%)	< 0.05	8 (61.53)	14 (63.63)
	> 0.05	5 (38.46)	8 (36.36)
3 mths, n (%)	< 0.05	6 (46.15)	12 (54.54)
	> 0.05	7 (53.84)	10 (45.45)

Table 3. Intraoperative Information

Tamponade, n (%)			
	Fluid	6 (46.15)	7 (31.81)
	Sterile air	6 (46.15)	5 (22.72)
	Gas	1 (7.69)	9 (40.90)
	Silicone Oil	0 (0)	1 (4.54)
Mean surgical time, minutes		30.61 ± 11.19	28.63 ± 9.26
Endolaser spot		637.92 ± 268.53	564.54 ± 259.38

TABLE 4. Rebleeding Status

	Immediate PPV (13)	Delayed PPV (22)
NO, n (%)	12 (92.3)	16 (72.72)
YES, n (%)	1 (7.69)	6 (27.27)

DISCUSSION

Vitreous hemorrhage has an incidence of about seven cases per 100.000 eyes which makes it one of the most common causes of acutely or subacutely decreased vision, with 32% secondary to PDR. About a third of these patients will undergo vitrectomy for non-clearing VH. Still, there is no defined timing of intervention in today's age of endolaser and minimally invasive vitrectomy techniques. We suggest that minimally invasive vitrectomy surgery with endolaser photocoagulation within 30 days of presentation yields visual results comparable to those of delayed for additional PRP sessions or to await natural clearing of hemorrhage.[1,7]

Furthermore, the majority of eyes examined by several retrospective studies retained good vision in the operative eye by 3 months and even 10 years. Outcomes are gradually improving, which Gupta et al attribute to initiating surgical intervention on patients with better visual acuity. Our results add to the current literature by demonstrating that PDR-associated VH may be managed by vitrectomy even earlier than previously suggested, decreasing the time the patient spends with low vision, also decreasing the need for repeated office visits.[9-11]

Parikh et al. found that patients receiving PRP for PDR-associated VH were more likely than patients with PDR alone to undergo vitrectomy within 1 to 2 years of PRP treatment. Taking these results in context with the current study, immediate vitrectomy may alleviate the need for preoperative PRP, especially since endolaser will be performed concurrently intraoperatively. Many retina surgeons are taking these patients to surgery within 1 month; yet, this is the study to demonstrate that doing so is safe and effective.[1,8]

The DRVS did not just focus on vitrectomy for VH. Even for severe, active PDR, 44% of patients randomly assigned to immediate vitrectomy had visual acuity of 10/20 compared to only 28% in the conventional management group (including PRP, observation, or vitrectomy for complications). Moreover, a recent study demonstrated visual success (> 15-letter improvement) in tractional diabetic macular edema, epiretinal membrane, and PDR-associated TRD at 1 year following vitrectomy. Frequency of post-vitrectomy hemorrhage was low for patients without TRD (8.1%) and similar to our current study (7.69%). As the indications for diabetic vitrectomy expand, the appropriate timing for surgical intervention as well as efficacy of adjunctive treatment will become increasingly important to understand.[6]

The study conducted by Zhang Rui et al (2016) found that, in the sample of the general Chinese population, the prevalence of retinopathy significantly increased in the tenth deciles of HbA1c, with optimal cutoffs of 6.4%, respectively. The current WHO guideline for diagnosing diabetes has high specificity but low sensitivity for detecting DR in this population. In our study, most sample showed that HbA1C that was closest to date of surgery is more than 6.4% (> 70%).[12]

There are limitations in this retrospective review. There were many exclusions for providing a homogenous data, yielding low numbers of patients included for analysis. The accuracy of DM years is also still questionable. Nevertheless, diabetic retinopathy is a heterogeneous disease and even with strict inclusion criteria one cannot guarantee that all patients would behave the same. Additionally, not all patients follow up for the same period of time, and follow-up appointments may be missed, which impacts the interpretation of final results. Importantly, this report includes only the results of the patients who underwent surgical intervention. Patients with natural clearing of PDR-associated VH were not included in this analysis in an effort to focus on the direct effect of surgery in this population.

Regardless of complications of diabetic retinopathy treated, prevention and immediate detection are clearly the goals of the savvy retina practitioner. In addition to the literature presented, the results provide further support for the utility and efficacy of immediate vitrectomy for VH secondary to PDR. We believe that immediate vitrectomy for PDR-associated VH will improve the quality of life and also decrease economic burden by facilitating their return to work and increased productivity. A prospective study with randomization into immediate vitrectomy or delayed vitrectomy with or without adjunctive therapy (PRP or intravitreal injection) would most assess these questions.

CONCLUSION

Immediate vitrectomy for VH due to PDR in this study significantly decreases time spent with vision loss, and also decreases post-surgical complications number. Modern vitrectomy surgery is safe and may be considered earlier in VH management.

REFERENCES

1. Jaafar El Annan, Petros E. Carvounis. Current Management of Vitreous Hemorrhage due to Proliferative Diabetic Retinopathy. Int Ophthalmol Clin. 2014 Spring; 54(2):141–153.
2. American Diabetes Association. Economic costs of diabetes in the U.S. in 2012. *Diabetes Care*. 2013;36(4):1033-1046.
3. Sharma S, Hollands H, Brown GC, Brown MM, Shah GK, Sharma SM. The cost-effectiveness of early vitrectomy for the treatment of vitreous hemorrhage in diabetic retinopathy. *Curr Opin Ophthalmol*. 2001;12(3):230-234.

4. Gupta V, Arevalo JF. Surgical management of diabetic retinopathy. *Middle East Afr J Ophthalmol*. 2013;20(4):283-292.
5. Ratnarajan G, Mellington F, Saldanha M, de Silva SR, Benjamin L. Long-term visual and retinopathy outcomes in a predominately type 2 diabetic patient population undergoing early vitrectomy and endolaser for severe vitreous haemorrhage. *Eye (Lond)*. 2011;25(6):704-708; quiz 709.
6. Ostri C. Intraocular surgery in a large diabetes patient population: risk factors and surgical results. *Acta Ophthalmol*. 2014;92 Thesis1:1-13.
7. Newman DK. Surgical management of the late complications of proliferative diabetic retinopathy. *Eye (Lond)*. 2010;24(3):441-449.
8. Parikh R, Shah RJ, VanHouten JP, Cherney EF. Ocular findings at initial pan retinal photocoagulation for proliferative diabetic retinopathy predict the need for future pars plana vitrectomy. *Retina*. 2014;34(10):1997-2002.
9. Gupta B, Sivaprasad S, Wong R. Visual and anatomical outcomes following vitrectomy for complications of diabetic retinopathy: the DRIVE UK study. *Eye (Lond)*. 2012;26(4):510-516.
10. Ushida H, Kachi S, Asami T, Ishikawa K, et al. Influence of preoperative intravitreal bevacizumab on visual function in eyes with proliferative diabetic retinopathy. *Ophthalmic Res*. 2013;49(1):30-36.
11. Agarwal A, Soliman MK, Sepah YJ, Do DV, Nguyen QD. Diabetic retinopathy: variations in patient therapeutic outcomes and pharmacogenomics. *Pharmgenomics Pers Med*. 2014;7:399-409.
12. Zhang Rui, et al. The Association of Retinopathy and Plasma Glucose and HbA1c: A Validation of Diabetes Diagnostic Criteria in a Chinese Population. Journal of Diabetes Research. 2016; 1-8.