Visual Outcomes of Traumatic Posterior Segment Complications in Upper Egypt: Tertiary Center Study

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Abstract

Background:

Ocular trauma is a significant contributor to visual deterioration worldwide, with nearly 1.6 million people suffering from blindness due to eye injuries. As a result, unilateral blindness, caused most commonly by ocular trauma, is the most common form of this condition.

Patients and **Methods**:

This prospective observational study included eighty cases who underwent vitreoretinal intervention from September 2020 to August 2022. Patients with recent intraocular surgery, other causes of posterior segment complications, pre-existing diseases affecting visual outcome, and loss of follow-up were excluded. Demographic features, mechanism and time of eye injury, clinical features, surgical approach, and outcome were recorded and analyzed.

Results:

Variables predictive of good visual outcome included a vision more than HM at presentation and closed-eye trauma. Conversely, variables predictive of poor visual outcome included vision equal to or less than HM at presentation, initial or secondary retinal detachment, initial central corneal wound, initial scleral wound, and the presence of RAPD. Notably, the visual outcome was not affected by age, presence of secondary cataract, initial vitreous hemorrhage, time of intervention, or recurrence after retinal detachment surgery for these 80 patients.

Conclusion:

This study identified multiple prognostic factors for visual outcomes following ocular trauma. Notably, presenting visual acuity emerged as the strongest predictor in this series.

Keywords:

Ocular trauma, posterior segment, prognostic factors

Introduction:

Ocular trauma is an important cause of worldwide visual deterioration [1]. Nearly 1.6 million people are blind from eye injuries; these facts make unilateral blindness most commonly caused by ocular trauma [2]. Injuries involving the posterior segment can be divided into open or closed-globe injuries, depending on the presence or absence of a full-thickness wound in the eye globe.

Examples of closed globe injuries include a traumatic macular hole, posterior lens dislocation, commotio retinae, choroidal rupture, retinal tear, retinal dialysis, retinal detachment, optic nerve avulsion, even globe rupture and traumatic optic neuropathy [3]. Open globe injuries (OGI) are riskier for complications such as post-OGI sympathetic ophthalmia, retinal detachment, traumatic endophthalmitis, and ocular siderosis[4].

Our study aimed to identify the incidence, socio-demographic pattern, clinical characteristics, and possible predictive factors affecting long-term

visual outcomes of traumatic posterior segment complications that underwent vitreoretinal intervention presenting to Assiut University Hospital.

Patient and methods:

This prospective observational study was conducted at the Department of Ophthalmology, Assiut University Hospital, from September 2020 to August 2022 after the approval by the Institutional Review Board of the Faculty of Medicine, Assiut University (IRB NO. 17101385). Patients signed an informed consent. A total of eighty eyes with traumatic posterior segment complications were enrolled and underwent vitreoretinal intervention. Exclusion criteria included a history of recent intraocular surgery except for the initial OGI repair, as well as other causes of posterior segment complications, pre-existing diseases such as glaucoma or diabetic retinopathy affecting ocular findings and visual outcome, and loss of follow-up.

Data were recorded for the following variables: Sex, age, residence, socioeconomic status, type of injury: open or closed, causative agent, time interval from initial OGI repair to pars plana vitrectomy, and information related to the initial OGI repair. Variables collected from the initial examination included visual acuity, pupillary evaluation, extraocular movements, intraocular pressure measurement after ruling out globe rupture, anterior segment evaluation, and posterior segment examination.

Posterior segment surgery data included the type of tamponade if used, number of PPV procedures, other procedures performed such as scleral buckle, endo-laser, membrane peel, and additional procedures, including cataract surgery and argon laser photocoagulation around a retinal tear. The post-operative evaluation included visual acuity, the anatomic status of the retina, post-operative complications, and their management. Information on the status of the retina and visual acuity was recorded at two weeks, one month, and two months. The final best-corrected visual acuity was taken at the end of three months.

Eye injury was divided into OGI and closed globe injury (CGI) according to "The Birmingham Eye Trauma Terminology system" [5]. Zones of OGI were identified depending on "The Ocular Trauma Classification" [6].

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± Standard Deviation (SD). The confidence level was kept at 95%; hence, the P value was significant if it was < 0.05.

Results:

Following the review of 200 eyes presenting with traumatic posterior segment complications, eighty eyes (40%) underwent surgical intervention at the ophthalmology department, Assiut University Hospital for non-clearing vitreous hemorrhage (VH), retinal tear, retinal detachment, posteriorly dislocated lens, intraocular lens (IOL), and retained intraocular foreign body (IOFB) as shown in Table (1):

Table 1: Traumatic Posterior Segment Complications:

	No.	%
Medical	63	31.5
Surgical	80	40
Non-clearing Vitreous Hemorrhage	40	20
Retinal Tear	42	21
Retinal Detachment	48	24
Posterior Dislocation of Lens\IOL	10	5
Intraocular foreign body	26	13
Non – treatable	57	28.5
Commotio Retinae	7	3.5
Choroidal Rupture	3	1.5
Optic Nerve Avulsion	1	0.5
Traumatic optic neuropathy	14	7
Disorganized globe	32	16

IOL: Intraocular Lens

- **Patient Background Data**

Demographic data for the 80 patients is shown in Table (2).

Table 2: Demographic Distribution:

	No.	%	P value
Age (years)			
Range	7-80		
Mean±SD	30.1±17.52		
Gender			
Male	62	77.5	<0.001**
Female	18	22.5	
Occupation			
Rural	50	62.5	0.003**
Urban	30	37.5	

SD: Standard Deviation

- **Trauma History:**

The history of trauma for the 80 patients is shown in Table (3).

Table 3: History of Trauma

	No.	%	P value
Side			
Left	40	50	0.5
Right	40	50	
Type of eye injury			
Closed	42	52.5	0.429
Open	38	47.5	
Type of open-globe injury			
Penetrating	8	10	
Rupture	4	5	
Intra-ocular foreign body	26	32.5	
Interval between trauma and vitreoretinal surgical intervention (days)			
Range	2-365		
Mean±SD	50.9±75.05		
Object			
Animal kick	2	2.5	
blunt object	32	40	
Bomb	2	2.5	
Chip	12	15	
Copper wire	2	2.5	
Door	2	2.5	
Nail	2	2.5	
Plant	4	5	
Rock	4	5	
Scissor	2	2.5	
Shot	16	20	

- SD: Standard Deviation
- **Slit-lamp Examination (Anterior Segment Presentation):**

The findings of the anterior segment of the eye in the 80 patients are shown in Table (4).

Table 4: Slit lamp examination (anterior segment)

	No.	%
Zone of injury		
No wound	44	55
Zone 1	16	20
Zone 2	10	12.5
Zone 3.	10	12.5
Corneal opacity		
Clear	64	80
Central	12	15
Peripheral	4	5
Iris		
Free	68	85
Iridodialysis	12	15
State of lens		
Clear lens	14	17.5
Cataract	48	60
Pseudophakic	8	10
Aphakic (Dislocated crystalline lens or IOL)	10	12.5

IOL: Intraocular Lens

- **Fundoscopic Examination (Posterior Segment Presentation):**

Vitreous hemorrhage was found in 40 cases (50%). Retina was detached in 48 cases (60%). Retinal tear was found in 42 cases (52.5 %). The crystalline lens \ IOL was dislocated in 10 cases (12.5%), and there was IOFB in 26 cases (32.5%) that was metallic in 20 cases (25 %) and non-metallic in 6 cases (7.5 %) as in Figure (1).

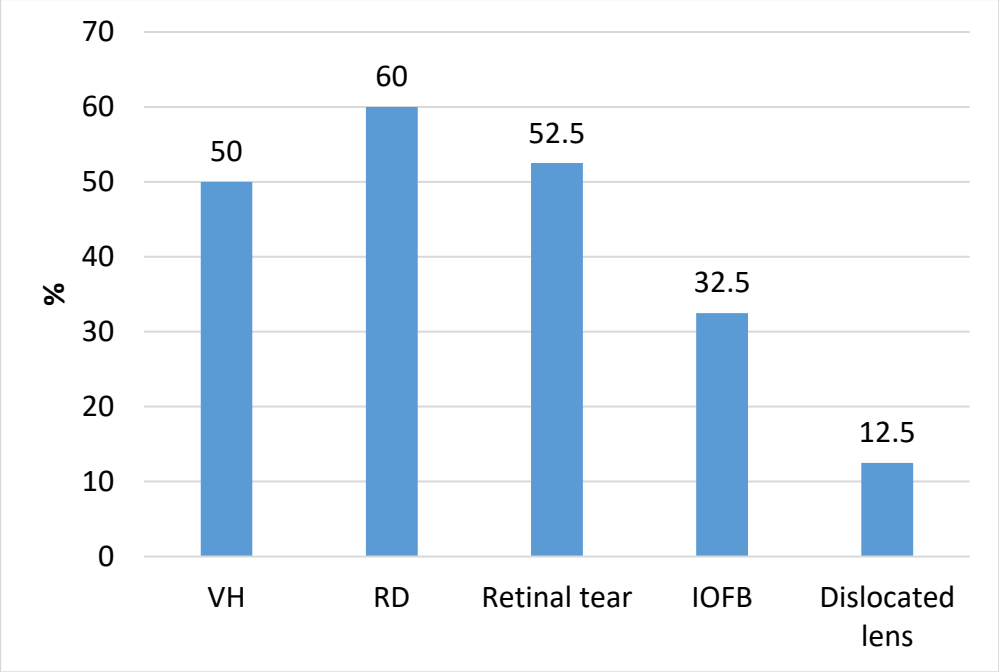

Figure 1: Posterior segment findings

- **Surgical Management:**

Vitreoretinal intervention details are summarized in Table (5). PPV was performed in 78 cases (97%), and scleral buckle was performed in only 2 cases (2.5%). Details regarding the type of tamponade used included 44 eyes (55.0 %) received silicone oil 2000, 34 eyes (42.5 %) received silicone oil 5000, while 2 eyes (2.5 %) received gas (Octafluoropropane C3F8 and Sulfur hexafluoride SF6) as a tamponade depending on the surgeon's preference and the condition of the retina.

Table 5: Operation

	No.	%
Operation		
PPV	78	97.5
Scleral buckle	2	2.5
Tamponade		
Silicon 2000	44	55
Silicon 5000	34	42.5
Gas	2	2.5

PPV: Pars Plana Vitrectomy

The study identified 6 cases (7.5%) of atrophia bulbi, 2 cases (2.5%) of endophthalmitis, 6 cases (7.5%) of macular preretinal membranes, and 6 cases (7.5%) of traumatic optic neuropathy, all associated with the poorest visual outcome ranging from no perception of light (PL) to counting fingers (CF), as in Table 6.

Table 6: Post-operative Complications

	No.	%
Atrophia bulbi	6	7.5
Endophthalmitis	2	2.5
Macular preretinal membranes	6	7.5
Traumatic optic neuropathy	6	7.5

- **Visual Outcome:**

The pre-operative visual acuity ranged from 6\6 to PL (Table 7).

Table 7: Pre-operative Visual Acuity

Preoperative VA	NO.	%
LP \HM	44	55
Less than 6\60	32	40
6\60 to 6\24	2	2.5
6\18 to 6\12	0	0
More than 6\12	2	2.5

LP: Light Perception, HM: Hand Movement

The final VA, as in Table (8), was no PL in 8 eyes (10 %) and PL \HM in 12 eyes (15 %). Ten eyes (12.5%) maintained a VA of less than 6\60. Eighteen eyes (22.5%) had VA of 6\60 to 6\24; and of those, 26 eyes (32.5%) had 6\18 to 6\12 vision, and six (7.5 %) had more than 6\12 vision.

Functional success (visual acuity ≥5/200 or less than logmar 1.6) was achieved in 65 % of the eyes (n=52).

Table 8: Post-operative Visual acuity

Final VA	NO.	%
No pl	8	10
PL \HM	12	15
Less than 6\60	10	12.5
6\60 to 6\24	18	22.5
6\18 to 6\12	26	32.5
More than 6\12	6	7.5
Functional Success (log mar < 1.6)	52	65

PL: Perception of Light

HM: Hand Movement

- **Predictive Factors of Final Vision:**

Table (9) showed predictors of visual outcomes identified by univariate analysis. Variables predicted good visual outcomes, including a vision more than HM at presentation and closed-eye trauma. Dislocated lens\IOL was the most common complication associated with functional success.

Variables predictive of the poor visual outcome included vision equal to or less than HM at presentation, initial or secondary retinal detachment, initial central corneal wound, initial scleral wound, and presence of RAPD.

Variables including age of patients, presence of secondary cataract, initial vitreous hemorrhage, time of intervention, and recurrence after retinal detachment surgery for these 80 patients did not significantly affect the visual outcome.

Table 9: Prognostic Factors Associated with Functional Success

		NO.	Functional success	P value
Age	<20 20-40 >40	28 34 18	16\28 (57%) 20\34 (59%) 16\18 (89%)	0.735
Time of intervention	<4 weeks >4weeks	32 48	24\32 (75%) 28\48 (58.3%)	0.195
Injury type	Open Closed	38 42	20\38 (52.6%) 32\42 (76.2%)	0.05*
Presenting DCVA	>HM ≤ HM	36 44	34\36 (94.4%) 18\44 (40.9%)	<0.001**
Initial central corneal wound	present Absent	12 68	4\12 (33.3%) 48\68 (70.6%)	0.030*
Initial scleral wound	present Absent	37 43	19\37 (51.4%) 33\43 (76.7%)	0.033**
Secondary cataract	present Absent	48 32	30\48 (62.5%) 22\32 (68.75%)	0.738
Crystalline lens \ IOL dislocation	present Absent	10 70	10\10 (100.0%) 42\70 (60%)	0.034*
Intraocular foreign body	present Absent	26 54	16\26 (61.5%) 36\54 (66.7%)	0.836
Vitreous hemorrhage	present Absent	40 40	24\40 (60.0%) 28\40 (70.0%)	0.482
Retinal detachment	present Absent	48 32	24\48 (50.0%) 28\32 (87.5%)	0.001**
Recurrence after retinal detachment surgery	present Absent	8 40	2\8 (25.0%) 22\40 (55.0%)	0.189
Presence of RAPD	present Absent	6 74	0\6 (0.0%) 52\74 (70.3%)	0.003**

DCVA: Distance Corrected Visual Acuity, IOL: Intraocular Lens, RAPD: Relative Afferent Pupillary Defect.

Discussion:

Regarding functional success, many factors influence final visual acuity, with initial visual acuity being a significant predictor [8-11]. This study confirmed that presenting visual acuity equal to or less than hand motion (HM) significantly correlated with worse outcomes compared to visual acuities greater than HM (P<0.001), establishing it as the most significant predictor of final visual acuity. This finding is consistent with the study by Yaşa (2018) [7], which reported that better visual acuity (>HM) at presentation was associated with improved post-operative visual acuity (>5/200).

Although the current study suggests that older age is associated with better visual outcomes than younger age, this association did not reach statistical significance. This finding is consistent with ***Chiquet (1998)***[8]. In contrast, ***Ehlers (2008)***[9] reported that older age was statistically significant for achieving excellent visual outcomes compared to younger age groups.

Like ***Qi (2015)[10]***, the current study shows that closed ocular trauma had better outcomes than open globe trauma.

In this study, the initial scleral wound appeared significantly a negative predictive factor of visual outcome. Several authors stress the prognostic value of the presence of initial scleral wound. ***Yang (2019)***[11], ***Stryjewski et al. (2014)***[12], and ***Brinton (1982)***[13] showed that the presence of wounds located posteriorly into the sclera had more risk of RD.

In our study, the ***Initial central corneal wound*** was associated with poor visual outcome due to significant visually affected central corneal opacity, similar to the study of ***Chiquet et al. (1999)***[14].

The timing of PPV in ocular trauma is an issue of debate. In the current study, the mean time from trauma to PPV was 50.9 days, but it included both open and closed-globe trauma.

Our data suggested that cases who underwent PPV during the first four weeks had better prognosis than those who had been treated after the first four weeks, although the differences were not statistically significant. The six eyes that were anatomic successes but functional failures because of macular preretinal membranes had all undergone vitrectomies more than a month after injury. Perhaps earlier vitrectomy would be associated with better outcomes in these cases. In two eyes that developed endophthalmitis, vitrectomy had been delayed for more than 4 weeks after the injury, and earlier vitrectomy might have benefitted these cases.

Following other studies, such as ***Yaşa (2018)***[7]and ***Yang (2019)***[11], we found a significant negative predictor between the occurrence of RD and final visual acuity.
Recent reports by Yaşa (2018)[7] and Öztaş (2015)[15] found that the ***recurring retinal detachments*** during follow-up also had a worse prognosis. Our data suggested the cases with RD that had recurrence associated with worse visual outcomes, although the differences were not statistically significant. This might be attributed to the small number of patients with recurrent RD.

Of the clinical signs at presentation, the presence of an ***RAPD*** had a significantly worse prognosis. This supports the view of ***Ehlers (2008)***[9].
Similar to other studies by Chiquet (1998)[8], ***vitreous haemorrhage*** did not affect the visual outcome. Nevertheless, according to other reports, ***Stryjewski (2014)***[12], severe intravitreous haemorrhage was predictive of a poor prognosis.

Conclusion:

Visual outcomes following traumatic posterior segment complications were found to vary according to multiple prognostic factors. Visual acuity emerged as the most important predictor of the final visual outcome of our study. Additionally, predictive factors included the presence of initial or secondary retinal detachment, an afferent pupillary defect, corneal and scleral wounds, and closed globe trauma.

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