Original Article

Ocular spectrum of kite injury: A six-year trend at a tertiary eye care center

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Purpose: To assess ocular morbidity attributable to kites (*patang*) with emphasis on the cause, type and severity of the injury, complications, and final visual outcome. **Methods:** All the patients with a history of kite injury during months of Makar Sankranti for consecutive 6 years (2014–2019) were included in this study. A B-scan, orbital X-ray, and CT scan were performed for extensive ocular evaluation. **Results**: Out of 68 patients with kite-related injury, 58 were male and 10 were female. Globe rupture (20), lid laceration (18), penetrating injury (9), wooden foreign body in the anterior or posterior chamber (7), superficial foreign body (4), hyphema (7), and vitreous hemorrhage (3) due to falling from height were noted. Factors associated with a poor final visual outcome in our study were poor initial visual acuity, globe rupture, intraocular foreign body, and development of endophthalmitis. **Conclusion:** Kites can cause serious preventable injuries mostly among pediatric males. The use of protective eyewear and public awareness can decrease ocular injury significantly.

Key words: Awareness, kite, ocular injuries

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Kite (*patang*) flying has tremendous popularity in India. It is celebrated on a large scale as a festival on the Makara Sankranti and Basant Panchami in northwest Indian states in January and February. During this time in this part of India, injuries are commonly seen due to the kite itself or the kite strings (*manja*). Continuous increase in competitiveness in this sport leads to the use of dangerous techniques by the people to flaunt their skills. They also started using harmful methods to make thread strong, like coating it with glass and glue to make the thread razor sharp. These days nonbiodegradable synthetic fibers based threads are used frequently, which are hard to break and leads to a sudden surge in dangerous kite-string-related injuries.[1,2] It can cause primary impact ocular injuries such as globe penetration or lid trauma. Secondary injuries occur due to falling from height ignorantly while flying kite or when the string gets wrapped around the feet of a person leading to falling from a height or moving two-wheelers get trapped in strings leading to injuries to head or eye.

While several papers have dealt with neck and torso injuries by kites and kite strings, ocular involvement has never been reported in the literature with such a large number of cases. We aimed to assess ocular morbidity attributable to kites with emphasis on the cause, type and severity of the injury, complications, and final visual outcome.

Methods

This study was conducted as a prospective cohort analysis of kite-related injuries to the eye during the month of Makar Sankranti (January) for consecutive 6 years (2014–2019) at a tertiary eye care center in northwest India. Sampling was done using a "consecutive sampling" method. This study adhered to the Declaration of Helsinki. The study was approved by the Research Ethical Committee of Institute. Written informed consent was taken from every patient/attendant.

Patients of all age groups with a recent history of kite-related injuries were included and analyzed according to age, gender, active participant or bystander, laterality, location, and severity of eye injury. The patients underwent a detailed ocular examination. A B-scan or orbital X-ray or CT scan was performed for extensive ocular evaluation as and when indicated. The injuries were classified according to the Birmingham Eye Trauma Terminology System (BETTS).[3] The cohort of 68 patients was studied concerning surgical interventions and post-traumatic complications, additional management during follow-up, days of hospitalization, number of consultations, time of follow-up, initial best-corrected visual acuity, and final best-corrected visual acuity. No patient had any kind of ocular surgery previous to the kite injury. Every patient/attendant was asked some specifically designed questions related to the awareness about kite-related ocular injuries. All the patients received appropriate surgical or medical therapy at our ocular emergency. A minimal follow-up of at least 12 months was used to assess the degree of damage over a longer period.

Data were collected using Excel (Microsoft Office 2010). Statistical analysis was performed with appropriate statistical software. Normally distributed data were expressed as mean ± standard deviation (SD) and range (min; max). Categorical variables were presented as numbers and percentages (%). For subgroup analysis, continuous variables

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were compared using the *t*-test. A *P* value < 0.05 was determined to be statistically significant.

Results

Of the 68 patients, 58 were males and 10 were females. The age range of these patients was 5 to 40 years (mean of 16 years). All the cases have unilateral involvement. Around 92.64% of the victims presented within 48 h of eye injury. The right eye was involved in 31 cases and left eye in 37 cases [Table 1]. The kite-related ocular injury was seen in 12 cases in 2014, 10 in 2015, 13 in 2016, 11 in 2017, 9 in 2018, and 13 in 2019. At the time of presentation, a variety of ocular surface damage was noted [Fig. 1, Table 2].

There were 50 cases of globe injury [Fig. 2] and 18 cases of adnexal (lid) injury. Nearly 52.93% of patients were with open globe injury while 16.17% had closed globe injury. The major injury was the globe rupture (29.4%), followed by the lid tear alone (26.5%) and lid tear with corneal tear (13.2%). Although most patients with closed eye injuries were treated on an outpatient basis. Cases with open eye injury were advised admission for further management and observation. Admitted cases included patients with lid tear, corneal and scleral tears, hyphema with raised intraocular pressure, intraocular foreign body (IOFB), and globe rupture [Fig. 3].

Primary tear repair was done in all the needed patients within 24 h. Among the cases with IOFB, 4 cases had wooden foreign body penetrated up to the crystalline lens while rest 3 had wooden foreign body penetrated deep in the posterior segment. Foreign body removal augmented with intracameral or intravitreal voriconazole was done within 1–5 days in all the cases. Among these open globe injuries, 12 cases had B-scan proven retinal detachment, for which vitrectomy was possible in only 3 cases. Three cases ended up in inoperable endophthalmitis. Traumatic cataract was developed in 28 cases which were removed at the mean duration of 6 weeks (range 4–10 weeks) after the primary surgery. The average number of days of stay of admitted patients was 5 days (median = 4 days).

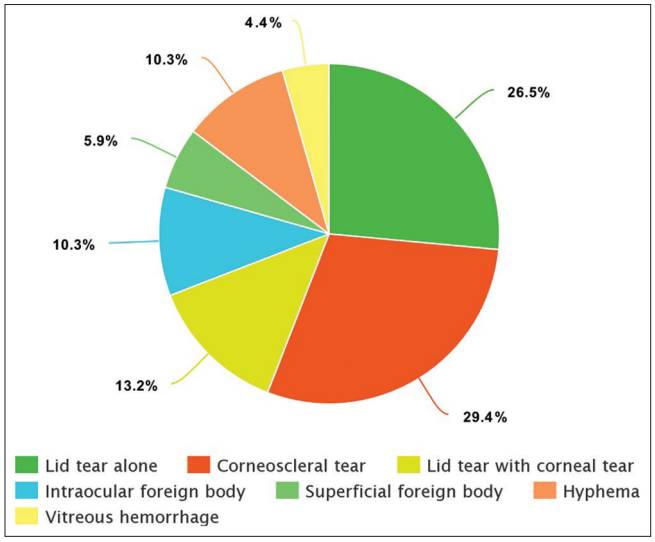

Figure 1: Graphical representation of the type of injury

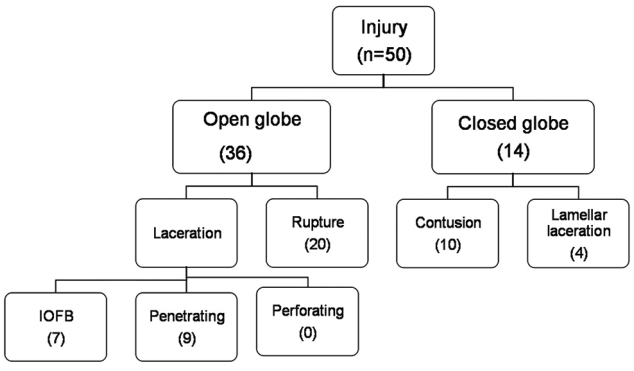

Figure 2: Pattern of ocular injuries according to Birmingham Eye Trauma Terminology System classification

Cases with hyphema and vitreous hemorrhage were regularly followed up on medical management. Among the cases with hyphema, 3 cases also had B-scan proven vitreous hemorrhage, out of which one underwent vitrectomy because of its unresolved nature at 3 months follow-up. In the end, all the cases with closed globe injury were recovered with good visual acuity.

Primary injury due to kite or kite string was seen in 54 cases, while the rest 14 cases had a secondary injury due to fall from height or vehicle. Primary impact mainly caused open globe trauma while closed globe trauma was associated with secondary injury. A total of 51 patients were actively involved in kite flying while 17 were bystanders including vehicle riders. Injuries in bystanders were corneoscleral tear (rupture) (8), lid tear (2), IOFB (2), and hyphema (5).

According to the initial assessment of vision at the time of presentation to the hospital 6 eyes had no perception of light (PL negative), 17 eyes had visual acuity of hand movement to the perception of light (PL positive) while 20 patients had to count fingers to 20/200 vision, 25 eyes had visual acuity better than 20/200. For statistical analysis, the final visual acuity was taken in LogMAR units and categorized into two groups ≤1 LogMAR and >1 LogMAR. Final visual acuity was significantly better with closed globe injury (P = 0.044). In the end, 8 cases ended up with no perception of light. Factors related to the poor final visual outcome were initial poor visual acuity, globe rupture, retinal detachment, post-traumatic endophthalmitis, and bystanders [Table 3].

Based on the questionnaire, 89.71% of patients were well aware of kite-related injuries involving any part of the body but only 54.41% of patients were aware of devastating ocular features. Besides this, none of them reported the use of any protective eyewear at the time of injury [Table 4].

Discussion

In India, kite flying is taken as a competitive sport wherein one tries to have a winning edge by coating his/her kite's string with glass and starch known as *manja*. However, by doing so, they forget that this *manja* can injure both humans and animals. Overall, the most frequently affected regions due to kite injury are head and neck (59%) and upper extremities (28%).[5] Kite-flyers are prone to injuries to their hands and faces.

Table 1: Social and demographical characteristics

VARIABLES	
Mean age (years)	16±4.22
Male/female	58/10
Right eye/left eye	31/37
Primary injury/secondary injury	54/14
Active participants/bystanders	51/17
Mean duration of the presentation	30.10±22.92 h
Mean duration of hospital stay	5.37±1.56 days

Table 2: Various ocular injuries

TYPE OF INJURY	INJURY	NUMBER (%)	MODE OF INJURY (*n*)
Open globe injury	Lid Laceration (full or partial thickness)	18 (26.47)	Kite string (12), kite (5) and fall from the vehicle (1)
	Rupture (corneoscleral tear)	20 (29.41)	Kite (18) and fall from height (2)
	Penetrating injury (corneal or scleral tear)	9 (13.23)	Kite (8) and fall from the vehicle (1)
	With lid tear	4 (5.88)	
	Without lid tear	5 (7.35)	
Closed globe injury	Intraocular foreign body	7 (10.29)	Kite (7)
	Superficial foreign body	4 (5.88)	While flying kite (4)
	Hyphema	7 (10.29)	Fall from the vehicle (5) and fall from height (2)
	Vitreous hemorrhage alone	3 (4.41)	Fall from height (3)

Table 3: Factors affecting final visual outcome

FACTORS	NUMBER (*n*)	BEST CORRECTED VISUAL ACUITY (final)		*P*
		0-1 Log MAR (*n*, %)	1.1 LogMAR- no PL (*n*, %)	
Type of injury				
Lid laceration	18	18 (100)	0 (0)	<0.0001
Globe rupture	20	2 (10)	18 (90)	<0.0001
Penetrating injury	9	5 (55.55)	4 (44.44)	0.6469
Intraocular foreign body	7	4 (57.14)	3 (42.85)	0.6064
Contusion	10	5 (50)	5 (50)	1.0000
Lamellar laceration	4	4 (100)	0 (0)	0.0082
Associated involvement				
Lens damage	28	21 (75)	7 (25)	0.0002
Hyphema	7	4 (57.14)	3 (42.85)	0.6064
Vitreous hemorrhage	3	2 (66.66)	1 (33.33)	0.4561
Retinal detachment	12	1 (8.33)	11 (91.66)	0.0001
Post-traumatic endophthalmitis	3	0 (0)	3 (100)	0.0253
Presenting visual acuity				
0-1 LogMAR	25	24 (96)	1 (4)	<0.0001
1.1- PL negative LogMAR	43	8 (18.60)	35 (81.40)	<0.0001
Involvement				
Active participant	51	28 (54.90)	23 (45.09)	0.3242
Bystander	17	5 (29.41)	12 (70.58)	0.0180
Primary injury	54	24 (44.44)	30 (55.55)	0.2505
Secondary injury	14	6 (42.85)	8 (57.14)	0.4578

PL- the perception of light

This study reported a wide spectrum of kite-related injuries. Open globe injuries are more common than closed globe injuries. Kite injuries affecting the globe are highly vision-threatening as the impact injury due to high-velocity objects is grossly disastrous.[6,7] Besides, the risk is not only with the active participants but also with the bystanders with higher chances of poor visual prognosis as ocular reflexes are not in an alert state in bystanders.[8,9] Secondary head injuries due to falls can be life-threatening. Luckily, none of our patients had a significant head injury. Hence, there was no case with neurophthalmological features.

Severe and preventable eye injuries not only affect an individual but also imposes a burden on the socioeconomic condition of society. Patients in our study were young and fully embedded in school or employment activities. Functional loss of an eye might reduce the potential lifelong manpower. Multiple surgical interventions, general anesthesia, and hospital stay are an add-on to economic burden. Besides, the injuries led to an absence of the victims at work and a reduced manpower and work capacity.

Kite flying cannot be banned in a country like India where it is taken as an enjoyable festival time. However, judicious offseason banning can be encouraged given the public sentiments and interest. A well-defined open area like a stadium or farmhouse could be used for kite flying on special occasions. Based on the response to the questions, a significant number of patients/caretakers were aware of the kite and kite-strings-related injuries. The major role in this awareness is electronic, digital, or social media. However, awareness about grievous ocular effects was quite low. Despite being aware of the consequences, none was using any protective measures. We should make common people aware of its sequel, through information booklets, pamphlets, and electronic media. People should be encouraged to follow safety measures like the use of protective goggles.

Conclusion

As studies about ocular features of kite-related injuries are very limited in literature, we tried to cover a wide range of spectrum over a long period to draw the public attention towards such an important ignored topic. There is a strong need for proper education and creating supervised awareness in society about the potential vision-threatening complications of kites and kite strings.

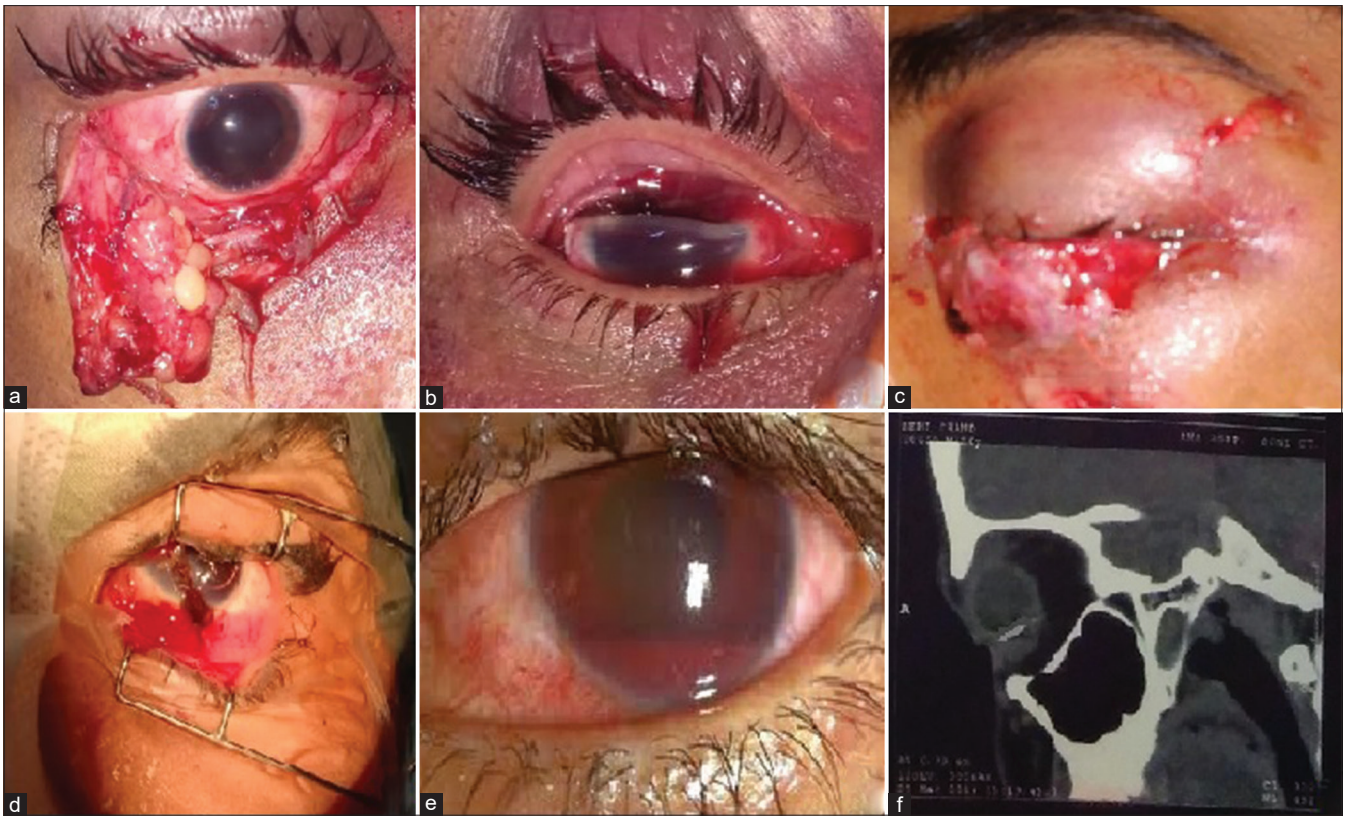

Figure 3: Ocular injuries (a) lid laceration with flap, (b) full-thickness corneal tear with scleral involvement, (c) lid laceration without canalicular involvement, (d) corneoscleral tear, (e) closed globe injury with hyphema, (f) CT scan showing intraocular foreign body

Table 4: Questionnaire related responses

QUESTIONS	YES (%)	NO
Any previous incident of kite-related trauma to you or your relatives or friends?	1 (1.47)	67
Was the patient actively flying kite or a bystander (including vehicle rider)?	51 (75)	17
Are you aware of kite-related injuries?	61 (89.71)	7
Are you aware of the grievous nature of ocular trauma by kites?	37 (54.41)	31
Do you know about the dangerous nature of kite strings?	63 (92.65)	5
Have you used any precautionary measurements, e.g., protective glasses?	68 (100)	0

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Prajapati C, Agrawal A, Atha R, Suri MP, Sachde JP, Shaikh MF, *et al*. Study of kite string injuries in Western India. Int J InjContrSafPromot 2017;24:136-9.
2. Borkar JL, Tumram NK, Ambade VN, Dixit PG. Fatal wounds by "manja" to a motorbike rider in motion. J Forensic Sci 2015;60:1085-7.
3. Kuhn F, Morris R, Witherspoon CD, Heimann K, Jeffers JB, Treister G. A standardized classification of ocular trauma. Ophthalmology 1996;103:240-3.
4. Sperry JL, Moore EE, Coimbra R, Croce M, Davis JW, Karmy-Jones R, *et al*. Western Trauma Association critical decisions in trauma: Penetrating neck trauma. J Trauma Acute Care Surg 2013;75:936-40.
5. Gupta P, Jain A, Patil NA, Thakor R, Kumar S. Kite string injuries: A thin line between a harmless sport and grievous injury. Int J Community Med Public Health 2018;5:2782-5.
6. Scott WR, Lloyd WC, Benedict JV, Meredith R. Ocular injuries due to projectile impacts. Annu Proc Assoc Adv Automot Med 2000;44:205-17.
7. Power ED, Stitzel JD, Duma SM, Herring IP, West RL. Investigation of ocular injuries from high velocity objects in an automobile collision. SAE Technical Papers. 2002;111:211-18.
8. Wisse RP, Bijlsma WR, Stilma JS. Ocular firework trauma: A systematic review on incidence, severity, outcome and prevention. Br J Ophthalmol 2010;94:1586-91.
9. Sundelin K1, Norrsell K. Eye injuries from fireworks in Western Sweden. Acta Ophthalmol Scand 2000;78:61-4.