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ORIGINAL PAPER

The Ocular Trauma Score as a Method for the Prognostic Assessment of Visual Acuity in Patients with Close Eye Injuries

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ABSTRACT

Introduction: Traumatic injuries of the eye are the most common cause of loss of visual function. In our study we performed Ocular Trauma Score (OTS). We compared with the values of visual acuity of injury and thus get an accurate model for determining the prognostic value of the final visual acuity before treatment of the patient. This model is a reliable test for both the ophthalmologist and the patient. **Aim of study:** The aim of this study was to show the socioepidemiological and demographic profile, as well as the most common mechanism in ophthalmic injuries, so to determine the final visual acuity and assessment and evaluation of sensitivity and specificity of ocular trauma score (OTS), and most importantly to determine the prognostic value final visual acuity after eye injuries. **Material and Method:** We conducted a clinical-epidemiological, retrospective-prospective study at the Department of Ophthalmology, Clinical Centre University in Sarajevo in the period 2009-2011. A sample of 124 patients with diagnosed closed of eye injuries were recruited. We applied Classifying Closed Globe Injury, performed Calculating the OTS and convert of total raw points into % chance of vision outcomes. **Results:** Comparison of age groups by gender shows that there is no statistically significant ($\chi^2 = 5.155$; $p = 0.2718$). Of the total number of closed eye injuries ($N = 124$) at the admission from groups D and E with the worst vision were 29 patients (23.38%), in group C had low visual acuity of 20 (16.12%), in group B the mean visual acuity 33 (26.61%), and in group A well-preserved visual acuity 42 (33.87%) patients. On the demission patients with well-preserved visual function was 84 (67.74%), with a medium of visual function 10 (80.64%), while the poorer visual function was 4 (3.225%) and 7 (5.645%) patients had a sense of light and projections and 1 (0.8%) patient had lost visual acuity-amaurosis. 18 (14.51%) patients did not take their eyesight due to a fresh post-operative recovery. **Conclusion:** Data on each patient are based on the possibility of such characteristics of the mechanism of injuries presentation of vision at the beginning of disease, injury and zones relative afferent pupillary defect possibility assumptions what will be with the vision postoperatively.

Key words: close eye injury, OTS, visual acuity.

1. INTRODUCTION

Eye injuries per Birmingham classification (Birmingham Eye Trauma Terminology) BETT are divided into closed and open eye injuries (1). They cover a wide range from injuries of adnex and eyelids, orbit, the bones of the head and face, eyeball and nerve, and can pose serious complications to the front, and the rear segment of the eye, and the outcome of treatment are varies from complete recovery with good visual function to blindness. To estimate the final visual acuity of the closed eye injuries is an important type of violation, the degree of visual acuity, presence or absence of relative afferent pupillary defect in the injured eye, and the zone of violation eyeball (2). Zone of violations eyeballs are divided into Zone I (superficial injuries of bulbar conjunctiva, sclera and cornea), Zone II (violation of lens and anterior segment) and Zone III (violation of the retina, vitreous, rear uvea and optic nerve) (Table 1) (2). Closed eye injuries per BETT divided into contusions, lamellar lacerations, surface foreign body and combined injuries. Poor presentation vision (grade) and presence of an APD in the injured eye were the most prognostic factors associated with poor visual outcomes in these patients (3). The aim of this study was to show the socioepidemiological and demographic profile, as well as the most common mechanism

in ophthalmic injuries, so to determine the final visual acuity and assessment and evaluation of sensitivity and specificity of ocular trauma score (OTS), and most importantly to deter-

Classifying Closed Globe Injury

Type (mechanism of injury) A. Contusion
B. Lamellar laceration
C. Superficial foreign body
D. Mixed

Grade (presenting visual acuity) A. >20/40 (0.5)
B. 20/50-20/100 (0.4-0.2)
C. 19/100-5/200 (0.2-0.025)
D. 4/200-L+P+ (0.02-L+P+)
E. NPL

Pupil (RADP)(relative afferent positive RAPD
Pupillary defect) negative RAPD

Zone I External (limited to the bulbar conjunctiva, sclera, cornea)
II Anterior segment (structures in relation with the anterior chamber and the pars plicata)
III Posterior segment (all internal structures posterior to the posterior lens capsule)

Table 1. *Classifying Closed Globe Injury*

VARIABLE	RAWPOINT
Initial vision	60
NLP	70
Lp/HM	80
1/200-19/200	90
20//200-20/50	100
≥20/40	-23
rupture	-17
endophthalmitis	-14
perforating injury	-11
retinal detachment	-10
APD	
Total	

Table 2. Calculating the OTS

RAW SUM	OTS	NLP	LP/HM	1/200-19/200	20/200-20/50	≥20/40
0-44	1	74%	15%	7%	3%	1%
45-65	2	27%	26%	18%	15%	15%
66-80	3	2%	11%	15%	31%	41%
81-91	4	1%	2%	3%	22%	73%
92-100	5	0%	1%	1%	5%	94%

Table 3. Convert Total rawpoints into % chance of vision outcomes. OTS=ocular trauma score; NLP=no light perception; LP/HM=light perception to hand motion vision; APD=relative afferent pupillary defect (2).

mine the prognostic value final visual acuity after eye injuries. That is, the goal of this study was to determine the incidence of closed eye injuries in relation to gender, age, occupation, anatomic localization of the complications and course of treatment.

2. METHODS

We conducted a clinical-epidemiological, retrospective-prospective study at the Department of Ophthalmology, Clinical Centre University in Sarajevo in the period 2009-2011. A sample of 124 patients with diagnosed closed of eye injuries were recruited. The inclusion criteria for patients in the study were be closed eye injuries. The exclusion criteria for patients from the study were open eye injuries, as well as chemical and thermal injury of the eyes.

Clinical examinations of the patients are exercised in the Cabinet for an eye injury are included: history of injury, bio-microscope examination of the eye, ophthalmological examination, determination of visual acuity, tonometry and, if necessary X-ray of the orbit and ultrasound of the eye.

In processing the data evaluated: gender, age, occupation, cause of injury, time since injury, visual acuity at admission and demission, eye pressure at admission and demission, diagnosis at admission, complications according to anatomic localizations, and other complications, the affected segment of the ocular globe, therapy, duration of hospitalization and the degree of remission. We applied Classifying Closed Globe Injury (Table 1), performed Calculating the OTS (Table 2) and convert of total raw points into % chance of vision outcomes (Table 3).

Statistical analysis

Statistical analysis was performed using Microsoft Office Excel 2007 and MedCalc version 10.0 software for biostatistics. The results are shown in tables and graphs by the number of cases, percentage, means, standard deviations and ranges. To test differences were used chi-square, Student's t-test and

Kolmogorov-Smirnov test normal distribution. All the results of statistical tests with $P < 0.05$ were considered significant.

3. RESULTS

The analysis of patients by gender shows that there is a statistically significant difference from the expected distribution with a high number of males 82.26% then females 17.74% (chi-square = 27.382, $p < 0.05$). Comparison of age groups by gender shows that there is no statistically significant ($\chi^2 = 5.155$; $p = 0.2718$). The largest number of subjects in the age group 40-59 years (34.67%). The youngest patient was 3 and the oldest 85 years, with a range of 82 years. Analysis of the average age of the total sample shows that was 37.19 ± 20.12 ; $1.8 \pm \text{SEM}$. The average age for men was 35.45 ± 19.89 ; for women 45.27 ± 19.64 . Statistical analysis by Student's t-Test shows that there is no statistically significant deviation ($p > 0.05$) from the expected distribution in our sample. Representation of patients by occupation: child 4.83%, student 22.57%, clerk 9.67%, employee 26.61%, retired 20.16%, unemployed 16.12% ($\chi^2 = 20.799$; $p = 1933-3$), statistical analysis by chi-square test shows that there is a significant difference in favor of workers ($p < 0.05$). The cause of injuries and their frequency among the subjects is shown in Table 4. Analysis of the data showed that there is a statistically significant difference in favor of wooden items as the most common cause of injury ($p < 0.05$).

Causes of injuries	N	%
Sport injury	12	9.67
Blow of the eye or head	92	74.19
Fall	8	6.45
Motor vehicle accidents	3	2.41
Other	9	7.25
Total	124	100

Table 4. Causes of injuries. $X^2=27,368$; $p=4,042-3$

Analyzing the time of injury to hospitalization ($X^2 = 70.322$, $p = 5.800^{-3}$), 89 patients (71.77%) were hospitalized in the first 24 hours after injury. Statistical analysis shows that there is a significant difference in favor of patients who are cared for in the first 24 hours after injury ($p < 0.05$). When determining the frequency of injury of the right and left eye ($X^2 = 40.853$, $p = 1.346^{-9}$) recorded the frequency of violations of the right eye 54.03%, 43.55% left and both of eye 2.42%. We determined visual acuity before and after hospitalization. Certain visual acuity on admission and after hospitalization ($X^2 = 32.846$, $p = 1.122^{-5}$). In our sample before hospitalization only 19.35% of patients had vizus 0.9-1.0 and after hospitalization can be observed a significant improvement, while 47.58% of patients had vizus 0.9-1.0, 14. 51% of subjects vizus not measured, and in one of the subject was created amaurosis. Examined the values of intraocular pressure before and after hospitalization ($X^2 = 88.348$; $p = 9.000^{-14}$), where is significant difference was observed in the reception of eye pressure in favor of pressure < 21 mmHg ($p < 0.05$). By determining the frequency of diagnosis at admission ($X^2 = 25.352$, $p = 1.259^{-5}$) the most frequent was contusio bulbi 53.22%, then the status of post contusionem 20.96% and 8.06% for laceratio lameris and contusio et laceratio (MIX) 17.74%, means that we have a statistically significant difference in favor of contusio bulbi.

Determining the frequency: complications of adnex ($X^2 = 43.544$, $p = 4.467^{-3}$), the representation of edema palpebrarum was 25.00%, 16.12% palpebrarum hematoma, ptosis 1.61%, without the hassle of the adnexa was 57.25 % of subjects; complications on the conjunctiva ($X^2 = 64.453$, $p = 1.100^{-3}$), representation for hiperemia was 58.06%, for suffusio 11.28%, corpus alienum 2.41%, without the hassle of the conjunctiva was 28.22% of subjects; corneal complications ($X^2 = 24.105$, $p = 2.327^{-5}$), representation erosio was 25.8%, edema 24.19%, 4.83% corpus alienum, without the hassle of the cornea was 45.16% of the respondents; complications in the anterior chamber ($X^2 = 0.062$; $p = 0.799^{-4}$) has not recorded a statistically significant difference between the presence and absence of hyphaema ($p > 0.05$). There was a statistically significant difference in the prevalence of iridocyclitis, but excluded patients who did not make themselves known complications to the iris and ciliary body ($p < 0.05$). Also, it was observed a statistically significant difference in favor of the absence of traumatic mydriasis ($p < 0.05$). Statistical analysis shows a significant difference in favor nonprogradient ionizing radiation, or are disabled patients who are not themselves known complications ($p < 0.05$).

Statistically significant difference was observed in favor hemophtalmos but excluded patients who had not occurred in the vitreous complications ($p < 0.05$). If we exclude patients who do not make themselves known complications in the retina and choroid, statistical analysis shows that there is a significant presence of commotion retina ($p < 0.05$). There is a statistically significant difference in favor of the absence of complications in the retrobulbar space for the benefit of the absence of fractures in the orbit, in favor of the absence of strabismus, the benefit of the greatest number of patients without astigmatism, in favor of the anterior segment of the eye, the greater the benefit of the application of medical therapy ($p < 0.05$). If we exclude patients who are not measured vizus, then recorded a statistically significant difference in favor of most of the patients with visual acuity 0.9-1.0 at demission ($p < 0.05$).

There was a statistically significant difference in favor of patients with improved intraocular pressure at demission < 21 , compared to patients in whom the pressure is not measured ($p < 0.05$). Statistical analysis by chi-square test shows that there is a significant difference in favor of length of hospital stay 0-7 days ($p < 0.05$). The average hospital stay was 8.5 ± 5.61 days, with a minimum duration of one day and a maximum of 31 days. Analysis of data ($X^2 = 6.642$; $p = 9.96^{-3}$) shows that no significant difference was observed in favor of a number of cured patients ($p < 0.05$).

VARIABLE	RAW POINT
Initial vision	4
NLP	25
Lp/HM	20
1/200-19/200	33
20//200-20/50	42
$\geq 20/40$	2
rupture	0
endophthalmitis	0
perforating injury	8
retinal detachment	31
APD	
Total	124

Table 5. Calculating OTS for all patients

Patient, age 55
 Causes of injuries-motor vehicle accidents
 Visual acuity- 0.2 (19/100)
 Raw point (table 2.) 80
 RAPD negative; raw point (table 2) -10
 Type (A+B+C=type D mixed) (Table 1.)
 Conclusion: type D mixed; visus(80)+RAPD(-10)=RAWSUM (70)
 In table 3. RAWSUM for 70 (66-80) and compared with visus on admission 19/100 and get 15%. Chance for vision outcomes is 15%.

Table 6. Example of calculation by OTS and the percentage chance of vision

Classifying Closed Globe Injury (n=124)
Type (mechanism of injury)
A. Contusion=89 (71.74 %)
B. Lamellar laceration=10 (8.064 %)
C. Superficial foreign body=3 (2.419%)
D. Mixed=22 (17.741 %)
Grade (presenting visual acuity)
Admission demission (n=106)(85.48%)
A. $> 20/40$ (0.5)=42 (33.87%) 84 (67.74 %)
B. 20/50-20/100 (0.4-0.2)=33 (26.61%) 10 (8.06 %)
C. 19/100-5/200 (0.2-0.025)=20 (16.12%) 4 (3.225%)
D. 4/200-L+P+ (0.02-L+P+)=25 (20.16%) 7 (5.64%)
E. NPL=4 (3.25%) 1(0.8 %)
18 patient (14.51%)without visual acuity because of the post OP
Pupil (RADP)(relative afferent positive RAPD=31 (25 %)
Pupillary defect) negative RAPD=93 (75%)
Zone I External (limited to the bulbar
Conjunctiva, sclera, cornea)=42 (33.87%)
II Anterior segment (structures in relation with the anterior chamber and the pars plicata)=72 (58.064%)
III Posterior segment (all internal structures post. to the posterior lens capsulae)=10 (8.064%)

Table 7. Classifying Closed Globe Injury

4. DISCUSSION

The aim of our study was to determine the gender and age structure of patients, occupation, items which is caused by injury, time since injury, injured eye, visual acuity before and after hospitalization, IOP before and after hospitalization, diagnosis at admission, complications according to the anatomical localization, the affected segment of the eye bulbus, type of therapy during hospitalization, duration of hospitalization and the degree of treatment.

The study included 124 patients with a confirmed diagnosis of closed eye injuries treated at the Department of Ophthalmology. The analysis of gender structure there were more male subjects compared to women. Our results are in line with the results of many studies (6, 7). In relation to age the dominant group in our study were age 40-59 years. Results of some studies which is not consistent with our state that belong to the age of 0-10, 30-39 and 50-59 (8, 9, 10). When we talk about occupation of subjects, the workers were the most common as patients. Study of Vuksa et al. (11) is consistent with our results. The most common cause of injuries in this study was a blow. According to our research are results of studies Shah et al. (7). Analyzing the time elapsed from injury to hospitalization, we obtained results that 71.77% of the patients hospitalized in the first 24 hours after injury. Studies which are not in line with our results said contradict most often due to long distances between rural areas and emergency medical services (10, 12). The incidence of injury of the right and left eye was similar. In line with these results, the

Figure 1. *Classifying Closed Globe Injury on hospital admission*

results of many studies (13, 15). In the study sample before to hospitalization only 19.35% of patients had vizus 0.9-1.0. Results of Onakpoya et al. (14) show that only 22.4% of subject at the admission in hospital, with a diagnosis of closed eye injuries, had normal vizus. After hospitalization previously mentioned visual acuity was found in 47.85% patients. In one patient identified the amaurosis. The result of this study is consistent with results of Mason et al. (15). Examining the value of IOP before and after hospitalization, 8.87% had increased eye pressure. Using the BETT (Birmingham Eye Trauma Terminology-classification of injury) we confirmed that contusio bulbi is the most common on hospital admission. On the eyelid as the most common complication is edema. Results of the study Qiu Huai-Yu et al. (16) coincide with this, in which the eyelid affected in 40.49%. The study complications from blunt injury cornea, we have obtained that the erosion or abrasion present in 25.8% of patients. In the camera bulbi anterior only complication is hyphaema, which occurred in a high percentage of 52.41%. In the study of Jovanovic et al. injuries caused in football in all subjects occurred hyphaema (100%) (17). Other studies indicate that hyphaema occurs most often in violation of the sport. In the

study sample, until recently, we have the result that the iridocyclitis occurred in 47.58% of respondents, and iridodialysis in 4.03 %. In accordance with our results in one study was spotted iridodialysis in 4.4% patients with a concussion (17). Traumatic mydriasis occurred in 25% of cases closed injuries. Jovanovic et al. identify traumatic mydriasis which is surgically processed (17). The investigation of complications in the vitreous at 8.87% patient has hemophthalmos. Identical data were given some of the authors (17). Given the ocular bulb as a whole the most common complications occurred in the front segment of the eye, as well as in other research (18).

5. CONCLUSION

Of the total number of closed eye injuries (N = 124) at the admission from groups D and E with the worst vision, there were 29 patients (23.38%), while in group C had low visual acuity of 20 (16.12%), in group B the mean visual acuity 33 (26.61%), and in group A well-preserved visual acuity 42 (33.87%) patients. On the demission patients with well-preserved visual function was 84 (67.74%), with a medium of visual function 10 (80.64%), while the poorer visual function was 4 (3.225%), and 7 (5.645%) patients had a sense of light and projections, and 1 (0.8%) patient had lost visual acuity-amaurosis. 18 (14.51%) patients did not take their eyesight due to a fresh post-operative recovery. Data on each patient are based on the possibility of such characteristics of the mechanism of injuries presentation of vision at the beginning of disease, injury and zones relative afferent pupillary defect possibility assumptions what will be the vision postoperatively. Can be determined by high sensitivity OTS test showing for closed eye injuries in group A high sensitivity and accuracy.

CONFLICT OF INTEREST: NONE DECLARED

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- 27 MAY Wed May 27 @12:00AM MIE 2015 - Madrid
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