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Chemical weapons

Easy to make, hard to destroy

Chemical weapons destroy men, women, and children indiscriminately but leave buildings and equipment intact, and the asphyxia, paralysis, and skin blistering that they cause are perceived as more terrible than shrapnel or bullet wounds.[1] The United Nations conference on disarmament has been considering ways to control them for a decade.[2] Despite this diplomatic activity at least 30 countries now have stockpiles of chemical weapons,[3] the United States is producing them again after an interval of 20 years,[4] and there is clear evidence of their use against military and civilian targets in the Middle East.[3 5]

Agents of chemical warfare produce their effects by either local or systemic action. Local irritants such as the vesicant mustard gases act principally on the skin and mucous membranes,[6 7] and chlorine and phosgene cause a local pneumonitis after their inhalation. Tear gas and other irritant but fairly non-toxic "harrassing" agents stimulate afferent nerve fibres in the conjunctiva and respiratory tract and have been widely used to quell civil unrest.[8] They too are chemical weapons under the terms of the Geneva Protocol, and their first use would be prohibited in war. Hydrogen cyanide and the organophosphorus nerve agents require systemic absorption to produce their toxic effects.[9] The nerve agents are deployed as volatile liquids or dispersed droplets and are lethal in milligram amounts. They undergo rapid absorption through the skin and lungs, and then form complexes with acetylcholinesterase—thereby inhibiting the enzymatic destruction of acetylcholine.[10] Unchecked stimulation of muscarinic receptors causes miosis, incontinence, hypersecretion, bronchospasm, and bradycardia. Excessive acetylcholine at nicotinic receptors results in muscle twitching followed by profound weakness. In the central nervous system initial restlessness is followed by medullary paralysis and death. Modern agents are colourless and odourless and may be detected only with complex instruments.[11 12]

Both physical and pharmacological forms of protection against chemical weapons have been developed. Overalls made of fabric impermeable to vapour—woven activated charcoal or rubber—provide some protection but greatly limit physical activity.[13] Penetrants have, however, been developed to render such clothing ineffective.[3] Gas masks are designed to filter particulate poisons and adsorb or decompose non-particulate toxins, but their efficacy depends on a good seal with the face, which is difficult to achieve.[14] Moreover, "mask breakers" (such as perfluorisobutene[3]) have been developed, which saturate the charcoal filters and permit the toxins free passage.

The effects of the organophosphorus nerve agents on acetylcholinesterase may sometimes be reversed by "reactivators."[10 15] These are oximes that displace the toxin from the enzyme if given before an irreversible reaction has occurred. The British Army apparently relies on pralidoxime, though this is ineffective against the nerve agent Soman.[16 17] The muscarinic effects of acetylcholine may be countered by atropine, although enormous doses may be needed. Prophylactic dosing with pyridostigmine (which reversibly inactivates acetylcholinesterase and prevents the irreversible effects of organophosphorus nerve agents) has also been suggested.[15 18] Droplets of nerve agents or mustards on the skin may be adsorbed by activated charcoal or Fuller's earth, oxidised with chloramine T or a slurry of bleaching powder, or hydrolysed by alkaline diethylenetriamine.[13 19]

The military seems to be the main beneficiary of this complex technology. Attempts to protect civilians, who are the main targets, seem futile. Older readers may recall with some affection the gas masks with which they were issued during the second world war, but these would offer little protection against modern agents. And civilians will derive little comfort from suggestions that they breathe through wet handkerchiefs,[10] wrap themselves in plastic sheets,[19] or dust contaminated skin with flour.[19]

The 1925 Geneva Protocol prohibits using chemical weapons but not possessing them.[2] It depends therefore on the implicit threat of retaliation in kind to secure compliance. Any scheme for further control has to tackle not only the issue of destroying existing stockpiles and manufacturing plants but also of verification.[2 20] The destruction of existing chemical weapons would require converting several hundred thousand tonnes[21 22] of very toxic chemicals to harmless derivatives world wide. Dismantling production plants would be potentially hazardous to workers, slow to accomplish, and tremendously expensive.[23-25] Accurate verification is confounded by the fact that the manufacture of many chemical weapons is technically undemanding.[26] Some may be made by the most rudimentary chemical industry, and producing organophosphorus nerve agents is only one step beyond manufacturing organophosphorus pesticides. Furthermore, chemical companies in their normal business use toxic intermediates that may easily be subverted for military purposes.[27]

Strategists argue that since Warsaw Pact forces are well equipped with chemical weapons possession by the North Atlantic Treaty Organisation provides mutual deterrence.[28] While the problems of verification remain unsolved and the military sees a role for chemical weapons there seems little reason for optimism.

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Training for coronary angioplasty

Demands a minimum of 125 procedures

In 1987 in the United States there were 638 coronary angioplasties compared with 857 coronary artery vein graft operations for every million of the population. Although the rate of coronary angioplasty in Britain (78 per million in 1987) is unlikely to match that in the United States, increasing awareness of the success of intervention in acute myocardial infarction[1] should expand the use of angioplasty. After successful thrombolysis the residual coronary artery stenosis still contains a large amount of thrombus and this, being soft, is particularly amenable to angioplasty.[2,3] Fortunately, angioplasty does not need to be performed urgently even after thrombolysis. We thus do not need a round the clock service.[4,5]

Training for angioplasty presents some unusual problems because it demands that physicians develop and maintain a high degree of manual skill. A recent report from the American College of Cardiology and the American Heart Association on training cardiologists in angioplasty suggests an initial minimum training of 125 procedures that should include 75 performed with the trainee as the primary operator.[6] As the procedure carries an increased risk if performed by an operator who is not proficient doctors intending to train for coronary angioplasty should be established independent investigators in coronary angiography.

Most candidates for a British senior registrar post in cardiology will have acquired enough experience of coronary angiography to allow them to begin training in coronary angioplasty. But should all cardiology units training senior registrars offer training in coronary angioplasty, and would such a development be practicable and desirable?

Radiologists might be regarded as equally suitable to perform coronary angioplasty. This arrangement would permit cardiologists more time for clinical cardiology but has the considerable disadvantage that complications of angioplasty must still be treated urgently by a cardiologist with or without a cardiac surgeon. Radiologists may perform the procedure, but a cardiologist must be present.

Within the present structure of higher training for cardiology, time could be made available for developing and maintaining angioplasty skills. There should be sufficient elasticity in both the year devoted to special interests and in that devoted to general medicine. Should we aim at developing doctors who specialise entirely in coronary angioplasty or should the procedure be seen as a part of the invasive cardiologist's skills?

It is unusual for British physicians to have to develop manual skills, and some will question whether a trainee can deal with direct referrals to outpatient clinics from general practitioners and develop and maintain the necessary skills for angioplasty. A cardiologist who practices angioplasty is more likely to determine accurately for a patient the pros and cons of angioplasty, drug treatment, or an operation. The view of a doctor working full time in angioplasty is probably more blinkered. None the less, it is superspecialists who will develop interventional cardiology further. The best policy in the immediate future will be to train all senior registrars in cardiology in coronary angioplasty.

National and international meetings have disseminated information about angioplasty using dramatic "live" demonstrations of the technique on closed circuit television. The British Cardiac Society sponsored a cardiovascular intervention workshop last year at The London Hospital employing