Paediatric ocular trauma

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Ocular injuries are the most common cause of acquired uniocular blindness in children. Paediatric ocular injuries are distinct from those in adults in many ways. Ocular trauma in children is mainly accidental and has an age-specific pattern. Children are most frequently injured at home by common and relatively innocuous objects. Most injuries occur by mechanical trauma. Penetrating trauma involving the posterior segment of the eye has a poorer prognosis compared to anterior segment trauma. Ocular injuries eventually lead to decrease in vision, cosmetic blemishes and are associated with psychosocial problems. Fortunately, most paediatric trauma is preventable by simple measures. Increased literacy and health awareness is vital. The irreversible nature of visual loss and immense morbidity associated with it needs to be emphasized and publicized. The prevention of trauma therefore, is of paramount importance.

OCULAR injuries are the most common cause of acquired uniocular blindness in children. Yet they have not received the attention that they deserve. Eye injuries account for approximately 8–14% of total injuries in children[1,2] and are the most common type requiring hospitalization (in up to 40% cases). Next to amblyopia, ocular injuries are the main reason for preventable monocular visual loss in childhood[3].

Paediatric ocular injuries are distinct from those in adults in many ways. Aetiologically, such injuries are largely accidental, as opposed to those caused by intentional violent assault in adults.

Ocular injuries may be sustained *in utero*, during delivery and after birth. *In utero* injuries are known to occur as a result of needle injury during amniocentesis. Globe perforation, non-pigmented epithelial cysts in the anterior chamber, aphakia due to resorption of lens and retinal holes and detachment have been reported. Trauma due to forceps application during delivery can lead to hazy cornea at birth, which needs to be differentiated from congenital glaucoma. Years later, bullous keratopathy may occur in such eyes.

Injuries have an age-specific pattern in children. It is well known that infants and children less than 3 years of age sustain less injuries due to close parental supervision[4]. However, they generally suffer handler-related injuries like from the fingernail of siblings, mother or caretaker, sewing and knitting needles, as well as scissors and knives. Older children injure themselves accidentally by sharp edges and spikes of toys, pencils, arrows, thorns and stones. Fall during swinging/sliding in parks is an important cause of ocular trauma associated with facial and orbital injuries.

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A marked preponderance of injuries is seen in the 6–10 years age group[5]. Children in this age group are relatively immature and exposed to varying surroundings making them more vulnerable to injuries. Male children are affected more due to their adventurous and aggressive nature[6,7].

Sports-related injuries are commonly seen in children in the 5–14 years age group[8]. Eye involvement in road traffic accidents does not show any age preference. Injuries by animal tail, bird beak, 'gulli' and fish hook are prevalent in rural areas. An uncommon mode of trauma is by hypodermic needles used to squirt water during play[9].

A prospective interventional study was conducted by the authors from June 2001 to May 2003 on 57 paediatric patients with ocular trauma, presenting to the Department of Ophthalmology, King George's Medical University, Lucknow. Patients aged 0–14 years who sustained ocular trauma were included in the study. All patients were subjected to a thorough clinical evaluation, including a detailed history and examination, followed by appropriate medical and surgical intervention.

In our study, 26 patients (45.62%) sustained injuries at home. This was followed by injuries on the street (19.29%), at the farm (12.28%), during play (10.53%) and at school (7.02%). Less common places of ocular injuries included the fish pond and river side. The domestic setting has previously been recognized as potentially dangerous. This study documents the perils at home with regard to ocular injuries in children. Our findings are similar to those of MacEwen *et al.*[8] (who conducted a similar study in United Kingdom), but different from those of Umeh and Umeh[10] (Nigeria; Table 1).

In contrast to the above findings, Al-Bdour and Azab[5] had reported a high incidence of sports-related injuries (74.1% of cases). As is evident from the above data, home, street, playground and school are the commonest places where ocular accidents occur in children.

Table 1. Comparative analysis of place of ocular injury

Place of injury	Present study (Lucknow, India, 2003) percentage of cases	MacEwen *et al.*[8] (United Kingdom, 1999) percentage of cases	Umeh and Umeh[10] (Nigeria, 1997) percentage of cases
Home	45.62	51.00	29.80
School	07.02	14.00	16.70
Playground	10.53	10.00	23.70
Street	19.29	10.00	–
Farm	12.28	–	10.10
Others	05.26	15.00	19.70

Table 2. Comparison of mechanism of ocular injury

Mechanism of injury	No. of cases	Present study (Lucknow, India, 2003) percentage of cases	Krishnan and Sreenivasan[11] (Pondicherry, India 1988) percentage of cases	MacEwen *et al.*[8] (United Kingdom 1999) percentage of cases
Blunt trauma	9	15.79	30.80	65.00
Penetrating trauma	42	73.67	69.20	24.00
Intraocular foreign body	3	05.27	–	04.00
Chemical	3	05.27	–	01.00
Others	–	–	–	06.00

Our study showed that mechanical injuries are the commonest mechanism of ocular injury (94.73% of cases). Amongst the mechanical injuries, penetrating trauma (due to sharp objects) was more common compared to blunt trauma. Chemical injuries accounted for only 5.27% of the cases (Table 2).

Our study concurs with Krishnan and Sreenivasan[11], who reported that penetrating injuries are more common. The higher incidence of blunt trauma in studies by MacEwen *et al.*[8] probably reflects the difference in mechanisms of injury seen in developed and developing countries like India, where penetrating injuries are relatively more common. Injuries other than due to mechanical causes are less common. Chemical injuries though uncommon, have a dismal prognosis unless subjected to immediate intervention.

The causes of ocular injuries are diverse and tend to vary in different geographical areas. They are also related to the socio-economic status of the study population (Table 3)[2,8,12]. In the Indian context, wooden stick injuries and those due to iron objects are common. Even objects like glass bangles, cycle spokes and teacup handles can cause grave ocular injuries. Bird beak and animal horn injuries commonly occur in the rural setting.

The environment and the media have an immense influence on the impressionable minds of children. Spurt in bow and arrow injuries during the period when the epics are televised, is ample evidence for the same. Fire crackers during Diwali and water balloons during Holi have led to the loss of many eyes, year after year.

At presentation, eliciting a history of the causative agent is important, though not always forthcoming, especially in unwitnessed trauma. Patience is the keyword while examining an injured eye. No forceful examination should be done. The assessment of visual acuity at presentation, should be geared to the age and level of cooperation of the child. External examination should include assessment of the lids, face, orbit, ocular motility and status of the pupil. Evaluation of the globe should include examination of the conjunctiva, cornea, anterior chamber, iris and lens. Posterior segment examination and measurement of intraocular pressure should be done only when safely possible. It is desirable to examine the injured eye under sedation/general anaesthesia for a complete evaluation of the extent of injury and in planning further management.

Ocular injuries (due to mechanical trauma) can be classified according to the Ocular Trauma Classification Group recommendations[13]. This system classifies ocular injuries according to four variables: (i) Type of injury based on the mechanism of injury. (ii) Grade of injury defined by visual acuity in the injured eye at the time of initial examination. (iii) Pupil defined as the presence or absence of a relative afferent pupillary defect in the injured eye. (iv) Zone of injury based on the anteroposterior extent of the injury.

Mechanical eye injuries may be closed-globe or open globe injuries. Closed globe injuries may be caused by blunt force (contusion), partial thickness sharp force (lamellar laceration), and superficial foreign body. In open-globe injuries, the cornea or sclera has a full thickness wound. This wound may be due to blunt trauma (rupture) or trauma by sharp objects (laceration). Sharp objects lead to penetrating injuries (single full thickness wound of the cornea or sclera), perforating injuries (two full thickness wounds of the cornea or sclera) or intraocular foreign body injury.

Table 3. Comparison of causes of ocular injury

Cause of injury	Present study (Lucknow, India, 2003) Percentage	MacEwen *et al.*[8] (United Kingdom, 1999) Percentage	Takwam and Midelfart[2] (Norway, 1993) Percentage	Soylu *et al.*[12] (Turkey, 1998) Percentage
Wooden stick	28.07	5.00	10.10	15.30
Fall	05.26	5.00	10.10	0.00
Stone/missile	03.52	7.00	21.50	12.00
Tools/metal	17.54	12.00	0.00	32.60
Firework	05.26	0.00	0.00	0.00
Chemical	05.26	1.00	0.00	0.00
Gunshot	01.75	3.00	0.00	12.00
Glass	01.75	3.00	0.00	12.00
Toys	0.00	30.00	18.50	0.00
Others/unknown	31.59	20.00	39.80	16.10

Figure 1. Knife injury leading to a central linear corneal laceration.

Figure 2. Bull-horn injury leading to left upper eyelid laceration and lower eyelid avulsion.

Anatomically, trauma may be divided into anterior segment trauma, posterior segment trauma, and adnexal and orbital trauma. Anterior segment blunt trauma is among the milder forms of trauma. Nonpenetrating corneal and ocular surface injuries usually respond to conservative management. Such injuries may lead to recurrent corneal epithelial erosions. Traumatic hyphema (blood in the anterior chamber) is usually managed conservatively. Traumatic glaucoma may have an immediate, intermediate or delayed presentation. Angle recession glaucoma can occur years after the injury. Lens injury by blunt trauma can lead to contusion cataract as well as subluxation/dislocation of the crystalline lens. Anatomic position and stability of the lens dictates the type of surgical management in such cases[14,15].

Penetrating anterior segment trauma may cause lacerations of the cornea (Figure 1), sclera or both. Irreparable perforating injuries (with two full thickness entrance and exit wounds) are usually caused by high-impact objects like missiles. Each of these may be associated with varying degrees of uveal tissue, lens and vitreous involvement. Early medical management in the form of tetanus prophylaxis and intravenous broad spectrum antibiotics is vital to prevent ocular infection.

The aim of surgical repair in these cases is a complete watertight closure with restoration of structural integrity. Self-sealing wounds carry a potential risk of endophthalmitis and panophthalmitis (infection involving all structures of the eyeball). The reported incidence of post-traumatic endophthalmitis is high, especially after open globe injuries (2.4–17%)[16]. Delayed diagnosis, polymicrobial infections, infections by virulent organisms and presence of intraocular foreign bodies adversely affect visual prognosis[17].

Posterior segment trauma may manifest as commotio retinae, choroidal rupture, posterior scleral rupture or retinal breaks in the form of retinal dialysis/detachment. A high index of suspicion needs to be kept for occult scleral ruptures. Patients with traumatic retinal detachment need to be operated as early as possible.

Good visual acuity at presentation and early primary repair are important favourable prognostic factors affecting final visual outcome in cases with ocular trauma[18]. Penetrating injuries generally result in poorer visual outcomes, compared to blunt injuries[19]. Posterior segment involvement adversely affects visual results[10].

Adnexal, including eyelid injuries (Figure 2) and facial injuries should be addressed as early as possible. Restoration of tissue anatomy is easier and results are more gratifying, if repair is done early in such cases. Preference

should be given to multispeciality, coordinated surgical care. Floor fractures are the most common type of orbital fractures in children[20]. Optic nerve injury, though uncommon, leads to irreversible visual loss.

Chemical injuries to the eye are an emergency and may have devastating results if left unattended. Alkali burns are frequently more disastrous than those caused by acids, as alkalis saponify the lipids of cell membranes and produce total disruption of cells. Acids quickly precipitate tissue proteins and are therefore less penetrating. Among alkali burns, those caused by lye, fresh lime and ammonia are frequently seen. Sulphuric acid burns, especially when handling motor vehicle batteries are not uncommon. Simple measures like wearing protective clothing, gloves and goggles can protect against chemical burns. Immediate copious irrigation of the eyes using the most readily available source of clean water can be sight-saving in chemical injuries. After first aid, early further management under the care of an ophthalmologist is essential.

Ocular injuries finally lead to diminution/loss of vision, cosmetic blemishes, morbidity due to associated facial injures and resultant personality defects.

The most important aspect of paediatric trauma is prevention. Education regarding masterly watchful inactivity and supervized play, the concept of child-proofing of houses, schools and play areas, the hazardous nature of firecrackers, and road safety measures is critical. Parents, elders, teachers and caretakers, as well as the media have an important role to play in prevention of injuries in children. The irreversible nature of visual loss and immense morbidity associated with it need to be emphasized and publicized. Sensitizing people with regard to the psychosocial aspects of ocular injuries (especially the emotional aspects) is also required in our set-up. Legislation to ban the use of bows and arrows, fire crackers and gulli danda by children would help in saving a lot of eyes. Prevention of trauma was and is still vital for reducing morbidity and costs associated with paediatric ocular injuries.

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Received 5 February 2004; revised accepted 24 March 2005