



A 3 YEAR RETROSPECTIVE STUDY OF EPIDEMIOLOGY AND DEMOGRAPHY OF OCULAR FIRE CRACKER INJURIES IN TERTIARY EYE CARE CENTRE.

Ophthalmology

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ABSTRACT

Aim: To evaluate the patterns of ocular injury and to determine ocular morbidity resulting from the use of firecrackers.

Materials and Methods: A retrospective study was conducted consisting of 156 eyes of 144 patients with firecracker injuries with different presentations and its epidemiology in tertiary eye centre during Diwali week of 2015 to 2017. Patients included were in age group between 5 and 45 years. A Detailed history along with complete ocular examination by torch light, slit lamp examination, fundus examination, x-ray skull with orbits, ultrasonography was done and extent and type of injuries were assessed and interventions taken accordingly. Visual outcomes before and after the intervention were recorded.

Results: Most of the patients were between 5 to 15 years (63.19%) predominantly males (70.83%). Explosive bomb was responsible for most of injuries (65.80%).

KEYWORDS

Diwali, fire crackers, ocular injuries

Introduction:

Diwali is one of the most popular Indian festivals and is celebrated on a mass scale, not only in India but also all over the world. People celebrate the festival by lighting earthen lamps and candles and bursting crackers. Although the chances of having a serious accident may seem remote, hospitals and clinics are filled with people suffering from burn injuries caused by firecrackers during this festival. Although government regulation prohibits the bursting of crackers after 10 PM, especially those that produce a loud sound, hardly any attention is paid to these regulations during the festivities. In the present year Supreme Court had banned firecrackers in Delhi due to alarming level of air pollution. Patients with fire cracker burns continue to pour into the hospitals at odd hours during the festival days.

Burn of the hands, face and eyes are the most common injuries during Diwali. Unfortunately, majority of the victims are children. They get injured while playing with the crackers unsupervised by the adults. There are instances of serious injuries caused by the fire crackers to the eyes, leading to loss of vision. Many children or even adults injure their hands trying to ignite the "Flower pot" while holding it in their hands. These firecrackers, which should only emanate light and sparkles on ignition, often burst thus causing burn injuries.

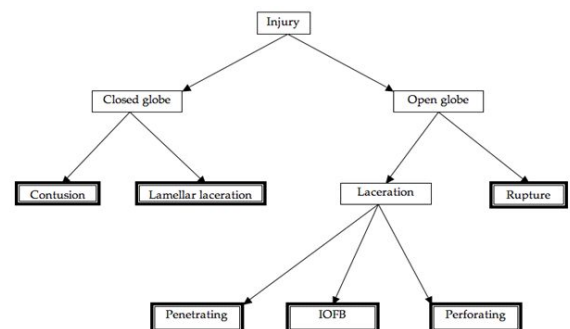
Aim:

To evaluate the patterns of ocular injury and to determine ocular morbidity resulting from the use of firecrackers.

Materials & Methods:

This was a retrospective study conducted in a tertiary eye care hospital, during the 'Diwali' festival week- the day of Diwali, 3 days before and 1 day after, from year 2015 to 2017 in which all patients of age group 5 to 45 years with firecracker injuries were included. A detailed ocular examination with torch light, slit lamp examination, Fundoscopy, Ultrasonography (USG) A and B scans and Gonioscopy, X-ray skull with both orbit was done as and when indicated. Visual outcome was noted before and after treatment to determine ocular morbidity. The injuries were classified according to Birmingham eye trauma terminology system (BETTS).

Patients with minor closed globe injuries were treated on an outpatient basis with conservative management like thorough saline wash with removal of soot particles and debris after ruling out open globe injury as per the standard treatment protocol for ocular burns and chemical injuries¹. They were started on copious lubricants, topical antibiotics & steroid combination eye drops and cycloplegics.



The patients with open globe injuries like corneal and scleral tear, traumatic iridodialysis with hyphema, and globe rupture were admitted and operated accordingly with maximum salvage of vision.

Most of the patients were residing near tertiary eye centre and few with serious injuries were referred from peripheral health centers belonging to low socio-economic status.

Results:

Out of 144 patients, 102 were males (70.83%) and 42 were females (29.16%).

One hundred and thirty two (91.66%) patients presented with unilateral ocular injuries and twelve (8.33%) patients with bilateral ocular injuries.

Thirty nine patients (27.08%) were referred from peripheral centers.

Six patients had grave ocular injury with no possibility of salvaging the vision, rest were managed according to injuries.

Out of 40 patients having open globe injury, 36 eyes (90%) were operated at our institute and rest of the patients could not be followed.

Vitreo-retinal surgical interventions were done in 18 eyes.

Traumatic cataract removal with posterior chamber intra ocular lens (PC-IOL) implantation was done in 7 eyes with good posterior capsular support, while scleral fixated IOLs were put in 3 eyes without

capsular support. Thirty patients were referred to plastic surgery department for lid and facial burns.

Ocular injuries were divided in to two groups: anterior segment & posterior segment:-

Anterior segment

TYPE OF INJURY	EYES
Corneal epithelial defects and erosions	115
Multiple corneal & conjunctival foreign bodies	79
Lid & facial burns	69
Lid lacerations & abrasions	20
Corneal/scleral/corneo-scleral tear	18
Hyphema with iridodialysis	14
Traumatic cataract	10
Globe rupture	11
Angle recession & secondary glaucoma	2

Posterior segment:

Vitreous hemorrhage	11
Comotio retinae	1
Retinal detachment	7

Figure 1. Sex distribution:

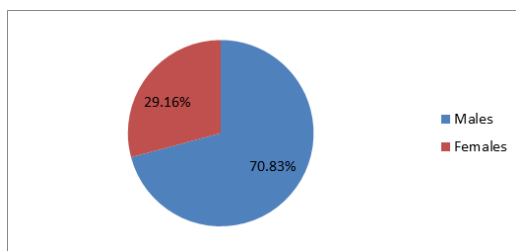


Figure 2. Laterality of presentation:

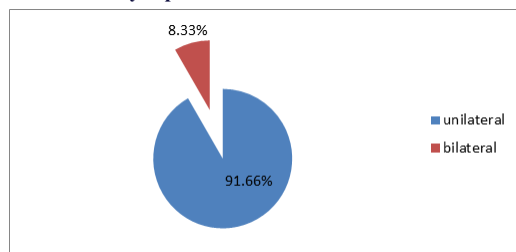
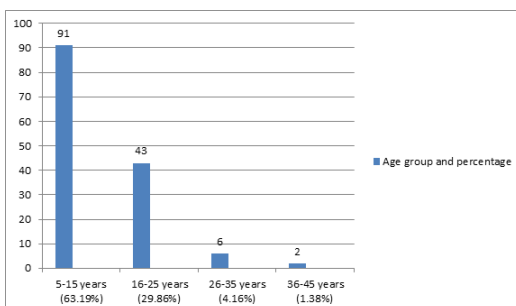
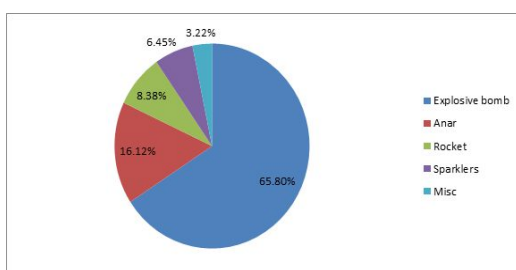


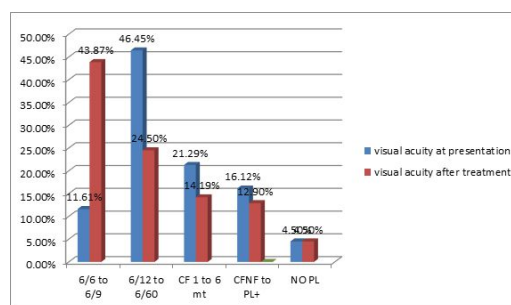
Figure 3. Age distribution:



4. Distribution of fire crackers involved in injury:



5. Comparison of Visual acuity:



Discussion:

Ocular injuries constitute about 20% of firework injuries. Trauma is one of the major causes of unilateral avoidable blindness in children. It is estimated that worldwide 160,000–280,000 children under the age of 15 years sustain ocular injuries every year. However, only 5% of ocular injuries usually require admission. Hence, the actual incidence of pediatric ocular trauma worldwide is much higher amounting to 3.3–5.7 million annually. With vision 2020 giving high priority to avoidable blindness^{6,11}, especially in children, every attempt should be made to prevent such injuries and blindness in children.

Although there is no sufficient data on Diwali-related burns in India, a published study from Delhi has shown that the number of people reporting with fire cracker injuries during a period of nine years from 2002 to 2010 have doubled from 0.81 to 1.51 per 100,000 population⁵. The injuries were of different types which ranged from conjunctival or corneal burns to globe rupture. Different interventions were done ranging from ocular wash to repair of globe perforation according to injury. Most of the patients were below the age of 15 years. Unlike the findings in some studies where victims were mostly those who were actively involved in igniting the firecracker, in our study victims and bystanders are equally involved in injuries^{2,3,4}. The most common firecracker causing injury in our study were explosive bombs followed by anar followed by rocket. Even though sparklers were reported to cause minimal injuries in one of the studies, were not found to be innocent in our study.

We have gone through detailed history of patients about how they were injured and concluded the following:

- Most of the injuries were caused as a result of negligence of those igniting the firecrackers.
- Some patients reported firecracker malfunction or poor quality as the cause of their injury. In some cases, the attempt to reignite or recover a failed firecracker was the cause of injury.
- Lack of knowledge about safety measures was one of the reason.
- The other major cause is the common practice of igniting firecrackers in the streets thus exposing passersby to injury in villages.

MECHANISM OF FIRECRACKER INJURIES:

1.Heat:

The heat produced from ignited fire crackers may exceed 65 °C. This rise in temperature cause burns on the exposed parts of the body, mainly the face and hands.

2.Blast:

Because of sudden displacement of air, there may be an increase in pressure causing blast effect. This pressure of the blast may cause injuries to the different parts of the body, by varying mechanisms on:

Eye:

Normally the eyes are protected by the reflex closure of eyelids. It may cause burns of lids alone. In cases of blasts there may be loss of eye due to rupture of globe. This is due to pressure distribution through the path of least resistance⁹. There may be associated fracture of facial bones which needs major effort at reconstruction. When vision is lost, it cannot be restored by any modality. Reconstruction is done, only for cosmetic purpose and to create socket for artificial eye.

Hands:

The pressure built up by blast passes through the tissues of least resistance in hand i.e., through the interosseous, musculo-tendinous soft tissue compartment and disrupts the tissues leaving the bone bare.

Aim in reconstruction of such injuries of the hand should not only be in restoring anatomical continuity of structures, but also in obtaining good functional results. Major efforts are required to reconstruct the anatomy and to rehabilitate the hand.

Ear:

Fireworks produce a sound that is in the 150 to 175 decibel range.

There are two things to note when considering whether or not fireworks will have the potential to cause hearing loss.

- (1) Distance of a person is from the sound source. Sound is less likely to affect hearing when positioned far from the firework explosion.
- (2) Loudness of the firework.

The World Health Organization recommends that adults not be exposed to more than 140 decibels of peak sound pressure. For children, the recommendation is 120 decibels. If dealing with a firework that explodes at 170 decibels, one should stand 15 to 20 meters away. Children should stand 50 to 60 meters away from the same firework. Infants should not be exposed to fireworks, because they generally experience the greatest amount of sound pressure.

Exposure to loud sounds can result in the following:

- Tinnitus – ringing in the ears, which can be a symptom of hearing loss.
- Temporary threshold shift – slight decrease in hearing, which usually only lasts 24 hours.
- Permanent hearing loss – a change in hearing that is permanent and cannot be restored.

Solutions:

To wear protective eye wear, restrict fireworks to public open spaces such as parks or playgrounds, regulating the quality of firecrackers and promoting the safe use in schools and via the media.

If eyes are injured by a firecracker, cover the injured eye with a pad, and rush to an eye-specialist immediately for an evaluation of the extent of the damage. Eye-sight can be lost in minutes and might be saved if it is immediately treated.

If fireworks are to be used, several precautions should be observed¹²:

- Adult supervision is essential.
- Wear eye glasses or goggles for protection.
- Place a bucket of water nearby to put out fires or douse those firecrackers which don't work.
- Read the manufacture's label and follow the directions.
- Ignite fireworks outdoors and only one at a time.
- Dispose of used fireworks properly.

A few don'ts are also in order:

- Don't give fireworks to small children.
- Don't stand too close to fireworks.
- Don't ignite fireworks indoors.
- Don't put them in pockets.
- Don't try to relight duds or make homemade fireworks.

The American Academy of Ophthalmology, in conjunction with the National Society to Prevent Blindness, the National Fire Protection Association, Fire Marshall's Association of North America and the American Academy of Pediatrics, is working to strengthen fireworks regulation, improve enforcement of state laws and educate the public regarding the hazards of fireworks.

Conclusion:

This retrospective study confirms that firework injuries are an important cause of preventable cause of significant ocular morbidity and mortality. The most frequently affected group of patients are children and young males¹⁸. Ocular injuries from fireworks can be severe, often leading to blindness, serious burns, and permanent disfigurement. The social, cultural, and economic significance of festivals is irrefutable. However, certain practices which are harmful to the individual and the community at large should be revisited. A combination of public awareness and appropriate legislation should be formulated regulating the sale and use of consumer fireworks to decrease recurring ocular morbidity.

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