Brief Communication

Calcium carbide related ocular burn injuries during mango ripening season of West Bengal, eastern India

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Abstract

Introduction: Calcium carbide used in fruit ripening industry as a cheap alternative to natural plant hormone ethylene produces highly inflammable acetylene gas. Inadvertent ignition of this gas can cause severe ocular burn injury with unilateral or bilateral blindness. **Objective:** To determine the characteristics and visual outcome of ocular burn injuries from calcium carbide during mango ripening season of West Bengal, eastern India. **Materials and methods: A** prospective study of all cases of calcium carbide related ocular burn injury attending a tertiary care hospital during mango ripening season was carried out. The demographic features, characteristics of the injury, management and outcomes were recorded. **Results:** Fifty five eyes of 33 patients were studied. Males were more commonly affected (20 patients, 60.6%) than females. The injury was bilateral in 22 patients (66.66%). Seventeen patients (51.51%) were below 20 years of age. Ten eyes had open globe injuries and 45 eyes had closed globe injuries. One eye of a patient had to be enucleated (3%). Children below 14 years of age were mainly injured while playing with indigenous fireworks of shooting carbide. Middle aged women were affected particularly during ignition of evening lamps. Carbide lamp was another source of injury. **Conclusion:** Males are more commonly affected by calcium carbide related ocular injuries. Children and young adults are the common victims. Such injuries can involve both the eyes and cause a permanent visual disability.

Keywords: calcium carbide, ethylene, ocular burn, West Bengal, India

Introduction

Calcium carbide (CaC_2) is used in the fruit ripening industry as a source of acetylene which is analogous to the natural plant hormone ethylene (Patnaik, 2003; Abeles & Gahagan, 1968). It is used extensively in rural households in West Bengal, eastern India, particularly during mango ripening season. Acetylene is a highly inflammable gas and it is often mixed with phosphene, another inflammable gas derived from calcium phosphide which is found as an impurity with calcium carbide. Inadvertent ignition of these gases can cause severe ocular burn injuries particularly to the children while playing with calcium carbide with water in bottles thus making indigenous firework of shooting carbide or to the housewives while igniting evening lamps in rooms harboring un-lidded calcium carbide containers.

However, only one report of calcium carbide related ocular burn injury was found despite thorough MEDLINE search (Testud et al, 2002).

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Here, we present 33 such patients who attended our tertiary care eye hospital in Kolkata, eastern India in last two years to emphasize the importance of calcium carbide as a source of ocular burn injuries during mango ripening season of West Bengal.

Materials and methods

This was a prospective case series. All the patients who attended the eye emergency and OPD of a tertiary care hospital in Kolkata, West Bengal, eastern India, suffering from burn injuries from calcium carbide ignition during mango ripening season of last two years (from April to July in 2010 and 2011) were included in the study.

Detailed ocular examinations were done for the patients. Assessment of visual acuity, slit lamp examination, fundus examination with 90 D lens and indirect ophthalmoscopy were done wherever possible. Ultrasonography B-scan and X-ray orbit were performed as and when indicated. The classification of injuries (Kuhn, 1996) was done using the Bermingham eye trauma terminology system (BETTS). A written informed consent was taken from all the patients/ their parents and the permission from the institutional ethics committee was obtained. All the patients were followed up for at least three months.

Results

Fifty-five eyes of 33 patients were observed with ocular burn injuries due to calcium carbide during the study period from April to July in 2010 and 2011, during mango ripening season of West Bengal. Among them 20 patients (60.6%) were male. Injury was bilateral in 22 patients (66.66%). Right eye was involved in 28 cases and left eye was involved in 27 cases. Age range of the patients varied between 9 years to 50 years. Seventeen patients were below 20 years of age.

Children were mainly injured while playing with calcium carbide and water in lidded glass bottles, thus creating indigenous fireworks. After vigorously shaking the glass bottles, the mouth of the bottle was ignited which caused the blasts. Women while igniting evening lamps caught fire in the rooms harboring un-lidded calcium carbide containers. Carbide lamp was another source of injury.

The most common presentation was blisters over the eye lids and superficial corneal burn (13 patients, 39.4%) followed by sclero-corneal rupture with uveal tissue prolapse (10 patients, 30.3%). Corneal deep burn with limbal ischemia was found in 8 patients (24.24%). Four patients (12.12%) presented with hyphema and 6 patients (18.18%) had cut injuries over the lid. According to BETTS, 10 eyes had open globe injuries and 45 eyes had closed globe injuries (Table 1).

Table 1: Distribution of eye trauma according to BETTS*

Type of injury	Number of eyes (Total no.55)
Contusions	4
Lamellar lacerations	8
Superficial foreign bodies	33
Penetrating injury	6
Perforating injury	0
Ruptured globe	4

* Bermingham eye trauma terminology system

Table 2: Visual outcome of 55 eyes of 33 patients suffering from calcium carbide related ocular burn injury

Vision	At initial presentation (Number of eyes)	After 3 months (Number of eyes)
>20/40	0	4
20/40 – 20/200	35	43
<20/200 - CF	7	3
HM+	8	2
PL+	4	1
PL -	1	2
CF – Counting finger, HM – Hand movement, PL – Perception of light		

At initial presentation, one eye of a 9-year-old boy had no perception of light (PL negative), which ultimately had to be enucleated. The visual acuity of hand movement to perception of light (PL positive) was found in 12 eyes. Seven eyes had vision of counting fingers to 20/200. Visual acuity was 20/40 to 20/200 in 35 eyes. After 3 months follow up 43 eyes had improved visual acuity at the range of 20/40 to 20/200 (Table 2) .

Vision did not improve in 3 patients with visual acuity of hand movement to perception of light. Another eye deteriorated from PL positive to PL negative state.

Thirteen patients with superficial eyelid burn and superficial corneal burn were treated at the ophthalmology outpatient department. Twenty patients with blisters and cut injury of the eyelids, deep corneal burn with limbal ischemia, sclero-corneal rupture with uveal tissue prolapse and hyphema were admitted. All the patients were given copious normal saline wash and all the particulate matter and soot particles were removed under local anesthesia with forceps. Sclero-corneal ruptures were repaired in all the cases except in one patient where the eye had to be enucleated (3% of all patients). The patients with hyphema were given anterior chamber wash and cut injuries over the lids were repaired. The patients were treated with systemic antibiotics, antibiotic-steroid eye drops and ointments, cycloplegic eye drops and tear substitutes. Regular dressings were done and the conjunctival fornices were swept with glass rods to prevent symblepharon.

Discussion

Ocular burn injuries due to fire crackers have been reported during various ceremonies all over the world. These injuries are common during Deepavali and Kalipuja, Gurupurva and Shab-e-Barat in India (Arya et al, 2001; Kumar et al, 2010). To the best of our knowledge, after a thorough MEDLINE search, there was only a single report of ocular burn injury due to calcium carbide published in the literature (Testud et al, 2002). In the Netherlands, there is a traditional custom called Carbidschieten (Shooting Carbide) where carbide and water are put in a milk churn with a lid and ignited with a torch to create an explosion (Carbidschieten 2009). In mango ripening season of West Bengal, eastern India, calcium carbide is widely available in village households as a cheap alternative to ethylene, a natural plant hormone. The indigenous copying of this Dutch fire works by the village boys of West Bengal was the main cause of calcium carbide related burn injuries to the children under 14 years of age. In other instances, women while igniting evening lamps caught fire in the rooms harboring un-lidded calcium carbide containers. Calcium carbide used in carbide lamps was another potential source of ocular burn injuries.

Males were predominantly affected (60.6%), which was similar to other ocular burn injury studies (Arya et al 2001, 83.3%). Most of the patients were below 20 years of age (17 patients, 51.51%) which corroborated with the findings of Arya (2001) et al (61.9%). We got a high percentage of female patients of 20 years to 40 years of age affected by the calcium carbide related ocular burn (12 patients, 36.36%). They suffered from the injury mostly while lighting evening lamps. Also, bilateral injury was higher (22 patients, 66.66%) in present study than in other studies (Arya et al 2001, 11.9%). However, the enucleation rate (3%) was similar to the other studies (Arya et al 2001, 2.3 %). Therefore, calcium carbide used as a mango ripening agent was found to be a potential source of ocular morbidity due to burn injuries in our study. Also, the high amount of carbide needed to ripen the immature fruit and the presence of trace amounts of arsenic and phosphide in carbide make the healthy food tasteless and toxic.

Conclusion

It is important to be aware of the potential blinding effects of calcium carbide explosion. The promotion of fruit ripening in centralized fruit processing units and the use of alternate safer agents like ethylene, a natural plant hormone can prevent such disastrous consequences and provide healthy fruits to the consumers.

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