Case Report

From Celebration to Consequence: Case Report of Late Onset Ocular Effects of Firework Injuries

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ABSTRACT

Firework-related injuries, particularly ocular trauma, pose a significant public health concern during cultural celebrations. We explore the case of a 20-year-old male who sustained firework-induced ocular trauma at the age of seven, subsequently developing traumatic cataract and glaucomatous optic atrophy.

The patient presented with decreased vision and pain in the left eye (LE), 13 years post-injury. He underwent cataract surgery nine years after the incident, with subsequent development of glaucomatous optic atrophy. Examination revealed visual acuity impairment, exotropia, and pupil abnormalities in the LE, along with scleral thinning and corneal opacity. Posterior segment evaluation showed optic nerve cupping and hemorrhages. Gonioscopy indicated angle recession and synechiae in the LE. Optical coherence tomography revealed retinal nerve fiber layer defects. Elevated intraocular pressure in the LE was successfully managed with anti-glaucoma medication.

Firework-related ocular trauma can lead to long-term complications, including traumatic cataract and glaucomatous optic atrophy. Timely cataract surgery and vigilant follow-up are essential for early detection and management of secondary glaucoma. Regulatory measures to mitigate firework-related injuries are imperative to prevent such incidents and preserve visual health.

Keywords: Firework injury, Glaucoma, Ocular trauma, Optic atrophy, Traumatic cataract.

Article Information

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INTRODUCTION

Around 12–18% of global injuries are estimated to result from fireworks [1]. Firecrackers play a pivotal role in diverse cultural celebrations, yet they carry the inherent risk of causing injuries, particularly ocular trauma. Fireworks-induced ocular trauma is caused due to the energetic force of explosions, leading to significant ocular morbidity and decreased visual acuity [2]. Ocular trauma causes traumatic cataracts, leukocoria, unilateral visual loss in 30-40% of the affected patient and, substantial psychological burden [3].

The prevalence of severe vision loss among younger men who have sustained eye injuries from firecrackers, ranges from 1 in 3-6 injuries globally [4,5]. 76% to 84% of the injured people in India were men and the majority of the patients were under 18 years [6,7].

Following blunt and penetrating ocular trauma, the six-month incidence of developing post-traumatic glaucoma ranges from around 2.67% to 3.40% [8,9]. Ocular trauma is considered as one of the leading causes of secondary glaucoma [10]. In the absence of proper treatment, this elevation in pressure may result in irreversible glaucomatous damage to the optic nerve, potentially leading to a permanent loss of visual function [11].

We report a case involving a young male of 20 years, who experienced firecracker injury at the age of seven, and the cataract surgery was ultimately performed nine years after the injury. Presently, the patient is grappling with glaucomatous optic atrophy.

CASE DESCRIPTION

A 20-year-old male student, presented to our outpatient department with complaints of decreased vision in the left eye (LE) for the past 13 years, now accompanied by pain that began since two months. The patient reported a history of sustaining an injury to his left eye at the age of seven while playing with firecrackers. Three hours later, he was taken to a nearby hospital, where he recalls having multiple foreign bodies removed from his cornea. He was advised to undergo cataract surgery in a few years once he was a bit older. On the same day, he was discharged with topical medication. He did not seek medical attention for this incident until nine years after the incident when he returned to the same hospital where small incision cataract surgery (SICS) with synecheolysis under guarded visual prognosis was performed for traumatic cataract. Visual acuity after surgery improved in the LE was 1/60 with the best corrected visual acuity (BCVA) 6/18. After the surgery, patient did not seek any ocular examination until the last two months when he experienced pain in LE.

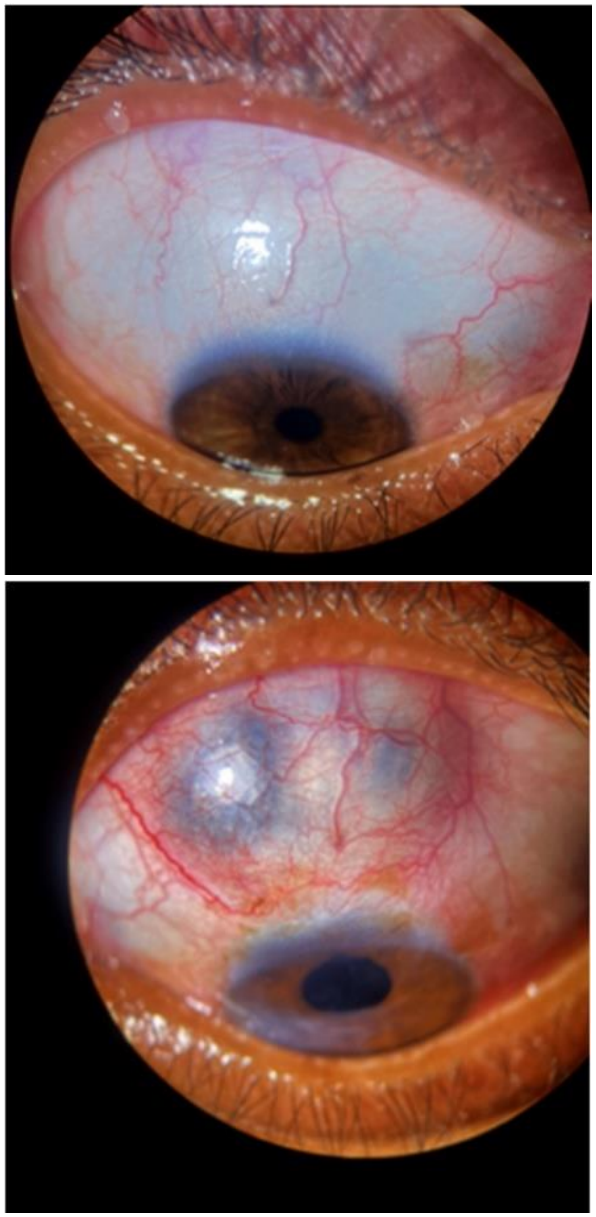
At present, BCVA in the right eye (RE) was 6/6 (0 LogMAR), and in the LE, there was only a positive projection of rays laterally. The Hirscberg test revealed left eye exotropia of 15 degrees. Extraocular movement was within the normal limit for the RE and showed an underacting inferior oblique muscle and an overacting superior rectus muscle in the LE. Pupils were round, regular, and reactive in the RE, while they were mid-dilated and fixed in the LE. Grade V relative afferent pupillary defect (RAPD) was positive in the LE.

Figure 1: Extraocular movement in nine gazes showing an underacting inferior oblique muscle and an overacting superior rectus muscle in the LE.

A slit lamp biomicroscopic examination of the RE showed clear conjunctiva, cornea, and lens.

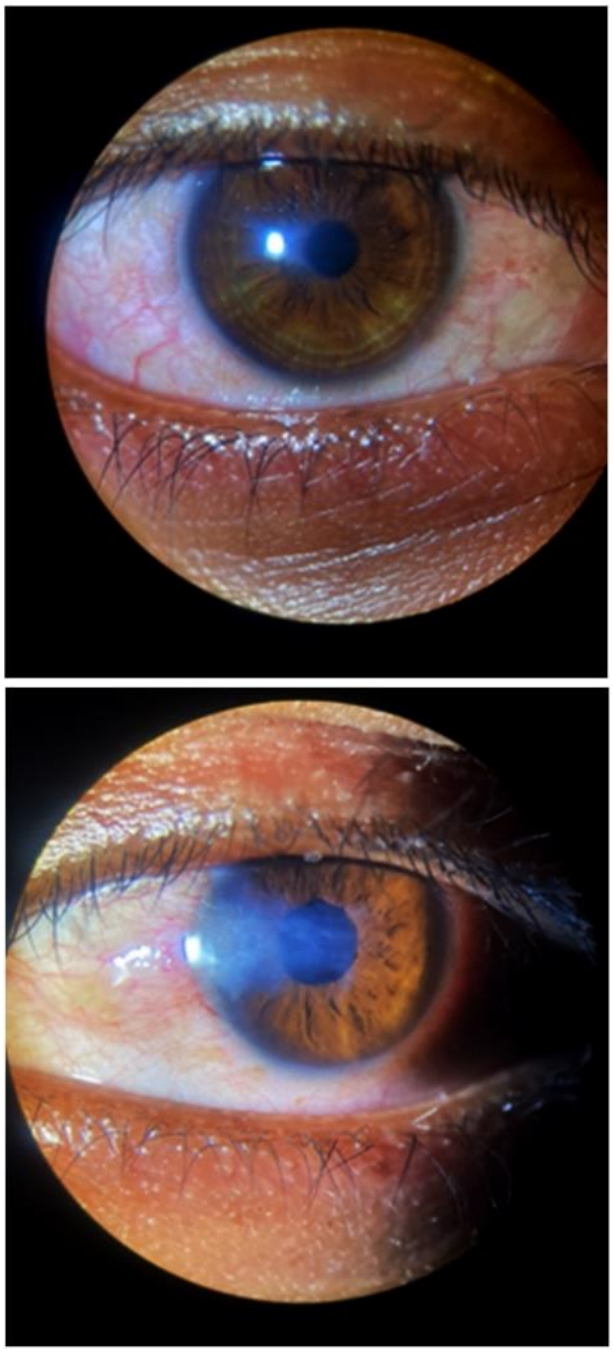
In the LE, there was sclera thinning with bluish outpouching in the superior conjunctiva that measured 9.5mm X 6.5mm. Leucomatous corneal opacity was observed in the peripheral,

paracentral, and center at 8-9:30 o'clock (6mm X 4mm). Anterior chamber depth in RE and LE was of van Herick grade III, no cells and flare was observed. Posterior capsular intraocular lens (IOL) was in situ. The posterior segment was within normal limits for the right eye, whereas the LE showed cupping of 0.95:1, and a pale disc. Intraocular pressure (IOP) was within the normal range in the RE and was 38 mmHg in the LE with the corrected IOP of 36 mmHg. This increase in IOP was associated with pain.



RE **Figure 2** LE

Figure 2: Anterior segment photo showing anterior staphyloma in the left eye measuring 9.5mm X 6.7mm in the superior bulbar conjunctiva



RE LE

Figure 3: Anterior segment photo showing leucomatous corneal opacity in peripheral, paracentral, and center in the LE measuring 6mm X 4mm

RE LE

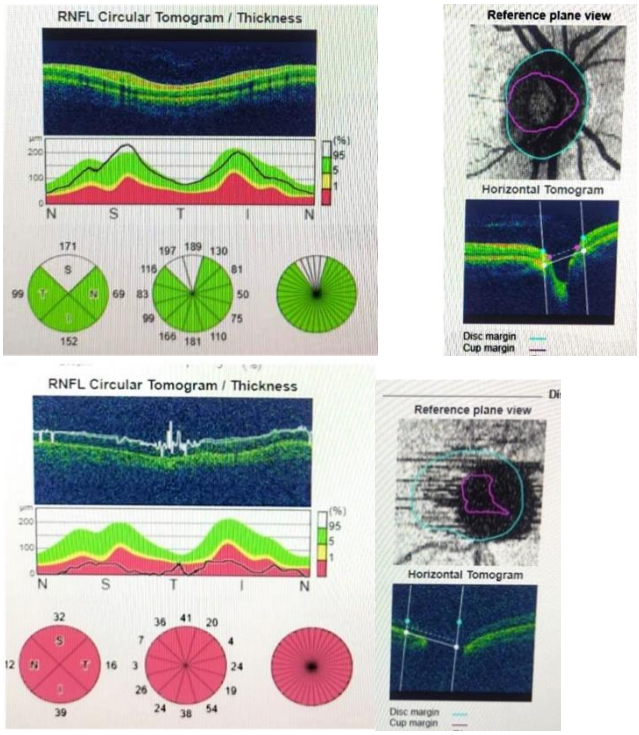
Figure 4: Fundus photo showing normal fundus in RE and LE showing pale disc

Gonioscopy performed in the RE revealed a visualized ciliary body band in all four quadrants, while in the LE, there was angle recession in the superior and temporal quadrants, peripheral anterior synechiae (PAS) in the inferotemporal quadrant, and a scleral spur in the nasal and inferonasal quadrants.

OCT disc in the RE showed no RNFL defect whereas LE showed RNFL defect in all the four quadrants.

The increase in IOP was treated with anti-glaucoma medication (eyedrop dorzolamide 2%, one drop twice a day, and a combination of eyedrop brimonidine 0.2% and timolol 0.5%, one drop twice a day). In the follow-up a week later, the pain and the redness had subsided and the IOP was 14 mmHg in the RE and 13 mmHg in the LE, however, the vision did not improve. Thus, the patient was kept in same medication and asked to follow up after a month.

On follow up, patient did not have ocular pain and congestion was not observed in LE on examination. Vision did not improve and IOP was within normal limit. Patient was asked to continue the same medication and stay in follow-up.



RE LE

Figure 5: RE OCT disc showing no RNFL defect and LE OCT disc showing RNFL defect in all quadrants

DISCUSSION

Fireworks constitute an integral component of various global celebrations, prominently featured during occasions like Dashain and Tihar in South Asia, as well as other diverse national commemorations worldwide. Among reported ocular injuries in the United States, approximately 2% are attributed to firework-related incidents [12]. Eye injuries are one of the most common types of injuries related to fireworks ranging from

21% to 31% of all fireworks-related injuries in the US and Europe [13].

The predominant ocular injuries resulting from fireworks encompass ocular burns, eyelid damage, corneal injuries, development of cataracts, angle-recession glaucoma, and vitreous hemorrhages. Among individuals experiencing open globe injuries, the majority sustained full-thickness lacerations involving both the cornea and sclera [14,15].

Cataracts can manifest immediately after trauma or appear months to years following the incident. Rapid cataract formation often occurs due to the rupture of the lens capsule, leading to the seepage of aqueous humor into the lens fibers. In cases where there is no capsule rupture, traumatic forces are suspected to damage the lens fibers, eventually resulting in cataract formation [16]. Surgical removal of the cataract and replacement with an intraocular lens is the most widely used form of treatment. In the presented case, the cataract was observed on the same day as the traumatic event. The cataract was likely formed from the trauma of the lens capsule. As the patient wasn't operated on at that point, the early development of glaucoma and the consequent optic nerve damage went unnoticed until later.

Traumatic glaucoma following blunt ocular trauma often stems from angle recession and lens-related factors. Following penetrating eye injury, glaucoma commonly arises due to secondary angle closure caused by peripheral anterior synechiae [17]. In cases of blunt trauma or mature cataracts, protein leakage through an intact lens capsule can overwhelm the trabecular meshwork with inflammatory cells and debris, potentially causing glaucoma. This intense inflammatory response occurs due to high molecular weight proteins, leading to blockage of the meshwork by inflammatory cells and leaked proteins [18]. Lensectomy is recommended when there's a pupillary block or angle closure, especially in cases where the lens is affected by cataract. Angle recession glaucoma typically manifests as a delayed increase in intraocular pressure (IOP) due to fibrosis, degeneration, and atrophy affecting the trabecular meshwork and the Schlemm's canal. This condition presents as a form of secondary chronic open-angle glaucoma. The reported glaucoma case resulted from trauma to the lens capsule, leading to lens particle glaucoma. Additionally, angle recession in the superior and temporal quadrant with peripheral anterior synechiae (PAS) in the inferotemporal quadrant contributed to this condition, observed 13 years post-trauma. Timely surgical removal of the traumatic cataract could have prevented its progression into glaucoma, averting visual acuity loss and amblyopia. Regular ocular exams could have detected early optic nerve damage, enabling early anti-glaucoma treatment to preserve better visual acuity and prevent further nerve damage.

CONCLUSION

Ocular trauma is a common firework-related injury. Prompt initial treatment for any form of ocular injury and consistent follow-ups are crucial to avoid complications such as late-onset glaucoma. Timely intervention, if performed could help to prevent systemic and ocular comorbidities thus promoting quality of life and vision. Also, implementing regulations for judicious use, conducting awareness programs regarding the use and regular quality assessment of the firecracker can notably reduce the occurrence of these injuries in the future.

Author Contribution: SR and SP conceptualized and designed the reviewed the literature; SP did data collection, SR and SP drafted the manuscript; and RNB did the critical analysis of the manuscript and all authors reviewed the manuscript and approved the final version of the manuscript. All authors agreed to be accountable for all aspects of the research work. Note: SR, SP, and RNB are abbreviated names of the authors.

Data Availability: Related photograph of this case will be available on request.

Informed Consent: Consent from patient was taken.

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Conflict of Interest: None declared.

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