

## IOP Change and Persistent IOP Elevation One Year following Pars Plana Vitrectomy.

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### Abstract

**Background:** Intraocular Pressure (IOP) elevation after uncomplicated Pars Plana Vitrectomy (PPV) is a common finding in postoperative period. The elevation of IOP is due to several factors such as viscoelastic residue, the use of silicon oil or an expanding gas tamponed, bleeding, a pupillary block, trabeculitis, and ciliary body oedema or a response to topical corticosteroid treatment. Medical treatment will reduce the IOP in most cases, however persistent glaucoma may occur as well.

**Aim:** Is to explore the incidence and significant factors of changes in intraocular pressure (IOP) and persistent IOP elevation (PIOPE) in one year follow-up of patients who underwent uncomplicated pars plana vitrectomy (PPV).

**Method:** An observation a retrospective study of total 80 patients (80 eyes) who underwent PPV in ARRASEN Medical Centre due to the presence of vitreomacular traction syndrome, persistent vitreous hemorrhage, and Rhegmatogenous Retinal detachment (RRD) from January 2021 to December 2021 was included in the study). Data will be collected from ARRASEN medical recorder through pre-tested questionnaire includes demographic and clinical characteristics and outcomes. The ethical permission obtained from the Libyan Board Ethical Committee.

**Result:** 80 patients underwent PPV with mean age group ( $56.60 \pm 11.92$ ), were 41(51.2%) males and 39 (48.8%) females. Reported 58 (72.5%) patients had normal IOP and 22 (27.5%) patients had high IOP postoperative immediately. Mean preoperative IOP was  $13.78 \pm 2.585$  mmHg, while sustain IOP postoperative in vitrectomized eye one month, after 3<sup>th</sup> months, 6<sup>th</sup> months, and 12<sup>th</sup> months ( $16.21 \pm 5.878$  mmHg;  $15.73 \pm 3.98$ ;  $15.57 \pm 5.786$ ;  $15.57 \pm 5.786$ ) respectively, with p-value  $< 0.05$ . SIOP was detected in vitrectomized eye and fellow eye within the period of follow up but it was highly significant in vitrectomized eye.

**Conclusion:** Incidence of persistent high IOP post PPV is 27% which is apparently high within Libyan patients with classical risk factors that may encourage to search for other causes.

**Keywords:** IOP, Silicone Oil, PPV, persistent IOP elevation (PIOPE), Glaucoma

### **Introduction**

Increased intraocular pressure is the main finding after vitreoretinal surgery. The main causes of rise in the IOP may be the result of an open- or closed-angle mechanism, inflammatory, residue viscoelastic, steroid- induced, and blood-mediated mechanisms (1). In addition, use of scleral buckling, silicone oil, or intraocular gas in conjunction with pars plana vitrectomy carries a risk of increased intraocular pressure (3). Approximately 35% of patients have IOP of at least 30 mm Hg within 48 hours of pars plana vitrectomy (4).. However, persistent increased intraocular pressure has a negative impact on the visual function and may carry high risk of glaucoma.

High intraocular pressure defined when the IOP >30 mmHg detected in the first 24 hours after the ocular procedure, 25 mmHg in the first 6 weeks, and >22 mmHg thereafter (2, 5,8). While the persistent intraocular pressure defined when the IOP >21 mmHg or >6 mmHg changes from the baseline IOP observed at consecutive visits, or the addition of a new IOP lowering medication during follow up (9).

Lalezary M et al investigated the incidence of IOP elevation in vitrectomized eyes (including all tamponade methods) and their results varied from 18% to 28%(4) while the incidence of elevated intraocular pressure (IOP) after vitrectomy with silicone oil ranges from 20% to 56%(3).

The purpose of the study is to identify the influential risk factors for high IOP and persistent IOP changes after pars plana vitrectomy.

### **Methods**

An observational retrospective study, a total of 80 patients (80 eyes) who underwent PPV (in ARRASEN Medical Centre) due to the presence of vitreomacular traction syndrome, persistent vitreous hemorrhage, and rhegmatogenous retinal detachment (RRD) from January 2021 to December 2021 will be included in the study.

All surgeries were performed under local anesthesia by the same surgeon.PPV was performed using a standard 23 G three-port system. Filtered air 1(1%), fluid 3 (2.9%), sulfur hexafluoride (SF6) 45 (43.7%), or silicone oil 54 (52.4%) were used as tamponades during vitrectomy. After a PPV to remove the central vitreous, the posterior hyaloid was separated, when necessary, by using triamcinolone acetonide. The internal limiting membrane and ERM were peeled off using brilliant blue G membrane dye. Similarly, a conjunctiva peritomy was closed with 7.0 Vicryl sutures once needed. In patients who were suitable for cataract surgery, PPV with Phacoemulsification and intraocular lens (IOL) implantation were performed first. Follow-up was conducted for at least 1 year.

A complete ophthalmological examination, including best corrected visual acuity, IOP measurement, and an anterior and posterior segment examination of the operated and fellow eye was performed preoperatively and at the postoperative first month, third month, the sixth month, and the first year. IOP was measured with a Goldman applanation tonometer.

Ethical approval was obtained from Scientific Libyan Board Committee and a retrospective study was conducted in accordance with the Helsinki Declaration.

Statistical analysis was performed with Social Package of Since Statistic (SPSS- version 25). Where t test was used in group comparisons of parameters. Spearman’s correlation analysis, a chi-squared test, and Fisher’s exact test were used to evaluate the relationships between parameters. Values were presented as mean±SD. P- value of ≤0.05 was considered statistically significant.

**Results**

A total 80 patients (80 eyes) for pars plana vitrectomy with the mean age (56.60 ±11.992), while male 41 (51.2%) and female 39(48.8%). Reported 58 (72.5%) patients had normal IOP and 22(27.5%) patients had high IOP postoperative immediately. Since 5 patients were known case of glaucoma and were under treatment. While most cases reported high IOP due to fluid tamponed 14(35%), SOIL 14 (35%), SF6 7 (19.4%) used after pars plana vitrectomy. Table-1

**Table-1**

	Normal (IOP)	High (IOP)	P-value
<b>Age</b> (year, mean±SD)	56.60 ±11.992		
<b>Sex</b>			
Male	25 (61%)	16 (39%)	<b>0.016</b>
Female	33 (84.6%)	6 (15.4%)	
<b>Side</b>			
OS	35 (77.8%)	10 (22.2%)	<b>0.172</b>
OD	23 (65.7%)	12(34.3%)	
<b>Indication</b>			
DVH	17 (77.3%)	5 (22.7%)	<b>0.016</b>
TRD	27 (61.4%)	17 (38.6%)	
RRD	14 (100%)	0 (0.00%)	
<b>Tamponed</b>			
Fluid	1 (25%)	14 (35%)	<b>0.410</b>
SF6	29 (80.6%)	7 (19.4%)	
SOIL	2665.0%)	14 (35.0%)	
<b>PMH</b>			
No H/O Glaucoma	58 (77.3%)	17 (22.7%)	<b>0.001</b>
H/O Glaucoma	0 (0.0%)	5 (100.0%)	

Demographic, clinical, and surgical characteristics were divided into two groups one represented normal IOP, and other high IOP.

The preoperative IOP was 13.78±2.585 mmHg, while sustain IOP postoperative in vitrectomized eye one month, after 3<sup>th</sup> months, 6<sup>th</sup> months, and 12<sup>th</sup> months (16.21±5.878mmHg; 15.73±3.98; 15.57±5.786; 15.57±5.786) respectively with significant p-value <0.05 ( 0.000, 0.00, 0.004, 0.001) respectively, which indicates SIOP post PPV documented. Table-2

**Table -2**

Change in IOP of the vitrectomized and fellow eyes

Intraocular pressure	Vitrectomized eye	P-value
Preoperative (mmHg, mean±SD)	13.78±2.585	
Postoperative		
After 1 <sup>st</sup> month	16.21±5.878	0.000
After 3 <sup>rd</sup> months	15.73±3.980	0.000
After 6 <sup>th</sup> month	15.57±5.786	0.004
After 12 <sup>th</sup> month	14.91±4.846	0.001

After 12th month 14.91±4.846 0.001

Paired sample t-test- P value< 0.05: IOP

High IOP was detected after one month in 21 patients in vitrectomized eye and 21 patients in fellow eye (22.48±7.769;14.38±2.418 mmHg) respectively. The result reported high IOP after 3th months in 22 patients in vitrectomized eye and 22 patients in fellow eye (19.64 ± 4.655; 13.64 ± 2.194 mmHg) respectively. High IOP after 6th months in 19 patients in vitrectomized eye and 19 patients in fellow eye (19.58±8.422; 13.16±2.141mmHg) respectively. High IOP after 12th months in 20 patients in vitrectomized eye, 20 patients in fellow eye (18.70±7.057; 13.30±1.750 mmHg) respectively. While persistent increased IOP was significant after surgery up to one year follow up p-value <0.05. (Tabel-3-)

**Table-3**

Mean IOP in vitrectomized eye and fellow eye

	(IOP) Vitrectomized Eye	(IOP) Fellow Eye	P
Postoperative(N, mmHg, mean±SD)			
1 <sup>st</sup> month	(21) 22.48±7.769	(21) 14.38±2.418	0.000
3 <sup>rd</sup> month	(22) 19.64 ± 4.655	(22) 13.64 ± 2.194	0.000
6 <sup>th</sup> month	(19) 19.58±8.422	(19) 13.16±2.141	0.009
12 <sup>th</sup> month	(20) 18.70±7.057	20) 13.30±1.750	0.003

Independent t-test categorized by IOP; p-value <0.05

## Discussion

Progressive glaucomatous damage is known postoperative complication following vitreoretinal surgeries with Intraocular pressure elevation. Moreover, eyes that require vitreoretinal surgery may already be prone to pressure elevations.

Our study reported the IOP of the vitrectomized eye was significantly higher than fellow eye at the 1st,3rd, 6th, and 12th months compared with the preoperative IOP measurement. However, there are several factors caused an increase the IOP after PPV such as viscoelastic residue, silicon oil or an expanding gas tamponed, bleeding, a pupillary block, trabeculitis, and ciliary body oedema or a response to topical corticosteroid treatment (1). In addition, length of time after the procedure, the diversity of surgical indications, the type of tamponade, and the definition of ocular hypertension and glaucoma used may explain differing results (8).

In our study, the cumulative rate of elevation IOP after 12 months of PPV was 27,5%, which is like the values reported elsewhere. (5,6,11)

Our study showed that high IOP could occur in case of silicone oil tamponade or fluid but less frequency in cases of SF6 gas tamponade.

Tognetti et al, defined Ocular Hypertension (OHT) as an IOP of >22 mmHg determined by at least 2 postoperative visits or an increase in IOP of >4 mmHg above the preoperative IOP, which reported 5.7% OHT in both the vitrectomized and the fellow eyes of 368 patients who underwent PPV for an idiopathic epiretinal membrane (5). Furthermore, Akdere et al, defined glaucoma as an IOP of >21 mm Hg and/or >4 mmHg higher than the preoperative IOP or fellow eye recorded in 2 visits and declined glaucoma onset as 43% after PPV in 107 patients (13).

On the other hand Wu et al, defined sustained IOP elevation (SIOPE) as IOP  $\geq$ 24 mmHg or 5 mmHg higher than the preoperative IOP and reported that it was significantly higher in the vitrectomized eye than the fellow eye (19.2% vs 4.5%;  $p < 0.0001$ ) in 198 patients who underwent PPV for idiopathic ERM, which was recommended ant glaucomatous therapy for PIOPE (12).

In contrast to the results of our study, Lalezary et al and Wu et al reported that there was no significant difference in the IOP between the 2 eyes at the last follow-up visit at least 12 months after PPV (4,6). Tognetto et al results differed and reported a significant difference in the IOP of treated and fellow untreated eyes 30 days after surgery, which gradually resolved to an insignificant difference within 26 months (5). Similar to the results of our study, Aykut et al., studied IOP changes after PPV was performed for rhegmatogenous retinal detachment and observed similar IOP values at a 12-month follow-up; however, they noted that the number of glaucoma medications needed postoperatively was significantly higher in the treated eye (14).

Despite some variability in study populations, definitions, and reporting, the current literature suggests a greater risk of developing open angle glaucoma after a vitrectomy in comparison with the preoperative IOP (15).

### In Conclusion

As every ophthalmologist knows, elevated IOP is a risk factor for glaucoma progression. Unfortunately, the IOP may rise significantly either transient or sustainable even after an uncomplicated PPV compared with that of the fellow eye or the preoperative IOP. persistent IOP elevation and preoperative IOP values should be taken into consideration in PPV evaluation.

Clinicians must closely monitor these patients postoperatively and good communication must be maintained between retina and glaucoma specialists, to ensure that all patients get the best outcomes possible.

Our study should help clinicians to estimate the risk and management of IOP elevation after PPV. Although our study was retrospective and by their nature cannot fully establish cause and effect and explain the whole observations, a prospective investigation with longer follow-up may strengthen our results in the future as well as to define the risk factors for secondary glaucoma and its optimal management.

### Disclosure:

The authors report no conflicts of interest in this work.

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