# PREDICTING SEVERITY AND VISUAL OUTCOMES OF EYE TRAUMA FOLLOWING TREATEMENT, USING OCULAR TRAUMA SCALE

**Teyyeb Azeem Janjua, Taimoor Ashraf Khan*, Abdallah Anis Raja**, Muhammad Abdullah Zahid*****

Armed Forces Institute of Ophthalmology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan,*Pak Emirates Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, **Army Medical College/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, ***Mayo Hospital Lahore Pakistan

## ABSTRACT

***Objective:*** To predict the severity and visual outcomes following treatment in patients sustaining eye trauma using ocular trauma scale.

***Study Design:*** Retrospective case series.

***Place and Duration of Study:*** Armed Forces Institute of Ophthalmology Rawalpindi, from Jan 2015 to Jan 2017.

***Methodology:*** A total of 50 patients with eye trauma were included. Injuries were classified according to 'Birmingham Eye Trauma Terminology System'. 'Ocular trauma scale' was used to predict the visual outcome. We analyzed the data by using Statistical Package for Social Sciences version 22.

***Results:*** Patients' mean age was 30 ± 5.632 years. Forty-nine (98%) had open globe injury and 01 (2%) had closed globe injury. Primary & secondary repair was performed and pars plana vitrectomy in 28 (56%), patients was most commonly performed procedure. Based on best-corrected visual acuity vision of 4 (8%) patients significantly improved. Twenty (40%) were bilaterally blind while 16 (32%) were unilaterally blind in right eye and 10 (20%) were blind in left eye.

***Conclusion:*** Open globe injuries of grade IV and V on Ocular trauma scale were found to be severe with the worst visual and anatomical outcomes. Use of protective eye equipment in high-risk individuals including welders, and sportsmen etc would have an invaluable role in reducing the incidence of ocular trauma and its severity.

**Keywords:** Closed globe injury, Open globe injury, Secondary repair, Visual rehabilitation, Visual outcomes.



## INTRODUCTION

Ocular trauma is an ophthalmic emergency, which can lead to various tissue injuries including; lesions of the globe, optic nerve damage and adnexal lesions[1]. Optic trauma can cause injuries which may range from superficial to severe damage and it is leading cause of visual impairment second only to cataract[2]. Ocular injuries can be broadly categorized into two main types; mechanical trauma and chemical injuries. Mechanical trauma can further be classified into blunt trauma, penetrating injuries and intraocular foreign bodies[3]. Eye ball injuries are very common and thus require further classification. Globe injuries can be eitherclosed or open. Blunt trauma usually causes closed globe injuries in which corneoscleral envelope remains intact, whereas a full thickness wound of the corneoscleral wall of the globe is involved in open globe injuries[3]. The most common vision limiting complications of ocular trauma is traumatic cataract formation[4].

Ocular losses can be embarrassing and emotionally torturous to the bearer as it results in great functional loss as well as aesthetic aspects to it as it involves the face. All over the world, trauma to the eye is one of the commonest causes of unilateral blindness andimparts a major burden on the health care system. The setting of ocular trauma occurs most commonly at the workplace and mostlyroad traffic accidents are becoming the cause these days. However, domestic and military eye trauma is probably under-reported[5]. Gender differences persist with males more likely to have an injury as compared to females[6].

Ocular trauma is responsible for severe morbidity and decreased quality of life, two determinant factors in poor prognosis of visual outcomes

**Correspondence: Dr Taimoor Ashraf Khan,** Bloch House Main Bhakkar Road Darya Khan, Distt Bhakkar, Pakistan
*Received: 25 May 2019; revised received: 01 Sep 2019; accepted: 18 Nov 2019*

are delay in seeking healthcare and open globe injuries[7].

Earlier, eye trauma was prevalent among children but recently it is has become an increasingly important cause of blindness in adultsas well. Worldwide, there are 19 million cases of unilateral visual impairment and 2.3 million cases of bilateral visual loss while 1.6 million people are legally blind from eye injuries because of trauma[8]. In general population the common causes ofeye injuries include contusions/abrasions (44.4%), foreign bodies (30.8%) and burns (10.2%) encountered in the home, public places and industrial sites[9].

Interestingly, eyes cover only 0.1% of body surface area yet the ocular morbidity is exponentiallygreater than proportional representation of ocular surface area[10].

Armed Forces Institute of Ophthalmology (AFIO), being a specialized center for eye diseases, received all the complicated cases of ocular injuries for further management including primary, secondary repair and visual rehabilitation. The rationale of this study was to use of ocular trauma scale (OTS) to predict the severity and visual outcomes following treatment in patients sustaining ocular trauma.

## METHODOLOGY

A total of 448 cases of ocular trauma reported to our hospital since Jan 2015 to Jan 2017. This was a retrospective case series of 50 patients with ocular trauma sustained some sort of open/ closed globe ocular trauma and subsequently managed at Armed Forces Institute of Ophthalmology (AFIO), Rawalpindi. Study period was of two-year from 1st January 2015 to 1st January 2017. Consecutive sampling technique was used. Documents of patients managed at this hospital and who were currently undergoing visual rehabilitation for eye injurie at visual rehabilitation center were assessed in retrospect. Armed Forces Institute of Ophthalmology (AFIO), Rawalpindi is a specialized center for patient with eye diseases. Hard copies of patients' documents were retrieved from the hospital's stat office with the help of clerical and medical staff. Data was retrieved and endorsed on a proforma by single investigator including age, gender, marital status, visual acuity at presentation, RAPD, primary repair, Secondary repair, Best Corrected Visual Acuity (BCVA) and type of injury and complications. 'WHO Classification of Visual Impairment' was used to classify the visual loss at presentation while the ocular injuries were classified according to 'Birmingham Eye Trauma Terminology System (BETTS)'. 'OTS' was used to assess the clinical presentation, severity of trauma and predicted the visual outcome following treatment. Those patients who sustained the trauma but survived and who were undergoing rehabilitation therapy at 'Visual Rehabilitation Centre AFIO, Rawalpindi' were included in this study. Patients who expired within 3 months post eye trauma or who were suffering from any other major comorbid condition, were excluded from the study. Informed verbal consent was taken from all the patients. Institutional review board and hospital ethics review committee approved this study and confidentiality of patients' data was maintained at all levels. The data was analyzed using the Statistical Package for Social Sciences version 22. Stratification of data in different age groups, eyes involved, type of injury, cause of injury was done. Actual visual outcome and ocular trauma scale score was compared.

## RESULTS

The most common age to encounter combat ocular injuries was 28 years (n=7). The age of the patients ranged from 22 to 43 years (range 21 years) with the mean age being 30 ± 5.632 years. Bilateral involvement of the eyes was most common, involving 28 (56%) cases followed by unilateral involvement of right eye 14 (28%) and left eye 08 (16%).

Forty nine (98%) of the injuries were open globe injuries whereas only 1 (2%) was close globe injury.

On the Open Globe Injury Classification (table-II), intraocular foreign body 38 (76%) was the most common diagnosis followed by pene-

trating injury 6 (12%). Most injuries were Grade-IV closely followed by Grade-III injuries. In 42 patients with open globe injury, relative afferent pupillary defect (pupil) was negative "OTS" (table-III) showed that the most frequently encountered injuries were Grade II and Grade III.

**Table-I: Stratification of nature of injury across patient's age, side involved and underlying cause.**

| Characteristic | Open Globe Injuries (n=49) | Closed Globe injuries (n=1) |
|---|---|---|
| **Age Groups** | | |
| 20-31 years | 28 (57.14%) | 1 (100%) |
| 32-43 years | 21 (42.85%) | - |
| **Side** | | |
| Right | 14 (28.57%) | - |
| Left | 8 (16.32%) | - |
| Bilateral | 27 (55.10%) | 1 (100%) |

**Table-II: Open globe injury classification.**

| Open Globe Injury Classification | Study Participant n=49 |
|---|---|
| **Type** | |
| Rupture | - |
| Penetrating | 6 (12.24%) |
| Intraocular Foreign Body | 38 (77.55%) |
| Perforating | - |
| Mixed | 5 (10.20%) |
| **Grade** | |
| ≥20/40 | 4 (8.16%) |
| 20/50 - 20/100 | 5(10.20%) |
| 19/100 - 5/200 | 17(34.69%) |
| 4/200 - light perception | 22(44.89%) |
| No perception of light | 1(2.04%) |
| **Pupil (RAPD)** | |
| Positive | 7(14.28%) |
| Negative | 42(85.71%) |
| **Zone** | |
| I | 27(55.10%) |
| II | 17(34.69%) |
| III | 5(10.20%) |

Further management was done at AFIO including primary repair, medical management and secondary repair including various complicated surgical procedures like pars plana vitrectomy in 28 (56%) in the patients who were expected to have some visual potential in their eyes. Conversely, eighteen patients (36%) who got irreparable trauma to the globe underwent enucleation. Nine patients (18%) developed traumatic cataract and underwent cataract extraction with intra-ocular lens (IOL) implantation.

Unfortunately, 20 patients remained bilaterally blind at the end of the study period owing to massive irreparable ocular trauma to both eyes. Twenty-six patients were unilaterally blind out of which 16 were affected on the right side and 10 on the left side. Some of them retained good vision in the other eye allowing them to maintain independent living. On the other side, four patients (8%) showed significant improvement in best-corrected visual acuity.

Visual rehabilitation was done in 32 (64%) patients who were legally blind. Out of these 21 (45.7%), patients had some form of ocular complications.

**Table-III: Ocular trauma scale.**

| Ocular Trauma Scale Grades | Right eye (%) | Left eye (%) |
|---|---|---|
| 1 | 7 (14) | 5 (10) |
| 2 | 21 (42) | 19 (38) |
| 3 | 12 (24) | 10 (20) |
| 4 | 1 (2) | 2 (4) |
| 5 | 9 (18) | 14 (28) |

## DISCUSSION

Ocular trauma in has a devastating effect on the life of the affected individual. Generally, it results in poor visual and anatomical outcomes despite optimal management. Ocular trauma in the domestic and civil setting has been well studied and documented. However, injuries sustained in the field are also an important cause of ocular trauma that have been under estimated and under reported. In the freedom war, in the time period between 2002 to 2007 of all the personals evacuated due to serious injuries 13% were due to ocular injuries[11].

In all genders and age groups, ocular trauma is an important but preventable health problem[12]. The most common and debilitating injuries reported in our study were open globe injuries. Almost all the ocular injuries were preventable and had devastating morbidity. In our study 100% of

injured were males and 78% suffered from a blast Injury whereas Weichel *et al* conducted a study, in which he reported 80% who suffered were males[13]. In another Finnish study, superficial foreign bodies (33%) were the most common causes of eye trauma, followed by injury due to body parts (13%), chemicals (13%) and injuries sustained because of sports equipment (10%)[14].

Furthermore, in the cases reported in our study, greater than 70% had visual acuity <6/60 as compared to 27% in a study conducted in the United States[15]. Similarly, in a Chinese study visual acuity remained poor in only 24% of the cases. In our study most of the cases had grade I - III injuries according to OTS. The patients who sustained Grade IV-V on their first visit according to OTS had worst anatomical and functional outcome at 6 months post-treatement despite, visual rehabilition, thus, reiterating the fact that OTS is a useful tool in predicting the severity of eye injuries and visual outcomes following treatement[16]. Results of our study are consistent with a similar national study conducted in Pesha-war where 66% of injuries were OTS grade 1-3[17].

Among the Indian population, Shashikala *et al* observed that the most frequently encountered age group was 20-30 years of age. In the Iraq war, Weichel *et al* observed the same trend where the mean age was 25 ± 7 years with a male predominance of (96.0%)[4]. Our results are also in line with these findings.

We performed the primary repair at specialized facility like Royal army of UK where primary repair is delayed until optimal facilities are available. This has resulted in great outcomes achieved in visual restoration where vision improved significantly in 8% of the patients with severe ocular trauma[18].

The incident of ocular injuries in the American Civil War was only 0.5% which raised to 9% in the Vietnam conflict. On the other hand, these injuries can be readily avoided, provided correct eye protection is worn. Unfortunately there is lack of awareness in this regard and most people are reluctant to wear eye gear as it may lead upto 25% reduction in visual field with current technology[19]. The actual data on the proportion of people using personal protective equipment at the time of injury is not available with us. However, it is well established that the use of protective eyeglasses for high risk groups including soldiers (balistic eye protection), welders (Face-Shields), sportsmen & wall-painters (Glasses) can reduce serious visual impairment. Roger *et al*, found reduction in eye injuries from 26% to 17% by the use of eye protection equipment[20]. In a study conducted on military personnel in the Lebanon war no soldier suffered from eye injury who had ballistic eye protection worn properly at the time of trauma[21]; reemphasizing the invaluable role of eye protection in preservation of visual function and eye anatomy.

## ACKNOWLEDGEMENT

We would like to thank the staff at AFIO, Rawalpindi in providing help with data collection.

Special mention to Dr Haziq Ur Rehman and Dr Muhammad Sami Ullah who gave their invaluable support in data collection and assembling it.

We are grateful to Professor Mazhar Ishaq (Ex Commandant AFIO Rawalpindi) and Professor Muhammad Amer Yaqub (Ex Head, Dept of Orbital & Oculoplastic surgery) at AFIO Rawalpindi for their constant support and guidance. We are thankful to Commandant AFIO Rawalpindi, Dr Imran Basit and Deputy Commandant (Tech) Dr Omar Zafar for critically reviewing this article.

**Disclouser**

Oral Presentation given in 2nd Surgeon General's International Conference 2017, Rawalpindi

## CONCLUSION

Open globe injuries of grade IV and V on Ocular trauma scale were found to be severe with the worst visual and anatomical outcomes. Use of protective eye equipement in high-risk individuals including welders, and sportsmen etc

would have an invaluable role in reducing the incidence of ocular trauma and its severity.

## CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

## REFERENCES


1. Qi Y, Zhang FY, Peng GH, Zhu Y. Characteristics and visual outcomes of patients hospitalized for ocular trauma in central China: 2006–2011. Int J Ophthalmol 2015; 8(1): 162–68.
2. Tichauer MB. Medscape. [Online].; 2017 [cited 2019 May 20. Available from: https://reference.medscape.com/slideshow/ocular-trauma-6008116.
3. Bowling B. Kanski's Clinical Ophthalmology. 8th ed. Sydney: Elsevier; 2016.
4. Bhandari AJ, Jorvekar SA, Singh P, Bangal SV. Outcome after cataract surgery in patients with traumatic cataract. Delta J Ophtalmol 2016; 17(2): 56-58.
5. Thylefors B. Epidemiological patterns of ocular trauma. Aust N Z J Ophthalmol 1992;20(2):95-98.
6. Desai P. Trends in serious ocular Trauma in Scotland. Eye (Lond) 2015; 29(5): 611–18.
7. Yong GY, Pan SW, Humayun Akhter F, Law TN, Toh TH. Determinant factors of poor visual outcome after ocular trauma: A retrospective study in central Sarawak, Malaysia. Asia-Pacific J Ophthalmol 2016; 5(2): 137-42.
8. Négrel AD, Thylefors B. The global impact of eye injuries. Ophthalmic Epidemiol 1998; 5(3): 143-69.
9. McGwin G, Owsley C. Incidence of emergency department-treated eye injury in the United States. Arch Ophthalmol 2005; 123(5): 662-66.
10. Sengupta P, Mazumdar M, Gyatsho J. Epidemiology of ocular trauma cases presenting to a tertiary care hospital in a rural area in West Bengal, India over a period of 2 years. J Dental Med Sci 2016; 15(3):92-97.
11. Vlasov A, Ryan DS, Ludlow S, Coggin A, Weichel ED, Stutzman RD, et al. Corneal and corneoscleral injury in combat ocular trauma from operations Iraqi freedom and enduring freedom. Mil Med 2017;182(S1): 114-19.
12. Weichel ED, Colyer MH. Combat ocular trauma and systemic injury. Curr Opin Ophthalmol 2008;19(6):519-25.
13. Weichel ED, Colyer MH, Ludlow SE, Bower KS, Eiseman AS. Combat ocular trauma visual outcomes during operations iraqi and enduring freedom. Ophthalmology 2008; 115(12): 2235-45.
14. Sahraravand A, Haavisto AK, Holopainen JM, Leivo T. Ocular traumas in working age adults in finland helsinki ocular trauma study. Acta Ophthalmol 2016; 95(3): 288-94.
15. Wang W, Zhou Y, Zeng J, Shi M, Chen B.Epidemiology and clinical characteristics of patients hospitalized for ocular trauma in SouthCentral China. Acta Ophthalmol 2017;95(6): e503-10.
16. Blanch RJ, Bindra MS, Jacks AS, Scott RAH. Ophthalmic injuries in British Armed Forces in Iraq and Afghanistan. Eye (Lond) 2011; 25(2): 218-23.
17. Naqvi SAH, Malik S, Zulfiqaruddin S, Anwar SB, Nayyar S. Etiology and severity of various forms of ocular war injuries in patients presenting at an Army Hospital in Pakistan. Pak J Med Sci 2016; 32(6): 1543-46.
18. Thomas R, McManus JG, Johnson A, Mayer P, Holcomb JB. Ocular injury reduction from ocular protection use in current combat operations. J Trauma Injury 2009; 66(Suppl-4): S99-103.
19. Orly Weinstein Yossi Mandel Jaime Levy Tova Lifshitz Avi Yitzhak, LTC, MHA Muhammad Abu Tailakh. Ballistic Eye Protection: Why Are Soldiers Reluctant to Use Them? Mil Med 2019; 184(3-4): e211-16.
20. Belkin M, Treister G, Dotan S. Eye injuries and ocular protection in the lebanon war, 1982. Isr J Med Sci 1984; 20(4): 333-38.
21. Ferenc DJP. Ocular Trauma: Principles and Practice New Yorl: Thieme; 2002.