

ARTICLE



Visual outcomes and prognostic factors of early pars plana vitrectomy for open globe injury

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OBJECTIVES: To identify the clinical features and outcomes of early vitrectomy in patients with open globe injury (OGI) and the prognostic factors for visual outcome.

METHODS: This retrospective observational case series included 390 eyes in 389 patients diagnosed with OGI receiving vitrectomy within four days after injury. Preoperative parameters included the injury types, wound locations, consequent tissue damages, initial visual acuity (VA), and ocular trauma score. Postoperative outcome measures included surgical procedures, retinal (re) attachment, complications, and final VA. The logistic analysis evaluated the prognostic factors for visual outcome.

RESULTS: Intraocular foreign bodies (59.2%) and penetrating injuries (28.7%) were the most common injury types. Among the 165 eyes with retinal detachment (RD), 121 (73.3%) had retinal reattachment during early primary vitrectomy, and 32 (19.4%) were repaired during a second or subsequent surgery. Thirteen eyes (3.3%) were enucleated. The final VA improved from the initial level in 207 eyes (55.2%), remained unchanged in 123 (32.8%), and decreased in 45 (12.0%). Multivariable regression revealed that the injury zone, initial VA, RD, and endophthalmitis were associated with poor visual outcomes ($P < 0.05$).

CONCLUSIONS: Higher zone injury, low initial VA, RD, and endophthalmitis are predictors of poor visual outcome in eyes undergoing early vitrectomy for OGI.

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INTRODUCTION

Open-globe injury (OGI) is a full-thickness wound of the eyeball because of a laceration or occult rupture [1]. OGI involves multiple ocular injuries and is a significant cause of permanent visual loss and ocular morbidity worldwide [2]. Furthermore, OGI threatens poor visual prognosis and contributes social-psychological pressure and economic burden to individuals and families. The global incidence of OGI is estimated as 3.5 per 100,000 persons yearly, corresponding to 203,000 annually injured persons worldwide [3].

Rapid evaluation of the type and degree of the injury is important for timely OGI treatment and management. Great strides have been made concerning microsurgical instruments, vitreoretinal techniques, and surgical training; besides, the OGI management strategy needs to be systematically evaluated with equal importance. The primary repair should include proper wound closure, treatment of prolapsed tissue, and elimination of blood and foreign bodies from the anterior chamber, ideally done within 24 h of injury. Secondary surgeries (such as pars plana vitrectomy (PPV)) are performed early (within 4 days) or later (10–14 days after injury) [4–6]. There is considerable controversy regarding the ideal vitrectomy timing [7]. Previous work reported that the “mainstream” option is a step-by-step strategy with

primary wound closure on day one, followed by intraocular reconstruction (typically vitreoretinal surgery) 10–14 days later [4, 8], assuming that posterior vitreous detachment (PVD) has occurred and the risk of intraoperative choroidal haemorrhage has subsided during this time window [9]. However, some surgeons insist on early vitrectomy by eliminating the haemorrhagic vitreous, damaged lens, and inflammatory substances. Endeavouring to restore the intraocular anatomic structure to normality is crucial to reducing the risk of traumatic proliferative vitreoretinopathy (TPVR) and is thus preferable to fighting an already advancing proliferation [4, 10]. Therefore, we assessed the feasibility, safety, and efficacy of early OGI vitrectomy by collecting and analysing the clinical features, visual outcomes, and prognostic factors of patients with OGI who received early PPV.

SUBJECTS AND METHODS

The medical records of 389 hospitalized patients with OGI who underwent early vitrectomy in Southwest Hospital (Army Medical University, Chongqing, China) between January 2010 and June 2021 were retrospectively collected and reviewed. The study protocol received Institutional Review Board approval (Southwest Hospital, Army Medical University, Chongqing, China; Register number: (B) KY202287).

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We included patients diagnosed with OGI according to the Birmingham Eye Trauma Terminology system (BETTs) criteria [2]. All eyes had posterior segment involvement, and a vitrectomy was performed within four days of the injury. Traumatic eyes with a history of ocular disease or previous treatment affecting vision, an OGI involving only the anterior segment or involving the posterior segment but not requiring vitrectomy (such as mild vitreous haemorrhage and choroid rupture) or systemic disease precluding vitrectomy were excluded. All charts had complete records of demographics, mechanism of injury, zone of injury, initial best-corrected visual acuity (BCVA), time interval to vitrectomy, ocular trauma score (OTS) [11], and concurrent ocular damages (such as corneal lacerations, iris and lens damage, vitreous haemorrhage (VH), retinal detachment (RD), choroid and optic nerve injury, and endophthalmitis. Surgical intervention, follow-up results, postoperative complications, and final BCVA were also documented.

Based on the BETTs, the mechanism of injury was classified as rupture, penetration, intraocular foreign bodies (IOFBs), and perforation; we also included mixed injury [12]. Wound locations were classified according to the Ocular Trauma Classification Group [12]. Furthermore, the zone of injury was coded using ordinals (Zone I: involve cornea and limbus only; Zone II: extend posteriorly from the limbus up to 5 mm posterior to the limbus; Zone III: extend over 5 mm posterior to the limbus). Additionally, BCVA was assessed with a Snellen chart. Initial and final BCVAs were the best-corrected VA on presentation and at the last visit, respectively. The BCVA was divided into five levels according to OTS: 20/40 or better, 20/200–20/50, 1/200–19/200, light perception (LP) / hand motion (HM), and no light perception (NLP) [11]. We defined the final BCVA \geq 20/200 as a good visual outcome and the final BCVA $<$ 20/200 as a poor visual outcome [13]. Endophthalmitis diagnosis was based on clinical symptoms and signs. Intraocular contents culture was performed only in some cases. Therefore, endophthalmitis diagnosis was based on clinical factors, not culture outcomes. OTS was calculated based on preoperative BCVA, mechanism of injury, RD, relative afferent pupillary defect (RAPD), and endophthalmitis [11].

Surgical interventions in minor patients (under the age of 18) were performed under general anaesthesia. Adult patients received local or general anaesthesia during primary wound closure and vitrectomy. Patients diagnosed or highly suspected with endophthalmitis received intravitreal antibiotics treatment (vancomycin 1 mg/0.1 ml) or antifungal agents (voriconazole 1 mg/0.1 ml) after an intraocular sample was taken (aqueous or vitreous) at the end of vitrectomy. During hospitalization, systemic and topical antibiotics or antifungal drugs were administered based on experience or culture sensitivity.

Continuous variables were presented as mean \pm SD. Binary logistic regression (uni-/multivariate) analysis explored the association between risk factors and visual outcome of early vitrectomy for OGI. All significant factors in the univariate logistic analysis were included in the multivariate analysis. Furthermore, the odds ratio (OR), 95% confidence interval (CI), and *P*-values were obtained. Statistical analysis was conducted using the SPSS software for Windows 20.0 (SPSS Inc, Chicago, IL). A *P*-value \leq 0.05 was considered significant.

RESULTS

A total of 390 eyes in 389 patients with OGI were analysed in this study, with an average age of 35.5 ± 17.4 years (1.5–75 years). The age group with high incidence were 40–50, 30–40, and 50–60 years old (26.7%, 17.0%, and 15.2%, respectively). The male-to-female ratio was 7.8:1. The mean follow-up time was 9.4 ± 11.5 months (3–113 months).

Regarding the mechanism of injury, IOFBs (231 eyes, 59.2%) accounted for most injuries, followed by penetrating injuries (112 eyes, 28.7%), rupture (31 eyes, 7.9%), and perforating injuries (16 eyes, 4.1%). In our study, 61 eyes (15.6%) were injured in zone I, 125 (32.1%) in zone II, and 204 (52.3%) in zone III. The common concurrent injuries at presentation were traumatic cataracts (83.3%), corneal lacerations (63.3%), iris injury (61.5%), vitreous haemorrhage (50.8%), retinal detachment (42.3%), and endophthalmitis (39.7%) (Table 1). Additionally, endophthalmitis occurred in 17 ruptured eyes (54.8%), 55 eyes (49.1%) with penetrating injuries, 3 (18.8%) with perforating injuries, and 80 (34.6%) with IOFBs.

Table 1. Characteristics of patients with OGI receiving early vitrectomy.

Baseline characteristics	Number*, n (%)
Total patients (total eyes)	389 (390)
Age	
<18	80 (20.6)
\geq 18	309 (79.4)
Mean \pm SD	35.5 ± 17.4
Range (years)	1.5–75
Sex	
Female	44 (11.3)
Male	345 (88.7)
Mechanism of injury	
IOFB	231 (59.2)
Penetrating injury	112 (28.7)
Rupture	31 (7.9)
Perforating injury	16 (4.1)
Zone of injury ^a	
I zone	61 (15.6)
II zone	125 (32.1)
III zone	204 (52.3)
Concurrent injury	
Corneal lacerations	247 (63.3)
Injury of iris	240 (61.5)
Traumatic cataract	325 (83.3)
Vitreous hemorrhage	198 (50.8)
Retinal detachment ^b	165 (42.3)
Optic nerve injury	29 (7.4)
Endophthalmitis	155 (39.7)
OTS	
Category 1 (0–44)	154 (41.1)
Category 2 (45–65)	177 (47.2)
Category 3 (66–80)	34 (9.1)
Category 4 (81–91)	10 (2.7)
Category 5 (92–100)	0 (0)

OGI open globe injury, IOFB intraocular foreign body, OTS ocular trauma score.

*The data are presented as mean \pm SD or number and percentage.

^aThe data described the site and extent of the wound in Zone 1 with posterior segment involvement.

^bThe data excluded retinal breaks or perforations without detachment.

Pars plana vitrectomy was performed in all injured eyes, of which primary repair was combined in 236 eyes (60.5%). Lensectomy, IOFB removal, and retinal detachment repair were conducted in 318 (81.5%), 221 (56.7%), and 153 eyes (39.2%), respectively. The tamponades employed included silicone oil (SO) (328 eyes, 84.1%), perfluoropropane (C₃F₈) (29 eyes, 7.4%), sterile air (21 eyes, 5.4%), and balanced salt solution (BSS) (12 eyes, 3.1%) (Table 2). Subsequently, the gas tamponade was replaced with silicone oil due to recurrent RD in 10 eyes.

During the final visit, 13 eyes underwent enucleation, none primarily. Among the enucleated eyes, 5 were diagnosed with penetrating injury, 6 with IOFBs, and 2 with rupture. Regarding the enucleation timing, 10 eyes were enucleated shortly after the early vitrectomy due to severe infection and intraocular damage, and 3 were due to phthisis caused by a retinal reattachment failure. A binary logistic regression analysis was made to explore the association between age, nature of injury and enucleation

Table 2. Surgical interventions in early vitrectomy.

Operations	Number, n (%)
Vitrectomy	390 (100)
Combined with primary repair	236 (60.5)
Lensectomy	318 (81.5)
IOFBs removal	221 (56.7)
Retina repair	153 (39.2)
Tamponade	
BSS	12 (3.1)
C ₃ F ₈	29 (7.4)
Sterile air	21 (5.4)
SO	328 (84.1)

IOFB intraocular foreign body, BSS balance salt solution, C₃F₈ perfluoropropane, SO silicone oil.

and it showed that retinal detachment and endophthalmitis were significantly associated with eyeball enucleation ($P < 0.05$).

Of the 165 eyes diagnosed with RD, 121 had retinal reattachment after a single vitrectomy, whereas 35 eyes had recurrent RD (32 eyes had retinal reattachment after second or more operations and 3 eyes failed in retinal repair). Of the 35 eyes with recurrent RD, 21 eyes developed proliferative vitreoretinopathy (PVR) during follow-up. Among the 390 eyes with OGI, the most frequent postoperative complications included PVR (52 eyes, 13.3%), and secondary glaucoma (35 eyes, 9.0%) (Table 3). Examinations of a patient with open globe injury before and after vitrectomy was presented in Fig. 1.

Regarding visual acuity, 15 patients (15 eyes) were uncooperative during the initial evaluation due to infant age, among which 3 patients (3 eyes) were uncooperative at the final visit. Their VAs were excluded from OTS calculation and logistic regression analysis. The initial BCVA mostly fell between LP/HM. Furthermore, 12 (3.2%) eyes had an initial BCVA of 20/40 or better, 20 (5.3%) had 20/200–20/50, 54 (14.4%) had 1/200–19/200, 275 (73.3%) had LP/HM, and the remaining 14 (3.7%) had NLP. In contrast, at the final visit, 52 (13.9%) eyes had a final BCVA of 20/40 or better, 92 (24.5%) had 20/200–20/50, 101 (26.9%) had 1/200–19/200, 97 (25.9%) had LP/HM, and 33 (8.8%) had NLP. The final BCVA level improved in 207 eyes (55.2%), remained unchanged in 123 (32.8%), and decreased in 45 (12.0%) (Table 4).

A total of 375 eyes were analysed for logistic regression. Univariate logistic regression revealed that the zone of injury factors, initial BCVA, VH, RD, and endophthalmitis ($P < 0.05$) were significantly associated with the final BCVA (Table 5). The significant factors in the univariate logistic regression analysis were then included in the multivariate logistic analysis. Univariate logistic regression revealed that the prognostic factors with statistical significance for the visual outcome were zone of injury ($P < 0.05$, OR = 0.438, 95% CI = 0.312–0.615), initial BCVA ($P < 0.05$, OR = 7.594, 95% CI = 2.808–20.536), RD ($P < 0.05$, OR = 0.256, 95% CI = 0.150–0.438), and endophthalmitis ($P < 0.05$, OR = 0.550, 95% CI = 0.332–0.912).

DISCUSSION

The early surgical repair, including vitrectomy, aimed to minimize the incidence of, and damage by, endophthalmitis and reduce the PVR rate in the early post-traumatic period. However, vitrectomy timing (early versus delayed intervention) remains controversial and continues to be debated. Therefore, further investigation is warranted to understand the role of surgical timing and explore the effect of early versus late vitrectomy on postoperative visual acuity.

Clinical arguments in favour of delaying the vitrectomy include, first, an increased risk of haemorrhagic choroidal detachment

Table 3. Anatomic outcomes and postoperative complications in patients with open globe injuries.

Outcomes	Number, n (%)
Enucleation	13 (3.3)
Retinal attachment	
By the first surgery	121 (31.0)
By the second or more surgery(ies)	32 (8.2)
Postoperative complications	
Corneal lysis	2 (0.5)
Decompensation of corneal endothelium	3 (0.8)
Band keratopathy	6 (1.5)
Recurrent retinal detachment	35 (9.0)
Proliferative vitreoretinopathy	52 (13.3)
Secondary glaucoma	35 (9.0)

(CD) and absence of posterior vitreous detachment during early vitrectomy [4]. Second, corneal oedema with or without a traumatic cataract prevents adequate viewing of the posterior segment in patients with a corneoscleral laceration. This may limit the scope of intraocular reconstruction during vitrectomy. Third, an unsutured posterior scleral wound threatens to reopen during vitreoretinal surgery [4]. Finally, if the infrastructure for optimal surgery is unavailable, it should be postponed. If the surgeon deems the risk of choroidal haemorrhage in vitrectomy was too high, surgery is better performed later [4].

However, other risk factors that limit early vitrectomy have been mitigated with the development of microsurgical instruments, improvement of surgical skills, and medications (for instance, triamcinolone staining can help to remove the vitreous body) [14]. Pars plana vitrectomy with small incision, sophisticated microsurgical techniques and the application of various intravitreal drugs obviously ameliorated the anatomical and functional outcome. Postoperative recovery is faster and the new technique has less side effects than the conventional technique. Many researches have shown that 23G/25G-PPV improves the postoperative recovery and the quality of life for some vitreoretinal disease like diabetic retinopathy [15] and macular hole [16]. It is very likely that early vitrectomy was delayed because of the limitation of microsurgical treatment such as a large gauge. Some surgeons consider that waiting for a spontaneous PVD is spurious as the cortical vitreous remained adherent to the posterior retinal surface several weeks after the injury [17], during which the TPVR has already advanced, causing irreversible damage [4]. Indeed, it has been acknowledged that unsutured posterior scleral wound is a relative contraindication of early vitreoretinal surgery, since the wounds of which are typically small, enabling its quick healing and sustained closure unless mechanical perturbation by surgery or abnormal intraocular pressure [4]. Given the superiority of wound healing based on anatomic features, vitrectomy within the first 4 days for the treatment of severely injured eyes is highly recommended by us.

Haemorrhagic choroidal detachment is a severe condition often occurs in serious ocular trauma or intraocular surgery. The blood abnormally accumulates in the suprachoroidal space following the rupture of ciliary blood vessels. It is usually a great challenge to eliminate the accumulated blood in the first few days after a choroidal haemorrhage develops. In these cases, the current mainstream is that surgery should be performed as soon as enough haemorrhage is drained to enable safe vitrectomy. Ultrasonography shows a 42% positive predictive value for haemorrhagic choroidal detachment in OGI [18]. We reviewed the clinical data from all 390 eyes, and found that 240 eyes received ultrasound examination after primary wound repair.

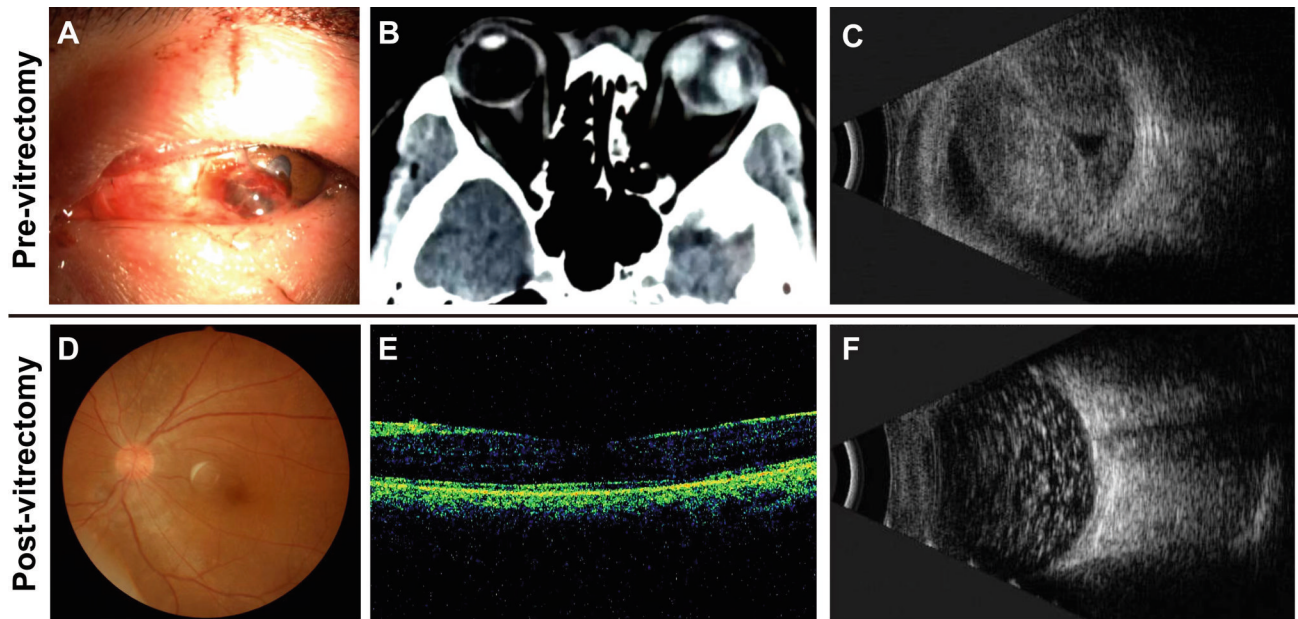


Fig. 1 Examinations of a patient with open globe injury before and after vitrectomy. **A, B** anterior segment photography and orbital CT scan before primary repair. **C** B-scan ultrasonography after primary repair shows disorder of intraocular structure. **D, E** fundus photography and optical coherence tomography post vitrectomy. **F**, B-scan ultrasonography show attached retina and dispersed silicone oil droplets after silicone oil removal.

Table 4. Distribution of initial and final visual acuities.

Initial VA	Final VA				
	NLP	LP/HM	1/200–19/200	20/200–20/50	≥20/40
NLP	4	6	3	1	0
LP/HM	27	83	76	62	27
1/200–19/200	2	7	17	15	13
20/200–20/50	0	1	4	11	4
≥20/40	0	0	1	3	8

VA visual acuity, NLP no light perception, LP light perception, HM hand motion.

Eight eyes were diagnosed with choroidal detachment (by B-scan), in which 4 eyes were detected with blood accumulation in suprachoroidal space after primary repair. Persistent haemorrhage which could not be controlled did not occur on these eyes or the others during vitrectomy. Intraoperative CD has not been well documented in terms of the cause, management and prognosis due to its minimal incidences. While it may be technically more challenging to perform vitrectomy during the primary wound repair or within the first four days after injury, if vitreoretinal expertise is immediately available during wound closure, it may be advantageous to conduct the definitive vitrectomy surgery at the same time. This is applicable when the surgeon is experienced in vitrectomy, and the logistics as well as infrastructure are favourable. If these conditions are not met, then a two-step strategy would be recommended.

In this study, enucleation was conducted in 10 eyes shortly after early vitrectomy due to severe infection and intraocular damage and in 3 eyes due to repeated retinal attachment failure during follow-up. The enucleation rate (13/390, 3.33%) was not high compared to other reports [19–22]. An epidemiology study in Queensland, Australia, reported an enucleation rate of 14.1% [23]. Two investigations in China revealed a 5.6% (79 of 1420 eyes, in Changsha) [22] and a 3.18% (10 of 314 eyes, in Tianjin) [21] enucleation rate. However, their injury sites were mainly in zone I

(62.8% and 57.0%, respectively). However, in our study, zone III injuries dominated (52.3%), which means our study had more severely damaged cases involving the posterior segment. This observation establishes that early vitrectomy is superior than traditional delayed vitrectomy as it leads to a better prognosis in the perspective of eyeball preservation, even under more severely injured conditions.

Post-traumatic endophthalmitis is a devastating complication after OGI and can cause irreversible functional or anatomical loss of the infected eye. Early vitrectomy could benefit the removal of infectious organisms to reduce subsequent infection risk [24]. Immediate and complete PPV alongside intravitreal antibiotics is now the gold-standard treatment for endophthalmitis according to the 2013 European Society of Cataract and Refractive Surgeons (ESCRS) guidelines [25], and this is even more relevant in a trauma setting. Essex et al. observed that certain IOFB injuries, such as those with dirty wounds, lens-capsule breach, rural address, and delayed primary repair, were risk factors of post-traumatic endophthalmitis [26, 27]. Notably, three of the five identified risk factors: dirty wound, delayed primary repair, and retained IOFB, can easily be managed by early primary repair.

Severe damage to intraocular structures, bleeding, inflammation, and infiltration of immune cells accelerate the traumatic proliferative vitreoretinopathy process [28]. TPVR risk increases

Table 5. Univariate analysis of prognostic factors that affect visual outcomes.

Prognostic factors	Subtype	FVA \geq 20/200	FVA < 20/200	P-value	OR	95% CI
Age	–	144	231	0.293	0.919	0.785–1.076
Sex	Female	17	25	0.684	1.180	0.532–2.616
	Male	127	206			
Mechanism of injury	Rupture	12	18	0.089	0.702	0.467–1.056
	Penetrating	30	71			
	Perforating	3	13			
	IOFB	99	129			
Timing of vitrectomy	<48 h	87	125	0.913	0.971	0.569–1.655
	\geq 48 h	57	106			
Zone of injury	I	51	9	0.000	0.382	0.263–0.556
	II	37	81			
	III	56	141			
Initial VA	\geq 20/200	26	6	0.000	8.358	2.909–24.018
	<20/200	118	225			
OTS level	Category 1	41	113	0.504	0.891	0.636–1.249
	Category 2	71	106			
	Category 3	23	11			
	Category 4	9	1			
	Category 5	0	0			
Corneal lacerations	Present	90	146	0.843	1.057	0.611–1.829
	Absent	54	85			
Injury of iris	Present	79	149	0.208	0.709	0.416–1.210
	Absent	65	82			
Traumatic cataract	Present	119	191	0.718	1.144	0.553–2.367
	Absent	25	40			
Vitreous hemorrhage	Present	78	118	0.019	1.997	1.119–3.565
	Absent	66	113			
Retinal detachment	Present	28	131	0.000	0.242	0.137–0.426
	Absent	116	100			
Injury of the optic nerve	Present	5	23	0.250	0.530	0.180–1.565
	Absent	139	208			
Endophthalmitis	Present	46	102	0.034	0.568	0.336–0.958
	Absent	98	129			

VA visual acuity, FVA final visual acuity, OR odds ratio, CI confidence interval, OGI open globe injury, IOFB intraocular foreign body, OTS ocular trauma score.

with time. Prophylaxis, rather than treatment, is the ideal option, as the prognosis of each successive TPVR operation is worse than the preceding one [17]. Early vitrectomy can remove the inflammatory debris and prevent intraocular proliferation [10]. Our prospective study [6] revealed that patients who received vitrectomy within four days after OGI had a lower TPVR incidence than that of patients underwent vitrectomy 10–14 days after OGI. In this study, although vitrectomy was performed early after OGI, TPVR already occurred in some patients: various degrees of proliferative retinal membranes were observed in 52 eyes (13.3%). Therein, subsequent retinal detachment occurred in half of those patients with proliferation. Early intervention can help to decrease TPVR incidence and thus keep the retina reattached to the anatomic position. In addition, no patient had other severe postoperative complications like sympathetic ophthalmia during follow-up.

Based on multivariate logistic regression analysis, the pre-operative prognostic factors that predict the poor visual outcome with early vitrectomy (BCVA < 20/200) are a high-zone injury, low initial VA, RD, and endophthalmitis. The zone of injury, based on

the anteroposterior extent of the injury or the wound length extending to the posterior pole, was negatively correlated with the final VA [12, 29]. Schmidt et al. [30] demonstrated that the initial VA significantly correlated with the final VA in OGI. Hutton [31] and Thompson et al. [32] observed that trauma-induced retinal detachment was also a prognostic factor for poor OGI outcome; since retinal detachment provides a suitable micro-environment for cell activation after destroying the blood-retinal barrier [33]. Williams et al. reported that endophthalmitis was also a prognostic indicator for a poor outcome [34], and 80.56% of patients with post-traumatic endophthalmitis had a final VA of <20/200 [21]. Therefore, the high zone injury, low initial VA, RD, and endophthalmitis are prognostic factors that predict the poor visual outcome of early vitrectomy. Albeit the zone or initial VA cannot be controlled, the risk of RD and post-traumatic endophthalmitis could be properly managed by early intervention.

Our study had limitations. First, including a matched control group of delayed vitrectomies in our study would have been ideal. This group would have served as a control to compare the

advantages and disadvantages of early versus delayed vitrectomy. This way, our study would have been a case-control study rather than case series. Second, selection bias may exist as patients with the incomplete medical records were not included and a review of the results may lead to missing data.

In conclusion, we report a large case series of OGI, with most having IOFBs and endophthalmitis. We observed that high zone injury, low initial BCVA, RD, and endophthalmitis are prognostic factors that predict the poor visual outcome of early vitrectomy. Furthermore, early vitrectomy may be beneficial to the clinical prognosis of OGI. Awareness of risk factors predicting the poor visual outcome may help while counselling patients with OGI, guiding clinical decision-making, and informing sight-saving interventions.

SUMMARY

What was known before

- The timing of vitrectomy is controversial and continues to be debated as an early versus delayed intervention. There are few reports on patients with open globe injury receiving early vitreoretinal surgery and, therefore, further investigation is warranted to understand the role of surgical timing and explore the effect of early versus late vitrectomy on postoperative visual acuity.

What this study adds

- Early vitrectomy may be beneficial in predicting the clinical prognosis, which is significant for extending the cognition on the surgery timing. In addition, high zone injury, low initial visual acuity, retinal detachment, and endophthalmitis are prognostic factors linked to poor visual outcomes of early vitrectomy.

DATA AVAILABILITY

Data will be made available upon request.

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AUTHOR CONTRIBUTIONS

HY and YL was responsible for conducting the research, designing the study; YH and HT contributed to analysing and interpreting the data, and editing and critical revision of the manuscript; NW and PG was responsible for following up with the patients and collecting the data; FK contributed in critical revision of the manuscript.

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COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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