

A N T H R A X

INTERIM PHLS GUIDELINES FOR ACTION IN THE EVENT OF A DELIBERATE RELEASE

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Note: these are interim guidelines. Comments are welcome from healthcare, laboratory and public health professionals, and should be sent to DRcomments@phls.org.uk. Since these are interim guidelines, they may be subject to changes as comments are received, so please ensure that you have the latest issue and version: available through the PHLS website at www.phls.org.uk/topics_az/deliberate_release/menu.htm

1 BACKGROUND

These guidelines are intended for healthcare, laboratory and public health professionals to guide clinical and public health action in the event of a deliberate release of anthrax.

1.1 Introduction

Anthrax is an acute infection caused by the Gram-positive, spore forming, bacterium *Bacillus anthracis*. Anthrax naturally infects many species of grazing mammals such as sheep, cattle and goats, which are infected through ingestion of soil contaminated by *B. anthracis* spores. There are three forms of human disease depending on how infection is acquired: cutaneous, inhalation and ingestion. In over 95% of cases the infection is cutaneous, acquired by inoculation of spores into small abrasions on the skin, usually during handling of untreated animal hides.

1.1.1 Deliberate release of anthrax

The threat of a deliberate release of anthrax is of the release of large quantities of spores in an aerosol. This threat is considered serious because:

- The organism is relatively easy to cultivate from environmental sources.
- The inhalation form of disease has a high mortality rate.

Despite this, creation of an infective anthrax aerosol is not easy – particles need to be between 1 and 5µm in size and sufficient energy is required to disperse them.

1.2 Epidemiology

Anthrax is a zoonosis to which most mammals, especially grazing herbivores, are susceptible. Human infections usually result from contact with infected animals or animal products. Direct exposure to secretions from cutaneous anthrax lesions may result in secondary cutaneous infection, but there have been **no known cases of person-to-person transmission of inhalation disease**.

1.2.1 Transmission

The spores of *B. anthracis* are extremely durable. Modes of transmission include:

- Cutaneous contact with spores, spore contaminated materials or infected skin lesions. Infection required an existing break in the skin.
- Inhalation of spores.
- Ingestion of contaminated meat.

1.2.2 Infectious dose

The ID50 for inhalation anthrax (the infectious dose required to cause disease in 50% of those exposed by inhalation) is generally regarded to be 10,000 spores; however it may be lower if the infectious particles have been very finely milled.

1.2.3 Incubation period

1 day to 8 weeks (mode 5 days), dependent on dose and exposure route.

- 1-7 days following cutaneous exposure.
- 1-6 days following inhalation exposure.
- 1-7 days following ingestion.

1.2.4 Period of communicability

- Transmission of anthrax infection from person to person is highly unlikely.
- Contact with skin lesions can occasionally result in subsequent cutaneous infection.
- Airborne transmission from person to person does **not** occur.

1.3 Clinical features

Human anthrax can occur in three forms: inhalation/pulmonary, cutaneous or gastrointestinal, depending on the route of exposure, and details of these diseases are given below. It can be expected that any malicious or deliberate release of anthrax spores will involve aerosol exposure.

Clinicians should be aware of the possibility of cases of inhalation anthrax, and any previously healthy patient with the following clinical presentations should be immediately reported to the Consultant in Communicable Disease Control and to the duty doctor at CDSC (020 8200 6868 - 24 hour service).

- **Rapid onset of severe, unexplained febrile illness or febrile death.**
- **Rapid onset of severe sepsis not due to a predisposing illness, or respiratory failure with a widened mediastinum.**
- **Severe sepsis with Gram-positive rods or Bacillus species identified in the blood or cerebrospinal fluid and assessed not to be a contaminant.**

1.3.1 Inhalation/pulmonary

- Non-specific prodrome of flu-like illness following inhalation of spores with fever, headache, myalgia and non-productive cough. Two to four days after initial symptoms, there is **abrupt onset of respiratory failure** and on chest X-ray a **widened mediastinum** is often present, suggestive of mediastinal lymphadenopathy and haemorrhagic mediastinitis. Note that a widened mediastinum may also be apparent in cases of TB due mediastinal lymphadenopathy.
- Gram-positive bacilli seen in blood cultures, usually after 2-3 days of onset of illness.
- Treatment may be successful in the prodromal stage, but by the time respiratory or bacteraemic symptoms develop, treatment may not arrest the disease before a fatal outcome.

1.3.2 Cutaneous

- Local skin involvement after direct contact.
- Commonly seen on hands, forearms and head.
- Three days after exposure a raised, itchy, inflamed pimple appears followed by a papule that turns vesicular and then 2-6 days later a black eschar develops. Extensive oedema accompanies the lesion – the swelling tends to be much greater than would normally be expected for the size of the lesion.
- Responds to oral antibiotics.
- Rarely may progress to bacteraemia or meningitis without treatment.

1.3.3 Gastro-intestinal

- Rare.
- Characterised by severe abdominal pain, nausea and vomiting with watery or bloody diarrhoea.
- 2-3 days after onset bacteraemia may develop.
- Usually fatal if it progresses to bacteraemia.

Clinical pictures illustrating the different forms of anthrax infection can be seen [here](#)

1.4 Mortality

Systemic infection resulting from inhalation of the organism has a mortality rate approaching 100%, with death usually occurring within a few days after the onset of symptoms. Cutaneous anthrax, the most common form, is usually curable with

antibiotics. The mortality rate among people with infection resulting from ingestion is variable, but may also approach 100%.

1.5 Organism survival

Anthrax endospores do not divide, have no detectable metabolism, and are resistant to drying, heat, UV light, gamma irradiation and many disinfectants. In some types of soil, anthrax spores can remain dormant for decades.

1.6 Antimicrobial susceptibilities

Most naturally occurring anthrax strains are sensitive to penicillin, which historically has been the preferred therapy for the treatment of anthrax. There are no clinical studies of the treatment of inhalational anthrax in humans. Thus, antibiotic regimens commonly recommended for first line treatment of sepsis have not been studied in this setting. Natural strains of *B. anthracis* are resistant to extended-spectrum cephalosporins.

In studies of small numbers of monkeys infected with susceptible strains of *B. anthracis*, oral doxycycline has proved efficacious. Doxycycline is therefore the preferred option from the tetracycline class of antibiotics because of its proven efficacy in monkey studies and its ease of administration. Other members of this class of antibiotics are suitable alternatives.

Although treatment of anthrax infection with ciprofloxacin has not been studied in humans, animal models suggest excellent efficacy. In-vitro data suggest that other fluoroquinolone antibiotics would have equivalent efficacy in treating anthrax infection, although no animal data exist for fluoroquinolones other than ciprofloxacin. Pharmacokinetic studies of ciprofloxacin in humans have demonstrated excellent penetration into lung tissue following oral administration.

2 CLINICAL PROCEDURES

2.1 Diagnosis and collection of samples

Despite its reputation, anthrax is not contagious, and humans are not highly susceptible to the disease. While theoretically it only takes one spore to initiate a cutaneous infection, *B. anthracis* is not invasive, requiring an existing lesion to penetrate the skin and commence infection. Use of standard Universal Precautions (gloves, gowns and hand washing) in the laboratory reduces the risk of cutaneous anthrax to zero in the simple procedures outlined below. Infectious doses in the pulmonary or intestinal forms are high, and these have to be delivered in the correct size of particle. It can be seen, therefore, that the simple laboratory isolation and identification tests described do not create higher risks of dangerous infection than other pathogens being handled in a routine containment level 3 clinical laboratory.

2.1.1 Precautions for sampling

The samples outlined below should be taken to confirm the diagnosis. These must be taken using Universal Precautions and with the utmost care to avoid inoculation injuries. The procedures for transporting samples to the laboratory are outlined in section 3.6. The receiving laboratory should be telephoned to expect arrival.

2.1.2 Samples to be taken from acutely ill humans

- Blood for culture.
- Nasal swabs (laboratory diagnosis is easier if these are sent dry since this prevents growth of other organisms and facilitates detection of anthrax spores).
- Sputum samples and swabs from cutaneous lesions.

2.1.3 Post mortem specimens

Samples may be taken from dead humans to assist diagnosis, including:

- Blood from a vein (the blood is non-clotting at death in anthrax).
- Nasal swabs.
- Swabs of haemorrhagic exudate from orifices.
- Swabs or sample of other body fluids if appropriate.

However full post-mortem examinations are discouraged if anthrax is suspected because of the risk of releasing anthrax spores present in body fluids, drips etc. If post-mortem is carried out, swabs or samples of lung, spleen or lymph node tissue should be sent (transport medium is not necessary, but it will not damage specimens).

2.1.4 Samples to be taken from the environment

Samples should be taken from any material (soil, dust, clothing, swabbing etc) in the environmental area thought to have been exposed to anthrax spores, or soiled by exudates from humans (or animals). Further advice on environmental sampling methods will be provided if a release is suspected.

2.1.5 Samples to be taken from others who have or may have been exposed

Depending on the scale of a release, it may be possible to obtain nasal swabs from people present within and around the exposed area at the time of release. This is to inform epidemiological investigations and guide confirmation of the release and designation of an exposed zone. **If a release is suspected, antibiotic prophylaxis should not be delayed for the result of nasal swabs**

2.1.6 Transport of samples

Strict procedures should be followed for the transport of samples of suspected anthrax, both from the clinical environment to the laboratory, and from local laboratories onto the reference laboratory. These are outlined in section 3.6.

2.2 Treatment**2.2.1 Inhalation and ingestion****Table 1: recommended treatment for inhalation and ingestion anthrax**

	Initial Therapy	Optional therapy if strain is proven susceptible	Duration
Adults	Ciprofloxacin 400mg iv every 12hr (change to oral 500mg bd when appropriate)	Benzympenicillin 2.4g iv every 4hr (change to oral therapy when appropriate)	60 days
Children*	Ciprofloxacin 20-30mg/kg per day iv divided into 2 daily doses, not to exceed 1g per day (change to oral therapy when appropriate)	Age <12y: Benzympenicillin 30mg/kg iv every 6hr Age ≥12y: penicillin G 2.4g iv every 4hr	60 days
Pregnancy*	Same as for non pregnant adult		

*Ciprofloxacin is not licensed for use in children or pregnant women.

Note that cephalosporins are **ineffective** for the treatment of anthrax.

Where the diagnosis is suspected but not confirmed, it may be necessary to start empirical treatment to cover the possibility of anthrax. However, in these circumstances, it will also be necessary to treat concurrently for other causes of acute respiratory illness.

2.2.2 Cutaneous

Treatment should be initiated with oral ciprofloxacin 500mg twice daily for 7 days. This can be changed to oral amoxycillin if the organism is found to be sensitive.

Treatment may need to be continued for up to 60 days if there is suspicion of deliberate release in order to provide cover for inhalation anthrax, which may have been acquired concurrently.

2.3 Infection control practice**2.3.1 Decontamination of exposed persons**

In the event of a known exposure to anthrax spores, the risk for re-aerosolisation from the clothing of those exposed is extremely low. However even a low numbers of spores could potentially lead to cutaneous infection in attending healthcare workers.

In situations where the threat of exposure to *B. anthracis* spores exists, cleansing of skin and potentially contaminated fomites such as clothing, personal possessions or environmental surfaces should be considered in order to reduce the risk of the cutaneous form of the disease. Decontamination of persons exposed to anthrax may include:

- Removal of contaminated clothing and possessions – it should be stored in labelled double plastic bags until exposure to anthrax has been ruled out.
- If anthrax is confirmed, all contaminated material must be incinerated or autoclaved.

- Minimal handling of clothing and fomites to avoid agitation.
- Instructing exposed persons to shower thoroughly with soap and water- appropriate facilities will be provided at the scene as necessary.
- Instructing attending personnel to wear appropriate barrier protection – Universal Precautions - when handling contaminated clothing and other fomites.

2.3.2 Isolation of patients

- Standard Universal Precautions should be used for the care of patients infected with B. anthracis – gloves, gowns and hand washing.
- Single room placement for anthrax patients is **not** necessary.
- Airborne transmission does **not** occur.
- Skin lesions may be infectious, but this requires direct skin contact.
- Standard Universal Precautions should be maintained when patients are moved.

2.3.3 Cleaning, disinfection & waste disposal

Contaminated environmental surfaces should be cleaned with 0.5% hypochlorite solution (5,000ppm; equivalent to one part household bleach added to nine parts water - NADCC may be used as an alternative chlorine releasing agent: two 4.75g tablets in one litre of water would give the necessary 5,000ppm equivalent of 0.5% sodium hypochlorite.)

2.3.4 Post-mortem

Post-mortem examinations are discouraged if anthrax is suspected. However, if they are undertaken, standard Universal Precautions should be observed with the use of appropriate personal protective clothing, including gloves, gowns and hand washing. Instruments should be autoclaved.

Cremation is the preferred method for disposal of the deceased. Embalming of bodies should be strongly discouraged.

2.4 Prophylactic treatment for persons exposed to anthrax spores

In the event of a known exposure to anthrax spores, antibiotic prophylaxis should be initiated as soon as possible – as described in Table 2.

Prophylaxis should continue until B. anthracis exposure has been excluded. If exposure is confirmed, prophylaxis should continue for **60 days**. During this period, no special precautions are required for exposed persons, but they should receive an anthrax information sheet and be instructed to seek medical attention immediately in the event of any suspicious symptoms.

Table 2: Recommended prophylaxis after exposure to B. anthracis

Antimicrobial agent	Adults	Children*
Oral Fluoroquinolones Ciprofloxacin	500mg bd	20-30mg per kg of body mass daily, divided into two doses – as a guide 10kg: 125mg bd 20kg: 250mg bd 30kg: 375mg bd 40kg: as for adult
If fluoroquinolones are not available or are contraindicated Doxycycline	100mg bd	5mg per kg body mass per day divided into two doses

* **Ciprofloxacin is not licensed for use in children or pregnant women.** There have been no formal studies of the use of ciprofloxacin during pregnancy, but is unlikely to be associated with a high risk of abnormalities of foetal development. There is some evidence that the use of fluoroquinolones in children (including by breast feeding mothers) may be associated with tendinopathy and arthropathy.

If B. anthracis exposure is confirmed, the organism must be tested for penicillin susceptibility. If susceptible, exposed persons may be treated with oral amoxicillin as an alternative to ciprofloxacin or doxycycline (40mg per kg of body mass per day in divided doses 8 hourly; not to exceed 500mg, three times daily).

However, pharmacokinetic studies have shown that ciprofloxacin achieves far higher concentrations in lung macrophages than penicillins, and is therefore a more effective prophylactic antibiotic. **The risk of adverse effects from antibiotic prophylaxis must be weighed against the risk of developing a serious disease.**

Ciprofloxacin has the added advantage that it is also an effective prophylactic treatment for other potential agents that may be used in deliberate release scenarios such as plague and tularaemia.

2.4.1 Immunisation

In certain circumstances, in addition to antimicrobial prophylaxis, post-exposure immunisation may also be indicated. This consists of 5 doses of vaccine at 0, 3 and 6 weeks, then at 6 months and 1 year after exposure. With vaccination, post-exposure antibiotic prophylaxis can be reduced to **4 weeks**. Advice on the use of vaccine **must** be obtained from PHLS-CDSC.

Note that anthrax vaccination is currently only available for people with an occupational risk of exposure. This includes people who work with animal hides or products and laboratory staff who handle the organism routinely. Prophylactic anthrax vaccination is not required for other members of the public. In the event of a deliberate release, individuals will be considered for vaccination on a case-by-case basis, according to their risk of exposure.

2.4.2 Contacts of cases

There is no need to provide antibiotic prophylaxis or immunisation to contacts of patients unless there is concern that they were also exposed to the initial release.

2.5 Environmental decontamination

The greatest risk to human health following a release of anthrax spores occurs during the period in which anthrax spores remain airborne, called primary aerosolisation.

The duration and scale of the infectious risk depends on the duration for which spores remain airborne and the distance they travel before they fall to the ground. This depends on meteorological conditions and aerobiological properties of the dispersed aerosol. The aerosol is likely to be fully dispersed within hours to 1 day at most, well before the first symptomatic cases would be seen.

In the event of a known release, an **exposed zone** will be defined according to the time and place of release in order to identify all persons exposed to primary aerosolisation. This is explained in section 4. The area surrounding the site of release will remain designated

as an exposed zone until sufficient time has elapsed and there is no further risk of infection.

Expert advice will be provided to determine the time after release for which spores are likely to remain airborne. Once they have settled, although they remain infectious for long periods, the risk to human health is much lower. Decontamination of small areas may be achieved with 0.5% hypochlorite solution (5,000ppm; equivalent to one part household bleach added to nine parts water).

2.6 Protection of frontline workers

This includes all emergency staff involved in management at the scene of a release, as well as those involved in treating patients with anthrax.

2.6.1 Protective clothing

Following an overt release of anthrax spores, the area affected by primary aerosolisation will depend on the time and place of release. This **exposed zone** (see section 4) presents a high risk of infection, and anyone entering it should wear full protective equipment such as Type 3 high efficacy air filter masks with Class A suits, conferring full biological protection.

Healthcare workers will not normally be asked to enter this zone, however it is possible that they may be called to treat casualties, for example if an explosive device has accompanied the release of biological agent. In this case the full protective clothing should be worn.

Exposed persons will normally be moved from the exposed zone, through decontamination, and into a place of safety (see section 4.3.1) for medical assessment and administration of prophylactic treatment. Those involved in decontamination, and others who have any contact with contaminated clothing and fomites should observe standard Universal Precautions - gloves, gowns and hand washing.

Emergency staff who attend exposed persons after decontamination has been completed do not need to take any special precautions. For healthcare workers involved in the management of hospitalised patients with all forms of anthrax, Universal Precautions provide sufficient protection, and mortuary staff should use similar barrier protection. More sophisticated countermeasures for airborne protection such as high-efficacy air filter masks airborne protection are **not** required.

2.6.2 Antibiotic prophylaxis and immunisation

Frontline workers entering the **exposed zone** should be offered antibiotic prophylaxis as in Table 2, and in addition, should be offered a course of vaccination at 0, 3 and 6 weeks then at 6 months and 1 year following exposure, subject to availability.

Prophylactic treatment may also be considered for frontline workers involved in other activities including:

- Decontamination of exposed persons.
- Handling exposed persons.
- Management of patients or disposal of bodies infected with anthrax.

Decisions about whom should receive prophylaxis should be taken on an individual basis according to duration and degree of potential exposure, and taking into account the availability and side effects of prophylactic treatments.

2.7 Other Considerations – patient, visitor and public information

Information sheets have been prepared for distribution in the event of an incident.

3 LABORATORY PROCEDURES

3.1. Risk assessment

B. anthracis is a Hazard Group 3 pathogen, and should thus be covered by existing risk assessments for handling such organisms in diagnostic microbiological laboratories. Note that blood samples from anthrax patients for clinical chemistry and haematology pose no special risk and can be handled according to normal procedures.

3.1.1 Receipt of samples

Samples should have been labelled as 'High risk' by the submitting staff, and should be handled according to local protocols for such samples. All laboratory procedures should be performed, by experienced MLSOs or scientists, in a containment level 3 facility using a Class 1 protective safety cabinet. Chain-of-evidence documentation should accompany specimens. In larger incidents, this would only be required for several of the initial cases.

3.2 Isolation and identification

Two smears should be made on microscope slides and fixed by immersion in absolute ethanol for 1 minute. Side 1 should be stained with Giemsa or Gram's stain, and the typical capsulated short chains of "box-car" bacilli looked for under oil immersion. Their presence is highly suggestive of anthrax. If numerous bacilli in short chains are visible, dispatch the second slide to a reference laboratory for confirmation. The specimens should also be cultured on to blood agar for incubation at 37°C in air/CO₂. Antimicrobial susceptibility tests must be set up as soon as possible.

3.2.2 Culture

B. anthracis is a non-motile, Gram-positive, aerobic bacillus 1.2 to 10µm in length, capable of forming central and terminal spores. Cultures should be inoculated onto an agar slope in a bijoux bottle and incubated overnight. After incubation, the typical white, non-haemolytic colonies, with bees-eye appearance (that is, oval, slightly granular but not dry, about 2mm diameter) and characteristically tacky on teasing with a loop, will be apparent in large numbers.

These can be subcultured to a slope in a class 1 protective cabinet within a containment level 3 facility that can then sent to the Reference Laboratory for confirmation.

3.2.3 Antibiotic sensitivity

Organisms should be tested for sensitivity to antibiotics including ciprofloxacin, penicillin, doxycycline and gentamicin.

3.3 Confirmation

Clinical microbiology laboratories should take care not to regard all isolates of *Bacillus* species as contaminants, especially if isolated from sterile sites (blood, cerebrospinal fluid) and/or multiple cultures are positive from the same patient.

The PHLS recommends that all sterile site *Bacillus* isolates be further evaluated, and if non-motile or non-haemolytic (particularly if they form short chains), and/or if the clinical syndrome is suggestive of anthrax, the isolates should be immediately referred to reference laboratory.

3.4 Waste disposal

In the laboratory, 0.5% hypochlorite (5,000ppm) disinfection is necessary for decontaminating surfaces that may have been exposed to *B. anthracis* spores. All other waste containers should be autoclaved.

3.5 Reference laboratory

All positive isolates and cultures should be sent to the reference laboratory for confirmation. In addition, samples may be sent directly to the reference laboratory if local laboratories lack the facilities for dealing with them. These and other specimens should then be sent to the reference laboratory taking care to observe the procedures outlined in section 3.6. The sender's name and address should be clearly marked. The reference laboratory should be telephoned prior to sending to expect the sample. Samples should be forwarded urgently to:

Special Pathogens
CAMR
Porton Down, Salisbury
Wiltshire, SP4 0JG
Contact: Dr G Lloyd
Tel: (+44) 01980 612100 (24hours)

3.6 Transportation of samples with suspicion of *B. anthracis*

The following procedures should be adopted for the transport of all specimens, and also all cultures for confirmation. These apply within hospitals and laboratories as well as for specimens sent to the reference laboratory:

- Every effort should be made to avoid external contamination of specimen containers during specimen collection.
- The primary container (bijoux or similar) should be screwed tight, labelled and placed in an intact plastic bag.
- A 'High Risk' label should be affixed to both specimen and request form. The latter should include any other relevant information and include adequate clinical details to indicate level of suspicion.
- Under no circumstances should the request form be placed in the same bag as the specimen.
- The bag should be sealed, using tape or heat sealer. Pins, staples and metal clips should not be used. A separate bag should be used for each specimen.
- Each specimen must then be placed in a leak-proof secondary container with sufficient absorbent material to absorb all the contents should leakage occur.
- Each specimen must be packaged individually - i.e. three specimens, three separate packages.
- The secondary container should be externally disinfected – e.g. by wiping with 0.1% hypochlorite (1,000ppm).

3.6.1 Samples sent to the reference laboratory

- Secondary containers should be placed within a final outer tertiary packaging.
- This packaging **must** comply with the UN 602 standard packaging for the transport of infectious substances by air, road or rail.
- The package should be certified to this standard and carry the appropriate UN certification numbers on the tertiary packaging along with the following information:
 - 1 BIOHAZARD – danger of infection symbol Class UN 6.2.
 - 2 Instructions not to open if found.

- 3 Telephone number of a responsible person - e.g. Consultant Microbiologist, Laboratory Manager.
- The container should be transported by an approved courier, without delay, directly to the reference laboratory.

3.6.2 Samples sent within hospitals and laboratories

- Secondary containers should be placed in a good quality box, which is well taped up and clearly labelled "Pathological Specimen – Open only in Laboratory".
- Specimens should be transported by hand by a responsible person using the above packaging. Vacuum-tube systems should **not** be used for transportation of specimens within hospitals or laboratories.
- Extra care should be taken to ensure that laboratory records are kept to a high standard.

3.7 Protection of laboratory staff

All laboratory procedures must be performed in a Containment Level 3 facility using a Class 1 biological safety cabinet. Under these circumstances there is no indication for antibiotic prophylaxis for laboratory staff unless there is an inoculation injury or a spillage releasing aerosols containing spores. Anthrax vaccine is only indicated for laboratory staff who routinely work with the organism.

Any member of laboratory staff, working with specimens or cultures of anthrax, who develops a febrile/respiratory illness should seek urgent medical attention.

4 PUBLIC HEALTH PROCEDURES

4.1 Surveillance and detection of deliberate releases of anthrax

A deliberate release may be overt with an announcement and/or confirmation by environmental sampling. However, it is also possible that a deliberate release may be covert and will not be identified until the first cases of disease arise.

Anthrax is a rare disease. In the last 20 years there has been fewer than one case per year in the UK. These are mainly cutaneous and are due to handling hides imported from countries with endemic disease (and thus often associated with the leather industry).

Deliberate release should be considered in the event of:

- Single **confirmed** cases of inhalation anthrax.
- Single **confirmed** cases of cutaneous anthrax arising in individuals who do not routinely have contact with animals or animal hides.
- Two or more **suspected** cases of anthrax that are linked in time and place, especially geographical related groups of illness following a wind direction pattern (analogous to legionnaire's disease).

Close co-ordination with veterinary colleagues is essential: grazing animals (cows, sheep, goats) are far more susceptible to disease and have a shorter incubation period than humans. Confirmed and suspected cases of anthrax in animals may provide an early warning system. Infected animals could also act as an ongoing source of potential human infection. **Incident managers should ensure that appropriate veterinary advice is taken.**

4.2 Case Definition

4.2.1 Suspected cases

Any previously healthy patient with the following clinical presentations should be immediately reported to the Consultant in Communicable Disease Control.

- Rapid onset of severe, unexplained febrile illness or febrile death.
- Rapid onset of severe sepsis not due to a predisposing illness, or respiratory failure with a widened mediastinum.
- Severe sepsis with Gram-positive rods or *Bacillus* species identified in the blood or cerebrospinal fluid and assessed not to be a contaminant.

If anthrax is suspected, microbiological specimens should be sent to the reference laboratory, and consideration should be given to initiating empirical treatment pending results. Obviously the level of suspicion of anthrax depends on local circumstances at the time – in the event of a known or suspected deliberate release the threshold for making a diagnosis of anthrax should be lower.

As discussed in section 3.3, clinical microbiology laboratories should also be alert to the possibility of anthrax. The PHLS recommends that all sterile site *Bacillus* isolates should be carefully evaluated, and if suspicious, and/or if the clinical syndrome is suggestive of anthrax, they should be immediately referred to reference laboratory.

4.2.2 Confirmed case

A case that clinically fits the criteria for suspected anthrax, and in addition, definitive positive results are obtained on one or more pathological specimens by the reference laboratory.

4.2.3 Definitive diagnosis in the reference laboratory

The definitive test for *B. anthracis* is polymerase chain reaction (PCR). This test can be applied to cultures sent from local laboratories, in which case results will be available in 3 hours from receipt of specimen. It can also be applied to isolates and other clinical samples, but this will normally require overnight culture at the reference laboratory, so the result will take 24 hours.

4.3 Public Health Action

4.3.1 Procedure for handling exposed persons

Depending on the site and method of release, anthrax spores may be dispersed over a wide area. Expert advice will be provided to define an **exposed zone** in time and space. All individuals who have been present in the exposed zone need to be identified. In the event of an overt release, some of them will still be at the scene when emergency services respond to the incident. This group will be decontaminated and then referred to health workers at a nearby **place of safety** for assessment and prophylaxis (this will be a clinical area just outside the exposed zone and within the cordon that will be established at the scene of the incident). Others will have left the scene before emergency services arrive and will be identified later when they approach GPs and A+E departments after details of the incident have been made public. Procedures need to ensure that these individuals are appropriately decontaminated, receive prophylaxis, and have their details collected for follow up.

4.3.2 Post-exposure prophylaxis

There are 2 groups of individuals for which prophylaxis is indicated:

- I **Individuals who have been present in the exposed zone** should be offered post-exposure prophylaxis as outlined in Table 2.
- II **Healthcare workers** may require prophylaxis as described in section 2.6.2.

If suspected or confirmed cases of anthrax arise among persons who have been outside but in close proximity to the exposed zone in time or space, the defined parameters of the exposed zone should be reviewed with a view to extending post-exposure prophylaxis.

Prophylaxis for other groups may be considered in the event of an incident. However, it is not advisable to give antibiotics to people who do not have a clear history of having been present at the time and site of release. It is inappropriate to provide antibiotics to large numbers of people who have not been exposed, but who are generally concerned or have non-specific mild illnesses.

4.3.3 Follow-up of exposed persons

After an overt release, a basic set of personal details needs to be collected from all persons present in the exposed zone.

4.3.4 Case finding

If cases of anthrax arise and a covert release is suspected, health services should be contacted to determine whether other possible cases have presented.

4.3.5 Preventing secondary spread

As previously mentioned, person-to-person spread of anthrax is negligible, and therefore there is no specific treatment or advice is required for secondary contacts. There is no

requirement for quarantine of infected patients. However those contaminated with Anthrax spores will need to be decontaminated as described in section 2.4.2.

4.4 Epidemiological investigation

If a case is strongly suspected or confirmed, the PHLS-CDSC should be notified immediately. If cases arise due to a covert release, or following an overt release but in people who have not been present in the exposed zone, it is important to collect some epidemiological details in addition to a basic set of personal details. This is in order to define or redefine the exposed zone and aid identification of others at risk of infection. Details should be as thorough as possible, whilst recognising that in the event of a large release with multiple exposed persons or cases, it may not be possible to collect comprehensive information from everyone.

The aim of epidemiological investigations may be:

- Following a covert release, to assist definition and ongoing review of the temporal and spatial parameters of the exposed zone so that post exposure prophylaxis can be distributed appropriately.
- Following an overt release, to guide review of the exposed zone if cases arise in persons who were not present within it.

4.4.1 Epidemiological sampling

Microbiological samples will be taken from the environment by the police. These will be tested in police laboratories. Depending on the scale of the release, it may be possible to take nasal swabs from people present in the exposed zone. These may provide further information to help guide ongoing administration of post exposure prophylaxis. However, if people are known to have been in the exposed zone, antibiotic prophylaxis should be given immediately and not withheld until the results from nose swabs are known.

LIST OF NATIONAL SPECIALISTS

Laboratory diagnosis and treatment

Advice can be obtained from:

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