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Pediatric ocular trauma: characteristics and outcomes among a French cohort (2007–2016)

Short title: Pediatric ocular trauma

C. Boret[1], C. Brehin[1,2], C. Cortey[1], M. Chanut[1], C.-H. Houzé-Cerfon[3], V. Soler[4], I.Claudet[1,5*]

[1]Pediatric Emergency Department, Children Hospital, CHU Toulouse, 31059 Toulouse Cedex 9, France

[2]UMR 1416, Inserm, IRSD, 31059 Toulouse Cedex 9, France

[3]Adult Emergency Department, Purpan Hospital, CHU Toulouse, 31059 Toulouse Cedex 9, France

[4]Department of Ophthalmology, Purpan Hospital, CHU Toulouse, 31059 Toulouse Cedex 9, France

[5]UMR 1027, Inserm, Paul Sabatier University, UPS, 31059 Toulouse Cedex 9, France

*Corresponding author: Pr Isabelle Claudet
Children Hospital
Pediatric Emergency Department
330, Great Britain Avenue
TSA 70034
31059 Toulouse Cedex 9, France
Email: claudet.i@chu-toulouse.fr

Abstract

Pediatric ocular trauma is a major cause of acquired monocular blindness. Posttraumatic visual impairment can lead to significant handicap. In France, recent data on the epidemiology of pediatric ocular trauma are lacking.

Aim – To describe the characteristics of a pediatric cohort with ocular trauma and to analyze patient outcomes.

Material and methods – This was a retrospective observational study of pediatric ocular trauma (age < 15 years) presenting to pediatric and ophthalmology emergency units of our tertiary university hospital between January 1, 2007 and December 31, 2016. Data were collected on: age, sex, time and circumstances of trauma, injury type and location, trauma mechanism, other associated injuries, hospitalization rate and length of stay, treatment, and sequelae (visual impairment). Ocular traumas were classified according to the Birmingham Eye Trauma Terminology (BETT) system and the Ocular Trauma Score (OTS).

Results – A total of 337 children were included (247 males). The global mean age was 8.4 ±4.1 years (range 6 months to 14.9 years). The trauma occurred at home (51 %) or in a public area (21%). Blunt objects (22%) and direct trauma (17%) were the main mechanisms. According to the BETT, 23% of ocular traumas were open-globe traumas (OGT): penetrating (*n*=39), perforating (*n*=12), with intraocular foreign body (*n*=24). Among closed-globe injuries (CGT), hyphema was the most frequent lesion (22%). Associated injuries were recorded in 32 patients. In all, 63% of patients had an OTS of 5 (good visual prognosis) while 39 children (12%) had an OTS of ≤ 3. In 47 patients there was an initial surgery; 62% of children were hospitalized. By the end of the ophthalmic follow-up, 32 patients (9.5%) had sequelae. Children aged between 2 and 5 years had the greatest proportion of sequelae (15%). Compared with female patients, male patients were older (*p*=0.0007) and were more

frequently injured by projectiles (p=0.036). Compared with CGT, OGT were more frequent among younger children (p=0.0015). Ocular injuries secondary to a projectile and spring–summer accidents were associated more frequently with a poor visual prognosis (OTS ≤3; p=0.036, OR=2.5 [1.1–5.8] and p<0.0001, OR=5.8 [3.2–10.7], respectively).

Comments – The annual admission for pediatric ocular trauma was stable during the study period (200 cases per 100,000 annual trauma admissions in the first period [2007–2011] and 195 cases per 100,000 during the most recent period [2012–2016]). Projectiles such as Airsoft gun bullets and paint ball are still the cause of severe injuries while reports on ocular injuries secondary to blaster or Nerf guns use are starting to be published.

Conclusion – The great majority of ocular traumas could be prevented, especially by wearing protective goggles during at-risk activities. French legislation should be stricter about the sale of any Airsoft gun to children under 18 years old. Parents must repeat educational warnings to their children handling sharp objects. The social and psychological burden of relative visual impairment is of importance: One in ten children will have a permanent visual defect.

Keywords: Ocular trauma, pediatrics, visual impairment, monocular blindness, posttraumatic cataract

1-Introduction

The global annual incidence of pediatric ocular trauma has been estimated between 9 and 15 cases per 100,000 inhabitants with 25% of injuries being open-globe traumas (OGT) [1-9]. These accidents are a major cause of acquired monocular blindness [10-12]. Posttraumatic visual impairment can lead to significant handicap with deep psychological and social impact on the child. In France, recent data on the epidemiology of pediatric ocular trauma are lacking.

2-Methods

2.1. Study design – We performed a retrospective observational study in the pediatric and the ophthalmology emergency units of a French tertiary university children's hospital between January 1, 2007 and December 31, 2016.

2.2. Objectives - The main objective of this study was to describe the characteristics and causes of injury in a pediatric cohort with ocular trauma. The secondary objectives were to compare this trauma according to age and sex.

2.3. Population – All children younger than 15 years presenting to both units after an ocular trauma were included. Exclusion criteria were: age ≥ 15 years, shaken baby syndrome, child abuse and ocular injuries related to neglect, isolated ocular adnexal and chemical injuries.

2.4. Methods – In our hospital, medical files are electronically recorded. The medical files were selected (by the Department of Medical Information [DIM]) by cross-referencing the associated ICD-10 diagnostic codes (S05.1–S05.6) assigned through the medical information system program (PMSI). For each patient, data were collected on: age, sex, time and circumstances of trauma, mode of transportation to the hospital, injury type and location, trauma mechanism, other associated injuries, hospitalization rate and length of stay, treatment,

options, sequelae (visual impairment), and rate of secondary surgery. Ocular injuries were classified according to the Birmingham Eye Trauma Terminology (BETT) system and calculation of the Ocular Trauma Score (OTS) (Table 1). The BETT distinguishes closed-globe and open-globe injuries (penetration [one entrance] and perforating lesions [entrance and exit wound] and the presence of an intraocular foreign body [IOFB]). After discharge, an ophthalmological follow-up took place 1 month, 6 months, and 1 year after trauma.

2.5. Ethical and regulatory considerations – This study was validated by the ethical and research committee board of the Toulouse University Hospital (November 17, 2016; registration number 13-1116) and declared to the National Commission for Informatics and Liberties (Mai 4, 2017; registration number 2061199).

2.6. Statistical analysis – For statistical analysis, data were entered in Microsoft Excel tables (Microsoft Corp, Redmond, WA). Analysis was performed with StatView 5.1 (SAS Institute Inc., Cary, NC) and EpiInfo 6.04fr (VF, ENSP-Epiconcept, Paris, France). In the descriptive analysis, data are presented as mean ± SD, median with extreme values, or with 95% confidence intervals where appropriate, unless otherwise indicated. To compare qualitative variables, a chi-squared test (Mantel–Haenszel) was used and a two-tailed Fischer's exact test if the expected value was <5. For quantitative independent variables, a paired Student *t* test was applied. A nonparametric Kruskal–Wallis test was performed in the case of non-normal distribution. Statistical significance was considered at $p < 0.05$.

3- Results

3.1. *Descriptive analysis* – During the study period, 412 patients were eligible for inclusion. A total of 65 files were excluded due to an erroneous diagnostic code (*n*=10), isolated adnexal lesions (*n*= 34), inflicted injuries (*n*=2), severe head trauma without ocular injury (*n*=2), and patients older than 15 years (*n*=27). In total, 337 children were included (male 73%). The prevalence of admissions varied from 22 to 46 patients per year. The male-to-female ratio was

2.7 (range 1.8–4.1 depending on group age). The global mean age was 8.4 ± 4.1 years (range 6 months to 14.9 years): boys 9.0 ±3.9 years and girls 7.2 ±4.1 years. Patients initially presented at the pediatric or ophthalmology emergency units (60% and 40%, respectively). The peak of admission was registered during the 6:00–12:00 PM period (46%). The time of trauma was known in 18% of cases. The main patient characteristics are summarized in Table 2. The distribution of the accident location was: home (51%), public area (21%), or at school (14%). The cause of trauma included blunt objects (22%) and direct traumas (17%) (for details, see Table 3). Ballistic trauma (Airsoft gun, paintball, blaster, and Nerf guns) represented 7% of injuries (14% in 2007 and 0% in 2016). Among the 337 patients, 416 injuries were diagnosed: right eye (44%), left eye (50%), both eyes (*n*=2). According to the BETT, 23% of patients had OGT (*n*=76): penetrating (*n*=39), perforating (*n*=12) injuries and IOFB (*n*=24) (Table 4). Hyphema was the most frequent injury in CGT (22%), one in five children had a corneal, scleral, or conjunctival laceration with or without an IOFB (Table 4). In 66 patients, there were multiple ocular injuries. Initial visual acuity was tested for 75 patients; it was normal or mildly impaired (VA > 4/10) in 36% of patients, and seriously decreased (AV < 1/10) in 19 patients (25%). Associated injuries were recorded for 32 patients: facial fractures (*n*=11), pericerebral hemorrhage and skull fracture (*n*=7), fractures to extremities (*n*=2), polytrauma (*n*=2), facial lacerations (*n*=6). The majority of patients had an OTS of 5 (good visual prognosis) (*n*=211), and 39 children had a low OTS (≤ 3). The score was not calculated for 65 patients because of the impossibility to quote the visual acuity. An initial examination with general anesthesia was required in 93 cases (39%); 47 patients had initial surgery: laceration repair (*n*=43), IOFB extraction (*n*=6), vitrectomy (*n*=4), hyphema evacuation (*n*=2), cataract phacoaspiration (*n*=1). Sixty-two percent of patients were hospitalized (ophthalmology unit; *n*=151) with a mean length of stay of 4.7 ± 4.1 days (range 1–39 days). After discharge, patients had ophthalmic follow-up: at 1 month (*n*=190), at

6 months (*n*=56), and at 1 year after trauma (*n*=39). The majority of patients (93%) with CGT had a final visual acuity greater than 5/10, as did 66% of patients with initial OGT. After 1 year, 32 patients had sequelae (9.5%), two thirds of them had an initial OGT. The greatest proportion of sequelae was diagnosed in the 2–5-year-old age group (*n*=10; 15%). The sequelae were: posttraumatic cataract (*n*=18), retinal detachment (*n*=6), monocular blindness (*n*=3). Secondary surgery was necessary for 27 children: cataract (*n*=18), retinal detachment (*n*=4), enucleation (*n*=4), corneal graft (*n*=1).

3.2. Comparative analysis – Different levels of comparison were used to isolate risk factors of ocular trauma according to sex, age (age ≥ 9 years vs. younger age), severity (OTS ≤ 3 vs. greater values), the BETT (OGT vs. CGT), or the period of admission (2015–2016 vs. 2007–2008). The main significant results are summarized in Table 5.

Compared with girls, boys were older (p=0.0007), were more frequently injured by projectiles (16% vs. 8%, p=0.036, OR=2.5 [1.1–5.8]), and tended to be hospitalized more often (64% vs. 54%, p=0.098, OR=1.5 [0.9–2.5]). Older children (age ≥ 9 years) were injured five times more often by projectiles (23% vs. 5%, p<0.0001, OR=5.5 [2.5–12.3]) or direct trauma (p=0.0001, OR=3.8 [2.0–7.5]) but had significantly fewer OGT (15% vs. 29%, p=0.002). According to the BETT, OGT was more frequent in younger children (mean age 7.4±3.3 years vs. 9.0±3.3 years, p=0.0015). A low OTS (score 1–3) was more frequent for patients admitted during the spring–summer season (May–August) (41% vs. 10%, p<0.0001, OR=5.8 [3.2–10.7]); after projectile-related trauma (27% vs. 16%, p=0.036, OR=2.4 [1.1–5.1]). Compared with patients with other pediatric traumas admitted during the study period (*n*=170278), cases of ocular trauma differed: more male patients (73% vs. 59%, p<0.0001, OR=19.1 [14.9–24.3]); more hospital presentations in the evening (51% vs. 44%, p=0.0055, OR=1.4 [1.1–1.7]); a higher proportion of children older than 5 years (75% vs. 56%, p<0.0001, OR=1.4 [1.1–1.7]); and a higher hospitalization rate (62% vs. 10%, p<0.0001,

OR=14.5 [11.6–18.1]). During the most recent period (2015–2016), ocular traumas were more frequent during the months of November to April (58% vs. 38%, $p \leq 0.037$, OR=2.3 [1.1–4.8]) and at night (18% vs. 2%, $p=0.03$, OR=9.8 [1.4–78.2]).

4-Discussion

Ocular trauma represents 7% of trauma admissions and 10–15% of presentations for ophthalmic causes. Over a third of ocular trauma occurs in patients under the age of 18 and one in five cases before the age of 12 [13]. According to the national database of the PMSI, the number of annual hospitalizations for ocular trauma in France was 3143 patients aged less than 15 years during the 2008–2016 period (419 in 2008 and 249 in 2016). This number does not include non-hospitalized ocular trauma patients or those admitted to private clinics. The PMSI analysis shows a decrease in the incidence of ocular trauma between 2008 and 2016; this trend was confirmed in the United States during 2006–2014 [2]. In our study, the annual admission for pediatric ocular trauma was stable during the study period (200 cases per 100,000 annual trauma admissions in the first 5 years [2007–2011] and 195 cases per 100,000 during the last 5 years [2012–2016]). Young children (age <5 years) are the ones most frequently exposed to high-risk ocular trauma leading to visual impairment [2]. Worldwide, the incidence of visual impairment or blindness caused by ocular trauma varies between 2% and 14% [4,5,6,13]. Home accidents are the most frequent (55–69%), followed by sport or leisure practices (27%) [2,3,7,9,11,13-15]. These particular epidemiological data are similar to the results of a recent Canadian study [16] performed among 289 patients aged less than 18 years, except that the sport activities differ (ice and field hockey are the major activities involved in Canada while in our study, soccer and tennis or table tennis were the most represented). Ocular traumas occur less often at school (9–18%) or in public areas (11–35%) [9,11,12,14,15] and rarely secondary to traffic-road accidents [6,10]. The great majority of ocular traumas are CGT (85%) and at low risk of visual impairment [2]. The male prevalence is quite constant, with the male–female ratio varying between 2: 1 and 9: 1 depending on age and ocular trauma mechanisms [2,3,8,11-13]. The age range of ocular trauma patients is generally 6–11 years [3,11,15-18]. The seasonality of ocular trauma is probably related to activities practiced depending on climate conditions and cultural common free-play or sport activities [6,8,9,14, 16]. The major reported mechanisms are projectiles (20–30%) propelled at high velocity (bullets from Airsoft guns, paintball, foam darts from blasters or Nerf guns) or projectiles thrown during sport or leisure activities (balloon, tennis ball, golf ball, baseball,

badminton shuttlecock, arrow, darts, hockey puck), or stones, coins, eggs [2,3,11,13,14,17]. In other cases, this happens after an accidental impact while playing, a physical aggression with a body part (elbow, hand, fingers, nails), or after impact with a blunt object (10–65%) or sharp object (stick, tree branch, knife, scissors, etc.) (9–15%) [13,18]. Ocular trauma occurs rarely after a fall onto the corner of furniture (7.5%) [2,11,13]. The last European directive about toy safety is very strict and has contributed to the decrease in toy-related ocular trauma (*Directive 2009/48/CE relative to toys safety* //ec.europa.eu/DocsRoom/documents/17193/attachments/1/translations/fr/.../native). Right and left eyes are equally affected and binocular injuries are rare (1–12%) [3,8,11,15,18].

CGT or contusions are the most frequent traumas (44–85%) [8,14,17,19] and mostly secondary to blunt objects. Hyphema (bleeding in the anterior chamber after iris and/or ciliary body injury) is the most frequent injury after CGT and can be associated with a retinal detachment (e.g., pop of a champagne cork) [10,12,19]. In OGT, corneal and/or scleral wounds are commonly diagnosed. In these OGT, the injuries can be penetrating or perforating and associated with an IOFB [10,19-22]. After an ocular trauma, an oval pupil should suggest an OGT. OGT usually occurs in younger children, is more severe, more complicated, requires more surgical procedures, and leads to more significant visual impairment than CGT [3,4,18,23,24]. This is especially the case with projectile-related ocular trauma [13,25-30]. In France, since 1999, the use of pneumatic guns (Airsoft-type guns) is highly regulated (*Décret n°99-240 du 24 mars 1999 relatif aux conditions de commercialisation de certains objets ayant l'apparence d'une arme à feu*). The sale of moderate-velocity guns (0.08–2 J at muzzle exit) to minors is prohibited and protective goggles are mandatory. Similar guns with a higher velocity (> 2 J) belong to category D of the French weapons classification. After an ocular trauma, the treatment remains mostly medical (70%) [11]. The therapeutic regimen involves: antibiotics (intravenous, intraocular, and/or oral), steroids (eye drops or oral route), mydriatic and/or healing eye drops. The antibiotic spectrum should be active on Gram-positive bacteria (*S. epidermidis*, *Streptococcus* sp.), and in OGT, on Gram-negative bacteria (*Bacillus* sp.). The French Group of Pediatric Infectious Disease recommends the prescription of

levofloxacin as a first-line treatment (10 mg/kg, max 500 mg per dose; po/iv every 12 h). An initial surgical treatment is indicated in 2–7% of ocular trauma [2,6,11,14,20]. In comparison, the hospitalization rate is much higher (13–78%), which is often explained by the need for general anesthesia for the first ophthalmic examination and this rate also depends on the type of injuries (inclusion of adnexal and/or chemical injuries), the patient's age, and the unit (emergency or ophthalmology) [7,13,23]. In the case of hospitalization, the mean length of stay varied between 3 and 9 days [1,2,4,5,8,11,18,23]. The OTS can indicate the prognosis but it is not always possible to evaluate. This holds true for 25–30% of cases [31,32]. The successful treatment rate for perforating OGT corresponds to a final visual acuity of 5/10 (20/40) or higher and is approximately 55% [20,21,24] in industrial countries. Perforating injuries could lead to an enucleation rate of up to 8% [33]. The main complication of ocular trauma is posttraumatic cataract, which can occur several years after the trauma [10-12]. Visual sequelae, according to the severity of ocular trauma, are more significant after OGT [19-21,23]. Known risk factors for severe visual impairment among children age younger than 5 years are retinal detachment, wound length greater than 6 mm, injuries with retrolimbal involvement, and globe rupture [34].

Our study had several biases or limitations: a recall bias because of the retrospective character and the loss of some children during the follow-up performed by specialist practitioners. Some data were missing because of the incomplete digitalization of medical files before 2010. The OTS could not be performed in 65 patients (21%) especially in very young or noncompliant children. This rate remains within the known limits of the score in children. Our study had selection bias. Firstly, we excluded adnexal and chemical injuries that could modify the hospitalization, surgical rates, and final visual acuity distribution. Secondly, we enrolled patients in a level I pediatric trauma center. As a regional reference center, we might have recruited more severe cases.

5-Conclusion –Hospital presentations after ocular trauma have not decreased during the 2007–2016 period. Ocular traumas occur mostly during free play in domestic areas and among children older than 5 years. Due to the rate of projectile-related ocular injuries (14%)**,** French legislation should be stricter about the sale of any Airsoft-type guns to children under 18 years of age, independently of their velocity. Ocular trauma secondary to the use of foam darts (blasters or Nerf guns) [34,35] should be monitored and protective goggles should be mandatory. The majority of ocular trauma can be prevented, especially with widespread use of wearing protective goggles while participating in at-risk activities. The social and psychological burden of related visual impairment is of importance: one in ten children will have a permanent visual defect.

Conflicts of interest: none

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Table 1– Ocular Trauma Score (OTS) calculation and visual prognosis estimation at 6 months

Initial raw score (based on initial visual acuity)	NLP	**60**
	LP or HM	**70**
	1/200 ≤ IVA ≤19/200	**80**
	20/200 ≤ IVA < 20/50	**90**
	≥ 20/40	**100**
Globe rupture		**-23**
Endophthalmitis		**-17**
Perforating injury		**-14**
Retinal detachment		**-11**
Relative afferent pupillary defect		**-10**
Score		**/100**

NPL: No light perception - LP/HM: Light perception/Hand motion-IVA: Initial visual acuity

Global score	**Score OTS**	**LP-**	**LP+/HM**	**1/200-19/200**	**20/200-20/50**	**≥ 20/40**
0–44	1	73%	17%	7%	2%	1%
45–65	2	28%	26%	18%	13%	15%
66–80	3	2%	11%	15%	28%	44%
81–91	4	1%	2%	2%	21%	74%
92–100	5	0%	1%	2%	5%	92%

Table 2 – Main characteristics of children with ocular trauma

Characteristics, *n* (%)		**Availability (%)**
N	337	
Male	247 (73)	100 %
Age (years)		100 %
Mean (SD)	8.4 (4.1)	
[0–2 years], *n* (%)	17 (5)	
[2–5 years]	68 (20)	
[5–10 years]	113 (34)	
[10–15 years]	139 (41)	
Circumstances of injury		91%
Domestic accident	172 (51)	
Public area	70 (21)	
School injury	48 (14)	
Traffic accident	18 (5)	
Not specified	29 (9)	
Referral mode		62%
Spontaneous	150 (45)	
Family physician, pediatrician	60 (18)	
Not specified	127 (38)	
Mode of transportation		60%
Parental car	155 (46)	
Ambulance	41 (12)	
Medicalized ambulance SAMU-SMUR	5 (2)	
(Emergency physician on board)	136 (40)	
Not specified		
May to October admission	180 (53)	100%
Weekend admission	107 (32)	
Daily admission [8:00 AM–6:00 PM]	165 (49)	100%
Severity		81%
-BETT / Open-globe injury	76 (23)	
-OTS		
OTS 1	4 (1)	
OTS 2	14 (4)	
OTS 3	21 (6)	
OTS 4	22 (7)	
OTS 5	211 (63)	
Not specified	65 (19)	
Initial visual acuity (VA)	75	23%
Normal (0.9–1.0)	14 (19)	
Mildly impaired (0.3–0.8)	35 (47)	
Poor (0.02–0.25)	12 (16)	
Deep (0.02–0.04)	10 (13)	
Light perception	1 (0.)	
No light perception	3 (0.)	
Evolution		100%
Hospitalization	208 (62)	
Treatment		98%
Nonsurgical	237 (70)	
Surgery	93 (28)	
Not specified	7 (2)	
Sequelae	**32 (9.5)**	
[0–2 years] (*n*=17)	0 (0)	
[2–5 years] (*n*=68)	10 (15)	
[5–10 years] (*n*=113)	10 (9)	
[10–15 years] (*n*=139)	12 (9)	

BETT: Birmingham Eye Trauma Terminology; OTS: Ocular Trauma Score; SD: standard deviation; SAMU: mobile unit for emergencies; SMUR: mobile unit for intensive care

Table 3 – Distribution of traumatic mechanisms among pediatric ocular trauma (percentage in parentheses)

Mechanisms, *n* (%)	**Male (*n*=247)**	**Female (*n*=90)**	**Total, n (%) *n*=337**
Blunt objects	**51 (21)**	**23 (26)**	**74 (22)**
- Ball/Balloon	17	5	22 (7)
- Wood stick	9	2	11 (3)
- Sports equipment*	7	0	7 (2)
- Metal bar	4	0	4 (1)
- Wire hanger	2	1	3 (1)
- Miscellaneous (including toys)	12	15	27 (8)
Direct trauma	**44 (18)**	**12 (13)**	**56 (17)**
- Body parts (wrist, elbow, foot)	38	9	47 (14)
- Nails	2	2	4 (1)
- Collisions	4	1	5 (2)
Projectiles	**40 (16)**	**7 (8)**	**47 (14)**
- Bullets (Airsoft gun)	24	1	25 (7)
- Stone	8	2	10 (3)
- Badminton shuttlecock	3	2	5 (2)
- Fireworks / firecracker	1	1	2 (1)
- Miscellaneous (acorn, prune)	4	1	5 (2)
Fall	**36 (15)**	**19 (21)**	**55 (16)**
Sharp objects	**17 (7)**	**8 (9)**	**25 (7)**
- Glass	5	3	8 (2)
- Knife	5	1	6 (2)
- Arrow/ darts	3	1	4 (1)
- Pencil	3	2	5 (2)
- Miscellaneous (compass, cutter)	1	1	2 (1)
Tree branch	**15 (6)**	**4 (4)**	**19 (6)**
Traffic-road accident	**6 (2)**	**6 (7)**	**12 (4)**
Intraocular foreign body**	**5 (2)**	**2 (2)**	**7 (2)**
Animals-related scratch or bite	**4 (2)**	**2 (2)**	**6 (2)**
High-pressure water jet	**0 (0)**	**1 (1)**	**1 (0.)**
Unspecified	**29 (12)**	**6 (7)**	**35 (10)**

*tennis racket, ping-pong bat, golf club, hockey stick or puck
**iron dust, sand

Table 4 – Distribution of ocular lesions and their severity (Birmingham Eye Trauma Terminology [BETT]) and prognostic (Ocular Trauma Score [OTS]) depending on sex

				Male ***n*=247**	**Female** ***n*=90**	**Total** ***n* (%)**
Contusions	Anterior chamber	Hyphema		74	17	91(22)
		Keratitis / corneal ulcer		27	6	33 (8)
		Corneal edema		8	2	10 (2)
		Subconjunctival hemorrhage		6	3	9 (2)
		Conjunctival hyperemia		6	1	7 (2)
		Posttraumatic mydriasis		5	2	7 (2)
		Iridodialysis		4	0	4 (1)
		Hypopion iritis		3	0	3 (1)
		Lens dislocation		1	0	1 (0.)
	Posterior chamber	Retinal edema		5	1	6 (1.)
		Vitreous hemorrhage		5	1	6 (1.)
		Retinal hemorrhage		4	0	4 (1)
	Not specified			61	37	98 (24)
Wounds	Corneal		IOFB-	21	9	30 (7)
			IOFB+	10	11	21 (5)
	Scleral		IOFB-	15	1	16 (4)
			IOFB+	3	0	3 (1)
	Conjunctival			6	3	9 (2)
	Non specified			9	2	11 (2)
Adnexal hematoma				32	6	38 (9)
Ocular rupture				1	0	1 (0.)
Not specified				9	1	10 (2)
Total				**314**	**102**	**416**
BETT Open-globe injury				60	16	76 (23)
OTS						
≤ 3				32	7	39 (12)
> 3				166	67	233 (69)
Unavailable				51	14	65 (19)

IOFB: Intraocular foreign body

Table 5 – Comparison of factors influencing pediatric ocular trauma depending on sex and age (percentage in parentheses)

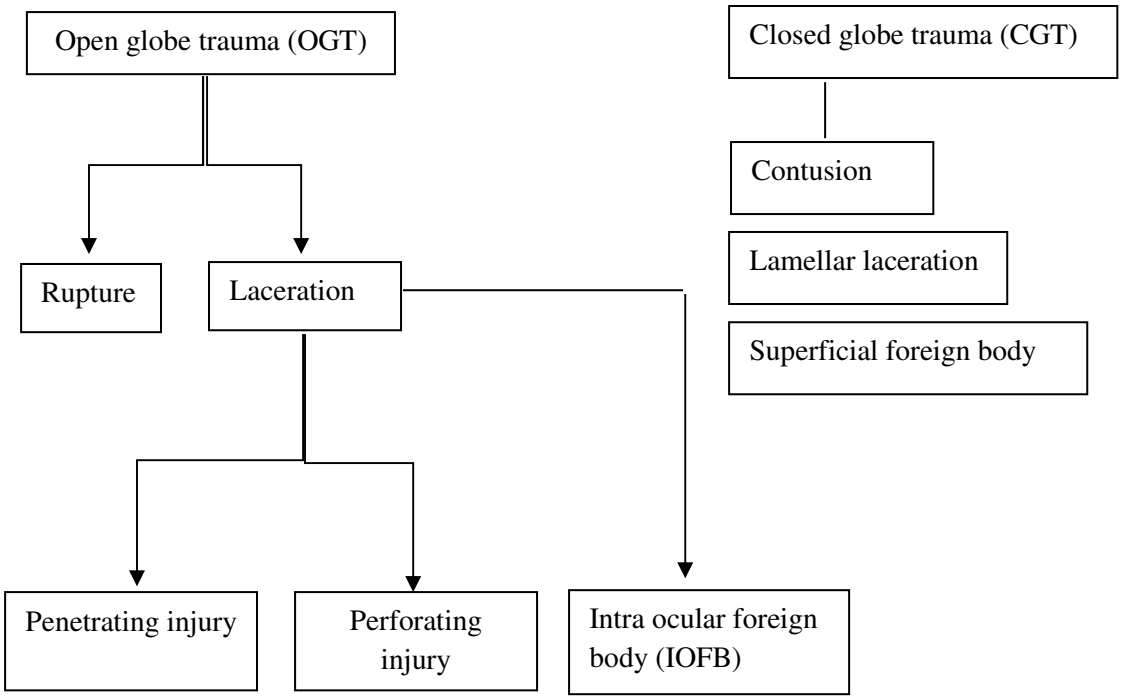
Risk factors	Male (*n*=247)	Female (*n*=90)	*p*	OR (95% CI)
Age, mean (years)	8.9	7.2	0.0007	
Admissions				
Evening (6:00–12:00 PM) (*n*=104)	85(34)	19(21)	0.02	2.0(1.1-3.5)
Mechanisms				
Projectiles (*n*=47)	40(16)	7(8)	0.036	2.5(1.1-5.8)
Severity				
OTS≤ 3	32(16)	7(9)	0.16	1.8(0.8-4.4)
Open-globe injury	60(24)	16(18)	0.21	1.5(0.8-2.7)
Hospitalization (*n*=208)	159(64)	49(54)	0.098	1.5(0.9-2.5)
Sequelae (*n*=32)	25(10)	7(8)	0.51	1.4(0.6-3.4)
	Age ≥ 9 years (*n*=168)	**Age < 9 years (*n*=169)**	***p***	**OR* (95% CI)**
Season				
Winter–spring (Nov–Apr) (*n*=157)	73 (43)	84 (50)	0.25	0.8 (0.5–1.2)
Mechanisms				
Blunt object (*n*=74)	32 (19)	42 (25)	0.08	0.6 (0.4–1.1)
Direct trauma (*n*=56)	43 (26)	13 (8)	0.0001	3.8 (2.0–7.5)
Projectiles (*n*=47)	39 (23)	8 (5)	<0.0001	5.5 (2.5–12.3)
Severity				
Open-globe injury (*n*=76)	26(15)	50(29)	0.002	0.4 (0.3–0.7)
Sequelae (*n*=32)	12 (7)	20 (12)	0.16	0.6 (0.3–1.2)

OR: Odd ratio; OTS: Ocular trauma score

Figure

Figure 1: The Birmingham Eye Trauma Terminology (BETT) system adapted from [23]

Figure 1


Open globe trauma (OGT)
Closed globe trauma (CGT)
Contusion
Lamellar laceration
Superficial foreign body
Rupture
Laceration
Penetrating injury
Perforating injury
Intra ocular foreign body (IOFB)