ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 03 | March - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MANAGEMENT OF FIREWORK INJURIES AT AN INDIAN REGIONAL BURNS AND PLASTIC SURGERY UNIT : TEN YEARS' EXPERIENCE

Plastic Surgery

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ABSTRACT

Celebration of various cultural and religious festivals as well as holidays involves use of fireworks. Injuries due to fireworks is essentially a preventable injury .The aim of this article is to review cases of burns and associated trauma due to fireworks at a regional burns and plastic surgery unit in India .A retrospective review was performed in all patients presenting to our centre with burn injuries due to fireworks over a period of ten years from March 2012 to March 2022. A Total 463 patients were identified. Cases were studied in terms of patients' demographics, trend of firework injuries throughout the year, mechanism of injuries, anatomical region wise involvement of burn injuries. Conservative and surgical treatment was provided according to the extent of burn injuries. Various treatment given and outcomes of treatment were recorded. Mean duration of hospital stay and recovery time was noted .Most injuries occurred in October and November (around the Diwali festival) Mechanism of injury were mostly flame burns, contact burns and injury from blast force. Most common injuries were sustained to hands, head and neck region and torso.A total of 54 (11.66 %) patients needed surgery. Fireworks can lead to burn injuries, a range of soft tissue injuries, fractures, as well as eye injuries.The severity of firework injuries can effectively by reduced by proper planning which involves preparedness of work force, awareness campaigns and educating public about safety measures.

KEYWORDS

Fireworks,burns,trauma,plastic surgery.

INTRODUCTION

Fireworks are commonly used all over the world to celebrate different occasions ranging from religious and cultural festivals as well as to mark various holidays and New year celebrations.[1,2] Because of their sound, sparkle and burst of colours, they mirror the festive mood. Examples are Diwali also known as festival of lights in India,[1,3] Halloween and Fourth of July celebrations in USA,[4] Hari raya festival in Malaysia,[5] Greek orthodox easter in Greece.[6] Day of Ashura in Morocco, Guy Fawkes night or bonfire night in United kingdom are other examples. Injuries sustained due to fireworks are mostly preventable. Various studies across the world have recognized that this is a global problem.[7–10]

Our aim is to review cases of burn injuries and trauma caused by fireworks in a regional burns and plastic surgery unit in India. We aim to study trends of firework injury, patient demographics, treatments given and their outcomes. We also intend to analyse what measures can be taken to prevent and minimise firework related burn injuries.

MATERIALS AND METHODS

A retrospective record based review was performed on all patients with firework injuries presenting to Burns and plastic surgery unit of Pandit Dindayal Upadhyay Medical College and Civil hospital, Rajkot over a period of 10 years from March 2012 to March 2022.

A total of 463 patients were included in our study. Demographic details of the patients, mechanism of injury, anatomical regions affected and treatment provided and outcomes were noted.

RESULTS

A total of 463 patients with burn injuries from fireworks were identified over a period of 10 years. Table 1 provides the demographic information of our study population. Mean age of our study population was found to be 26.3 years. Involvement of a relatively younger population in firework injuries corresponds to risk taking behaviour of youth. 133 (28.73%) patients were found to be under 18 years of age (Figure 1). 330 (71.27%) patients were found to be over 18 years of age. A total of 321 (71.27%) males were found in our study population whereas number of females was 142 (30.66%). (Figure 2). Mean percentage of total body surface area (%TBSA) involved in fireworks burn injury came out to be 2.9%. Mean duration of hospital was 1.9 days. Time to heal was a mean of 12 days.

Conservative management which included first aid and dressings and then subsequent follow up on OPD basis was carried out in 409 patients. Surgical intervention was required in 54 patients, out of which 12 had hand fractures due to blast force injury. Eye injury was noted in 39 patients which was managed by Ophthalmologist.

Month wise frequency distribution of fire cracker burns were noted in our study (Figure 3). Our results show an overwhelming majority of cases occurred around the months of October, November and December. This period in India corresponds to Diwali festival, Wedding season and New year celebrations. So our study shows a clear cut pattern of seasonal trend of firework injuries.

Mechanism of injury in our study was mostly flame burns which amounted to 70%. Flash burn accounted for 25% where as contact burn and blast injury were 10% and 5% respectively.(Figure 4). In our study hands were most commonly involved anatomy wise with 394 cases (Figure 5). Face and neck was involved in 66 cases. The primary reason for predominant involvement of hand and face region is that these areas are exposed areas. Genitalia and perineum was involved in 9 cases and lower limb was involved in 23 cases. Surgical treatment was carried out in a total of 54 patients. Surgical intervention in deep partial thickness and full thickness burn consisted of wound debridement, and application of FTSG and STSG. (Table 4, Figure 6)

Hand injuries most commonly needed surgical intervention. Exposed tendons and bones were managed by pedicled groin and abdomen flaps and cross finger flaps. Injuries due to blast force resulted in fracture of hand bones and tendon injuries. These were managed by tendon repair and k-wire fixation.

Table 1: Demographic details of study population

Variable	Number/mean
Age (years)	Mean 26.3
Age >18 yrs	330(71.27 %)
Age<18 yrs	133(28.72%)
Male	321(69.33%)
Female	142(30.66%)

Conservative/first aid	409
Eye injury	39
Hand fracture	12
%TBSA	Mean 2.9%
Hospital stay(In days)	Mean 1.9
Time to heal(In days)	Mean 12
Surgical intervention	54

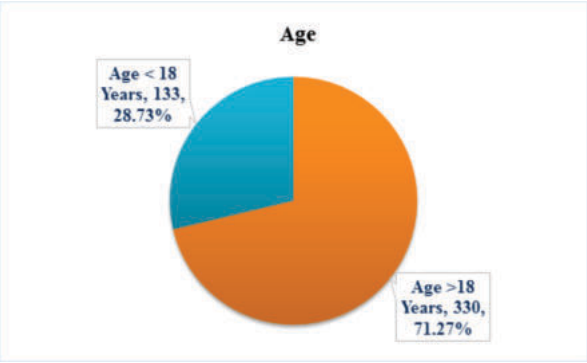

Figure 1: Age Distribution of Study Population

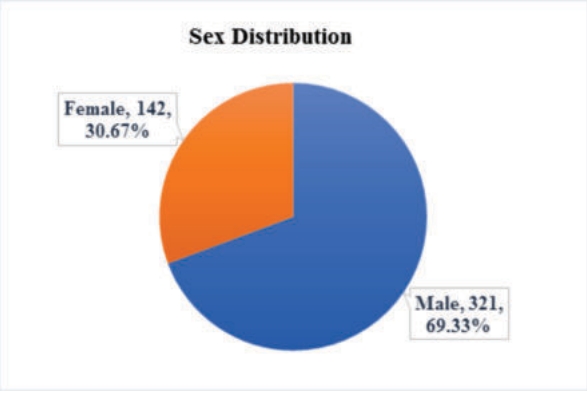

Figure 2: Sex Distribution of Study Population

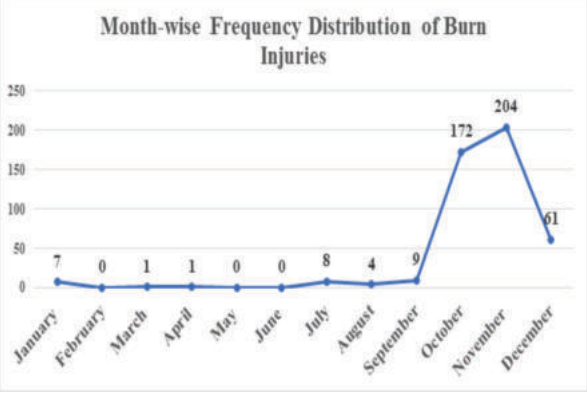

Figure 3: Month-wise Frequency Distribution of Burn Injuries

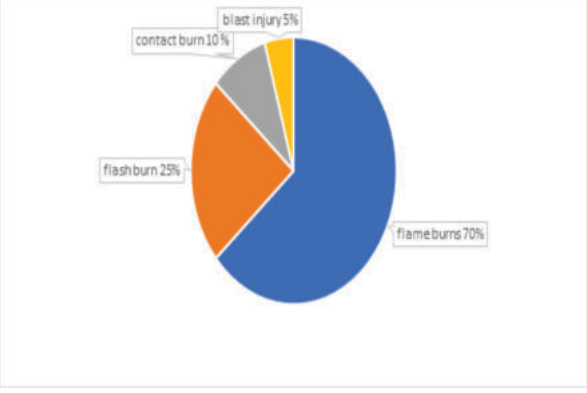

Figure 4: Mechanism of Injury

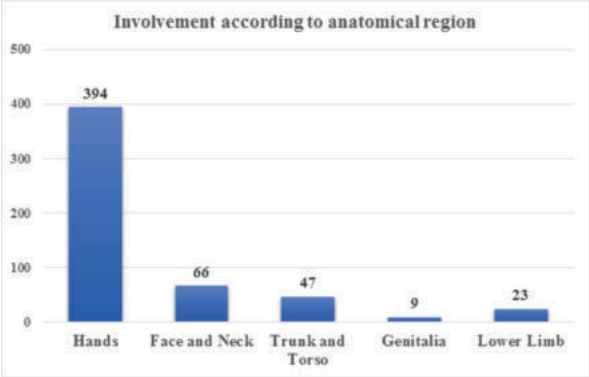

Figure 5: Involvement According to Anatomical Region.

Table 4: Treatment/Surgical Intervention

Sr. No.	Treatment/surgical intervention	Frequency
1	Conservative	409
2	Surgical Intervention	54
3	Wound Debridement	23
4	STSG/FTSG	17
5	Pedicled Groin/Abdominal Flap	5
6	Tendon Repair	7
7	Hand Fracture /K-Wire Fixation	7
8	Cross Finger Flap	6

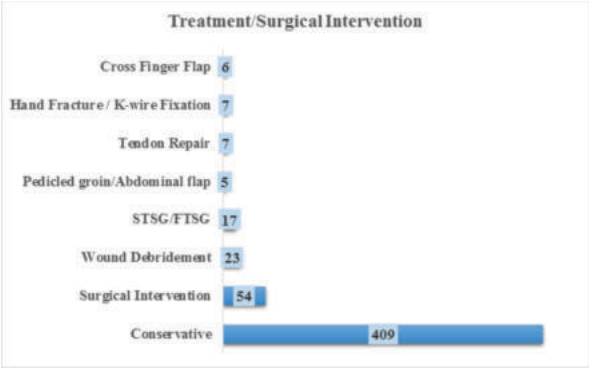

Figure 6: Treatment/Surgical Management.

DISCUSSION

In our study 321 (69.33%) patients were male. This is comparable to data analysed from other parts of the world such as China and Iran.[11,12] The reason for this pattern of injury being that males are prone to risk-taking behaviour. To overcome this young males can specifically be targeted in awareness campaigns.

In this study, 133 (28.72%) of the population was under eighteen years of age. Data from other studies has supported the trend of paediatric firework injuries.[4,13,14] Most common reason for children getting affected by firework injuries is because of their curious and adventurous nature. Also they are very vulnerable because their reflexes are not very strong and they are not prepared to deal with such injuries because of their inexperience.

Children can be effectively saved from firework injuries by specific campaigns targeting school children. They should be under the supervision of parents and guardians while lighting fireworks.

Being a retrospective study specific details of fire crackers causing injury was not available. In our observation, Anar(flower pot)was found to be the most common causative factor and leading cause of hand burns. This was followed by bombs(sound emitting fireworks), which lead to blast injuries of hands. Because of the blast force soft tissue rupture, tendon and bone injury was seen. Fire crackers like chakri(ground spinners), sparklers contributed to flash burns.

Hands were the most commonly injured body part in our study. The reason being hands are exposed and are involved in lighting fireworks. Our data is consistent with other studies conducted in Iran, Australia and Saudi Arabia which show preponderance of hand injuries.[9,12,15]

As explained before blast injuries of hand from bombs lead to exposed tendons and bones which were treated by pedicled flaps such as groin and abdominal flaps as well as cross-finger flaps. K-Wires were used to fix fractures of fingers. This lead to prolonged hospital stay and subsequent rehabilitation of hands by physiotherapist.

Second most common site was head and neck also because of their exposed nature. To overcome this ignition from distance should be encouraged.

Mechanism of burn is also a causative factor for anatomic region effected by burn injury. Flame burns lead to clothes catching fire and that leads to injures all over the body not just specific body parts.

Our results have shown a seasonal nature of firework injuries in October, November, December. This period in India corresponds to Diwali festival, wedding season and New year celebrations.[8] This correlates with seasonal trends in other countries. In United Kingdom and US firework referrals are increased during Halloween and guy fawkes night during October and November.

Fireworks also result in ophthalmic injuries and disabilities.[2,12] Therefore early eye examination and referral is key to management. First aid at our centre involved irrigation with normal saline and referral to ophthalmologist.

Management of firework injuries just like burn injuries in general essentially requires a multidisciplinary approach which involves general surgeon, plastic surgeon, ophthalmologist, specifically trained nursing staff and physiotherapist to rehabilitate hand injury cases so that they don't go into stiffness after surgical management.

Prevention is a key to management of firework injuries. Specific laws and legislations can be formulated by government regarding use of fireworks. Since we are aware of the seasonal nature of firework injuries, awareness campaigns on mass media can give specific advisory by specialists such as plastic surgeons, people trained in handling firework injuries before events like Diwali, New year celebrations etc. Simple measures like keeping fire extinguishers, bucket of water and sand near the source where fireworks are lit can reduce the morbidity of injuries due to fireworks. Parental supervision of children while lighting fireworks is very important.

In our country, as there is shortage of burn specialists, it can lead to overwhelming of workforce. To overcome work fatigue, we can initiate specific training programmes where general surgery, nursing staff, medical officers can be included in the work force.

CONCLUSION

The study at our centre demonstrated the wide range of injuries associated with fireworks which includes not only burn injuries but associated soft tissue injuries and fractures.Management of firework injuries requires a multidisciplinary approach with collaboration of plastic surgery, eye surgeon and physiotherapist Preparation is the key. Workforce can be alerted and kept on guard since the pattern of injuries is predictable and cantered mostly around the festive season, wedding season and new year celebration. Advisory should be issued in general public interest .Plastic surgeons have an important role to play in educating the general public. Awareness campaigns by mass media can educate the general public.

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