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Sir,

Ocular Exposure to CS Gas: The Importance of Correct Early Management

After assessment by 16 police forces,¹ all but two of the 43 forces in England and Wales² are now being issued with CS gas. Given this, and the growth in illegal usage, the prevalence of ocular injury from this agent seems destined to increase. We report the presentation and management of six patients simultaneously exposed to CS gas and review the current literature.

Case Report

The six individuals were affected when an illegally held substance, presumed to be CS gas (*O*-chlorobenzylidene malononitrile), was sprayed into the doorway of a public house. Two were hit by the spray directly, the other four being affected as the agent drifted into the bar. All six were rapidly transferred to Southampton Eye Unit where they underwent standard treatment for CS gas exposure of avoiding contact with water, or other irrigating solutions, and placing in a well-ventilated area. Electric fans were employed to increase airflow across the eye and facilitate the vaporisation of any dissolved gas.

Ocular examination 30 minutes later revealed only slight conjunctival injection. In particular the peri-orbital skin was undamaged, the pH was neutral in all 12 eyes, corneal sensation was normal and the anterior chambers quiet. One apparently paradoxical finding was a decreased tear break-up time (of 6–9 seconds) in the eyes of the four individuals indirectly affected, compared with normal in the two individuals receiving spray direct to the face. The following day all were asymptomatic with no respiratory or dermatological sequelae.

Despite a strong smell of CS vapour, no member of staff suffered any ill effects. No specific protective measures were taken other than opening the windows to improve ventilation.

Discussion

CS gas was developed at the Chemical Defence Experimental Establishment at Porton, England in the 1950s. The white crystalline substance was initially placed in a canister with an explosive device which, upon detonation, formed a smoke of suspended particles. Further development resulted in the product being micronised and mixed with an anti-agglomerant (CS₁) or treated with silicone water repellent (CS₂), a form which remains potentially active as a dust for several weeks.³

Tear gas, used world-wide for crowd control, is the common term for a group of some 15 chemicals otherwise referred to as 'harrassing agents' on account of their ability to cause temporary disablement. The most common are *O*-chlorobenzylidene malononitrile (CS gas), 1-chloroacetophenone (CN gas) and dibenzoxazepine (CR gas). Toxicology data are scant as much of the research has been military and some classified as secret,⁴ but all are irritant to skin, eyes and respiratory tract.

CR gas is the most potent lacrimator, but has few systemic effects.⁵ CN gas is the most toxic and a constituent of the self-defence spray Mace; deaths from asphyxiation or pulmonary injury have been reported. CS gas is 10 times more potent as a lacrimatory agent than CN but with less toxicity: studies amongst volunteers noted rapid cessation of all symptoms within minutes of removal from exposure. The British Secretary of State for the Home Department in 1969³ concluded that 'whilst exposure to CS gas can be lethal in the form of toxic pulmonary damage leading to pulmonary oedema, such an occurrence would only be at concentrations that were several hundred times greater than exposure dosage that produces intolerable symptoms' which would force the individual to leave the vicinity. In times of conflict such evasive action may not be possible and in May 1988 the Federal Laboratories Inc. in the USA suspended sale of the agent.⁶

Until recently United Kingdom mainland police forces had used CS gas only during the Toxteth riots of 1981.⁷ However, in March 1996, despite earlier deferral when a police officer suffered ocular burns,⁸ more than 2000 officers in 16 authorities in England and Wales were issued with CS gas in a 6 month trial. No proven fatalities have occurred, but CS gas has been implicated by the media in the death of one individual during an aggravated arrest.¹

Illegally acquired CS gas has a concentration of 0.2%, with large amounts of propellants and solvents⁹ which may contribute to the symptoms. The 'CS gas Incapacitant' used by the police force⁵ contains a 5% solution of CS in a solvent of methyl iso-butyl ketone propelled by nitrogen. The solvent is an ocular irritant which on contact with the skin causes tingling, irritation, erythema, drying and blistering. Initial symptoms occur up to 8 hours after exposure and may last for a week.

If the correct treatment is instigated, in the majority of cases all symptoms cease 15–30 minutes after withdrawal from exposure. Contrary to the general rule of copious ocular irrigation following chemical injury,¹⁰ evaporation (facilitated by a fan or air from a cold hairdryer) is the preferred management. Irrigation simply prolongs the severe burning sensation.¹¹

Affected skin may be washed with soap and water and any contact dermatitis treated with topical steroids. True chemical burns should be managed in the same way as thermal burns. Any patient with respiratory symptoms should be admitted for observation, humidified oxygen providing symptomatic relief. Some advocate that contaminated clothes should be removed and sealed in plastic bags: only on contact with water does the agent evaporate and exert its toxic effect. Severely contaminated clothing should be washed, through several cycles, in cold water in a well-ventilated area.

Ocular injury following CS gas exposure should be treated by forced evaporation only. Irrigation should be avoided to speed recovery from the unpleasant symptoms. Common sense alone should protect staff from the risk of injury, the only sensible precaution being the provision of maximal ventilation by opening windows wherever possible.

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