Journal of Surgery and Surgical Specialities
Volume 1, Issue 3, September 2025; pp: 87-93
eISSN: 2455-2860 DOI: 10.65129/surgical.v1i3.157

RESEARCH ARTICLE

Prevalence and Clinical Spectrum of Non-Festival Firecracker Blast Injuries in a Tertiary Care Centre

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Abstract

Aim: Cracker burst injuries are one of the devastating injuries that have increased in frequency and severity in the last decade. This study aims to review the prevalence and various presentations of cracker burst injuries, excluding festival seasons (Diwali, New Year, Christmas), due to inadvertent use by children, faulty and poor quality crackers, during death processions and common in cracker manufacturing industries. **Patients and Methods:** A retrospective study was conducted in patients admitted with cracker burst injuries in the Department of Plastic Surgery, Thanjavur Medical College, between December 2022 and December 2024 (excluding festivals). The patients with cracker burst injuries were classified as mild, moderate and severe, and their presentations, management, deformity, functional loss and outcomes were studied. **Results:** 70 patients with cracker burst injuries were admitted and treated in the department of plastic surgery between December 2022 and December 2024, excluding the injuries happened during festivals. Most of the patients were males. The age group ranged from 2 to 65 years, with an average of 20 years. The most common cause of injury was faulty crackers (device failure), followed by cracker misuse and industrial accidents. Treatment and surgery ranged from simple dressings to amputations. Surgical procedures include tendon and muscle repair, K-wire fixation, flap cover, graft and even amputation. **Conclusion:** Cracker burst injuries are increasing in frequency nowadays, even during non-festival days. These injuries are preventable by creating proper awareness about the precautionary measures while firing crackers, educating people about the disabilities and functional loss encountered after cracker burst injuries and instructing the manufacturers about the quality control of the crackers.

Keywords: Cracker Blast, Cracker Burst Injuries, Deformity, Disability, Firecrackers, Hand

1. Introduction

Firecracker-related injuries traditionally peak during festive periods. However, hospitals increasingly encounter such injuries also during non-festival days. These incidents often involve the upper limb, particularly the dominant hand, and may lead to significant long-term disability. This study analyses the prevalence, mechanisms, clinical patterns, and treatment outcomes of cracker burst injuries occurring during non-festival periods and highlights the preventable nature of these injuries[1,2].

2. Aim and Objectives

Cracker burst injuries are one of the devastating injuries that have been increasing in frequency and severity in the last decade. The study aims to review the prevalence and various presentations of cracker-burst

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Article Received on: 24-05-2025 Revised on: 06-07-2025 Accepted on: 28-08-2025

injuries, excluding festival seasons (Diwali, New Year, Christmas)

Causes

- Due to faulty and poor-quality crackers
- Cracker manufacturing industries
- Due to inadvertent use by children
- During death processions.

3. Review of Literature

A retrospective analysis by Tandon *et al.*[3] from a tertiary care centre in Delhi reviewed emergency burn clinic records spanning nine years (2002–2010), specifically examining the days before, during, and after Diwali. The review documented 1,373 firecracker-related injuries, showing a steady rise in cases despite existing legislation intended to regulate firecracker use. The annual incidence translates to roughly one affected individual per 100,000 population, highlighting the substantial public health impact. Young individuals were predominantly involved, with 73% falling between 5 and 30 years of age, and most presented with minor burns involving less than 5% Total Body Surface Area (TBSA). Even with regulatory interventions and judicial directives, the upward trend persisted. The study emphasised the necessity of more effective preventive strategies, stronger enforcement mechanisms, and expanded educational initiatives—especially through contemporary digital communication channels—to improve public safety.

Puri *et al.*[4] carried out a mixed retrospective and prospective evaluation at KEM Hospital, Mumbai, covering a decade (1997–2006) and including 157 cases of firework-related injuries. The investigators assessed demographic factors, supervision at the time of injury, types of fireworks used, patterns of use, and injury characteristics associated with specific devices. Children aged 5–14 years comprised 35% of cases, and an overwhelming 92% were unsupervised. Misuse of fireworks accounted for the largest proportion of injuries (41%), followed by device malfunction (35%). Injury severity varied with firework type: flare fountains and aerial devices were responsible for most cases, while sparklers caused comparatively few. High-energy devices—such as rockets and string bombs—produced severe blast effects leading to fractures, tendon disruption, neurovascular injury, and even amputations. Treatment ranged from conservative measures to urgent reconstructive surgery. Importantly, the authors observed a sharp reduction in firework injuries over the study period, dropping from 41 cases in 1997 to 3 in 2006, attributed to improved public awareness, regulatory measures, and dedicated safety campaigns. These findings reiterate that such injuries are largely preventable and stress the importance of stricter manufacturing standards, sustained education, and supervised firework use.

Winicki *et al*[5] conducted an epidemiological study in the United States, analysing firework-related injuries over 11 years (2012–2022) using the Consumer Product Safety Commission's National Electronic Injury Surveillance System. They identified 3,219 confirmed cases, corresponding to an estimated 122,912 emergency visits nationwide, with incidence increasing by more than 17% over the study period—from 2.61 to 3.05 cases per 100,000 population. Young adults aged 20–24 years represented the most affected age group, and males exhibited more than double the injury rate seen in females. The upper limbs, head, and neck were the most frequently involved regions, and over 20% of adults required hospitalisation, reflecting the severity of injuries encountered. Aerial fireworks and illegal explosive devices were disproportionately associated with high-risk and severe outcomes. The authors concluded that firework-related injuries continue to rise and highlighted the need for strengthened regulatory frameworks, improved oversight of high-risk devices, and targeted prevention strategies to mitigate avoidable morbidity.

4. Materials and Methods

This retrospective observational study included all patients admitted with firecracker burst injuries between December 2022 and December 2024, excluding Diwali, New Year, and Christmas. Patient

demographics, mechanism of injury, injured site, severity, radiological findings, surgical interventions, complications, and hospital stay duration were recorded.

Data Collected:

- Age, sex, alcohol intake, and occupation
- Mechanism of injury
- Anatomical region and severity
- Radiological findings
- Surgical and non-surgical interventions
- Complications, hospital stay, and outcomes. Injury severity was classified as: (Chart 2)• Mild – soft tissue injuries without bone or joint involvement (Figure 1)• Moderate – involvement of bone/joint without amputations. (Figure 2)• Severe – partial or complete hand amputations or flame burns > 50%. (Figure 3) All patients underwent systematic evaluation, and management was tailored based on tissue viability and functional expectations.

Figure 1. Mild injuries.

Figure 2. Moderate injuries.

Figure 3. Severe injuries.

5. Results (Including Observations)

A total of 70 patients presented with cracker-burst injuries during the study period. As per Chart 1, males constituted 77% of cases, consistent with risk-taking behaviour and occupational exposure patterns. Children (23%) formed a significant subset, reflecting the dangers of unsupervised handling. The mean age was 20 years, demonstrating vulnerability among adolescents and young adults (Table 1).

Half the patients (50%) were under the influence of alcohol, significantly correlating with unsafe ignition practices and delayed response to misfires. (Table 1).

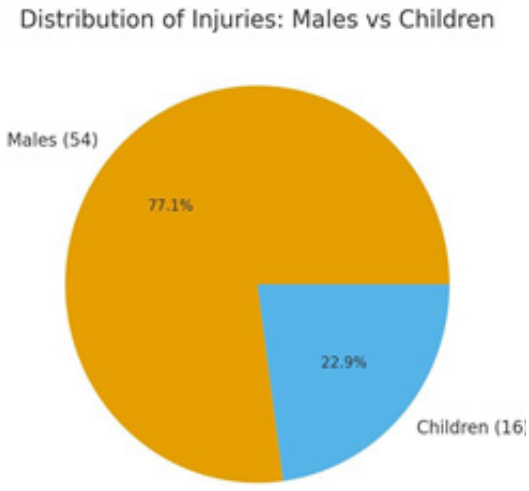

Chart 1. Gender distribution.

Table 1. Patient demographics

Parameter	Value
Total patients	70
Gender distribution	54 males (77%), 16 children (23%)
Age range	2–65 years (mean 20 years)
Alcohol intake during injury	35 patients (50%)

Faulty or delayed-firing crackers (45%) were the most common cause. These involved device malfunction, premature explosion, or unexpected discharge during disposal attempts. Cracker misuse (26%), such as lighting bombs in the hand, was the second major contributor. Unsupervised children (20%) accounted for a substantial proportion. Industrial accidents (11%) tended to result in high-magnitude blast injuries involving multiple body regions (Figure 9), and one patient had a midfoot amputation (Figure 8). The predominance of faulty devices underscores a serious lapse in manufacturing quality control. (Table 2).

Table 2. Mechanisms of injury

Cause	Patients	Percentage
Faulty/delayed firing crackers	32	45%
Cracker misuse (lit in hand)	18	26%
Unsupervised children	14	20%
Industrial accidents	8	11%

Severity distribution in Chart 2 shows severe injuries in 48 patients (68%) — a disproportionately high percentage compared to festival-related studies. These involved complex blast wounds, metacarpal fractures, Carpometacarpal (CMC) dislocations, devascularised digits, and multiple finger amputations. Moderate injuries (20%) included fractures requiring fixation. Mild injuries (11%) were the least frequent, indicating that even non-festival incidents carry significant destructive potential.

Management included the following (Table 3):

- Debridement and closure (24 patients): The most common initial intervention, reflecting extensive contamination and tissue devitalisation.
- Ray amputation or shortening (14 patients): Required for non-viable digits with tendon, bone, and neurovascular destruction.
- Flap coverage (9 patients): Used in cases with exposed bone or tendon and large soft-tissue deficits (Figure 5).

Figure 4. K-wire fixation.

Figure 5. Flap covers.

Figure 6. Facial soft tissue injuries.

Figure 7. Ocular foreign bodies.

Figure 8. Mid-foot amputation.

- K-wire fixation (6 patients): For metacarpal/phalangeal fractures and CMC disruptions. (Figure 4)

Figure 9. Burns involving the trunk and multiple areas were managed conservatively.

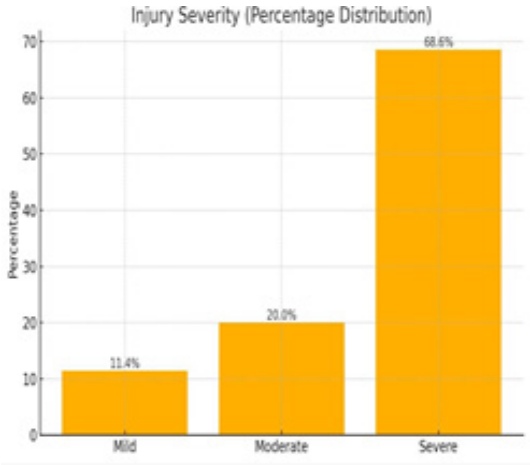

Chart 2. Severity of injuries.

Table 3. Treatment modalities

Treatment Type	Number of Patients
Conservative	6
Debridement and closure	24
K-wire fixation	6
Ray amputation/ shortening and closure	14
Flap cover	9
Split-skin graft	6
Major amputation	6

- Major amputations (6 patients): Indicating devastating blast force, particularly in industrial settings. (Figures 3 and 8)
- Two deaths, both due to industrial explosions, involved TBSA burns exceeding 75–90%.

The surgical burden reflects the complexity of blast mechanics and the need for staged reconstruction.

6. Discussion

Firecrackers are widely used during celebrations due to their sound, visual appeal, and symbolic association with festivity. However, cracker-related trauma occurring outside traditional festive periods has emerged as a significant and preventable public health concern. The present study demonstrates that such injuries are not only frequent but also severe, with a striking predominance among young adults and children. The involvement of the dominant hand in 75% of cases reflects how these injuries adversely affect long-term functional ability, occupational capacity, and overall quality of life. Bilateral hand injuries were documented in 6% of patients, and one case involved a near-total mid-foot amputation (Figure 8), further emphasising the unpredictable and catastrophic nature of these events[5].

Faulty crackers, particularly unexploded devices that later discharged during handling or disposal, were the most common cause of injury (45%), followed by misuse and industrial accidents (Chart 3). Nearly half of all patients sustained injuries from delayed firing while attempting to dispose of failed crackers. Notably, alcohol consumption contributed to risk behaviour, with 50% of patients under its influence at the time of injury. Industrial accidents, though less frequent, carried disproportionately high morbidity and mortality; among four affected patients, two succumbed to extensive flame burns exceeding 75–90 %, while another with 60% burns survived after conservative management (Figure 9).

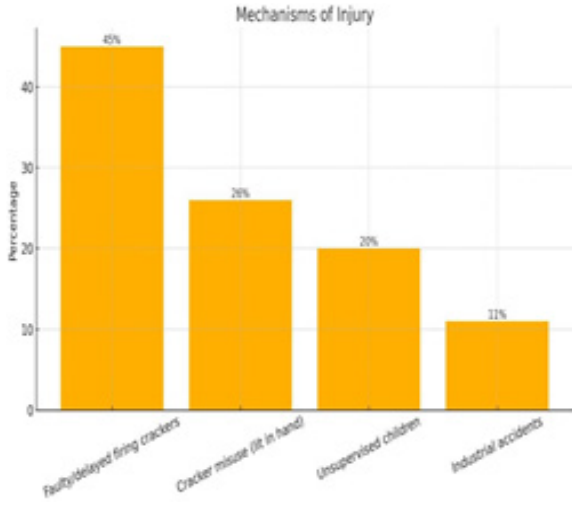

Chart 3. Mechanisms of injury.

The injuries observed ranged from minor lacerations to extensive tissue destruction requiring complex reconstructive procedures. Most patients sustained severe injuries, with first-web-space lacerations being the most common presentation (13 cases) owing to typical hand positioning during ignition. The thumb was the most frequently injured digit (12 patients), highlighting its vulnerability and functional significance. Severe lacerations involving the palm and fingers were noted in nine cases, while amputations—particularly at the Metacarpophalangeal (MCP) and Interphalangeal Joints (IP) occurred in another nine cases. Fractures of the metacarpal bones, carpometacarpal dislocations, and involvement of the second and third metacarpals formed a consistent injury pattern. The most characteristic configuration included a crushed first web space with variable thenar muscle injury, dorsal CMC dislocation of the thumb, second and third metacarpal fractures, and partial amputation of multiple fingers[7].

Associated injuries extended beyond the hand and included soft-tissue trauma to the face (Figure 6), trunk (Figure 9), and upper limbs, along with ocular injuries such as corneal foreign bodies (Figure 7) in two patients. Five patients also presented with superficial or deep burns involving multiple body regions. Hospital stay duration correlated strongly with injury severity, with moderate and severe trauma requiring prolonged treatment exceeding two weeks.

Management strategies varied depending on tissue viability and injury severity. Treatment modalities ranged from simple dressings for minor wounds to

staged debridement, K-wire fixation, shortening and closure, grafting, flap covers, ray amputation, and major limb amputations in severe cases. The need for amputations (28 patients), including ray and major amputations, reflects profound tissue destruction. Flap coverage requirements underline the necessity of advanced reconstructive capabilities in managing such trauma.

Industrial accidents, though fewer (11%), carried significantly worse morbidity and mortality — A critical observation for policy-makers and occupational health authorities. Long-term rehabilitation, physiotherapy, and psychological support were essential components of recovery due to functional impairment and the emotional burden associated with disfigurement.

Overall, this study underscores that non-festival firecracker injuries remain a significant yet preventable trauma burden. The findings highlight the urgent need for preventive strategies, including stricter industrial safety policies, public education on safe handling and disposal practices, regulation of firecracker quality, and community-level awareness programs. Improving safety measures and behaviour modification could substantially reduce the incidence and severity of such injuries and also improve long-term outcomes.

Prevention

- Restrict access to firecrackers for children, especially those below 5 years of age.
- Implement strict parental/adult supervision during handling.
- Enforce quality control measures for manufacturing units.
- Conduct awareness programs in schools and communities.
- Educate the public about long-term disability resulting from hand injuries.
- Promote safe disposal practices for failed crackers.

7. Summary and Conclusion

Non-festival cracker burst injuries constitute a serious, preventable cause of trauma. Faulty devices, misuse, and inadequate supervision contribute significantly to morbidity. Most injuries are severe and require complex reconstructive surgery, with potential long-term functional impairment. Improved manufacturing standards, targeted awareness campaigns, strict industrial safety measures, and responsible handling practices are crucial to reducing the incidence and severity of these injuries.

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