Open Eye Injuries in the Pediatric Population in Kuwait

Abdul M. Behbehani Nashaat Lotfy Hania Ezzdean Salem Albader
Mostafa Kamel Nadia Abul

Ibn Sina Hospital, Kuwait

Key Words

Open globe · Ocular trauma · Pediatric eye injuries · Kuwait

Abstract

Objective: To report the epidemiological characteristics of pediatric open globe injuries and to discuss treatment, management and outcomes of such injuries. **Materials and Method:** The hospital records and operative notes of 95 patients 16 years old and younger who were treated for open eye injury at Ibn Sina Hospital, Kuwait between September 1995 and January 1999 were reviewed. The average age of patients was 6.6 years. Patients were divided into three groups according to their final visual acuity (FVA): group 1, FVA of 20/40 or better; group 2, 20/40–20/200, and group 3, 20/400 or worse. The FVA of each group was compared to initial visual acuity (IVA), wound entry site, injury-to-presentation interval, injury-to-surgery interval, time of surgery, duration of surgery, associated injuries and medical treatment. **Results:** Injury was most common in children 3–6 years old. Most injuries occurred during play at home (46%), between the months of July and November (58%), and evening time (42%). The most common causes were glass, pencil, stick, soft drink bottle, metal bar, and stone. The cornea was the most common entry site (59 cases). Seventy-three patients presented on the day of injury, and 38 of them had surgical repair that same day. The follow-up

period ranged from 2 weeks to 58 months. Thirty-eight patients (40%) had an FVA of 20/40 or better (group 1), 23 (24%) between 20/40 and 20/200 (group 2), 12 (13%) 20/400 or worse (group 3), and 22 (23%) had no record of FVA. The difference between IVA and FVA of wound entry site was statistically significant ($p < 0.005$). Differences due to injury-to-presentation interval, injury-to-surgery interval, time of surgery, duration of surgery, associated injuries, and the use of systemic antibiotics were found not to be statistically significant ($p > 0.2$). **Conclusion:** The prevalence of open globe injury among the pediatric population in Kuwait was high. Most injuries were due to household objects and occurred at home in the evening during the summer and autumn. IVA and anatomical location of the wound impacted on final outcome.

Copyright © 2002 S. Karger AG, Basel

Introduction

For children under the age of 20, ocular trauma is the leading cause of noncongenital unilateral blindness [1]. There are approximately 160,000 cases of pediatric ocular trauma reported annually in the United States, accounting for 15–50% of all ocular traumas [2–10]. The majority of these cases (9–30%) involves either ocular laceration or rupture, both of which are associated with poor outcomes [3, 5, 8, 10–14].

KARGER

Fax +41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

© 2002 S. Karger AG, Basel
1011–7571/02/0114–0183\$18.50/0

Accessible online at:
www.karger.com/mpp

Abdulmutalib Behbehani
Department of Surgery, Faculty of Medicine
Kuwait University, PO Box 24923
13110 Safat (Kuwait)
Tel. +965 5319475, Fax +965 531959, E-Mail a.h.bahbahani@hsc.kuniv.edu.kw

Table 1. Data reviewed from patient records

Nationality, gender and age
Laterality and history of eye problem
Injury circumstances and etiology
Time of injury
Initial and final visual acuity
Time to presentation and surgery
Time and duration of primary repair
Site of wound entry and associated injuries
Preoperative and postoperative treatment
Duration of follow-up
Complications
Secondary and tertiary surgery

Table 3. Age and gender distribution

Age, years	Male	Female	Total
0–3	17	6	23
3.1–6	19	9	28
6.1–10	18	6	24
10.1–16	16	4	20
Total	70	25	95

Table 2. Cause of injury

Tool	Mechanism	n
Glass	s	15
Pencil	s	12
Stick	b	9
Soft drink bottle explosion	s	6
Stone	b	6
Metal bar	b	5
Plastic toy	s	4
Fall	b	3
Fist	b	3
Palm tree	s	3
Animal	s	2
Finger nail	s	2
Fireworks	b	2
Catapult	b	2
Hanger	s	2
Knife	s	1
Gunshot	s	1
Hair clip	s	1
Scissors	s	1
Plastic ruler	s	1
Plastic spoon	s	1
Razor	s	1
Belt	b	1
Chair	b	1
Unknown		10

s = Sharp; b = blunt.

Management of ocular trauma in a pediatric patient presents several challenges to the ophthalmologist. Difficulties associated with assessing histories and lack of patient compliance with physical examination often compromise initial preoperative evaluations. Surgical management is technically demanding, requiring knowledge of numerous anatomical landmarks and the use of small instruments. In addition, an increased ocular inflammatory response in children, along with the development of amblyopia and/or poor patient compliance may complicate the postoperative course [2].

In Kuwait, the incidence of severe ocular injury in children is 0.35 per 1,000 annually, reportedly comprising 56% of all ocular injury patients admitted for treatment [15, 16]. A large portion of these injuries involves ocular perforation or rupture [15]. In this study, the first epidemiological review of ruptured globes in children in Kuwait, we report epidemiological characteristics of pediatric open globe injury and discuss experiences with treatment, manage-

ment, and outcome of such injuries. We used the Ocular Trauma Classification Group's definition of 'open globe' as full-thickness eye-wall (cornea-sclera) wound caused either by a blunt object (ruptured globe) or a sharp object with entry wound only (penetrating globe injury) [17].

Subjects and Methods

We reviewed the hospital records and operative notes of 120 patients 16 years and younger who were treated for open globe injuries at Ibn Sina Hospital, Kuwait between September 1995 and January 1999. The patients ranged in age from 4 months to 16 years, with an average age of 6.6 years (± 3.8 years). Twenty patients treated for open globe injury were excluded from the study due to unavailability of records or a previous history of eye disease or trauma. This review therefore includes 95 patients of whom 70 were male and 25 female. Ibn Sina Hospital is the main ophthalmic department and referral center for ocular trauma in Kuwait.

Each patient's record was reviewed for the categories listed in table 1. Patients were classified according to final visual acuity

Table 4. Comparison of groups by age, IVA, wound entry and associated injury

		Patients	FVA			No record	p value
			group 1 ≥ 20/40	group 2 20/40– 20/200	group 3 ≤ 20/400		
Age, years	0–3	23	5	3	3	12	0.299
	3.1–6	28	13	7	3	5	
	6.1–10	24	11	10	1	2	
	10.1–16	20	9	3	5	3	
IVA	≥ 20/40	7	5	0	0	2	0.011
	20/40–20/200	8	7	1	0	0	
	≤ 20/400	38	12	16	7	3	
Wound entry site	Corneal	59	21	22	7	9	0.028
	Corneoscleral	22	11	0	4	7	
	Scleral	9	5	0	1	3	
	Limbal	5	1	1	0	3	
Associated injury	Full thickness only	28	10	6	4	8	0.266
	Iris prolapse	31	13	7	0	11	
	Lens damage	11	3	5	3	0	
	Vitreous loss	5	3	1	0	1	
	Mixed	20	9	4	5	2	

(FVA) into three groups: group 1, good visual acuity, 20/40 or better; group 2, moderate visual acuity, 20/40–20/200; or group 3, poor visual acuity, 20/400 or worse. Patient data, including initial visual acuity (IVA) defined as the visual acuity at presentation, etiology of injury, associated ocular injuries (corneal, scleral, etc.) and injury-to-presentation interval, was extracted from the records. The data were subsequently analyzed to determine their impact on FVA, the recorded visual acuity at last follow-up. The Q test was used to compare these categorical variables.

Since the main operating room at our hospital is open between 7.00 a.m. and 10.00 p.m., patients undergo emergency primary repair on the day of admission when possible; otherwise the repair is performed on the following day. Some repairs were performed during regular working hours while others were performed after regular working hours when the operating room is presumably not at its full capacity. We evaluated the effects of injury-to-surgery interval, and time and duration of the surgery on the FVA in our patients.

Records of pre- and postoperative use of topical and systemic antibiotics and steroids were also analyzed with respect to the FVA.

Results

Sixty-two patient records (65%) specifically stated the location of injury, and of these, 46% occurred at home, 8% at school and 10% in other places. Fifty-six of the injuries (59%) were reported as accidental, 6 (6%) as assault (injury intentionally inflicted by another individual) and

in 33 (35%), circumstances or location of injury were not recorded. No case was reported as child abuse. Fifty-eight percent of injuries occurred between July and November, with the highest incidence in October (16%) and lowest in June (4%). Of the 53 cases where the time of injury was reported, 40 (42%) occurred in the evenings and 13 (14%) in the morning. The right eye was involved in 52 cases (55%) and the left eye in 43 (45%).

The follow-up period for patients ranged from 2 weeks to 58 months, with a mean of 15 months. IVA was recorded for 53 patients of whom only 48 had FVA recorded. Of the 42 patients who did not have IVA recorded, 25 had FVA recorded. Thus, a total of 73 patients had FVA recorded. Of these 73, 38 patients (40%) had a FVA of 20/40 or better, 23 (24%) between 20/40 and 20/200, and 12 (13%) 20/400 or worse. Twenty-two patients (23%) had no record of FVA.

In 85 cases, the etiology of injury was recorded (table 2), indicating 24 different types of injury. Sixty-six (69.5%) had a recorded FVA. The most common causes were broken glass, pencil, stick, metal bar, stone, and explosion of soft drink bottle. Penetrating injuries accounted for 53 cases (62%) and blunt injuries accounted for 32 (38%). The injury did not influence FVA. Injury was most common in children 3–6 years old (table 3).

Table 5. Comparison of the groups with respect to surgery intervals, time and duration

		FVA			No record	Total patients	p value
		group 1 ≥ 20/40	group 2 20/40– 20/200	group 3 ≤ 20/400			
Injury-to-presentation interval	Same day	29	15	10	19	73	0.669
	Later	5	4	1	0	10	
Injury-to-surgery interval	Same day	15	10	4	9	38	0.675
	Later	19	9	7	10	45	
Time of surgery	Regular hours	14	12	6	14	46	0.302
	After regular hours	24	9	6	6	45	
Duration of surgery	1 h or less	23	13	4	1	41	0.579
	> 1 h	6	2	2	3	13	

Table 6. Comparison of the groups with respect to pre- and postoperative medication

		FVA			No record	Total patients	p value
		group 1 ≥ 20/40	group 2 20/40– 20/200	group 3 ≤ 20/400			
Preoperative systemic antibiotics	Yes	24	16	9	16	65	0.434
	No	12	4	2	3	21	
Preoperative topical steroid	Yes	1	2	2	1	6	0.206
	No	35	18	9	18	80	
Postoperative systemic antibiotics	Yes	29	16	10	15	70	0.486
	No	8	6	1	4	19	
Postoperative systemic steroid	Yes	3	2	1	1	7	0.941
	No	34	20	10	18	82	

The final outcome of FVA according to age, IVA, wound entry site and associated injury is shown in table 4. For age-groups, wound entry site and associated injury, all records were found (n = 95). Only 53 records were found for IVA, however. For age-groups, wound entry site and associated injury, FVA was recorded for 73 patients. Of the initial 53 patients who had IVA recorded, FVA was recorded in 48 cases. Age differences and associated injuries did not impact on FVA, where as IVA and wound entry site had significant impacts on FVA (p = 0.01 and 0.03, respectively).

Of 95 patients, 73 presented the same day as the injury and 10 later. Thirty-eight were operated on the same day as they presented and 45 were operated on later. Forty-six

were operated on during regular operating hours and 45 were operated on after regular operating hours. The duration of surgery was 1 h or less for 41 patients; for 13, the duration of surgery was greater than 1 h. The FVA was not impacted by type of medication whether given pre- or postoperatively (table 5).

Preoperatively, 65 (68%) patients received systemic antibiotics and 21 did not; 6 received topical steroids and 80 did not. Postoperatively, 70 received systemic antibiotics and 19 did not; 7 received topical steroids and 82 did not. The recorded FVA for each medication is shown in table 6. FVA was not impacted by type of medication whether given pre- or postoperatively.

Table 7. Type and time of procedure performed

Complications	Time of repair			Total
	primary	secondary	tertiary	
Cataract	5	8	16	29
Retinal detachment (RD)		2	4	6
Cataract and RD		2	2	4
Strabismus			5	5
Phthisis				3
Sympathetic ophthalmia				1
Endophthalmitis				1
Corneal abscess evisceration		1		1
Intraocular lens implant		13	7	20

Primary repair was done at the same time as the primary wound closure, secondary repair was done during the initial hospital admission, and tertiary repair was done at a subsequent admission.

Table 7 shows different complications documented in our patients at the timing of repair. Although cataract was the most common complication ($n = 29$), there were only a few posttraumatic infections. One patient was a 12-year-old boy who developed endophthalmitis after sustaining a penetrating corneal injury from a pen. He presented with counting finger vision, had same-day surgery, and received oral antibiotics but no corticosteroids pre- and postoperatively. No organism was cultured and the eye developed phthisis bulbi. The other case of corneal infection involved a patient who, in addition to topical antibiotics, also received oral antibiotics (he too, was not given steroids). The FVA was 20/80 following lens aspiration and intraocular lens implant. The 3rd patient, a 3-year-old boy, developed sympathetic ophthalmia after sustaining a blunt injury with an iron bar. The injury caused a corneoscleral wound with iris and vitreous prolapse and lens damage. It was repaired on the day of injury but eviscerated 8 days later. No patient had his eye enucleated.

Discussion

Kuwait has a high incidence of traumatic penetrating eye injuries in children [15, 16]. Several large studies have been published outlining the epidemiology of eye injuries in the pediatric population [8, 10–15, 18, 19] where the reported male:female ratio is 4:1, consistent with our finding. Investigators have theorized that aggressive behavior in young boys probably accounts for the disparity between the two genders. The average age of our patients (6.6

years) was younger than that found in other studies [14, 20]. All of our cases were monocular, showing no great preference for either eye [3, 10], as previously reported. Glass, pencil, wood stick, stone, and metal bar (55%) were the most common cause of injury. The cornea was the most frequently involved anatomical site (60%), similar to the incidence reported in other studies [14, 18, 20].

Our findings concerning where, how and when the injuries occurred are consistent with those reported in the literature [3, 8, 10, 13, 15, 18, 19]. The majority of the injuries occurred at home rather than at school due to accidents rather than assaults. Most of the injuries occurred in the summer and autumn and in the evening, as opposed to during the day. Our assault rate was somewhat lower than that in the literature, probably due to underreporting of child abuse [21].

Thirteen percent of our patients had an FVA 20/400 or worse. In previous studies, the percentage of children who had similar FVAs was 5–45% [12, 14, 15, 22]. Forty percent of our patients achieved FVA 20/40 or better. In previous studies, the percentage of children who achieved this outcome was 14–72% [14, 15, 18, 22].

Previous studies found certain factors to be associated with worse visual outcome in children. These factors include mixed corneoscleral wound [20], corneal involvement [3], scleral injury [3], larger corneal wound [18], a combination of iris prolapse, lens trauma and vitreous loss [20], vitreous hemorrhage and retinal detachment [20], trauma requiring vitrectomy [18], gun-related injuries [18], and traumatic cataract, necessitating lensectomy and vitreous surgery [22]. In this study, wound entry site,

as shown in table 4, affected final visual outcome ($p = 0.03$).

Some investigators have suggested that IVA is less valuable in predicting FVA in children than in adults [18]. The Ocular Trauma Classification Group [17] summarized four specific anatomical and physiological variables that have been shown to be prognostic of the final visual outcome in ocular trauma: type of injury (mechanism), grade of injury (IVA), the presence of a relative afferent pupillary defect in the involved eye and the zone of injury (location and extent). In our study, children who presented with an IVA worse than 20/400 and those with a corneal entry wound had a significantly worse outcome as compared to others. In addition, age, etiology of injury, injury-to-presentation interval, injury-to-surgery interval, or time and duration of surgery did not affect FVA. Variables shown in table 5, such as the injury-to-presentation interval, the injury-to-surgery interval, and duration of surgery likewise did not affect FVA, suggesting that delaying surgical treatment within a day if necessary may not cause harm to these patients.

The use of systemic antibiotics pre- or postoperatively shown in table 6 did not seem to alter the FVA or rate of infection except in the case of 2 patients who developed posttraumatic infection, although they had received oral and topical antibiotics. However, since the choice of antibiotic and the route of administration in our population varied greatly according to the treating physician, this clinical observation should be looked at cautiously. Indeed, various antibiotics have been shown to have different intravitreal penetration when given intravenously in experimental models [23–26]. The previously noted low incidence of posttraumatic infection in our pediatric population is consistent with a previous report from Kuwait

[15] and other studies [10, 14, 20, 27]. The use of systemic steroids in the children did not alter their visual outcome. Further studies are needed to specifically investigate the prophylactic use of systemic antibiotics and steroids and their role in reducing infection, even though intraocular and systemic use of antibiotics in treating posttraumatic endophthalmitis has been demonstrated [28, 29]. In our study, the incidence of complications such as sympathetic ophthalmia, phthisis bulbi, evisceration and enucleation were low, similar to previous reports. Likewise, the incidence of cataracts after open surgery and that of retinal detachment found in this study is similar to previous reports [8, 10, 11, 14, 18, 20].

This study has several limitations. The large number of unrecorded data in the patient records may be due to unclear and/or questionable circumstances surrounding the injuries as well as the difficulty in collecting data (especially for visual acuity and the documentation of relative afferent pupillary defect in the involved eye) in traumatized pediatric patients. In addition, the patients had variable follow-up times – some as short as 2 weeks – despite efforts to contact all patients at the beginning of the study for a complete examination. Finally, we did not account for different surgeons and surgical techniques used during initial and subsequent repair.

Conclusion

The prevalence of open globe injury among the pediatric population in Kuwait was high. Most injuries, attributable to household objects, occurred at home in the evening during the summer and autumn. IVA and anatomical location of the wound impacted on final outcome.

References

- 1 National Society for the Prevention of Blindness, Data Analysis: Vision Problems in the U.S. New York, National Society for the Prevention of Blindness, 1978, pp 24–33.
- 2 Alfaro DV, Liggett PE: Vitreoretinal Surgery of the Injured Eye. Philadelphia, Lippincott-Raven, 1999, pp 289–300.
- 3 DeRespinis PA, Caputo AR, Fiore PM, Wagner RS: A survey of severe eye injuries in children. *Am J Dis Child* 1989;143:711–716.
- 4 Maltzman BA, Pruzon H, Mund ML: A survey of ocular trauma. *Surv Ophthalmol* 1976;21: 285–290.
- 5 Scharf J, Zonis S: Perforating injuries of the eye in childhood. *J Pediatr Ophthalmol* 1976;13: 326–328.
- 6 Thordarson U, Ragnarsson AT, Gudbrandsson B: Ocular trauma in 105 patients. *Acta Ophthalmol* 1979;57:922–928.
- 7 Canavan YM, O'Flaherty MJ, Archer DB, Elwood JH: A ten-year survey of eye injuries in Northern Ireland, 1967–76. *Br J Ophthalmol* 1980;64:618–625.
- 8 Niiranen M, Raivio I: Eye injuries in children. *Br J Ophthalmol* 1981;65:436–438.
- 9 Ilisar M, Chirambo M, Belkin M: Ocular injuries in Malawi. *Br J Ophthalmol* 1982;66:145–148.
- 10 Rapoport I, Romen M, Kinek M, Koval R, Teller J, Belkin M, Yelin N, Yanco L, Savir H: Eye injuries in children in Israel: A nationwide collaborative study. *Arch Ophthalmol* 1990; 108:376–379.
- 11 Moreira CA, Debert-Ribeiro M, Belfort R: Epidemiological study of eye injuries in Brazilian children. *Arch Ophthalmol* 1988;106:781–784.
- 12 Strahlman E, Elman M, Daub E, Baker S: Causes of pediatric eye injuries: A population-based study. *Arch Ophthalmol* 1990;108:603–606.

- 13 Takvam JA, Midelfart A: Survey of eye injuries in Norwegian children. *Acta Ophthalmol* 1993; 71:500–505.
- 14 Soyulu M, Demircan N, Yalaz M, Isiguzel I: Etiology of pediatric perforating eye injuries in southern Turkey. *Ophthalmic Epidemiol* 1998; 5:7–12.
- 15 AL-Salem M, Ismail L: Eye injuries among children in Kuwait: Pattern and outcome. *Ann Trop Pediatr* 1987;7:274–277.
- 16 Al-Salem M, Sheriff SM: Ocular injuries from carbonated soft drink bottle explosions. *Br J Ophthalmol* 1984;68:281–283.
- 17 Pieramici DJ, Sternberg P Jr, Aaberg TM Sr, Bridges WZ Jr, Capone A Jr, Cardillo JA, de Juan E Jr, Meredith TA, Mieler WF, Olsen TW, Rubsamen P, Stout T: A system for classifying mechanical injuries of the eye (globe). The Ocular Trauma Classification Group. *Am J Ophthalmol* 1997;123:820–831.
- 18 Rudd JC, Jaeger EA, Freitag SK, Jeffers JB: Traumatically ruptured globe in children. *J Pediatr Ophthalmol Strabismus* 1994;31:307–311.
- 19 Luff AJ, Hodgkins PR, Baxter RJ, Morrell AJ, Calder I: Aetiology of perforating eye injury. *Arch Dis Child* 1993;68:682–683.
- 20 Elder MJ: Penetrating eye injuries in children of the West Bank and Gaza Strip. *Eye* 1993;7: 429–432.
- 21 Al-Ateeqil W, Shabani I, Abdulmalik A: Child abuse in Kuwait: Problem in management. *Med Principles Pract* 2002;11:131–135.
- 22 Alfaro DV, Chaudhry NA, Walonker FA, Runyan T, Saito Y, Liggett P: Penetrating eye injuries in young children. *Retina* 1994;14: 201–205.
- 23 Yoshizumi MO, Leinwand MJ, Kim J: Topical and intravenous gentamicin in traumatically lacerated eyes. *Graefes Arch Clin Exp Ophthalmol* 1992;30:175–177.
- 24 Alfaro DV, Pince K, Park J, Runyan T, Ryan SJ, Liggett PE: Systemic antibiotic prophylaxis in penetrating ocular injuries: An experimental study. *Retina* 1992;12:S3–6.
- 25 Alfaro DV, Runyan T, Kirkman E, Tran TV, Liggett PE: Intravenous cefazolin in penetrating eye injuries: Treatment of experimental posttraumatic endophthalmitis. *Retina* 1993; 13:331–334.
- 26 Nossov PC, Alfaro DV, Michaund ME, Winter LW, Laughlin RM, Moss ST: Intravenous cefazolin in penetrating eye injuries: A swine model. *Retina* 1996;16:246–249.
- 27 Amansakhatov ShA, Artykov AA, Ezizova GK, Tsereteli EK, Berdyev BB, Charyeva ACH: (Clinical etiological analysis of infective penetrating wounds of eyes in children). *Vestn Oftalmol* 1998;114:25–28.
- 28 Alfaro DV, Roth D, Liggett PE: Posttraumatic endophthalmitis: Causative organisms, treatment and prevention. *Retina* 1994;14:206–211.
- 29 Alfaro DV, Roth DB, Laughlin RM, Goyal M, Liggett PE: Paediatric post-traumatic endophthalmitis. *Br J Ophthalmol* 1995;79:888–891.