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. The origin of the festivity goes back to a Zoroastrian tradition circa 1725 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.

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%) followed by eyes (up to 27%) which also sustain the most serious ones. 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.

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. (Appendix; Table 1)

Based on various reports, more than 10% of the casualties need hospitalization and surgical care. 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. (Appendix; Table 2)

On rare instances, firework agents have caused extensive burns and scarring, amputations of the extremities, intracranial injury, and even death (due to extensive burn or massive explosions). Frequently, severe injuries of the eyes cause monocular blindness: up to 10% of the injured eyes. The expression ‘fireworks blindness’ is being used in order to create awareness over this potential risk. 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. The explosive nature of the injury, on rare occasions, has resulted in bilateral blindness.

Despite some publicized facts about this serious public health problem, 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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References
### Appendix

#### Table 1. Taxonomy of fireworks-related eye injuries: Anatomical Categorization

<table>
<thead>
<tr>
<th>External</th>
<th>Anterior segment</th>
<th>Posterior segment</th>
<th>Orbital</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Eyelid burn</em></td>
<td><em>Thermal conjunctivitis</em></td>
<td><em>Scleral contusion</em></td>
<td><em>Intraorbital foreign body</em></td>
</tr>
<tr>
<td><em>Eyelid abrasion</em></td>
<td><em>Conjunctival abrasion</em></td>
<td><em>Commotio retinae</em></td>
<td><em>Retrolbulbar hemorrhage</em></td>
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<tr>
<td><em>Eyelid foreign bodies</em></td>
<td><em>Conjunctival laceration</em></td>
<td><em>Retinal hemorrhage</em></td>
<td><em>Blow out fracture</em></td>
</tr>
<tr>
<td><em>Eyelid contusion</em></td>
<td><em>Conjunctival burn</em></td>
<td><em>Berlin's edema</em></td>
<td><em>Orbital fracture with deformity and/or entrapment</em></td>
</tr>
<tr>
<td><em>Partial thickness eyelid laceration</em></td>
<td><em>Punctate epithelial erosion and keratopathy</em></td>
<td><em>Partial thickness scleral laceration</em></td>
<td><em>Optic nerve avulsion</em></td>
</tr>
<tr>
<td><em>Eyelid margin laceration</em></td>
<td><em>Corneal abrasion</em></td>
<td><em>Partial thickness corneoscleral laceration</em></td>
<td><em>Traumatic optic neuropathy</em></td>
</tr>
<tr>
<td><em>Full thickness eyelid laceration</em></td>
<td><em>Corneal burn</em></td>
<td><em>Vitreous base avulsion</em></td>
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<tr>
<td><em>Canthus laceration</em></td>
<td><em>Corneal foreign bodies</em></td>
<td><em>Vitreous hemorrhage</em></td>
<td></td>
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<tr>
<td><em>Eyelid laceration with significant tissue loss</em></td>
<td><em>Corneal contusion</em></td>
<td><em>Retinal tear and dialysis</em></td>
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<tr>
<td><em>Eyelid laceration with lacrimal apparatus involvement</em></td>
<td><em>Posttraumatic infectious keratitis</em></td>
<td><em>Choroidal rupture at macula or elsewhere</em></td>
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<tr>
<td></td>
<td><em>Partial thickness corneal laceration</em></td>
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<td></td>
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<tr>
<td></td>
<td><em>Full thickness limbal laceration</em></td>
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<tr>
<td></td>
<td><em>Full thickness corneal laceration</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Posttraumatic uveitis</em></td>
<td></td>
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<tr>
<td></td>
<td><em>Iris sphincter rupture</em></td>
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<td></td>
<td><em>Hyphema (gross and microscopic)</em></td>
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<td></td>
<td><em>Iridodialysis</em></td>
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<tr>
<td></td>
<td><em>Traumatic cataract</em></td>
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<tr>
<td></td>
<td><em>Lens subluxation/dislocation</em></td>
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</table>

BETT (Birmingham Eye Trauma Terminology) system is the standardized scheme for ocular trauma. BETT and the International Classification of the Diseases 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

<table>
<thead>
<tr>
<th>Severity</th>
<th>Injury Description</th>
</tr>
</thead>
</table>
| **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

<table>
<thead>
<tr>
<th>Demography</th>
<th>Agent-related</th>
<th>Past medical and social history</th>
<th>Context</th>
<th>Event</th>
<th>Pre-event</th>
<th>Outcome</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Agent</td>
<td>Past ocular history and pre-injury best corrected vision</td>
<td>Qualitative description of the accident</td>
<td>Goggles or glasses wearing</td>
<td>Pre-hospital care</td>
<td>Ocular injuries; diagnostic titles</td>
<td>Examinations and diagnostic procedures performed, like imaging studies</td>
</tr>
<tr>
<td>Gender</td>
<td>Explosive vs. non-explosive</td>
<td>General systemic</td>
<td>Mechanism of injury</td>
<td>Role: producer, operator, bystander, or passer-by</td>
<td>Time from the onset of injury to examination</td>
<td>Laterality</td>
<td></td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>Legal vs. illegal</td>
<td>Exposure to education (in media, TV, newspapers, or at school about dangers of fireworks)</td>
<td>Time of injury</td>
<td>Adult supervision (for ages less than 15 years)</td>
<td></td>
<td>Photographs, sizes, positions (axial, anterior to extra ocular muscle insertions, scales of 1 to 4 plus or percentage of involvement)</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Home-made vs. manufactured</td>
<td>Outdoor, indoor, or in a public display</td>
<td>Habits (if &gt;= 15 years and related to fireworks festivities): smoking, alcohol, and/or addiction</td>
<td></td>
<td></td>
<td>Injury zone&lt;sup&gt;2&lt;/sup&gt;</td>
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<tr>
<td>Occupation</td>
<td>Tampered with</td>
<td>Run by a professional vs. an amateur</td>
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<td>Visual acuity and best corrected vision; at presentation, discharge, and follow up</td>
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<tr>
<td>Cultural background and traditions</td>
<td>Supply source: licensed agent, friend, self, or illegal seller</td>
<td>Locality in which injury occurred</td>
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<td></td>
<td></td>
<td>Relative afferent pupillary defect</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Intentionality</td>
<td></td>
<td></td>
<td></td>
<td>Injury type&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Estimated distance from the focus of injury</td>
<td></td>
<td></td>
<td></td>
<td>Severity</td>
<td></td>
</tr>
</tbody>
</table>

Negrel proposed an injury scheme in which injury related attributes are organized under categories: pre-event, event, and postevent.<sup>25</sup> 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.