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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- 1 Yih J-P. CS gas injury to the eye. *BMJ* 1995;311:276. (29 July.)
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Poisons centre will monitor cases

EDITOR,—Jean-Paul Yih's concern about the identification and management of injuries to the eye caused by *O*-chlorobenzylidene malononitrile (CS) gas¹ 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*-chlorobenzylidene 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 lamp⁵; 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

in a series of 32 samples of cerebrospinal fluid in which xanthochromia was found on spectrophotometry.² Failure to see xanthochromia does not exclude subarachnoid haemorrhage.

Secondly, only eight patients had an entirely normal computed tomogram. This rate of false negative results (3.8% (8/208)) is rather low since the sensitivity of computed tomography is only 95% on the day of bleeding and falls thereafter.³ In addition, the patients in whom the computed tomogram was normal were significantly more likely to have xanthochromia than those in whom it showed an abnormality (6/8 v 6/18, $P < 0.05$). This finding, which at first may seem paradoxical, is consistent with the hypothesis that the group with no abnormality on computed tomography is depleted by the misdiagnosis and exclusion of those without xanthochromia. Clearly, those with an abnormality on computed tomography are not subject to this potential source of misdiagnosis.

It has been stated that bloodstained cerebrospinal fluid without xanthochromia when the computed tomogram is normal can be explained by thunderclap headache and a traumatic lumbar puncture.⁴ In view of our findings we suggest that this could cause subarachnoid haemorrhage to be overlooked, particularly if the cerebrospinal fluid sample is taken within 12 hours of the onset of symptoms or if the supernatant is assessed by visual inspection: in both these cases xanthochromia may be absent in patients with subarachnoid haemorrhage. We believe that if the clinical suspicion of subarachnoid haemorrhage is sufficient to merit computed tomography then a lumbar puncture is indicated if the computed tomogram is normal. Uniform bloodstaining of the cerebrospinal fluid is highly suggestive even in the absence of xanthochromia and merits either conventional angiography or magnetic resonance angiography. This approach should prevent subarachnoid haemorrhage arising from an intracranial aneurysm going unrecognised.

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Medicine and nursing

Medicine and nursing need both scientific and naturalistic inquiry

EDITOR,—The issue of the *BMJ* of 29 July, exploring how nursing and medicine may interact more usefully, should prompt the nursing journals to initiate a similar debate in their pages. It was with dismay, though, that we read the two letters^{1,2} concerning an article by Hay.³ Although Hay's article received comment in the nursing press, the arguments surrounding it provide a timely rejoinder to the articles in the *BMJ*. The enthusiasm and impatience of nurses and midwives to develop research based practice, albeit within a framework that encompasses more than the scientific paradigm, is obvious to those in the professions. A recent series of workshops throughout Britain on the use of research in nursing led by one of us has reinforced this impression.

Hay is labouring under the misconception that "bedside nursing" is solely an intuitive activity

synonymous with the caring role of wife or mother and therefore in no need of a research base. Nothing could be further from the truth. Both objective science and more naturalistic methods of inquiry have a part to play, the former answering such questions as "Which is the most effective pressure relieving mattress?" and "Which urethral catheter is least likely to become blocked or infected?" and the latter addressing different issues, such as whether a hospital waiting list is really a queue and what in reality happens during the interactions between nurses and their clients. Indeed, nursing and midwifery have been far more progressive than medicine in recognising that health care research, involving as it does the social world of carers and patients, cannot be tackled solely through the scientific model—as witnessed by the fact that the *BMJ* has only recently published a series of articles outlining the scope and application of methods in qualitative research.⁴ It is not just science and mathematics (as Hay implies) in which health care researchers need to be proficient.

We agree that not all practitioners, be they doctors or nurses, should be expected to undertake research. If research based practice is to become a reality, however, then practitioners must be able to critically appraise both original research articles and reviews. To suggest that nursing or nurses should not strive to meet these standards does a disservice both to the profession and, more importantly, to those for whom it provides care.

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Nurses should have experience of medical training

EDITOR,—I agree with Jane Salvage that the traditional division of labour between doctors and nurses is changing and that nursing work is currently undervalued.¹ The move towards the ideal of expert nurses complementing but not substituting for expert doctors to provide a better service for patients must be based on mutual understanding of each other's current roles. Many doctors are ignorant of nursing work. I believe, however, that nurses are equally if not more ignorant of doctors' work. Most medical courses address doctors' ignorance of nursing work to some extent by incorporating some experience in nursing work. As far as I am aware, the converse is not true. Perhaps this should be considered in nursing courses to help mutual understanding.

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Senior nurses are out of touch

EDITOR,—Jane Salvage's attempts to examine what is happening to nursing is notable for its rejection of the past.¹ The contributions of Jacqueline Short (a nurse who became a doctor) and Ann Bradshaw (a lecturer in nursing), both with a different view,² are

said to show shaky reasoning and nostalgia for a mythical golden age.¹ M Barton³ rejects Hay's assertion⁴ that the nursing leadership is "frog-marching" nursing towards clinical autonomy (and research) against the wishes of the "rank and file." Our experience is that this is the case—not for every nurse, and clearly not for Barton, but for many. Acceptance of autonomy seems to be limited by an accountability that is equated with fear. This is engendered by a disciplinary regime often implemented by those who shout loudest on professionalism and relations with medicine.

Unlike the medical hierarchy, leaders in nursing rarely care for patients routinely in the same context as the rank and file. Many experienced ward nurses find themselves alienated from the leaders' views, often feeling unable to dissent in public or in print.

The public has its own clear idea of what nurses do. Booth has characterised nursing in terms of both mechanical and very complex functions, exemplified by plumping pillows and comforting patients.⁵ Many fear that leaders in nursing with a rather different agenda are hijacking their profession. Evolution is inevitable and necessary, but if the future holds a new role so radically different that those who are currently known as nurses may not be willing or able to accept it, then those who devise the successful model should find a distinctive name for their new profession. The future of nursing cannot exclude nurses, leaving the "basics to the untrained while we go ever higher."⁶

Whether nurses should accept further mechanical responsibilities that are rightly no longer considered to be appropriate for junior doctors is a matter for debate. Currently, nurses who have been so trained at times refuse to exercise these skills, invoking their professional autonomy when they are not happy about inadequate time being left for their more traditional work. A radical approach to "structural inequalities of sex and hierarchy"⁷ is not the answer, especially as entry to medicine at least is now independent of sex. Leaders in nursing may have lost their way in sociological theories, whose popular face has become an obsession with "handmaidenism," but the real problem lies elsewhere. The rank and file have seen the future, and it is understaffed.

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Problems of hierarchy are not confined to nursing

EDITOR,—The correspondence between M Barton¹ and Robert L Hay² clearly illustrates the difficulties that doctors and nurses have when trying to understand one another's changing professions. Both professions will continue to face profound changes in the way they practise. Change is always difficult and provides a rich environment for discontent and suspicion. It is only by trying to understand the pressures on each other's professions that we can avoid destructive bickering and conflict, which would weaken the public's confidence in our professionalism. Two articles attempted to keep the dialogue open in a spirit of mutual respect.^{3,4}

Hay singles out poor research in nursing, male leadership, and incomprehensible management style for particular criticism.² Perhaps the medical profession should put its own house in order before lecturing others. The stereotype of a domineering (usually male) consultant encouraging his registrar