ORIGINAL ARTICLE

Patterns of Ocular Trauma Presenting to the University Hospital of the West Indies in Jamaica

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ABSTRACT

Objective: *The purpose of this study is to identify the causes of ocular trauma, determine the groups at risk and types of injuries presenting to the Eye Unit at the University Hospital of the West Indies.*

Method: *A prospective observational study was done over a 14-month period on trauma related referrals to the ophthalmology department. A questionnaire was administered and data were collected on the patient's age, gender, affected eye, aetiology and location of trauma, visual acuity and intra-ocular pressure (IOP). Statistical analysis was performed using STATA.*

Results: *There were 84 eyes of 80 patients, of which 71.3% were males and 28.7% were females. The ages ranged from 3–64 (mean 31.2 ± 15.1) years. The highest incidence of trauma was seen in the 18–35-year age group (41.3%). Males had an odds ratio risk of 1.37. Blunt trauma occurred in 35.7% of cases and penetrating trauma in 33.3% of cases. The highest incidence of eye injury occurred at home (47.5%) followed by the workplace (25.0%), then road traffic setting (13.8%). Assault-related eye injury was seen in 17.5% of cases and 62.5% of all injuries were accidental. The rate of hospitalization was 40.5%, of which 85.3% were males while 14.7% were females. Previous trauma in the affected eye occurred in 14.3% of cases.*

Conclusions: *Males have a high odds risk ratio of ocular trauma. The majority of eye injuries occur in the home environment. Most injuries were accidental and could be avoided with the use of eye protection or care with interpersonal and work-related activities.*

Keywords: Blunt trauma, eye injuries, Jamaica, ocular trauma, University Hospital of the West Indies

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INTRODUCTION

Ocular trauma is a leading cause of preventable monocular blindness worldwide and is a serious public health concern in developed and developing countries (1). In a research programme for the prevention of blindness, the World Health Organization (WHO) estimated that 55 million eye injuries occur yearly, of which 750 000 people require hospitalization (2). There are ~2.4 million eye injuries annually in the United States of America [USA] (3). Population based studies in the USA have reported eye injury as the third most common indication for hospitalization in emergency departments, and the National Society for the Prevention of Blindness estimates that up to 90% of all eye injuries are preventable, especially in the paediatric age group (4–6). Ocular injuries may also be associated with other injuries including facial fractures, in which case severe visual impairment may occur (7).

The impact of ocular trauma is a major cause for concern due to its devastating effects on the individual as well as the burden it places on the socio-economic and health resources of any nation. Epidemiological studies in our environment are necessary to determine the causes of ocular trauma so that strategies to prevent or reduce their occurrence are implemented. This study was conducted to identify the aetiology and nature of ocular trauma affecting our population, including the groups at risk, visual outcome and the need for hospitalization or surgery in our setting.

SUBJECTS AND METHODS

This is a prospective study of 80 patients referred to the ophthalmology division of the University Hospital of the

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West Indies (UHWI) during a 14-month period. Consecutive subjects who were referred to the eye unit with eye injury were invited to participate in the study and were included once written consent was obtained.

Data were collected on patient's age, gender, affected eye, aetiology of trauma, place of trauma, use of eye protection, imaging studies done, surgical intervention, visual acuity and intraocular pressure (IOP) at presentation, at three months and length of follow-up. Additional ocular and non-ocular injuries, the need for combined sub-specialty management and additional ocular imaging were recorded. The study was approved by the University Hospital of the West Indies/University of the West Indies/Faculty of Medical Sciences Ethics Committee. Confidentiality and anonymity were maintained and the study was conducted according to the guidelines of the Declaration of Helsinki. Results were analysed using statistical analysis from STATA 12.0 software and correlations using various statistical methods were reported.

RESULTS

A total of 84 eyes of 80 consecutive subjects comprised this study.

Age and gender distribution

The study group included 57/80 (71.3%) males and 23/80 (28.7%) females, with > 2.5:1 ratio of male to female incidence of eye injury. The ages ranged from 3–64 (mean 31.7 ± 15.1) years. The females ranged in age from 3–56 (mean 29.4 ± 16.2) years, while the males ranged in age from 9–64 (mean 32.6 ± 14.8) years. The subjects were categorized into three age groups: < 18 years old (21.4%), 18–35 years old (38.1%) and > 35 years old (40.5%). On further analysis, no significant differences in association was found between age group and gender (Chi-squared 0.451, $p = 0.502$). Males experienced more ocular trauma than females in all age groups except in the < 18-year old group (Fig. 1).

The risk ratio of males developing ocular trauma compared to females was 1.32 (95% CI 0.37, 4.78, $p = 0.669$). Adults in the age group 18–35 years had an odds ratio of 1.35 ($p = 0.700$) for developing ocular trauma when compared to those < 18 years old, and the > 35-year age group had an odds ratio of 1.23 [$p = 0.793$] (Table 1).

Aetiological agents of eye injury

The majority (21.4%) of injuries were caused by blunt objects (Fig. 2). These were of various sizes and materials including plastic bottles, a mobile phone, stones and a belt buckle. Road traffic accidents caused 13.1% of injuries which resulted from broken side mirrors and windscreens (Fig. 2). Vegetative and plant matter such as sticks, wood and tree branches resulted in 12 (14.3%) eye injuries. There was a similar incidence of chemical and thermal aetiological agents causing injury (9.5% each). Two patients sustained bilateral thermal injury after a microwaved egg exploded. Chemical injuries were caused by battery acid, household bleach and cement in its powdered or mixed forms. There was one incidence of injury due to a gunshot wound.

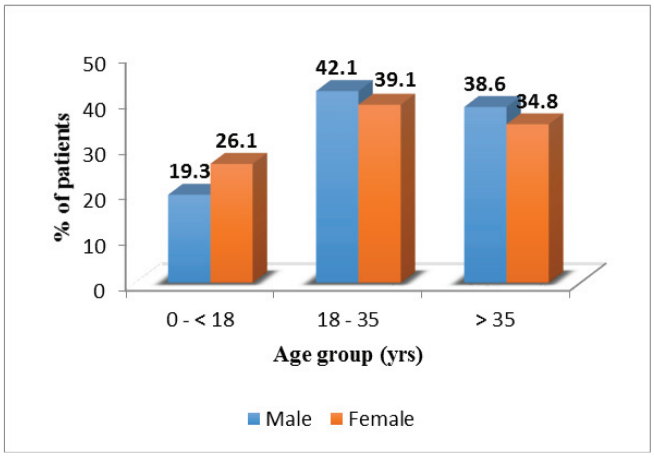

Fig. 1: Age and gender distribution of the sample population.

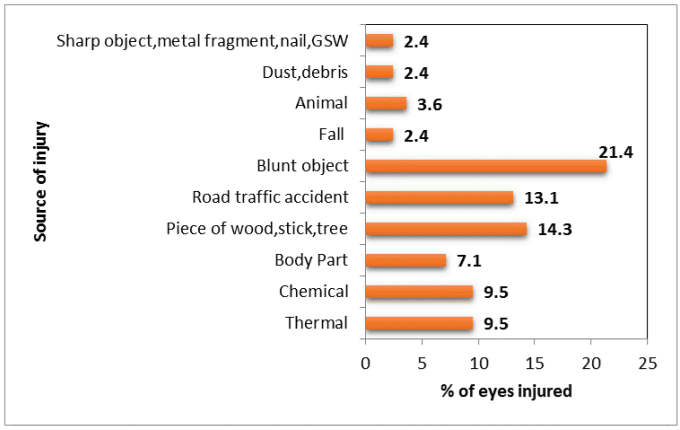

Fig. 2: Aetiological agents causing eye injury.
GSW: gunshot wound

Table 1: Logistic regressions adjusted for age and gender

Characteristics	Number of eyes n (%)	Odds ratio	95% confidence interval	*p*-value
Gender, male		1.32	(0.37, 4.78)	0.669
Age (years)				
Paediatrics (< 18)	18 (21.4%)	1.00	–	–
18–35	32 (38.1%)	1.35	(0.29, 6.20)	0.700
Over 35	34 (40.5%)	1.23	(1.25, 5.97)	0.793

Injuries related to road traffic accidents accounted for a significant proportion of eye injuries and all age groups were susceptible; 13.75% of ocular injuries sustained occurred from road traffic accidents (Fig. 3). Seatbelts were not used in 72.7% of the road traffic accidents. They were only used in three out of 11 road traffic accident-related cases (Table 2). Road traffic accidents were more frequent in males than females with an almost 1.75:1 ratio and resulted in penetrating injuries in 81.8% of cases, with the exception of only two students < 18 years old. However, the 18–35-year age group was most affected in the road accident setting (24.2%), where only 27.3% of passengers had the required seatbelts in use.

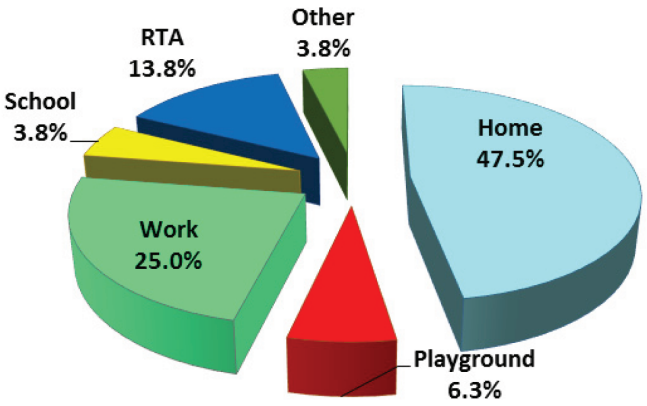

Fig. 3: Location of where the ocular injury occurred.
RTA: road traffic accident

Table 2: Characteristics of eye injury in 84 eyes of 80 patients

Gender	0 – < 18 years	18 – 35 years	> 35 years
Male, n (%)	11 (64.7)	24 (72.7)	22 (73.3)
Female, n (%)	6 (35.3)	9 (27.3)	8 (26.7)
Location of injury			
Home, n (%)	10 (58.8)	11 (33.3)	17 (56.7)
Playground, n (%)	3 (17.7)	1 (3.0)	1 (3.3)
School, n (%)	1 (5.9)	2 (6.1)	0 (0)
Work, n (%)	1 (5.9)	8 (24.2)	11 (36.7)
Road traffic accident, n (%)	2 (11.8)	8 (24.2)	1 (3.3)
Other, n (%)	0 (–)	3 (9.1)	0 (0)
Intent of injury			
Assault, n (%)	4 (23.5)	5 (15.1)	5 (16.7)
Accidental, n (%)	13 (76.5)	22 (66.7)	15 (50.0)
Self-inflicted, n (%)	0 (–)	6 (18.2)	10 (33.3)
Eye protection			
Not required, n (%)	16 (94.1)	22 (66.7)	19 (63.3)
Required, n (%)	1 (5.9)	11 (33.3)	11 (36.7)
Seatbelt			
Not required and not used, n (%)	15 (88.2)	24 (72.7)	30 (100.0)
Required and not used, n (%)	1 (5.9)	7 (21.2)	–
Required and used, n (%)	1 (5.9)	2 (6.1)	–
Hospitalization			
Yes, n (%)	8 (47.1)	13 (39.4)	8 (26.7)
No, n (%)	9 (52.9)	20 (60.6)	22 (73.3)

Location of injury

The highest incidence of eye injury occurred at home (47.5%), followed by the workplace (25.0%); eye injury related to road traffic accidents accounted for 13.8% (Fig. 3). Blunt trauma (18/38; 47.3%) was the cause of most injuries occurring at home, while penetrating injuries occurred in 31.6% [12/38] (Fig. 4). Thermal and chemical corneal burns also occurred at home. There were two cases of intraocular foreign bodies (IOFB) at home in which eye protection was not used whilst hammering nails.

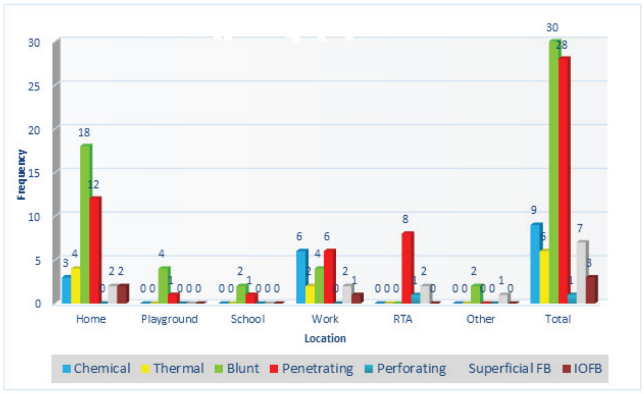

Fig. 4: Distribution of injury by location and type.
RTA: road traffic accident; IOFB: intraocular foreign body

Males (23/38; 60.5%) were more likely to suffer ocular injuries at home than females (15/38; 39.4%). The use of eye protection was required at home in 10 cases (26.3%) and at work in 12 cases (63.2%), but was not used. More than half of the population > 35 years old (56.7%) and < 18 years old (58.8%) suffered eye injury at home, followed by 33.3% in the 18–35-year age group (Table 2).

Type of injury

Eye injuries included blunt trauma (30/84; 35.7%), penetrating injury (28/84; 33.3%), corneal burns (thermal burns (6/84; 7.1%) and chemical burns (9/84; 10.7%)), perforating injury (1/84; 1.2%) and intraocular foreign body (IOFB) in 3.6% (3/84) of cases (Fig. 5). There was one anterior segment IOFB (in the lens) and two posterior segment IOFB (within vitreal cavity), and seven non-penetrating superficial foreign bodies (7/84) in 8.3% of cases. Males were more likely to sustain a penetrating than blunt injury when compared to females, risk ratio of 1.12.

Type of injury and intraocular pressure

Blunt trauma was the most common injury, occurring in 35.7% of cases, whilst penetrating injury occurred in 33.3% of cases (Fig. 5). The mean intraocular pressure (IOP) at presentation was 15.5 ± 6.7 mmHg (range 7–42 mmHg).

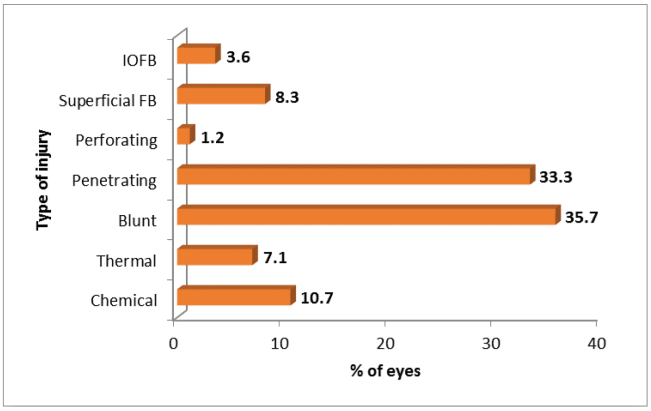

Fig. 5: Type of injury.
IOFB: intraocular foreign body; FB: foreign body

Three injured eyes had elevated IOP on presentation with values of 35, 38 and 42 mmHg, all resulting from blunt trauma. Of these, two were hospitalized and required surgical intervention. Blunt trauma showed a higher incidence of elevated IOP, 13.3% *versus* 3.6% (penetrating). Patients suffering from blunt trauma eye injuries were more likely to present with visual acuity of count fingers or worse due to hyphaema formation. The mean IOP on discharge was 13.7 ± 6.2 (range 2–35) mmHg.

Visual acuity

The mean LogMAR visual acuity on presentation in the affected eye was 1.05 ± 1.15. The mean visual acuity on discharge was 0.74 ± 1.09. Younger patients were more likely to have better visual acuities on discharge. In the < 18-year age group, the mean LogMAR vision on discharge was 0.66 ± 1.06 compared to 0.75 ± 1.10 in adults.

Intent of injury

Assault-related eye injury was seen in 17.5%, accidental in 62.5% and self-inflicted in 20% of cases (Fig. 6).

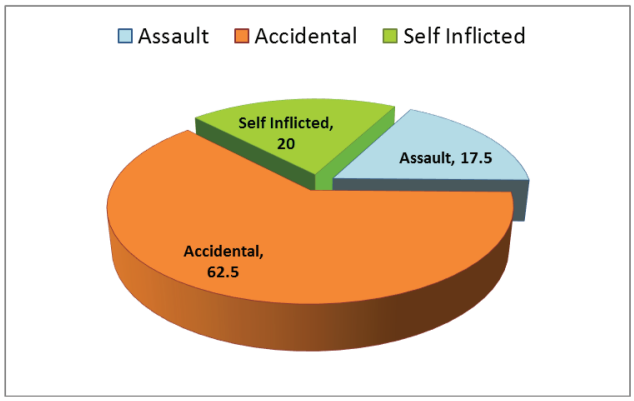

Fig. 6: Percentage of patients according to intent of eye injury.

Incidence of hospitalization associated with type of injury

The incidence of hospitalization for ocular trauma was 40.5% and this was associated with penetrating (58.8%), blunt (17.6%), thermal (11.8%), and perforating (8.8%) injuries. Males were hospitalized in 34.5% of cases and female admissions were 14.7%. Younger patients were more likely to have an injury requiring admission. Hospitalization was most common in the < 18-year age group (47.1%), than the 18–35 years age group (39.4%) and those > 35 years old [26.7%] (Table 2). Males were more likely to be admitted than females, in a 4:1 ratio.

Surgical intervention was required in 45.2% (38/84) of eye injuries compared to 54.8% (46/38) of cases which were treated conservatively. Additional ocular injury was observed in nine of 84 cases. Additional imaging was required in 27 cases (32.14%) and the most frequent single imaging studies utilized were X-ray imaging (15.5%), B scan ultrasound (7.1%) and computed tomography (CT) scan in 3.6% of cases. Combined imaging (two or more) was utilized in 5.6% of cases.

Previous vision and trauma in affected and fellow eye

Abnormal vision in the affected eye before presentation was reported in 10.7% of subjects and previous trauma to the affected eye was 14.3% (12 of 84 eyes). Regarding the fellow eye, only 3.4% of patients had sustained previous eye injury.

DISCUSSION

Ocular trauma has been investigated in many population-based studies in the USA and Canada as well as the United Kingdom and Australia (8–12). There is a geographical variation in the cause of ocular injury which is age and gender specific (8, 9, 13–15). Studies from different regions (4) such as the Caribbean (8, 9) Singapore (13) and India (14, 15) demonstrate variations in the characteristics, incidence and prevalence of ocular trauma. These variations emphasize the influence of different methods of data collection, socio-economic factors and industrialization of a population on the epidemiology of eye trauma.

Another factor worth considering is the inclusion criteria used in any given study to define ocular trauma. In our study, this was interpreted as any injury to the eye and adnexa which led to an emergency ophthalmology referral. Other definitions include: injuries which result in the restriction of an individuals' normal activities for at least one day, injuries which result in, or threaten permanent visual loss and structural changes, or a recent injury which causes a patient to seek medical attention (16, 17).

Some methods used in the literature for data collection include surveys *via* telephone interviews (17, 18), the review of emergency department records (10) and hospital discharge statistics (13, 19, 20), each of which has advantages and

disadvantages. In this study, we utilized patient interviews similar to the method described in one study by Khatry *et al* (16). Such methods tend to be more accurate than data from emergency departments which tend to be biased toward much more severe injuries. Also, discharge data information is dependent on the specific coding utilized for the patient's injury which is limited in cases of multiple trauma to fewer (one or two) diagnoses (16).

The present study demonstrates that Jamaican males are more susceptible to eye injury than females, irrespective of their age. There was a male predominance with a male:female ratio of 2.5:1 which is similar to earlier studies (8, 9). This was comparable to other studies varying between 1.74 and 5.5 (4, 6, 11, 16, 17, 21). The highest incidence of ocular trauma occurred in the 18–35-year age group. This concurs with other studies but some authors also describe a bimodal pattern where an increased incidence is observed in the 25–30-year age group (first peak), and the second peak incidence is seen after 70 years (13, 19).

Blunt injuries were the most frequent type of injury and resulted in severe ocular injuries such as hyphaema, ruptured or dislocated lens, vitreous haemorrhage, secondary glaucoma and rhegmatogenous retinal detachment. This was different from an earlier study where 50% of ocular injuries were open globe and 29.8% were from blunt trauma in hospitalized adults with ocular injuries (8). In the present study, one patient presented with a retinal detachment and had a final visual outcome of no perception of light. Blunt trauma showed a higher incidence of elevated IOP, 13.3% *versus* 3.6%, when compared to penetrating trauma, and cases with blunt trauma were more likely to present with severe visual impairment (visual acuity worse than counting fingers). There was a high association between blunt trauma and the need for hospitalization.

Hyphaema as a result of ocular injury can be a concern due to the presence of the sickle cell gene in 10% of the Jamaican population (22). Mowatt and Chambers previously reported that 45.4% of Jamaican patients presenting with hyphaema had elevated IOP > 21 mmHg; of these, 18% had the sickle cell trait (23). This condition makes them more prone to glaucoma due to the sickling of the red blood cells, which blocks the trabecular meshwork. Further, the use of carbonic anhydrase inhibitors is contraindicated due to the risk of precipitating a sickling crisis. Of the sickle cell patients in that study, 80% had elevated IOPs of between 29 and 64 mmHg on presentation (23). Management for these cases can be difficult and may result in surgical intervention to control the glaucoma. In the present study, we did not collect data on sickle cell status.

The highest incidence of ocular trauma in Jamaica occurs at home followed by the work place, then road traffic accidents. The domestic setting produced all types of trauma, but blunt and penetrating injuries were the most frequent types of injuries occurring in the home. This correlation was also seen in studies by Desai *et al* and Khatry *et al* (11, 16). In the paediatric age group, our study reports and agrees with the literature that the majority of injuries occurred at home and could be avoided with supervision (4, 8, 9, 24). These important trends highlight the need for prevention strategies to increase public awareness and re-emphasize the use of protective eyewear within the high-risk groups in the population while engaging in common domestic activities which can likely cause eye injury. These trends also indicate that further efforts are still required in our population to regulate the availability and use of effective eye protection in the workplace setting. Stricter penalties for non-compliance should be enforced to ensure good practices amongst workers. Estimations by Dannenberg *et al* suggest that less than 10% of injured workers used adequate protective eyewear at the time of injury (25).

Penetrating injuries are also a significant public health problem, frequently caused by sharp objects, metal fragments, pieces of wood and glass fragments. In other studies, metallic and sharp objects were more frequently the cause of eye injuries in males, while females showed a higher risk of blunt trauma (21, 26). In the present study, 33.3% of patients had penetrating injury compared with 1.9–9.2% in other studies (11, 12, 16, 27).

These findings may be attributed to less strict seatbelt enforcement laws in our environment. Also, this study was conducted in the capital city of Kingston where students and the majority of the adult workforce (18–35-year age group) commute daily from the rural areas *via* public and private transportation and they are equally susceptible to injury. The use of seatbelts has been shown to prevent ocular injuries and reduce the risk of mortality. In developed countries, legislation along with close surveillance *via* closed circuit systems encourages this practice (28, 29). In our environment, stricter enforcement regulations will decrease the incidence of severe ocular trauma in all age groups.

Ocular trauma related to assault was reported between 9.2 and 16.3% in the literature reviewed and, similar to our study, was mostly associated with body parts and blunt objects (6, 27). In our paediatric group, injury was seen in the domestic and road traffic setting. Suggestions for ways to improve and resolve interpersonal conflicts can reduce the incidence of ocular trauma. Awareness of the causes of ocular trauma and implementation of preventative strategies can help the reduction of serious ocular trauma (30).

Trauma registries have a purpose in collating essential public health information which can be analysed and the results used in planning and policy-making, ultimately reducing morbidity (3, 25, 31). This would be helpful both for developing countries and also on an international scale with an international trauma databank ultimately allowing countries to have global benchmark data, with the aim of improving our trauma care systems and prevention policies (32).

The majority of eye injuries in Jamaica occur at home and are preventative. Public education campaigns must be

aimed at the groups at risk identified in this study as they form the majority of the working population and are directly related to the productivity and socio-economic growth of the island. A reduction in ocular trauma will reduce permanent visual impairment, leading to a significant reduction in the burden on the health services of the island.

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Author contributions

Study design and questionnaire: LM; collection of data: JNI; analysis of data: JNI, LM; statistical analysis and construction of tables: JNI, CAW, LM; wrote paper: JNI, LM.

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