Bulletin of the *Transilvania* University of Braşov – Special Issue
Series VI: Medical Sciences • Vol. 10 (59) No. 2 - 2017

THE CONSEQUENCES OF BLUNT TRAUMA ON THE LENS

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Abstract: *Traumatic injuries of the eye are a common cause for which the patients come to the ophthalmology emergency room. We tried in our study to determine the demographic profile of the patients who suffered closed eye injuries in Sibiu and it's near locations in a period of 8 years. We also studied the most common mechanisms of trauma and the circumstances in which it happened. The most common traumatic mechanism were contusions.*

Key words: *blunt trauma, closed globe injury, traumatic cataract, lens subluxation*

1. Introduction

Traumatic injuries of the eye are a common cause of visual function loss. After a blunt trauma the lens can be affected either by luxation or subluxation or by cataract. This problem leads to a decrease in visual acuity, glare, ocular hypertension and a decrease in quality of life. The patients who underwent a cataract surgery aren't safe either as the IOL may be affected as well.

2. Objectives

The goal of this study is to determine de demographic profile of these patients and to determine the prevalence of lens damage and its association with age, sex, environment, mechanism of action and other circumstances.

3. Material and Methods

We conducted a clinical-epidemiological retrospective and prospective study at the Department of ophthalmology, County Hospital of Sibiu, Romania in the period 2008-2016. We have recruited a number of 188 patients with 194 injured eyes, 6 of them had both eyes injured.

The inclusion criteria were closed eye injury, using Birmingham Eye Trauma Terminology System (BETTS). We have included both phakic and pseudophakic eyes.

The exclusion criteria were open globe injury, chemical or thermal injury of the eye.

Clinical examinations of the patients were made in the Department of ophthalmology and included: history of injury, visual acuity, intraocular pressure, slit lamp examination of the anterior and posterior pole.

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In processing the data we evaluated: age, gender, location, cause and mechanism of injury, visual acuity on admission and demission, intraocular pressure on admission and demission lens damage if there was any.

We grouped visual acuity as follows:

1	≥0.5 (1/2)
2	0,3 – 0,2 (1/3 – 1/5) (including)
3	0.16 – 0.025 (1/6 – 1/40)
4	0.02 (1/50), counting fingers, hand movement, light perception
5	no light perception

The mechanism of injury was classfied as follows:

1	Contusion
2	Lamellar Laceration (partial thickness)
3	Superficial foreign body
4	Mixed

Circumstances of injury where also classified as seen in the table below:

1	While being engaged in work
2	Contact with an object, undeterminated intent
3	Aggression by physical force or the use of a blunt object
4	Road accident
5	While Cutting wood

Data analysis was performed using SPSS Statistics (v. 20) [5] and Microsoft Excel 2013[6]. For continuous variables was first checked the normality criterion and variable description was made using indicators mean, standard deviation (SD), percentiles (P25, P50, P75). For comparison we used Student T-Test and Anova or Mann-Whitney and Kruskal-Wallis, as appropriate. In case of categorical variables frequencies and percentages were computed and for comparison the Chi-Square test was used. A p value less than 0.05 was considered statistically significant [4].

4. Results and Discussions

DEMOGRAPHIC DESCRIPTION

Patients age was between 3 and 81 years old, the average age for the entire sample was about 40 years old ((N=194, M=41.01, SD=20.557, P25=23, P50=40, P75=57).

In terms of gender, the group consists of 76.8% (N = 149) men and significantly (p = 0.000) fewer women (23.2%, N = 45), mean age in males (N = 194, M=41.01, SD=20.47, P25=22, P50=40, P75=57) was lower than the mean age of women (M=43, SD=20.08, P25=28, P50=41, P75=60). From the point of view of the home environment, the number of urban people (51%, N = 99) was approximately equal (p = 0.830) with those in rural areas (49%, N = 95) M = 39, SD = 19.88, P25 = 22, P50 = 34, P75 = 56), mean age for those in urban setting (M=39, SD=19.88, P25=22, P50=34, P75=56), was lower (p=0.091) than the mean age in rural areas.

MECHANISM OF INJURY

Among the most frequently encountered production mechanisms were 66% (N = 128) contusions followed by mixed mechanisms 19.6% (N = 38), lamellar lacerations 11.9% (N = 23) and superficial foreign bodies 2.6%

This hierarchy is maintained regardless of the environment or gender, with the mention that there were no superficial foreign bodies found in females.

Age values in case of contusions (M=43.59, SD=20.80) and foreign bodies (M=45.40, SD=21.37) was higher (Kruskal Wallis test, p=0.094) than lacerations (M=38.09, SD=18.03) or mixed mechanism.

PRODUCTION CIRCUMSTANCES

From the point of view of production circumstances, 64.4% (N=125) happened by contact with an object (undetermined intention), 12.9% (N=25) aggression by physical force or the use of a blunt object, 10.8%(N=21) while being engaged in work, 8.2% (N=16) while cutting wood and only 3.6%(N=7) road accident. This hierarchy is maintained for both environments of origin (Chi-Square test, p=0.299), the only exception is that we have no cases of injuries while cutting wood in females (Chi-Square test, p=0.114).

Road accidents and aggressions where meat in patients with a mean age under 40 years old M=27.86, SD=11.75; M=35.20, SD=21.02), while engaged in work or undetermined intentions were meat at an age until 45 years old (M=44.86, SD=15.54; M=41.20, SD=21.12). Cutting wood was found an average age of 50 years old (M=51.31, SD=16.95) (Kruskal-Wallis test, p=0.041).

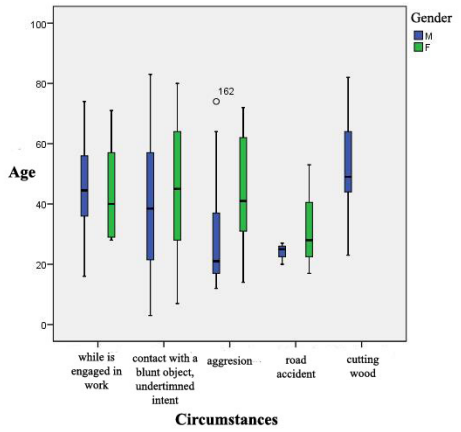

Fig. 1. *Distribution of blunt trauma acording to age, circumstances and gender*

LENS MALPOSITIONS

From the total number of injuries 17.5% (N=34) were lens malpositions, of which 47.06% (N=16, 8.2% of total cases) luxations, 44.12% (N=15, 7.7% of total cases) subluxations and 8.82% (N=3, 1.5% of total cases) IOL subluxation. In the cases of malpositioned lens, males had 53.8% luxations followed by 42.3% subluxation and 3.8% IOL subluxation while (Chi-Square test, p=0.118) females had 50% lens subluxations, 25% luxations and 25% IOL subluxations, respectively in urban areas we found 61.5% were luxations, followed by 30.8% subluxations and 7.7% IOL subluxations while (Chi-Square test, p=0.403) in rural areas 52.4% subluxations, 38.1% luxations and 9.5% IOL subluxations.

The mean age for patients with lens malpositions was greater than 50 years (subluxated IOL M=52.67, SD=21.82, SD=21.82, luxations: M=52.75, SD=22.64, subluxations: M=61.27, SD=18.88), while the mean age for those who had no changes is significantly (Anova test, p=0.000) lower (M=37.92, SD=18.78). 75% of lens luxations were caused by contusions, 6.2% (N=1) Lamellar Laceration (partial thickness) and 18.8%(N=3) mixed mechanism. In a very significant percentage lens subluxation 80% (N=12) were cause by contusions and 20% (N=3) mixed mechanisms, while the subluxation of the lens was caused only by contusions (100%, N=3).

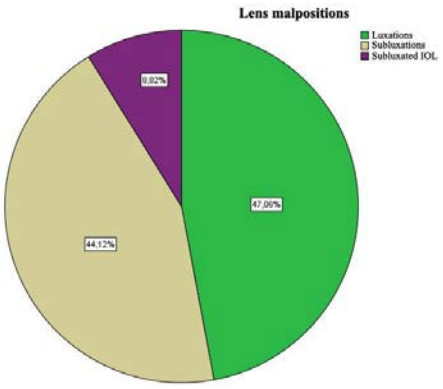

Fig. 2. *Lens malpositions after closed globe injury*

CATARACT

From all the patients in our study 9.8% had traumatic cataract as a complication of

closed globe injury. In males (N=149) a percentage of 9.4% (N=14) had traumatic cataract, and in females (N=45) a percentage of 11.1% (N=95) (chi square test, p=0.462), 8.1% (N=8) from the patients in urban areas (N=99) had traumatic cataract and 11.6% from those in rural areas (N=11) (chi square test, p=0.282).

Fig. 3. *Traumatic cataract after blunt trauma*

Patients who had traumatic cataract had a higher average age (M = 53.42, SD = 24.47) (Mann-Whitney test, p = 0.011) versus those who did not show this complication (M = 39.85, SD = 19.49)

This difference is maintained regardless of gender, with a difference between areas of about 10 years in males and 25 years in females (males: M=49.14, SD=27 vs. M=39.64, SD=19.56, p=0.163; females: M=65.40, SD=8.98 vs. M=40.53, SD=19.38, p=0.011).

Also, this difference is kept regardless of the environment, with a difference between environments of about 10 years for the urban and 15 years for rural (urban: M=48, SD=26.84 vs. M=37.95, SD=19.12, p=0.283; females: M=57.36, SD=23.07 vs. M=41.90, SD=19.77, p=0.016).

Traumatic cataract was caused in 94.7% of (N=18) of cases by contusions and in 5.3% (N=1) by mixed mechanism, in the majority of cases the circumstances where contact with an object, undeterminated intent and there were no cases while they were working.

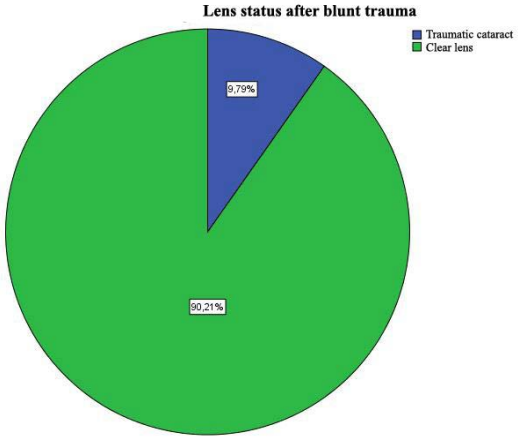

Fig. 4. *Lens status after a closed globe injury*

In we compare our results with some other studies we found there is a difference in incidence. For example, in a study conducted in China between 2006 – 2011 the authors found a 25% incidence in traumatic cataract. There are few studies that analyze only closed globe injuries. In the previously mentioned study the difference in incidence is caused by inclusion and exclusion criteria. Our study focused only on closed globe injuries.

The degree of opacity of the lens after a traumatic event depends on many factors, from the producing mechanism to the object or the way it impacted, the impact site, the kinetic energy emitted to impact, the absence or presence of the protective devices and the existence of local or systemic associated pathology.

As a lesion production mechanism, if we do not discuss penetrating or perforating lesions that induce a direct injury to the

crystalline lens or capsule, and we analyze the contusive mechanism that is predominant in the patients in the study group, we can say that closed globe injuries produce localized lesions on the lens as well as on the adjacent anatomical formations. These lesions are due to the equatorial compression and decompression of the eyeball that produces oscillatory energy waves.

The eyeball is protected by the orbital edge, but if the object causing the trauma is smaller than the diameter of the orbit, the likelihood of injuries is increased.

The contusive trauma does not produce a solution of continuity in the crystalline capsule, so the most common lesion is an opacification of the lens in the form of a snowball or rosette.

It is possible for the posterior capsule or the zonular fibers to be affected by the traumatic event which can lead to a series of intraoperative complications.

The time in which traumatic cataract can form is correlated with the age of the patient, with the number of epithelial cells affected and with the degree of posttraumatic inflammation.

In a young patient who need surgery because of traumatic cataract the management of the case is very important. Also, we have to explain the consequences of surgery: loss of accommodation (in case of a monofocal implant) and a high incidence in posterior capsule opacification.

According to Morfields Manual of Ophthalmology the rate of capsular opacification at 2 years is under 10%, but in young patients it can reach up to 100%.

Of course if capsular opacification appears we can fix the problem by doing another surgery (posterior capsulorexis) or performing ND:YAG capsulotomy. It is recommended that YAG capsulotomy to be performed at least 3 months after cataract surgery in order to reduce the risk of cystoid macular edema.

The risk of posterior capsulotomy is retinal detachment. The risk of retinal detachment is inversely proportional to the age of the patient.

5. Conclusions

The mean age for the people who had lens damage (malpositions or cataract) was 53 years, regardless of there environment.

The most frequent trauma mechanism was contact with a blunt object, underminated intent.

Patients from the rural environment are older than those from the urban environment for all circumstances studied.

The mean age is bigger in females than in males for all the 5 traumatic mechanism studied, especially for aggressions.

Related to lens malpositions the most frequent complications were luxations followed by subluxation. There was only one case of subluxated IOL.

For the entire sample 9.8% had traumatic cataract.

The most frequent mechanisms for traumatic cataract were contusions followed by mixed mechanism.

On the second place we found aggressions and on the last place road accidents, the mean age for these two mechanism being under 40 years.

None of the patients with traumatic cataract declared that the incident happened at work.

For males we found am improvement in the visual acuity at discharge in 70% of the patients.

Young patients who need cataract surgery after a traumatic event have a high risk of capsular opacification.

Patients need to be informed of the benefits and risk of cataract surgery (endofalmitis, posterior capsule opacification, retinal detachment, loss of accommodation if the patient is under 40

years old and chooses a monofocal implant, cystoid macular edema) in order for them to choose the best option.

Acknowledgements

Special thanks for my colleagues from the department of ophthalmology, County Emergency Hospital of Sibiu, especially to Mihai Elena M.D. for her continued support patience and good advice.

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