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# A Retrospective Study of the Etiology and Patterns of Ocular Trauma in Preschool Children Presenting to the Emergency Department over a Five-Year Period in Shenzhen

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## Abstract

**Objective:** To analyze the epidemiological characteristics of ocular trauma in preschool children presenting to the emergency department and to propose targeted prevention strategies.

**Methods:** A retrospective analysis was conducted on data collected from preschool children with ocular trauma who presented to our emergency department from May 2, 2018, to May 2023.

**Results:** A total of 324 preschool patients with ocular trauma were identified, comprising 157 patients (48.46%) aged 0–3 years and 167 patients (51.54%) aged 4–6 years, with a male-to-female ratio of 2.05:1. The leading causes of ocular trauma were contusions in 113 cases (34.88%), followed by injuries from blunt objects in 64 cases (19.75%), and falls in 55 cases (16.98%). The predominant types of trauma were blunt ocular adnexal trauma in 208 cases (64.2%), with eyelid injuries being the most common, and blunt ocular trauma in 96 cases (29.63%). Chemical injuries occurred in 9 patients (2.78%), and intraocular foreign body injuries in 11 patients (3.4%). The majority of the children were managed conservatively with treatments such as local eye drops post-injury. **Conclusion:** Most ocular injuries are preventable. Caregivers should enhance supervision of preschool children and minimize injury risks in daily life.

**Keywords:** Preschool Children; Ocular Trauma; Emergency Department; Epidemiological Characteristics; Prevention Strategies

## 1. Background

Ocular trauma in children is a frequent emergency condition encountered in emergency departments and is the leading cause of acquired monocular blindness [1]. Approximately 20,000 cases of ocular trauma occur annually in children within the United States, accounting for 4% of all ocular injuries [2]. Globally, about 28,000 children under the age of 15 are admitted to hospitals each year due to ocular trauma [3]. Visual impairment resulting from ocular trauma has lasting impacts on the child and imposes a significant psychological and financial burden on families and society. Literature suggests that 90% of ocular injuries can be prevented [4]. Current studies focusing on pediatric ocular trauma primarily address hospitalized children [5-7], with limited reports on such injuries in children presenting to emergency departments. Through a retrospective analysis of pediatric ocular trauma patients seen in the emergency department, this study aims to understand the epidemiological characteristics of ocular trauma in children to inform targeted preventive measures that could reduce the incidence of ocular trauma and associated visual impairment in children.

## 2. Materials and Methods

### 2.1 Study Subjects

Preschool children who presented with ocular trauma to the emergency department of our institution between May 2, 2018, and May 2, 2023, were included in this study. The term "ocular trauma" was used to query the medical records system, leading to the creation of an EXCEL spreadsheet for the emergency treatment of ocular trauma in children under six years of age.

### 2.2 Study Methods

A retrospective analysis was conducted, examining the child's gender, age, affected eye, time of presentation, cause of injury, location, site, and type of ocular trauma, as well as the treatment measures administered. Trauma types were categorized into blunt trauma of the eyeball and ocular adnexa, chemical injuries, and intraocular foreign body injuries.

### 2.3 Statistical Methods

An Excel database was established for data collection, and the statistical software SPSS was employed for data analysis. Measurement data that followed a normal distribution were reported as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ), whereas enumeration data were expressed as percentages. The chi-square test was used for intergroup comparisons, with a P-value less than 0.05 considered statistically significant.

## 3. Results

### 3.1 General Data

In total, 324 cases of ocular trauma in children were retrospectively analyzed in this study. Of these, there were 157 cases (48.46%) aged 0-3 years and 167 cases (51.54%) aged 4-6 years. The male-to-female ratio was 2.05:1, with males outnumbering females in all age groups. No significant difference was observed in the distribution between groups ( $\chi^2 = 2.472$ ,  $P > 0.05$ ).

**Table 1: Gender Distribution of Ocular Trauma in Children Across Different Age Groups**

Age	Total cases	Proportion%	Gender			
			Male	Proportion%	Female	Proportion%
0 to 3 years	157	48.46%	99	63.06%	58	36.94%
4-6 years	167	51.54%	119	71.26%	48	28.74%
Total	324	100.00%	218	67.28%	106	32.72%

**3.2 Distribution of Trauma Types**

Out of the 324 children with ocular trauma, the majority had blunt ocular adnexal trauma, accounting for 208 cases (64.2%), with eyelid injuries being the most prevalent. Specifically, there were 96 cases (29.63%) of blunt ocular trauma, 9 cases (2.78%) of chemical injuries, and 11 cases (3.4%) of intraocular foreign body injuries. A significant difference was observed in the distribution of ocular trauma types across different age groups ( $\chi^2=337.620$ ,  $P<0.001$ ). The mean time to presentation varied by trauma type: 17.7 hours for blunt ocular adnexal trauma, 20.61 hours for chemical injuries, 27.19 hours for blunt ocular trauma, and 59.50 hours for intraocular foreign body injuries. Notably, 85.91% of the children presented within 24 hours after sustaining the injury. A significant difference was also found in the time of presentation among the different types of trauma ( $\chi^2=76.623$ ,  $P=0.043$ ).

**Table 2: Time of Presentation by Trauma Type**

Type of injury	Mean Time to Presentation (h)	Minimum Time to Presentation (h)	Maximum time of presentation (h)
Other	13.4	1	48
Eyelid injury	17.5	0.5	336
Orbital injury	19	1	168
Eye injury	30.5	0.5	240
<b>Total</b>	<b>22.1</b>	<b>0.5</b>	<b>336</b>

**3.3 Causes of Injury**

The etiology of pediatric ocular injuries is diverse, and in the current study, the causes of injury were categorized into bruises, blunt object injuries, falls, sharp instrument injuries, chemical injuries, scratches, boxing injuries, animal injuries, car accidents, burns, insect bites, and intraocular foreign body injuries. Among these, crashes were the most frequent cause, with 113 cases (34.88%), followed by blunt object injuries with 64 cases (19.75%), and falls with 55 cases (16.98%), as depicted in the accompanying table

**3.4 Therapeutic Measures**

In the present study, a total of 198 children (61.11%) received solely conservative treatment with topical eye drops post-injury. Eighty-six children (26.54%) underwent debridement and suturing. Seven children (2.16%) were treated with irrigation of the conjunctival sac.

**Table 3: Causes of Ocular Trauma**

Causes of injury	Number of Occurrences	Proportion
Crash	113	34.88%
Blunt object injury	64	19.75%
Falls	55	16.98%
Sharps injury	32	9.88%
Other	26	8.02%
Intraocular foreign body	11	3.40%
Chemical injury	9	2.78%
Scratch	4	1.23%
Animal injury	3	0.93%
Boxing injury	4	1.23%
Insect bite	1	0.31%
Traffic accident injury	1	0.31%
Burn and scald	1	0.31%
<b>Summary</b>	<b>324</b>	<b>100.00%</b>

**Table 4 Items injured by ocular trauma**

Injured item	Indoor	Outdoor	Unknown	Total
Furniture	59	0	0	59
Humans	10	8	26	44
Building	16	4	16	36
Toys	15	12	4	31
Other	15	6	8	29
Stationery	19	0	1	20
Animal plant	1	7	2	10
Chemicals	9	0	0	9
Unknown	2	2	82	86
Total	146	39	139	324

Five children (1.54%) required removal of intraocular foreign bodies. One child (0.31%) needed hospitalization. Due to unclear medical records, the treatment approach remained unidentified for 8 children (2.47%).

Table 5: Distribution of Therapeutic Measures by Type of Injury

Type of injury	Conservative treatment	Debridement suture	Flushing conjunctival sac	Other	Removal of intraocular foreign body	Hospitalization	Total
Other	4	1	0	0	0	0	5
Eyelid injury	103	74	0	7	1	1	186
Orbital injury	8	8	0	0	0	2	18
Eye injury	83	3	17	1	4	7	115
<b>Total</b>	198	86	17	8	5	10	324

#### 4. Discussion

Preschool children exhibit a high level of sexual activity and possess an intense curiosity about their surroundings. However, due to their limited ability to protect themselves and perceive danger, ocular trauma is more likely to occur in their daily lives. The data from this study reveals the characteristics of ocular trauma in preschool children presenting at the emergency department: (1) The male-to-female ratio was 2.05:1, with male children outnumbering females across all age groups. This is consistent with studies from other regions in China [8-9], likely because boys tend to be more active, engage in risk-taking games, and interact with easily injurious toys such as knives, swords, and sticks, coupled with a lack of self-protection awareness, which can lead to accidental injuries when they are in unsupervised areas. (2) The principal causes of ocular trauma among children are bruises, blunt object injuries, and falls, with common items of injury including sharp objects such as furniture, human bodies, doors, table corners, pencils, scissors, and toys. British research indicates that children and preschoolers have not yet fully developed various bodily systems and often fall or trip; they are the primary group affected by furniture-related ocular trauma [4]. For this reason, it is advisable to educate guardians on improving home safety by using buffer protection devices on furniture edges and some sharp corners, as well as reasonably limiting access to age-inappropriate sharp toys to prevent ocular trauma. (3) Blunt trauma to the ocular adnexa was the most common type of injury, followed by blunt ocular trauma and intraocular foreign body injuries. Eyelid injuries are the most frequent, typically caused by bruises and falls, often accompanied by visible wounds that parents can detect promptly, allowing for timely medical treatment. In contrast, intraocular foreign body injuries are relatively hidden and may not be detected immediately, leading to longer treatment times. (4) Most children with ocular trauma receive conservative treatment, followed by debridement and suturing, with few requiring hospitalization for surgery. This is associated with preschool children being limited by age, having poorer cognitive and autonomic motor functions compared to children over seven years old, and also being under close family supervision, with relatively serious types of injuries mostly involving skin injuries.

In summary, ocular trauma in preschool children is predominantly among boys, with numerous causes of injury. Analysis of clinical data from this group suggests that a significant

proportion of pediatric ocular trauma could be prevented. Efforts should be made to strengthen the education of guardians and educational institutions regarding the protection of children from ocular trauma, to facilitate the timely detection and emergency care of such injuries, and to avoid incorrect first aid measures that could cause irreversible damage. In daily life, guardians should limit preschool children's contact with sharp objects, such as scissors, knives, and stick toys, enhance toy safety inspections, and simultaneously, bolster preschoolers' self-protection awareness by discouraging them from playing with sharp items like scissors and toothpicks, and from indiscriminately throwing stones and setting off fireworks and other dangerous goods. During outdoor activities, appropriate eye protection should be worn to avoid ocular trauma. Prompt treatment of ocular trauma is essential to prevent exacerbation due to delayed care.

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