A retrospective analysis of eye injuries in rural KwaZulu-Natal, South Africa

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Abstract

Purpose: To provide epidemiological data on ocular injuries among patients utilising two provincial hospital eye care clinics in rural KwaZulu-Natal, South Africa.

Methods: Record cards of 440 ocular injured patients seen at two selected rural provincial hospitals over a period of four years were reviewed.

Results: More males (68.9%) had eye injuries than females (31.1%). The Black population (97.7%) had a higher prevalence of ocular injuries than other race groups. Young patients between 21 and 30 years old incurred more ocular injuries (31.4%) than other age groups. Open globe injuries were more frequent (56.1%) than closed globe injuries (43.9%). Blunt trauma/contusion (36.4%) was the most frequent type of injury (36.4%). Solid objects (53.4%) were responsible for more than half of the injuries followed by assaults (28.2%). The majority of the eye injuries (54.5%) occurred at home. There was a reduction in visual acuity of 37.7% of the subjects following treatment.

Conclusion: Ocular trauma is a relatively common health problem in rural KwaZulu-Natal and is significantly more common among the male and Black population. (*S Afr Optom* 2012 **71**(4) 159-165)

Key words: Ocular injury, eye injury, rural health, occupational injury.

Introduction

Ocular trauma is a significant cause of unilateral blindness and visual impairment in many communities¹. Ocular injuries are routinely common because new hazards frequently arise in everyday life, but by identifying the underlying factors in their aetiology, it may be possible to devise effective strategies for reducing the incidence of visually damaging trauma^{2, 3}. People who live and work in remote areas are probably more at risk than those of the better-off social classes because the lower working class is associated with situations where ocular

trauma may be more experienced¹. The main causes of injuries in rural poor communities are agricultural practices⁴. Lack of access to preventive health care in rural areas has worsened the situation and it is therefore of concern that in rural areas where necessary services are scarce more injuries (80%) are reported⁴. No previous study could be found in the literature that provided data on eye injuries in South Africa. Therefore, the aim of this study was to provide epidemiological data on ocular injuries among patients utilising the rural provincial hospitals in KwaZulu-Natal, South Africa.



Materials and methods

This study used a quantitative retrospective study design where analysis was based on a review of case records of patients with ocular injuries who had presented at two rural provincial hospital eye clinics. The study population comprised patients who presented at the eye clinics during the period of January 2005 - December 2008. A total of 440 record cards, 220 from each rural hospital were randomly selected and reviewed. Cases were analyzed with respect to demographics, place of trauma, 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). 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 McNemar-Bowker test were used as appropriate. Statistical significance was set at a 95% confidence interval and probability values or *p*-values of 0.05 were applied.

Results

The total sample size comprised of 440 and 430 (97.7%) Black, four (0.9%) Coloureds and six (1.4%) Indians. There were no Whites in the sample. There were 303 (68.9%) male and 137 (31.1%) female patients in total and their ages ranged from one to 89 years with a mean and standard deviation of 29 years ± 16.82 . The highest occurrence of ocular injuries was among the 21 to 30 years age group (31.4%), followed by the 31 to 40 age category (20.9%) and the 0 to 12 age group (12.7%). Few patients over 65 years of age (2.3%) were included.

Type of ocular injuries

The Birmingham Eye Trauma Terminology (BETT) was used to classify the main types of ocular trauma into open globe and closed globe injuries. An open globe injury involves a full thickness wound (an injury penetrating into the globe) of the corneoscleral wall which may result from penetrating or blunt eye trauma. Closed globe injuries are commonly due to blunt trauma where the corneoscleral wall of the globe remains intact

(a partial thickness corneal wound) but intraocular damage may be present. In this study open globe injuries constituted 56.1% and closed globe injuries were 43.9%. The injuries are further subdivided into types of injury in order of decreasing frequency, blunt trauma 36.4%, intra ocular foreign bodies 29.5%, lacerations 18.2%, penetrating 8.4% and burns 7.5%. Blunt trauma was most frequent among age categories from 13 years to over the age of 65 years. Each type of injury occurred most frequently among the 21 to 30 age group. In the age category of 0 to 12 years, lacerations (21.3%) were most common. Each type of injury occurred more among males except for blunt trauma (39.1% versus 31% of females versus males, respectively) and burns (13% versus 10.3% of females versus males, respectively) as illustrated in Figure 1 which shows the type of injury in relation to the gender of the patients.



Figure 1. Type of injury in relation to the gender of the patients

Ocular signs and laterality

Less than half (46.8%) of the patients presented with associated ocular signs mostly haemorrhages (17.5%) followed by hyphaema (8%). The least frequent signs were orbital fracture and endophthalmitis (0.9%). The ocular signs were further analyzed according to the type of associated injury (Table 1).

Unilateral injuries were more frequent than bilateral injuries (97.5% versus 2.5%, 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=0.000; Fisher's exact test).



Table 1. Showing the type of injury in relation to associated ocular signs. In each column, both the percentage and number of injuries (*n*) in brackets are provided.

OCULAR SIGNS										
					TD				Raised	
	Нур	OF	Haems	Endo	cells	TU	CSO	CL	IOP	All types
TYPE OF										
INJURY										
Blunt trauma	62.9 (22)	50 (2)	61 (47)	-	-	52.3 (23)	25 (5)	91.7 (11)	70 (7)	56.5 (117)
Penetrating	5.7 (2)	-	2.6(2)	-	-	2.3 (1)	15 (3)	-	-	4.3 (9)
IOFBs	17.1 (6)	25 (1)	15.6 (12)	50 (2)	-	31.8 (14)	25 (5)	-	30 (3)	20.8 (43)
Lacerations	11.4 (4)	25 (1)	20.8 (16)	50 (2)	-	13.6 (6)	10 (2)	8.3 (1)	-	15.5 (32)
Burns	2.9 (1)		-	-		-	25 (5)	-	-	2.9 (6)
				100					100	
Total	100 (35)	100 (4)	100 (77)	(4)	-	100 (44)	100 (20)	100 (12)	(10)	100 (207)

Hyp = hyphaema, OF = orbital fracture, Haems = haemorrhages, Endo = endophthalmitis, TD cell = tobacco dust cells, TU = traumatic uveitis, CSO = corneal scarring/opacity, CL = corneal laceration, IOP = intra ocular pressure, IOFBs = intra ocular foreign bodies.



Place of injury

Figure 2. Showing place of injury for patients (N = 440).

The most common place to experience an injury was in the home as illustrated in Figure 2. The home was the most common place of injury in the 21 to 30 age group (24.6%) followed by the 0 to 12 year age group (21.3%). With the exception of agriculture, the majority of the ocular injuries incurred at all places of injury were in the 21 to 30 age group. Home related injuries were more frequent among males (62.5%) than females (37.5%). Males commonly sustained injuries in the industrial workplace (13.2%). The Black population sustained more injuries in the home (54.7%) followed by the social environment (18.6%). None of the Indian and Coloured patients had industrial related injuries. Race was insignificantly associated with place of trauma (p=0.380; Fisher's exact test).

Cause of injury

The following solid objects; metal pipes, planks, coffee mugs, metal rods, pellet guns, stones, wood

splinters from chopping, piece of tile, broken glass, scissors and screw drivers - were responsible for 53.4% of the injuries. In all age groups the majority of injuries were due to other solid objects followed by assaults (53.4% and 28.2%, respectively). Each cause of injury was also more prevalent in the 21 to 30 age group. Ocular injury due to accidental falls was more frequent in the 0 to 12 age group (8.9%). Males sustained more injuries from solid objects (68.1%). Assaults occurred more in males than females (66.1% versus 33.9%, respectively) and injuries from thermal burns occurred only in male patients (2.3%).

Ocular injuries due to all causes occurred in Black patients. However, only assault, other solid objects, chemicals and thermal burns were observed in all the other races. There was no significant association found between cause of injury and race (p=1.000; Fisher's exact test).



Injuries from other solid objects were the most frequent cause of injury across all possible places of ocular trauma as is illustrated in Table 2. Ocular injuries caused by solid objects were more common in the home followed by assaults. The cause of injury was significantly related to the place of injury (p=0.000; Fisher's exact test). Only 2.7% (n = 12/440) of patients had evidence of alcohol abuse on presentation at hospital with an ocular injury.

PLACE OF INJURY							
	Commercial	Agriculture	Industry	Home	Sports	Social	Total
	workplace					environment	
CAUSE							
OF							
INJURY							
assault	5.9 (1)	5 (1)	-	25 (60)	20 (2)	71.4 (60)	28.2 (124)
ball	-	-	1.4(1)	-	20 (2)	-	0.7 (3)
other	70.6 (12)	85 (17)	43.5 (3)	62.5 (150)	60 (6)	23.8 (20)	53.4 (235)
hammering	-	-	-	0.8 (2)	-	-	0.5 (2)
MGD	17.6 (3)	5(1)	21.7 (15)	1.7 (4)	-	-	5.2 (23)
SG	-	-	5.8 (4)	1.7 (4)		3.6 (3)	2.5 (11)
falling	-	-	-	3.3 (8)	-	1.2 (1)	2 (9)
chemical	5.9 (1)	5 (1)	20.3 (14)	4.2 (10)	-	-	5.9 (26)
thermal	-	-	7.2 (5)	0.8 (2)	_	-	1.6 (7)
Total	100 (17)	100 (20)	100 (69)	100 (240)	100 (10)	100 (84)	100 (440)

Table 2. Cause of injury (columns: % (*n*)) in relation to place of injury

MGD=metal from grinding equipment or drills, SG=shattered glass

Visual outcome

On presentation, 51.2% of the patients had good vision (6/12 or better), however there was a slight decline on the visual outcome after treatment as only 42.7% had 6/12 or better visual acuity (Table 3). This was similar to patients who presented with poor vision (<6/60) (29.2%) where a decline in visual outcome was

also noted following treatment (37.9%). Almost half (48.9%) of patients with blunt trauma and 23.4% of patients with penetrating trauma had poor vision (6/60 or worse) after treatment. The majority of the patients that had IOFBs (26.4%), lacerations (18.9%) and burns (17%) had good visual outcome. There was a significant association between final visual acuity and type of injury (p=0.002; Fisher's exact test).

Table 3. Shows initial and final Snellen visu	al acuity (columns: $\%(n)$)
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	INITIAL VISUAL ACUITY	RESULTANT VISUAL ACUITY
VISUAL ACUITY		
6/12 or better	51.2 (198)	42.7 (53)
6/15-6/60	19.6 (76)	19.4 (24)
<6/60	29.2 (113)	37.9 (47)
Total	100 (387)	100 (124)



Discussion

Males were more exposed to eye injuries compared to females possibly because a greater proportion of males are employed in high risk occupations^{1, 5}. The majority of the patients experiencing ocular trauma were between the ages of 21 and 40 years in agreement with a report from Ghana⁴. The working class population often tends to be in the young middle age groups hence it may be expected that this group may be vulnerable to occupational injuries. Of concern was the finding that a significant percentage (13.8%) of patients incurring ocular injuries was children up to the age of 12 years. This is critical because their vision is still developing at that age⁶. If not treated there could be negative implications on their future including studying, employment and subsequently independence later on in life can be compromised. Very few patients (2.3%) over the age of 65 years incurred ocular injuries. Access to health care may change with age and socioeconomic factors may have affected their presentation to the hospital hence the statistics⁶. Statistics South Africa indicates a greater number of Blacks are employed in industry, agriculture and construction compared to the other race groups which could be the main reason for having more Blacks experiencing ocular injuries which is in agreement with the current study⁸.

Type of injury

There was a greater proportion of open globe as compared to closed globe injuries. This corresponds with previous reports^{5, 9}. A significant number of injuries relating to blunt trauma occurred during wood chopping and gathering of wood as some of these areas still use wood for preparing their meals and heating their houses. Many cases of IOFBs were associated with the use of a hammer, metal from grinding equipment or drilling and shattered glass as also found in a study from Singapore¹⁰. This was said to be due to carelessness and unawareness among workers when carrying out these duties^{11, 13}.

Blunt trauma was mostly sustained by patients between 21 and 30 years, which was consistent with previous reports^{10, 12}. The 0 to 12 year age group experienced more lacerations (corneal, conjunctiva and eyelid) and IOFBs. Children cannot be fully responsible for their actions, therefore educating parents in providing a safer environment for children is advisable.

Due to more exposure to dangerous occupational environments, all the types of eye injuries were mostly incurred by males except for blunt trauma which was more common among females as also suggested by reports from USA^{5, 7}. The reason given was that projectile objects cause the majority of open globe injuries among males which were incurred during home improvement projects⁷. Females are more vulnerable to injuries from domestic violence which in most instances result in blunt trauma⁵.

Ocular signs

Haemorrhages were the most frequent associated ocular signs following injury as comparable to previous reports^{5, 13}. The ocular signs relate more to the anterior segment and the possible reason for their presentation and frequency could be that the anterior segment of the eye is more vulnerable to the direct mechanism of injury¹⁴.

The majority of the ocular signs such as hyphaema and haemorrhages were associated with blunt trauma which is also in accordance to other studies^{2, 12}. The literature reveals that endophthalmitis complicates approximately 5% of cases following trauma^{3, 12}. However, only four (0.9%) patients in the study had endophthalmitis as an associated ocular sign in the present study. The difference may be due to the difference in the mechanism of injury, different treatment modalities and under diagnoses.

Unilateral injuries occurred more often than bilateral injuries and this was similar to a report from Poland¹³. The majority of the injuries were blunt/ contusional which was often unilateral. Chemical burns or splashes often caused bilateral injuries. In the present study, frequent causes of bilateral injuries were due to paint, battery acid and petrol/diesel from generators.

Place of injury

It has been established in most studies that the home remains an important place for ocular injuries in agreement to the present study^{15, 16}. In our study, the high risk of injury in rural areas may be due to the fact that agriculture (4.5%) is often practiced providing an unsafe environment with insufficient safety precautions being undertaken. This was also indicated in a report from Ireland².

The high risk of injury in the home was evident especially among the 0 to 12 and 21 to 30 age groups. Males were more at risk while doing home improvement



projects and children while at play which is in contrast to a study done in India where females and children were found to be more at risk¹⁶. The potential for injuries exists mostly for active children and they spent the majority of their time at home as suggested by a Brazilian report¹⁷.

In Baltimore of Maryland, Blacks had a higher rate of injuries in all places cited for ocular trauma as compared to other race groups which is in agreement with the current study⁷. The difference may be work related, assault related and sport related among the racial groups⁷.

Cause of injury

A solid object found in any environment can cause or can be used to cause an injury. Solid objects were found across all places cited for ocular trauma according to previous reports in agreement with the present study^{2, 10}. Preventative measures have focused on other areas such as sports besides the home and the social environment; therefore these areas still remain a priority for injury prevention. Males were observed to have, twice or more, higher rates of ocular injuries from solid objects compared to females.

Metal from grinding equipment or drills and chemical burns were frequent causes of injury in industry and this is consistent with previous studies^{11, 18}. These sources of type of injury are mostly found in expanding economies in their manufacturing sectors where barriers to the use of protective devices still remain in these industrial sectors^{11, 19}.

Assaults resulted in a whole range of the types of injuries. The cause and circumstances of assaults are difficult to identify and are contributed to by many social factors especially in the social environment and does not only result in serious ocular trauma but is also life threatening in the event of body trauma⁶. Assaults were found to be frequent between the ages of 21 and 30 years attributable possibly to social activities that most young age groups engage in as suggested by previous reports^{7, 12}. Therefore, awareness campaigns through media especially on assaults can be effective to the audience.

Chemical burns were also responsible for causing ocular injuries as in accordance to recent studies^{18, 20}. Many household products and especially those used for cleaning (acidic floor cleaner, Jeyes fluid, Jik) also pose a threat to the eye in agreement with previous reports^{13, 22}. In the present study, acid burns were found to be more frequent than alkali burns. This finding is

comparable to a Nigerian report²⁰. Sometimes these types of injuries may be due to a lack of information provided by the supplier to customers informing them about potential hazards associated with the use of the product concerned.

Ocular injuries due to accidental falls were infrequent (2%), but predominant in the 0 to 12 age group. This is in disagreement with a study from Ireland². Children at this stage are very active without evaluating the risks. During agricultural pursuits, ocular injuries from solid objects such as thorns, rake and grass occurred frequently. This is similar to a report from Ghana⁴. Agricultural pursuits are mostly carried out manually without evaluating the risks while there is also greater exposure to potential hazards during working hours.

A previous report documented the rate of alcohol or drug usage suggesting that alcohol has an indirect aetiological profound effect on ocular injuries. This finding is in agreement to the current study⁹. This is because patients who are intoxicated have poorer judgment impaired by the alcohol or exhibit greater risk taking behaviour⁹. The same would apply to drug abusers or users and therefore periodic monitoring of the levels of alcohol and counselling of patients could minimize the alcohol related injuries.

Visual outcome

The majority of the patients presenting with good vision in this study achieved 6/12 or better, however a decline was also noted among these patients (42.7%). Patients who initially presented with poor vision (6/60 or worse) also had a decline in visual outcome (37.9%). Visual acuity was not measured in patients aged five years or younger but a study⁶ in rural Nepal is in agreement with the current study. This is influenced by the severity of injury, enucleation/evisceration and age of the patient. Early management and diagnosis of most injuries improves the prognosis because many injuries present acutely³. We found blunt trauma to have poorer visual outcome (<6/60) following treatment. Intraocular foreign bodies and lacerations had good visual outcomes, however, a poor outcome was also observed with certain cases of lacerations. These findings are similar to a study in the United Kingdom²¹. Therefore, it can be assumed that the causative agents involved and the mechanism of injury may be similar irrespective of the different geographic locations.



Results of the current study show that ocular trauma is unfortunately a relatively common problem in rural KwaZulu-Natal and occurs frequently among children and young adults, and in males warranting presentation to the eye casualty department for treatment. Another problem is the shortage of staff at rural hospitals. Health and safety education, awareness campaigns through media on ocular injuries could make a major difference in our communities at large and should be directed to the unrecognized locations for ocular trauma.

A number of training programmes such as rural registrar programmes for ophthalmologists can be established. Continuous optometric education in rural areas has been a problem which is a major issue that needs to be addressed by the Health Professions Council of South Africa (HPCSA) in conjunction with the South African Optometric Association (SAOA). Even though these programmes may appear costly, they can be effective to the rural audience and if all these programmes are already in place, the only thing required would be to devise strategies on how to keep them sustainable and effective.

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