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ORIGINAL ARTICLE

Epidemiology of open-globe trauma in the southeast of Spain

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PURPOSE. *To describe epidemiologic and clinical findings of open-globe trauma (OGT) in the southeast area of Spain.*
METHODS. *A retrospective descriptive study of 94 eyes with OGT evaluated between 1999 and 2007, in a primary referral hospital.*
RESULTS. *The incidence of OGT in our area was 6.76 per 100,000 inhabitants/year. The majority of patients were male (89%) and young (80% of patients < 50 years old), with an average age of 37 ± 20 years (mean ± SD). The most common causes and location of injury were wire-induced trauma (50%) and accidents at work (56%), respectively. The types of injury encountered were ruptures, intraocular foreign bodies, perforating injury, penetrating injury, and mixed injury. Sixty-six percent of these injuries were penetrating in zone I (55%). The injuries found were vitreous hemorrhage (33%), cataracts (47%), vitreous prolapse (30%), retinal detachment (8%), endophthalmitis (2%), and associated with a facial trauma (7%). Eighty percent of surgery was carried out under general anesthesia. Fifty-one percent of the eyes underwent one operation only (5% were enucleated). Sixty-one percent of the eyes resulted in visual acuity of less than 50%.*
CONCLUSIONS. *The incidence of OGT in the southeast of Spain is very high, being in most cases produced by accidents while using wire in greenhouses. This provokes severe monocular visual loss among the young population. (Eur J Ophthalmol 2010; 20: 578-83)*

KEY WORDS. *Eye injuries, Incidence, Observational study, Ocular trauma, Workplace*

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INTRODUCTION

Open globe traumas (OGT) are a major cause of monocular blindness, and have a strong socioeconomic impact (1). Ocular traumas are classified as open if the injury affects the complete thickness of the ocular wall (2, 3).
It is estimated that there are around 2.3 million people with bilateral low vision from injuries, and almost 19 million with unilateral blindness or low vision (1).
Ocular traumas represent the main cause of ocular globe loss. Ocular trauma is a common reason for accident and emergency consultations, involving 3% of all such consultations in Spain, although recent data are missing. It is calculated that every year, 72,000 inhabitants suffer eye injuries which lead to decreases in visual acuity. Such figures result in considerable physical, psychological, and socioeconomic burdens for the patient and society in general, since numerous studies on ocular trauma have revealed a high prevalence of OGT in young males of productive age (4-7).
Despite advances in treatment, the prognosis concerning many of these injuries continues to be negative (4, 5, 8, 9). The causes for ocular injuries vary greatly in different parts of the world, and even within the same country. As a result of this variation, having access to up-to-date epidemiologic data from different zones across the world is crucial (1).

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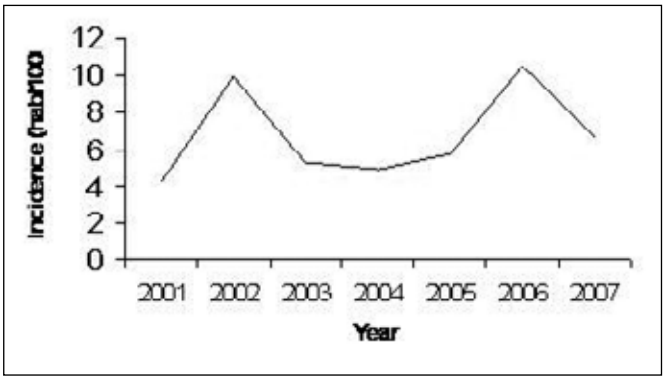

Fig. 1 - *Time course of incidence in open globe trauma during 2001–2007.*

The main difference between ocular traumas and other causes of blindness is that the majority of the former are avoidable (10).

The Hospital de Poniente in Almeria is located in the southeast of Spain and serves an average of 183,762 inhabitants per year. The main activity in the region is intensive greenhouse agriculture, which requires young persons, including immigrants.

The aim of this study is to identify the epidemiologic characteristics of OGT in the western area of Almeria. This study should contribute to the development of preventative measures in this area.

MATERIALS AND METHODS

A descriptive retrospective study was carried out with all patients diagnosed with OGT in the Hospital de Poniente. The period of the study was from June 1, 1999, to July 31, 2007. All information regarding the injury, its circumstances, and the treatment received was obtained from medical reports by the necessary hospital staff and data were recorded in a data collection book. The variables studied were nationality, age, sex, year of injury, eye affected, cause, type and zone of injury, accident which caused the injury, type of image analysis (computed tomography scan or ocular ultrasonography), tissue affected, whether the injury produced cataract, capsular rupture, dialysis, angle recession, vitreous hemorrhage, vitreous prolapse, type of anesthesia used, associated facial trauma, enucleations carried out, number of operations, and final visual acuity (FVA).

Causes were classified as wire, splinter, falling, blunt object, sharp object, and others.

Injury type and zone were described in accordance with the Birmingham Eye Trauma Terminology (BETT) (3). The OGTs were divided between ruptures (caused by a blunt object) and lacerations (usually caused by a sharp object). Lacerations were then subclassified into penetrating or perforating entrance and exit wounds and intraocular foreign bodies (IOFB). The injury zone was defined by the most posterior structure of a perforating wound (Tab. I). The tissues affected by the course of the injury are also listed: cornea, sclera, sclerocornea, or limbus.

The FVA with optical best correction is recorded between 15 days and 1 year after, depending on the severity of the injury. Visual acuity was measured in standard conditions with E from the Snellen chart, and was defined as follows: >20/40, 20/50 to 20/100, 19/100 to 5/200, 4/200 to perceiving light and failure to perceive light, in accordance with the classification used by Kuhn et al (3).

A descriptive statistical analysis was carried out using SPSS software 14.0 (SPSS Inc., Chicago, IL). The qualitative variables are presented as percentages and quantitative variables are presented as mean with standard deviation (SD).

RESULTS

A total of 94 eyes from 92 patients were studied over a period of 8 years. The mean incidence rate was 6.77 per 100,000 inhabitants/year. The time course of OGT incidence is shown in Figure 1. The sociodemographic variables are displayed in Table II. The patients were aged between 0 and 90 years. Eighty percent of patients were under 50 and 42% were immigrants.

The causes and types of accidents which resulted in the injuries are detailed in Table III. The most frequent accident type was work-related (56%), followed at a considerable distance by domestic accidents (13%). The main causes of OGT accidents at work were wire-induced (81%) and splinters (19%). Forty-one percent of such accidents at work affected members of the immigrant population. The most frequent cause of OGT in domestic accidents was falling (58%). Fifty-eight percent of domestic accidents involved people aged 50 or over, and 25% involved people younger than 10.

Wire is the most frequent cause of OGT in the population aged 19–45 (74.5%), while 70% of OGT injuries caused

as the result of a fall involved patients aged 50 years or over. Of these, 50% were in individuals aged over 65. The type of mechanism, injury area, and the tissues affected are detailed in Table IV. The most frequent mechanism was a penetrating injury (72%) in zone I (73%) and the most common wound was corneal (55%).

The clinical aspects of wounds are shown in table V. The most frequent complications were cataract (47%), vitreous hemorrhage (33%), and vitreous prolapse (30%).

We found 2% of endophthalmitis and enucleation was performed at 2%.

FVA was recorded at >0.5 in 39% of all cases (Fig. 2), although 45% had visual acuity of <0.1. We have analyzed the relationship between the type of injury and FVA. Penetrating injuries were significantly associated with a better visual acuity (odds ratio [OR]=3.18 [95% CI; 1.28–7.89]; p=0.01). Prolapsed vitreous was observed in 69.23% of ruptures of the globe and 25.80% of penetrating injuries. Interestingly, the absence of vitreous prolapse was significantly associated with a better FVA (odds ratio [OR]=0.2255 [95% CI; 0.10–0.68]; p=0.006).

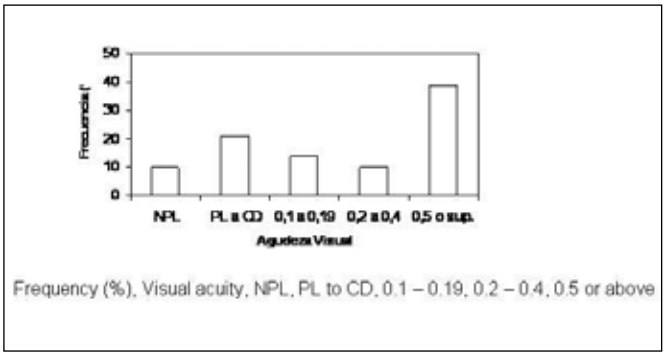

Fig. 2 - *Final visual acuity.*

DISCUSSION

The data confirmed that the most common cause of OGT in this area is wire penetration at work. The pattern of eye injuries in the region reflects the occupations of its inhabitants (1).

Greenhouse agriculture is one of the main production sectors in the Almeria region (Spain). Wire is a commonly used material in greenhouses for padding the floor and assembling plastic sheets and tunnels. The use of protective glasses is recommended in order to avoid the risk of knocks or punctures through tools or dangerous surfaces. It would be necessary to implement a health education program to promote the use of protective glasses.

This study confirmed that the majority of OGT injuries happen at work (56%), followed by home accident (13%), as

TABLE I - TYPE OF INJURY AND AFFECTED OCULAR ZONE

Types of mechanical ocular trauma			**Zone**		
			I	**II**	**III**
Open (full-thickness wound)	Rupture (caused by a blunt object)		Cornea	Sclera (from the corneoscleral rim to 5 mm)	Sclera (behind zone II)
	Laceration (usually caused by a sharp object)	Penetration			
		Perforation			
		IOFB			
Closed	Contusion		External eye wall (bulbar conjunctiva, sclera or cornea)	Anterior segment injury (including the crystalline lens and pars plicata)	Posterior segment
	Laceration				
	Superficial foreign body				

TABLE II - SOCIODEMOGRAPHIC CHARACTERISTICS

Characteristics	Values
Age, y, average ± SD	37.34±20
Sex, %	
Male	90
Female	10
Nationality, %	
Spanish	59
Maghrebi	12
Sub-Saharan	2
Eastern countries	15
Other nationalities	12

TABLE III - CAUSES AND TYPES OF ACCIDENTS THAT CAUSED THE INJURIES

	No. (%) of patients
Cause	
Wire	51 (44)
Splinter	8 (7)
Fall	9 (8)
Blunt object	16 (14)
Sharp object	12 (10)
Others	3 (3)
Accident	
Work-related	55 (49)
Domestic	11 (10)
Aggression	17 (15)
Traffic	4 (3)
Sport	1 (1)
Children's games	5 (4)

TABLE IV - MECHANISM, ZONE, AND TISSUES AFFECTED BY INJURY

Variable	Frequency, %
Type	
Rupture	15
Penetration	72
Intraocular foreign body	12
Perforation	1
Zone	
I	73
II	15
III	12
Injury	
Corneal	55
Scleral	20
Corneoscleral	6
Limbic	19

TABLE V - CLINICAL ASPECTS

Variable	Frequency, %
Eye	
Right	40
Left	56
Vitreous hemorrhage	33
Iris dialysis	6
Angle recession	0
Cataract	47
Capsular rupture	41
Vitreous loss	30
Detached retina	8
Endophthalmitis	2
Associated facial trauma	7
Cat	81
Ocular eco	14
Anesthesia	
General	88
Local	2
Topical	1
Enucleation	5
No. of operations	
0	7
1	51
2	38

CT = Computed tomography; Ocular eco = ocular ultrasound.

had been reflected by other studies (5, 6, 7). Nevertheless, our result does not support that the home is the most frequent setting for ocular accidents, as reported first in a previous study (4), and later confirmed by others (11, 12). In Spain, most studies were carried out before 1995, with a national multicenter study identifying the most frequent cause of ocular traumas to be work-related.

The average annual OGT incidence rate for this region (6.76 per 100,000 inhabitants/year) is much higher when compared to data obtained in similar studies concerning other parts of the world: 3.7 in northeast Australia (Queensland) between 1995 and 2002 (13), 3.9 in southern Australia between 1994 and 1998 (14), and 3.3 in a western part of Sweden from 1989 to 1991 (15).

Our results are in agreement with the majority of studies published: young male adults present a higher risk of ocular trauma. Those who have a higher risk of OGT are males (89%) between the ages of 18 and 45 (5, 8, 14, 16). However, causes, type of injury, and visual prognosis vary among the age groups.

Twenty-two percent of OGT patients are from the Maghreb or other eastern countries, since the greenhouse generate a large number of jobs for untrained.

The variables defined by the BETT system have been used to make it easier to draw comparisons between different studies (2, 3). The most frequent type of injury is penetration (72%). Wire is responsible for 96% of penetrating wounds. In contrast, rupture injuries tend to be the result of falls or a blunt object impact.

The most common injury type is penetration, while the most frequent injury zone is the cornea. These findings have also been observed in other studies, despite the fact that a recent study in Egypt found ruptures to be the most common type of injury in OGT cases (17). The clinical aspects are more difficult to compare, given the large degree of diversity among the different studies.

In our study, the rupture was the type of injury with the worst visual results. This was a predictable finding since rupture is a predictive factor for poor visual outcome according to the American Society of Ocular Trauma Score (18). This scoring system also includes other variables for lower visual outcome such as detached retina and endophthalmitis (6 and 1 cases, respectively, in penetrating injuries in our study). These could explain the poor visual results of some penetrating injuries. However, we found that the absence of vitreous prolapse was a predictor of good final visual acuity.

In spite of advances made in the treatment of such injuries, a large percentage of patients are left legally blind (with visual acuity of less than 0.1) as a result of such injuries (4, 8, 14, 17, 19). A FVA of 0.5 or above was found in 39.4% of patients, while visual acuity of less than 0.1 was found in 44.7%.

One of the limitations of our retrospective study is that the initial visual acuity and the afferent pupillary defect was not always detailed in the clinical record.

These data reflect the necessity to increase the efforts to prevent these type of accidents, with future studies being required to implement preventive actions in this field.

Most cases of OGT produced in the western area of Almeria are caused by accidents while using wire in greenhouses. This provokes severe monocular visual loss among the young population.

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