Adrian Laurenţiu STUPARIU
General Railroad Hospital Sibiu, "Lucian Blaga" University, Sibiu, Romania
George Constantin MANIU,
Lorand KISS
"Lucian Blaga" University, Sibiu, Romania

CHARACTERISTICS OF OCULAR TRAUMA IN CHILDREN

Case Study

Keywords
Blunt eye trauma,
Close globe injury,
Pediatric,
Visual acuity,
Trauma type,
Zone

Abstract

In order to identify the characteristics of ocular trauma in children for design of data analysis based, accurate and targeted preventive measures, we have studied 29 patients who suffered blunt eye trauma, age 18 and below. The following parameters where taken into account: environment, gender, traumatized eye, type of trauma, zone, circumstances, visual acuity and intraocular pressure. Results: Contusions were the most common type of injuries, the most frequent circumstance was contact with a blunt object undetermined intent, and in more than 50% of cases zone II was the most affected. 50% of patients were between 12-15 years, eye trauma caused by aggression was found to be more frequent between 14-15 years, while injuries produced by a blunt object, undetermined intent where found at a younger age, approximately 12 years old. Ocular hypertension or hypotension was found more often in the rural environment. Visual acuity over 0.5 on admission was found in 38% of patients, and on discharge there number went up to 86% of cases. The patients spent on average 7 days in the hospital.

INTRODUCTION

Ocular trauma represents a major cause of monocular disability world wide. This can cause low vision, blindness or visual impairment having a negative impact in future development of children (Desai 1996; Brophy 2006).
The purpose of this study is to determine the profile of children who suffered a close globe injury, the circumstances in which it happened and the impact it had on the visual acuity, in order to design data analysis based, accurate and targeted preventive and management measures and strategies.

MATERIALS AND METHODS

Patients included in this study suffered a close glove injury between 01.01.2008 and 31.07.2016 and we enrolled 29 children. The inclusion criteria were: under 18 years old (including), closed globe injury (according to BETTS classification), patients presented to the emergency room under 24 hours since it happened. Open globe injuries, thermal and chemical injuries were excluded from this study.
The next parameters were taken into account: visual acuity on admission and discharge, intraocular pressure on admission and discharge, anterior and posterior pole examination using a slip lamp and a non contact posterior pole lens.
Visual acuity was determined using a Snellen chart with best corrected visual acuity. Intraocular pressure was measured using Icare rebound tonometer TA01i. The advantages of this tonometer is that it does not require local anesthetic and is more easy to use with children.
The anterior pole was examined using a slit lamp with Zeiss optic system.
Posterior pole examination was made using a Heine direct ophthalmoscope and posterior pole lens 90D and 78D.
Anterior and posterior pole photos were made using a non midriatic camera from Canon.
Patients who were suspected in having orbital fractures underwent and X ray/and or CT examination.
In order to determine the demographic profile we have followed: age, gender, date of trauma (month and year), time spent in hospital.
According to the affected area the have the following 3 zones: Zone I – superficial lesions of bulbar conjunctiva, sclera and cornea; Zone II – anterior chamber, iris and lens; Zone III – retina, vitreous, optic nerve and uvea
According to the type of trauma like contusions, lamer lacerations (non penetrating), superficial foreign bodies and mixed mechanism were considered.
Visual acuity was classified in the following groups:
1 for ≥0.5 (1/2), 2 for 0,3 – 0,2 (1/3 – 1/5) (including), 3 for 0.16 – 0.025 (1/6 – 1/40), 4 for 0.02 (1/50), counting fingers, hand movement, light perception and 5 for no light perception.
For every patient we have measured the intraocular pressure and we classified it as follows: ocular hypotension (≤9 mmHg), normal tension (10 – 21 mmHg), ocular hypertension (≥ 22 mmHg)
Data preprocessing (Maniu 2017) and data analysis (Mocan 2015) was made using SPSS v20 (IBM) software package. For description of the category variables: environment, gender, injured eye, type of trauma, zone, circumstances, visual acuity, intraocular pressure we have determined the values in number and percentage form, and for continuous variables: age, number of days spent in hospital, we have determined average, standard deviation, median, interquartile interval (IQR, between 25% and 75%). For comparison of the average age and number of days spent in hospital, we have used Student T and ANOVA tests, and for the variable association we have used Chi-Square test. Significance level was considered 0.05 (Mocan, 2005; Popa 2007, Maniu, 2014).

RESULTS

From the 29 patients up to 18 years of age, 79.31% (N=23) of cases were males (3.83:1), with 51.72% (N=15) from the rural areas. From the traumatized eye point of view half of the urban patients were had the right eye traumatized while in rural areas 60% of the patients suffered trauma to this eye. 52% of male patients have left eye trauma, while in female patients 83% of the injuries have been in the right eye.
From the type of trauma point of view 62.07% (N=18) were contusions, 27.59% (N=8) mixed mechanism and 10.34% (N=3) lamer lacerations and no situations of superficial foreign bodies. Contusions prevailed both in the urban area (N=8, 57,14%) and rural area (N=10, 66,67%), in males (N=17, 73.91%), but not for females (N=1,16.67%) in this situation mixed trauma was more frequent (N=4, 66,67%).
The most affected area was zone II (N=15, 51.72%) followed by zone I (N=9,31.03%) and zone III (N=5, 17.24%). This distribution was maintained for the patients from the urban area without having a significant difference between the number of cases by zone (N=6, 42.86% in zone II, chi-square test, p=0.607), while for patients from the rural area the same distribution applied but it was a bigger difference between the number of cases who had zone II affected (N=9, 60%) and the other zones (chi-square test, p=0.607). For the male gender we have the same zone distribution, while for the

female gender who have equal number of cases only for the zones I and II (N=3, 50%).
When we have studied the circumstances in which the injury happened, 68.97% (N=20) happened because of contact with a blunt object/ undetermined intent and the rest by aggression (N=7, 24.14%) and one case of road accident and respectively one case while it was engaged in work (N=1 3,45%). For the patients in the urban area we found slightly more cases of trauma caused by a blunt object (N=8, 57.14%) compared with the aggression cases (chi-square test, p=0.593), while for the patients from the rural area in 80% (N=12) of cases the traumatism was caused by contact with a blunt object / undetermined intent (chi-square test, p=0.000). Both for females (N=4, 66.67%) and males (N=16, 69.57%) more than 60% of the cases were injuries caused by contact with a blunt object / undetermined intent an in addition, for the last mentioned category (males) there were 20.09% of cases (N=6) cause by aggression.
Zone II was affected most often by contusions (N=11, 61.1%), for the other zones their incidence was almost the same (zone III: N=4, 22.2%; zone I: N=3, 16.7%). Mixed trauma affected mostly zone II (N=4, 50%) followed by zone I (N=3, 37,5%) and only one case for zone III (N=1, 12,5%). Laceration affected only zone I (N=3, 100%) (Chi-Square test, p=0.071).
Closed globe injuries where found in children aged between 3 and 14 years old, the average age was M=13.14 years (SD=4.11, median=15, IQR (12;15)). The average age for females (M=14.17, SD=3.71, median = 15, IQR (14;17)) was slightly higher (student T test, p=0.501) than the average in males M=12.87, SD=4.25, median = 15, IQR (12;15)). For both areas, urban and rural, the mean age was about the same, 13 years (student T test, p=0.856) (figure no. 2).
The mean age for children who suffered eye trauma by mixed mechanism M=11.50, SD=4.84, median = 14, IQR (7;15)) was slightly lower compared to that of the patients with lamer lacerations (M=12, SD=6.24, median = 14, IQR (5;17)) and with those who suffered contusions (M=14.06, SD=3.35, median = 15, IQR (13;16)) (Anova test, p=0.313).
A situation with lamellar laceration is presented in figure no. 1. For both urban and rural areas, the average age for contusions was about 13-14 years, and for mixed trauma about 11-12 years. Mixed trauma was found more often for the male gender around the age of 10 and for female gender at an average age of 13-14 years (student T test, p=0.274). The same average age of 13-14 years was determined for males who suffered contusions.
The average age for children who suffered injuries in zone I (M=13.44, SD=3.57, median = 14, IQR (13;15)) and zone II (M=13.27, SD=4.43, median = 15, IQR (10;16)) was 13 years old and for zone III was 12 years (M=12.20, SD=4.76, median = 15, IQR (12;15)) (Anova test, p=0.859). For the children in the urban area the average age varies between 12 years for trauma which affected zone I and 13-14 years for trauma that affected zone II and II, while for patients in the rural area the average age for zone III was 10 years, 13 years for zone II and 15 years for zone I.
Trauma caused by contact with a blunt object/undetermined intent was found in children with an average age of 12 years (M=12.20, SD=4.47, median=15, IQR (9;15)), the patients who suffered eye trauma caused by aggression had a higher age, approximately 14-15 years (M=14.86, SD=2.34, median= 15, IQR (12;17)) (student T test, p=0.060). There was one case of trauma while he was engaged in work, at 16 years and one case of road accident aged 17 years. This distribution is maintained for children found in urban and rural areas, both in boys and girls.
Visual acuity on admission was over 0.5 in 37.93% of cases (N=11), between 0.3-0.2 in 24.14% of cases (N=7) and the same amount of cases were with light perception/hand movement (N=7, 24%), respectively between 0.16-0.025 there were 13,79% (N=4) of cases. There were no cases with no light perception. This distribution is maintained for both areas, urban and rural, regardless of gender.
Visual acuity on discharge was over 0.5 in 86.21% of cases (N=25), there was one case with visual acuity between 0.3-0.2 and 0.16-0.025, and two cases in the situation of light perception/hand movement (N=2, 6.9%). For the female gender, in all cases, visual acuity on discharge was over 0.5.
27.59% of children presented ocular hypertension on admission (N=8) and there was one case of hypotension (3.45%), on discharge there were 3 cases of ocular hypertension (10.34%) and one case of hypotension (3.45%). There were more cases with ocular hypertension among the patients from the rural area (rural: N=5, 33.33% vs urban: N=3, 21.43%) and was more frequent in males (male: N=7, 30.43% vs. female: N=1, 16.67%). The patient with hypotension was a female from the rural area.
Hypertension at discharge was found in two cases from rural and one from urban area while hypotension had a rural boy.
The number of days that patients spend in the hospital was between 3 and 19 with an average of M=7.31 days (SD=3.88, median = 6, IQR (5;9)) with no significant difference between areas, (urban: M=7.29, SD=4.29, median = 7, IQR (5;8) vs. rural: M=7.33, SD=3.62, median = 6, IQR (5;10), student T test, p=0.974) or gender (males: M=7.61, SD=4.28, median = 6, IQR (4;11) vs. females: M=6.17, SD=1.33, median = 6, IQR (5;7), student T test, p=0.179).

CONCLUSION AND DISCUSSION

The characteristics of ocular trauma in children can be achieved and summarized, based on the results of the data analysis (as with other literature studies (Maniu 2014)), as follows: the most cases of ocular trauma were caused by contusions (mean age 13-14 years), the most frequent circumstance was by contact with a blunt object/undermined intent, the most affected area was zone II, visual acuity on admission was in 38% of cases over 0.5, and on discharge it improved to 86% and length of stay in the hospital was on average of 7 days.

Male preponderance of ocular trauma in children from our study agrees with other studies (on adults or children population) (Strahlman 1990, Serrano2003, Knox 2008, Moren 2008).

Ocular inflicted trauma can have a negative impact for children in their development and in choosing a career. A reduced visual acuity comes with some job limitations in some sectors, like professional driving, police, army, navy, airplane pilots. Also it may impair their ability to get a driver license. These are only some small examples; the list can go on. A visual acuity under 0.5 has limitations even for working in a factory on the assembly line.

Closed globe injury can affect the cornea causing corneal leukoma, traumatic cataract, secondary glaucoma, retinal detachment.

Traumatic cataract it also can create several problems in children. Because they are still in development and the eye is still growing, biometry can be challenging. Posterior capsule opacification has a very high rate in children and this is the reason why a posterior capsulorhexis is recommended during surgery. The posterior capsulorhexis can be done in a second time, but if the child is very young cooperation may be difficult and a posterior ND:YAG capsulotomy, may be very challenging to perform. Also because of the traumatic injury the surgeon my encounter zonular laxity and the need to implant a tension ring in order to stabilize the capsular bag. If there is no capsular support available in order to ensure a safe IOL implantation, an iris claw IOL can be used. We think that a posterior chamber implant is more suitable. If we take into account the age, an anterior chamber IOL in time can decompensate the cornea, by causing loss of endothelial cells. Anchoring the IOL to the sclera is also an option. Choosing one type of IOL over another when there is no capsular support depends from case to case and of course depends on the surgeon's experience.

Children with ocular hypertension need close monitoring for the following years. According to EGGS guidelines we should follow these patients for long periods of time, check the intraocular pressure, and make fundus photos and visual fields.

Depending on age IOP measurement may be difficult, because children can sometime be less compliant. Applanation tonometry remains the gold standard in measuring IOP, but requires anesthesia and cooperation from the patient. For children the Icare rebound tonometry has been used with success, because measurements are done quickly and there is no need for corneal anesthesia. At the moment there is no OCT database available for children this investigation needs to be observed in dynamic to check if there is any RNFL modification. We should be careful to make the following examinations on the same machine or at least the same type. Different OCT producers have different reference planes, and the results can be compared. The same thing goes for the visual field, same strategy same device, and best corrected vision.

Preventive strategies should include programs (in schools, media, different organizations) of injury awareness, protection, prevention, motorization approaches.

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APPENDICES

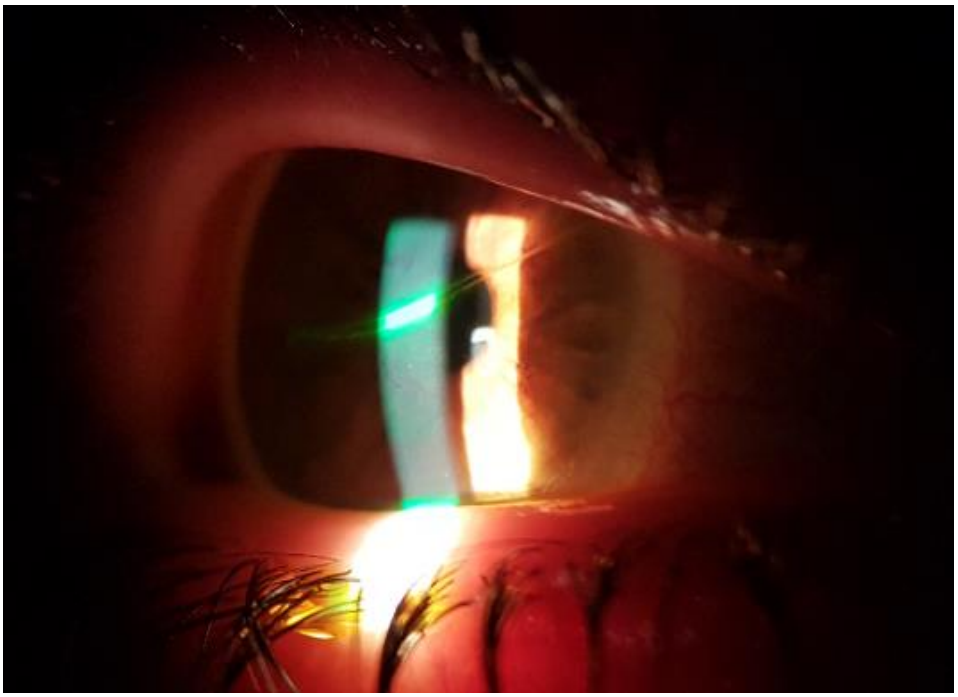

Figure No.1 Child who suffered a lamer laceration with a pencil tip

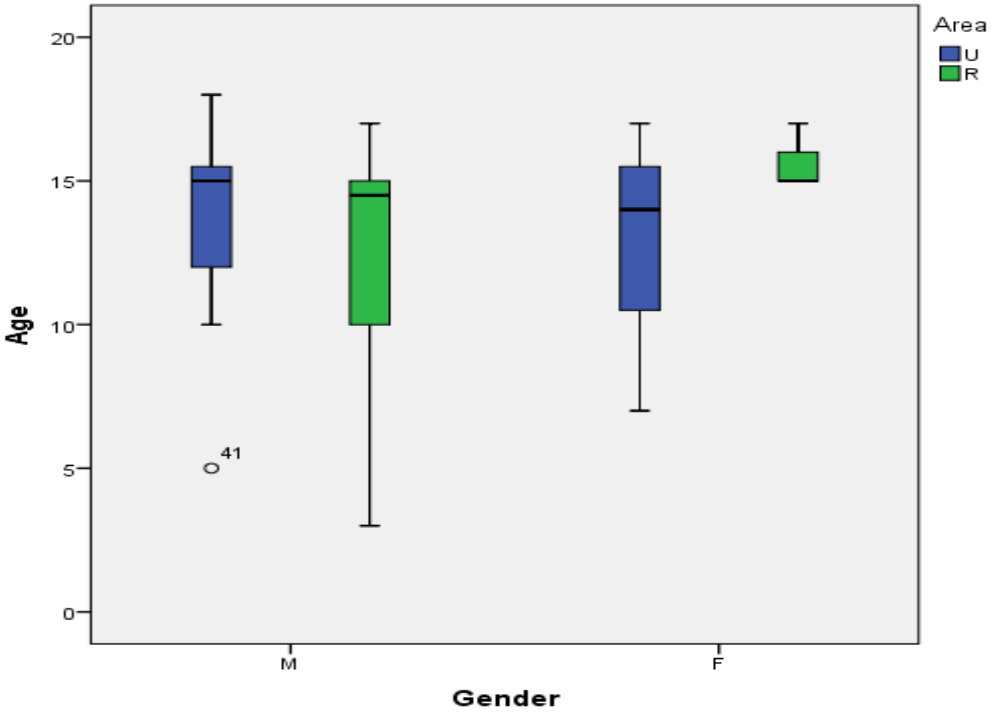

Figure No.2 Age distribution for the two genders in case of each area