https://doi.org/10.29309/TPMJ/2026.33.08.10506 www.theprofesional.com

ORIGINAL ARTICLE

Factors related to poor visual outcomes in open globe injuries.

Abdul Hanan Zahid[1], Ahmad Hassan[2], Rai Muhammad Farooq ur Rehman[3], Syed Ahmer Hussain[4], Atia Nawaz[5], Nausherwan Aadil[6]

ABSTRACT… Objective: To identify clinical and injury-related factors associated with poor visual outcomes in patients presenting with open globe injuries, **Study Design:** Analytical Cross-sectional study. **Setting:** Department of Ophthalmology, Nishtar Hospital, Multan. **Period:** February 2025 to December 2025. **Methods:** This analytical cross-sectional study was conducted in the Department of Ophthalmology at Nishtar Hospital, Multan. Patients with clinically diagnosed open globe injuries who underwent primary surgical repair and completed a minimum follow-up of six months were included. Demographic data, mechanism and zone of injury, presenting visual acuity, associated ocular findings and management details were recorded. Visual acuity was assessed at presentation and at final follow-up. Factors associated with poor visual outcomes were analyzed using appropriate statistical methods. P value of <0.05 was considered statistically significant. **Results:** A total of 120 patients with open globe injuries were analyzed, with a mean age of 32.6 ± 14.8 years and a male population (76.7%). Laceration injuries were slightly more common than rupture injuries (54.2% vs. 45.8%). More than half of the patients (56.7%) presented with visual acuity worse than 6/60. Zone III injuries were observed in 30.0% of cases. Common associated ocular findings included lens injury (48.3%), vitreous hemorrhage (43.3%), retinal detachment (28.3%), intraocular foreign body (18.3%) and endophthalmitis (11.7%). At final follow-up, poor visual outcomes were significantly associated with rupture-type injuries, Zone III involvement, poor presenting visual acuity, retinal detachment and endophthalmitis ($p < 0.05$). **Conclusion:** Poor visual outcomes following open globe injuries are primarily determined by the severity and anatomical extent of the injury at presentation. Poor presenting visual acuity, rupture mechanism, posterior segment involvement, retinal detachment and post-traumatic endophthalmitis are the most important predictors of unfavorable visual prognosis. Early surgical intervention and preventive strategies remain essential to reduce visual morbidity associated with open globe injuries.

Key words: Open Globe Injury, Ocular Trauma, Prognostic Factors, Retinal Detachment, Visual Outcome.

Article Citation: Zahid AH, Hassan A, Farooq ur Rehman RM, Hussain SA, Nawaz A, Aadil N. Factors related to poor visual outcomes in open globe injuries. Professional Med J 2026; 33(08):1593-1598. https://doi.org/10.29309/TPMJ/2026.33.08.10506

INTRODUCTION

Open globe injury is defined as a full-thickness wound of the outer layer of eye. It involves the cornea, sclera or both. These injuries represent one of the most devastating forms of ocular trauma.[1] Open globe injury is considered as a leading cause of monocular blindness worldwide, particularly in young individuals. The visual prognosis following OGIs varies widely, ranging from near-normal vision to no light perception (NLP). It also depends on the severity and nature of the injury.[2]

Age and gender play an important role in both the occurrence and outcome of open globe injuries. Young males are mostly affected due to occupational hazards, sports activities and interpersonal violence. Pediatric OGIs often have poorer outcomes because of delayed presentation, difficulty in examination as well as amblyopia.[3] Advanced age has also been associated with worse visual outcomes, possibly due to reduced healing capacity, pre-existing ocular comorbidities and higher incidence of blunt trauma mechanisms.[4]

The mechanism of injury is a major determinant of visual prognosis. OGIs are commonly classified as: Rupture (due to blunt trauma) and Laceration (caused by sharp objects), including penetrating and perforating injuries.[5] Rupture injuries generally carry a poor prognosis compared to sharp lacerations because they are often associated with extensive intraocular damage, posterior segment involvement and expulsion of intraocular contents. High-velocity injuries caused by metallic foreign bodies or explosions are often associated with severe tissue destruction and poor visual outcomes.[6]

1. MBBS, Post graduate Trainee (FCPS) Ophthalmology, Nishtar Medical University, Multan.
2. MBBS, MS-Ophthalmology, Level IV Post graduate Resident Ophthalmology, Nishtar Medical University and Hospital, Multan.
3. MBBS, Resident Ophthalmology, Nishtar Hospital, Multan.
4. MBBS, MCPS, FCPS, FRCS, Professor Ophthalmology, Nishtar Medical University and Hospital, Multan.
5. MBBS, MS-Ophthalmology, Level IV VR Trainee Ophthalmology, Nishtar Medical University and Hospital, Multan.
6. MBBS, FCPS, Senior Registrar Ophthalmology, Nishtar Medical University and Hospital, Multan.

Correspondence Address:
Dr. Abdul Hanan Zahid
Department of Ophthalmology, Nishtar Medical University, Multan.
hananzahid7334@gmail.com

Article received on:
02/02/2026
Date of revision:
03/04/2026
Accepted for publication:
07/04/2026

Visual acuity at presentation is one of the strongest predictors of final visual outcome. Patients presenting with no light perception (NLP) or light perception (LP) are at higher risk of poor visual recovery. Several studies have shown that worse presenting visual acuity links with the following: Extensive ocular tissue damage, Posterior segment involvement, Optic nerve injury and Retinal detachment.[7]

The anatomical zone of globe injury is another important factor. Zone I: include cornea and limbus, Zone II: Anterior sclera i.e, up to 5 mm posterior to limbus and Zone III: include posterior sclera i.e, >5 mm posterior to limbus. Injuries of Zone III are strongly associated with poor visual outcomes due to frequent involvement of the retina, choroid and the optic nerve. (Gupta et al., 2019) Posterior segment injuries often result in complications such as retinal detachment, vitreous hemorrhage and proliferative vitreoretinopathy. All these complications negatively impact visual prognosis.[8]

Several intraocular complications at presentation or during follow-up are linked to poor visual outcomes: Retinal detachment, Vitreous hemorrhage, endophthalmitis and intraocular foreign bodies. Retinal detachment is one of the most important predictors of poor visual recovery.[9] Traumatic retinal detachments are often considered complex and associated with large retinal breaks and proliferative vitreoretinopathy.[10] Vitreous hemorrhage blocks vision of the retina that leads to delay in the diagnosis of retinal pathology. (Osman, 2015)This can lead to worse outcomes. Endophthalmitis is a severe complication associated with inflammation, retinal damage and high rates of blindness. If the wound closure is delayed than these injuries further increase the risk.[11] Intraocular Foreign Body particularly metallic or organic material increases the risk of infection and retinal damage. Toxic reactions such as siderosis also contribute to poor visual outcomes.[12]

In order to improve the visual prognosis, early surgical repair is important. Delay in globe closure has been associated with higher rates of infection, increased tissue necrosis and poor visual outcomes.[13] Wound closure restores ocular function, reduces the risk of endophthalmitis. It further allows for early secondary interventions such as vitrectomy when indicated.[14]

The need for multiple secondary surgeries including pars plana vitrectomy, retinal detachment repair or keratoplasty often reflects the severity of the injury.[15] These procedures may save the eye anatomically but functional visual recovery remains limited in severe cases. Visual prognosis is limited especially when the macula or optic nerve is involved.[16]

In developing countries, limited access to specialized ophthalmic trauma care, delayed referral as well as lack of protective eyewear and poor compliance with follow-up can significantly worsen the outcomes. Occupational safety measures and public awareness play an important role in the prevention and early management of the condition.[17] Poor visual outcomes remain common despite the improvements in surgical repair techniques and vitreoretinal interventions. Understanding of these factors is important for the prediction of the outcomes, guiding proper treatment as well as setting realistic expectations for patients and their families.

METHODS

This was an analytical cross-sectional study conducted in the Department of Ophthalmology at Nishtar hospital, Multan. The study period extended from February 2025 to December 2025. This study was carried out in accordance with the principles of the Declaration of Helsinki. Approval was obtained from the ethical review committee of the institution (Ref. no. 4190/NMU dated=18/02/2026). Informed consent was obtained from all patients or their guardians.

Study Population: Patients presenting with open globe injury during the study period were included. Open globe injury was defined as a full-thickness wound of the cornea or sclera. Both adult and pediatric patients of either gender were enrolled. Inclusion Criteria: Patients with clinically diagnosed open globe injury, patients who underwent primary surgical repair at the study center, patients who completed a minimum follow-up period of 3–6 months and patients with available complete medical records. Exclusion Criteria: Closed globe injuries,

patients with pre-existing ocular pathology affecting visual acuity (e.g., advanced glaucoma, corneal opacity, retinal disease), patients with previous ocular surgery in the injured eye and patients lost to follow-up or with incomplete records.

Data Collection

Data was collected using a structured proforma from patient medical records and operative notes. The following variables were recorded: 1. Demographic data i.e, age and gender was recorded. 2. Mechanism of injury, rupture or laceration, object causing injury, laterality, time from injury to the presentation were also noted. 3. Clinical findings at presentation: presenting visual acuity, zone of injury (Zone I, II or III), presence of hyphema, lens injury, vitreous hemorrhage, retinal detachment, endophthalmitis, and intraocular foreign body were also recorded. 4. Timing of primary globe repair, surgical technique and need for secondary procedures such as pars plana vitrectomy were also taken into account. 5. Postoperative complications and final visual acuity were also observed.

Classification of Injury

Open globe injuries were classified according to the Birmingham Eye Trauma Terminology (BETT) system. The zone of injury was classified as: Zone I: cornea and limbus, Zone II: sclera up to 5 mm posterior to the limbus and Zone III: sclera more than 5 mm posterior to the limbus. Visual acuity was assessed using a Snellen chart. It was converted to logarithm of the minimum angle of resolution (logMAR) for statistical analysis. Low vision categories such as counting fingers, hand movements, light perception and no light perception were assigned standard logMAR equivalents. Final visual outcome was categorized as: Good visual outcome ≥ 6/18, moderate outcome < 6/18 to ≥ 6/60 and poor outcome < 6/60. The primary outcome measure was best-corrected visual acuity (BCVA) at the last follow-up visit. Secondary outcomes included identification of clinical and injury-related factors associated with poor visual outcome. Confidentiality of the patient data was strictly maintained throughout the study. Data was utilized solely for research purposes.

Data was entered and analyzed by using SPSS version 24. Quantitative variables were expressed as mean ± standard deviation while qualitative variables were presented as frequencies and percentages. Associations between poor visual outcome and potential risk factors were analyzed using the Chi-square test or Fisher's exact test for categorical variables and independent t-test for continuous variables. Multivariate logistic regression analysis was performed to identify independent predictors of poor visual outcome. A p value of < 0.05 was considered statistically significant.

RESULTS

A total of 120 patients with open globe injuries were included in this study. The mean age of the patients was 32.6 ± 14.8 years (range: 4–70 years). Males constituted the majority of cases (92 patients, 76.7%), while 28 patients (23.3%) were females.

TABLE-I

Demographic characteristics of patients (n = 120)

Variable	Frequency (n) %
Gender	
Male	92 (76.7%)
Female	28 (23.3%)
Age group (years)	
≤18	26 (21.7%)
19–40	54 (45.0%)
>40	40 (33.3%)

Sharp object–related lacerations were the most common mechanism of injury (65 cases, 54.2%). Then a globe rupture due to blunt trauma was reported (55 cases, 45.8%). Zone II injuries were most frequently observed.

TABLE-II

Injury characteristics of open globe injuries

Variable	Frequency (n) %
Mechanism of injury	
Laceration	65 (54.2%)
Rupture	55 (45.8%)
Zone of injury	
Zone I	38 (31.7%)
Zone II	46 (38.3%)
Zone III	36 (30.0%)

At presentation, 68 patients (56.7%) had visual

acuity worse than 6/60. Poor presenting visual acuity was more commonly seen in patients with posterior segment involvement.

TABLE-III

Presenting visual acuity at admission

Visual Acuity	Frequency (n) %
≥ 6/18	18 (15.0%)
< 6/18 – ≥ 6/60	34 (28.3%)
< 6/60 – LP	48 (40.0%)
No light perception	20 (16.7%)

Retinal detachment was observed in 34 patients (28.3%), vitreous hemorrhage in 52 patients (43.3%), and endophthalmitis in 14 patients (11.7%). Intraocular foreign body was present in 22 cases (18.3%).

TABLE-IV

Associated ocular complications

Ocular Finding	Frequency (n) (%)
Vitreous hemorrhage	52 (43.3%)
Retinal detachment	34 (28.3%)
Lens injury	58 (48.3%)
Endophthalmitis	14 (11.7%)
Intraocular foreign body	22 (18.3%)

At final follow-up (minimum 6 months), 50 patients (41.7%) achieved good visual outcome while 44 patients (36.7%) had poor visual outcome. Poor outcomes were significantly associated with rupture injuries, Zone III involvement, poor presenting visual acuity, retinal detachment and endophthalmitis ($p< 0.05$).

TABLE-V

Factors associated with poor visual outcome

Factor	Poor Outcome n (%)	P-Value
Rupture injury	32 (58.2)	0.003
Zone III injury	30 (83.3)	<0.001
Presenting VA < 6/60	38 (55.9)	0.001
Retinal detachment	26 (76.5)	<0.001
Endophthalmitis	12 (85.7)	<0.001

Poor visual outcomes following open globe injuries were strongly associated with posterior segment involvement, rupture-type injuries, poor presenting visual acuity, retinal detachment, and post-traumatic endophthalmitis. These factors remained significant predictors of visual prognosis.

DISCUSSION

Open globe injuries are considered a major cause of visual morbidity worldwide, particularly in developing countries. Despite advances in microsurgical techniques and vitreoretinal interventions, visual outcomes following such injuries are often poor. This study evaluated factors that are associated with poor visual outcomes in patients with open globe injuries. Several predictors, including poor presenting visual acuity, rupture-type injuries, posterior segment involvement (Zone III), retinal detachment, and post-traumatic endophthalmitis were also identified.

In our study, a clear predominance was observed in male group. This is consistent with previous reports that young males are more frequently affected due to occupational hazards, outdoor activities and trauma. Kuhn et al. reported a higher incidence of open globe injuries among males, particularly in the working-age population. The mean age in our study is also similar with some studies showing that ocular trauma commonly affects economically productive age groups.[18]

The mechanism of injury was found to be an important determinant of visual outcome. Globe ruptures were significantly associated with poor visual prognosis compared to laceration injuries. This finding is similar with previous studies, which have shown that rupture injuries are often caused by blunt trauma and are associated with extensive intraocular damage, posterior segment involvement and expulsion of ocular contents. Pieramici et al. and Schmidt et al. have both reported significantly worse outcomes in rupture injuries compared to sharp-object lacerations.[19]

In this study, visual acuity at presentation was emerged as one of the strongest predictors of final visual outcome. Patients with visual acuity worse than 6/60 or no light perception were at significantly higher risk of poor vision. This emphasizes initial visual acuity as a critical prognostic indicator. Poor presenting vision usually reflects severe damage to critical ocular structures such as the retina, choroid or optic nerve. Thereby, limiting the potential for

visual recovery. Agarwal et al. also reported that patients who had poor visual acuity were at risk of loss of vision.[20]

The zone of injury was another significant factor. In this study, injuries involving Zone III were strongly associated with poor visual outcomes. Posterior segment involvement increases the risk of complications. These complications include retinal detachment, vitreous hemorrhage and proliferative vitreoretinopathy. Similar findings have been reported by Esmaeli et al. and Agrawal et al., who demonstrated that posterior scleral wounds are associated with worse anatomical and functional outcomes.[21]

Retinal detachment was one of the most significant predictors of poor visual outcome. Traumatic retinal detachments are often complex. These are mostly associated with large retinal breaks, choroidal damage and proliferative vitreoretinopathy. Due to this, surgical repair becomes challenging. Previous studies have shown that the presence of retinal detachment markedly reduces the likelihood of good visual recovery, even with timely vitreoretinal surgery.

Post-traumatic endophthalmitis was associated with the worst visual outcomes in this study. Although, it was less common. Endophthalmitis leads to severe intraocular inflammation, retinal toxicity and irreversible damage to ocular tissues. This finding is similar with study by Thompson et al., who demonstrated that delayed presentation, contaminated injuries and intraocular foreign bodies significantly increase the risk of infection and poor visual prognosis.[22]

The presence of an intraocular foreign body (IOFB) was also associated with poor outcomes. This was common when metallic or organic materials were involved. It increases the risk of infection, retinal damage. Toxic effects such as siderosis negatively influence final visual acuity. Similar associations have been noted in multiple traumas.

The findings of the present study emphasize the importance of early diagnosis, surgical repair and timely referral to specialized ophthalmic trauma centers. Early globe closure reduces the risk of infection. It allows appropriate planning of secondary procedures such as pars plana vitrectomy, which may improve anatomical outcomes in selected cases. However, functional visual recovery remains limited in severe injuries involving the posterior segment.

CONCLUSION

Open globe injuries continue to represent a major cause of severe visual impairment despite advances in surgical management. The present study demonstrates that poor visual outcomes are strongly associated with poor presenting visual acuity, rupture-type injuries, posterior segment involvement (Zone III), retinal detachment and post-traumatic endophthalmitis. These factors reflect the severity of initial ocular damage. These remain the most reliable predictors of final visual prognosis. Early detection of high-risk features, surgical intervention and timely referral to specialized ophthalmic trauma services are essential to improve outcomes. Preventive strategies that include occupational safety measures and public awareness are important in reducing the incidence.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Abdul Hanan Zahid:** Conception of idea.
2	**Ahmad Hassan:** Proof reading.
3	**Rai Muhammad Farooq ur Rehman:** Data analysis.
4	**Syed Ahmer Hussain:** Manuscript writing.
5	**Atia Nawaz:** Data analysis.
6	**Nausherwan Aadil:** Data collection.