

Biological weapons: the facts not the fiction

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The history of biological weapons

Attempts to use biological weapons date back to before the First World War, but at that time the Germans tried to produce biological weapons which would have been effective against animals and plants. A German spy was caught in Norway with 18 sugar cubes, each containing a small vial of anthrax solution.

Erhard Geissler's thorough research¹ on biowarfare in the Second World War suggests that there was no active use of biological weapons during that conflict. In Germany, Himmler and his colleagues seem to have sidelined what activity there was, although there is evidence of work directed towards the production of a vaccine against plague, and a plan to drop 250,000 plague and typhus infected rats in large cages over England.

Before the war, international treaties had outlawed the use of chemical and biological weapons except as a retaliatory measure. Churchill had, however, been convinced that the noses of German V1 and V2 rockets were to contain biological agents, and he thus instituted a retaliatory programme that resulted in the development of an 'n-bomb' containing 109 infected bomblets, and the manufacture of anthrax-infected cattle cakes. The plan was to drop these cattle cakes over the German countryside, with the aim of reducing beef production by 30%. In the

event, the noses of Hitler's rockets contained only high explosives and neither British plan was executed.

Japan, meanwhile, was conducting research into anthrax, plague, enteric fever, cholera and glanders. No laboratory work was done; instead experiments were conducted on prisoners of war and the indigenous population of occupied China.

The USSR has a long record of research into biological warfare. Evidence is often cloudy, but we know, for example, that a 1928 decree allowed scientists to investigate the possibility of weaponising typhus. There is also circumstantial evidence to support the hypothesis of deliberately created outbreaks, during Second World War, of tularaemia and Q Fever in Stalingrad and the Crimea, and of typhus in Bryansk and Kiev.

During the Yeltsin/Bush summit of 1992, the Soviets admitted that in 1979 there had been an accident at a biowarfare facility producing weapons grade anthrax: a filter had been taken off at the end of a shift, and when production was later restarted it had not been replaced. It is estimated that only 1g of anthrax was released, but this is equivalent to 80 million spores. Between 200 and 1,000 people died, and 60,000 were treated. Everyone who contracted inhalational anthrax within 28 days of the accident died, and fatality was 50% in those who contracted it thereafter. Further, all cases of the disease in humans occurred within 4 km downwind of the facility, whereas animals were infected as far away as 50 km. This supports the theory that humans have a degree of resistance to anthrax.

The UK and the USA also conducted research on biological weapons during the Cold War. In Britain, a surrogate marker for anthrax was dropped into the London Underground. It spread for up to ten miles, and trains that passed through the marker were also heavily infected. After the 1960s, however, British work concentrated on protection against, and the detection of, outside threats.

The USA spent a total of \$750m on research into biological warfare, choosing tularaemia as its lethal agent, and Venezuelan equine encephalitis, capable of incapacitating sufferers for up to six months and with pain unresponsive even to morphine, as its non-lethal agent. President Nixon suddenly announced the termination of the programme at the end of the 1960s.

Conference programme

■ From catapults to capsomeres

Dr R Spencer, Deputy Director, Public Health Laboratory, Bristol

■ Spores, spots and trots: clinical features and management of biological agents

Dr A Miller, Consultant Physician/Honorary Senior Lecturer in Infectious Diseases, Worcestershire Acute Hospitals NHS Trust

■ Clinical presentations and responses at hospital level

Dr N Beeching, Senior Lecturer in Infectious Diseases, Liverpool School of Tropical Medicine

■ Bioterrorism as psychological warfare

Professor S Wessely, GKT School of Medicine and Institute of Psychiatry, London

The speakers were joined by:

■ Professor L Donaldson, Chief Medical Officer, Department of Health, London

■ Dr P Bevan, Deputy Director of Public Health, NHS London Region

Up until 1998, research had identified 45 cases of the use of biological or chemical weapons by individuals or non-state sponsored organisations. Twenty were carried out by lone individuals, of whom 18 had medical or scientific knowledge. Twenty-one involved the contamination of food or water, resulting in eight deaths.

Before the recent anthrax attack in the USA, probably the best known bioterrorist assault on civilians was the sarin nerve gas attack in the Tokyo subway, carried out in 1995 by the Aum organisation. This resulted in 12 deaths and the hospitalisation of thousands. The Aum organisation had previously attempted to use botulinum toxin and anthrax but, despite their wealth, it seems that they were unable to successfully jump the final hurdle of weaponisation. Anthrax had been released by Aum up to four times before 1995, but as these attacks had not resulted in any infections, they went unnoticed.

Dr Robert Spencer, Deputy Director of the Public Health Laboratory in Bristol, suggested that in the past, organisations such as the IRA have used terrorism as a way of gaining access to the political table, often giving advance warning of attacks – allowing maximum publicity and the evacuation of those in danger. With the advent of the current wave of bioterrorism, we are seeing a shift in practice. The intention now is to produce maximum publicity, but also maximum casualties.

The present threat

The Centers for Disease Control in Atlanta has classified potential biological and chemical agents into three categories. Category A contains the most serious threats: these substances are easily disseminated, often transmissible from person to person, likely to cause high mortality, panic and disruption, and would require some form of special intervention by the relevant public health authorities. Agents in this category are:

- anthrax
- botulinum toxin
- smallpox
- plague
- tularaemia
- viral haemorrhagic fevers.

Agents in Category B have many of the same effects as A, but to a lesser extent. Category C contains substances that, although they have no history of use as biological weapons, could be weaponised. Since such attacks do not necessarily have to be targeted at humans, foot and mouth disease could be included in this category.

Anthrax

Anthrax is in many ways a rather poor weapon: it is possible to vaccinate against it, treatment is available and it does not spread from person to person. Further, it is impossible to use it as a strategic weapon because it makes areas in which it is used uninhabitable. On the other hand, it is readily available as an endemic zoonosis of herbivores – in the past it has been spread

to people working closely with animals, as is suggested by its former name of ‘wool sorter’s disease’.

There is little modern clinical experience of the condition: the last UK case was in 1978, so many of the mortality figures and ideas of clinical management are 20 to 30 years old.

Botulinum toxin

Botulinum toxin is the most poisonous substance known to man: one gram of the substance could potentially kill one million people. Its attraction for terrorist organisations, however, is reduced by various factors: the toxin can be rapidly inactivated by standard water-cleaning procedures so it is very difficult to achieve concentrations high enough to cause any significant damage; botulism does not spread from person to person; and treatment is available.

In summary, there is little clinical experience of Category A agents, as classified by the Centers for Disease Control, and the potential for large outbreaks is always there since some agents could be genetically manipulated to become transmissible from person to person. Ciprofloxacin is a good broad-range treatment for these threats, but doctors need to ensure an adequate supply, and that it is not used too readily in case the organism becomes drug resistant.

The attack scenario

The first indications of and reactions to a bioterrorist attack in the UK would depend on whether or not the release was covert. In the event of a declared attack, the police would be the first to know, and would take the lead in conjunction with the appropriate regional health officials.

If covert, the realisation that there had been a bioterrorist attack would take longer. Emergency departments and general practices would probably be the first to notice that anything was amiss, but since general practices constitute a more ‘diffuse’ service, it is likely that any attack would take longer to be detected if its victims were presenting in that setting. It is important that doctors be on the look-out for high levels of any disease, but in particular those which involve the lungs or the gut, and those whose symptoms may easily be confused with influenza A, Legionnaire’s disease or meningitis.

Plans for a response to a possible bioterrorist attack have been in preparation for some years at governmental level, but have been brought into the open in the wake of the September 2001 bioterrorist attacks in the USA. In March 2000, a document had been published jointly by the Department of Health and the NHS Executive, and circulated amongst directors and regional directors of public health. *Deliberate release of biological and chemical agents: guidance to help plan the health service response*, dealt with the management of people exposed to biological agents, their contacts, and health care personnel. It also discussed the issue of the contamination of people and environments and the process of isolating those directly affected, as well as treatment, prophylaxis and vaccination. It was suggested that

while suspect packages should not be treated like bombs, with immediate evacuations, sensible precautionary measures should be taken to limit the risk of infection.

Although it is impossible to know how real is the threat of a bioterrorist attack in the UK, the country is said to be well prepared for such an eventuality. Surveillance systems are well established: there is already a good public health network, and notification will probably be a speedier process given the current levels of awareness, and so soon after the foot and mouth crisis. It is important, however, to assemble adequate stock-piles of the appropriate vaccines, antibiotics and so on, and for both health care professionals and the public to remain calm.

The aftermath

Psychiatrists and psychologists, as much as physicians, should prepare to address the threat of bioterrorism.

Bioweapons are unpredictable and as likely to harm the user as the intended victims. The world's militaries are thus less likely to acquiesce to treaties banning the use of obviously effective weapons, than to treaties banning biological and chemical weapons.

The effectiveness of such weapons is only fully revealed as the psychological and social consequences are played out. Biological weapons are attractive to terrorists because they allow them to achieve what their name suggests as their primary aim: to instil terror. Such weapons can create fear, uncertainty, confusion, anxiety, panic and a loss of confidence in ourselves and our public institutions. Professor Wessely, of the GKT School of Medicine and Institute of Psychiatry, London, suggested that, 'when psychological weapons lose their novelty, they lose their primary potency, which is their capacity to cause fear.'

The psychological consequences of the use of biological weapons can be divided into two categories: the acute, or immediate, effects, and the long-term effects. The acute psychological effects in the USA are already evident. At the time of the conference on which this article is based (October 2001), for example, about 20 episodes of mass hysteria had been reported in the newspapers. The best way to counteract these and other short-term effects is to provide the public with sound, sensible and accurate information. Too much may create anxiety about threats which had previously not been considered: an 'over the top' official response creates an 'over the top' reaction in the public. However, it is probably better to err towards the latter than to provide too little information, which might encourage fears of cover-up or conspiracy.

The levels of anxiety in the USA are unlikely to remain as high as they are now. As time passes, people become used to such threats. In the Second World War, for example, it was predicted that the bombing of major cities in both Germany and Great Britain would result in mass panic and public disorder. In the event there was an unexpected calm. It is likely that Americans will learn to live normally under this new threat they face, just as the UK population, and especially those who live in London, has learned to cope with the threat presented by some Irish republican organisations.

Further information

Royal College of Physicians

www.rcplondon.ac.uk/calendar/2001/seminar_bwtfntf.htm

Public Health Laboratory Service

www.phls.co.uk/

Protocols for patient diagnosis and management, public health management. Regular updates at present.

Centers for Disease Control

www.bt.cdc.gov/

Numerous US-oriented protocols; detailed source reference and excellent links to other sites.

British Medical Journal

www.bmj.com

Editorials and news items in issue dated 20 October 2001.

Nature

www.nature.com/nature/anthrax

Scientific advances on anthrax research and related links in past issues of Nature.

Journal of the American Medical Association

www.ama-assn.org/ama/pub/category/6232.html

Offering a series of articles on the use of tularemia, botulinum toxin, plague, anthrax and smallpox free of charge.

American College of Physicians/American Society of Internal Medicine

www.acponline.org/bioterro/medicalaspects.htm

Medical aspects of biological terrorism.

US Army Medical Research Institute of Infectious Diseases

www.nbc-med.org/SiteContent/HomePage/WhatsNew/MedManual/Sep99/Current/sep99.htm

Medical management of biological casualties handbook.

The long-term psychological and medical effects of the use of biological weapons may involve some people developing puzzling new illnesses, analogous to conditions such as Gulf War syndrome. Others may develop cancers or reproductive hazards, which may or may not be connected to the events in 2001. But perhaps the most damaging consequence could be a loss of faith in politicians, doctors and others in positions of responsibility. This may prove far more damaging than the short-term effects, and be precisely the intention of those behind the attacks.

References

- 1 Geissler E *et al.* (eds). *Biological and toxin weapons: research, development and use from the Middle Ages to 1945*. Sipri Chemical and Biological Warfare Series, No. 18. Oxford: Oxford University Press, 1999.