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Unveiling the Impact: A Study on Firecracker -Related Burn Injuries During Diwali Celebrations

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ABSTRACT

Firework injuries to the hand can be devastating due to the explosive and ballistic nature of these devices. Patients often have a combination of fractures, traumatic amputations and soft tissue injuries. To observe the characteristics of firecracker burn injury patients (age, sex, place, body area involved, burn depth and type of firework responsible) attending the emergency department (ED) on Diwali and 10 days post Diwali 2023. To discuss some preventive aspects of the firecracker injuries. This is a retrospective observational study of all firecracker-related injury patients presenting to our Emergency Department from the day of Diwali to ten days post-Diwali 2023. The records of patients, during this period, were collected from the medical records department of Patna Medical College and Hospital (PMCH), Patna after getting approval from the ethical committee. The study includes types and characteristics of firework injury patients: age, sex, place, body area involved, burn depth and type of firework responsible in the specified period are recorded. Treatment done for these patients is not included in the study. A total number of 51 patients came to emergency department of PMCH from the day of Diwali to ten days post diwali, in which majority were males, including elderly people above 50 years of age and children below 10 years of age and fire fighters doing their duty as well. Majority of the burn injuries involved less than 20% of body area, injury to right hand being most common followed by face. Fountain was found to be the most common cause of firecracker burn injury, others being rocket, ground spinner and firecracker powder as well. Severe hand trauma due to firecrackers has an evident impact on hand function and activities in all adolescents. The injuries have a significant long-lasting psychological impact on the parents. As a result of our research, we believe that stricter laws are required for reducing the number of burns during this period because, despite the ban on firecrackers, newer indigenous methods are being devised for their preparation. Increasing public awareness and regulating the availability of the ingredients can help in reducing the number of such injuries in the future.

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Key Words

Burn-related injury, fire cracker burn, psychological impact

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INTRODUCTION

Firecrackers are extensively used in India during various festivals, ceremonies and social events, as is true the world over. They find a special place during Diwali, which is an annual festival marking an important Hindu mythological event. During this weeklong festival, the whole country lights lamps and hence it is known as the "festival of lights". In India, firecrackers are available for use by the common public. Every individual is free to light the crackers wherever he/she desires. It is a well-known fact that whenever firecrackers are used, there is always a risk of burn and injury[1]. Firework injuries to the hand can be devastating due to the explosive and ballistic nature of these devices. Patients often have a combination of fractures, traumatic amputations and soft tissue injuries[2]. Firecrackers are not only an integral part of the celebration but also an unfortunate cause of burn injuries. Carelessness and inappropriate production or use of fireworks can lead to these terrible accidents[3]. In India, there are several patients being referred to tertiary care hospitals with blast injuries. The pattern of these injuries are quite different from those of large scale blast injuries because in most cases these blast injuries occur from firecrackers and homemade bombs, which have a variable blast potential with low intensity explosives deflagrating at rates up to 400 m/s and high intensity explosives deflagrating at rates varying from 1000-9000 m/s[2]. Plastic surgeons are frequently involved in the primary care of these patients as many such injuries involve the hand. The predominance of the hand in involvement in such injuries is due to accidental blast during hurling a bomb as well as the injury sustained when a person tries to shield himself from a bomb being hurled at him with his hands[4].

Aims and Objectives:

- To observe the characteristics of firecracker burn injury patients (age, sex, place, body area involved, burn depth and type of firework responsible) attending the emergency department (ED) on Diwali and 10 days post Diwali 2023.
- To discuss some preventive aspects of the firecracker injuries.

MATERIALS AND METHODS

This is a retrospective observational study of all firecracker-related injury patients presenting to our Emergency Department of Patna Medical College and Hospital (PMCH) from the day of Diwali to ten days post-Diwali 2023. The records of patients, during this period were collected from the medical records department of PMCH, Patna after getting approval from the ethical committee. The study includes types and characteristics of firework injury patients: age, sex, place, body area involved, burn depth and type of firework responsible in the specified period are recorded. Treatment done for these patients is not included in the study. The data set is presented in (Table 1) below.

RESULTS AND DISCUSSIONS

A total number of 51 patients came to emergency department of PMCH from the day of Diwali to ten days post Diwali, in which majority were males (n=43, 84%) as shown in (Fig. 1). Of the total 51 cases, majority of the cases were aged below 10 years (n=17, 33.34%).

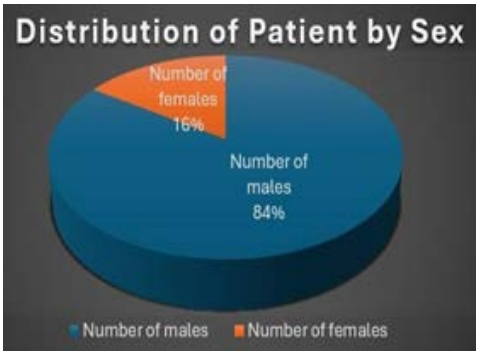

Fig 1: Distribution of Patients by Sex

Our age distribution demonstrates that people belonging to age group 0-10 years (n=17, 33.34%) were the most vulnerable. Excitement, inexperience in handling fire crakers, lack of awareness for potential firecracker related injuries make people of age >20 years as potential victims of firecracker injuries. The data set suggests >half of the patients coming from an age group of >20 years (n=30, 59%) as shown in (Fig. 2). This trend is supported by the data from other cultures such as other parts of India and the USA, where children under fourteen formed 40%-50% of the cases[5,6].

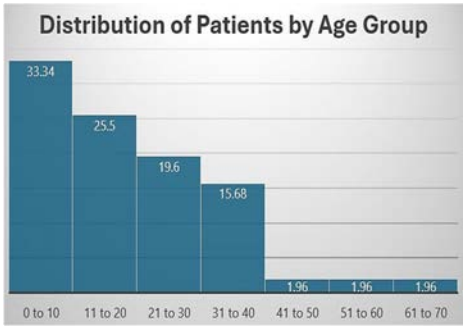

Fig 2: Distribution of Patients by Age Group

(Table 1) shows that the firework most commonly involved in burn injuries is the fountain, which accounts for 42% of all cases. The percentage distribution of other firecrackers involved in the burn for thread firecracker, gunpowder, rocket, ground spinner, oil lamp and sparklers are 27.45%, 13.73%, 3.92%, 1.96%, 1.96% and 1.96% respectively (as shown in Fig. 3). Of the test cases, four cases were reported of fire fighters.

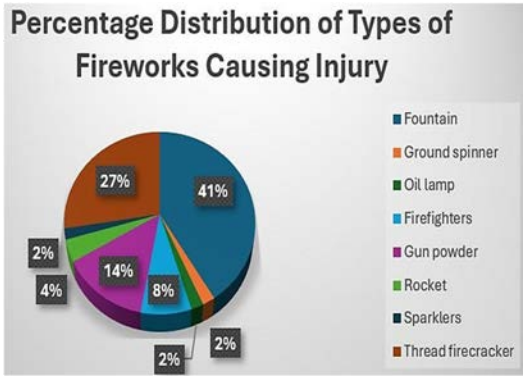

Fig 3: Distribution of Types of Fireworks Causing Injury During Diwali Festival 2023

(Fig. 4) comprehends with data from Kalita and Gurindagunta[3] where right hand alone is involved in 44% of the cases, followed by 42% of the cases accounting for face and neck. The data set demonstrates hands as the most vulnerable body part for firecracker burn injuries, where left hand accounts for 13.72% and bilateral hands account for 25.49%. This is followed by bilateral legs as 3% of the total cases and chest, abdomen and back with 2% of the total cases. There was only one case reported for burn on right leg and in the perineal region, respectively.

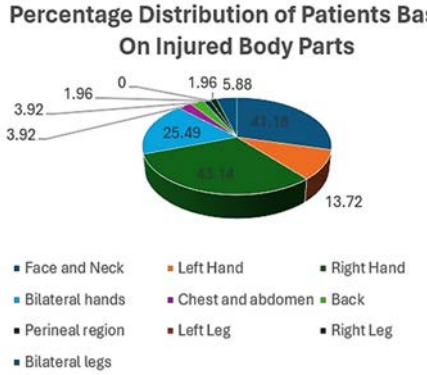

Fig 4: Distribution of Patients Based on Body Parts Injured During Diwali

In a country like India, with a population of 1.4 billion having huge diversity in culture and social events, use of firecrackers is very common during celebrations because of their sound, sparkle and sudden burst of colours, expressing the festive mood[1]. Due to its huge demand for celebrating Diwali, there is mass production of firecrackers. Some of the common sources to manufacture firecrackers include plastic, use of cardboard, flash powder (a mixture of potassium perchlorate and aluminum powder), smokeless powder, straw paper, cordite, etcetera. The black powder or gunpowder contains sulphur, charcoal and potassium nitrate.

Due to recent ban on firecrackers in different parts of the country, a new pattern of burn injuries has emerged due to indigenous attempt at manufacturing firecrackers in the private and small-scale settings. A study conducted by Puri[5] from 1998-2006 reported 157 cases related to firecrackers. These firecracker injuries included burns, soft tissue injuries and bony injuries[7,8]. The present study was a hospital-based, single-center, retrospective study of firecracker injuries from Diwali to post ten days of Diwali, 2023. In this study, majority of the patients were male. Our age distribution demonstrates children less than 20 years of age as vulnerable population, with 17 cases reported for children aged <10 years. The data set demonstrates the percentage burn varying from 5% in cases of face, neck and bilateral hands to 50% burn reported for back and bilateral thigh for a 70-years old female due to oil lamp. This study highlights hands as the most prone body part affected by firecracker injury of which majority was contributed by fountain cracker, where the main causes of injuries were reported to be absence of elderly supervision, negligence, failure to maintain safe distance from firecrackers, excitement of celebration and lack of experience to handle fireworks among others.

The fact that so many cases were seen in a single center highlights the enormous health importance of regulating firecracker use and enforcing safety precautions and thus, every possible measure is being taken in different parts of the world to overcome the challeng. The Banger firework (UK) was banned in November 1996. In New Zealand, a bill was introduced for restriction on the sale of fireworks in March 1992. In 2005, the apex court of India said the right to live in an atmosphere free from noise pollution has been upheld as guaranteed by the constitution. The government promoted a complete ban on bursting sound-emitting firecrackers between 10 p.m. and 6 a.m. through slogan “No to firecrackers after 10 p.m.” However, it is observed from Table 1 that there is no impact of the legislation on the incidence of firecracker-related burn injuries received in our hospital. This is progressively increasing in spite of multiple amendments of the legislation since 2005 and repeated advice from the High court in 2009.

Firecracker injuries are considered as preventable injuries. Some of the preventive measures include implementation of stricter laws for the quality of fireworks and its manufacturing and a complete ban on burning fireworks in the residential areas. Rather, the fireworks should be encouraged only in the open spaces (such as parks or playgrounds). Other measures include awareness programs in schools, colleges and rural areas, ban on use of use illegal/counterfeit /unbanded fireworks, never leave children unattended around fireworks, obey safety barriers and ushers, stay at a safer distance from the launching site and proper disposal of firework debris under elderly/professional supervision. An arrangement of fire extinguisher or a bucket of sand or water at the site for emergency and

Table 1: Number of Firecracker-Related Injury Patients from Diwali to 10 Days Post Diwali

Serial No.	IPD	Name	Age/sex	Percentage burn	Reason for burn	Part of body
1	ERPL/940	Habibulla	9/M	10-12%	Gun powder	Right Hand and toe
2	ERPL/941	Saurav Kumar	27/M	5%	Sutli	Left hand
3	ERPL/942	Vikas Kumar	21/M	25%	Anaar	Face and B/L hand
4	ERPL/944	Bittu Kumar	15/M	5%	Anaar	Right Hand
5	ERPL/945	Shamim Salim	20/M	5%	Anaar	Right Hand
6	ERPL/947	Guddu Ram	35/M	40%	Firefighters	B/L Hand and Upper Chest
7	ERPL/948	Sanjay Kumar	35/M	30%	Firefighters	Face, neck and Right Hand
8	ERPL/948	Dharamveer	25/M	35%	Firefighters	B/L Hand and Upper Chest
9	ERPL/949	Chandan	24/M	20%	Firefighters	Face, neck and Right Hand
10	ERPL/950	Akash Kumar	14/M	5%	Anaar	Right Hand
11	ERPL/951	Md. Sameer	17/M	10%	Anaar	Right Hand and Face
12	ERPL/954	Roshni Kumari	10/F	5%	Sutli	Right side face
13	ERPL/962	Rudra Bheem	12/M	10%	Anaar	Face
14	ERPL/971	Prince Kumar	12/M	12%	Anaar	Right Hand and Face
15	ERPL/974	Aryan	7/M	18%	Anaar	Perineal region
16	ERPL/979	Nagendra	16/M	5%	Sutli	Right Hand
17	ERPL/984	Ayush Raj	6/M	10%	Anaar	Right Hand and Face
18	ERPL/986	Rajshree Devi	70/F	50%	Diya	Back and B/L Thigh
19	ERPL/987	Sumit Kumar	9/M	20%	Gun powder	Right hand, face, and neck
20	ERPL/997	Manav Kumar	5/M	15%	Sutli	Face and B/L hand
21	ERPL/1008	Ayush Kumar	13/M	5%	Anaar	Right Hand
22	ERPL/1012	Anjali Kumari	8/F	20%	Anaar	Face and B/L hand
23	ERPL/1013	Anshu Kumar	10/M	15%	Sutli	Face and B/L hand
24	ERPL/1019	Swati Kumari	5/F	15%	Sutli	Face and B/L hand
25	ERPLO/880	Salok Kumar	13/M	5%	Anaar	Left hand
26	ERPLO/881	Niraj Kumar	26/M	5%	Anaar	Left hand
27	ERPLO/882	Golu Kumar	12/M	5%	Gun powder	Right hand
28	ERPLO/883	Shubham Kumar	25/M	5%	Sutli	Right hand
29	ERPLO/884	Jitender Kumar	50/M	5%	Sutli	Right hand
30	ERPLO/886	Gopi Krishna	22/M	5%	Anaar	Right hand
31	ERPLO/888	Anurag Kumar	36/M	2%	Sursuri	Right hand
32	ERPLO/890	Chandan Kumar	36/M	5%	Sutli	Right hand
33	ERPLO/892	Sittu Raj	27/M	5%	Anaar	Right hand
34	ERPLO/893	Vikas Kumar	33/M	5%	Anaar	Right hand
35	ERPLO/911	Adhi Raj	10/M	5%	Anaar	Left hand
36	ERPLO/914	Jai Kumar	38/M	5%	Anaar	Left hand
37	ERPLO/915	Amit Raj	15/M	7%	Sutli	B/L hands
38	ERPLO/929	Jagdav Kumar	34/M	5%	Rocket	Right hand
39	ERPLO/970	Ujjwal Singh	28/M	7%	Rocket	B/L hands
40	ERPL/981	Prabha Devi	60/F	45%	Gun powder	Back, B/L lower limb
41	ERPL/984	Ayush Raj	6/M	10%	Gun powder	Face and neck
42	ERPL/989	Sumit Kumar	9/M	20%	Gun powder	Face and left hand
43	ERPL/997	Manav Kumar	5/M	15%	Sutli	Face and B/L hand
44	ERPL/1008	Ayush Kumar	13/M	5%	Anaar	Right Hand
45	ERPL/1012	Anjali Kumari	8/F	20%	Anaar	Face and B/L hand
46	ERPL/1013	Anshu Kumar	10/M	15%	Sutli	Face and B/L hand
47	ERPL/1019	Swati Kumari	5/F	15%	Sutli	Face and B/L hand
48	ERPL/1020	Chintu Kumar	7/M	15%	Sutli	Face and right hand
49	ERPL/1024	Sujit Kumar	12/M	10%	Gun powder	Face
50	ERPL/1048	Golu Kumar	24/M	10%	Anaar	Face and left hand
51	ERPL/1051	Chandni Devi	38/F	45%	Chakri	B/L lower limb

promotion of safer Diwali practices can help in celebrating the festival merrily by avoiding these preventable accidents.

CONCLUSION

Firecrackers are an integral part of celebration in India, where they are used to express excitement and happiness. However, despite passing number of legislation and amendments, they did not have any impact on the number of patients visiting the hospital during festivals. Severe hand trauma due to firecrackers has an evident impact on hand function and activities in all adolescents. The injuries have a significant long-lasting psychological impact on the parents. As a result of our research, we believe that stricter laws are required for reducing the number of burns during this period because, despite the ban on firecrackers, newer indigenous methods are being devised for their preparation. Increasing public awareness and regulating the availability of the ingredients can help in reducing the number of such injuries in the future.

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