Ocular Trauma Caused by Confetti Cannons

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ABSTRACT **Background:** Eye trauma is an unfortunate and often preventable cause of vision loss. Confetti cannons are common causes of injury. Awareness of ocular hazards of confetti cannons remains low because of limited reports describing ophthalmic injuries following their use.

Objectives: To describe outcomes of ocular trauma caused by confetti cannons and to increase recognition of their ocular risks.

Methods: A retrospective analysis was conducted of eye injuries caused by confetti cannons presenting to a single medical center between 2016 and 2020. Data collected included age, gender, eye injured, ocular damage, visual outcome, and details of surgeries performed.

Results: Overall, six consecutive patients (2 males, mean age 19.5 ± 9.74 years) were identified and studied. In all patients only one eye was injured (3 right eyes) during a private celebration, most commonly (n=5) to a bystander while in the vicinity of a cannon operated by someone else. Most common eye injuries included corneal erosion (n=4), traumatic hyphema (n=4), and retinal edema (n=3). Mean initial logMAR visual acuity in the injured eye was 0.73 ± 0.18, improving to 0.25 ± 0.16 at the final visit (P = 0.125). Two patients underwent eye surgery due to their trauma: one to repair globe penetration and another to undergo intravitreal injection of tissue plasminogen activator and C3F8 for submacular hemorrhage, followed 8 months later by intravitreal bevacizumab injection for choroidal neovascularization.

Conclusions: Confetti cannons pose hazards that can cause severe ocular trauma resulting in permanent vision loss. Increasing awareness of device hazards is necessary to prevent eye injuries.

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Vision loss secondary to ocular trauma remains a global problem, causing approximately 30–40% of monocular blindness cases and affecting approximately half a million people worldwide annually [1]. Children are especially at risk for eye injuries, with ocular trauma described as a leading cause of unilateral vision loss in the pediatric population [2]. Other predisposing risk factors include male gender, lower socioeconomic status, hazardous lifestyle, and work-related injuries [1,3]. Without doubt, many eye injuries can be prevented by raising awareness of the risks inherit within certain activities and taking appropriate safety measures accordingly.

Confetti bits are small pieces of shredded paper, plastic or aluminum, whose purpose is to be thrown into the air during celebrations such as public sporting events and parades, private parties, and weddings. Typically, confetti is industrially produced, but it can also be made at home from silk paper and other industrial shredded paper pieces that are fashioned into small metal scraps. Typically, confetti is dispersed by cannons that are either triggered manually or by electric activation. Electronic cannons can produce a much higher projectile energy, resulting in greater scattering of paper volume and larger radius of dispersion, ranging from 8 meters (for a 25 cm length cannon) to more than 12 meters (for an 80 cm length cannon). The basic mechanical principle common to all cannons involves a sudden burst of pressure, released from compressed air or nitrogen, stored in a small container at the bottom of the device.

Often confetti cannons are readily available and marketed as a harmless party accessory without any restrictions imposed on its purchase or use, including limitations on acquisition by children and any guidance for safety precautions or warnings on improper use.

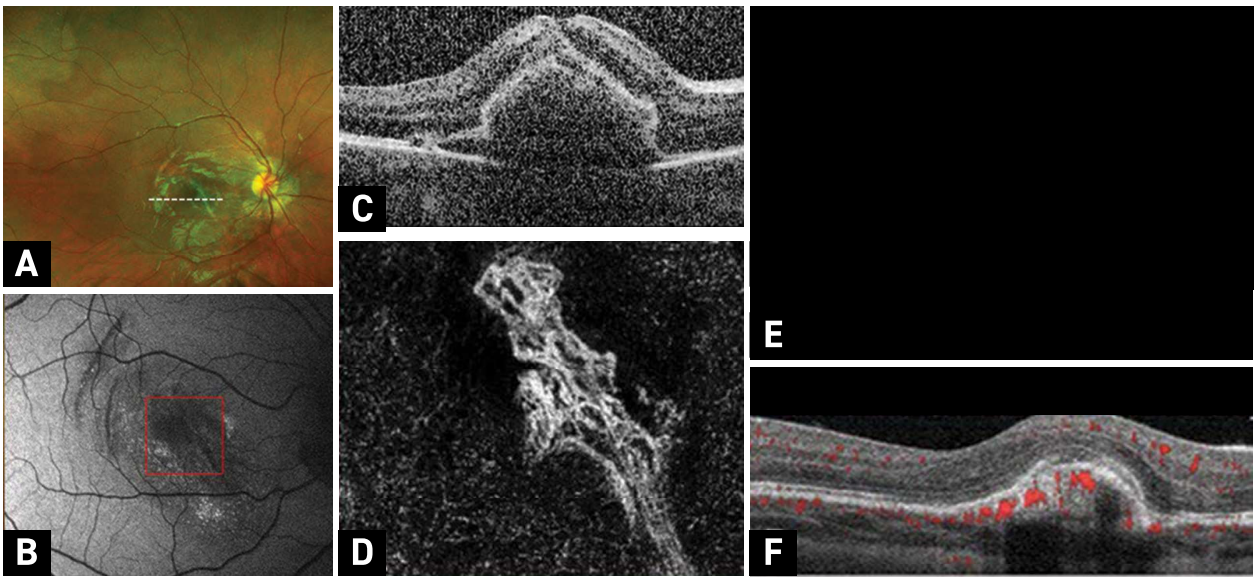
Despite their common use, recognition of their ocular hazards remains low because of limited reports describing ophthalmic injuries following their use. The purpose of this study is to describe our experience with six cases of ocular injuries due to confetti cannons in order to describe its ocular consequences; thereby, increasing awareness of the risks involved while using a confetti cannon, which is not harmless at all.

PATEINTS AND METHODS

A retrospective data analysis was conducted of consecutive patients sustaining ocular trauma from confetti cannons treated at a single medical center between 2016 and 2020. Cases were identified from the hospital's registry and database of patients. The study was approved by the institutional review board. The study was performed according to the rules and regulations of the Declaration of Helsinki.

Figure 1. Patient 1 multimodal imaging with choroidal rupture and secondary choroidal neovascularization

OCT = optical coherence tomography



[A] Color photography 6 months after presentation of the posterior pole showing bright longitudinal vertically oriented lesions consisting with the location of choroidal rupture

[B] Fundus autofluorescence of the macular area showing 3 hypoautofluorescent strikes revealing choroidal rupture

[C] OCT scans representing the location of the dotted line in [A]. Subretinal hemorrhage at the subfoveal space masking the location of choroidal rupture at presentation, scan quality is low due to vitreous hemorrhage

[D] Flow signal representation of the outer retinal slab showing choroidal neovascularization following the course of the rupture. OCT angiography scans representing 3 × 3 mm^2 of the central macula represented in [B] 18 months after presentation. Flow signal representation of the outer retinal slab showing choroidal neovascularization following the course of the rupture

[E] OCT scans representing the location of the dotted line in [A]. Eight months later, fibrovascular scarring at the area of the rupture, note mild discontinuity of the ellipsoid layer overlying the scar tissue

[F] OCT angiography scans representing 3 × 3 mm^2 of the central macula represented in [B] 18 months after presentation. Cross sectional scan with flow overlay, showing the flow signal (red) within the pigment epithelial detachment

Data collected included age, gender, injury circumstances, eye injured, type of ocular damage, logMAR visual acuity recorded at time of initial and final follow-up visits, details of eye surgery when performed, and time until follow-up. The ocular trauma score (OTS) was used for assessing injury severity [4,5].

Statistical analysis was performed using GraphPad Prism 7 (GraphPad Software Inc., San Diego, CA, USA). Descriptive statistics are provided, and Wilcoxon paired *t*-test was conducted for comparing visual acuity at presentation and final follow-up visits. *P* value < 0.05 was considered statistically significant using a two-tailed analysis.

RESULTS

Overall, six consecutive patients (2 males, mean age 19.5 ± 9.74 years) who sustained confetti eye injuries were identified [Table 1]. Mean follow-up was 10.6 ± 9.35 months (range 0.1–27 months).

In all patients only one eye was injured (3 right eyes) during a private celebration. In five patients (83%) the injury occurred to a person standing in vicinity to a confetti cannon operated by someone else, and the sixth patient (17%) presented with an eye injury following self-operation of the confetti cannon.

The most common eye injuries included corneal erosion (66%, n=4), traumatic hyphema (66%, n=4), and retinal edema (50%, n=3). Mean hyphema height at presentation was 1.0 ± 0.7 mm (range 0.5–1.7 mm). Mean OTS at presentation was 3.66 ± 0.47 (range 3–4). In all patients LogMAR visual acuity in the injured eye at time of presentation was lower than 0.4 (mean 0.73 ± 0.18, range 0.4–1.3), improving to 0.25 ± 0.16 (range 0–0.4) at the final visit ($P = 0.125$).Two patients (33%) had surgical interventions, one needed repair of globe penetration (case 1) and the other had intravitreal injection of tissue plasminogen activator and C3F8 for submacular hemorrhage, followed 8 months later by intravitreal bevacizumab injection for choroidal neovascularization (case 2).

Table 1. Baseline characteristics for patients presenting with confetti ocular trauma

Patient number	Age (years)	Sex	Eye	Visual acuity* at presentation	Type of injury	Ocular Trauma Score	Surgical intervention	Final visual acuity*	Follow-up period (months)
1	8	Female	Right	1.3	Choroidal rupture, eyelid hematoma, conjunctival hemorrhage, corneal erosion, hyphema	3	TPA+C3F8	0.2	27
2	10	Male	Left	1.4	Corneal penetration, corneal erosion conjunctival hemorrhage	3	Corneal suturing	0.1	10
3	25	Female	Right	0.4	Corneal erosion, hyphema, retinal edema	4	None	0.1	17
4**	36	Female	Right	0.4	Hyphema, retinal edema	4	None	0.4	0.5
5	13	Female	Left	0.6	Corneal erosion, hyphema	4	None	0	9
6	24	Male	Left	0.4	Eyelid hematoma	4	None	0.4	0.1

All uninjured eyes had 0.0 acuity

*LogMAR visual acuity in the injured eye

**Patient 4 was amblyopic in the injured right eye and maintained his baseline visual acuity following trauma

TPA = tissue plasminogen activator

DESCRIPTIONS OF THE TWO PATIENTS WHO UNDERWENT SURGERY

CASE 1

An 8-year-old girl sustained an injury to her right eye while standing near a confetti cannon during a birthday party. Visual acuity in the right eye was 20/400 and 20/20 in the left eye. She presented with an upper eyelid laceration, conjunctival hemorrhage, corneal erosion, anterior chamber hyphema of 1.7 mm height, vitreous hemorrhage, and foveal choroidal rupture with a submacular hemorrhage. The left eye was completely normal. Five days after her initial admission, she underwent intravitreal injection of tissue plasminogen activator (TPA) and C3F8 gas injection to treat the submacular hemorrhage under general anesthesia. The submacular hemorrhage was displaced one week after surgery. Eight months following her initial presentation, an active choroidal neovascularization with macular edema was identified using optical coherence tomography angiography at the location of the choroidal rupture [Figure 1] and she underwent an intravitreal injection of bevacizumab. At her last follow-up appointment, more than 2 years following the trauma, her visual acuity in the injured right eye improved to 20/30 with a central macular scar formation at the location of choroidal rupture.

CASE 2

A 10-year-old boy was injured in his left eye while playing with a friend who fired a confetti cannon. He was first hit by the confetti particles but shortly thereafter sustained a second hit while trying to manipulate the cannon's apparatus. His initial visual acuity in the right eye was 20/20 and 20/500 in the left eye. Examination of the left eye identified ocular penetration from two corneal lacerations. Iris prolapse was detected through one of the corneal lacerations, without evidence of damage to the crystalline lens or any other ocular structure posterior to the lens. A computed tomography scan ruled out the presence of an intraocular foreign body. The corneal lacerations were sutured using 10-0 nylon sutures and the iris prolapse was repositioned. Ten months after the trauma visual acuity in the injured eye improved to 20/25.

DISCUSSION

We reported six cases of eye injuries caused by confetti cannons, all occurring at home or private parties. Although the prognosis for visual recovery is usually fairly good, permanent ocular damage and vision loss may occur.

Eyes are exposed to trauma by many insults including explosive materials or high velocity objects, most commonly occurring during sports, work, or combat [6,7]. Eye injuries at home are much less common [8]; however, they can still have the same consequences of permanent vision loss [8,9]. Common scenarios for home injuries include falling, colliding, or smashing into objects or piercing different materials [10]. Adolescents and young adults are especially at risk for

eye injuries [7,10,11]. In our study, mean age of patients presenting with eye trauma caused by confetti cannons was 19 years. Similarly, Arad et al. [12] reported two cases of eye trauma from confetti cannons occurring to 16- and 21-year-old celebrators in a discotheque.

In most studies males have a higher rate of ocular trauma as a result of their increased participation in hazardous activities [2,6,11,13,14]. However, we found that confetti eye injuries are an exception having an equal chance for injuring both sexes. This finding may possibly be explained by the common occurrence of confetti eye trauma to a bystander standing in the vicinity of the device operated by someone else at a household party, which does not have any gender predilection. Interestingly, in all patients only one eye was injured, which is probably related to the small explosion range of privately used confetti cannons with a limited dispersion range of their particles. Trauma to just one eye was also found in the two separate cases of confetti eye injuries reported by Arad et al [12].

The visual outcome of ocular trauma is directly related to the severity of the trauma and initial vision loss [5]. In our study, the mean OTS following confetti eye trauma was of 3.6, corresponding to mild to moderate eye injury severity and associated with a good chance for recovery. Based on this trauma score, the calculated chance of achieving a final visual acuity of 20/40 (logMAR = 0.4) or better after 6 months is between 74 and 92. At the time of their last follow-up visit all patients had visual acuity in that range (including one patient who was amblyopic and maintained his previous visual acuity of 20/40).

The most common consequences of confetti cannon injuries were eyelid lacerations, conjunctival hemorrhage, corneal erosions, and hyphema, which were treated medically. However, two patients had more severe eye trauma, which required surgical interventions. One patient had a corneal penetrating wound and the other had a choroidal rupture associated with vitreous hemorrhage and submacular hemorrhage. In the two cases of eye trauma caused by confetti cannons, which were reported by Arad et al. [12], one patient had a hyphema that gradually resolved with medical therapy without any ocular sequela and the other had a retro equatorial perforation that was repaired. In our study, we found that eye injuries from confetti cannons were caused by two major mechanisms: a direct hit from the explosive or confetti particles or a blunt trauma from the explosion echo. It seems that confetti particles are especially dangerous to the eyes due to their small size and sharp morphology, potentially leading to severe eye damage. Although, we found that confetti eye injuries can occur both in pediatric and adult populations, it seems that children are more prone to sustaining a more severe eye injury.

In our study, the two patients requiring corrective surgery were the also the youngest of the group, possibly explained by their shorter height and the closer distance between their eyes and the confetti cannon, which that is normally launched vertically. Unfortunately, in Israel like in many other countries no distribution regulations or proper safety warnings exist for customers interested in purchasing confetti cannons. These devices are widely available online or in toy or party accessories stores, which is in contrary to the acquisition of fireworks that are more strictly regulated limiting children's purchase [15].

LIMITATIONS

Limitations of our study include its retrospective design relying on the accuracy and completeness of data recorded in medical files. In addition, we did not routinely collect data regarding the specifics of the confetti cannons used. Therefore, it is impossible for us to determine if some types, brands or cannon sizes are associated with a greater risk for eye trauma.

CONCLUSIONS

Confetti cannons used in private celebrations are associated with a risk of causing severe eye trauma, most commonly to a bystander person who is in close proximity to the device during its operation. Although, recovery of vision is common, this device can potentially cause severe ocular damage requiring surgery and leading to permanent vision loss. Increased awareness of the risks involved with using confetti cannons, better regulating distribution and using safely measures while employing the device may limit ocular trauma from this device, which isn't harmless at all.

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Capsule

Pain itching to block OSM

Inflammatory skin diseases are often associated with the development of chronic itch. Although inflammation-related cytokines have been shown to modulate the activity of peripheral itch-selective neurons, the involvement of inflammatory mediators in the pathophysiology of chronic itch remains unclear. **Tseng** and **Hoon** discovered that the cytokine oncostatin M (OSM) plays a major role in itch. OSM is up-regulated in immune cells during skin diseases associated with itch. In vitro, OSM modulated itch neurons' excitability and sensitivity to pruritogens. In vivo data showed that OSM depletion or inhibition reduced itch behavior in a rodent model of dermatitis, suggesting that targeting OSM could be effective in reducing itch associated with inflammatory conditions.

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Capsule

Human genetics OAS1 links dementia and COVID-19

Dementia increases an individual's risk of severe COVID-19. Alzheimer's disease is characterized by extensive neuroinflammatory changes, amyloid-beta deposits, and tau tangles. Oligoadenylatesynthetase 1 (OAS1) mediates innate immune responses through interferon and is a known risk factor for the development of Alzheimer's disease. **Magusali** and colleagues examined genetic variants around the gene OAS1 to investigate the correlation between severe COVID-19 and dementia. The authors found that a haplotype near OAS1 containing four linked genetic variants down-regulates the expression of OAS1. Two of the variants are associated with the development of Alzheimer's, and the other two are associated with severe COVID-19. Examining co-expression networks for microglial *Oas1* in mouse models of Alzheimer's disease, as well as in humans afflicted with dementia and COVD-19, identified an interferon-response network.

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Capsule

Lectins enhance SARS-CoV-2 infection and influence neutralizing antibodies

SARS-CoV-2 infection, which involves both cell attachment and membrane fusion, relies on the angiotensin-converting enzyme 2 (ACE2) receptor. It is paradoxically found at low levels in the respiratory tract, suggesting that there may be additional mechanisms facilitating infection. **Lempp** and colleagues showed that C-type lectin receptors, DC-SIGN, L-SIGN, and the sialic acid-binding immunoglobulin-like lectin 1 (SIGLEC1) function as attachment receptors by enhancing ACE2-mediated infection and modulating the neutralizing activity of different classes of spike-specific antibodies. Antibodies to the amino-terminal domain or to the conserved site at the base of the receptor-binding domain, while poorly neutralizing infection of ACE2-overexpressing cells, effectively block lectin-facilitated infection. Conversely, antibodies to the receptor binding motif, while potently neutralizing infection of ACE2-overexpressing cells, poorly neutralize infection of cells expressing DC-SIGN or L-SIGN and trigger fusogenic rearrangement of the spike, promoting cell-to-cell fusion. Collectively, these findings identify a lectin-dependent pathway that enhances ACE2-dependent infection by SARS-CoV-2 and reveal distinct mechanisms of neutralization by different classes of spike-specific antibodies.

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