

WORK IN A ROUTINE HOSPITAL MICROBIOLOGY LAB - WHAT HAS BIOTERRORISM GOT TO DO WITH ME? A VIEW FROM THE SHARP END

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REZUMAT

Articolul are la bază o prezentare făcută la conferința "Biosafety and biosecurity - medical countermeasures against biological agents and weapons", care a avut loc la Timișoara, România, în 8-9 noiembrie 2007. În acest articol autorul descrie unele dintre acțiunile întreprinse în Marea Britanie cu scopul de a preveni obținerea de microorganisme cu potențial de utilizare în scopuri bioteroriste și necesitatea vigilenței personalului în laboratoarele de microbiologie din spitale, ca linie de apărare și mijloc de depistare a bioterorismului.

ABSTRACT

This article is based on a presentation given at a conference titled "Biosafety and biosecurity - medical countermeasures against biological agents and weapons", held in Timisoara, Romania on 08-09 November 2007. In this article the author describes some of the action being taken in the United Kingdom in an attempt to prevent acquisition of organisms with the potential to be used by bioterrorists, and the need for vigilance by staff in hospital microbiology laboratories as one of the lines of defence against, and means of detecting, bioterrorism.

1. INTRODUCTION

The author is a laboratory based scientist with many years experience in several United Kingdom (UK) National Health Service (NHS) laboratories, but no direct experience or training in the area of bioterrorism. This article is written from that point of view, and from the perspective of a district general hospital microbiology laboratory, beginning with a brief description of the location of Basildon Hospital and the facilities available at the hospital. Bioterrorism is then discussed under the headings prevention, detection and communication.

2. GEOGRAPHY

The author's laboratory is situated in Basildon, in the county of Essex, approximately 30 kilometres east of the city of London and approximately 30 minutes by road from the eastern part of the city. A major incident in London could have an impact on Basildon Hospital, even if only indirectly because of the need to move "routine" cases away from the London hospitals, as they might be overrun with patients as a result of a bioterrorism incident. The part of the UK where the author's laboratory is situated is relatively close to mainland Europe. During the autumn of 2007 there was, in Essex, an outbreak of blue tongue, a disease of farm animals which is carried by small insects. Two of the possible causes of this outbreak which have been put forward are (1) that the carrier insects were blown across the North Sea, and (2) that the insects were carried on shipping containers from a European port to one of the large complex of ports in north Essex and south Suffolk. One of the factors supporting the latter theory is that the early cases in the outbreak were close to one of the major roads leading away from the port complexes. Either possibility should raise concerns

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Received for publication: Feb. 05, 2008. Revised: May 07, 2008.

about transmission of bioterrorism instigated disease across the North Sea.

3. DESCRIPTION OF BASILDON HOSPITAL

Basildon Hospital is the district general hospital serving a population of 370,000 in the southern part of the county of Essex. The hospital has 656 beds and provides the normal range of services supplied by this type of hospital, and in addition has a cardiothoracic surgery centre which opened in July 2007. The hospital has a total staff of 4,000 of whom 150 work in the Pathology Laboratory, including the 30 in the Microbiology Department. The Microbiology Department annually processes 145,000 bacteriology samples; 50,000 serology tests and 11,000 tests for *Chlamydia trachomatis*.

4. PREVENTION OF BIOTERRORISM

In the UK the police have taken an interest in the physical security of hospital microbiology laboratories. The reason for this interest is that during the investigation of a terrorist incident at the Glasgow (Scotland) airport during 2007, one of the people arrested was a laboratory worker. As a result of this, a scheme is being introduced to prevent potential bioterrorists obtaining supplies of pathogenic material from hospital microbiology laboratories. The scheme has the (unofficial) title “3D’s” – Deter, Delay and Detect.

(At the time of writing there was no written publication available to give as a reference. The following information was gained from personal discussion with police officers, and others, with knowledge of this scheme).

4.1. Deter. Access to microbiology laboratories is to be controlled by increasing security to laboratories to deter potential bioterrorists from gaining entry. Layers of security are an important, for example, the only access to the laboratory is by doors with digital locks. An electronic lock system with card access is being installed at the time of writing. The laboratory (Containment Level 3 Laboratory) where cultures of highly organisms, for example *Mycobacterium tuberculosis*, are stored is locked, and the keys stored in a safe when the laboratory is unoccupied. During working hours access to the laboratories by visitors is controlled by a receptionist. Casual visitors are no longer permitted because of the possibility that the visitor might be assessing the layout and security of

the laboratory. Any new staff members have their backgrounds examined and undergo police checks. It is recommended that when new laboratory complexes are to be built, microbiology departments should not be on ground level to increase the difficulty of gaining entry, but also to prevent access to the department by driving a vehicle through an exterior wall.

4.2. Delay. Having several layers of security means that the time taken to access the laboratory would increase, and that, in turn, would increase the chances of an intruder being detected. Cultures of highly pathogenic organisms are, at present, stored in a locked cupboard in the locked Containment Level 3 Laboratory described above. Another result of the need to increase security is that a locked safe, which will be fixed to the floor of the laboratory, will be installed for storage of cultures.

4.3. Detect. Intruder detection systems will need to be installed. Basildon Hospital has a closed circuit television (CCTV) system for patient and staff security. The CCTV system is monitored by hospital security staff. At present this does not extend to the interior of the Pathology Laboratories, but it should do so in the near future. An entry detection system (“burglar alarm”) will probably need to be fitted to the Containment Level 3 Laboratory. Final recommendations are yet to be received.

5. DETECTION OF BIOTERRORISM

The first of a series of PowerPoint training presentations available from the UK Health Protection Agency (HPA) about bioterrorism lists the following CDC Category A organisms as “the main suspects” as agents of bioterrorism – anthrax; plague; smallpox; botulism; tularaemia; viral haemorrhagic fevers and encephalitis.¹ There are many other organisms with the potential for use in bioterrorism, indeed the author heard reference to the possibility of making mutations to measles and mumps viruses, which could then be weaponised during a recent radio programme. In the UK HPA presentation mentioned above, are included some 1970 WHO estimates of a worst case scenario if 50 kg of the following agents were to be released into an area with a population of about 5 million people:

	Cases	Deaths
Anthrax	250,000	100,000
Plague	150,000	36,000
Tularaemia	250,000	19,000

The overt, or obvious, release of agents of bioterrorism would be relatively easy to recognise and the emergency services (police, ambulance, fire) probably involved first, with their priorities including – controlling the affected area; identifying the agent used and giving health advice.

Covert, or secretive, release of agents of bioterrorism would probably be first recognised by health services. This release could be as contamination of water or food supplies or heating and ventilation systems, for example. The ability to recognise these events is needed by hospital microbiology laboratories. As laboratory trained scientists we are trained to look for, find and recognise pathogenic micro-organisms among the body's normal flora. We also rely on medical based awareness with our Consultant Microbiologists seeing patients and talking to clinical colleagues. There is a need to train the scientific staff of the microbiology laboratory to be aware normal patterns of bacterial isolation and to notice unusual patterns of isolation. We need to be able to find the unusual among lots that is "normal".

To give two examples – some time ago, in the laboratory where the author worked at the time, there were several isolates of a strain of Salmonella which had not been seen there before. These isolates were part of a country-wide outbreak of Salmonella napoli caused by contaminated chocolate manufactured in Italy. Another case, which occurred in the UK involved increased numbers of isolates of Campylobacter species. On investigation this proved to be due to a failure of the pasteurisation process at a dairy. It is possible to envisage other causes for both cases.

5.1. Standard Operating Procedures. It is important that the methods and media used in hospital microbiology laboratories are capable of detecting the microorganisms which may be used by bioterrorists. The need for laboratory staff to be trained to follow those Standard Operating Procedures (SOP's) is paramount. All staff should be made aware of, know to look for and be able to recognise the microorganisms used in bioterrorism. Is it possible that Bacillus anthracis will be dismissed as another harmless or contaminating Bacillus species? Should we be looking for Vibrio cholerae in cases of severe diarrhoea? It is around 150 years since there were outbreaks of cholera in London from contaminated water supplies from one water pump, but would we consider this organism now from patients in a big city?

5.2. Quality Control Of Procedures. Quality control (QC) checks need to be performed to ensure that the processes are capable of isolating pathogens

used in bioterrorism. It is obviously not a good idea to use the actual pathogen, but it should be possible to use one or more less pathogenic strains to check the processes and media used. It is also important to check the output of the laboratory systems. It has been reported that in a laboratory using an automated identification system with automated reporting, isolates incorrectly identified as Yersinia pestis were reported several times, and nobody noticed!

5.3. External Quality Assurance. External Quality Assurance (EQA) schemes should also be used as an independent assessment of the procedures and media in use. The United Kingdom External Quality Assurance Scheme (UK NEQAS) organised from the HPA Centre for Infections at Colindale, London, has over 1,600 participants in 36 countries (<http://www.hpa.org.uk/cfi/quality/eqa/default.htm>). The scheme provides regular dummy specimens for all types of sample. The results are collated, analysed and reported back to the participating laboratories as both a summary of all participants, and as individualised reports for each laboratory. Cumulative scores for the laboratory are included, as is a comparison of the laboratory performance with all participants. This is done by comparing the mean score of each laboratory for the last few samples with the mean of all participating laboratories.

5.4. Laboratory Accreditation. There are several schemes for laboratory accreditation. One of the most widely used among hospital laboratories in the UK is run by Clinical Pathology Accreditation (UK) Ltd (CPA-UK). This scheme involves peer review by experienced scientists, using a carefully defined set of protocols to ensure that the inspected laboratory meets the necessary standards.

5.5. Containment. Having isolated a micro-organism from a suspected case of bioterrorism, it is obviously important that the members of the laboratory staff do not become infected themselves and/or transfer the infectious agent to others. It is very expensive to train microbiologists, and good ones are hard to find and keep. They need to be looked after by provision of properly installed and maintained facilities for the containment of highly pathogenic microorganisms.

6. BIOTERRORISM AND COMMUNICATION

Communication of the fact that a potential case of bioterrorism has been found is extremely important. It is absolutely no use having the knowledge that an

outbreak has occurred, and then doing nothing about telling anyone else. In the UK it is compulsory to report isolation of some microorganisms to the relevant authorities. Firstly infections are reported to the local HPA Communicable Diseases Consultant (CDC). One of the functions of the CDC is to investigate the source of any notifiable infection in an area which may be covered by two or three microbiology laboratories. This will enable the CDC to observe patterns of infection over a wide local area. Communication with the CDC is two-way; they will notify the local microbiology laboratories of any suspected infectious disease outbreaks. Infections are also reported to the Communicable Diseases Surveillance Centre (CDSC) at the HPA Centre for Infections, London. For most microorganisms this is a two stage process. Infections are reported to a Regional Epidemiologist, who covers the east of England, by at least 15 laboratories. These results are collated and reported to the CDSC. Reporting is carried out using computerised systems. These communications are also two-way, so that local laboratories are aware of what is happening by means of summary reports produced both in their region and nationally. If the need for communication in either direction is urgent e-mail or telephone will be used.

7. CONCLUSION

Communication is almost as important as isolation of the microorganism in the first place. A good source

of general information and recommendations about the handling of bioterrorist incidents is Heptonstall J, et al.²

To quote from the above document:

“We may live in troubled times, but the adage ‘common things are common’ remains true: the unconscious patient is more likely to have taken an overdose, drugs or alcohol, to be a diabetic, or to have had a stroke than to have been exposed to cyanide.

But remember: YOU may be the first person to recognise that a CBRN incident has occurred.”

Probably the most important thing to remember about bioterrorism is to make sure that somebody else knows that you have found a possible case, then the link with other possible cases can be made and the required action taken.

ACKNOWLEDGEMENTS

The author is grateful for assistance and information provided by Dr. David N. Petts, PhD and Dr. Adrian H. B. Deas, PhD.

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