

Original Research Article

Between The Devil And The Deep Blue Sea : Glaucoma After Vitrectomy In Proliferative Diabetic Retinopathy Patients

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ABSTRACT

Purpose: To investigate risk factors causing glaucoma in patients after vitrectomy for proliferative diabetic retinopathy(pdr).

Methods: A prospective, observational study was performed on patients referred for vitrectomy after pdr between November 2020 to July 2022 and followed for 1 year. subject parameters which were taken into considerations were age, gender, history of systemic illness, duration of diabetes, insulin use, hba1c levels. ocular examination was done for best corrected visual acuity, preoperative intraocular pressure (iop), ocular history regarding cataract surgery, pan retinal photocoagulation or any other ocular surgery, ocular pathology for example vitreous hemorrhage, tractional retinal detachment, macular edema, history regarding vitrectomy like intraoperative retinal tamponade use, pre or post operative use of anti-vegf, combined lens extraction with vitrectomy. all these variables are studied and correlation between them and development of glaucoma was analyzed.

Results: Out of 50 patients 7 patients developed glaucoma. Pre operative factors which increased the risk of developing glaucoma are; higher mean age($p=0.0450$), intraoperative tamponade use (0.0490), tractional retinal detachment ($p=0.0490$), having other systemic illness besides diabetes($p=0.0397$).

Conclusion: It was found in our study that pre operative factors such as higher age, other systemic illness besides diabetes, intra operative tamponade use, tractional retinal detachment are probable risk factors for development of glaucoma after vitrectomy.

Key words: proliferative diabetic retinopathy, vitrectomy, neovascular glaucoma

Introduction

Glaucoma is a chronic, progressive optic neuropathy caused by group of ocular conditions which lead to damage of optic nerve with loss of visual function. glaucoma can be primary or secondary like inflammatory, neovascular, lens induced, corticosteroid induced. Psuedoexfoliative syndrome or pigmentary glaucoma.

Neovascular glaucoma a type of secondary glaucoma is defined as neovascularization of iris and angle leading to increase in intraocular pressure, it is mostly caused by severe retinal ischemia which generally occurs in proliferative diabetic retinopathy ^[1]

Proliferative diabetic retinopathy (pdr) is a complication of diabetes caused by changes in the blood vessels of the eye due to high blood sugar levels that create changes in the veins, arteries and capillaries. As a treatment we have laser, intravitreal injections of anti-vegf and vitrectomy if vitreous haemorrhage does not resolve ^[2]

preoperative ocular factors, demographics, clinical factors, surgical procedures, and post operative complications can be the reason for glaucoma after vitrectomy in patients of pdr.

Previously identified risk factors for glaucoma after vitrectomy include preoperative iris neovascularization, male sex, postoperative retinal detachment, undergoing a combination vitrectomy/lens extraction procedure, and prolonged vitreous haemorrhage(vh).

Aims and Objectives

To investigate, incidence of glaucoma, types, risk factors and severity of glaucoma after vitrectomy in pdr patients.

Materials and Methods

A prospective, observational study was performed on patients of western India who had undergone vitrectomy surgery for proliferative diabetic retinopathy. The study was conducted between November 2020 to July 2022 and 50 patients were selected and followed for a period of 1 year.

Inclusion criteria

- Patients diagnosed to have proliferative diabetic retinopathy and had undergone vitrectomy surgery for complications of same.
- Patients were aged >18 years and were able to provide informed consent.

Exclusion criteria

- Patients having history of preexisting neovascular glaucoma, ocular trauma
- Patients having uveitis, some other vitreoretinal disease
- Patients likely to be lost to follow up
- Medical unsuitability for completion of trial
- Recent involvement in another interventional research study of any other topic.
- Patients not giving consent or not able to understand same.

Data was collected from the patients presenting to ophthalmology department at western India during the period of 2 years. data collection was done which included patient's demographic information, detailed history regarding past ocular surgery and any systemic illness, detailed ocular examination and laboratory tests done. History taken for pan retinal photo coagulation, intravitreal injection anti-vegf, any intraoperative events like; use of any retinal tamponade (silicon oil, air, sulphur-hexafluoride, perfluoro-propane), endo photocoagulation, intraocular lens implantation or aphakia after surgery.

complete ocular examination was done visual acuity tested on Snellen's chart, intraocular pressure was measured by non-contact tonometer on immediate postoperative day and later on after 1 month by Goldman applanation tonometer. Anterior segment evaluation was done by slit lamp examination. Investigations including complete blood count, lipid profile and random blood sugar were done, fasting and post prandial blood sugar and hba1c test.

patients were followed up on postoperative day1, 1 week, 1 month, 3 months,

6 months and after completion of 1 year. they were examined for best corrected visual acuity on Snellen's chart, intraocular pressure was measured using non-contact tonometer on post op day 1 and then by Goldman applanation tonometer, slit lamp examination was performed to look for corneal oedema and development of neovascularization of iris. disc evaluation was done using direct ophthalmoscope and visual field analysis was done at 1 month, 3 months,6 months and at the end of 1 year.

Observation

A total of 50 patients were enrolled and followed up for 1 year.

table:1 demographic characteristics

		Glaucoma (n=7)	Non-glaucoma (n=43)	P value
Age		59.29±8.08	49.87±11.52	0.0450
Gender	male	6	26	0.8260
	female	3	15	
Previous eye surgery		7	35	0.3750
Insulin use		2	9	0.7540
Fasting blood sugar		127.23±42.14	121.71±29.88	0.7430

FIGURE 3: Risk factors

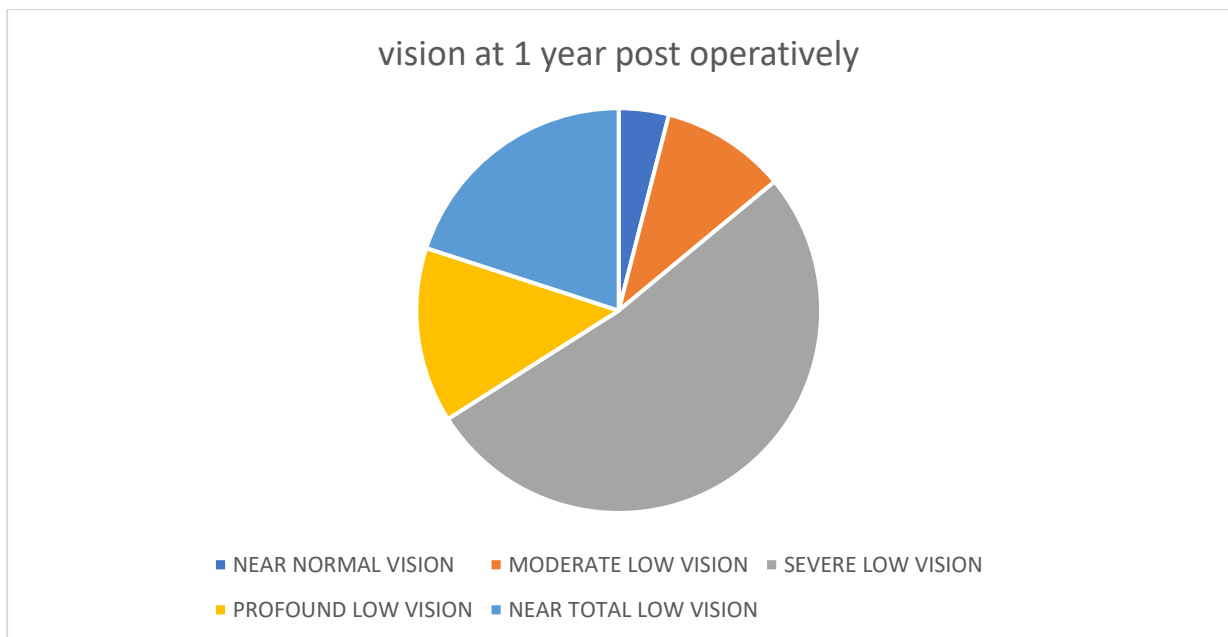
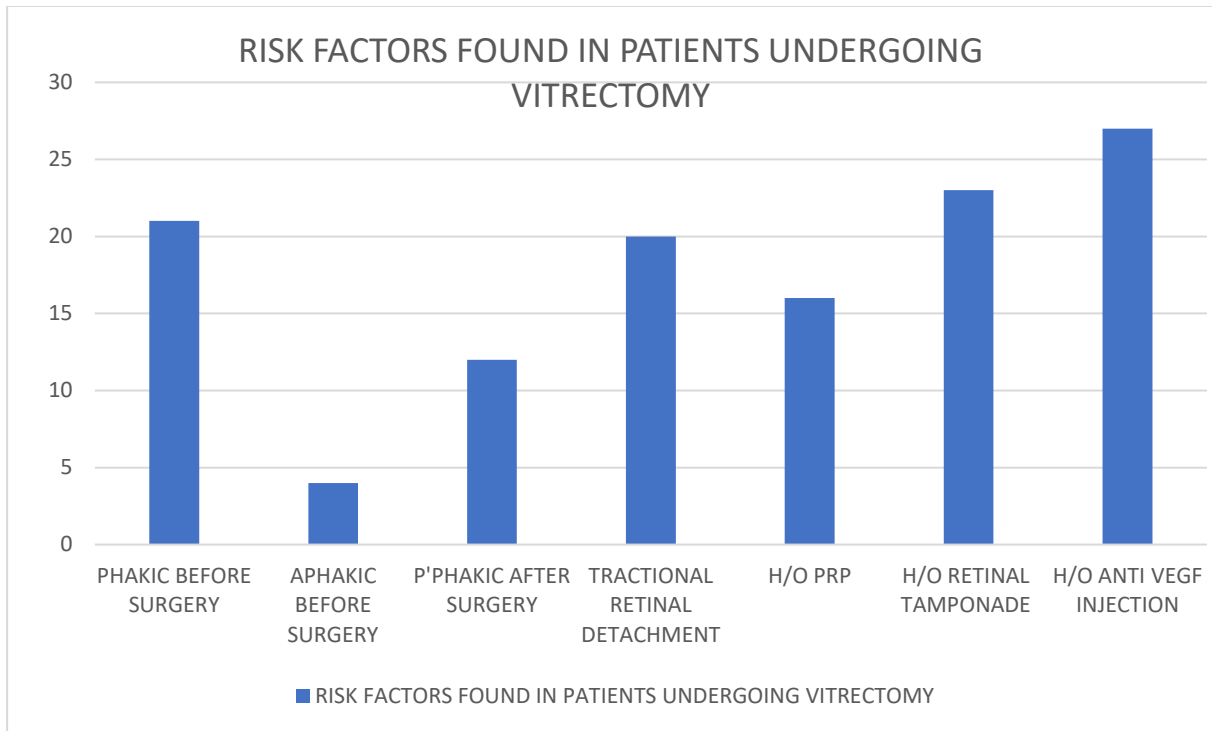


FIGURE 4: VISUAL ACUITY

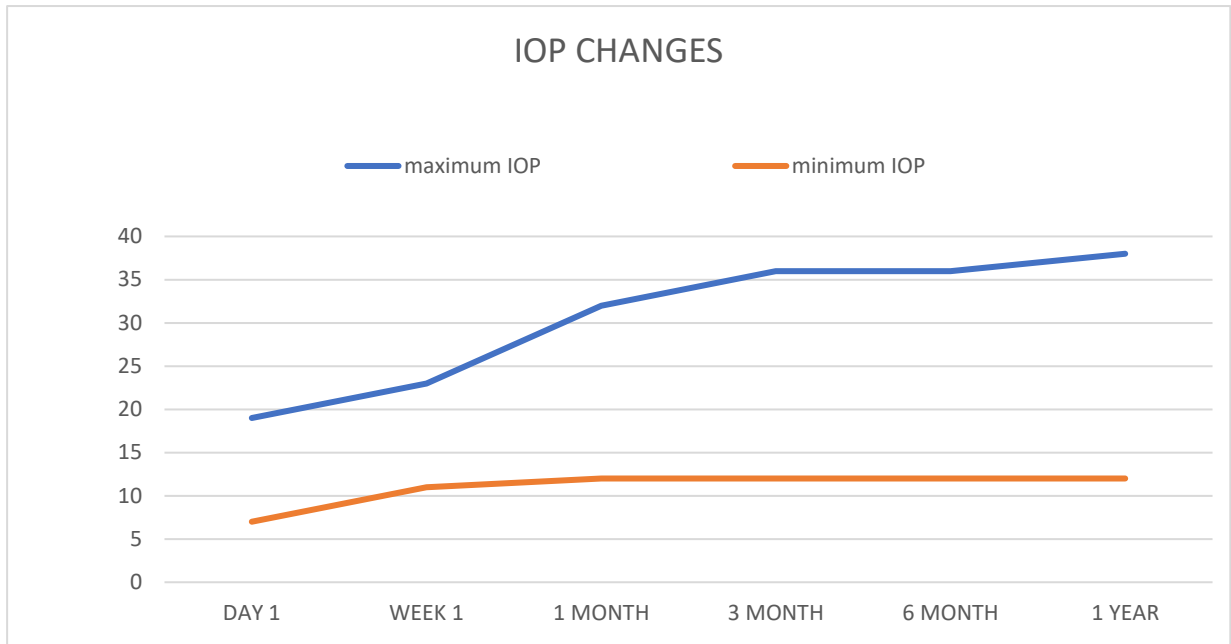


FIGURE 5: IOP CHANGES

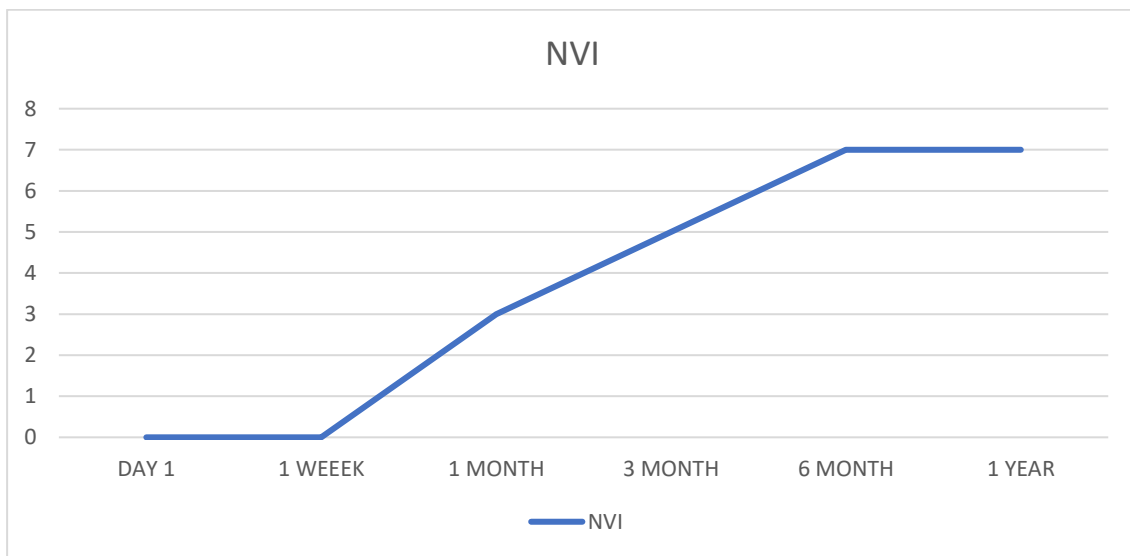


FIGURE 6: NEOVASCULARIZATION OF IRIS

Conclusion

In our study overall incidence of glaucoma after vitrectomy was found 14%.

Among the risk factors which were included in the study (figure 3), it was observed that patients with higher mean age, patients in whom silicone oil was used as retinal tamponade, and patients having trd as a complication of pdr before vitrectomy and patients having diabetes and hypertension as systemic illness developed glaucoma after vitrectomy surgery (table 2)

In our study indications for vitrectomy were pdr with tractional retinal detachment (48%), pdr with vitreous haemorrhage (42%), pdr with macular oedema (8%) and pdr with total retinal detachment (8%).

TABLE 2: RESULTS

	GLAUCOMA POSITIVE	GLAUCOMA NEGATIVE	TOTAL	P VALUE
AGE	59.29± 8.08	49.87±11.52	51.30±11.50	0.045
PREVIOUS EYE SURGERY	5	14	19	0.0369
TRD	4	8	12	0.0444
ASSOCIATED SYSTEMIC ILLNESS	4	8	12	0.0397
SILICONE OIL USE AS RETINAL TAMPONADE	6	14	20	0.049

Risk factors like male gender, phakic before surgery, pseudo phakic after surgery, history of pan retinal photocoagulation, duration of diabetes mellitus, pre-operative anti vegf use showed significant association with development of glaucoma after vitrectomy in different studies, but in our study, we did not observe any significant association of this risk factors.

Statistical analysis done with the help of chi-square test. Independent t-test is used for comparison of two mean. <0.05 p value considered as statically significant.

Diabetic retinopathy (dr) is a microvascular disorder occurring due to the long-term effects of diabetes mellitus. In absence of timely treatment, diabetic retinopathy may lead to vision-threatening damage to the retina.^[3] Secondary glaucomas leading to optic disc damage and vision loss are not unusual in patients who have undergone vitrectomy for proliferative diabetic retinopathy ^[4].

This puts the clinician in a decisional dilemma, as not treating the proliferative diabetic retinopathy may be potentially blinding but vitrectomy used as a treatment modality for the same is frequently complicated by development of secondary glaucoma and puts the patient at a risk of developing yet another potentially blinding disease which makes the choice as difficult as choosing between the devil and the deep blue sea.

Discussion

Incidence of post operative glaucoma in patients with proliferative diabetic retinopathy is 2% to 18% ^[5,6]. Maximum number of patients in our study were in age group 50-59 years and in our study glaucoma incidence was significantly higher in mean age group of 51.3+/-11.5 p. This is comparable with a study done by Masashi Sakamoto *et al*, whose mean age was 54.0+/-10.8 years. ^[7]

According to liang, x., zhang, y., li, yp. *et al.* trd is associated with development of glaucoma postoperatively; in our study also, we found that pdr patients who underwent vitrectomy for tractional retinal detachment had significantly higher incidence of development of glaucoma this is because in severe form of diabetic retinopathy with detached retina, retina losses its blood supply from the choroid and becomes more ischaemic producing more amount of vaso proliferative factors leading to nvg.^[8]

According to masashi sakamoto et. al, retinal tamponade use is an associated risk factor. in our study too also, we observed that silicone oil used as retinal tamponade is significantly associated with glaucoma development after vitrectomy. A possible mechanism is inflammation of anterior chamber in response to retinal tamponade and subsequent angle neo vascularization induced by inflammatory cytokines, which directly increase susceptibility to organic angle closure and trabecular dysfunction. this process is likely to promote nvg. Also, emulsified silicone oil particles can directly block the angle structures and increase iop.^[7]

In our study, presence of other systemic illness with diabetes is significantly associated with glaucoma occurrence. Most found systemic illness with diabetes is hypertension. according to netland pa *et al*, in younger patients, hypertension improves ocular perfusion pressure and showed protective effect. However, in older age group this protective mechanism is lost and most likely because of blood vessels alterations induced by arterial hypertension with disturbed oxygen and nutrition supply, risk of glaucoma increased. In our study, most patients were aged, and this can explain the relationship between developing glaucoma and presence of diabetes with hypertension.^[9]

In our study, we observed that the history of pan retinal photocoagulation was not a risk factor for glaucoma after vitrectomy. prp leads to diffusion of oxygen from choroid to retina or retinal pigment epithelial cells causing down regulation of angiogenic factors, preventing nvg.^[10] Possible mechanisms of glaucoma after prp are breakdown of blood retinal barrier leading to movement of fluid from choroid to vitreous, decreased uveoscleral outflow from congestion of ciliary body, laser damage to short ciliary nerves causing decreased ciliary muscle tone, as well as the release of prostaglandins.

According to hun jin choi, m.d. *et al*, the incidence of glaucoma increases particularly in pseudo-phakic eyes with significance of $p=0.0497$.^[11] In our study we observed that patients who were operated for cataract surgery previously and were pseudo-phakic before vitrectomy have significant association for the development of glaucoma after vitrectomy. Phacovitrectomy may increase the risk of nvg by destroying the barrier between the anterior and posterior segments of the eye, leading to anterior diffusion of vaso proliferative substances such as vegf and inflammatory cytokines leading to nvg.^[12]

According to kwon jin-woo md *et al* study, prevalence of nvg was found 11.8%. It shows development of nvg in patients who are treated with anti vegf injection for resolution of vitreous haemorrhage.^[13] This result is not expected because intravitreal anti-vegf is reportedly effective for the treatment of nvg as an adjunctive or primary therapy. This unexpected finding can be due to possible mechanism of increased fibrosis after anti vegf leading to peripheral anterior synechia, which is an important mechanism involved in nvg development. after intra vitreal anti vegf connective tissue growth factor(ctgf) increased, while vegf levels decreased. The ctgf/vegf was shifted towards increased levels of ctgf that led to accelerated fibrosis.^[14,15] in our study, intravitreal ranibizumab use preoperatively as well as postoperatively is not associated with development of glaucoma. ($p=0.9280$) However, the ctgf/vegf ratio was not evaluated in this study. Therefore, additional studies are needed to examine ctgf and vegf levels.

Major limitations to this study are small sample size, increasing the sample size would produce more statistically reliable results in this study, prospective cohort study can also be considered, a limitation as retrospective cohort seems to be more suitable in a study having rare outcomes as in our study.

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