Editorial

Chaharshanbe-Soori Fireworks and Public Health

Peoples of Persian culture celebrate the last Wednesday of the year on its eve, the Tuesday night, according to the Persian calendar. Named Chaharshanbe-Soori, literally 'red Wednesday', the festivity is held on a day from 12 to 19 of March. The event precedes Nowruz (the Persian New Year) and comprises several traditions of which setting up bonfires and jumping over them is an integral part. Red refers to fire, itself symbolizing brightness, purity, life, and health in ancient Persia.[1] The origin of the festivity goes back to a Zoroastrian tradition circa1725 BC.

Fireworks are used in many celebrations around the world: the Fourth of July (the United States' Independence Day), the New Year in China, Halloween and Guy Fawkes Night in the UK, Diwali in India, Hari Raya Festival in Malaysia, and Prophet Mohammad's Birthday in Libya.[2-7]

In today's Iran, the original ceremony of bonfires has been transformed into a social bedlam in the big cities in which a wide variety of illegal and hand-made firework agents are being used. The situation is being further complicated by the fact that the government does not recognize the celebration as a legitimate national festival in a contrast to similar such ceremonies in the world (including Iran) in which fireworks are being organized as public displays managed by professionals wherein civilians attend to in the form of spectators; the role of children and the young is kept limited; and the usage of firework agents is highly regulated.

Use of hand-made and unconventional devices or explosives create frequent burns and injuries. Hands are the most common place of injury (up to 53%)[8-10] followed by eyes (up to 27%) which also sustain the most serious ones.[8] An even uglier aspect is that the injury affects bystanders or passersby too. In fact, it has been shown that the severity of injury is even worse in this category.[11]

Eye injuries cover a wide spectrum of ocular trauma in terms of anatomical involvement: superficial and deep (the eyelids to the optic nerve); type of injury: penetration, contusion, rupture, and intraocular foreign body; mechanism of injury: blunt, penetrating, thermal, etc. They cover relatively simple entities like corneal foreign body and abrasion to full-thickness globe lacerations, hyphema, vitreous hemorrhage, and posttraumatic endophthalmitis.[12,13] {Appendix; Table1}

Based on various reports, more than 10% of the casualties need hospitalization and surgical care.[13,14] But, the frequency of severe injuries is not limited to inpatient admissions: some eyes sustain devastating intraocular damage despite an intact globe from angle recession to traumatic cataract and retinal detachment to traumatic optic neuropathy.[12] {Appendix; Table 2}

On rare instances, firework agents have caused extensive burns and scarring,[16] amputations of the extremities,[15] intracranial injury,[17] and even death (due to extensive burn or massive explosions).[9] Frequently, severe injuries of the eyes cause monocular blindness: up to 10% of the injured eyes.[20] The expression 'fireworks blindness' is being used in order to create awareness over this potential risk.[21] Additionally, disfigurement of the external eye happens not infrequently adding to the morbidity. Enucleation and/or no light perception are estimated at 1% in fireworks injury hospital series.[13] The explosive nature of the injury, on rare occasions, has resulted in bilateral blindness.

Despite some publicized facts about this serious public health problem,[18,19] it has largely been neglected in the scientific and policy circles. Currently, the injury constitutes a major contributor to (ocular) trauma in our country and the outlook over the elimination and control of the threat is not bright. It is expected that the clinicians provide the public and policy makers with information and advice on the issue. There is a need for more scientific contributions to the literature as the evidence on the magnitude and extent of the problem is limited.

Tables 1 to 3 of the Appendix list related eye injuries, present a severity ranking model, and organize a scheme for the study of such injuries. The descriptors and determinants cover clinical and epidemiologic aspects and are instrumental in related researches. Quantification of the severity of ocular trauma is important at least for two reasons: prognosis; and characterization of risk factors of the more severe injuries for preventive purposes.

Nationwide studies are needed to estimate burden (in terms of burn and monocular blindness) and to determine risk factors. A national registry of hospitalized and/or severe cases is extremely helpful for surveillance of the phenomenon and in order to maintain awareness and to monitor trends; remarkable variation in the frequency, severity, and profile of the injuries has been observed in the recent years. Description of the psychosocial picture and the adverse effect on quality of life is another important aspect. Case reports of unusual injuries are needed. Little is known about the long-term course of severe injuries. Sociologically-inclined studies should clarify alternative aspects of the phenomenon.

Iranian ophthalmologists' have an exceptional role as they are the most consulted on this issue. Prevent Blindness America states: 'there is no secure way for nonprofessionals to use fireworks'. It further states: 'it is only safe to enjoy the splendor and excitement of fireworks at a professional display'.[18] In a similar vein, I (SFM) believe that we, Iranian ophthalmologists, should embark on a more active public health advocacy that addresses public awareness, law enforcement, and provision of a healthy festivity alternative, i.e., professional public displays. This public health crisis recurring annually just prior to Nowruz is effectively forgotten till the next year. Such injuries—used to be a serious public health issue in the developed nations—should become a thing of the past in Iran too.

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* Appendix is published at the end of the issue, pages 77 to 80.

References

1. http://www.iran-press-service.com/ips/articles-2006/march-2006/norouz_19306.shtml
2. Arya SK, Malhotra S, Dhir SP, Sood S. Ocular fireworks injuries. Clinical features and visual outcome. Indian J Ophthalmol 2001;49(3):189-90.
3. D'Argenio P, Cafaro L, Santonastasi F, Taggi F. Capodanno Senza Danno: the effects of an intervention program on fireworks injuries in Naples. Am J Public Health 1996;86(1):84-6.
4. Isa AR, Moe H. Fireworks related injuries during Hari Raya festival in Hospital Universiti Sains Malaysia -- 1986 to 1990. Med J Malaysia 1991;46(4):333-7.
5. Jackson D. Injuries from fireworks. Br Med J 1961;2(5261):1184-7.
6. Mohan D, Varghese M. Fireworks cast a shadow on India's festival of lights. World Health Forum 1990;11(3):323-6.
7. Dhir SP, Shishko MN, Krewi A, Mabruka S. Ocular fireworks injuries in children. J Pediatr Ophthalmol Strabismus 1991;28(6):354-5.
8. Puri V, Mahendru S, Rana R, Deshpande M. Firework injuries: a ten-year study. J Plast Reconstr Aesthet Surg 2009;62(9):1103-11.
9. Michael A, Greene, Yongling Tu. 2009 Fireworks Annual Report: fireworks-related deaths, emergency department treated injuries, and enforcement activities during 2009. Washington, DC: US Consumer Product Safety Commission; 2009.
10. Fogarty BJ, Gordon DJ. Firework related injury and legislation: the epidemiology of firework injuries and the effect of legislation in Northern Ireland. Burns 1999;25(1):53-6.
11. Kuhn FC, Morris RC, Witherspoon DC, et al. Serious fireworks-related eye injuries. Ophthalmic Epidemiol 2000;7(2):139-48.
12. Rahimi F, Mohammadi SF, Hashemian MN, et al. Angle recession in fireworks-related blunt eye injuries with hyphaema. Asian Journal of Ophthalmology 2006;8(2):62-5.
13. Mansouri MR, Mohammadi SF, Hatef E, et al. The Persian Wednesday Eve Festival "Charshanbe-Soori" fireworks eye injuries: a case series. Ophthalmic Epidemiol 2007;14(1):17-24.
14. Berger LR, Kalishman S, Rivara FP. Injuries from fireworks. Pediatrics 1985;75(5):877-82.
15. Mäkitie I, Paloneva H, Tikka S. Explosion injuries in Finland 1991-1995. Ann Chir Gynaecol 1997;86(3):209-13.
16. Smith GA, Knapp JF, Barnett, TM, Shields BJ. The rockets' red glare, the bombs bursting in air: fireworks-related injuries to children. Pediatrics 1996;98(1):1-9.
17. Saunte JP, Trojaborg NS, Nielsen OA, Thygesen J. [Two cases of severe eye and cranial injuries due to firework explosions]. Ugeskr Laeger 1999;161(51):7069-70.
18. http://www.preventblindness.org/safety/fireworksafety.htm
19. Saadat S, Naseripour M, Rahimi B. Safety preparedness of urban community for New Year fireworks in Tehran. Burns 2009;35(5):719-22.
20. Tavakoli H, Khashayar P, Amoli HA, et al. Firework-related injuries in Tehran's Persian Wednesday eve festival (Chaharshanbe Soori). J Emerg Med 2010. [Epub ahead of print]
21. Newell FW, Vail D. Fireworks blindness. Am J Ophthalmol 1972;74(1):167-8.
22. Kuhn F, Morris R, Witherspoon CD. Birmingham Eye Trauma Terminology (BETT): terminology and classification of mechanical eye injuries. Ophthalmol Clin North Am 2002;15(2):139-43.
23. International Classification of Diseases (ICD)". World Health Organization. http://www.who.int/classifications/icd/en/. Retrieved 23 November 2010.
24. Kuhn F, Maisiak R, Mann L, et al. The Ocular Trauma Score (OTS). Ophthalmol Clin North Am 2002;15(2):163-5.
25. Négrel AD. Magnitude of eye injuries worldwide. J Comm Eye Health 1997;10(24):49-53.

Appendix

Table 1. Taxonomy of fireworks-related eye injuries: Anatomical Categorization[13]

External	Anterior segment	Posterior segment	Orbital
• Eyelid burn • Eyelid abrasion • Eyelid foreign bodies • Eyelid contusion • Partial thickness eyelid laceration • Eyelid margin laceration • Full thickness eyelid laceration • Canthus laceration • Eyelid laceration with significant tissue loss • Eyelid laceration with lacrimal apparatus involvement	• Thermal conjunctivitis • Conjunctival foreign bodies • Allergic/Chemical external eye injury • Conjunctival abrasion • Conjunctival laceration • Conjunctival burn • Punctate epithelial erosion and keratopathy • Corneal abrasion • Corneal burn • Corneal foreign bodies • Corneal contusion • Posttraumatic infectious keratitis • Partial thickness corneal laceration • Full thickness limbal laceration • Full thickness corneal laceration • Posttraumatic uveitis • Iris sphincter rupture • Hyphema (gross and microscopic) • Iridodialysis • Traumatic cataract • Lens subluxation/dislocation	• Scleral contusion • Commotio retinae • Retinal hemorrhage • Berlin's edema • Partial thickness scleral laceration • Partial thickness corneoscleral laceration • Vitreous base avulsion • Vitreous hemorrhage • Retinal tear and dialysis • Choroidal rupture at macula or elsewhere • Macular hole • Intraocular foreign body • Full thickness scleral laceration • Full thickness corneoscleral laceration • Traumatic retinal detachment • Posttraumatic endophthalmitis	• Intraorbital foreign body • Retrobulbar hemorrhage • Blow out fracture • Orbital fracture with deformity and/or entrapment • Optic nerve avulsion • Traumatic optic neuropathy

BETT (Birmingham Eye Trauma Terminology) system is the standardized scheme for ocular trauma.[22] BETT and the International Classification of the Diseases[23] systems do not cover specific eye injuries but our list is intended to be all-inclusive. See 'additional injuries' in Table 2.

Table 2. Fireworks-related eye injuries: Severity Categorization

Catastrophic	Optic nerve avulsion Traumatic retinal detachment Posttraumatic endophthalmitis Full thickness corneoscleral laceration Intraocular foreign body Traumatic optic neuropathy
Very severe	Full thickness corneal laceration Full thickness limbal laceration Traumatic cataract Lens subluxation or dislocation Choroidal rupture at macula Retinal dialysis Vitreous hemorrhage Vitreous avulsion
Severe	Partial thickness corneoscleral laceration Partial thickness corneal laceration Posttraumatic keratitis Partial thickness scleral laceration Orbital fracture with deformity or entrapment Gross hyphema Berlin's edema Iridodialysis
Moderate	Blow out fracture Intraorbital foreign body Canthus laceration Full thickness eyelid laceration Eyelid margin laceration Retrobulbar hemorrhage Microscopic hyphema Sphincter rupture (traumatic miosis and mydriasis) Retinal hemorrhage (sub, intra, pre & prepapillary) Commotio retina (not involving macula) Scleral contusion

Appendix

Mild	Partial thickness eyelid laceration Conjunctival laceration Posttraumatic uveitis Corneal contusion Second degree eyelid burn Corneal foreign body
Trivial	Periorbital contusion/ eyelid contusion Corneal burn (second degree) Corneal abrasion Eyelid foreign body Conjunctival abrasion Eyelid burn Eyelid abrasion Allergic and/or chemical injury of the external eye Punctate epithelial erosion of cornea (also include first degree burn) Conjunctival foreign body Thermal conjunctivitis
* Orders within the groups are meaningful as well.	
Additional injuries	Vitreous prolapse Iris/uveal prolapse /incarceration Ocular hypertension Ocular hypotony 'Double perforation' Vitreoretinal incarceration Iris rupture/laceration Angle recession Size of corneal or scleral laceration Location of corneal or scleral laceration; axial, paraxial & peripheral

'Ocular trauma score' has already been described for eye injury severity ranking.[24]
The abovementioned six ordinal severity categories are ordered according to the injury permanence, risk for visual impairment, and (predicted) cosmetic outcome.
The primary diagnosis (the diagnosis in the higher rank) can be used for severity ranking. Simultaneous diagnoses and contralateral and additional injuries, presenting visual acuity, and presence of afferent pupillary defect response can be considered for further severity differentiation.

Table 3. Study scheme for fireworks-related eye injuries from epidemiologic and clinical perspectives

Pre-event			Event		Post-event	Outcome	Others
Demography	**Agent-related**	**Past medical and social history**	**Context**	**The injured**			
• Age • Gender • Socioeconomic status • Education • Occupation • Cultural background and traditions	• Agent • Explosive vs. non-explosive • Legal vs. illegal • Home-made vs. manufactured • Tampered with • Supply source: licensed agent, friend, self, or illegal seller	• Past ocular history and pre-injury best corrected vision • General systemic • Exposure to education (in media, TV, newspapers, or at school about dangers of fireworks)	• Qualitative description of the accident • Mechanism of injury • Time of injury • Outdoor, indoor, or in a public display • Run by a professional vs. an amateur • Locality in which injury occurred • Intentionality • Estimated distance from the focus of injury	• Goggles or glasses wearing • Role: producer, operator, bystander, or passer-by • Adult supervision (for ages less than 12 years) • Habits (if >= 15 years and related to fireworks festivities): smoking, alcohol, and/or addiction	• Pre-hospital care • Time from the onset of injury to examination	• Ocular injuries; diagnostic titles • Laterality • Photographs, sizes, positions (axial, anterior to extra ocular muscle insertions, scales of 1 to 4 plus or percentage of involvement) • Injury zone[2] • Visual acuity and best corrected vision; at presentation, discharge, and follow up • Relative afferent pupillary defect • Injury type[2] • Severity • Hospitalization and its duration • Indications for hospitalization • Operations • Associated body injuries • Disability period • Costs: inpatient, indirect, rehabilitation, and home rest • Enucleation • Visual impairment: blindness and low vision; monocular and binocular • Cosmetic status	• Examinations and diagnostic procedures performed, like imaging studies

Negrel proposed an injury scheme in which injury related attributes are organized under categories: pre-event, event, and postevent.[25]
In addition to subjects mentioned in the Editorial text, investigations on the long-term course of multiple embedded corneal foreign bodies, complications of conjunctival burns and limbal stem cell deficiency, corneal contusion, and chemical and allergic injuries are recommended.

* For references refer to the Editorial of the issue.