## Treating CS gas injuries to the eye

### Exposure at close range is particularly dangerous

EDITOR,—Jean-Paul Yih's editorial on injuries to the eye caused by *O*-chlorobenzylidene malononitrile (CS) gas, or tear gas, draws attention to the short term effects of the gas on the eye and suggests that such injuries may well be a future problem as individual police officers in Britain will soon be carrying pocket aerosols of CS gas.[1] Yih implies that the ocular toxicity of CS gas is rapidly reversible; however, the ocular irritation from 1-chloroacetophenone (another tear gas agent) typically lasts only 15 minutes but may persist for up to three days.[2] The problems are particularly pronounced when the charge of tear gas is fired at close range: powder infiltration of the conjunctiva, cornea, and sclera will occur. The forces are so great that conjunctival tearing may occur. Corneal stromal oedema and later deep vascularisation may ensue, and a multitude of complications have been reported, including symblepharon, pseudopterygium, infective keratitis, trophic ketatopathy, posterior synechia, secondary glaucoma, cataracts, hyphaema, vitreous haemorrhage, and traumatic optic neuropathy.[2] Thus exposure to tear gas is not a benign phenomenon, and serious ocular morbidity can result. One would expect this to occur frequently when tear gas is being administered at close range from an aerosol likely to be directed at the subject's face.

A major problem in handling a casualty with a chemical injury is to prevent the attendant staff from being contaminated with residual chemical agent. Thus the casualty's contaminated clothing should be removed and is best decontaminated by being hung on a washing line on a windy day. As this is probably impossible in most hospitals, the clothing should be temporarily stored in a sealed polythene bag to prevent degassing. If clothing is to be washed, cold water should be used because hot water will cause any residual CS gas to vaporise and give rise to symptoms in staff. Eyes contaminated with CS gas should be treated by blowing dry air over them; this should ideally be done in an open space with no attendants down wind or they too will be exposed to the effects of the gas. The casualty's facial skin and hair are best decontaminated by washing in cool water.

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2 Hoffman DH. Eye burns caused by tear gas. *Br J Ophthalmol* 1967;51:263-8.

### Poisons centre will monitor cases

EDITOR,—Jean-Paul Yih's concern about the identification and management of injuries to the eye caused by *O*-chlorobenzylidine malononitrile (CS) gas[1] is reflected by the number of inquiries about such injuries received by the National Poisons Information Service (London). In 1994, 354 emergency inquiries about CS gas were received from health care professionals throughout Britain.

In some circumstances differential diagnosis of the chemical is easy, but a recent inquiry to the service concerned an incident in which the ambulance crew had assumed that lacrimation was due to CS gas. In fact, the exposure had been to ammonia, and the initial management had therefore been inappropriate as the patient had not been decontaminated immediately. Ammonia is potentially more toxic than CS gas and can cause long term ocular damage.[2]

In most circumstances only short term health effects are associated with exposure to CS gas, but experience at the National Poisons Information Service (London) has pointed to long term health effects occurring. Several case reports also document such effects: 184 Vietnamese people at a detention centre reported cough, burns, shortness of breath, chest pain, sore throat, and fever, with all but one recovering within two weeks (G S Lau *et al*, fifth world congress of the World Federation of Associations of Clinical Toxicology Centres and Poison Control Centres, Taipei, 1994). A previously well 21 year old woman had continuing coughing, wheezing, and shortness of breath for two years after short term exposure.[2] Two cases of allergic dermatitis were confirmed by patch testing after the development of eczematous skin lesions and multiple vesicular eruptions.[4]

Many of the calls to the centre are related to single cases of either accidental or intentional exposure. Clusters of cases have, however, arisen after exposure in confined spaces. As chemical terrorism is potentially more of a hazard after the experience in Tokyo last March, emergency medical responders should be aware of the potential problems caused by CS gas and other volatile chemicals when they are used in confined spaces.[5] The centre is currently attempting to monitor the number of incidents involving CS gas, particularly as the police now have access to this product for public order disturbances and will soon be undertaking trials of CS gas for self defence.

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### Illegal "Mace" contains more toxic CN particles

EDITOR,—Jean-Paul Yih is right to warn of an imminent increase in the number of patients presenting as emergencies after exposure to *O*-chlorobenzylidine malononitrile (CS) gas.[1] Eye injuries are likely to predominate. It should be borne in mind that illegally obtained tear gas may well be composed not of CS but of another of the family of lachrymatory agents. These chemicals display a range of toxic and irritant effects.

The most common of these agents is chloroacetophenone, which is more toxic than CS.[2] It is the active component of the self defence spray Mace, being delivered by aerosol. Though the ocular symptoms from this may persist for over 24 hours, complete recovery is the rule. Systems that deliver chloroacetophenone powder, such as those fired from tear gas pistols or pens, are also readily purchased abroad. Solid particles of powder fired from these weapons cause mechanical as well as chemical injuries, especially if they are fired at close range. The mechanical damage is greater with the use of larger cartridges or old ammunition. The chloroacetophenone powder coalesces in the cartridge over time and forms larger and more penetrant particles on discharge. Fragments of the cartridge may also perforate or penetrate the ocular structures.[3]

Chloroacetophenone is neurotoxic and caustic.[4] If sufficient particles of it penetrate the corneal stroma severe scarring and ulceration with epithelial decompensation may ensue. Corneal sensation may be permanently reduced. Conjunctival effects include sloughing, limbal ischaemia, and the formation of symblepharon.

The initial treatment of these ocular injuries is to irrigate with isotonic saline and remove the remaining powder with a cotton wool pledget. Any remaining stromal particles should be removed with a needle tip at a slit lamp[5]: they are easy to remove as the surrounding stroma is often liquefied from the caustic effects of the chloroacetophenone powder. Mechanical injury is assessed and management started.

I endorse the advice that attendant medical staff should take great care in avoiding contamination while handling and examining any patient with tear gas injuries. I speak from experience.

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## Pitfalls in the diagnosis of subarachnoid haemorrhage

EDITOR,—Damianos E Sakas and colleagues report on four cases in which subarachnoid haemorrhage could have been mistaken for head injury and emphasise the role of computed tomography in such cases. We recently reviewed 26 patients who had both computed tomography and lumbar puncture out of 208 patients with confirmed subarachnoid haemorrhage seen at our institution over 41 months. Two clinically important pitfalls in the diagnosis of subarachnoid haemorrhage by computed tomography were highlighted.

Firstly, only six of 18 patients in whom computed tomography showed an abnormality had xanthochromia on analysis of cerebrospinal fluid. Our laboratory uses naked eye examination to detect xanthochromia. This method is insensitive and in a previous study detected only half of cases