

Research Article

Characteristics of Pediatric Ocular Injury in a Tertiary Healthcare Facility in West Borneo

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Received 21 February 2025; Accepted 8 July 2025
<https://doi.org/10.23886/ejki.13.1078.1>

Abstract

Sudden vision loss in the pediatric population caused by ocular injury significantly reduces their quality of life. This study aims to describe the demographics, clinical manifestations, causes of injury, and management of ocular injury in the pediatric population. A retrospective review was conducted on pediatric ocular injury cases presented to Dr. Soedarso General Hospital in West Borneo, which were recorded from January 2020 to December 2024. Demographic data, types of injury, causes of injury, and management approach were extracted for the study. The ocular injury was classified according to Birmingham Eye Trauma Terminology. A total of 25 patients were included in the study, which consisted of 18 males and 7 females with a mean age of 8.08 ± 4.15 years (3-16 years old). Almost all cases occurred unilaterally ($n=24$), with open globe injuries being the most common type ($n=18$). The surrounding environment and organic materials played significant roles in the occurrence of ocular injury ($n=12$). Around half of the cases ($n=13$) were not managed by ophthalmologists within 24 hours of the injury. Understanding the pattern of pediatric ocular injury may increase awareness of the occurrence of trauma among general practitioners, which may prevent further injuries.

Keywords: ocular injury, pediatric, visual acuity.

Karakteristik Cedera Mata Anak di Fasilitas Kesehatan Tersier di Kalimantan Barat

Abstrak

Kebutaan mendadak pada populasi anak yang seringkali disebabkan oleh trauma okular dapat menurunkan kualitas hidup penderitanya. Tujuan studi ini adalah mengetahui karakteristik demografi, manifestasi klinis, penyebab trauma, dan tata laksana trauma okular pada populasi anak. Penelitian retrospektif ini dilakukan pada kasus cedera mata anak yang datang ke Rumah Sakit Umum Daerah Dr. Soedarso, Kalimantan Barat dari bulan Januari 2020 hingga Desember 2024. Data demografi, jenis trauma, penyebab trauma, dan tata laksana trauma mata dikumpulkan. Trauma mata diklasifikasikan berdasarkan Birmingham Eye Trauma Terminology. Sebanyak 25 pasien diikutsertakan dalam penelitian ini, terdiri atas 18 laki-laki dan tujuh perempuan dengan rerata usia $8,08 \pm 4,15$ tahun (3-16 tahun). Hampir seluruh kasus trauma mata terjadi unilateral ($n=24$), dengan jenis trauma mata terbuka paling sering terjadi ($n=18$). Lingkungan sekitar dan materi organik berperan penting pada terjadinya trauma mata ($n=12$). Sebanyak 13 kasus tidak mendapat perawatan dokter spesialis mata dalam waktu 24 jam setelah trauma. Memahami pola cedera mata anak dapat meningkatkan kesadaran akan terjadinya trauma di kalangan dokter umum, sehingga dapat mencegah terjadinya cedera lebih lanjut.

Kata kunci: trauma mata, anak, tajam penglihatan.

Introduction

Lifetime visual deprivation caused by ocular injury is one of the leading causes of monocular blindness in the pediatric population. A report from the World Health Organization showed that one of the most common causes of blindness in adults and children was corneal opacity due to injury.¹ Various results from epidemiological ocular injury studies in the pediatric population were reported due to their differences in geographical characteristics, socioeconomic status, and cultural impact.²⁻⁴ Males were more prone to ocular injury than females due to their aggressiveness and curiosity.⁵ In terms of age, most studies showed that ocular injury in children occurred in middle childhood ages (6-11 years old).^{4,6,7} According to the Birmingham Eye Trauma Terminology (BETT) classification, ocular injury consists of closed globe injury (CGI) and open globe injury (OGI), which may occur differently in children depending on age and activity.^{8,9} In children, CGI is more common than OGI due to its nature. However, OGI was found to carry worse visual outcomes compared to CGI.⁹ Living in rural areas was also shown to be associated with ocular injury in children, which resulted in the need for regional ocular injury databases, especially in the pediatric population.^{4,6}

Ocular injury in children affects the organs, impairs vision, and changes how the patient perceives the environment. Moreover, in children's growth and development phase, visual deprivation may affect their quality of life, such as education, social, and psychological functionality.^{10,11} Parents, as their primary caregivers, are also affected by abrupt and irreversible visual loss, which may further lead to depression and anxiety disorders.^{12,13} Therefore, managing ocular injury in the pediatric population urgently and comprehensively is important. A systematic review and meta-analysis study by McMaster et al¹⁴ showed that early primary repair in OGI (less than 24 hours after injury) reduced the endophthalmitis rate compared with delayed primary repair (more than 24 hours after injury).

The epidemiology study of ocular injury in Indonesia is limited. The study is only available in several tertiary centers across the nation. This

study aims to identify the prevalence and the causes of pediatric ocular injury, as well as the interval between the injury and primary surgical repair in the tertiary General Hospital in West Borneo.

Methods

This retrospective observational study was conducted at Dr. Soedarso General Hospital in West Borneo. The study adhered to the Declaration of Helsinki, and the protocol was approved by the Institutional Review Board of the Medical Ethics Committee, Dr. Soedarso General Hospital, with registration number 76/RSUD/KEPK/VIII/2024.

The data were collected from medical records from January 2020 to December 2024. The study included all children of the age group ≤ 18 years old who had ocular injuries and presented as outpatients and inpatients of the ophthalmology department. Demographic profile, clinical presentation, and the interval between the injury and primary surgical repair, was collected. Ocular injury status was classified according to BETT into two large groups, which were CGI and OGI.¹⁵ Further classification of the zone of injury was categorized according to Globe and Adnexal Injury Terms and the Proportion of Experts Reaching Consensus in the Delphi Panel.¹⁶ The cause of injury was also extracted and classified into blunt and sharp objects. This study classified the interval between the injury and primary surgical repair into intervals I and II.¹⁷ Interval I refers to the period from when the ocular injury occurred until the patient consulted an ophthalmologist. In contrast, interval II refers to the period from the patient acquired a working diagnosis to the acquisition of definitive management.

The data obtained were analyzed using SPSS (version 20.0; IBM Inc., Chicago, IL, USA). Categorical and continuous variables were described in tables and charts, which consisted of frequencies and percentages, and in the form of the mean (standard deviation/SD) and range (minimum to maximum), respectively.

Results

A total of 25 pediatric subjects with ocular injury, both inpatients and outpatients, were included in this study. The injury commonly occurred in the 6-10 year-old group (n=11), ranging from 3–17 years old. The study population comprised 18 males and 7 females. Most of the subjects came from residential areas relatively

near (<100 km) to tertiary healthcare facilities (n=22), but some of them (n=3) came from very distant regions (>100 km). A variety of ocular injuries were reported from 2020 to 2024. However, a significant reduction was reported in 2021, the same year as the peak of the COVID-19 pandemic (Table 1).

Table 1. Patient's Demographic Characteristics (n=25)

Characteristics	n
Sex	
Male	18
Female	7
Age (years)	
0–5	8
6–10	11
11–17	6
Distance to hospital*	
<100 km	22
100–200 km	2
>200 km	1
Trauma incidence (year)	
2020	6
2021	1
2022	8
2023	6
2024	4

*Tertiary hospital

Most of the subjects had unilateral injuries (n=24). The injury was classified based on BETT, which consisted of CGI (n=4) and OGI (n=18). Globe rupture to zone I (cornea) was the most common injury, followed by perforating injury involving all parts of the ocular. Other injuries that did not affect the ocular were four cases. These injuries were canalicular (n=1) and palpebral (n=3). No orbital fractures were observed during the study. More details can be found in Table 2.

Blunt ocular injury (n=15) commonly occurred. The mechanism of injury obtained showed that it happened mainly during playtime, either caused by the environment (n=6) or organic material (n=5) where they played. Sharp ocular injury also occurred during playtime. However, in sharp ocular injury, dangerous

objects that needed strict parental guidance were viewed as toys by the children, such as metals (n=4) and stationery (n=4), were responsible for the occurrence of the injury (Table 3).

In this study (Table 4), surgical interventions were needed in most pediatric ocular injury cases (n=23). Conservative management was applied to mild ocular injuries, such as uncomplicated hyphema. In terms of the interval between the injury and primary surgical repair, around half of the cases (n=12) were able to consult an ophthalmologist less than 24 hours after the injury occurred. In most cases, the period from diagnosis by an ophthalmologist to acquiring definitive management is less than 24 hours (n=22).

Table 2. Characteristics of Ocular Injury

Characteristic	n
Affected eyes (n=25 patients)	
Unilateral	24
Bilateral	1
Type of Injury* (n=26 eyes)	
Closed globe injury	
Contusion	4
Lamellar laceration	0
Open globe injury	
Globe rupture	9
Penetration injury	4
Perforation injury	5
IOFB***	0
Adnexal injury	4
Zone of Injury** (n=22 eyes)	
Closed globe injury	
Zone I	3
Zone II	1
Zone III	0
Open globe injury	
Zone I	10
Zone II	6
Zone III	2

*Type of injury according to Birmingham Eye Trauma Terminology classification

**Type of injury according to Globe and Adnexal Trauma Terms and the Proportion of Experts Reaching Consensus in the Delphi Panel

***Intraocular foreign bodies

Table 3. Causes of Ocular Injury (N=25 patients)

Type of Cause	n
Sharp Injury	
Metals (knife, nail)	4
Stationery (pen tip)	4
Organic material (tree branch)	1
Blunt Injury	
Toys	4
Organic material (dirt, tree branch, stone)	5
Others (corner table, hanger, clay tiles)	6
Unknown	1

Table 4. The Management and Intervals of Ocular Injuries

Variables	n
Management (n=26 eyes)	
Conservative	3
Surgical	23
Interval between the injury and primary surgical repair, hours (n=25 patients)	
Interval I*	
<24	12
24–48	6
>48	7
Interval II**	
<24	22
24–48	2
>48	1

*period from the time the ocular injury occurred until consultation with an ophthalmologist

**period from the patient-acquired working diagnosis to the acquired definitive management

Discussion

This current study described the socio-demographic characteristics and ocular status of ocular injuries in both pediatric outpatients and inpatients. Neither previous studies nor a consensus about pediatric ocular injury has been reported in this region. We only reported 25 children (26 eyes) who presented with ocular injury in the previous 5 years. Multiple factors may be taken into account, such as healthcare and other supportive facility inadequacy, information insufficiency, negative attitude toward injury conditions, and social culture burden, which resulted in underreporting of ocular injury in children.

The trend of ocular injury incidents fluctuated from 2020 to 2024, with a significant reduction in 2021. This may be due to the COVID-19 pandemic, which was first observed in Indonesia in the first trimester of 2020. Not until 2021 did the COVID-19 pandemic in Indonesia reach its peak. During the COVID-19 pandemic, patients tend to delay care-seeking either in primary or higher healthcare facilities. The risk and fear of being infected with the COVID-19 virus were the main reasons for this delayed care-seeking habit.^{18–20} On the other hand, strict health protocols applied in healthcare facilities and social restriction policies worsen this situation.

Ocular injury predominantly occurred in the age group of 6–10 years old. Studies showed various results regarding the children's age group affected by ocular injury.^{4,6,9,21–23} Children aged 6–10 begin to receive formal education in schools, which may expose them to new objects such as stationery. Additionally, a combination of being inquisitive about learning new things and inexperienced about forthcoming danger makes ocular injuries unavoidable for these children. In this study, ocular sharp injury was commonly caused by metal materials such as knives and pens, followed by the pen's tip. Intensive primary caregivers were needed to restrict and monitor potentially dangerous objects such as knives and nails, especially in the age group below 10 years old. Blunt ocular injury showed different results, in which organic materials such as dirt, tree branches, and stones were the most common causes of ocular injury (n=5). This

occurred during playtime when subjects fell or tripped to the ground, which involved orbital injury. A safe environment during children's activity, especially playtime, should be available to reduce the risk of ocular injury. This study showed that environments such as corner tables, clay tiles, and hangers were also responsible for ocular injury (n=6). Different age groups may show different causal trends of ocular injury. Other trends were shown in several ocular injury studies, some of which occurred during the age of 11–17 years. Sports activity was responsible for the high prevalence of ocular injury in this age group.^{24,25} Whereas in the 0–6 years old age group, toys were responsible for the occurrence of ocular injury.⁹ Therefore, WHO encourages campaigns to improve awareness to prevent ocular injury in the pediatric population.¹

Previous studies reported that males were more prone to ocular injury than females.^{21,22,24,26} Our study showed similar results, in which ocular injuries were predominantly males (n=18) compared to females (n=7). This may be due to males' higher involvement in outdoor and riskier activities and the nature of male aggressiveness and curiosity.⁵

Around 95% (n=24) of subjects in this study had a unilateral ocular injury, with OGI being the most common ocular injury. Similar trends have been reported in several studies.^{3,5,7,27} OGI yielded poor outcomes compared to CGI. Visual rehabilitation in the pediatric population may be complicated, as the risk of amblyopia lurks and may worsen the visual outcome. However, other studies showed different results, revealing that CGI predominantly occurred in children.^{9,23,24,28} This occurred because CGIs or mild cases had been treated in primary or lower healthcare facilities. Indonesia has National Insurance Healthcare, which has a vertical referral system. Every case completed in the primary or lower healthcare facility cannot be referred to the higher healthcare facility. The involvement of zone I in most of the cases in this study, either in closed or OGI, suggested that anterior structures are more vulnerable to injury.

Surgical management was required in almost all cases in this study (n=23), as most were OGIs and adnexal injuries needing surgical management. However, the period between the occurrence of ocular injury and the consultation with an ophthalmologist at a capable healthcare facility varied between cases. In this study, around half of the children (n=12) received surgical management in less than 24 hours, and the other half (n=13) received ophthalmologic consultation in more than 24 hours. In general, OGI, which occurred in 18 eyes in this study, may cause numerous complications such as endophthalmitis, retinal detachment, cataracts, corneal scarring, proliferative vitreoretinopathy (PVR), phthisis, and many more, which may end in evisceration or enucleation. Several cases (n=2) in the study were presented after a month of injury, followed by the sequelae of the injury. One of them was presented with phthisis bulbi, the end-stage of OGI, and the other with retinal detachment followed by vitreous hemorrhage due to CGI. Both cases came from different regions with a more than 200 km distance. Late ophthalmologist encounters after the injury were affected by multiple factors, including the primary caregiver and their children, healthcare facility availability, and socioeconomic factors. As in West Borneo, ophthalmologists and their facilities are scarce and not evenly distributed. Therefore, neglected, late-management, or underreported cases were commonly noticed. Low economic status may also prevent the patient from getting referred to a higher healthcare facility. Various studies showed that more than 24 hours of early surgical management might increase the risk of endophthalmitis.^{14,29} Further visual outcomes may also be improved by early surgical management.^{30,31}

Several limitations had to be noted in this retrospective study. Reported medical reports were very limited in describing a complete clinical history of each patient, such as visual acuity. Visual acuity evaluation in children may be challenging due to uncooperative patients and a lack of coordination with their primary caregiver, which might result in missing data. The total number of pediatric ocular injuries may be underreported, as mild cases of ocular injury may be treated in primary or lower

healthcare facilities. Socioeconomic factors and the availability of healthcare facilities also interfered with the lower referral cases of ocular injury in tertiary healthcare facilities.

Conclusion

Most ocular injuries occurred among the ages of 6–10, mainly presenting as OGI. The surrounding environment where the children's daily activities played an important role in the injury, as blunt injury caused by their surroundings, was the most common cause. Most injuries also needed surgical intervention, unfortunately, in half of the cases, the consultation to ophthalmologist was delayed. Long-term visual deprivation caused by ocular injury in the pediatric population may significantly reduce the quality of life and cause mental health problems in patients as a result of poor management of ocular injury. Therefore, health promotion in the population had to be considered to reduce the incidence of pediatric ocular injury.

Conflict of Interest

The authors declare that they have no conflict of interest.

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