The Usage of Ocular Trauma Scoring in the Visual Prognostic Evaluation of Traumatic Eye Injury

Burak Turgut, Sabiha Gungor Kobat, Rumeysa Tanyildizi

Department of Ophthalmology, School of Medicine, Firat University, Elazig, Turkey

Abstract

Aim of this study was to investigate the visual prognostic value of ocular trauma score (OTS) in traumatic eye injuries. A hundred and fourteen patients with the ocular trauma, which were underwent surgery between January 2008 and January 2012 at Firat University Hospital Clinic of Ophthalmology, were included in the study. The medical records of the patients were reviewed retrospectively. Similarly to the OTS study group, patients were divided into five groups based on their visual acuity (no light perception (NLP), light perception / hand movements (LP/HM), 1/200-19/200, 20/200-20/50, 20/40 and up) at the presentation. Ocular trauma classification was made according to the Birmingham Eye Trauma Terminology (BETT). The variables used in ocular trauma score (initial and final visual acuity, rupture, endophthalmitis, perforation, retinal detachment, afferent pupillary defect) were evaluated for each patient individually. A numerical value (raw number) was assigned to each of these variables. Numerical values related to the OTS variables were converted into OTS categories and the possible or expected visual outcome and prognosis were obtained. The percentages of the eyes in each category in the OTS study were compared with those of the eyes in our study. The average follow–up duration of patients was 10 months (range 5-12 months). The average age of patients was 24,7± 21,3 (1-86) years. Of the 27 (24%) were females and 87 (76%) were males. When we compared the table of distribution of final visual acuities in all OTS categories, in our group, NLP ratios were significantly lower in category 1 and 2 (p=0.0017, p=0.00009, respectively), whereas LP/HM ratios in categories 1, 2 and 3were significantly higher in our group than in the OTS study (p=0.00002, p=0.001, p=0.000001, respectively). When we compared final visual acuities in each categories of our study and the OTS study, in our study, 20/200 to 20/50 and 20/40 and over ratios in categories 2 and 3 were significantly lower than those in the OTS study, (p=0.00003, p=0.003, p=0.000001, respectively). 20/200 to 20/50 ratio in category 4 in our group was significantly higher than that in the OTS group (p=0.000001), whereas 20/40 and over ratio in category 4 in our study group was significantly lower than that in the OTS group, (p=0.000001, respectively). Ocular trauma scoring might provide information about visual outcomes of injury and categorical evaluation of traumatic ocular injuries at initial examination.

Key Words: Visual acuity, ocular trauma score, prognosis, ocular trauma

(Rec.Date: Nov 27, 2013 Accept Date: Dec 09, 2013)

Corresponding Author*:* Burak Turgut, MD., Firat University School of Medicine Department of Ophthalmology, Elazig, Turkey.
E-mail: drburakturgut@yahoo.com

Introduction

Traumatic eye injury makes up 7% of the traumatic body injuries and it forms 10-15% of all eye diseases [1,2]. Ocular trauma especially affects children and the working population and it can cause loss of vision and the eye, and economic burden, and however, it is a preventable public health problem. The economic burden of ocular injuries is considerably high amount. According to the formal web page of United States Eye Injury Registry (USEIR), The National Safety Council estimates that job-related eye trauma costs including medical and hospital bills, workmen's compensation, and lost production time amount to $300 million annually in USA.

In case of the development of using antibiotics and sutures in the field of ophthalmology and the advances in microsurgical and vitreoretinal surgical techniques in recent years, the management of ocular trauma is promising [3, 4]. However, a long-term and difficult process starts for both the patient with ocular trauma and the physician, but the vision loss and blindness cannot be completely prevented after the injury [3-5].

Ocular injuries are a cause of physical and psychological trauma for both patients and their families. Patients and their families should concern very detailed about the visual prognosis, or whether they will be become blind. It is very important for ophthalmologist to take the right decisions and to provide information for patients and their families about the prognosis [6].

Although there are many reported factors that determine the prognosis of ocular traumas, none of them were standardized. Ocular Trauma Score (OTS) is developed by using more than 2,500 cases of ocular trauma from USEIR Center. Scoring system is depends on five anatomical characteristics (rupture, endophthalmitis, perforating injury, retinal detachment, APD) and functional characteristics (initial visual acuity). It is possible to get scoring value immediately after first evaluation or initial surgery [7, 8].

Aim of this study is to investigate the visual prognostic value of OTS in traumatic eye injury.

Materials and Methods

A total of registered 114 patients that had surgery due to the ocular trauma between January 2008 and January 2012 at Firat University Hospital, Ophthalmology Clinic were studied. Patients were analyzed retrospectively. All of the patients were examined for their age, sex, time of their injury, cause of injury, hospital admission time, time of the surgery, type of the trauma, the classification of the incision, visual acuity, final visual acuity, and pathologies following the injury. Ocular trauma classification was made according to the Birmingham Eye Trauma Terminology (BETT). The variables used in OTS (initial and final visual acuity, rupture, endophthalmitis, perforation, retinal detachment, afferent pupillary defect) were evaluated for each patient individually. A numerical value (raw number) was assigned to each of these variables. Numerical values related to the OTS variables were converted into OTS categories. In case of a specific variable was not present, its value was zero. Similarly to the OTS study group, patients were divided into five groups based on their visual acuity (no light perception, light perception / hand movements, 1/200-19/200, 20/200-20/50, 20/40 and up) at the presentation. Then, the calculated raw scores were translated into OTS and the possible or expected visual outcome and prognosis were obtained (Table 1) [7-9]. The percentages of the eyes in each category in the OTS study were compared with those of the eyes in our study.

Results

Of 114 patients, 27 (24%) were females and 87 (76%) were males. The mean follow –up duration of patients were 10 months (range 5-12 months). The average age of patients was 24,7± 21,3 (range 1-86) years. Right and left eyes were involved in 48 (42%) and 66 (58%) of patients, respectively. Blunt trauma in 64 of 114 cases (56%), 50 (44%) of them had tree branch, glass, scissors, knife and other sharp objects injuries. Anatomical site of injuries are 56% corneal incision (64), 27% sclera (31), 17% corneoscleral (19) (Table 2). The visual acuity was at the level of no light perception in ten eyes (7%), perception/hand movements in 58 eyes (41%), 1/200-19/200 in 12 eyes (8%), 20/200-20/50 in 19 eyes (13%), 20/40 and above in 15 eyes (11%). Additional surgery was needed in 25 cases with cataract, 7 cases with vitreous hemorrhage, and 5 cases with retinal detachment. The mean visual acuities at the presentation and the final were given in Table 3.

The percentage of final visual acuity in each OTS categories in our study group is compared with the OTS study group, and the results are demonstrated in Table 4. In Table 4, first

column data represents the percentage of eyes in OTS study group, whereas second column data with bold letters represents the percentage of eyes in our study group in each category.

When we compared the table of distribution of final visual acuities in all OTS categories, in our group, no light perception (NLP) ratios were significantly lower in category 1 and 2 (p=0.0017, p=0.00009, respectively), whereas LP/HM ratios in categories 1, 2 and 3were significantly higher in our group than in the OTS study (p=0.00002, p=0.001, p=0.000001, respectively).

When we compared final visual acuities in each categories of our study and the OTS study, in our study, 20/200 to 20/50 and 20/40 and over ratios in categories 2 and 3 were significantly lower than those in the OTS study, (p=0.00003, p=0.003, p=0.000001, respectively). 20/200 to 20/50 ratio in category 4 in our group was significantly higher than that in the OTS group (p=0.000001), whereas 20/40 and over ratio in category 4 in our study group was significantly lower than that in the OTS group, (p=0.000001, respectively).

Table 1. Calculation of the Raw scoring

Variable		**Value of Raw Score**
A.The values of Visual acuity at first examination	No light perception	60
	Light perception/Hand movements	70
	1/200-19/200	80
	20/200-20/50	90
	20/40 and over	100
B. Rupture		-23
C. Endophthalmitis		-17
D. Perforating		-14
E. Retinal Detachment		-11
F. APD		-10

Table 2. Wound Location

Wound Location	Number of patients (%) n=114
Cornea	64 (56%)
Cornea+Sclera	19 (17%)
Sclera	31(%27)

Table 3. Visual acuities of patients at the presentation and final

Visual acuity	Presentation (%) n=114	Final (%) n=114
No light perception	10 (7%)	13 (9%)
Light Perception/Hand Movements	58 (41%)	29 (20%)
1/200-19/200	12(8%)	15(11%)
20/200-20/50	19 (13%)	44(31%)
20/40 and over	15(11%)	41(29%)

Discussion

Ocular trauma is one of the most common preventable causes of severe visual loss. There are a number of reasons why ocular trauma should be considered as an important field of study in ophthalmology. First, 30 to 40% of all eye injuries result in functional loss of vision. Second, ocular trauma usually occurs as secondary to accidents in work places where key areas of prevention can be identified. Third, because a number of ocular structures gets affected because of ocular trauma, management proves to be difficult as sometimes different ophthalmology subspecialties can get involved especially for surgical cases. Fourth, a different approach is needed for pediatric ocular trauma patients because of risk of amblyopia [3, 4].

Table 4. Comparison of final visual acuities and OTS categorical distributions between OTS study and our series

Raw Score Interval	OTS Category	Number of Eyes	No Light Perception	Light Perception / Hand Movements	1/200-19/200	20/200-20/50	20/40 and over	P value
0-44	1	**14**	74/**57**[a]	15/**43**[b]	7/**0**	3/**0**	1/**0**	<0.0001
45-65	2	**34**	27/**6**[c]	26/**82**[d]	18/**12**	15/**0**[e]	15/**0**[e]	<0.0001
66-80	3	**40**	2/**0**	11/**60**[f]	15/**20**	31/**13**[g]	41/**7**[f]	<0.0001
81-91	4	**14**	1/**0**	2/**0**	3/**0**	22/**100**[f]	73/**0**[f]	<0.0001
92-100	5	**12**	0/**0**	1/**0**	1/**0**	5/**0**	94/**100**	0.066

Bold letters indicate data of our study.

[a]: p=0.017, [b]: p=0.00002, [c]: p=0.00009, [d]: p=0.001, [e]: p=0.00003, [f]: p=0.000001, [g]: p=0.003

Long and difficult stage starts for the patient with ocular trauma and the physician, and unfortunately the vision loss and blindness cannot be completely prevented after the injury [3-5]. Patients and their families are most concerned about the visual prognosis. Because of that reason it is very important to give them predictable information about the prognosis and proper management of the problem [6].

There are a lot of prognostic factors used in determining prognosis of ocular trauma: 1) age, 2) sex, 3) cause of injury, 4) endophthalmitis, 5) location of wound, the length and the size of the wound, 6) tissue prolapsed, 7) vitreous hemorrhage, 8) the number of surgeries that has been done, 9) facial fractures, 10) the time of vitrectomy, 11) hyphema, 12) muscle adhesion proximity, 13) use of prophylactic antibiotics, 14) place of intraocular foreign object and its structure, 15) initial visual acuity, 16) involvement of right and left eye, 17) lens damage, 18) perforating injury, etc. [1, 3, 5, 7, 11, 12]. Even though some studies demonstrate that some of these variables have prognostic value, but some studies show that some of these variables do not have prognostic values.

Instead of this conflicting information, an ocular trauma scoring system to be a more reliable and convenient prognostic method has been developed. This scoring system was developed by USEIR on more than 2,500 cases of ocular trauma. Based on this scoring system which is called the Ocular Trauma Score (OTS), patients may have a prediction concerning their visual acuity about 6 months later. High OTS and high initial visual acuity indicates that final visual acuity will be better.

Ocular trauma score is currently seen as an ideal system to predict to prognosis because of the known and used characteristics of the system, the prognostic values being qualitative not quantitative, the values that are obtained being simple variables and possible to calculate, and the system being repeatable and reliable [13]. OTS is similar prognostic system to APGAR score that is used in children. The system is based on five anatomical characteristics (rupture, endophthalmitis, perforating injury, retinal detachment, APD) and one functional characteristic (initial visual acuity). Scoring value is possible to obtain from initial evaluation or immediately after initial surgery and it gives us valuable information about prognosis [7, 8].

In a retrospective study of 114 patients who presented with open-globe injuries, Unver et al reported that OTS can give valuable information about prognostic evaluation and that OTS showed positive correlation with final visual acuity [14].

Uysal et al evaluated the prognostic value of the OTS in 61children with open-globe injuries in a retrospective, interventional case study. They reported that the OTS provides reliable prognostic information in children with open-globe injuries [15].

Cao et al. conducted a research on 3644 patients who admitted to hospital due to ocular trauma. In this comprehensive retrospective study OTS was used for visual prognostic evaluation and in they reported that The OTS correlated with the final visual acuity of patients [16].

Sobaci et al have previously investigated the prognostic value of OTS in patients without any patient in 5th category with deadly weapon-related open globe injuries. They reported that final visual acuities in OTS categories including 1st, 2nd, 3rd and 4th categories were similar to those in the OTS study group, except for LP/HM in category 2 (53% vs. 26%). They

concluded that OTS calculated at initial examination might provide prognostic information in this eye trauma population [17].

In another study, Ozec at al evaluated the calculated OTS from 125 patients and they observed that OTS was compatible with final visual acuity 1 year after the surgery [18].In our study, the medical files of patients, that they were admitted to hospital and had surgery due to the ocular trauma, were retrospectively checked and the prognostic value of OTS was investigated. At the time of admission, the patients with high acuity are observed to have higher OTS values. In our study group, NLP ratios were significantly lower in category 1 and 2, whereas LP/HM ratios in categories 1, 2 and 3 were significantly higher in our group than in the OTS study group. 20/200 to 20/50 and 20/40 and over ratios in categories 2 and 3 were significantly lower than those in the OTS study. 20/200 to 20/50 ratio in category 4 in our group was significantly higher than that in the OTS study group, whereas 20/40 and over ratio in category 4 in our study group was significantly lower than that in the OTS study group. These results may be due to that most patients have severe and delayed ocular injuries because our hospital is tertiary referral center for life region and that enucleated eyes were excluded from study.

Prediction of final visual acuity has great importance for the patient with traumatic ocular injury, his/her parents and managing ophthalmologist. The OTS uses a limited number of variables which can be determined at the time of the initial examination to predict the final functional outcome up to 70-80% within one visual category shortly after traumatic ocular injury.

Conclusion

The ocular trauma scoring system is a useful system for both ophthalmologist and patients to provide information about results of injury and prognosis. High values in OTS provide us quantitative data which indicates better prognosis. However further studies including large case numbers similar to those of OTS are needed to use this scoring system worldwide for visual prognostic evaluation of traumatic eye injury.

Conflict of interests

The authors report no conflict of interest in this work.

Acknowledgments

Involved in the conduct of study (BT, SGK and RT); collection of data, typing and editing of manuscript; statistical analysis and editing of manuscript (BT, SGK and RT) and preparation, review, or approval of the final manuscript (BT, SGK and RT).

References

1. Strahlman E, Elman M, Daub E, Baker S. Causes of padiatric eye injuries. A population-based study. Arch ophtalmol. 1990;108(4):603-6.
2. Negrel AD, Thylefors B. The global impact of eye injuries. Ophthalmic Epidemiology. 1998;5(3):143-69.
3. Hassett P, Kelleher C. The epidemiology of occupational penetrating eye injuries in Ireland. Occup Med. 1994;44(4):209-11.
4. Maltzman BA, Pruzan H, Mund ML. A survey of ocular trauma. Surv Ophthalmol. 1976;21(3):285-90.
5. Hutton WL, Fuller DG. Factors influencing final visual results in severely injured eyes. Am J Ophthalmol. 1984;97(6):715-22.
6. Turgut B, Gül FC. Terminology, Classification and Scoring in Ocular Trauma: Review. Türkiye Klinikleri J Ophthalmol. 2010;19(1):44-9.
7. Kuhn F, Moris P, Mester V, Witherspoon CD, Mann L. Predicting the severity of an eye injury: the ocular trauma score (OTS). In: Kuhn F, ed. 1st ed, Ocular Traumatology. Berlin: Springer-Verlag, 2008;17-22.
8. Kuhn F, Maisiak R, Mann L, Meter V, Morris R, Witherspoon C. The ocular trauma score (OTS). Ophthalmol Clin North Am. 2002;15(2):163-6.
9. Unver YB, Kapran Z, Acar N, Altan T. Ocular trauma score in open-globe injuries. J Trauma. 2009;66(4):1030-2.
10. Eltutar K. The classification and terminology of ocular trauma-Oküler Travmatoloji ve Medikolegal Oftalmoloji. 1st ed. Turkish Ophthalmology Society No:5, İstanbul, 2007;18-23.
11. De Juan E, Sternberg P, Michels R. Penetrating ocular injuries: types of injuries and visual results. Ophthalmology. 1983;90(11):1318-22.
12. Coleman D. Early vitrectomy in the management of the severely traumatized eye. Am J Ophthalmol. 1982;93(5):543-51.
13. Unal MH, Aydin A, Sonmez M, Ayata A, Ersanli D. Validation of the ocular trauma score for intra ocular foreign bodies in deadly weapon-related open-globe injuries. Ophthalmic Surg Lasers Imaging. 2008;39(2):121-4.
14. Unver YB, Acar N, Kapran Z, Altan T. Visual predictive value of the ocular trauma score in children. Br J Ophthalmol. 2008;92(8):1122-4.

15. Uysal Y, Mutlu FM, Sobaci G. Ocular Trauma Score in child hood open-globe injuries. J Trauma. 2008;65(6):1284-6.
16. Cao H, Li L, Zhang M. Epidemiology of patients hospitalized for ocular trauma in the Chaoshan region of China, 2001-2010. PLoS One. 2012;7(10):e48377.
17. Sobaci G, Akin T, Erdem U, Uysal Y, Karagul S. Ocular trauma score in deadly weapon-related open-globe injuries. Am J Ophthalmol. 2006;141(4):760-1.
18. Ozeç AV, Sincer A, Toker Mİ, Erdoğan H, Arıcı MK. Clinical aspect and visual prognosis in perforated eye injury. Türkiye Klinikleri J Ophthalmol. 2010;19(3):141-5.