



## Ophthalmology

# A STUDY ON CLINICAL PROFILE OF PATIENTS WITH FIRECRACKER-RELATED OCULAR INJURY IN EMERGENCY DEPARTMENT OF A TERTIARY CARE CENTER IN BUNDELKHAND REGION.

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| <b>Dr. Jitendra Kumar*</b> | Professor & Head, Dept. of Ophthalmology, MLB Medical College, Jhansi, Uttar Pradesh – 284001, India *Corresponding Author |
| <b>Dr. Amit Rao</b>        | Junior Resident, Dept. of Ophthalmology, MLB Medical College, Jhansi, Uttar Pradesh – 284001, India                        |
| <b>Dr. Shikha Tolia</b>    | Junior Resident, Dept. of Ophthalmology, MLB Medical College, Jhansi, Uttar Pradesh – 284001, India                        |

**ABSTRACT** **Background:** In India, injuries from firecracker are quite common. They are primarily utilised throughout the many Indian festivals. Injuries caused by firecrackers in the emergency department (ED) are profiled and their results are examined in this study. **Purpose:** The objective of this research was to document cases of sight-threatening ocular injuries caused by firecrackers. **Methods:** Retrospective analysis was done on the medical records of 14 patients who visited the institute within a week of the Diwali festival in October 2022 and had 14 eyes that had been damaged by fireworks during other celebrations. The information gathered covered patient demographics (age, sex), ocular characteristics that were present, management, and results. Medical care was provided for ocular injuries of grades I and II. Amniotic membrane transplantation was used to treat all grade III–V injuries. **Results:** All of the 14 patients who were seen were male and ranged in age from 6 to 42 (mean age group 18 years). Four of them were hurt by bottle rockets, while eight of them were hurt by exploding firecrackers. Five of the patients were either spectators or onlookers while the other six were active in lighting firecrackers. Out of 14 patients, 6 had problems with their right eye (RE), 4 had problems with their left eye (LE), and 1 had problems with both eyes (BE). Two eyes had moderate conjunctival congestion and a superficial burn over the periorbital area, two eyes had conjunctival injury and one eye had a vitreous haemorrhage, two eyes had traumatic detachment of the retina, and one eye had an avulsed optical nerve. There were 14 eyes total. Six eyes had open globe perforating injuries involving the cornea or the cornea and sclera both. The majority of damaged eyes have an OTSS score of II, which indicates a poor prognosis for visual acuity. **Conclusions:** A deficiency of limbal stem cells in young people due to ocular trauma might cause corneal blindness. In this age group, eyesight loss can result in both cosmetic abnormalities and a loss of economic productivity. Therefore, additional advocacy work is required to stop these injuries.

**KEYWORDS :** Firecrackers, cracker-related injuries, Blindness, Cornea injuries

## INTRODUCTION:

India's Bundelkhand Regions record the greatest number of trauma cases, majority of which are due to firecrackers. [1, 2] To convey a joyful spirit during celebrations, firecrackers are frequently employed. Guy Fawkes Night in the United Kingdom, Bastille Day in France, Independence Day and Halloween in the United States, among numerous other celebrations across the world, all involve the usage of firecrackers.[3,4] Injuries from fireworks are typically brought about by either improper handling of fireworks or equipment failure while being utilised. India as a nation celebrates quite a few of festivals that feature a light and music extravaganza created by firecrackers. [3] However, even the smallest amount of negligence when handling these fireworks can result in serious to severe injuries. In India, there are 7 firework-related injuries for every 100,000 people each year.[3,4] Despite targeted legislation being implemented for it, studies done in Delhi shown a rise in the frequency of firecracker-related injuries around the time of Diwali. Studies from Guwahati, India's Northeast, have discovered a similar trend against festivals.[5,6] In Darwin, Australia, a different study revealed an upsurge in these incidences around the time of Territory Day (July 1). According to earlier research, a startlingly high proportion of young teenagers are involved in such accidents, and the upper limbs and face are the most often injured body parts. [4,7-8] According to the nature and location of the mistakenly, damage to the hand's underlying structures has the potential to cause a major handicap and can negatively impact routine daily tasks. Most minor hand injuries need immediate medical attention and surgery to lower this risk. The present retrospective investigation was carried out to ascertain the frequency of patients with firecracker injuries, the severity of the injuries, the body regions involved, and the management in the emergency department (ED), leading to the various results in the lives of the patients, functions, and impairment. As far as we are aware, this is the first study to concentrate on the demographics and result of such injuries in the Bundelkhand regions of India.

## MATERIALS AND METHODS

### Design

This research was a part of a much larger retrospective investigation of patients with serious trauma.

### Setting

The research study was carried out in the ED of the tertiary medical facility Maharani Laxmi Bai Medical College in Jhansi. With 40 beds, the emergency department (ED) cares for 200 patients daily, both trauma and non-trauma patients.

### Participants

The study included all patients who experienced firecracker-related ocular injuries throughout the study period during one week of the Diwali celebration in October 2022. The study excluded all patients with injuries unrelated to firecracker damage as well as individuals with insufficient data in their files.

### METHODS

All patients who presented to the hospital's emergency department during a week of the event and had firecracker-related eye injuries are included in this prospective investigation centred in tertiary care. The sufferers' eyes were examined, and a thorough account of the incident was taken. All of the patients' wounds were carefully cleaned with normal saline, and any superficial debris were eliminated while they were under topical anaesthesia. Every patient had a slit lamp exam and, if possible, a fundus examination with an indirect ophthalmoscope. As a screening tool to rule out the intraocular foreign body as needed, an X-ray orbit was suggested. Depending on the situation, patients have also been advised to undergo a CT or B-scan. For people who required surgical care, a specific regular blood test was prescribed. The ocular trauma scoring system (OTSS) was used to categorise the wounds. (Table- 2).

### Bias

Due to the retrospective nature of this investigation, we were unable to regulate how exposure or outcomes were measured and had to rely on third parties to maintain reliable records.

### Study Size

We selected patients from the one-year period in order to analyse the seasonal variation in firecracker injuries. We did this by including all 14 patients who visited the ED during the course of the trial.

### Laboratory Test

Based on the initial primary and secondary surveys, all patients underwent standard blood tests and pertinent radiographic examinations.

## RESULTS

All of the 14 patients seen were male and ranged in age from 6 to 42 (mean age group 18 years). Three of them were hurt by bottle rockets, while nine of them were hurt by exploding firecrackers. Four of the patients were either spectators or bystanders, while seven of them actively participated in the lighting of firecrackers.

Six of the 14 patients had the right eye (RE), four had the left eye (LE), and four had both eyes (BE) affected (Table 1).

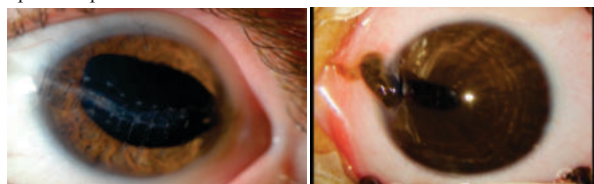
Out of 14 cases, two eyes had mild conjunctival congestion and superficial burns over the periorbital area, two eyes had conjunctival injury, and seven eyes had open globe perforating injuries involving the cornea only or the cornea and sclera both. One eye suffered an optic nerve avulsion, one eye had a vitreous haemorrhage, and two eyes had severe retinal detachments.

Nine of the 14 patients were under the age of 18 years old. It demonstrates that small children made up the majority of the explosive damage victims. Only 4 of the patients were older than 18 years. The majority of eye injuries were caused by firecracker explosions. The damaged eye of the patients is shown in the photos below both before and after the surgery. Several additional images depicting eye damage at the time of the patient's presentation. Four of the 14 cases were handled cautiously. Topical antibiotics with steroids, anti-inflammatories, cycloplegics, and lubricating eye drops were administered for them.

Seven of these required surgery, six of which required corneoscleral repair, and one of which required corneo-limbal repair (Figure 2). One patient was sent to the plastic surgery department with superficial burns to the face, periorbital area on both sides, conjunctival congestion in both eyes, and no visual complaints. According to the OTSS Table 2, the eye injury was graded. The majority of affected eyes have an OTSS score of II, which indicates a poor prognosis for visual acuity.



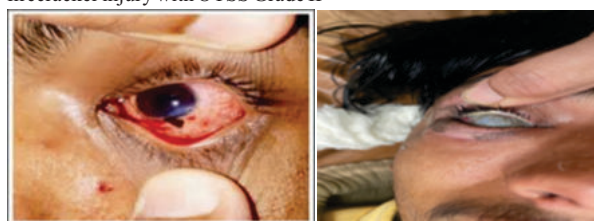
**Figure 1 and 2:** Case -1 & 2 Corneo scleral laceration due to firecracker injury with OTSS G II. Pre-operative and immediate post-operative photos.



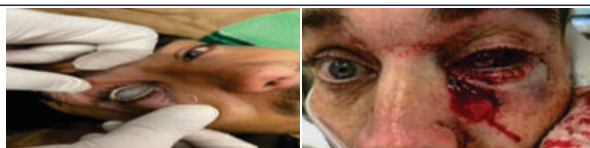
**Figure 3 and 4:** Case- 3 & 4 Corneo limbal laceration due to firecracker injury with OTSS Grade II. Pre-operative and immediate post-operative photos.



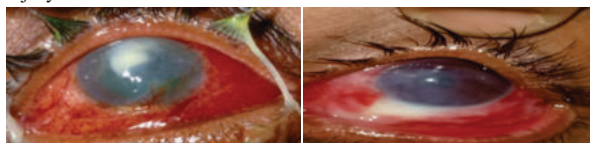
**Figure 5 and 6:** Case-5 & 6 Corneo scleral laceration due to firecracker injury with OTSS Grade II



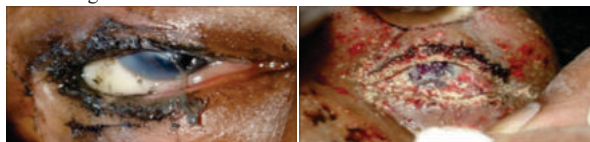
**Figure 7 and 8:** Case- 7 & 8 Corneo limbal tear due to firecracker injury with OTSS Grade II



**Figure 9 and 10:** Case-9 & 10 Corneo limbal laceration with lower lid injury due to crackers with OTSS Grade II



**Figure 11 and 12:** Case- 11 & 12 Firecracker associated injury causing conjunctival congestion. On indirect ophthalmoscopy, vitreous hemorrhage was found. OTSS Grade III



**Figure 13 and 14:** case-13 & 14 Corneo limbal tear due to firecracker injury with OTSS Grade II

**Table 1: classification of the 14 afflicted eyes according to the clarity of their vision at presenting**

| Visual acuity at presentation                              | No. of eyes |
|------------------------------------------------------------|-------------|
| 6/6-6/18                                                   | 4           |
| 3/60                                                       | 1           |
| 1/60                                                       | 2           |
| HMCF- PL negative                                          | 7           |
| HMCF - Hand Movement close to face, PL Perception of light |             |

**Table 2: Ocular Trauma Scoring System (OTSS)**

| Case    | Age/Sex | Raw Score     | OTSS    |
|---------|---------|---------------|---------|
| Case 1  | 15Y/M   | 55            | II      |
| Case 2  | 8Y/M    | 55            | II      |
| Case 3  | 21Y/M   | 45            | II      |
| Case 4  | 14Y/M   | 55            | II      |
| Case 5  | 9Y/M    | 48            | II      |
| Case 6  | 18Y/M   | RE- 47, LE-59 | II (BE) |
| Case 7  | 15Y/M   | 65            | III     |
| Case 8  | 16Y/M   | 80            | III     |
| Case 9  | 5Y/M    | 75            | III     |
| Case 10 | 29YM    | 68            | III     |
| Case 11 | 11Y/M   | 100 (BE)      | V (BE)  |
| Case 12 | 41Y/M   | 100           | V       |
| Case 13 | 30Y/M   | 100           | II      |
| Case 14 | 28Y/M   | 100           | V       |

**Table 3: The majority of afflicted eyes have an OTSS score of II, which means that their chances of achieving good vision are poor.**

| OTSS      | No. Of eyes |
|-----------|-------------|
| GRADE II  | 7           |
| GRADE III | 4           |
| GRADE V   | 3           |

## DISCUSSION

Regarding injuries from firecrackers in northern India, we were unable to locate a similar case in the literature currently in print. The Chinese developed fireworks, a category of explosive pyrotechnic devices, around the seventh century. China continues to be the world's leading producer and exporter of pyrotechnics, with India coming in at number two. All of the victims in our study were men, and 75% of them were under the age of 18, which is consistent with previous accounts. Fireworks are a crucial component of the Diwali celebrations. Therefore, there is a higher frequency of firecracker-related eye injuries during this holiday. The majority of injuries are typically brought on by the irresponsibility of those lighting the firecrackers, although some have also been caused by unaware spectators who were not involved in lighting firecrackers. An open globe perforating damage had occurred in almost 50% of the eyes. There is a significant chance that 17% of all eyes may develop phthisis, which is often accompanied by early blindness and facial deformity. According to OTSS, 11 out of the total 14 injured eyes had unsatisfactory end visual outcomes (Table 3).

We can see from these damaged eyes and the expected results that firecracker injuries result in significant morbidity; as a result, public education should be prioritized to lower their frequency. All different ages are susceptible to firecracker-related injuries, but youngsters are especially at risk for severe ocular morbidity and irreversible blindness. Therefore, when lighting firecrackers, youngsters should always be under the supervision of the older group.

## CONCLUSION

Firecrackers have the potential to seriously harm one or both eyes, causing irreversible vision loss in one or both eyes. Males are the only ones that get these wounds, and mostly children and young adults. This serious, irreversible visual degradation is thus preventable but has a large economical cost to society. As demonstrated in our study, sparklers or green firecrackers did not result in any injuries to the study's victims; as a result, their use should be encouraged in substitute of explosive firecrackers. It is only the tip of the iceberg because this is just one hospital-based case series. Therefore, it might be advantageous to maintain a national registry to evaluate the burden and guide future action. The general population should receive instruction on how to handle firecrackers safely. Companies who make firecrackers should be told to produce less explosive, safer firecrackers.

The study has several limitations, including a small sample size, a reliance on patient data from a single centre, and a short follow-up period that prevented evaluation of the injury's long-term prognosis.

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