

## OCULAR FIREWORK INJURY: A CASE FOR ADVOCACY

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### Abstract

**Background:** Ocular trauma is a common finding in eye care practices. These injuries can be mild with no visual or ocular consequence, and it can be devastating with loss of vision in one or both eyes or significant deformity. Fireworks of various types are commonly used during festivals and occasions. This article reports cases of ocular firework injury seen at the Lagos State University Teaching Hospital (LASUTH).

**Method:** This was a retrospective hospital study. Case notes of patients with ocular firework injury between January 2022 and December 2023 (2 years) at the Eye Institute of LASUTH were retrieved. Data on demographic, mechanism of injury, intervention and eventual ocular status was collected and analyzed using descriptive statistics.

**Results:** 5 cases of ocular firework injury was seen during the period. There were 4 males and 1 female. Age range was between 5 - 51 years. The 4 males were primary victims and they were irreversibly blind in the affected eye at presentation and all 4 had surgical intervention. There was only one secondary victim.

**Conclusion:** Fireworks injuries at the Eye institute of LASUTH were found to have severe visual consequence with all primary victims losing vision in the affected eye. Advocacy and Government policies can see to a massive reduction in these fatal complications of fireworks.

**Keywords:** Ocular trauma, fireworks, ophthalmology

### BACKGROUND

Ocular trauma is a major cause of morbidity that can affect both adult and pediatric populations in both rural and urban settings. The incidence of ocular trauma varies in different part of the world.<sup>1</sup>

Originally invented in China, fireworks are considered low explosive pyrotechnic devices containing combustible materials which in combination with other agents allow it to perform either of four; noise, light, smoke or floating materials (confetti).<sup>2</sup> The anatomy of a firework is based on which level it performs. Aerial fireworks use projectile mechanisms to achieve significant height above ground level, while ground fireworks remain mostly at ground level. Festive seasons are celebrated in most parts of the world with loud and extraordinary fireworks displays.

In articles describing ocular traumas, fireworks have been reported to be etiologies of ocular trauma. In an hospital based study of ocular trauma in India, fireworks were responsible for 11 in 66 children with a diagnosis of ocular trauma in the

one year period between 2018 and 2019.<sup>3</sup>

Fireworks are known to be a significant cause of danger and harm to animals,<sup>4</sup> noise and environmental pollution.<sup>5,6</sup> Fireworks are restricted and banned in several countries in the world.<sup>2</sup> Restriction is mostly due to the high risk of bodily injuries and fire incidents that can result to bystander and persons activating the fireworks. An Italian town Collecchio has in 2015 limited use of fireworks to only silent fireworks and this was due to the heavy noise pollution.<sup>5,6</sup> Firework bans are effective and in the United States of America, the odds of firework ocular injuries where it is legal was compared with regions where it was banned. It was found that direct firework and firework related injuries had higher odds in regions where fireworks were legal as compared to where it was banned, thus creating a case for advocacy.<sup>7</sup>

Ocular firework injuries are peculiar in that they can either lead to either a combination of open or closed globe with ocular adnexa injuries. Several studies have been conducted in Nigeria describing ocular

firework injuries. A 3 year retrospective study done in south east Nigeria at the Guinness Eye Center Onitsha showed that patients with firework injuries had multiple ocular pathologies. Half of affected eyes went blind in this study. Bystanders according to their study accounted for 75% of the injuries thus putting emphasis on the potential harm of firework to intentional and unintentional bystanders.<sup>8</sup> In another case report in the south western part of Nigeria, of 3 person with ocular firework injury, 2 persons were bystanders, and 2 persons had irreversible vision loss.<sup>9</sup> A 16 year retrospective study done in Saudi Arabia, bystanders amounted to over 1/3 of the total persons with firework eye injury in that period. The study found the fireworks most culpable for eye injuries was banger.<sup>10</sup>

The range of injuries documented in ocular firework injuries include Lid burns and laceration, subconjunctival haemorrhage and conjunctival lacerations, corneal/scleral lacerations/abrasion, hyphema, iris tears, angle recession, lenticular opacities and dislocation, intraocular foreign body, secondary glaucoma, optic nerve avulsion, vitreous haemorrhage, retina/choroidal detachment, macular hole, commotio retinae, choroidal ruptures, orbital wall fractures and even death.<sup>8, 10</sup>

Management of firework injuries can sometimes require multi-specialist input due to associated burns and soft tissue injuries in other part of the body. Open or closed globe injury can require treatment modalities that range from conservative monitoring, topical medications, surgical intervention and for the irreversibly blind, low vision aids and rehabilitation services. In a Chinese study evaluating eye removal following ocular trauma, of 1674 patients, firework accounted for 117 patients with males accounting for 13 times more injury and globe removal than females.<sup>11</sup>

Legislation to limit the environmental disturbances and injuries from fireworks have been explored by different state and countries around the world. Legislations limited type/class of fireworks,

supplier of fireworks, firework noise level emission, sales of fireworks to adults and children, distribution of fireworks, and time/period of use. Britain introduced the Firework (safety) regulation of 1996/1997 banning banger and in 2003/2004 the firework act and firework regulation. Banger injuries were no longer observed in Newcastle upon Tyne following these legislation.<sup>12</sup>

## METHODOLOGY

This study was conducted at the Department of Ophthalmology, Lagos State University Teaching Hospital (LASUTH), Ikeja. This study was a retrospective study. Data was gathered from the period of January 2022 to December 2023. The Inclusion Criteria were patients of all age groups with history of direct (primary) ocular injury from firework and patients of all age groups with history of ocular injury due to close proximity (secondary) to firework explosion. The Exclusion Criteria were cases of ocular trauma that did not directly or indirectly involve the use of fireworks.

Case notes of patients with a history of ocular firework injury were identified and retrieved from LASUTH eye clinic. Age, gender, nature of firework injury, presenting visual acuity, associated injuries, surgical intervention and post intervention visual acuity was obtained from case note. Ethical approval to conduct this study was obtained from the Lagos State University Teaching Hospital (LASUTH) Health Research and Ethics Committee. Data obtained was kept confidential with no access to unauthorized individuals.

## RESULTS

A total of 5 persons were seen with ocular firework injuries between 2022 and 2023. There were 4 males and 1 female. Age range was 5 - 51. 4 persons were primary victims of fireworks injury while 1 was a secondary victim. All 4 male primary firework victims were irreversibly blind at presentation and had surgical interventions for

globe damage and lid injuries. Injuries found included globe rupture, corneoscleral laceration, epithelial erosion, retinal detachment, vitreous haemorrhage, subconjunctival hemorrhage, lid lacerations, hyphema, facial avulsion and peri orbital ecchymosis. (Table 1)

**TABLE 1**

Case	Gender	Age	Primary victim/Secondary (bystander)	Presenting Visual acuity		Primary Ocular Injury	OTS *	Intervention	Postoperative Visual acuity		Associated adenexa injury
				OD	OS				OD	OS	
1	M	19	Primary	NLP	6/5	Right Globe rupture with extensive corneo-sclera laceration and subconjunctival haemorrhage	1	Globe repair	NLP	6/5	nil
2	M	16	Primary	LP	6/6	Right Corneal epithelial defect and Retinal detachment	2	Vitreoretina review	HM	6/6	nil
3	F	5	Bystander	6/5	6/5	Left lower lid/face avulsion	5	Lid repair	6/6	6/6	nil
4	M	19	Primary	NLP	6/9	Right corneo scleral laceration with hyphema	2	Globe Repair and anterior chamber washout	NLP	6/6	nil
5	M	51	Primary	NLP	6/9	Right globe rupture	1	Globe repair	NLP	6/9	Upper lid laceration, periocular ecchymosis

\* **OTS - Ocular trauma score.**

## DISCUSSION

Similar to other non communicable diseases, fireworks can create significant disability among affected persons. The ocular trauma score (OTS)<sup>13</sup> of 4 of the participant gave an estimated probability of 6/9 at 6 months to be less than 1% in 2 persons and 15% in another 2. 3 persons were in the working class age and the loss of vision in these individuals can cause a significant limitation and restrictions at home and the work place. Risk factor in this series include male gender, middle age and distance/proximity to firework explosion. All 5 firework injuries in this series were documented during the ember months of December and January. Similar findings were found in study in south western Nigeria.<sup>9</sup> These periods are significant for loud celebrations and festivities. Sadly, an extensive literature search showed that there are no enforcement and regulations in Lagos state as regards the age range of persons that can buy these fireworks, the type of fireworks that can be sold and the number of fireworks that can be bought. Currently, driving regulations in Nigeria by the Federal Road safety Commission requires that drivers have at least 6/36 visual acuity in the worse eye and 6/12 in the better eye for private motor vehicle drivers.<sup>14</sup> 4 of the participants will not be able to own a license to drive as this is against the law in Nigeria. The psychological and emotional devastation that can result from loss of an eye has also been documented in several studies. Depression, anxiety, and social withdrawal are common following loss of an eye.<sup>15</sup>

Exploding fireworks can sprint in any direction/vector at incredibly high velocity. Bystanders who are victims of fireworks injury usually have little or no time to react to the incoming impact. The loud bang associated with

firework was the cause of extensive facial injuries in the 5 year old patient in this study. She was startled and in her flight of fear was hit by a moving vehicle. Animals are also documented to be extremely startled with the loud bangs associated with fireworks.<sup>4</sup> Birds, dogs and other domestic animals are particularly affected and most suffer severe physical injuries. In some countries, loud fireworks have been abolished to reduce animal harm.

## RECOMMENDATIONS

Despite the few cases reported in this series, ocular firework injuries have the potential to attain levels of public health significance if not addressed holistically. Government agencies and relevant stakeholders can establish policies that can deter and potentially reduce the incidence of firework injuries. In the cigarette industry, legislation to reduce the devastating lung pathologies suffered by chronic smoker led to the implementation of graphic images on the packs of cigarette packs and bold imprints explaining the health hazard from cigarette smoking. Similar measures against use of fireworks in Nigeria would help in preventing firework injuries which could affect the eye and other parts of the body. Health Education is also very influential in limiting the incidence of firework injuries.

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