

Diwali in the ED: A Festival of Injuries

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Abstract

Diwali is one of the largest festivals for Hindus. It has been celebrated for more than 2,500 years. Traditionally it is celebrated with many rituals including lamps, colored decorations and foods. With easy availability and affordability of fireworks, it has become the dominant ritual in the modern era. These Fireworks are now the cause of multiple health concerns in the second largest country in the world.

Keywords: *Diwali; Injuries*

Introduction

Diwali is one of the largest festivals for Hindus. It is a festival being celebrated since more than 2,500 years. In the northern part of India, Diwali or Deepavali is the celebration of the story of Hindu deity Rama's return to the city of Ayodhya, in India after defeating Ravana an Emperor of modern day Sri Lanka. Millions of lights were spread out across the city Ayodhya just to help Lord Rama and his wife Sita come back home and to welcome them. Lighting lamps has long been one of the ways that Hindus celebrate Diwali. People clean their homes and shop for gold or kitchen utensils to help bring good fortune, decorate their homes with clay lamps, create design patterns called Rangoli on the floor using colored powders or sand. Diwali is a time when friends and relatives visit with gifts and best wishes for the new year. On the main day of the festival, families gather for Lakshmi puja, a prayer to Goddess Lakshmi, followed by feasts. However, the festival that includes traditional sweets and savories, fireworks, colored decorations, and lamps comes with a number of associated injuries seen in emergency rooms.

In the past century, use of fireworks have become a major part of Diwali celebrations. Use of fireworks to celebrate festivities all over the world has concerns for safety, noise and air pollution and impacts on long term health.

Methods

We used the US National Library of Medicine National Institutes of Health to query for keywords Diwali. The authors read all the articles and key relevant references.

Discussion

A study on firework injuries done in China showed that the most common injured body parts were the hands and fingers followed by the head or face except eyes and trunk. Burns were the most common type of injury, most having 1 - 10% burns. The most common region burned were hands and fingers. Contusions or lacerations were the second most common type of injury. The age group most likely

to sustain injuries was the 5 - 14-year old children which may be attributable to experimental nature of children. These injuries occurred most frequently among males [1].

Trauma to the eyes due to fireworks often cause life-long disability. Majority of ocular injuries occur in young adults in whom vision loss is particularly detrimental. A single centre study done by Chang, *et al.* showed that corneal abrasions were the most common type of ocular injury and affected both eyes in 8% of patients. 1% of patients had bilateral hyphema, strongly associated with the use of rockets and crackers. 17% patients presented with globe rupture. Chorioretinal injuries included commotio retinae choroidal rupture and intraretinal hemorrhage. Other injuries included traumatic glaucoma secondary to iridodialysis or angle recession, eyelid lacerations, corneal lacerations or avulsions, scleral lacerations [2]. In a retrospective study in a Level 1 Trauma/Burn Center in Western America 21% had injury to the globe. Of them 70% experienced partial or complete permanent vision loss and 18% of them underwent enucleation [3].

Among hand injuries, in a study of 105 patients, 12 patients (11%) did not have thumb or first web space injuries and 29 patients (28%) also had traumatic carpal injuries. 78 patients (74%) sustained isolated hand and wrist injuries and 31 patients (26%) had injuries to other body parts as well (face, globe, brain, arm, trunk, and/or leg) [4]. Shells/mortars, followed by homemade fireworks, were shown to have caused the greatest proportion of eye and hand injuries resulting in permanent impairment [3].

Similar findings were shown in a study done in Iran, where firework injuries not only resulted in significant burn injuries, but also eye injuries, soft tissue defects and fractures which required plastic surgical interventions ranging from skin grafts to local and pedicled tissue transfer and fracture fixation [5].

In a study done at a Tertiary center in Mumbai, India showed that the hand was the most commonly injured body part (131 injuries, 74%), followed by the face (33 injuries, 19%), trunk (8 injuries, 4.5%) and lower limb (4 injuries, 2.3%). Burns were the most common type of injury (72%), 80% of which were hand burns, followed by facial burns (19%). Blast injury accounted for 28% of total injuries which caused contusions, lacerations and soft tissue (including neurovascular injuries) and bony injuries. 60% of the bony injuries were to the thumb [6].

Apart from firework injuries, impact from exposure to all pollutants generated from burning of fireworks is specially concerning. Particulate Matter of 2.5 micrometer diameter (PM 2.5) are considered the most harmful for the body. They are able cause a spectrum of medical conditions ranging from eye, nose, throat and lung irritation. Respiratory tract is easily susceptible and present with coughing, sneezing, runny nose and shortness of breath. In the long term it worsens lung function, asthma and heart disease [7,8].

In the city of Delhi, Diwali leads to increasing pollution levels. A study done across various locations in Delhi showed that over a period of two days, pollution during Diwali adds to about 40 $\mu\text{g}/\text{m}^3$ to PM 2.5 particulate concentration [7].

In a community-based health survey conducted during Diwali in 2013 revealed an increase in the number of patients in Delhi with problems related to respiratory diseases, hearing issues, eye irritation and headache.

A study done in the northeast part of India showed that during Diwali, the mean PM10 concentration was 81% higher than other days and 3.1-times higher than the Indian National Ambient Air Quality Standards. Noise levels were shown to be increased by 65% and the concentration of bacteria in PM10 was shown to be reduced by 39% during Diwali. The study also measured concentrations of metals, cations and anions which were increased by 51%, 72% and 77%, respectively. The analysis period revealed an increase in hospital admissions due to respiratory symptoms [9].

In a study done in the city of Hyderabad, India, during Diwali for a period of 3 years (2009 - 2011), ozone concentrations during Diwali festivity days were found to be much higher than those observed on control days, especially at night hours. The night-time concentration

of nitrogen oxides were shown to be significantly increased on pre-Diwali and Diwali days in the year 2009. The night time sulphur dioxide concentrations were also found to be significantly increased during the Diwali festivity days compared to the control days [10]. These high pollutant concentrations are serious health hazards. Short-term exposure to ozone may be associated with increased psychiatric emergency services admissions [11].

Apart from the above-mentioned injuries and health impacts explosion of fireworks give rise to short-phase overpressure blast waves. This may rupture the tympanic membrane and injure the cochlea which may cause sensory neural hearing loss or mixed hearing loss. During the festival of Diwali, there is a surge in the number of patients in the ED with worsening of chronic conditions like Diabetes, from noncompliance of their management. Change from routine activities, increase in substance abuse, alcohol intoxication and distraction by friends and families disrupt the balance of medically fragile individuals can be blamed for it. Traumatic injuries are also increased with higher incidence of motor vehicle accidents.

Conclusion

The festival of Diwali can turn into a traumatic event for many. Apart from the injuries related to burning of fireworks, long term health impacts due to short term exposure to pollutants requires solutions to minimize the preventable injuries and health impacts. Awareness regarding safety precautions, strong legislation and strict quality control may act as a deterrent to the use of fireworks and help decrease devastating injuries.

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