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A CLINICAL STUDY OF CRACKER BLAST INJURIES OF HAND

Plastic Surgery

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ABSTRACT

Firecracker-related injuries have been identified as one of the more important causes of burns. The predominance of hand involvement in such injuries is due to accidental blast during handling a cracker as well as the injury sustained when a person tries to shield himself from a cracker blast with his hands. This study was aimed at evaluation of cracker blast injuries with respect to demographics of affected population, etiology, type of injury and the entailed management. It was a retrospective study which encompassed a total of 50 admitted patients in the burns ward in a tertiary care hospital in South India from 01 Jan 2022 to 31 Dec 2022. The spectrum of injuries sustained was from simple laceration over hand to amputation of fingers. The most common surgical procedure performed was debridement couple with skin grafting. All the patients had a intensive physiotherapy sessions in the post op period. In conclusion, early debridement and wound coverage with post- operative splinting in the functional position is the key to management. By following safety precautions and by taking strict quality measures by the manufacturers, we can prevent these incidents and the disabilities that can occur due to them.

KEYWORDS

INTRODUCTION

Firecracker-related injuries have been identified as one of the more important causes of burns. Around Diwali, Christmas and New Year, these types of blast injuries result in hundreds to thousands of damages annually[1]. A firecracker is a small explosive device primarily designed to produce a large amount of noise. They consist of either black powder (also known as gunpowder) or flash powder in a tight paper tube with a fuse to light the powder. Black powder contains charcoal, sulfur and potassium nitrate. The explosion of a conventional fire cracker generates a blast wave that spreads out from a point source. In general, damage produced by blast waves decreases exponentially with distance from the point source of the blast. This factor is very important in hand injuries, because injury occurs mostly when the victim is holding the cracker in his/ her hand.

The predominance of hand involvement in such injuries is due to accidental blast during handling a cracker as well as the injury sustained when a person tries to shield himself from a cracker blast with his hands[2]. Most of the victims suffer from burns on the face, arms, and hands. Medical attention is most often needed ranging from simple cleaning of the wound to suturing and even to surgery. In some cases, amputation is warranted. Plastic surgeons are frequently involved in the primary care of these patients as many such injuries involve the hand.

AIM OF THE STUDY

To study the age & gender distribution, to evaluate various types of hand injuries, treatment options and their outcomes.

MATERIALS AND METHODS

A total of 50 patients who were admitted in the Plastic surgery department for a period of 12months from Jan 2022 to December 2022 were taken into the study. The patients with cracker blast injuries of the hand were grouped as mild, moderate or severe with the help of X-rays, clinical photographs and operative notes.

1. Mild injuries: Patients with only involvement of the soft tissues with no involvement of bone or joints [3]
2. Moderate injury : Patients having injuries to bones and joints in addition to soft tissues but no amputations of any kind
3. Severe injuries: Patients with amputations of part or whole of the hand.

Cracker blast injuries of the hand were treated with both repair and replacement depending on the extent of the injury, which was highly variable. All patients were advised an immediate intensive postoperative physiotherapy program and were subsequently rehabilitated.

Figure 1: Mild degree of Injury

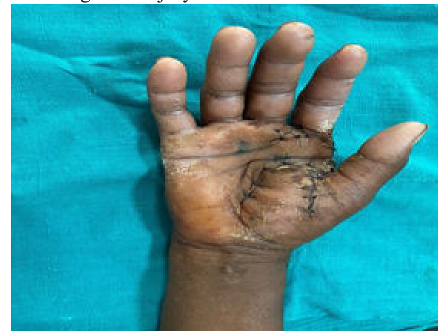

Figure 2: Complete recovery after 02 weeks

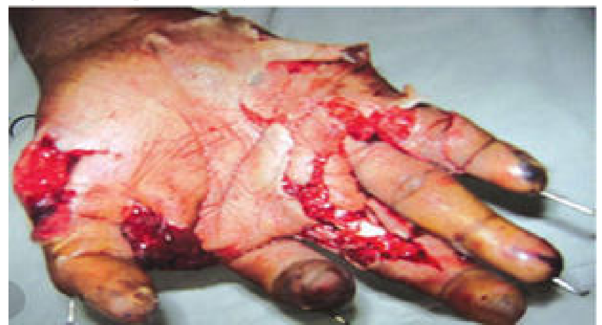

Figure 3 – Moderate degree of injury being managed with percutaneous K wires

Figure 4 – severe injury showing amputation of digits

Figure 5 – severe injury of non – dominant hand

RESULTS

A total of 50 patients were included in the study with 40 male and 10 female patients.

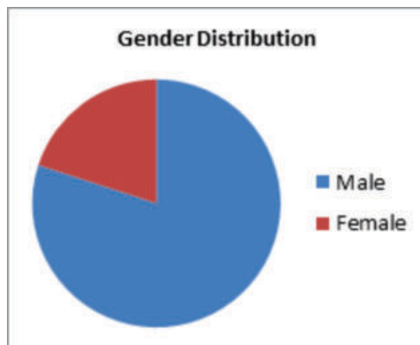

Figure 6 – gender distribution of the cases

The patient's age group encountered was from 6 – 65 yrs with maximum cases in the age bracket of 16 – 25 yrs (n = 20, 40%). The most common causes leading to hazards of fireworks were misuse (n = 30, 60%) and device failure.

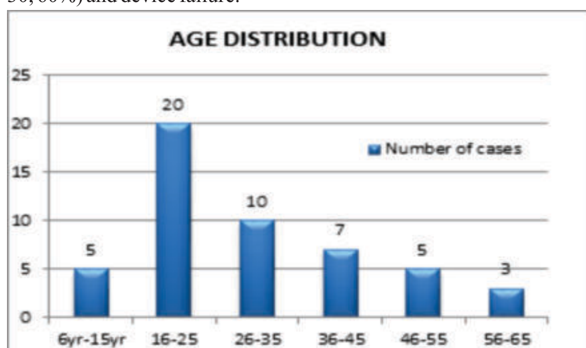

Figure 7 – age distribution of the cases in the study

In 66% of cases (n = 33), the dominant hand was involved and in 8% cases (n = 4), both hands were involved.

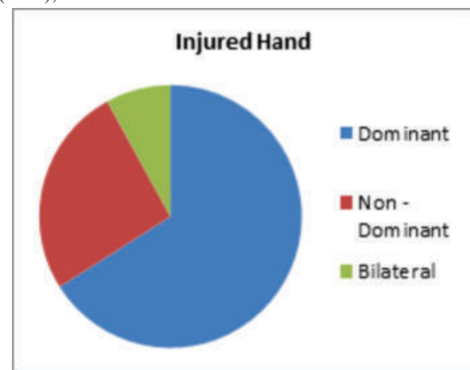

Figure 8 – involvement of dominant, non dominant and both hands

Most common mechanism which resulted in sustaining injury was throwing of firecracker, due to which thumb was frequently injured (n = 29, 58%) followed by index finger (n = 23, 46%). Moderate severity of injury, involving fracture of small bones of hand, was frequent in the study (n = 20, 40%) followed by mild injury (n = 17, 34%). The most common bone fractured was first metacarpal along with involvement of the first carpo – metacarpal joint.

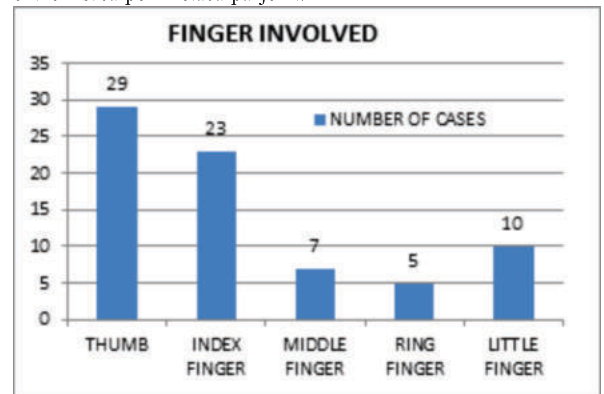

Figure 9 – finger involved in cracker blast

Severe injuries were involving amputations, at level of metacarpals (n = 09, 18%) followed by distal phalanx (n = 04, 08%). Injuries involving amputation had varying degrees of tissue loss posing a challenge for reconstruction and increasing hospital stay. They were invariably accompanied with stiffness of small joints of hands which was overcome to some degree with vigorous physiotherapy. The most common procedure for management was debridement followed by skin grafting (n = 20, 40%).

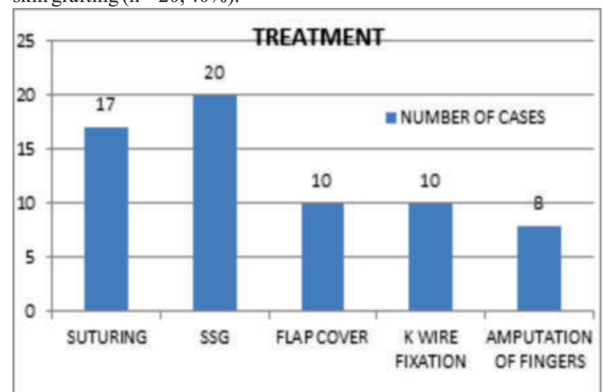

Figure 10 – treatment undertaken for the patients

Metacarpal and phalanx fractures were fixed using K wires. In cases where there was significant loss of soft tissue and bone, completion amputations were performed for phalanges and flap cover was done for fracture of metacarpals. Patients underwent multiple surgeries as a part of management, with maximum of 4 surgeries per patient. The patients stayed in the hospital for duration between 5 days to 21 days.

All the participants received physiotherapy staring from the acute phase of the injury which included active and passive exercises, splinting (static and dynamic) to provide treatment beyond hospital stay.

DISCUSSION

Blast Injuries to the hand are three times more common from low explosives than from high explosives. Some of the more frequently used explosives include firecrackers, pipe bombs and dynamites. In a significant number of cases, homemade firecrackers are the cause of explosion[4].The effects of blasts fall into the following four categories:

1. Primary (direct effects of pressure)
2. Secondary (effects of projectiles)
3. Tertiary (effects due to wind), and
4. Quaternary (burns, asphyxia, and exposure to toxic inhalants)

Once the immediate life threatening conditions have been treated and the injured extremity has been stabilized, a plan for reconstruction of bone and soft tissue should be done.[5-6]Although revascularization of ischemic tissues and replantation of amputated parts are time honored procedures, repair at the acute setting after an explosion has been limited because of the destructive forces exerted during the blast.[7]

In present study, a total of 50 patients were included, over a period of 01 year. There was a male preponderance in the study, at 80% of the total number. Male preponderance in cracker blast injuries has been observed by various studies conducted in India[8-11]. The maximum number of cases were observed in the age bracket of 16 to 25 years in our study. In studies conducted at other institutions in India, the most affected age group was - <19[8] and 13 - 20[10]. The dominant hand was affected in almost all the studies that were compared with the present study[8-12].

The most common affected digit by cracker blast was thumb, in the present study. The maximum incidence of fracture and amputations were seen in the bones associated with thumb. This was concurred by other studies by Chittoria et al[9] and Ricardo et al[12]. In the present study, injuries related to fracture (moderate) had an incidence of 40% as compared to mild (34%) and severe (26%). Similar results were reported by studies conducted by Rajeswari et al[10] and Ravikumar et al[11]. In the study conducted by Ricardo et al, almost 50% cases had amputation of one or more digit with thumb amputation in 45% cases. The level of amputation, recorded by present study and other studies by Ricardo et al and Chittoria et al was most commonly observed at distal phalanx followed by first metacarpal, of the thumb.

All patients in the study, were subjected to primary debridement followed by primary closure if possible. In others, serial debridement followed by either healing by secondary intention or SSG or definitive flap coverage was done. Joint disruptions were managed with K-wire fixation on an immediate basis and associated reconstruction. Fractures were managed with definitive wound closure followed by fixation with either K-wire or mini plates. Most common procedure employed was split skin grafting after a thorough debridement. Patients underwent a median of 2 (range 1-4) surgical operations for their injuries with a maximum of 4 surgeries done on a single patient. In the study conducted by Ricardo et al, there was a median of 3 surgeries done for 20 patients in their study. This higher number was due to the fact that they had higher incidence of severe injuries associated with amputations and hence they had a larger number of flap coverage (65%) and bony fixation (65%), as compared to the present study (20% cases - flap coverage and 20% cases - K wire fixation)

CONCLUSION

Celebrations should end in joy not in sorrow. Cracker blast injuries of the hand can have a spectrum of effects ranging from a mild injury to amputation of the whole hand. The key to management is attention towards early debridement and wound coverage with post- operative splinting in the functional position. By following safety precautions and by taking strict quality measures by the manufacturers, we can prevent these incidents and the disabilities that can occur due to them.

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