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**Original Research Article**

# Clinical Profile and Management of Firecracker-Induced Ocular Trauma: A Hospital Based Observational Study

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**ABSTRACT**

**Purpose:** To describe the demographic profile, pattern of ocular injuries, clinical presentation, and management of patients presenting with firecracker-related ocular injuries during festive season in the year 2025 at a tertiary eye care centre.

**Methods:** A retrospective observational study was conducted on patients presenting with firecracker-related ocular injuries during festive season in the year 2025 to a tertiary eye care centre. Demographic characteristics, involvement as a bystander or participant, type of firecracker, mode of arrival, time interval between injury and presentation, presenting visual acuity, ocular findings, and management were retrieved from medical records and analysed using descriptive statistics.

**Results:** A total of 57 patients were included in the study. The mean age was 21.8 ±15.4 years (range, 2.5–60 years), with the highest proportion of injuries occurring in the 11–20-year age group (35.1%). Males accounted for 84.2% of the patients. Bystanders constituted 66.7% of the injured individuals, while 33.3% were active participants. Bijli crackers were the most common type of firecracker involved (24.6%). Most patients (75.4%) presented within 4 hours of injury, and 80.7% presented directly to the tertiary eye care centre. At presentation, 43.9% of eyes had a visual acuity of 6/12 or better, whereas 22.8% had vision between 3/60 and perception of light, and 1.8% had no perception of light. Corneal epithelial defects/abrasions were the most common ocular finding (40.4%), followed by hyphema (22.8%) and vitreous haemorrhage (14.0%). Most patients (86.0%) were managed conservatively, while 14.0% required surgical intervention.

**Conclusion:** Firecracker-related ocular injuries during festive season in the year 2025 predominantly affected young males and frequently involved bystanders. Corneal injuries were the most common ocular finding, although serious anterior and posterior segment injuries were also encountered. These findings underscore the importance of public awareness, supervision during festive celebrations, and preventive measures to reduce avoidable ocular morbidity associated with firecracker use.

**Keywords:** Firecracker-Related Ocular Trauma, Bystander Injury, Festive Season.

## INTRODUCTION

Firecrackers are an integral part of cultural celebrations in India, particularly during the

festival of Diwali. However, the explosive nature of these devices makes them an important cause of preventable ocular trauma. Firecracker explosions generate mechanical force, thermal energy, and chemical effects that can produce a wide spectrum of ocular injuries ranging from superficial eyelid burns and corneal abrasions to severe globe-threatening injuries resulting in permanent visual impairment.[1,2]

Firecracker-related ocular trauma has distinct characteristics due to the sudden nature of explosion, high velocity of projectile fragments, and close proximity of individuals during use. Although people handling firecrackers are commonly affected, bystanders also constitute a significant proportion of victims, emphasizing the unpredictable nature of these injuries.[3,4] Children and young adults are frequently involved due to increased exposure, curiosity, and inadequate knowledge regarding safety precautions.[5,6]

The clinical presentation of firecracker-related ocular injuries varies widely depending one type of firecracker, distance from explosion, and protective measures used. Reported injuries include eyelid burns, conjunctival and corneal injuries, foreign bodies, hyphema, traumatic cataract, lens dislocation, vitreous haemorrhage, retinal injuries, and open-globe injuries. Severe cases may require surgical intervention including primary globe repair, cataract extraction, pars plana vitrectomy, and other reconstructive procedures.[1,2,3,7]

Kumar et al. reported ocular injuries during the Deepavali festival and highlighted the significant visual morbidity associated with firecracker trauma, with several patients requiring surgical management.[1] Venkatesh et al. evaluated the spectrum of firework trauma during Diwali in North India and reported both open- and closed-globe injuries, with surgical intervention required in a substantial proportion of cases.[3] Patel and Mukherjee emphasized that firework injuries can cause severe ocular damage and require early diagnosis and appropriate management to reduce visual disability.[2]

Studies from different regions have demonstrated variations in demographic profile, type of firecracker involved, injury pattern, and final visual outcome. Dhiman et al. evaluated changing trends in Diwali-related ocular injuries after regulatory measures and highlighted that despite preventive efforts, severe injuries continue to occur during festival seasons.[8] Joshi et al. and Gupta et al. also reported the clinico-epidemiological characteristics of firecracker-related ocular trauma during Diwali and emphasized the preventable nature of these injuries.[5,9] Recent Indian data from Prakash et al. and other tertiary eye care centres continue to demonstrate a wide spectrum of injuries requiring both conservative and surgical management.[10]

International studies have similarly reported significant ocular morbidity following firework-related trauma. Madhusudhan et al. described the clinical profile and outcomes of firework-related ocular injuries during festive seasons and highlighted the importance of preventive strategies and early intervention.[7] Large series from other countries have reported that firework injuries may result in severe anterior and posterior segment damage, including open-globe injuries, vitreous haemorrhage, retinal detachment, and poor visual outcomes.[4,6]

Despite advances in ocular trauma management, firecracker-related ocular injuries remain an important cause of avoidable visual disability. Understanding the current pattern of injury, treatment requirements, and visual outcomes is essential for improving emergency management and developing effective preventive strategies.

The present study was conducted to evaluate the demographic profile, clinical characteristics, treatment modalities, and visual outcomes of patients presenting with ocular injuries caused by firecrackers during Diwali 2025 at a tertiary eye care centre.

## MATERIALS AND METHODS

This was a retrospective observational study conducted at Minto Ophthalmic Hospital, Regional Institute of Ophthalmology, Bangalore Medical College and Research Institute, Bengaluru. Medical records of all consecutive patients presenting with firecracker-related ocular injuries during festive season in the year 2025 were reviewed.

Demographic details, mechanism of injury, laterality, type of ocular involvement, presenting visual acuity, clinical findings, treatment modalities, and visual outcomes were recorded. All patients underwent complete ophthalmic evaluation including visual acuity assessment, slit-lamp examination, intraocular pressure measurement, and fundus evaluation whenever possible. Additional investigations such as B-scan ultrasonography

or computed tomography were performed when indicated.

Patients were managed either conservatively or surgically depending on the severity and anatomical involvement. Data were analysed and expressed as frequencies and percentages.

## RESULTS

### Demographic Characteristics

| Category | Subcategory | Numbers (N=36) | Percentage |
|---|---|---|---|
| Age Group | 0 - 10 Years | 14 | 24.6% |
| | 11 - 20 Years | 24 | 42.1% |
| | 21 – 30 Years | 4 | 7.0% |
| | 31 – 40 Years | 8 | 14.0% |
| | 41 – 50 Years | 4 | 7.0% |
| | 51 – 60 Years | 3 | 5.3% |
| Sex | Male | 50 | 87.7% |
| | Female | 7 | 12.3% |

**Table 1: Age And Sex Distribution of Patients with Firecracker-Related Ocular Injury (N = 57)**

A total of 57 patients with firecracker-related ocular injuries were included in the study. The mean age was 20.6 ±15.2 years (median: 17 years; range: 2.5–60 years). The majority of patients belonged to the 11–20 years age group (24, 42.1%), followed by the 0–10 years age group (14, 24.6%). Patients aged 31–40 years accounted for 8 (14.0%) cases, while those aged 21–30 years and 41–50 years each comprised 4 (7.0%) cases. The 51–60 years age group had the fewest patients, with 3 (5.3%) cases. (Table 1)

There was a marked male predominance, with 50 (87.7%) male patients and 7 (12.3%) female patients. (Table 1)

### Involvement in Firecracker

| Involvement | Numbers (N = 57 Eyes) | Percentage |
|---|---|---|
| Bystander | 31 | 54.4% |
| Participant | 26 | 45.6 |

**Table 2: Distribution of Patients Based On Involvement in Firecracker Injury (N = 57)**

Of the 57 patients included in the study, 31 (54.4%) were bystanders, while 26 (45.6%) were participants involved in handling or bursting firecrackers at the time of injury. Bystanders constituted a slightly higher proportion of cases than participants. (Table 2)

### Type of Fire Cracker

| Type Of Fire Cracker | Numbers (N= 57) | Percentage |
|---|---|---|
| Bijli | 15 | 26.3% |
| Atom Bomb | 6 | 10.5% |
| Lakshmi Bomb | 6 | 10.5% |
| Flower Pot | 5 | 8.8%% |
| Rocket | 2 | 3.5% |
| Bijli Roll | 2 | 3.5% |
| Sursur Batti | 2 | 3.5% |
| Shots | 3 | 5.3% |
| Pistol Cracker | 2 | 3.5% |
| Triangle Cracker | 1 | 1.8% |
| Gun Powder | 1 | 1.8% |
| Kitkat Bomb | 1 | 1.8% |
| Sara Pataki | 1 | 1.8% |
| Chit Put | 1 | 1.8% |
| Unknown | 1 | 1.8% |

**Table 3: Type of Firecracker Causing Ocular Injury (N = 57)**

Among the identified firecrackers, Bijli was the most common type associated with ocular injury, accounting for 15 (26.3%) cases. This was followed by Atom bomb and Lakshmi bomb/Lakshmi pataki, each responsible for 6 (10.5%) cases, while Flower pot was implicated in 5 (8.8%) cases. Shots (including shots, single shot, and skyshot) accounted for 3 (5.3%) cases. Rocket, Bijli roll, Sursur batti, and Gun/Pistol cracker each contributed 2 (3.5%) cases. Triangle cracker, Gun powder, KitKat bomb, Sara pataki, Chit Put, and Unknown firecracker type were each reported in 1 (1.8%) case. (Table 3).

**Mode of Arrival to Hospital**

| Mode Of Arrival | Numbers (N= 57) | Percentage |
|---|---|---|
| Direct Arrival | 46 | 80.7% |
| Reffered | 11 | 19.3% |

**Table 4: Mode of Arrival to the Hospital (N = 57)**

Among the 57 patients, 46 (80.7%) presented directly to the hospital, while 11 (19.3%) were referred from another healthcare facility. (Table 4).

**Duration between Trauma and Time of Presentation**

| Duration | Numbers (N = 57) | Percentage |
|---|---|---|
| ≤1 Hour | 17 | 29.8% |
| >1–4 Hours | 28 | 49.1% |
| >4–12 Hours | 10 | 17.5% |
| >12 Hours | 2 | 3.5% |

**Table 5: Duration between Trauma and Presentation to the Hospital (N = 57)**

The majority of patients presented to the hospital within 4 hours of injury (45, 78.9%). Seventeen (29.8%) patients presented within 1 hour, while 28 (49.1%) presented between >1 and 4 hours after trauma. Ten (17.5%) patients presented between >4 and 12 hours, and only 2 (3.5%) presented more than 12 hours after injury (1 day). (Table 5).

**Visual Acuity at Presentation**

| Presenting Visual Acuity | Numbers | Percentage |
|---|---|---|
| >6/12 | 25 | 43.9% |
| 6/12 -6/60 | 11 | 19.3% |
| 6/60–3/60 | 4 | 7.0% |
| 3/60 – PL +Ve | 13 | 22.8% |
| No Perception of Light | 1 | 1.8% |
| Unable To Assess (Child Follows Light) | 3 | 5.3% |

**Table 6: Distribution of Visual Acuity at the Time of Presentation (N= 57)**

At presentation, 25 (43.9%) eyes had a visual acuity of 6/12 or better, while 11 (19.3%) had visual acuity between <6/12 and 6/60. Counting fingers vision was present in 4 (7.0%) eyes, and 13 (22.8%) eyes had hand movements to perception of light (PL+) vision. No perception of light (NPL) was observed in 1 (1.8%) eye. Visual acuity could not be reliably assessed in 3 (5.3%) young children, who were documented as following light. (Table 6)

**Spectrum of Ocular Diagnoses**

| Diagnosis Category | Included Diagnosis | Numbers | Percentage |
|---|---|---|---|
| Eye Lid And Adenexa | Periorbital Edema | 1 | 1.8% |
| | Lid Burn | 7 | 12.3% |
| | Lid Edema | 5 | 8.8% |

| | | | |
|---|---|---|---|
| | Lid Tear | 3 | 5.3% |
| | Lid Abrasion | 2 | 3.5% |
| Conjunctival Disorders | Conjunctival Tear | 2 | 3.5% |
| | Subonjunctival Hemorrhage | 2 | 3.5% |
| Corneal And Limbus | Corneal Epithelial Defect | 23 | 40.4% |
| | Superficial Punctate Keratitis | 6 | 10.5% |
| | Corneal Burn | 1 | 1.8% |
| | Corneal Foreign Body | 1 | 1.8% |
| | Corneal Opacity | 1 | 1.8% |
| | Corneal Tear | 2 | 3.5% |
| | Limbal Ischemia | 2 | 3.5% |
| Sclera | Scleral Tear | 1 | 1.8% |
| Anterior Chamber | Hyphema | 13 | 22.8% |
| | Traumatic Uveitis | 7 | 12.3% |
| | Iridodialysis | 2 | 3.5% |
| | Iris Prolapse | 1 | 1.8% |
| Lens | Traumatic Cataract | 2 | 3.5% |
| | Lens Subluxation | 1 | 1.8% |
| Vitreous | Vitreous Hemorrhage | 8 | 14.0% |
| Retinal And Choroid | Berlin Retina | 6 | 10.5% |
| | Choroidal Detachment | 1 | 1.8% |
| | Macular Hole | 1 | 1.8% |

**Table 7: Ocular Findings at Presentation**

Corneal involvement was the most common ocular finding, with corneal epithelial defect/abrasion observed in 23 (40.4%) eyes [Fig 1], followed by hyphema in 13 (22.8%) [Fig 2] and vitreous hemorrhage in 8 (14.0%) eyes. Among eyelid injuries, lid burns were the most frequent finding (7, 12.3%) [Fig 3], followed by lid edema (5, 8.8%). Traumatic uveitis and commotio retinae (Berlin's edema) were each noted in 7 (12.3%) and 6 (10.5%) eyes, respectively, while superficial punctate keratitis was present in 6 (10.5%) eyes [Fig 4]. Less frequent findings included conjunctival congestion (5, 8.8%), limbal ischemia, iridodialysis, traumatic cataract, subconjunctival hemorrhage, and lid abrasion (each 2, 3.5%). Corneal burn, corneal foreign body [Fig 5], lid laceration [Fig 7], scleral tear, corneoscleral tear, corneal lamellar tear, iris prolapse, globe rupture [Fig 6], lens subluxation, choroidal detachment, macular hole, and periorbital edema were each observed in 1 (1.8%) eye. Multiple ocular findings were present in several eyes. (Table 7)

**Treatment Modalities Provided**

| Treatment Category | Numbers | Percentage |
|---|---|---|
| Conservativ | 49 | 86.0% |
| Surgical | 8 | 14.0% |

**Table 8: Treatment Modalities Provided to Fire Cracker Injury Patients (N = 57)**

The majority of patients were managed conservatively, with 49 (86.0%) receiving medical treatment alone. Surgical intervention was required in 8 (14.0%) patients. (Table 8)

**Clinical Photographs**

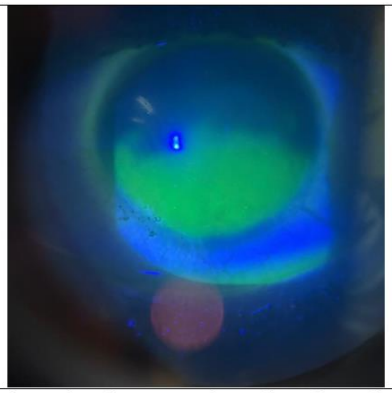

*Figure 1: Fluorescein-stained cornea viewed under cobalt blue illumination demonstrating a large corneal epithelial defect after firecracker injury*

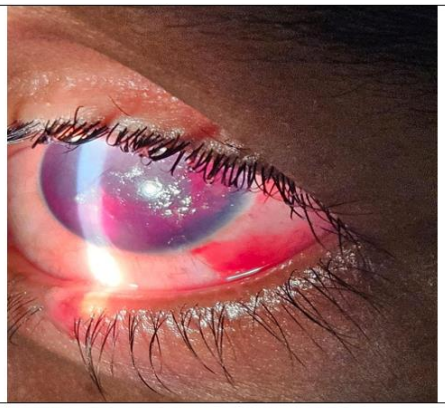

*Figure 2: Traumatic hyphema associated with diffuse corneal edema*

*Figure 3. Thermal burn involving the upper eyelid and periocular skin secondary to firecracker injury*

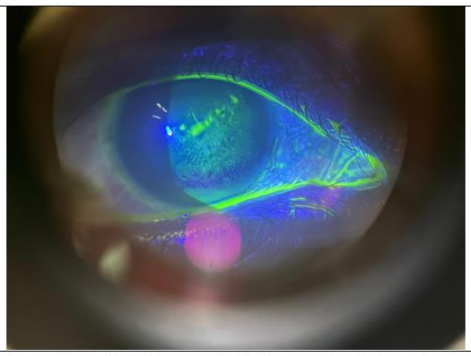

*Figure 4: Shows superficial punctate keratitis following thermal burns*

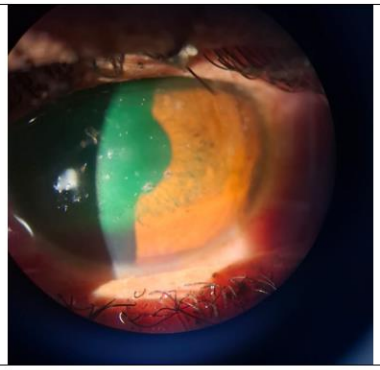

*Figure 5: Embedded fire cracker particles within the anterior corneal stroma*

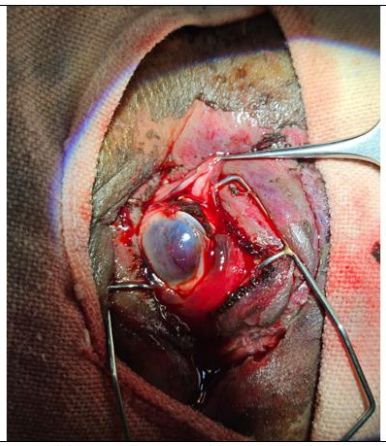

*Figure 6: Open-globe rupture with prolapse of uveal tissue noted intraoperatively during primary globe repair*

*Figure 7: Full-thickness upper eyelid laceration with exposed orbital rim/bone following blast injury*

## DISCUSSION

In the present study, 57 patients with firecracker-related ocular injuries were evaluated during festive season in the year 2025. The mean age was 20.6±15.2 years, with maximum involvement in the 11–20 years age group (42.1%). Similar predominance of young Individuals has been reported in other studies. Morris et al. observed that adolescents and young adults represented the largest group affected by firework-related ocular trauma in the United Kingdom, with children and young adults accounting for most injuries.[11] A systematic review by Wisse et al. also identified younger age groups as the most commonly affected population across multiple countries.[12] The age distribution in our study was comparable with these reports, suggesting that exposure during recreational use remains an important contributor to firecracker-related ocular trauma.

Male predominance was observed in our study, with males accounting for 87.7% of cases. Similar male predominance has been consistently reported in previous studies. Kumar et al. reported 84% male involvement in their Deepavali injury series, while Venkatesh et al. reported 82.7% male patients in North India.[1,3] International studies have also reported male predominance, with Morris et al. reporting males as the majority of firework injury victims.[11] The higher incidence among males in our cohort may reflect greater participation in firecracker-related activities.

Unlike studies where direct handlers constituted the majority of injuries, our study found that bystanders accounted for 54.4% of cases. This finding is important because it demonstrates that ocular injury risk extends beyond individuals actively using firecrackers. Wisse et al., in their systematic review, reported that bystanders represented a considerable proportion of firework injuries, particularly among explosive devices used in crowded environments.[12] D'Souza et al. also reported significant bystander involvement in their Indian series of firework-related ocular trauma.[13] The higher proportion of bystander injuries in our study may be related to the crowded nature of Diwali celebrations in residential areas.

In our study, Bijli cracker was the most commonly implicated firecracker (26.3%), followed by Atom bomb and Lakshmi bomb (10.5% each). Previous Indian studies have reported different patterns depending on regional preference and availability of firecrackers. Sarma et al. reported explosive crackers as frequent causes of severe ocular trauma in their tertiary centre study.[14] Haring et al., analysing firework injuries in the United States, also found that explosive devices were associated with more severe injuries compared with low-intensity fireworks.[15] Although Bijli crackers were the most frequent cause in our study, severe injuries were observed with different types of crackers, suggesting that injury severity depends not only on the type of cracker but also on distance and direction of explosion.

Corneal epithelial defect/abrasion was the most common ocular finding in our study, affecting 40.4% of eyes. Similar anterior segment involvement has been reported in previous studies. Patel and Mukherjee reported corneal injuries among the commonest manifestations of firework trauma.[2] D'Souza et al. also observed corneal involvement as one of the predominant findings in Indian patients.[13] The frequency of corneal injury in our study may be related to direct contact with small fragments generated during explosion.

Hyphema was observed in 22.8% of eyes in our study. This finding was higher compared with some published series. Sarma et al. reported hyphema among the common anterior segment injuries following firecracker trauma.[14] Firecracker explosions generate blunt and penetrating forces simultaneously, which may explain the association of hyphema with these injuries.

Posterior segment involvement was observed in our study, with vitreous haemorrhage occurring in 14% of eyes and commotio retinae in 10.5%. Similar posterior segment complications have been reported in previous studies. Madhusudhan et al. described vitreous haemorrhage, retinal injury, and traumatic maculopathy among patients with firework-related ocular trauma.[7] Pahor also reported posterior segment involvement as an important cause of poor visual outcome following firework injury.[16] The presence of posterior segment injury despite relatively common superficial injuries highlights the importance of complete ocular evaluation.

Surgical intervention was required in 14% of patients in our study. This proportion was lower compared with studies reporting more severe referral patterns. Venkatesh et al. reported a higher proportion of surgical cases, including globe repair and vitreoretinal procedures.[3] Wisse et al. reported that surgical intervention rates vary widely depending on inclusion criteria and healthcare setting, with tertiary referral centres receiving more severe cases.[12] The relatively lower surgical requirement in our study may be due to the predominance of superficial and anterior segment injuries.

## CONCLUSION

In this study of 57 patients with firecracker-related ocular injuries during Diwali 2025, the majority of affected individuals were young males, with the 11–20 years age group contributing the highest number of cases. Bystanders accounted for more than half of the injuries. Corneal epithelial defects/abrasions were the most frequent ocular finding, followed by hyphema and vitreous haemorrhage. Most patients (86%) were managed conservatively, while 14% required surgical intervention. The study demonstrates that although many firecracker injuries were limited to anterior segment involvement, severe injuries involving

the posterior segment and requiring surgical management were also encountered.

**Source of Funding**
None

**Conflict of Interest**
None

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