

Characteristics of eye injuries in urban KwaZulu-Natal Province, South Africa: 2005-2008

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Abstract

Purpose: To provide epidemiological data on ocular injuries among patients utilising the provincial hospitals eye care clinics in urban KwaZulu-Natal, South Africa. This data can be used in the future planning and intervention for ocular injuries at provincial hospitals.

Methods: Record cards of 220 ocular injury patients seen at two selected urban provincial hospitals over a period of four years were reviewed.

Results: Male presentation was higher (79.1%) compared to females (20.9%). The Black population (85.9%) experienced more ocular injuries than other race groups. The 21 to 30 age group incurred more injuries (32.3%) than other age groups. Open globe injuries occurred more frequent (56.4%) than closed globe injuries (43.6%). The frequent type of

injury was blunt trauma/contusion (32.7%). More than half of the injuries were from solid objects (56.4%) followed by assaults (16.4%). The home was the common place to incur an injury (72.2%). Twenty four patients (10.9%) required surgical intervention at initial presentation. One hundred and fifty eight (71.8%) patients returned for follow up examination. Twenty five percent of the patients remained with poor vision following treatment.

Conclusion: Ocular trauma due to burns is usually bilateral while that due to blunt trauma and intra ocular foreign bodies are generally unilateral. Solid objects were the most frequent cause of ocular injury and injuries due to this cause were most often incurred in the home. (*S Afr Optom* 2013 72(3) 119-126)

Key words: Protective device, ocular injury, prevention

Introduction

Ocular injuries remain a significant global health problem (19 million cases of unilateral blindness)¹. A greater number of ocular injuries occur in the workplace which could be related to a higher risk for ocular injury in work environments². For instance, industrial activities are the main causes of ocular injuries in more developed communities. The total

cost to society from ocular trauma is due to a loss of income and the cost of rehabilitation services¹. It is therefore not surprising that interest in the epidemiology of ocular injuries has grown over the past few years due to an increased awareness of the significant impact that ocular injuries have on long term visual disability and the economics of health care especially in developing countries^{1,3}. A limited number of general surveys in ocular trauma appear in

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the ophthalmic literature in South Africa. Therefore, the aim of this study was to provide characteristics of ocular injuries among patients utilising the urban provincial hospitals in KwaZulu-Natal province, South Africa. The current paper only focuses on patients who presented at urban hospitals with ocular injuries whereas our previous paper (see *S Afr Optom* 2012 71(4) 159-165) focused on patients who presented at rural hospitals only. However, both papers were aimed at identifying the characteristics of eye injuries in the KwaZulu-Natal province.

Materials and methods

This study used a quantitative retrospective study design. The study population comprised patients who presented at the eye clinics during the period of January 2005 - December 2008. Cases were analyzed with respect to demographics, place and nature of trauma, type of injury and visual outcome. The proposal for this study was approved by the Biomedical Research and Ethics Committee of the University of KwaZulu-Natal (HSS/0095/10M). Record cards of 220 patients who presented at eye clinics of two urban provincial government hospitals were randomly selected and reviewed.

All patients who presented to the hospital with ocular injuries within the specified four years, both genders, all race groups and all age groups were included in the study. The data was captured and analyzed using the Statistical Package for Social Sciences (SPSS) in consultation with a statistician. The Chi square test, Fisher's exact test and the McNemar-Bowker test were used when appropriate. Statistical significance was set at a 95% confidence level and the *p*-value of 0.05 was selected.

Results

Demographics

The record cards reviewed included those of 174 (79.1%) male and 46 (20.9%) female patients and their ages ranged from 1-89 years with a mean of 29 years \pm 16.82. The sample comprised of 189 (85.9%) Blacks, nine (4.1%) Coloureds, 20 (9.1%) Indians and two (0.9%) Whites. The 21 to 30 age group incurred more injuries (32.3%), followed by the 31

to 40 age category (17.7%) and then the 0 to 12 age group (15.9%). There were few patients (4.1%) over 65 years as illustrated in Figure 1.

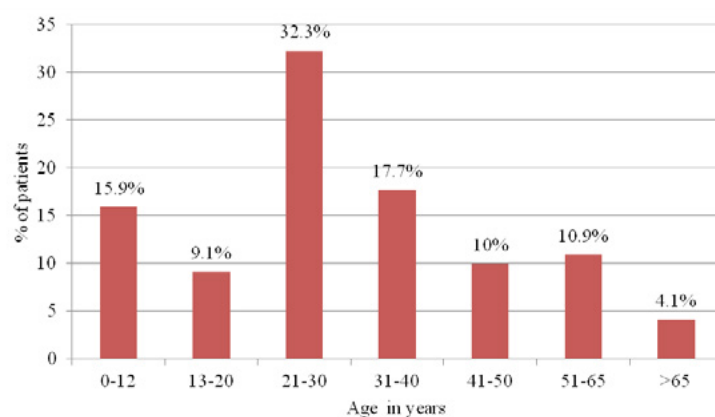


Figure 1. Age distribution of patients

Type of ocular injuries

Open globe injuries constituted 56.4% and closed globe injuries were 43.6% classified using the Birmingham Eye Trauma Terminology (BETT)³. The injuries are further subdivided into types of injury, blunt trauma 32.7%, lacerations 24.1%, intra ocular foreign bodies (IOFBs) 18.2%, penetrating 14.1% and burns 10.9%.

The patients who were in the 21 to 30 age group had more injuries (32.3%, *n*=71). Lacerations and IOFBs had an equal number of cases in the age category of 0 to 12 years (25.7%, *n*=9/35). Each type of injury occurred more amongst males except for blunt trauma (33.7% vs. 42.3% of females *versus* males, respectively) as illustrated in Figure 2.

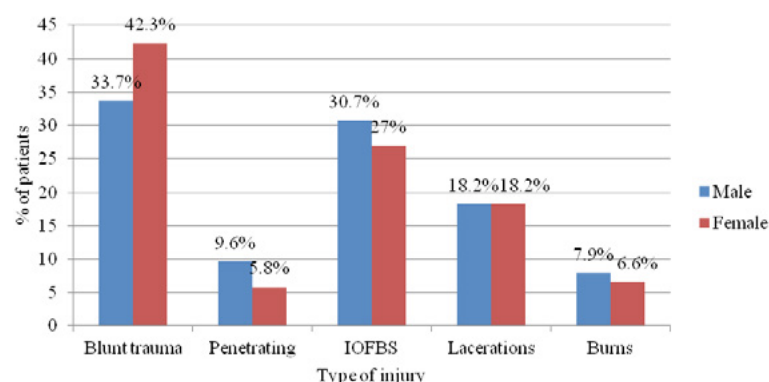


Figure 2. Types of injuries in relation to gender of the patients

Laterality

Unilateral injuries were more frequent than bilateral

injuries (94.5% versus 5.5% respectively). Bilateral injuries were from burns and blunt trauma (37.5% and 2.8% respectively). Burns tended to present bilaterally while blunt trauma and IOFB injuries tended to be more unilateral and this association between the type of injury and laterality was found to be significant ($p<0.001$; Fisher's exact test).

Place of injury

More ocular injuries were incurred in the home (72.2%), followed by the industrial workplace (9.5%), social environment (7.3%), commercial workplace (4.5%), agriculture (3.2%) and sport field (2.7%). The 21 to 30 age group incurred more injuries in industry (47.6%) and in the home (30%). A significant percentage of injuries were also found in the 0 to 12 year age group (21.3%) in the home. Males experienced more home related injuries compared to females (79.1% versus 20.9%, respectively). The association between place of trauma and gender was found to be insignificant ($p=0.472$; Fisher's exact test). Blacks sustained more injuries in the home (72.5%) while Indians, Coloured and Whites had an equal number of ocular injuries in the industrial workplace (4.8%).

Cause of injury

Solid objects such as metal pipes, metal rods, stones and broken glass (56.4%) were common causes of injury. Solid objects were the most frequent cause of injury appearing in excess in all age groups (56.4%) followed by assaults (16.8%). All the causes of injuries were frequent in the 21 to 30 age group.

All causes of ocular injuries were found to be equally common among Blacks. However, thermal burns was the frequent cause of injury among Indians (15%, $n=3/20$), among Coloureds it was solid objects (5.6%) and among Whites it was chemical burns (6.7%).

The frequent cause of injury across all possible places of ocular trauma was solid objects. Assaults were more frequent within the home as compared to outside the home (73% versus 27%, respectively). The majority of the ocular injuries caused by solid objects were more common in the home. The cause of injury was significantly related to the site of injury

($p<0.001$; Fisher's exact test).

Treatment

On presentation, 196 (89.1%) patients received medication as a form of treatment for their injuries and in the remaining 24 patients (10.9%) surgical management was required. The majority of the patients with blunt trauma were treated with medication on initial presentation (93.1%, $n=67/72$). The exact medication used was not ascertained. Surgery was marginally more frequently required on patients that had lacerations (37.5%) compared to the other causes of injury. Out of the total number of surgeries performed (Table 1), 51.4% were corneal repair/graft and were mostly done on patients with lacerations (64.5%).

Table 1. Types of injuries (in % and numbers (n)) in relation to the treatment strategy at initial presentation to the hospital

	Medication	Surgery	Total
Type of injury			
Blunt trauma	34.2 (67)	20.8 (5)	32.7 (72)
Penetrating	11.7 (23)	33.3 (8)	14.1 (31)
IOFBs	19.4 (38)	8.3 (2)	18.2 (40)
Lacerations	22.4 (44)	37.5 (9)	24.1 (53)
Burns	12.2 (24)	-	10.9 (24)
Total	100 (196)	100 (24)	100 (220)

Table 2 shows the type of injury in relation to the type of surgery for patients who had to undergo surgical intervention. The majority of the patients with blunt trauma (35.3%) had traumatic cataract removal. The 21 to 30 age group had the most number of surgical procedures performed (35.1%) as well as traumatic cataract removals (25%).

Follow-up

In the entire sample, 71.8% (158) returned for follow-up examination while 28.2% ($n=62$) were non-compliant and failed to return for scheduled follow up treatment. Follow-up was more frequently observed in patients who had incurred lacerations (81.1%) and blunt trauma (70.8%). The exact reasons for non-compliance could not be ascertained.

Table 2. Types of injuries (in % and numbers (*n*)) in relation to type of surgery for patients who had to undergo surgical intervention

	Corneal repair/graft	Segment reconstruction	Retinal surgery/vitreotomy	Traumatic cataract removal	Suturing	All types
Type of injury						
Blunt trauma	17.6 (3)	23.5 (4)	5.9 (1)	35.3 (6)	17.6 (3)	100 (17)
Penetrating	50 (9)	-	16.7 (3)	27.8 (5)	5.6 (1)	100 (18)
IOFBs	33.3 (1)	33.3 (1)	-	33.3 (1)	-	100 (3)
Lacerations	64.5 (20)	3.2 (1)	-	-	32.3 (10)	100 (31)
Burns	100 (5)	-	-	-	-	100 (5)
Total	51.4 (37)	6.9 (5)	5.6 (4)	16.7 (12)	19.4 (14)	100 (74)

Table 3. Types of injuries (in % and numbers (*n*)) in relation to visual outcome

Type of injury	Blunt trauma	Penetrating	IOFB	Lacerations	Burns	Total
Visual acuity						
6/12 or better	14.9 (7)	10.6 (5)	25.5 (12)	29.8 (14)	19.1 (9)	100 (47)
6/15-6/60	25 (5)	15 (3)	25 (5)	25 (5)	10 (2)	100 (20)
<6/60	30.4 (7)	21.7 (5)	8.7 (2)	26.1 (6)	13 (3)	100 (23)
Total	21.1 (19)	14.4 (13)	21.1 (19)	27.8 (25)	15.6 (14)	100 (90)

Admission and non admitted cases

Non-admission was more frequent than admission (64.1% versus. 35.9%, respectively). If patients were admitted it was often following injuries from solid objects and assaults (55.7% and 21.5% respectively). The 21 to 30 age group had more admissions (35.4%) while the 0 to 12 age group also had a fair percentage for admissions (11.4%). Patients with poor visual acuity (<6/60) were also more likely to be admitted (52.5%). More patients who incurred domestic accidents required hospital admission (35%). Admissions were more frequent for patients with penetrating injuries (51.6%).

Visual outcome

On presentation, 48.2% of the patients had visual acuity of less than 6/60 while a few (25.6%) remained at this level following treatment. Eight (3.6%) patients required enucleation/ eviscerations at initial presentation with poor vision (<6/60). In addition, more patients had their eyes enucleated/eviscerated at a later stage (1.4%, *n*=3). Patients who had blunt trauma (30.4%) and penetrating trauma (21.7%) had

poor visual outcome, that is, <6/60. The majority of the patients that had IOFBs, lacerations and burns had good visual outcome (Table 3).

Discussion

Demographics

Males were more exposed possibly because greater proportions are employed in high risk occupations compared to females^{4,5}. The majority of the patients experiencing ocular trauma were between the ages of 21 and 40 years. These findings concur with the findings of other studies⁴⁻⁸. This age group is most likely to be employed in industry or agriculture which are high risk areas for ocular trauma^{9,10}. Children under the age of 12 years were also found to be incurring ocular injuries while at play. Efforts to increase eye health awareness in this target group should include parents and children to prevent blindness due to ocular injuries^{5, 6, 11}. A few elderly patients (4.1%) over the age of 65 years incurred ocular injuries. It is probable that people in this age group are unlikely to be active and most are retired hence lesser exposure

to ocular hazards. In contrast, however, a study in Scotland found a higher prevalence of ocular injuries in the same age group (60%)¹². Differences in study location may have contributed to this stark difference and a large sample size was used compared to the present study.

The majority of the patients who sustained ocular injuries were Black in agreement to reports from Baltimore, Maryland and Massachusetts^{8, 13}. Racial differences may be attributable to variations in occupational status and hence work environments and exposure. Blacks may be found to be in occupations that are more physically demanding such as in the mining sector while Whites may be expected to hold office based employment more often⁸.

Type of injury

A greater proportion of open globe injuries compared to closed globe injuries were observed with a predominance of blunt trauma/contusions. This corresponds to the findings by Singh *et al*¹⁴ in North India who reported 41.4% of open globe injuries and 26.4% of closed globe injuries. Blunt trauma in most cases ranged from minimal contusions to extensive disruption of the globe which may be as a result of more exposure to blunt objects in any environment¹⁵. In agreement to reports from India and United States^{16, 17}, IOFBs were most often attributable to grinding and shattered glass. Dandona *et al*¹⁷ found that public health work safety messages had a significant impact on reducing the occurrence of penetrating injuries in the workplace. The majority of the patients who experienced blunt trauma were between the ages of 21 and 30 years. Verma *et al*¹⁸ found that contusion of the eyeball were more common in this age group than any other age group. A possible reason for the observed trend is that this age group could be exposed to more injuries in the workplace, in sports and in the social environment consisting of different causative agents. Burns were also frequent in the 21 to 30 age group. This is in agreement to a report from India that showed that young people working in laboratories and factories constituted two-thirds of the patients experiencing injuries from chemical agents they work with and emphasized the use of eyewear be mandatory when performing their duties⁹. The younger age group (0-12 years) experiences more lacerations and IOFBs than blunt

trauma which contributes to non-congenital unilateral blindness. This finding is consistent with previous reports¹⁹⁻²¹ and educating parents in preparing a safer environment for children is advisable.

Reports from Baltimore, Maryland and Massachusetts found that all the types of eye injuries were mostly incurred by males except for blunt trauma, which agrees with the present study^{8, 13}. The statistics in South Africa of violence²² against women which in most instances involve blunt trauma stands at 49%²². However, these statistics should be read with caution as statistics generally underestimates the extent of domestic violence. Mobilization and campaigns in the media to raise awareness to address violence against women can be effective in reducing the assault related eye injuries²².

Laterality

In the present study, only 5.5% of patients incurred bilateral injuries. Previous reports¹ show prevalence of bilateral injuries of 0.3% to 27%. This difference can be attributable to the fact that the current study was also conducted at hospitals that are not close to industrial areas unlike in the previous reports. In urban settings chemicals are often used in laboratories or industries which when a splash is projected at short distance may result in extensive damage to the ocular surface^{9, 23, 24}. Chemical injuries tend to be more bilateral than other ocular injuries.

Place of injury

The findings of the present study indicate that the majority of ocular injuries occurred in the home. The hospitals chosen for the study are situated in cities surrounded by urban communities whereas industries are located in the outskirts of the respective towns. However, previous reports indicate that the majority of ocular injuries occurred in industry^{20, 25- 27}. Reports^{12, 28} from Scotland also found an increasing frequency with age as a risk factor for experiencing serious ocular trauma in the home. Males and children were at high risk of incurring ocular injuries in the home. This result contrasts with those of Chattopadhyay *et al*²⁵. Blacks incurred more injuries in all places of trauma which includes the home. In industry, Indians, Whites and Coloureds had an equal number of injuries. This may be attributable to occupational differences among

the different racial groups⁸.

Cause of injury

According to previous reports²⁹⁻³¹ solid objects pose a threat to the eye. These findings are similar to those found in the present study. The majority of the patients experiencing ocular trauma through assault were between the ages of 21 and 30 years, which is possibly attributable to social activities (sporting and alcohol related violence injuries). This view has been reflected in other similar studies^{8, 12, 19}. The middle age groups are vulnerable to chemical injuries and metal from grinding equipment or drills. In cases where eye protection should have been applicable, it seems that barriers to its use still remain which include discomfort, forgetfulness or not citing its importance^{26, 31}. Loss of productivity can be expected as a consequence of ocular injury especially in the middle age groups because the majority of the patients work in places where they are vulnerable to ocular injuries³¹.

Previous reports^{12, 20, 29, 30} have shown that solid objects were found to have contributed the most injuries across all places cited for ocular trauma. Although machinery in industry and tools in the home are still the major causes of moderate to severe eye injuries, the present study shows that assaults were more frequent in the home. Similarly, surveys from USA and Malawi also found that assaults were becoming a major cause of ocular injuries^{10, 11}.

The Black population was more likely to sustain injuries than the other race groups. This could be due to racial differences in exposure to high risk injury as suggested by reports from previous studies^{8, 13}. For example, Coloureds experienced more ocular injuries from solid objects, Whites sustained more chemical burns and thermal burns were only experienced by the Indian population.

Treatment

The majority of the patients were treated with medication and few underwent ocular surgery. A similar finding was reported by Serrano *et al*²⁴, who found that 77.4% of the patients did not require any surgical procedures but 22.6% needed surgery. Medication was found to be the more frequent method of treatment possibly due to the fact that more patients incurred closed globe rather than open globe injuries, which in most instances would have

required surgical intervention. Corneal repair/graft and traumatic cataract removal were often performed, and this is consistent with the findings of previous reports²³. Corneal repair/graft was frequent across all age groups, but the highest in the 21 to 30 age group which is similar to a Korean report by Oum *et al*¹⁹. Suturing following penetrating injuries were also often performed in the 21 to 30 age group and traumatic cataract removal in the 51 to 65 age groups. The 0 to 12 year age group was not an exception for corneal repair/graft (19.4%). A survey from Hong Kong also found that 20% to 29% of corneal transplants were done on children following ocular trauma³². The disadvantages with corneal repair/grafts include rejection of the new cornea, experiencing decreased vision, increased pain, increased redness of the eye and increased light sensitivity³³.

Patients who incurred lacerations were most likely to require surgical intervention as reported by Gyasi *et al*². This is dependent of how badly the eye was lacerated or ruptured. Patients requiring surgery following blunt trauma often required cataract removal, while burns only required corneal repair/graft in severe cases. Ilsar *et al*¹⁰ reported similar findings in Malawi. This can be attributed to the level of development of the country in terms of healthcare, experts and adequacy of equipment to perform the necessary surgical treatment.

Many patients (71.8%) were seen over a follow-up period. This is similar to that reported in the Baltimore, Maryland, where 82.1% of patients were seen over a follow-up period²³. Severity of the injury and poor visual acuity may be possible factors influencing patients to return for follow-up examination. The reasons why some patients did not return could include the distance they would need to travel to get to the hospital, travelling costs and negligence from patient's side². Patients with blunt trauma and lacerations were most likely to return for follow up treatment. Long term follow-up is important as it becomes difficult to determine the exact prognosis in these eyes especially in blunt trauma where an after effect to a more posterior structure occurs after a period of time². In accordance with a study by MacEwen¹⁵, injuries from solid objects were commonly cited as common causes of ocular trauma warranting patient admission for treatment. The age group between 21 and 30 years incurred more injuries

that necessitated admission. This is consistent with a report by Oum *et al* from Korea¹⁹. Children up to the age of 12 years also experience injuries requiring hospital admission. This is similar to the findings of MacEwen¹⁵ and Bhogal *et al*²⁸ from Glasgow.

Admission

The current study shows that 35.9% of admissions were made. Hospital-based studies conducted in Ghana show that 5% to 16% of all ophthalmic admissions to eye hospitals/units are related to ocular injuries^{2, 34}. The decision to admit a patient may depend on the quality of care, availability of space and skilled personnel to attend to patients.

Patients' admissions were dependent on the visual acuity at presentation, the poorer the visual acuity the greater the chances of being admitted. This trend was also noted in previous studies^{12, 26}. The severity of the injury has been found to correlate with poor visual acuity and this may imply a posterior segment involvement³⁵. Reports from United Kingdom and Ireland found that domestic accidents were responsible for warranting hospital admission^{28, 36}. In Baltimore, Maryland, blunt trauma and penetrating injuries were equally common and often require hospital admission which is in agreement to findings of the present study¹³. Possible reasons are that penetrating injuries require immediate careful attention followed by prompt surgical repair to prevent functional loss.

Visual outcome

Patients who initially presented with poor vision (<6/60) had better visual outcome although in a few vision remained the same as that following the injury. A study from the United Kingdom reported that sharp injuries were associated with good visual outcome compared to blunt mechanisms. A significant number of patients had to undergo enucleation/evisceration (3.6%) on presentation or at a later stage (1.4%). Findings reported in Malawi¹⁰ (13.2%) and Manchester²¹ (12%) where patients also required enucleation/evisceration were twice as high compared to the present study. This difference may be due to the causative agents involved during the time of injury and treatment protocols may have differed. Delay in performing enucleation/evisceration on a severely damaged eye with no prognosis restricts allied specialists in attempting to repair maxillofacial

associated injuries for fear of interfering with the already damaged globe and subsequently cosmesis³⁷.

In conclusion, the main findings of the present study are that ocular trauma is more prevalent in the home. The majority of the ocular injuries were contusional/blunt. Ocular injuries were more frequent in males, in the middle age groups and also among children which is a cause for concern. In addition, some cases of the ocular injuries incurred required hospital admission.

The lack of provision of statistics in some of the hospitals can also pose a setback for research purposes. This can provide information on whether the number of injured patients is increasing, stable or decreasing. It can also help identify if the outcomes of treatment with new developments and equipment put in place yields better results and encourage timely delivery of high quality health services. However, this can be attributed to lack of human resource (skilled personnel) and equipment.

The results of this study should be interpreted within the context of certain limitations. For example, this was a retrospective study and therefore, recording bias is likely that results in actually underestimating the incidence of most of these clinical measures and findings. Additionally, the epidemiology of eye injuries is dynamic and this may cause difficulty in the interpretation of the results of a retrospective study. Most of the hospitals were receiving patients from primary health care clinics, therefore the possibility of missing out superficial injuries was inevitable and it is more likely that results from this study represent mostly severe injuries underestimating the true prevalence of these injuries. Furthermore, superficial foreign body trauma may be underestimated because most practitioners remove foreign bodies without

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