

### Childhood penetrating eye trauma visits to the emergency room. *Causes and outcomes*

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Eye trauma is an ophthalmologic emergency that accounts for approximately 3% of all Emergency Room visits in United States of America.<sup>1</sup> The consequences of serious eye injuries are not infrequent and visual outcomes can be extremely poor, especially in situations involving penetrating eye trauma. The purpose of this study was to determine the clinical and demographic characteristics of childhood penetrating eye injuries, their predisposing factors, and the visual outcome.

A retrospective review of clinical results within the past 15 years was conducted for all the pediatric cases involving penetrating eye injuries from King Abdulaziz University Hospital, Riyadh, Kingdom of Saudi Arabia between January 1995 and December 2010. A penetrating eye injury was defined as a full thickness wound of either the cornea or the sclera (or both) caused by sharp object. The data were obtained from admission charts, surgical records, and outpatient clinical files

Ethical approval was obtained from the Institutional Review Board (IRB), King Saud University, Riyadh, Saudi Arabia. The data included patients' age and gender, a description of the injuring object, size and location of the wound, status of the crystalline lens, reporting of any additional anterior and posterior segment findings at the time of the initial examination, performance of any additional surgical procedures, and final visual acuity. Inclusion criteria were children equal to or less than 15 years who sustained penetrating eye injury prior to their presentation. Exclusion criteria were patients who missed the follow-up, or those with missing data files. Visual acuity outcomes were divided into the following 3 groups: (1) 20/20 to 20/40, (2) 20/50 to 20/160, and (3) 20/200 or worse. Snellen chart was used for visual acuity measurement whenever it was possible. Visual acuity of 20/200 or worse was considered to be poor visual outcome. Follow-up period ranged from 2-60 months. The potential prognostic factors studied included patients' age, object causing the ocular trauma, presence of any associated injuries, and location and length of the wound.

A total of 71 cases of penetrating ocular injuries in children were included in our study. Of these, 39 (55%) were males and 32 (45%) were females. Forty-one cases (58%) were Saudis, while 30 cases (42%) were non-

Saudis. The mean age of this group was 7.5 years; 9 months were the youngest and 15 years were the oldest (SD=3.5 years). The most common object involved in the traumas was knife, which was identified in 17 cases (24%), followed by glass 11 cases (15.5%), and a pen 9 cases (12.7%). In addition to these objects, some of the other trauma-causing objects included a clothes hanger, a toy, and the edge of a ruler.

The most common type of penetrating ocular injury observed in our analysis was a corneal laceration 62 cases (87.3%). Of these 62 cases, 40 cases were also observed to have a prolapsed iris, and 20 cases were associated with a scleral laceration. The most common complication observed during the follow-up period was a corneal scar, which was reported in 52 cases (73.2%). Retinal detachment was reported as a complication in 9 cases, observed at the time of injury in 5 cases and observed after the time of injury in 4 cases (3 days, 4 months, one year and 3.5 years). Endophthalmitis was observed in one case characterized by a delayed presentation (occurring 15 days after the trauma). The patients' visual acuity was measured at the time of the final visit during the follow-up period. Interestingly, most patients were among the good visual outcome group (their visual outcome was between 20/20 and 20/40). Three of the patients had no light perception (NLP), because their situations were complicated by retinal detachment, endophthalmitis and evisceration. Age was a risk factor for the final visual acuity ( $p=0.024$ ). The visual acuity outcome was noted to be better with increasing age at the time of injury. The younger the child, the worst visual acuity outcome. In contrast, we observed no relationship between the final visual acuity and the patients' gender ( $p=0.687$ ).

There was no significant difference in the final visual outcome between patients with a corneal laceration and patients with a corneoscleral laceration ( $p$ -value=0.648). On other hand, the size of the corneal laceration (mean wound length=4.9 mm, SD=3) was positively correlated with the final visual outcome ( $p=0.042$ ). Notably, the duration of time between the ocular-damaging event and the performance of the primary repair ranged from 30 minutes to 48 hours in most cases, with the exception of 4 cases in which their primary repair was performed 3, 4, 5 and 15 days after the event. The visual acuities of these patients were 20/25, CF, 20/20 and NLP. In our study, 35 cases (49%) involved an injured lens. Thirty-two children had a traumatic cataract formation, while 28 children underwent cataract extraction. This procedure was performed as part of the primary operation in

11 patients (with primary implantation of posterior chamber intraocular lens (PCIOL) in one patient). In addition, 2 patients underwent secondary implantation, while 8 patients remained aphakic. Notably, 17 patients underwent secondary cataract extraction with PCIOL implantation. Overall, 9 patients (26%) achieved a final visual acuity of 20/40 or better. In addition, 9 patients achieved a final visual acuity of 20/160 or better, 2 patients had NLP due to an associated retinal detachment, while the majority (41%) were found to have poor final visual acuity (20/200 to LP). When we compared the visual outcome for those who underwent lens aspiration at the time of the primary repair we found no significant correlation between the time of lens aspiration and the visual outcome (using the Mann-Whitney U test,  $p=0.357$ ).

Table 1 shows the different predictors of poor visual acuity ( $\leq 20/200$ ). The 71 cases (predominantly male patients) were found to be consistent with a previous study.<sup>2</sup> This preference is believed to be due to the natural characteristics of males that predispose them more to the different types of ocular traumas. We found that the most common causative object of ocular trauma was a knife (17% of cases), which was likewise the most common causative agent reported in the Mansouri et al study.<sup>3</sup> In our study, pencils/pens accounted for 13%

(9 cases, all of them occurring in children of at least 6 years of age) of cases and for a significant percentage of the cases reported in other studies for example 12.2% in the 2010 Liu et al study.<sup>4</sup> In our study, 49% of our patients were characterized by an injured lens (35 cases: 32 cataract, 3 lens subluxation). The management of such cases is determined by the severity of the lens injury. For example, cataract extraction performed at the same time of primary repair is recommended if there is severe lens damage that may lead to a significant inflammatory reaction and lens-induced glaucoma. In less severe cases, cataract extraction and intraocular lens (IOL) implantation is usually performed later, although primary IOL implantation performed at the time of the primary repair.<sup>5</sup> In our study, out of the 32 children characterized with traumatic cataract formation, 28 underwent cataract extraction. The procedure was performed as part of the primary operation in 11 eyes (primary implantation of PCIOL in one eye, secondary PCIOL implantation in 3 eyes, while 7 eyes remained aphakic). Seventeen eyes underwent secondary cataract extraction, followed by subsequent PCIOL implantation. When we compared the visual outcomes for patients who underwent cataract extraction at the time of primary repair with patients who underwent cataract extraction as a secondary procedure, we observed no significant correlation between the time of lens aspiration and the visual outcome (using Mann-Whitney U test,  $p=0.357$ ). Most of the lens injury ( $n=16$  [47%]) reported herein were found to have poor final vision (20/200 to NLP), and only 9 patients (26%) achieved a final visual acuity of 20/40 or better, which is a lower percentage than that reported in the 2005 Chuang and Lai's study.<sup>6</sup> The latter report described a series of 21 patients with penetrating ocular traumas who underwent primary cataract extraction and primary IOL implantation. Chuang and Lai's report found that 56.7% of these patients achieved a final visual acuity of 20/40 or better. However, in our study, we cannot ignore the fact that 9 of our damaged lens patients were associated with other major complications, 8 of which involved retinal detachment and one patient that involved vitreous hemorrhage that contributed significantly to the resulting poor vision.

One of other indicators of poor visual outcome identified in the current study was a younger age ( $p=0.024$ ). The visual acuity was better in those with who were older (that is, older than those of the amblyopic age). In contrast, we found no relationship between the

**Table 1** - Predictor variables for the worst visual acuity of  $\leq 20/200$ .

Predictor variables	Visual acuity $\leq 20/200$ number (%)	P-value
<i>Age (in years)</i>		0.033*
≤6 (n=28)	12 (42.9)	
>6 (n=43)	8 (18.6)	
<i>Wound type</i>		0.653
Corneal (n=35)	11 (31.4)	
Others (n=30)	7 (23.3)	
<i>Corneal injury size</i>		0.105
≤8 (n=56)	13 (23.2)	
>8 (n=15)	7 (46.7)	
<i>Retinal detachment</i>		0.012*
Yes (n=9)	6 (66.7)	
No (n=62)	14 (22.6)	
<i>Iris prolapse</i>		0.793
Yes (n=40)	12 (30.0)	
No (n=31)	8 (25.8)	
<i>Lens injury</i>		0.003*
Yes (n=35)†	16 (45.7)	
No (n=36)	4 (11.1)	

\*Statistically significant,

†Odd ratio=5.59, 95% confidence interval: 1.25 to 25.1 (significant)

final visual acuity and the patient's gender ( $p=0.687$ ). These results drastically differ from the results of the 2009 Mansouri et al study,<sup>3</sup> which found that a better visual prognosis was associated with both males and with younger age groups. The size of the corneal laceration was significantly correlated to the final visual outcome ( $p=0.042$ ), with poor visual outcome correlated with wound sizes greater than 6 mm. Grieshaber et al<sup>7</sup> study found that the indicators of poor visual outcome were wound sizes greater than 11 mm in length, mixed corneoscleral type wounding, and involvement of the lens and posterior segment in the injury.

Retrospective type of the current study is considered to be a limitation and further prospective multicenter studies would reflect the magnitude of penetrating eye injuries in Kingdom of Saudi Arabia.

In conclusion, this study demonstrates the need to emphasize the importance of the parental supervision to prevent eye trauma at home as well as the need to implement measures to improve the safety of children in schools and to stress the role of teachers in educating students regarding the danger of sharp objects to prevent or mitigate the occurrence of such injuries in the future.

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