Archives of
Ophtalmological Research

Original Article

DOI: 10.51271/AOR-0033

Open globe injuries: associated findings, management, and visual outcomes

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Cite this article: Kılıç R, Güneş A, Demir HD, Şener E. Open globe injuries: associated findings, management, and visual outcomes. *Arch Ophthalmol Res.* 2025;2(3):39-42.

Received: 29/03/2025 ◆ **Accepted:** 06/04/2025 ◆ **Published:** 28/07/2025

ABSTRACT

Aims: The aim of this study was to conduct a retrospective analysis of the outcomes of open globe injuries (OGI) in adults diagnosed and treated at our hospital.

Methods: A retrospective review was conducted on the medical records of patients diagnosed and treated for OGI at our clinic. OGI were classified as laceration and rupture. Lacerations were further divided into penetrating, perforating injuries and intraocular foreign body. All OGI were assessed and subsequently underwent surgical repair to restore structural integrity within 24 hours of arriving at our hospital.

Results: A total of 37 cases of OGI were evaluated in this study, consisting of 28 males (75.7%) and 9 females (24.3%). The average age of the patients was 45.8±14 years. The mean age was 48.2±17.2 years for females and 45±13.1 years for males. The initial mean best corrected visual acuity (BCVA) was 2.03±0.79 logMAR, and the mean BCVA at the last follow-up was 0.77±1 logMAR. It was observed that metal objects and wood were the most common causes of injuries. Penetration and rupture were found to be the most common types of injury (45.9%). Intraocular foreign bodies were observed in 8.1%. No perforations were observed.

Conclusion: Open globe injuries continue to be a significant health issue due to their poor visual outcomes.

Keywords: Cataract, intraocular foreign body, open globe injuries, trauma, vitreous hemorrhage

INTRODUCTION

Open globe injuries (OGI) are severe ocular traumas in which the integrity of the globe is compromised, typically through a puncture, tear, or rupture of the cornea and/or sclera.[1] These injuries pose a serious risk to both vision and the structural integrity of the eye, often caused by trauma from penetrating or perforating foreign objects, blunt impact, or lacerations.[2] Open globe injuries are classified as medical emergencies due to the significant risk of vision impairment, infection, and other serious complications that can result in permanent damage to the eye or even its loss.[1-3] Prompt identification and intervention are crucial to protect vision and minimize further harm to the eye's sensitive structures, such as the retina, optic nerve, and lens.[2,3] Treatment typically involves surgical repair, infection prevention, and secondary surgeries for rehabilitation to help recover as much function as possible.[1-4]

Imaging, when used alongside a comprehensive ophthalmologic examination, can be an invaluable tool in assessing traumatic eye injuries.[5] Imaging characteristics indicative of globe rupture include changes in the normal shape or size of the eye, discontinuity of the sclera, intraocular air, a deepened anterior chamber, and the presence of an intraocular foreign body.[5]

To our knowledge, no published study has addressed OGI in our region. The purpose of this study was to conduct a retrospective analysis of the outcomes of OGI in adults diagnosed and treated at our hospital.

METHODS

The study was carried out with the permission of the Tokat Gaziosmanpaşa University Non-intervention Scientific Researches Ethics Committee (Date: 04.03.2025, Decision No: 25-MOBAEK-090). This study was conducted between 2021 and 2025 at the Department of Ophthalmology, Faculty of Medicine, Tokat Gaziosmanpaşa University, in accordance with the principles of the Helsinki Declaration. Patients 18 years of age and older with open globe injury were included in the study. Patients with closed globe injury, as well as those with inadequate follow-up duration, were excluded from the study.

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A retrospective review was conducted on the medical records of patients diagnosed and treated for OGI at our clinic. Data were extracted from the patient files, which included information on age, gender, cause of trauma, best corrected visual acuity (BCVA), findings from both anterior and posterior segment examinations, presence of intraocular foreign bodies, computed tomography findings, treatment provided, surgical procedures, and follow-up period. The visual acuity scores were transformed into LogMAR units.

Open globe injuries were classified according to the system developed by the ocular trauma classification group.[6] Patients were classified into rupture, penetrating injuries, perforating injuries, and intraocular foreign body categories. All patients were 18 years of age or older. All OGI were assessed and subsequently underwent surgical repair to restore structural integrity within 24 hours of arriving at our hospital.

Descriptive statistics were used to analyze the data, with the results presented as mean±standard deviation and percentages. The comparisons between the two groups were made using the Mann-Whitney U test. Comparisons between paired samples were made using the Wilcoxon test. Results were considered significant when the p-value was below 0.05.

RESULTS

A total of 37 cases of OGI were evaluated in this study, consisting of 28 males (75.7%) and 9 females (24.3%). The average age of the patients was 45.8±14 years. The mean age was 48.2±17.2 years for females and 45±13.1 years for males. There was no significant difference between females and males in terms of age (p=0.571). The mean follow-up duration was 12.1±11.1 months.

The initial mean BCVA was 2.09±0.77 logMAR, and the mean BCVA at the last follow-up was 1.07±1.15 logMAR. There was a significant difference between the initial and last follow-up mean BCVA (p=0.001). The final visual acuity was no light perception in 5 cases (13.5%). When we compared the affected zones and visual acuity, the best final BCVA was seen in zone I injuries, followed by zone II and zone III, respectively. The initial mean BCVA was 1.93±0.92 logMAR in zone I, 2.06±0.63 logMAR in zone II, and 2.53±0.21 logMAR in zone III. The final BCVA was 0.67±0.93 logMAR in zone I, 1.11±1.20 logMAR in zone II, and 1.98±1.13 logMAR in zone III.

It was observed that metal objects and wood were the most common causes of injuries. Table 1 shows the causes of OGI. We evaluated the affected zones and found that 19 injuries (51.4%) were in zone I, 9 injuries (24.3%) were in zone II, and 9 injuries (24.3%) were in zone III. Penetration and rupture were found to be the most common types of injury (45.9%). Intraocular foreign bodies were observed in 8.1%. We did not observe any perforations. The most common associated findings in OGI are vitreous hemorrhage, cataract, and hyphema. The associated findings are shown in Table 2.

Table 1. The etiological causes of OGI

Cause	n	%
Cutting/piercing metal object	12	32.4
Wood	9	24.3
Stone	4	10.8
Traffic accident	4	10.8
Glass	3	8.1
Blunt trauma	2	5.4
Cow horn	1	2.7
Fall	1	2.7
Other/unknown	1	2.7

OGI: Open globe injuries

Table 2. Anterior and posterior segment findings associated with OGI

Findings	n	%
Traumatic cataract	18	48.6
Vitreous hemorrhage	12	32.4
Hyphema	11	29.7
Iridodyalisis	6	16.2
Eyelid laceration	5	13.5
Retinal detachment	4	10.8
Intraocular foreign body	4	10.8
Nucleous dislocation	3	8.1
Canalicular laceration	1	2.7

OGI: Open globe injuries

Primary suturation was carried out in all cases. Two cases with no light perception underwent evisceration due to phthisis bulbi during follow-up. There was uncontrolled pain in one case with no light perception at follow-up, and this patient also underwent evisceration. In total, 3 patients underwent evisceration.

Lens clearance with phacoemulsification was performed in 4 cases during the first surgery. After primary suturing, cataract surgery with phacoemulsification and intraocular lens (IOL) implantation was performed on 5 cases. Pupilloplasty was added to one of these surgeries in the same procedure. Cataract surgery with phacoemulsification and scleral-fixated IOL implantation was performed in 2 cases. Secondary IOL implantation was performed in one case. Keratoplasty was performed in two cases due to corneal opacity. Keratoplasty surgeries were performed in different hospitals. Pars plana vitrectomy was performed for 4 patients: one for nucleus dislocation, two for vitreous hemorrhage and retinal detachment and the last one for intraocular foreign body and vitreous hemorrhage. There was one case in which the patients did not want to undergo a second surgery due to retinal detachment.

There were 3 cases with intraocular foreign bodies. Two of the 3 intraocular foreign bodies were located in the lens, and the other one was in the retina. Primary suturation, intraocular foreign body removal, lens clearance with phacoemulsification, and IOL implantation were performed in one case during the first surgery. Primary suturation, intraocular foreign body removal, and lens clearance with phacoemulsification were performed in the second case. Primary suturation was carried out for the third case in the first surgery. Then, phacoemulsification, IOL implantation, and pars plana vitrectomy with intraocular foreign body removal from the retina were performed in the second surgery.

DISCUSSION

Open-globe injuries are a common cause of blindness, typically resulting from sharp objects or blunt trauma. These injuries are characterized by a laceration or rupture in the

cornea or sclera, leading to the exposure of the inner contents of the eye to the external environment.[7] Open globe injuries were classified as laceration and rupture.[6] Ruptures occur due to blunt trauma, where increased intraocular pressure causes the eye wall to rupture at its weakest points. Lacerations, on the other hand, are caused by sharp trauma, where an object cuts or punctures the eye. Lacerations can be further divided into penetrating and perforating injuries. If the object remains inside the eye, it is referred to as an intraocular foreign body.[3,6]

The male patients are more affected than females, with a male-to-female ratio of about 3:1 in this study. Altıntas et al.[8] reported a male-to-female ratio of 3.12 in our country, which is similar to ours. Ozbek et al.[9] reported a 4:1 male-to-female ratio, also from Turkiye. Another study from Turkiye indicated a high male-to-female ratio.[10] In general, there is a male predominance in OGI in the literature.[1,4,8-12] This may be related to occupational exposure and the risk-taking behavior in men.

It was found that the mean age of the patients was 45.8±14 years in our study. It was 48.2±17.2 years for females and 45±13.1 years for males. Yıldırım et al.[10] reported the mean age as 37.82±26.07 (range: 1-95 years). The mean age ranged from 24 to 37 years in studies from Turkiye, which included pediatric cases.[1,8-11] However, we included only patients aged 18 or older. We believe that the higher mean age in our study is due to this difference. Cro et al.[12] also reported a relatively high median age, similar to ours.

We presented that the initial mean BCVA was 2.09±0.77 logMAR, and at the last follow-up, it was 1.07±1.15 logMAR. We observed the best BCVA in zone I OGI, followed by zone II and zone III OGI. We also observed that the most affected zone was zone I, followed by zone II and zone III. Batur et al.[1] indicated that the mean initial BCVA was 2.25±1.10 logMAR, and the mean final BCVA was 1.25±1.19. They also observed that zone I was the most affected zone, and the best BCVA was in this zone. Lee et al.[13] reported that the mean BCVA was 2.04±0.97 logMAR at presentation, and the final mean BCVA was 1.40±1.16 logMAR. These results suggest that a poor visual outcome can be observed after OGI, especially in zone III, and are similar to ours.

When we evaluated the trauma etiologic factors, it was determined that cutting/piercing metal objects were the most common cause (32.4%), followed by wood (24.3%), stone (10.8%), traffic accidents (10.8%), and glass (8.1%) as other common causes. Yıldırım et al.[10] observed that the most common etiologic causes were 28.5% cutting/piercing tools, 13.9% wood, and 9.9% glass, which is similar to our results. Cutting/piercing metal objects, wood, glass, blunt trauma, stone, traffic accidents, and falls were generally observed as the most common causes of OGI in the literature.[1,8-11]

We noted traumatic cataract (48.6 %), vitreous hemorrhage (32.4 %), hyphema (29.7 %) and iridodyalisis (16.2 %) as the most frequent anterior and posterior segment findings associated with OGI. Cro et al.[12] detected vitreous hemorrhage (66 %), cataract (35 %) and hyphema (34 %) as most common associated findings of OGI. In a report from Turkiye, hyphema (33.1 %), vitreous hemorrhage (12.6 %) and iridodyalisis (11.9 %) were determined as prevalent associated findings of OGI.[10] These findings are similar to other studies in the literature.[2,3,14]

CONCLUSION

Open globe injuries continue to be a significant health issue due to their poor visual outcomes. The fact that affected individuals are often of a young age further emphasizes the importance of this issue. Therefore, it is crucial to investigate the causes of eye trauma and identify preventable or correctable factors.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Tokat Gaziosmanpaşa University Non-intervention Scientific Researches Ethics Committee (Date: 04.03.2025, Decision No: 25-MOBAEK-090).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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