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Epidemiological profile and visual outcome of ocular trauma in a referral center in northeastern Brazil

Perfil epidemiológico e prognóstico visual do trauma ocular em um centro de referência da região nordeste do Brasil

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Abstract

Objectives: *To evaluate the epidemiological profile and prognosis of patients with mechanical ocular trauma.* ***Methods:*** *Descriptive cross-sectional observational study of consecutive patients evaluated during a one-year period at a public referral center in São Luis, Maranhão, Brazil. The Ocular Trauma Score (OTS) was used to estimate final visual acuity. The variables were analyzed using the chi-square test with a significance level of 5%.* ***Results:*** *Out of a total of 154 patients (mean age of 30.1 years), 27.92% were younger than 16 years, and 81.8% were men, with most coming from the state's countryside (55.2%). Most of the patients were dependents (34%) or rural workers (19%). Regarding the OTS prognosis, 33.77% of the patients were category 5 and 31.16% category 1 or 2, indicating worse prognosis. The best prognoses (visual outcomes) were inversely proportional to age and time to treatment (p<0.001).* ***Conclusion:*** *Ocular trauma remains an important cause of ocular morbidity in childhood and in informal work. Adult supervision and socio-educational measures are mandatory to change this scenario.*

Keywords: *Eye injuries/epidemiology; Eye injuries/prevention & control; Morbidity; Prognosis*

Resumo

Objetivos: Avaliar o perfil epidemiológico e o prognóstico visual de pacientes com trauma ocular mecânico. **Métodos:** Estudo observacional transversal descritivo de pacientes consecutivos atendidos durante o período de um ano em um centro de referência público em São Luís, Maranhão. O Ocular Trauma Score foi aplicado a fim de estimar a acuidade visual final. As variáveis foram analisadas por meio do teste de Qui-quadrado com nível de significância de 5%. **Resultados:** Encontrou-se 154 pacientes tratados, a média de idade foi 30,1 anos, 27,92% menores que 16 anos, homens (81,8%) e do interior do Estado (55,2%). A maioria eram dependentes (34%), dos trabalhadores ocorreu o predomínio do trabalhador rural (19%). Quanto ao prognóstico, 33,77% dos pacientes apresentavam-se na categoria 5 e 31,16% na 1 ou 2, de pior prognóstico. Os melhores prognósticos foram inversamente proporcionais a idade e ao tempo até o atendimento (p<0,001). **Conclusão:** O trauma ocular se mantém como importante causa de morbidade ocular na infância e no trabalho informal. A supervisão de adultos e medidas socioeducativas são fundamentais para mudar esse cenário.

Descritores: Traumatismos oculares/epidemiologia; Traumatismos oculares/prevenção & controle; Morbidade; Prognóstico

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Introduction

Ocular trauma is an important cause of ocular morbidity and one of the major causes of unilateral irreversible blindness in the world, especially in children and young adults.[1-4] During one year, 55 million eye injuries limit occupational activities for more than one day, and 750,000 cases require hospitalization, according to the World Health Organization (WHO) blindness prevention program. Eye injuries have impacts at both the socioeconomic and health levels and are an economic burden to families and countries.[5,6]

The Birmingham Eye Trauma Terminology (BETT) and the Ocular Trauma Score (OTS) were developed for mechanical trauma categorization, both reported by Kuhn et al.[7,8] The first study classifies an ocular lesion as closed (contusion or laceration) or open-globe (rupture or perforation). The latter uses parameters such as initial visual acuity (VA), presence of rupture, perforating type injury, endophthalmitis, afferent pupillary defect and retinal detachment to predict the final VA outcome after 6 months of injury. OTS was one of the earliest classifications of ocular trauma to demonstrate the importance of VA in stratifying trauma patients. From 2002, OTS started to be used in ophthalmologic routines also for prognostic evaluation in both pediatric and adult lesions.[9,10]

The main purpose of the present study was to analyze the epidemiological profile, correlating with the visual prognosis, of patients who presented with mechanical ocular trauma at a referral center in northeastern Brazil.

Methods

This was a descriptive cross-sectional observational study, in which the sample consisted of consecutive patients who suffered mechanical ocular trauma and who were initially cared for at an emergency service and then referred to HUUFMA (Hospital Universitário da Universidade Federal do Maranhão), one of the public referral services for emergency ophthalmology in São Luís, Maranhão, during the period from March 1, 2016 to February 28, 2017.

The physicians responsible for the patient care provided a data sheet containing age, sex, race, occupation and main residence (state's capital or countryside), place of trauma occurrence (work, home, scene of violence, recreation area or traffic accident), use of personal protective equipment (PPE), affected eye, type of open-globe trauma (rupture, perforating, penetrating and presence of intraocular foreign body) or blunt trauma (contusion or lamellar laceration), object of trauma (blunt instrument, firearm and others) and time to treatment at HUPD service.

Physical examination included best-corrected VA, presence of afferent pupillary defect, traumatic cataract, iris lesion and/or retained intraocular foreign body, signs of endophthalmitis, presence of vitreoretinal hemorrhage, retinal tear or detachment and choroidal detachment. VA was measured with a Snellen chart and, in cases of severe vision loss, hand movement and light perception were tested.

Polytraumatized patients, those under life-threatening conditions or who refused treatment, those with psychiatric disorders that prevented ophthalmologic examination or who refused to sign an informed consent form were excluded.

First, patients were classified according to BETT7. Open-globe traumas were divided into subgroups: (1) rupture, injury resulting from contusion with increased intraocular pressure via an internal-external mechanism; (2) laceration with penetrating lesion, caused by the entry and exit of an object through the same eye; (3) laceration with perforating lesion, with inlet and outlet holes produced by the object of trauma; and (4) laceration with retained intraocular foreign body. Closed traumas were classified as (1) contusion or (2) lamellar laceration.

Subsequently, OTS was applied8. OTS was determined from the main prognostic factors, including initial VA, presence of ocular rupture, endophthalmitis, perforation, retinal detachment and afferent pupillary defect (Table 1). According to the OTS prognostic data, the score calculated for each patient scores ranged from 0 to 100, and the patient was categorized into five groups according to the estimated probability of follow-up VA category at 6 months: no light perception (NLP), light perception (LP)/hand movements (HM), <20/200, 20/200 to 20/50 and ≥20/40 (Table 1).

Table 1
Ocular Trauma Score calculation and probability of visual outcome

Initial visual factor	Raw points
A. Initial visual acuity	
NLP	60
LP/HM	70
<20/200	80
20/200 – 20/50	90
≥ 20/40	100
B. Globe rupture	-23
C. Endophthalmitis	-17
D. Perforation injury	-14
E. Retina detachment	-11
F. Afferent pupillary defect	-10

Probability of visual outcome

Raw score sum	OTS category	SPL (%)	PL/MM (%)	<20/200 (%)	20/200 -20/50(%)	≥20/40 (%)
0 – 44	1	73	17	7	2	1
45 – 65	2	28	26	18	13	15
66 – 80	3	2	11	15	28	44
81 – 91	4	1	2	2	21	74
92 - 100	5	0	1	2	5	92

NLP: no light perception; LP: light perception; HM: hand movements; OTS: ocular trauma score.

Data were analyzed using SPSS® software (version 17.0). Descriptive statistics were initially performed using frequency measures and mean and standard deviation. For data analysis, patients were also classified into six age groups: 0 to 15, 16 to 20, 21 to 34, 35-50, and over 50 years. The distribution of the categorical variable frequencies for general characterization, anamnesis data and clinical evaluation were compared between the groups using the chi-square test or Fisher's exact test. The level of significance was set at 5%. The study was approved by HUUFMA institutional review board, protocol number 1.389.326.

Results

A total of 154 individuals were included in the study. The lesions found were unilateral in the vast majority of patients,

and only 2 cases (1.3%) were bilateral. The left eye was the most affected in the sample evaluated (55.2%). Regarding the trauma mechanism, 99 (64.3%) were closed-eye traumas, while 55 (35.7%) were open traumas. Clinical examination also revealed that contusion accounted for 47% of the ocular traumas, followed by lamellar laceration (16%), penetrating laceration (15%), perforating laceration (11%), retained intraocular foreign body (8%) and rupture (3%). The most prevalent mechanisms of injury were perforating or cutting object (22.1%), plant material (21.4%) and rhombus object (20.1%).

Most patients were male (81.8%) and the mean age was 30.13 ± 20.22 years. The most affected age groups were younger than 16 years and between 21 and 34 years representing respectively 27.92 and 28.57% of the patients. Regarding ethnicity, 58.4% of the patients described themselves as mixed, and 55.2% of the patients lived in the countryside. When dividing the sample into open and closed injuries, only the place where the trauma occurred showed statistically significant differences between the groups (p<0.001). While most of the patients with closed trauma were from the state's capital (58.6%), almost all patients with open trauma (80%) were countryside residents.

Considering the patient's occupation, it was observed that 34% were students or dependents. Among the workers, the mean age was 39.84 years, and most of them were male (93.5%) and living in the countryside (65.21%). The largest percentage of patients were rural workers (36.95%), followed by construction workers (21.73%). PPE was being used at the time of injury only in 6.5% of patients. Regarding the location of the injuries, the majority occurred in the patients' home (38.3%), followed by work (29.9%) and in situations of violence (13%). Comparative analysis revealed statistically significant differences between mechanism of trauma and place of occurrence (p=0.043). Most of the blunt traumas occurred at home (44.4%), while most of the open traumas occurred at work (40%), also noting that 18.2% of the latter occurred in situations of violence.

Table 2
Percentage distribution according to the time between the injury and the initial visual acuity of the patients cared for

	Eye injury		
	Open (%)	Closed (%)	p-value
Time			
≤ 12 h	9.1	25.3	0.023*
13-24 h	14.5	20.2	
25-48 h	12.7	15.1	
> 48 h	58.2	38.4	
No information	5.5	1.0	
Visual acuity			
NLP	25.5	6.1	<0.001*
LP/HM	47.3	13.1	
<20/200	9.1	8.1	
20/200-20/50	12.7	15.2	
≥ 20/40	3.6	53.5	
No information	1.8	4.0	

NLP: no light perception; LP: light perception; HM: hand movements.
* Statistically significant difference between types of ocular trauma (p<0.05) according to the chi-square test.

The time lapse between the injury and specialized medical care was also measured. Most of the patients, i.e., 70 (45.4%), reached the referral center for clinical or surgical intervention within the first 48 hours after the accident. Thirty (19.5%) were cared for within 12 hours and 28 (18.2%) between 13 and 24 hours, and only 22 (14.3%) received care 25 to 48 hours after trauma (Table 2). Initial VA in most patients was ≥20/40 (35.7%) or LP/HM (25.3%), but it was NLP in 13% of the patients. Comparative analysis revealed statistically significant differences between the mechanisms of trauma for the variables time to medical care (p=0.023) and VA (p<0.001). In the open-globe traumas, there was a longer time to treatment, along with a worse VA and greater percentage of lacerations of the conjunctiva, cornea, sclera and iris, lens lesions and hyphema.

Five of the 154 patients evaluated were children who did not report VA, and therefore, OTS could not be determined for them. Among the other 149 patients, the majority (33.77%) were classified in category 5, followed by 31.16% classified in category 1 or 2, with a worse prognosis. OTS was also inversely proportional to age; that is, children showed traumas with a score of 5 (p<0.001). The traumas with a score of 5 according to OTS showed a shorter time to treatment (p<0.001). There was also a statistical difference when comparing the patient's residence and OTS. Most of the patients from the countryside had an OTS severity of 1 (p=0.001). Gender and the use of PPE did not exhibit statistical difference in relation to OTS (Table 3).

Discussion

Ocular trauma represents an important cause of visual disability that brings an important social and economic burden impacts quality of life, especially among young individuals. (11) In Brazil, there is no unified ocular trauma record system; studies have been performed in various ophthalmological centers to trace the epidemiological profile of ocular trauma in Brazil. Those studies show different results depending on the place and year the data were collected. The common point between them was the need of the education and society's awareness about preventive measures related to this issue.[12]

The home environment was the site of higher incidence of ocular trauma in several reported studies.[2,13,14] Most of the closed-globe traumas occurred in this scenario (44%), while open traumas occurred mainly during work activities (40%) or under situations of violence (18.2%).[15] Nevertheless, it was interesting that the place where the trauma occurred did not interfere with the OTS result; that was, serious trauma occurred in all scenarios. Among the accidents that occurred in the home environment, 32 (66.1%) involved patients under the age of 21, indicating the need for attention to household utensils or other potentially dangerous objects.[2,13,16]

The incidence of open trauma in this study (35.7%) could also be considered high. Several studies have shown a higher prevalence of closed-eye trauma, mainly due to ocular surface foreign bodies (54.6 - 81.8% of ocular lesions).[17,18] The reason for this disparity is related to the level of complexity of the referral center studied. HUPD is a tertiary care hospital responsible for complementary examinations and surgical care in complex traumatic injuries. Superficial foreign bodies and light corneal abrasions, which were involved in most closed traumas, were usually treated at primary and secondary hospitals and were consequently not referred to the tertiary service. This type of trauma is very common among industry and construction workers.[17]

Table 3
Correlation of the Ocular Trauma Score (OTS) with sex, age, PPE use, place and time until trauma care and patient residence

	Ocular Trauma Score (OTS)					
	1 % (n)	2 % (n)	3 % (n)	4 % (n)	5 % (n)	p-value*
Sex						
Male	4.92 (6)	29.51 (36)	22.13 (27)	11.48 (14)	31.97 (39)	0.586*
Female	3.70 (1)	18.52 (5)	18.52 (5)	11.11 (3)	48.15 (13)	
Age						
< 16 years	0.00 (0)	31.58 (12)	18.42 (7)	5.26 (2)	44.74 (17)	<0.001*
16 – 20 years	7.69 (1)	23.08 (3)	30.77 (4)	7.69 (1)	30.77 (4)	
21 – 34 years	4.55 (2)	15.91 (7)	31.82 (14)	4.55 (2)	43.18 (19)	
35 – 50 years	8.00 (2)	40.00 (10)	8.00 (2)	16.00 (4)	28.00 (7)	
> 50 years	6.90 (2)	31.03 (9)	17.24 (5)	27.59 (8)	17.24 (5)	
PPE						
Yes	0.00 (0)	0.00 (0)	33.33 (1)	0.00 (0)	66.67 (2)	0.493*
No	8.62 (5)	32.76 (19)	22.41 (13)	10.34 (6)	25.86 (15)	
Trauma place						
Home	1.75 (1)	24.56 (14)	17.54 (10)	14.04 (8)	42.11 (24)	0.586*
Work	8.70 (4)	28.26 (13)	19.57 (9)	10.87 (5)	32.61 (15)	
Leisure	6.25 (1)	31.25 (5)	37.50 (6)	0.00 (0)	25.00 (4)	
Traffic	0.00 (0)	10.00 (1)	30.00 (3)	10.00 (1)	50.00 (5)	
Violence	5.00 (1)	40.00 (8)	20.00 (4)	15.00 (3)	20.00 (4)	
Time to treatment						
< 13 hours	0.00 (0)	11.54 (3)	7.69 (2)	7.69 (2)	73.08 (19)	<0.001*
13 –24 hours	3.70 (1)	14.81 (4)	29.63 (8)	3.70 (1)	48.15 (13)	
25 –48 hours	4.55 (1)	27.27 (6)	13.64 (3)	31.82 (7)	22.73 (5)	
> 48 hours	5.71 (4)	37.14 (26)	27.14 (19)	10.00 (7)	20.00 (14)	
Patient residence						
State's capital	2.99 (2)	10.45 (7)	17.91 (12)	14.93 (10)	53.73 (36)	0.001*
Countryside	6.10 (5)	41.46 (34)	24.39 (20)	8.54 (7)	19.51 (16)	

PPE: personal protective equipment. * Chi-square test. ** t-test. n: absolute value;

It was important to note that 93.5% of workers were not using PPE at the time of trauma, certainly having a significant impact on the incidence of open trauma in the present study. Workers may perceive PPE as uncomfortable or have the impression that they restrict vision.[17,19-21] Above all, it could be concluded that in the sample studied, most individuals were in a work environment that did not encourage the use of PPE or that did not have adequate information about the need to use eye protection.

Maranhão is the state with the highest incidence of informal labor in the country with more than 672,000 workers employed in informal jobs. Formal employment according to Brazilian labor laws requires the employer to provide employees with guidance and training on the use of PPE. In addition, Maranhão has a large proportion of rural workers in family farming, mainly in the contryside. The educational profile of the economically active population over 25 years old in the state reveals that 59.4% of male workers do not have any education or only have incomplete primary education. [22] Thus, it is important to promote educational campaigns in primary care for the incentive to make use of PPE, with focus on the rural and informal workers.[21]

Most of the patients who suffered open-globe traumas were from the countryside (80%). The patients' residence could also determine the time to treatment after the injury. Most patients (45.4%) were treated within the first 48 hours after the accident. Among the patients coming from the countryside, this percentage was even higher (59.5%). Those data highlight the importance of improving accessibility to a specialized ophthalmological service in the Public Health System in Maranhão. It is known that the longer the time between trauma and specialized care, particularly in open trauma, the greater the chance of developing complications such as retinal detachment, vitreous hemorrhage and endophthalmitis. This has a significant impact on the patient's final VA. Accordingly, many studies address the importance of early identification and referral to improve patients' visual prognosis.[4,6,13]

OTS represents an important tool to estimate the visual prognosis of ocular trauma patients. Most of the studies found positive results regarding the applicability of the test even in the pediatric population. According to OTS, approximately one-third of the sample (33.77%) had a 92% chance of having a final VA greater than or equal to 20/40. While the second largest group of patients (31.16%) showed a chance of blindness (VA worse than 20/200) of up to 72%. Younger patients had better visual prognosis.

Preventing blindness and subnormal vision requires multidisciplinary measures involving ophthalmologists, epidemiologists, health educators, nurses and other health care professionals. [23] Data from the national literature demonstrate the lack of educational preventive actions related to this issue.[12] Therefore, it is necessary to include eye trauma in health education programs and audiovisual media campaigns to encourage ocular

trauma prevention in specific populations, especially among children and workers. [6,24]

Conclusion

Ocular trauma remains an important cause of ocular morbidity in childhood and in informal work. It is important to make parents aware about preventing ocular trauma in children in the home environment and during leisure activities, and about educational measures in schools to prevent accidents as well. A major monitoring of the use of PPE and orientation among professionals are also necessary, especially among rural workers, who account for one of the bases of economic activity in Brazil.

In addition to primary prevention, secondary prevention should be reassessed. A large number of patients treated in this study were from the countryside, which often delays the diagnosis and treatment of ocular trauma, influencing the patient's prognosis. An adequate primary health care and an efficient referral to the specialized services can decrease the time to treatment. To do this, it is also important to provide adequate training for health care providers including non-specialists.

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