

Visual Results In Individuals Following The Restoration Of Penetrating Corneal Injuries

Md. Mostak Ahmed Al Zafri¹, Zahidul Ahsan Menon², Tanjila Hossain³,
Bimol Kumar Agarwala⁴, Shirin Ara Alam⁵, Robiul Islam⁶

Curator, Department Of Anatomy, Dhaka National Medical College, Dhaka, Bangladesh

Professor, Department Of Ophthalmology, Sir Salimullah Medical College, Dhaka, Bangladesh

Assistant Professor, Department Of Ophthalmology, Sir Salimullah Medical College, Dhaka, Bangladesh

Associate Professor (CC), Department Of Endocrinology, Dhaka National Medical College, Dhaka, Bangladesh

Registrar, Department Of Ophthalmology, Sir Salimullah Medical College, Dhaka, Bangladesh

Assistant Professor, Department Of Ophthalmology, Sir Salimullah Medical College, Dhaka, Bangladesh

Abstract

Background: A penetrating corneal injury is characterized by a full-thickness breach of the cornea. If not managed appropriately, it can lead to severe consequences such as blindness, loss of the eye, or phthisis bulbi. Potential complications include iris tissue prolapse, crystalline lens opacity, vitreous prolapse, vitreous hemorrhage, retinal tears, and retinal detachment. Prompt surgical intervention is essential for enhancing visual outcomes and maintaining ocular integrity.

Objective: To evaluate the clarity of vision in individuals who have undergone repair for penetrating corneal injuries.

Material and Methods: This prospective investigation involved 100 eyes affected by penetrating corneal injuries within the anterior segment, encompassing both genders. The study was conducted at Sir Salimullah Medical College & Mitford Hospital in Dhaka from January 2022 to December 2022. Comprehensive ophthalmic and systemic examinations were conducted on all patients, with particular attention to initial visual acuity. Surgical repair procedures were carried out under general anesthesia, adhering to strict aseptic protocols, by a highly skilled single surgeon. Follow-up evaluations were conducted on the first postoperative day, at one week, one month, and three months post-surgery. A comparative analysis was performed to assess changes in visual acuity from preoperative to postoperative periods across the follow-up timeline. The collected data were meticulously checked, cleaned, and prepared before being analyzed using SPSS (Statistical Package for Social Sciences) version 25.0.

Results: The study reveals that the most affected age group was 21–40 years, with the highest incidence observed in the 31–40 years range. Males comprised the majority of cases (80%), yielding a male-to-female ratio of 4:1. The leading presenting complaints included physical assault (20%), followed by agricultural trauma (18%), road traffic accidents (16%), project-related foreign body injuries (12%), sharp object injuries (12%), and work-related incidents (10%). Initial visual acuity assessments demonstrated that 60% of patients had poor vision, ranging from hand movement to light perception. Additionally, 16% presented with a visual acuity of 6/60, and only 10% achieved 6/18 vision. By the final follow-up, best-corrected visual acuity (BCVA) outcomes showed that 12% of patients attained a BCVA of 6/18, while 72% had a BCVA of 6/60 or worse, with some cases resulting in no light perception.

Conclusions: This study highlights that penetrating eye injuries significantly contribute to vision loss and impairment in one eye, even when patients receive timely medical care and undergo prompt corneal repair. Therefore, raising public awareness about eye injury prevention is essential and should be a key focus of advocacy initiatives. Promoting the use of protective eyewear, especially among high-risk occupational groups such as artisans, is crucial. If necessary, government regulations should mandate the use of protective eyewear within these groups to reduce the incidence of eye injuries.

Date of Submission: 13-01-2025

Date of Acceptance: 23-01-2025

I. Introduction

A penetrating corneal injury is a full-thickness disruption of all corneal layers. Without proper management, it can lead to blindness, loss of the eye, or phthisis bulbi. Associated complications may include iris prolapse, crystalline lens opacity, vitreous prolapse, vitreous hemorrhage, retinal tears, and retinal detachment.¹⁻

³Maintaining effective and functional vision is essential for overall well-being and plays a vital role in performing daily activities successfully. Vision loss can result from congenital factors or acquired causes, with trauma being one of the most sudden and impactful contributors due to its instantaneous nature. Trauma can cause a range of tissue injuries affecting the globe, optic nerve, and adnexa, ranging from superficial damage to vision-threatening conditions.^{2,4} Common sources of trauma include assault, domestic incidents, occupational accidents, and sports-related injuries.^{5,6} Ocular trauma is a leading cause of ocular morbidity, with males being more susceptible to such injuries than females.² The spectrum of ocular trauma varies widely depending on the nature and location of the injury. Mechanical trauma to the eye is classified by the Birmingham Eye Trauma Terminology (BETT) and the Ocular Trauma Classification Group into open and closed globe injuries.⁸ An open-globe injury is characterized by a full-thickness wound of the eye wall, involving the sclera, cornea, or both. This vision-threatening condition frequently results in blindness. A penetrating injury, a subtype of open-globe injury, involves a single full-thickness wound caused by a sharp or pointed object, typically without an exit wound. Penetrating injuries may also involve intraocular retention of a foreign body.^{9,10} A review of the literature identifies several factors that can predict outcomes following an open-globe injury. These include the mechanism or type of injury, preoperative visual acuity (VA), the time interval between injury and surgery, the presence of a relative afferent pupillary defect (RAPD), and the size and location of the wound. The international classification of ocular trauma incorporates these variables, as they significantly impact the final visual outcome. Additional factors influencing visual prognosis include retinal detachment, uveal or retinal tissue prolapse, vitreous hemorrhage, lens damage, hyphema, and the number of surgical interventions required.^{9,11-14} Initial visual acuity has been shown to be the most reliable predictor of final visual outcomes in cases of open-globe injuries.¹² This study aims to assess the final visual outcomes in patients with penetrating corneal injuries.

II. Materials And Methods

This prospective study was conducted at Sir Salimullah Medical College & Hospital, Dhaka, from January 2022 to December 2022. The study included patients aged 15 years and older of both sexes with penetrating corneal injuries involving the anterior segment. A total of 100 participants were enrolled. Data were collected from patients presenting to the emergency department and follow-up rooms using a structured questionnaire. Comprehensive ophthalmic and systemic examinations were performed, with particular attention to the assessment of presenting visual acuity. All surgical repairs were performed under general anesthesia, adhering to strict aseptic precautions, by a single skilled surgeon. Follow-up assessments were conducted on the first postoperative day, after 7 days, after one month, and after three months. During each follow-up visit, the anterior segment was evaluated with a focus on visual acuity. Data were thoroughly checked, cleaned, and edited before analysis. Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) version 25.0. Descriptive statistics were utilized to interpret the findings and a p-value of <0.05 was considered statistically significant.

III. Results

Table shows maximum (50%) patients were 21-30 years age group followed by 26% were 31-40 years, 18% were 15-20 years, 4% were 41-50 years and only 2% were 51-60 years. The average age was 27.68±7.69 years. Majority (80%) were male and 20% were female (Table 1). Table shows common presenting complaint physical assault (20%) then, agricultural trauma (18%), road traffic accident (16%), project foreign body (12%), sharp object (12%) and during working (10%) (Table 2). Maximum (58%) were time presentation were ≥24 hours and 42% were <24 hours (Table 3). Maximum (42%) hand movement in distant unaided VA (Table 5). Majorities (62%) were right site and 38% were left site (Table 4). Table shows visual acuity was statistically significant improvement of final outcome (Table 6).

Table 1: Demographic characters of the study subjects (n=100)

Characteristics	No. of patients	Percentage (%)
Age in years		
15-20	18	18.0
21-30	50	50.0
31-40	26	26.0
41-50	4	4.0
51-60	2	2.0
Mean±SD	27.68±7.69	
Sex		
Male	40	80.0
Female	10	20.0

Table 2: Presenting complaints of the study subjects (n=100)

Presenting complaints	No. of patients	Percentage (%)
Playing	4	4.0
Physical assault	20	20.0
Sharp object	12	12.0
Road traffic accident	16	16.0
Agricultural trauma	18	18.0
Projectile foreign body	12	12.0
Fish hook	2	2.0
Accidental trauma	6	6.0
During working	6	10.0

Table 3: Time presentation of the study subjects (n=100)

Time presentation	No. of patients	Percentage (%)
<24 hours	42	42.0
≥24 hours	58	58.0

Table 4: Site of the study subjects (n=50)

Site	No. of patients	Percentage (%)
Right	38	38.0
Left	62	62.0

Table 5: Distant unaided VA the study subjects (n=50)

Distant unaided VA	No. of patients	Percentage (%)
Hand movement	42	42.0
Perception of light	18	18.0
3.60	8	8.0
6.12	2	2.0
6.18	10	10.0
6.36	4	4.0
6.60	16	16.0

Table 6: Visual acuity at presentation and last follow up of penetrating ocular injury cases (n=50)

VA	At first follow up		Final follow up		P value
	No	%	No	%	
Hand movement	14	14.0	0	00	0.001
Perception light	2	2.0	0	00	
6/6	0	00	4	4.0	
6/12	8	8.0	10	10.0	
6/18	6	6.0	12	12.0	
6/24	0	00	20	20.0	
6/30	4	4.0	26	26.0	
6/36	18	18.0	12	12.0	
6/60	48	48.0	16	16.0	

IV. Discussion

Penetrating corneal injury is a well-established cause of preventable visual loss.¹⁵ This study to assess the visual acuity in patients with penetrating corneal injury after repair. In this study amongst the 50 cases of corneal injuries study the most common age group affected was between 21 and 40 years followed by 31-40 years. Therefore, the findings of the study are in well agreement with the findings of the other research works.^{9,12,13} According to Mashaka study, injuries were more in most active period of life (15-50) years and there were 15% lesions among children and lesions declined after the age of 71.¹⁶ This has a considerable socioeconomic impact because people of this age group are bread winners of their families. Ying et al. and Salvatore et al. reported an average age of 35.5 years and 35.6 years respectively.¹⁷ In this study, there was a higher, yet statistically insignificant, incidence of penetrating ocular injuries among males, though compared to females (P=0.001). The male to female ratio was 4:1, which is consistent with findings from the majority of similar studies.^{11,16,17} However, this ratio was slightly higher than previous studies.^{2,12,19} The fact that more males are involved in high-risk behavior and vocation, and are adventurous and aggressive makes them more prone to penetrating corneal injuries.¹² This study shows common presenting complaint of physical assault (20%) then, agricultural trauma (18%), road traffic accident (16%), project foreign body (12%), sharp object (12%) and during working (10%). Similar findings have been reported in previous studies.^{9,12,20} This observations, however, differ from those other studies who reported household accident was the major cause of corneal injuries.^{9,18,21} The difference in observation between the current study and previous studies indicates a variation in the etiology of eye injuries at different times and localities.^{22,23} The low prevalence of injuries following accidental trauma in this series (6%)

can be attributed in part to enforcement seat belt use as previously reported.^{24,25} A large proportion of these injuries occurred under domestic setting and perhaps preventive measures in houses could reduce such corneal injuries in the future. In this study shows the greatest proportion of the patients presented ≥ 24 hours (58%) while 42% presented within 24 hours. This is consistent with recent studies in the environment, Fasina reported that 53.3% of his patients presented within 24 hours while Henry et al. reported a very high proportion of 75%.^{17,19,22,26,27} This implies that there is a high level of awareness in the environment on ocular emergency in recent times when compared with the late presentation reported in previous studies. In this study shows the initial visual acuity in this study was also poor as 60% had VA that ranged from hand movement to light Perception, 16% presented with 6/60, and only 10% had 6/18 vision or better. This poor initial visual acuity is consistent with other studies on eye injury especially the penetrating form.^{13,14,19} Similarly, Fasina whose article was principally on penetrating eye injury, reported IVA of 6/18 or better in 3.0% of his patients while majority 63.0% had less than 3/60 vision and 16.3% had NLP.²⁶ At last follow-up, the overall best corrected visual acuity (BCVA) was 6(12%) patients with 6/18 or better BCVA; 36 (72%) patients with 6/60 or less BCVA and had no light perception. Our outcomes are similar to previous studies of penetrating/perforating eye injuries,^{12,14,15} There is a statistically significant difference between the initial visual acuity and the final follow up visual acuity $P=0.001$, invariably all patients with poor initial visual acuity (IVA) ended up with poor final follow up visual acuity while those with fairly good IVA ended up with almost the same as their final follow up visual acuity even though few of them improved while some others also got worse. The result of this comparative analysis between FVA and IVA is consistent with other similar reports on penetrating eye injury^{10-12,15} for instance in a multivariate analysis of prognostic factors in penetrating eye injury, Fadamiro et al.²⁵ noted that a good initial vision statistically correlates with a good final vision and vice versa. Sana and Dongre et al. found that the Pre-operative visual acuity and postoperative visual acuity found to be statistically significant ($p=0.000$).^{28,29} This emphasizes the fact that prevention of ocular injury should be prioritized as prevention is cheaper and better than treatment. Blindness prevention campaign should therefore be incorporated into the primary eye care to minimize ocular morbidity in eye injury. A well structured or planned eye health education workshop should be carried out at the local government area to teach the other health workers on eye health promotion so that the message will be widely disseminated to the rural dwellers. Furthermore, prompt recognition and ophthalmologic interventions are essential to maximizing functional outcome.

V. Conclusion

The research highlights a significant incidence of corneal injuries, with a 10% improvement in vision following corneal repair procedures. Key factors contributing to positive postoperative outcomes include prompt patient presentation, rapid clinical assessment, and early intervention in cases of unavoidable corneal injuries. Furthermore, promoting the use of protective eyewear is crucial, particularly in high-risk occupational sectors such as artisanal work. If necessary, government regulations should mandate the use of protective eyewear within these groups to improve safety and prevent injuries.

Reference

- [1] Salvatore C, Alessandra C, Francesco DP, Francesco P And Giovanni C. A Five-Year Retrospective Study Of The Epidemiological Characteristics And Visual Outcomes Of Patients Hospitalized For Ocular Trauma In A Mediterranean Area. *BMC Ophthalmology* 2008;8:6-12.
- [2] Richard JB, Jonathan B, Hedayat J, Philip IM, Effect Of Time To Primary Repair On Final Visual Outcome After Open Globe Injury. *Br J Ophthalmol* 2019;103:1491-1494.
- [3] Chang CH, Chen CL, Ho CK, Lai YH, Hu RC. Hospitalized Eye Injury In A Large Industrial City Of South-Eastern Asia. *Graefes Arch Clin Exp Ophthalmol* 2008;246: 223-228.
- [4] Parver LM. Eye Trauma: The Neglected Disorder (Editorial). *Arch Ophthalmol* 1986;104:1452.
- [5] Négrel AD, Thylefors B. The Global Impact Of Eye Injuries. *Ophthalmic Epidemiol* 1998;5(3):143-169
- [6] Pieramici DJ, Sternberg P, Jr., Aaberg TM, Sr., Bridges WZ, Jr., Capone A, Jr., Cardillo JA, De Juan E, Jr., Kuhn F, Meredith TA, Mieler WF, Olsen TW, Rubsamen P, Stout T. A System For Classifying Mechanical Injuries Of The Eye (Globe). The Ocular Trauma Classification Group *Am J Ophthalmol* 1997;123(6):820-831.
- [7] Koo L, Kapadia MK, Singh RP, Sheridan R, Hatton MP: Gender Differences In Etiology And Outcome Of Open Globe Injuries. *J Trauma* 2005; 59:175-178.
- [8] Thompson CG, Kumar N, Billson FA, Martin F: The Aetiology Of Perforating Injuries In Children. *Br J Ophthalmol* 2002;86:920-922
- [9] Pieramici DJ, Sternberg P, Jr., Aaberg TM, Sr., Bridges WZ, Jr., Capone A, Jr., Cardillo JA, De Juan E, Jr., Kuhn F, Meredith TA, Mieler WF, Olsen TW, Rubsamen P, Stout T. A System For Classifying Mechanical Injuries Of The Eye (Globe). The Ocular Trauma Classification Group *Am J Ophthalmol* 1997;123(6):820-831.
- [10] Issac DL, Ghanem VC, Nascimento MA. Prognostic Factors In Open Globe Injuries. *Ophthalmologica* 2003;217:431-5.
- [11] Pieramici DJ, Au Eong K, Sternberg PJ, Marsh MJ. Prognostic Significance Of A System For Classifying Mechanical Injuries Of The Eye (Globe) In Open Globe Injuries. *J Trauma* 2003;54:790-4.
- [12] Leonardo D, Ghanem VC. Prognostic Factors In Open Globe Injuries. *Ophthalmologica* 2003;217:431-5.
- [13] Rofail M, Lee GA, Rourke P. Prognostic Factors For Open Globe Injury. *Clin Exp Ophthalmol* 2006;34:783-6.
- [14] Schmidt GW, Broman AT, Hindman HB, Grant MP. Vision Survival After Open Globe Injury Predicted By Classification And Regression Tree Analysis. *Ophthalmology* 2008;115:202-9.

- [15] Shah M, Shah S, Khandekar R. Ocular Injuries And Visual Status Before And After Their Management In The Tribal Areas Of Western India-A Historical Cohort Study. *Graefes Arch Clin Exp Ophthalmol* 2008;246:191-7.
- [16] Mashaka W. An Analysis Of The Visual Acuity Outcomes Following Surgical Repair Of Penetrating Corneal Injuries Among Patients Seen At Sekuru Kaguvi Hospital (SKH), Eye Unit At Parirenyatwa Central Hospital In Harare, Zimbabwe. (Unpublished Masters Thesis). University Of Zimbabwe. Zimbabwe Digital Health Repository 2016; [Http://Hdl.Handle. Net/10646/2937](http://hdl.handle.net/10646/2937)
- [17] Qi Y. Characteristics And Visual Outcomes Of Patients Hospitalized For Ocular Trauma In Central China: 2006-2011. *International Journal Of Ophthalmology* 2015;8:162-168.
- [18] Cillino S. A Five Year Retrospective Study Of The Epidemiological Characteristics And Visual Outcomes Of Patients Hospitalized For Ocular Trauma In A Mediterranean Area". *BMC Ophthalmology* 2008;8:16-25.
- [19] Rofail M, Lee GA, Rourke P. Prognostic Factors For Open Globe Injury. *Clin Exp Ophthalmol* 2006;34:783-6.
- [20] Fadamiro C And Ajite K. Analysis And Visual Outcome Of Penetrating Eye Injury In A Nigerian Tertiary Hospital. *EC Ophthalmology* (2019);10:382-389.
- [21] Thakker MM, Ray S. Vision Limiting Complications In Open Globe Injuries. *Can J Ophthalmol* 2006;41:86-92.
- [22] Thevi T, Mimiwati Z, Reddy SC. Visual Outcome In Open Globe Injuries. *Nepal J Ophthalmol* 2012; 4(8):263-270.
- [23] Fujikawa A, Mohamed YH, Kinoshita H, Matsumoto M, Uematsu M, Tsuki E. Visual Outcomes And Prognostic Factors In Open-Globe Injuries. *BMC Ophthalmology* 2018;18:138.
- [24] Gul A And Raza A. Visual Outcome Of Open Globe Injuries In Paediatric Patients. *Journal Of Rawalpindi Medical College (JRMC);* 2017;21(3): 226-228
- [25] Fadamiro C And Ajite K. Analysis And Visual Outcome Of Penetrating Eye Injury In A Nigerian Tertiary Hospital. *EC Ophthalmology* (2019);10:382-389.
- [26] Fasina O. Visual Outcome Of Penetrating Eye Injuries In Ibadan. *Afr. J. Med. Med. Sci.* 2012;41:5-11.
- [27] Lin H, Lema GMC, Yoganathan P. Prognostic Indicators Of Visual Acuity After Open Globe Injury And Retinal Detachment Repair. *Retina* 2016;36:750–757.
- [28] Sana Nadeem, Muhammad Ayub, Humaira Fawad. Visual Outcome Of Ocular Trauma. *Pak J Ophthalmol.* 2013;29(1):34-39.
- [29] Dongre M. & Khaire BS. Study Of Ocular Trauma Cases Admitted To Hospital And Their Visual Outcome. *International Journal Of Current Medical And Applied Sciences* 2016;10(1):21-26.