

Frequency of Post-Operative Hypotony in 23 Gauge and 25 Gauge Pars Plana Vitrectomy in Advanced Diabetic Eye Disease

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ABSTRACT

Purpose: To compare the frequency of post-operative hypotony between 23G PPV and 25G PPV in advanced diabetic eye disease.

Study Design: Quasi experimental study.

Place and Duration of Study: Study was conducted at department of Ophthalmology, Lahore General Hospital, Lahore from 7th April 2016 to 6th October 2016.

Methods: Total 100 cases of advanced diabetic eye disease with age ranging from 25 – 65 years and either gender were selected. Patients with nystagmus and claustrophobia, lamellar macular holes, epiretinal membrane and neovascular glaucoma were excluded. Patients were divided by lottery method into 2 groups. Data of the patient i.e. name, age, sex, patient's registration number and address was recorded. Every patient had detailed preoperative work-up; including best corrected visual acuity by Snellen's chart, intraocular pressure by applanation tonometer, indirect ophthalmoscopy and B-scan for retinal status. Group A underwent 23G PPV and group B underwent 25G PPV. Patients were followed after 24 hours of surgery to measure intraocular pressure to access hypotony.

Results: Mean age of patients in group A was 50.16 ± 10.40 years and in group B was 50.26 ± 9.91 years. Out of 100 patients 57 (57.0%) were females and 43 (43.0%) were males, with female to male ratio of 1.1:1. Post-operative hypotony was seen in 24 (48.0%) patients with 23G PPV and 02 (4.0%) patients with 25G PPV (p-value = 0.0001).

Conclusion: This study concluded that the frequency of post-operative hypotony in 23G pars plana vitrectomy was higher as compared to 25G pars plana vitrectomy in advanced diabetic eye disease.

Key Words: Diabetic retinopathy, Pars Plana Vitrectomy, Hypotony.

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INTRODUCTION

Diabetes mellitus (DM) is of three types. Type I or insulin dependent DM or juvenile diabetes, type II or non-insulin dependent DM or adult-onset diabetes and gestational diabetes which occurs when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level.¹ Incidence of

diabetes mellitus is 10 – 14% worldwide. Diabetes mellitus type 2 (formerly non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes) is a metabolic disorder that is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency while in diabetes mellitus type 1, due to destruction of islet cells in the pancreas, there is an absolute insulin deficiency.²

Diabetes mellitus (DM) is one of the commonest world health problems affecting 92.4 million adults worldwide and its prevalence in Pakistan is 13.4%.³ Among the large number of diabetic people, 35% develop some form of diabetic retinopathy and 10% progress to vision threatening stages and require treatment.⁴ Prevalence of diabetic retinopathy in Pakistan was 28.76% in 2012.³ Diabetic retinopathy contributes 10.2% to total blindness worldwide. Unfortunately, this blindness mostly affects the working age group of population.⁴

Although the exact mechanism of diabetic retinopathy is unclear, but several theories have been postulated to explain the course of disease. Hyperglycemia alters blood vessel formation in retina of the eye, it can lead to blurring of vision and ultimately to blindness if left untreated.⁵ Patients with type 2 diabetes mellitus, due to its delayed diagnosis, already have diabetic complications at the time of diagnosis. Duration of diabetes is directly proportional to the development of diabetic retinopathy.⁶ Prevalence of diabetic retinopathy in patients with type 2 diabetes at the time of diagnosis varies from 5 – 35%.⁷

Timely diagnosis of diabetic retinopathy and appropriate management can help delay the complications. Initial stages of diabetic retinopathy can be treated with good systemic control of blood sugar levels by showing compliance to their physicians and laser photocoagulation of retina. However, advanced diabetic eye disease requires surgery. Pars plana vitrectomy (PPV) remains the gold standard surgical treatment.⁸ Improving the surgical technique aiming towards a better visual outcome developed trans-conjunctival suture-less vitrectomy. This also provides better patient's comfort during and after surgery.⁹

A study comparing 23G PPV and 25G PPV for posterior segment disease revealed that post-operative hypotony was 41.3% with 23G PPV and none with 25G PPV. Another study showed that eyes operated

with 23G PPV present with intra-ocular pressure (IOP) less than 6 mm Hg (hypotony) more frequently when compared with eyes operated through 25G PPV ($p = 0.034$). This resulted in more frequent application of port sutures in eyes operated through 23G PPV ($p = 0.014$).¹⁰

25G PPV may prove a good alternate to the traditionally used 23G PPV. Giving the patient an extra benefit in the form of better comfort and earlier visual rehabilitation. Smaller incision also allows better anatomical preservation of delicate ocular structures and lessens the risk of post-operative infections according to principles of minimum invasive surgery.⁹

This study was conducted with the aim to compare post-operative hypotony in 23G and 25G PPV. Currently both approaches of surgery are in use and according to the results of this study, better surgical approach can be adopted to avoid post-operative hypotony.

METHODS

This Quasi experimental study was conducted at Department of Ophthalmology, Lahore General Hospital, Lahore from 7th April 2016 to 6th October 2016. Total of 100 patients were included in the study with 50 patients in each group. Non-probability, consecutive sampling technique was used. Patients from 25-65 years of age from both sexes, with diabetes for more than 5 years and diagnosed with advanced diabetic eye disease were included in the study. Patients with nystagmus and claustrophobia and pre-operative IOP of less than 6 mm Hg, patients who were unable to maintain supine posture, mentally handicapped patients, patients with neo-vascular glaucoma, epiretinal membrane and patients with lamellar macular holes were excluded from the study. Informed consent was obtained from all patients. Data of the patients including name, age, sex, patient's registration number and address were recorded. Every patient had detailed preoperative work-up which included best corrected visual acuity by Snellen's chart, intraocular pressure by applanation tonometer, indirect ophthalmoscopy and B-scan for retinal status. Patients were divided by lottery method into 2 groups. Group A underwent 23G PPV and group B underwent 25G PPV. Intraocular pressure was measured by applanation tonometry on first post-operative day. Data was recorded on a pre-designed proforma. 23G

and 25G PPV procedure are minimally invasive retinal surgeries to deal with retinal diseases through small trans-conjunctival scleral incisions at pars plana. These micro incisions facilitate the insertion of instruments e.g. vitrectomy cutter, endo-illuminator and fluid to maintain globe integrity and intraocular pressure. Patients were followed after 24 hours of surgery to measure intraocular pressure to access hypotony. SPSS version 12.0 was used for statistical analysis of the data. Results were shown as mean and standard deviation was used for quantitative variables i.e. age and post-operative intra-ocular pressure of patients. Frequency and percentage were calculated for qualitative variables like gender and hypotony

(present/absent). Frequency of hypotony was compared in both groups by using chi square test with p-value ≤ 0.05 as significant. Effect modifiers like age, gender and duration of DM were controlled through stratifications. Post-stratification chi square was applied to see their effects on outcome and p value ≤ 0.05 was considered as significant.

RESULTS

In this study, the age ranged from 25 to 65 years with mean age of 50.21 ± 10.11 years. Mean age of patients in group A was 50.16 ± 10.40 years and in group B was 50.26 ± 9.91

Table 1: Age Distribution for Both Groups (n = 100).

Age (Years)	Group A (n = 50)		Group B (n = 50)		Total (n = 100)	
	No. of Patients	% age	No. of Patients	% age	No. of Patients	% age
25 – 40	11	22.0	10	20.0	21	21.0
41 – 55	18	36.0	20	40.0	38	38.0
56 – 65	21	42.0	20	40.0	41	41.0
Mean \pm SD	50.16 \pm 10.40		50.26 \pm 9.91		50.21 \pm 10.11	

Table 2: Distribution of Patients According to Duration of DM (n = 100).

Duration (Years)	Group A (n = 50)		Group B (n = 50)		Total (n = 100)	
	No. of Patients	% age	No. of Patients	% age	No. of Patients	% age
6 – 10	21	42.0	23	46.0	44	44.0
> 10	29	58.0	27	54.0	56	56.0
Mean \pm SD	8.24 \pm 4.09		8.39 \pm 4.18		8.32 \pm 4.13	

Table 3: Stratification of Post-operative Hypotony According to Age.

Age of Patients (Years)	Group A (n = 50) Hypotony		Group B (n = 50) Hypotony		P-value
	Yes	No	Yes	No	
25 – 40	04 (36.36%)	07 (63.64%)	00 (0.0%)	10 (100.0%)	0.034
41 – 55	09 (50.0%)	09 (50.0%)	01 (5.0%)	19 (95.0%)	0.002
56 – 65	11 (52.38%)	10 (47.62%)	01 (5.0%)	19 (95.0%)	0.001

Table 4: Stratification of Post-operative Hypotony According to Gender.

Gender	Group A (n = 50) Hypotony		Group B (n = 50) Hypotony		P-value
	Yes	No	Yes	No	
Male	12 (57.14%)	09 (42.86%)	01 (4.55%)	21 (95.45%)	0.000
Female	12 (41.38%)	17 (58.62%)	01 (3.57%)	27 (96.43%)	0.001

Table 5: Stratification of Post-operative Hypotony According to Duration of DM.

Duration	Group A (n = 50) Hypotony		Group B (n = 50) Hypotony		P-value
	Yes	No	Yes	No	
6 – 10 years	10 (47.62%)	11 (52.38%)	00 (0.0%)	23 (100.0%)	0.000
> 10 years	14 (48.28%)	15 (51.72%)	02 (7.41%)	25 (92.59%)	0.001

years. 41.0% patients were between 56 to 65 years of age. Out of 100 patients, 57 were females and 43 were males, with female to male ratio of 1.1:1. Mean duration of diabetes mellitus in group A was 8.24 ± 4.09 years and in group B was 8.39 ± 4.18 years. Most of the patients (56.0%) had >10 years of duration of diabetes mellitus. Mean intra-ocular pressure was 9.41 ± 3.12 mm Hg. Post-operative hypotony was seen in 24 (48.0%) patients with 23G PPV and 02 (4.0%) patients with 25G PPV (p-value = 0.0001). Stratification of post-operative hypotony with respect to age groups showed significant difference in post-operative hypotony in both groups.

Similarly, statistically significant difference was found in post-operative hypotony in both genders between both groups. For details see tables 1 to 5.

DISCUSSION

Complicated vitreoretinal disease, such as advanced diabetic eye disease has been treated using 20-G or 23-G PPV. However, in 2002, Fujii described 25-G PPV, which has revolutionized the vitreoretinal surgeries.¹¹ The advantages include short duration of surgery, decreased inflammation, rapid visual recovery, comfortability, reduced rate of iatrogenic retinal breaks, preservation of limbal stem cells, and reduced corneal astigmatism.

The indications for 25-G PPV are macular holes, idiopathic epiretinal membranes, refractory macular edema, and non-resolving vitreous hemorrhage.¹² The delicacy or limited variety of instrumentation for 25-G PPV has rendered its use limited for uncomplicated surgeries.^{13,14,15} Data has shown comparable outcomes and complication rates between 25-G PPV and 20-G or 23-G systems for complicated retinal surgeries like diabetic Tractional retinal detachment.¹⁶

A study comparing 23G PPV and 25G PPV for posterior segment disease revealed that post-operative hypotony was 41.3% with 23G PPV and none with 25G PPV.¹⁷ Another study showed that eyes operated with 23G PPV presented with intra-ocular pressure (IOP) less than 6 mm Hg (hypotony) when compared with eyes operated through 25 G PPV (p = 0.034). The aim of small gauge vitrectomy or minimally invasive vitreous surgery (MIVS) is to minimize invasion with maximum success of the surgery. The much-criticized small gauge vitrectomy has now gained popularity. Thus, instruments used in vitreoretinal surgery are now available in 23-G and 25-G sizes. Initial success

rate for 25-G vitrectomy has increased from 74% to 92.9% with gas as tamponade.¹⁸

Literature shows approximately up to 25% rates of hypotony following suture-free vitrectomy. The severity can range from mild and transient cases, which resolve after conservative management, to severe cases which could lead to hypotonic maculopathy, optic choroidopathy and large choroidal mounds. The following factors can lead to wound leakage and can result in hypotony; redo surgery on a vitrectomized eye, multiple instrumentation, young age, widespread dissection of vitreous base and wound construction alteration.¹⁹

The two-step procedure is superior to one-step technique in terms of lower rates of wound leakage. Technique of trocar insertion can influence the rate of hypotony. Direct insertion of cannula is associated with higher rates of wound leakage.²⁰ Oblique or oblique-parallel entry helps in scleral wound re-apposition, thus reducing wound leakage. Retraction of the conjunctiva while trocar entry may be beneficial.²¹

While using one-step technique, wound leakage is minimal for extreme oblique trocar entry and relatively higher for oblique and direct cannula entry. No difference was observed in wound leakage following 23-G and 25-G vitrectomies.²² This is further supported by imaging of wound healing by optical coherence tomography of the anterior segment. After a 25-G vitrectomy, scleral wounds assessed by optical coherence tomography were closed at 60.5% at one month follow up and 63.9% at three month follow up. After a 23-G vitrectomy, 57.4% of scleral wounds were seen closed at one month and 61.1% at three months postoperatively.²³

In a study by Bamonte et al, rate of hypotony after 25-G vitrectomy was 9.2%.²⁴ They also found that the rate of hypotony was higher in cases where fluid tamponade was used. On the whole, it was concluded that frequency of post-operative hypotony in 23 G PPV was higher compared to 25G PPV in advanced diabetic eye disease.

CONCLUSION

This study concluded that the frequency of post-operative hypotony in 23G Pars plana vitrectomy is higher when compared to 25G Pars plana vitrectomy in advanced diabetic eye disease.

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Authors' Designation and Contribution

Hussain Ahmad Khaqan; Associate Professor: *Concepts, Designs, Literature Research, Data Acquisition, Data Analysis, Manuscript Preparation, Manuscript Editing, Manuscript Review.*

Usman Imtiaz; Post Graduate Trainee: *Literature Research, Data Acquisition, Data Analysis, Statistical Analysis, Manuscript Preparation, Manuscript Editing, Manuscript Review.*

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