

The presentation, patterns, and outcomes of corneal injuries in children seen in Lighthouse for Christ Eye Centre, Mombasa

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Abstract

Introduction: Corneal injuries constitute a significant cause of corneal blindness, impacting vision significantly, with approximately 1.5 to 2 million new cases of monocular blindness. Children's quality of life and Disability Adjusted Life Years may be impacted by ocular trauma, which is a significant and leading cause of acquired and preventable monocular blindness, particularly in developing nations.

Study objectives: The study aimed to determine the patterns and outcomes of corneal injuries in children seen in Lighthouse for Christ Eye Centre, Mombasa between January 2018 and December 2022.

Methods: A hospital-based retrospective case series study design was carried out and 90 medical records of all children up to 18 years of age with corneal injuries were included. A structured questionnaire was used to retrieve information from the medical records. It encompassed the clinical presentation, patterns, outcomes and complications of corneal injuries. Data was coded and entered in SPSS version 26 for analysis. Descriptive statistics such as tables, charts and frequencies were used to summarize the retrieved information.

Results: The male-to-female ratio was 2:1.2 and the 5-10 years age group sustained most injuries with a mean age of 6.7 years and a median age of 6 years. The time-to-presentation was 2-7 days. Corneal lacerations were the most common pattern of corneal injuries mostly caused by sticks. Associated ocular injuries included cataracts and hyphema. Uncorrected visual acuity of 6/12 or better was attained by 12.2% at 1 month and 7.8% at 3 months. About 1/3 of the patients were blind in the injured eye at 3 months post- injury, according to the Distance Visual Impairment grading (ICD 11). Corneal scars were the most common complication of corneal injuries.

Conclusions: Corneal injuries in children occurred mostly during playtime due to the curious nature of play and unsupervised play among older children. Males sustained more injuries attributed to their carefree and aggressive nature of play. Corneal lacerations were the most common injury.

Key words: Corneal injuries, Birmingham Eye Trauma Terminology System, Visual acuity, Distance Visual Impairment grading, Corneal Scars.

Introduction

Ocular trauma is a leading cause of acquired, preventable monocular blindness, with an impact on a child's quality of life, particularly in developing nations¹⁻³. World Health Organization's (WHO) Blindness Data Bank of 1995 revealed that an estimated 55 million ocular injuries occur worldwide annually^{4,5}. Corneal injuries are one of the most common reasons for visits to the emergency department in the paediatric age group⁶. They constitute a significant

cause of corneal blindness, impacting vision significantly, with approximately 1.5 to 2 million new cases of monocular blindness⁷.

The Birmingham Eye Trauma Terminology System (BETTS) classifies ocular injuries into open and closed-globe injuries depending on whether the eyewall, which includes the cornea and sclera, is involved. Closed-globe injuries involve partial-thickness wounds of the eyewall and are sub-

classified into contusions and lamellar lacerations. Open globe injuries involve full-thickness wounds to the eyewall and are sub-classified into globe rupture, perforations, penetrating injuries, and intraocular foreign bodies. Ocular trauma in children commonly occurs due to penetrating injuries^{7,8}.

The cornea, which makes up the majority of the eye's refractive surface, is the anterior-most structure of the eye. The cornea accounts for 40-45 Diopters of the eye's total refractive power, making its primary function optical⁹. Trauma to the cornea involving the basement membrane takes six weeks to heal completely⁶. Corneal fibrosis is an irreversible change in the cornea's normal anatomy and physiology after an injury resulting in visual impairment¹⁰. This study sought to elucidate the impact of corneal injuries among children, the clinical presentation and patterns of the injuries, and the outcome of the treatment modalities in our setup.

Traumatic injuries and exposure-related injuries are the two types of corneal injuries. Abrasions, contusions, and foreign objects lodged in the cornea are examples of traumatic wounds. Burns from chemical, thermal, and radioactive sources are among the injuries brought on by exposure^{6,11}. Corneal lacerations, partial or full-thickness, are the most common type of injury^{10,12}. The extent of the corneal injury impacts the development of complications, such as corneal scars which may result in deprivational amblyopia and poor visual outcomes².

Children are a vulnerable group in society, and their underdeveloped motor skills and curious nature while at play cause them to disregard the possible risks and outcomes of their actions, putting them at high risk of ocular trauma, especially corneal injuries.

Furthermore, poor outcomes of ocular injuries in a child contribute to many years of Disability Adjusted Life Years (DALYs), which impacts their quality of life as they live longer with the visual impairment than adults.

Methods

Study design

The study was a retrospective study conducted at Lighthouse for Christ Eye Centre (LHFCEC), Mombasa. Data was collected from 29th January 2024 to 9th February 2024.

Study area

The study was done at Lighthouse for Christ Eye Centre (LHFCEC), Mombasa, Kenya, a busy outpatient centre offering comprehensive eye care services which serves adult and paediatric patients in the urban setting and receives referrals from rural areas.

The medical team comprises Ophthalmology subspecialists, i.e., resident Cornea and Oculoplastics subspecialists, visiting consultants i.e. Vitreoretinal surgeon and Paediatric and Squint surgeons, general ophthalmologists, ophthalmic clinical officers, and ophthalmic nurses. It serves approximately 1200 patients per month in outpatient clinics, with about 20 children managed for ocular trauma annually.

Target population

LHFCEC is an outpatient eye facility. Outpatient medical records of children with corneal injuries who attended LHFCEC between January 1, 2018 and December 31, 2022.

Case definition

A child was defined as per the United Nations Convention of 2018, as a person under the age of eighteen years with an ocular injury involving the cornea. Good visual outcome was defined as uncorrected visual acuity i.e., UCVA 6/6 – 6/12 in the injured eye.

Inclusion criteria

Medical records of children with corneal injuries that included open and closed-globe injuries according to the BETTS classification.

Exclusion criteria

Medical records of children with corneal pathology that were not a direct sequela of injury e.g., infective keratitis with no history of injury and those missing visual acuity at the 1-and 3-month follow up visit, were excluded.

Sample size estimation

This sample size calculation was based on having enough power to determine the proportion of children who attained a normal visual acuity (6/6 to 6/12) 3 months after injury.

Murithi et al.'s study on globe injuries in children hospitalized at Kenyatta National Hospital found that the proportion of children with normal visual acuity, i.e., 6/6 to 6/12 at three months after injury, was 21.8%²¹.

The sample size was calculated using following Fischer's formula:

$$n = Z^2 (pq)/d^2$$

Where:

n = Minimum sample size

Z = 1.96 standard deviation (95% confidence interval)

p = Proportion of children with normal VA, three months post-operatively (21.8%)

q = 100-p

d = Acceptable margin of error 8.6%

$$\frac{(1.96^2 \times 21.8 \times 77.2)}{(8.6)^2}$$

n=90

Sample selection method

Simple random sampling selection was used until the sample size was attained.

Data collection

The data collection tool consisted of three sections namely presentation, patterns, and outcomes of corneal injuries with a set of questions for each section.

Variables such as biodata (name, age, sex and county of residence), presenting visual acuity, cause of injury e.g. (sticks, stones), setting where the injury occurred (home, school, another setting), circumstances of the injury (during playtime, sports injury, assault), management of injuries i.e. medical or surgical management and the best corrected visual acuity were retrieved from medical records.

The questionnaire recorded the variables above from the medical records and its reliability depended on the completeness of the data recorded in the medical files.

Results

There were 120 outpatient medical records retrieved. Out of these, 30 records were excluded due to missing visual acuity at the 1-month and 3-months follow-up clinic visit. 90 medical records with complete details were analyzed.

Table 1 shows the demographic characteristics and geographical distribution of the children studied. The mean age of the children was 6.7 years (SD +3.8), while the median was 6 years (IQR, 4.0 – 9.0) years. The youngest patient was 9 months and the oldest patient was 17 years.

Table 1: Characteristics of the children

Characteristic	Number of children (%)
Age in years	
<5	26 (28.9)
5– 10	46 (51.1)
>10	18 (20.0)
Sex	
Male	56 (62.2)
Female	34 (37.8)
County of residence	
Mombasa	24 (26.7)
Kilifi	21 (23.3)
Kwale	17 (18.9)
Malindi	13 (14.4)
Lamu	6 (6.7)
Mariakani	2 (2.2)
Voi	2 (2.2)
Tana River	1 (1.1)
Others*	4 (4.4)
Total	90 (100)

Table 2 shows the visual acuity in the injured eye at presentation to LHFCEC. Out of 90 patients, 49 patients (54.4%) sustained an injury to the left eye and 41 patients (45.6%) had an injury to the right eye. There were no patients who had sustained bilateral injuries. Most of them, 52 patients, had presenting visual acuity <3/60 while only 7 patients (7.8%) presented with good visual acuity. There was no record of a pre-existing refractive error in the injured eye in all the medical records that were reviewed.

Table 2: Visual acuity in the injured eye at presentation to LHFCEC

Visual acuity at presentation	Number of children, (%)
6/6 - 6/12	7 (7.8)
<6/12 - 6/18	2 (2.2)
<6/18 - 6/60	6 (6.7)
<6/60 - 3/60	1 (1.1)
<3/60	52 (57.8)
Fixing and following light (FFL)	2 (2.2)
Not fixing and following light	1 (1.1)
Central Steady Maintained (CSM)	1 (1.1)
Not taken	18 (20.0)
Total	90

Figure 1 shows the duration between injury and presentation to LHFCEC. More than half of the patients sought treatment within 2-7 days. Out of 90 patients, 42 patients (46.7%) had been referred from a peripheral health facility while 48 patients (53.3%) had self-referred to LHFCEC.

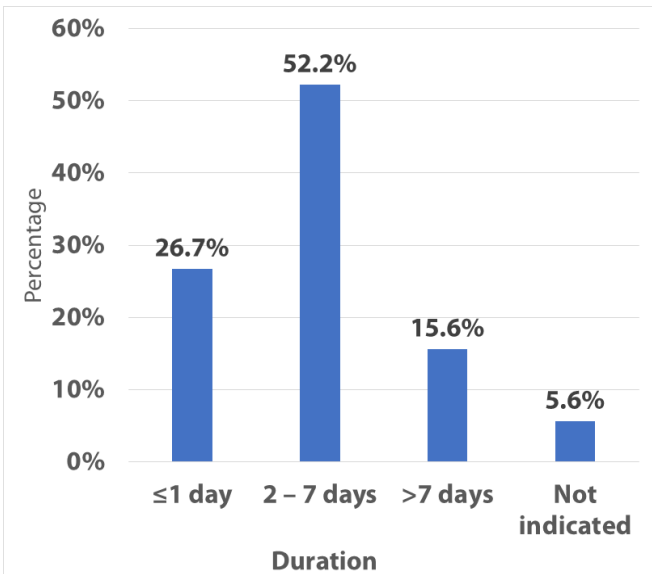


Figure 1: Duration between injury and presentation to LHFCEC (n=90)

Figure 2 shows patterns of corneal injuries. Out of 90 children, 57 of them presented with corneal lacerations (63.3%) as the most common pattern injury.

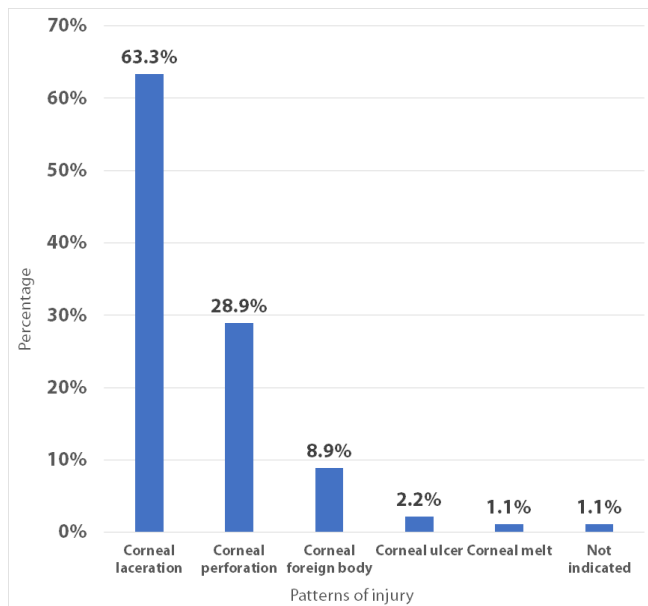


Figure 2: Patterns of corneal injury (n=90)

Figure 3 shows the cause of injury. Sticks were the most common cause of corneal injuries (47.8%, 43) followed by stones (7.8%, 7). Other causes of injury included broken glass, a ball, a catapult, a needle prick, a coconut splinter and a pair of scissors.

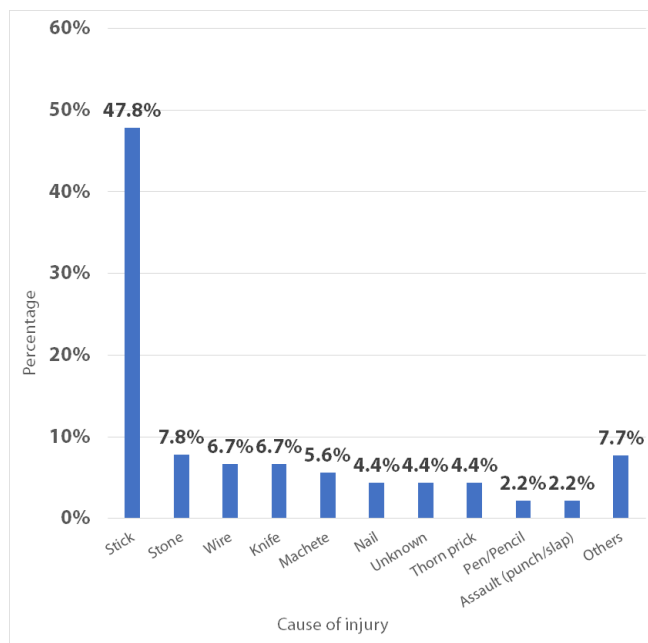


Figure 3: Cause of injury (n=90)

Figure 4 illustrates other ocular injuries. The most common associated injury was traumatic cataracts (40%).

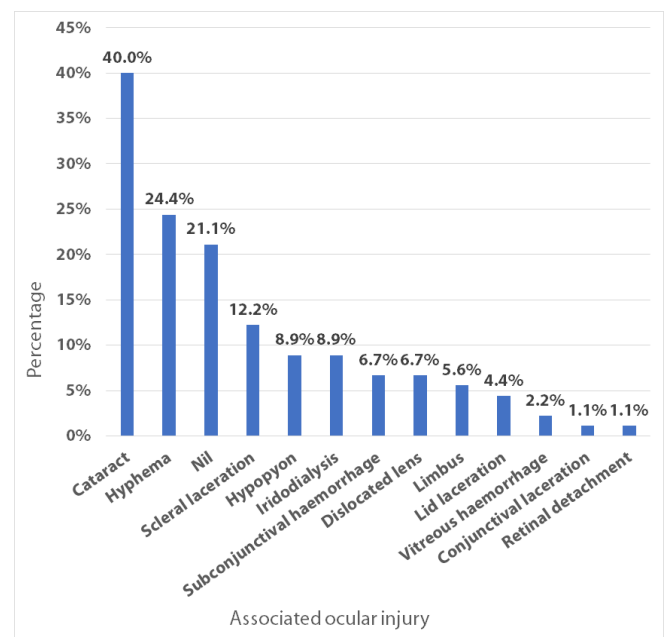


Figure 4: Associated ocular injuries (n=90)

Figure 5 compares pre-operative visual acuity with visual outcomes at the 1-month and 3-month follow-up clinic visits.

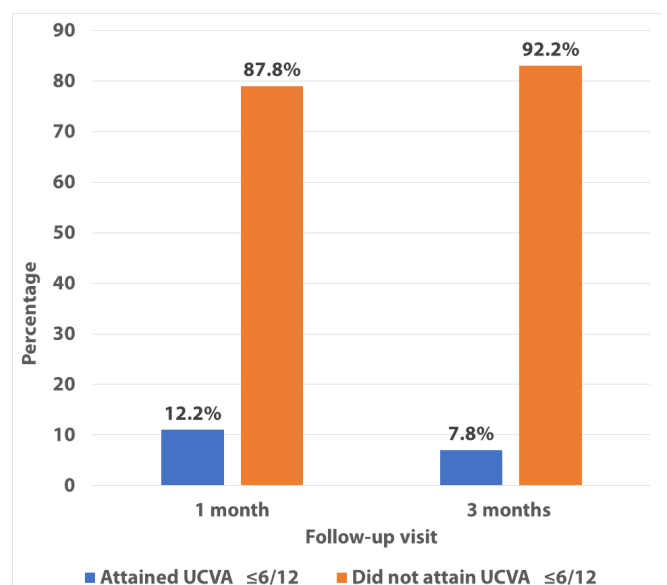


Figure 5: Visual outcome 1- and 3-months post injury

Table 3 shows distance visual impairment grading (ICD 11) at 3 months post-injury. About 1/3 of the patients (34.4%) were blind and another 1/3 of patients were lost to follow-up. Only 4 patients (4.4%) had no visual impairment.

Table 3: Distance Visual Impairment grading (ICD 11)

Distance visual impairment grading	Number of children, (%)
No visual impairment	4(4.4)
Mild visual impairment	5(5.6)
Moderate visual impairment	7(7.8)
Blindness	31(34.4)
No 3-month visit	31(34.4)
CPCM Grading used	4(4.4)
CSM Grading used	3(3.3)
FFO & FFL used	5(5.6)
Total	90

Figure 6 shows the complications of corneal injuries. Most patients had one or more complications of injury, of which corneal scar (54.4%), and loose sutures (51.1%) were the highest.

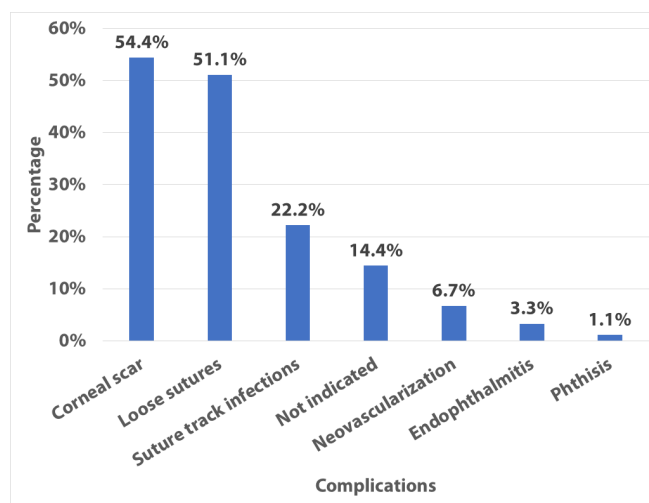


Figure 6: Complications (n=90)

Table 4 shows the association between patterns of corneal injuries and associated ocular injuries. Corneal lacerations were more likely associated with cataracts, hyphema and scleral lacerations in comparison to corneal perforations. Notably, patients with corneal lacerations were more likely to have cataracts (OR=1.1, 95% CI: 0.4 – 2.8, p=0.870). Scleral lacerations were more likely in patients who had sustained corneal lacerations (OR=1.3, 95%CI: 0.3 – 5.2, p=0.756).

Table 4: Association between corneal injuries and other ocular injuries

	Corneal lacerations (n=57)	%	Corneal perforations (n=26)	%	OR (95% CI)	p- value
Cataract						
Yes	23	40.4	10	38.5	1.1 (0.4 – 2.8)	0.870
No	34	59.6	16	61.5	Reference	
Hyphema						
Yes	15	26.3	7	26.9	1.0 (0.3 – 2.8)	0.954
No	42	73.7	19	73.1	Reference	
Scleral laceration						
Yes	8	14.0	3	11.5	1.3 (0.3 – 5.2)	0.756
No	49	86.0	23	88.5	Reference	

Discussion

All 90 children sustained monocular injuries and 47 out of 90 patients (52%) of the children had V.A. <3/60 at presentation to our facility. In our study, 49 out of 90 patients (54.4%) sustained more injuries in the left eye than in the right eye, 41 out of 90 patients (45.6%). This was in contrast to Murithi et al's²¹ study which found that the right eye was injured 1.2 times more frequently than the left eye²¹. More than half of the children, 47 out of 90 patients (52.2%), presented to LHFCEC within 2-7 days of injury. This is similar to Sagina et al's study which found that

45% of the patients presented to the facility within 2-7 days of injury¹⁷. This was possibly due to prior medical treatment that had been sought at peripheral health facilities before self-referral or referral by the health facilities.

The most common pattern of corneal injuries was corneal lacerations among 63.3% of patients. Additionally, sticks (47.8%) were the most common cause of injury. Other causes of injury were broken glass, balls, catapult, needle prick, wall, coconut splinter and a pair of scissors. This was comparable to studies done by Sagina et al¹⁷ who found

injuries were caused by sticks (60.6%) and Murithi et al²¹ who found that sticks (35%) were the common cause of injury. In contrast, Omobolanle et al's¹⁰ study in Nigeria found stones (22.2%) were the common cause of injury.

Associated ocular injuries mostly included cataracts (40%) and hyphema (24%). The majority of the patients underwent corneal repair, lens washout and anterior chamber washout. Postoperatively, the majority of the patients were put on topical antibiotics, cycloplegic and steroid drops. These findings were similar to studies done in Kenya by Sagina et al.¹⁷ and Murithi et al.²¹ in which cataracts were the most commonly associated injury at 30% and 29.1% respectively and patients had similar postoperative management.

Our study revealed that 45 out of 90 patients (50%) sustained injuries in the home setting and more than 51 out of 90 patients (56.7%) sustained injuries during playtime. Notably, very few patients attained good uncorrected visual acuity (UCVA) of 6/12 or better during the 1-month and 3-month follow-up visits. At the 1-month follow-up visit, only 12.2% of the patients attained this and it was lower at the 3-month follow-up visit at 7.8%. These findings were lower in comparison to Murithi et al who found 21.8%²¹ and Sagina et al.¹⁷ who found 23.1% attained good UCVA.

Corneal scars were the most common complication in our study with 54.4%. In both Sagina et al.¹⁷ and Murithi et al's²¹ studies, they found corneal scars as the most common complication at 28% and 35% respectively. Corneal scarring could explain the low number of patients who attained good UCVA (7.8%) at the 3-month follow-up visit in our study.

I recommend Continuing Medical Education (CME) sessions for healthcare workers on the management of ocular injuries to enable prompt referral of patients. Additionally, sensitization on eye injuries among caregivers to encourage supervised child play to reduce their occurrence. Lastly, education among caregivers on the importance of taking their children post corneal injury management for follow-up clinic appointments. This will help in improving visual outcomes and reduce complications in the injured eye.

Acknowledgement

I would like to extend my heartfelt gratitude to Lighthouse for Christ Eye Centre, Mombasa, for supporting me throughout my master's programme, funding my research and allowing me to conduct my research at their facility.

Ethical Considerations

Approval to conduct the study was sought from Kenyatta National Hospital/University of Nairobi-Ethics and Research Committee and the National Commission for Science,

Technology and Innovation.

Permission was granted from Lighthouse for Christ Eye Centre, Mombasa through aid of an official letter of support from the Ophthalmology department at the University of Nairobi.

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