



EYES IN THE LINE OF FIRE: PATTERNS OF FIRECRACKER-INDUCED EYE TRAUMA IN A TERTIARY EYE CENTER

Ophthalmology

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ABSTRACT

Background: Firecracker-related ocular trauma is a preventable but persistent public health issue, particularly during festivals. These injuries contribute substantially to visual morbidity, often affecting young individuals and bystanders. **Objective:** The present study aimed to assess the demographic profile, pattern, and outcomes of ocular injuries caused by firecrackers during festival seasons, based on two years of retrospective data from a tertiary eye care center. **Methods:** A retrospective observational analysis was conducted in the Department of Ophthalmology, Akash Institute of Medical Sciences and Research Centre, covering the period from November 2023 to October 2025. The study included 45 patients with documented firecracker-induced ocular trauma. Data on age, gender, type of firecracker, mechanism and classification of injury, presenting visual acuity, treatment, and final outcome were collected and analyzed using SPSS version 25. **Results:** Among 45 patients, 37 (82.2%) were males and 8 (17.8%) females, with a mean age of 24.1 ± 8.6 years. Bystanders constituted 40% of cases. The most frequent injurious firecrackers were bombs (31%), followed by rockets (27%), and sparklers (22%). Closed globe injuries occurred in 29 patients (64.4%), while open globe injuries were found in 16 (35.6%). Corneal abrasions (33.3%) and hyphema (26.6%) were the most common lesions. At final follow-up, 46.7% regained visual acuity $\geq 6/18$, 37.8% achieved partial recovery, and 15.5% suffered permanent visual impairment. Severe injuries correlated significantly with explosive-type firecrackers ($p < 0.05$). **Conclusion:** Firecracker-related ocular injuries remain preventable tragedies. Public education, stricter enforcement of safety regulations, and widespread use of protective eyewear are essential to safeguard vision during festive celebrations.

KEYWORDS

Firecracker injury, ocular trauma, visual loss, ophthalmic emergency, festival safety

INTRODUCTION

Fireworks are a long-standing part of cultural and religious festivities worldwide, but their misuse continues to cause serious ocular trauma. The human eye is particularly vulnerable to injury from explosive and chemical components of firecrackers because of its exposed and delicate structure. Even a brief exposure to high-velocity particles or thermal bursts can result in devastating and sometimes irreversible damage. Firecracker-related ocular injuries range from mild conjunctival burns to complex open-globe ruptures and retinal damage, with potential for lifelong visual disability¹.

Numerous Indian and international studies have consistently reported a seasonal surge in ocular trauma cases during festival periods such as Deepavali and New Year. In a landmark case series they found that most injuries occurred in unsupervised young males using explosive firecrackers at close range¹. Festive seasons in South India emphasized that despite repeated awareness programs, the pattern of injuries remained unchanged, with nearly half of victims being bystanders². This highlights a failure in community awareness and adherence to safety measures.

Internationally, a study described a high incidence of pediatric open-globe injuries in Iran, reinforcing that children remain the most at-risk population due to inadequate supervision and curiosity⁶. These findings collectively emphasize the preventable nature of such ocular injuries and the ongoing need for multidisciplinary efforts combining education, regulation, and prompt ophthalmic care.

The present study aims to analyze the epidemiological profile, clinical spectrum, and outcomes of firecracker-related ocular injuries over a two-year period at a tertiary care hospital. By comparing local data with established literature, this study seeks to identify persistent risk factors and evaluate the effectiveness of preventive efforts in mitigating visual morbidity during festival seasons.

MATERIALS AND METHODS

A retrospective study conducted at the Department of Ophthalmology,

Akash Institute of Medical Sciences, Bengaluru, from November 2023 to October 2025. Patients with firecracker-related ocular trauma during festivals were included. Patients underwent systemic and ocular evaluation, including visual acuity, slit-lamp, posterior segment exam, indirect ophthalmoscopy, and tonometry. B-scan or CT was done if needed. Injuries were classified per BETTS as open- or closed-globe. Analysis was done using SPSS v25; descriptive statistics were expressed as mean $\pm$ SD and percentages, and associations were tested with Chi-square ($p < 0.05$). Minor injuries were treated conservatively with topical antibiotics, steroids and lubricants; surgical repair was done for significant ocular trauma, including lid, corneal, scleral, or intraocular procedures.

Inclusion Criteria

- Patients of all ages and genders with confirmed firecracker-related ocular injury.
- Complete documentation of mechanism, examination findings, and treatment outcomes.
- Both unilateral and bilateral ocular involvement.

Exclusion Criteria

- Ocular trauma not associated with fireworks.
- Patients with prior ocular disease affecting vision (e.g., corneal dystrophy, glaucoma).
- Incomplete or illegible records.

RESULTS

Demographic Profile

Of the 45 patients, 37 (82.2%) were males and 8 (17.8%) females. The mean age was 24.1 ± 8.6 years (range 6–49 years).

Table 1: Demographic Details

Demographic Details	Frequency	Percentage
Males	37	82.2
Females	8	17.8

The highest incidence (68.9%) occurred among individuals aged

11–30 years. Eighteen patients (40%) were bystanders, while twenty-seven (60%) were directly handling fireworks at the time of injury.

Type Of Firecracker

The distribution of causative firecrackers is shown below:

Table 2 : Type Of Firecracker

Type Of Firecracker	Frequency	Percentage
Bombs	37	31.1
Rockets	8	26.7
Sparklers	10	22.2
Ground spinners/fountains	9	20

Explosive devices such as bombs and rockets were significantly linked with severe ocular damage ($p = 0.04$).

Pattern Of Ocular Injury

Closed globe injuries were recorded in 29 patients (64.4%), while 16 (35.6%) sustained open globe trauma. The most common lesions included.

Table 3 : Pattern Of Ocular Injury

Pattern Of Ocular Injury	Frequency	Percentage
Corneal abrasion	15	33.3
Hyphema	12	26.6
Lid lacerations	8	17.8
Globe rupture	7	15.6
Retinal Detachment	3	6.7

Table 4 : According To BETTS Classification Distribution

Acc to BETTS Classification	Frequency	Percentage
Close globe injury	29	64.4
Open globe injury	16	35.6

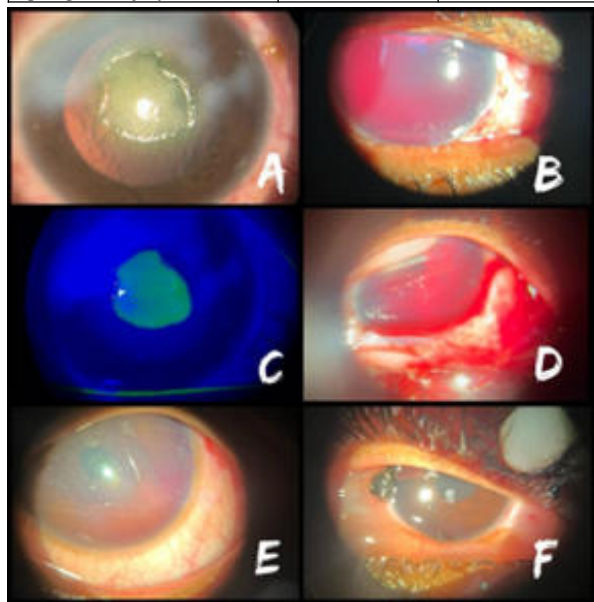


Fig 1 : Patterns of Firecracker injury to eye.

A-Corneal epithelial defect. B-Hyphema post-firecracker injury. C-Positive fluorescein staining of epithelial defect. D-Open globe injury. E-Hyphema with epithelial defect. F-Soot particles on cornea with chemosis.

Visual Outcome

At presentation, 18 patients (40%) had vision $<6/60$. After appropriate medical and surgical management:

Table 6: Visual Outcomes After Management

Visual Outcomes	Frequency	Percentage
Good recovery VA $\geq 6/18$	21	46.7
Partial improvement VA 6/24-6/60	17	37.8
Poor or no recovery VA $\leq 6/60$	7	15.5

Complications included secondary glaucoma (3 cases), traumatic cataract (2 cases), and endophthalmitis (1 case).

DISCUSSION

The current study's findings align with previous reports demonstrating

that most firecracker-induced ocular injuries occur among young males and during major festive periods^{1,2}. In the present series, over 80% of the patients were men in their second or third decade of life, mirroring demographic trends noted in earlier Indian and international studies. This pattern reflects both behavioral and social factors- greater participation of young males in lighting fireworks, risk-taking tendencies, and lack of adherence to safety instructions.

Bystanders accounted for 40% of injuries in this study, consistent with the observations^{2,3} which emphasized that passive spectators are often unaware of imminent danger. Such findings underscore that ocular injuries are not confined to active participants but are a broader community hazard during festival celebrations.

The predominance of closed-globe injuries in our study parallels the results of Kurien et al., where over 60% of cases involved superficial trauma such as corneal abrasions and hyphema⁴. However, the presence of open-globe injuries in approximately one-third of patients reaffirms the severe potential of explosive firecrackers. Pujari et al. (2018) highlighted that high-energy projectiles from bombs and rockets cause extensive structural damage, correlating with the poorer visual outcomes seen in our data^{4,5}. Despite temporary regulatory bans in some regions, illegal or homemade explosive devices continue to contribute significantly to ocular trauma.

Visual recovery in nearly half of the patients in the current study is encouraging, similar to the improvement rates reported by Kurien et al.⁵. Nevertheless, around 15% experienced permanent visual loss, demonstrating that even with advanced surgical management, outcomes are often limited once the posterior segment or optic nerve is involved. Peyman et al. (2023) further reinforced this by documenting severe pediatric open-globe injuries that resulted in irreversible blindness, particularly in unsupervised settings.

Sustained community education, active parental supervision, and enforcement of safety standards are essential. The study by Pujari et al. (2018) illustrates that policy interventions such as temporary bans and awareness drives can significantly reduce the injury load, provided they are consistently implemented. Additionally, integrating ocular safety campaigns into school curricula and encouraging the use of protective eyewear can help minimize preventable injuries among children and adolescents.

CONCLUSION

Firecracker-related ocular trauma continues to threaten vision and quality of life, particularly during festival seasons. This study of 45 patients over two years demonstrates that most victims are young males, but nearly half are innocent bystanders. Explosive fireworks such as bombs and rockets cause the most severe damage, including open globe injuries and permanent vision loss.

Early presentation to tertiary care centers can improve outcomes, yet the cornerstone of management remains prevention. Public education, strict enforcement of safety regulations, supervision of minors, and use of protective eyewear are crucial. Creating controlled zones and promoting safer alternatives can help ensure that festivities remain joyous rather than sight-threatening.

Conflicts Of Interest – Nil

Financial Support And Sponsorship - Nil

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