

## BIOLOGICAL AND CHEMICAL TERRORISM AGENTS

### BIOWEAPONS

The Centers for Disease Control (CDC) have listed several agents as being the most likely to be used for biological terrorism. It is imperative that Clinicians are familiar with signs, symptoms and clinical syndromes that could arise from the covert use of these agents. The following list is not all-inclusive but covers the most likely agents.

### ANTHRAX

Recent bio-terrorism attacks using spores of the bacterium *Bacillus anthracis* delivered by mail have highlighted the potential for serious illness caused by this agent. Anthrax is a bacterium that forms spores that infect via inhalation, gastrointestinal, or cutaneous routes. Anthrax is not communicable from one person to another. It can be dispersed as a powder or aerosol. Infection could also follow contamination of food products. Anthrax infections occur naturally, usually from exposure to infected animals or animal products. Naturally occurring Anthrax infections are typically of the cutaneous type.

#### Signs and symptoms:

Inhalational anthrax disease occurs 2-43 days following exposure. The illness begins with fever, dyspnea, chest and abdominal pain, vomiting, chills, weakness and cough. Hours to a few days later, patients will experience dyspnea, shock, fever and diaphoresis. Death follows rapidly for most patients after this stage. Prophylaxis with antibiotics prior to symptoms prevents illness.

Gastrointestinal illness follows oral ingestion of the spores. Two distinct syndromes may occur, one with ulceration and edema of the esophagus, and the other involving the cecum and terminal ileum. Both of these forms lead to sepsis. The intestinal infection causes abdominal pain, rigid abdomen, and bloody diarrhea.

Cutaneous infection occurs when spores are deposited on exposed skin, particularly any open cuts or abrasions. Cutaneous lesions occur no later than 12 days after exposure. Illness may begin with a pruritic macule or papule that forms an ulcer. Local edema and a painless eschar form after that. Lymphangitis and systemic illness can occur.

### PLAGUE

Plague is an illness caused by infection from *Yersinia pestis*. It occurs naturally on rare occasions in the western U.S. Naturally occurring Plague usually involves spread from rodents to humans through flea-bites. Plague can

be aerosolized and would result in the more virulent pneumonic variety of infection. Pneumonic plague is directly communicable from infected patients to medical personnel or others without the flea vector.

### Signs and Symptoms:

Plague resulting from a terrorist attack would result in the rapid onset of a virulent pneumonia 1-6 days after exposure. Fever, dyspnea and cough with bloody sputum would be the first symptoms. Gastrointestinal symptoms also may occur with abdominal pain, vomiting and diarrhea.

## SMALLPOX

Smallpox, a disease caused by variola virus, was eradicated in 1977. Laboratory stocks were kept in the former Soviet Union and at the CDC. Reports that smallpox was created in large amounts and weaponized in the former Soviet Union has raised concern that smallpox could end up as a weapon of bio-terrorism. Case fatality rates are about 30%, and smallpox is highly communicable to close contacts.

### Signs and symptoms:

Incubation period is typically 12-14 days (range 7-17 days). Typical illness begins with high fever, malaise, backache and headache. A maculopapular rash then appears on face and arms, it is also visible in the mouth. In 1-2 days the rash becomes vesicular and later pustular, which crust over by day 8-9. Patients are most infectious during the first week of illness. Two forms of atypical smallpox account for 10% of the cases-hemorrhagic smallpox which is always fatal and malignant smallpox which is frequently fatal. Hemorrhagic smallpox has a shorter incubation period and has sudden onset of severe fever, abdominal, head and back pain followed by petechiae and hemorrhage into skin and mucous membranes. Malignant smallpox has similar onset to typical smallpox, but the vesicular lesions become confluent, and large soft areas of pustular lesions. Sometimes there is hemorrhage into the lesions. If the patient survives, the lesions heal without scabs forming.

## BOTULINUM TOXIN

Botulinum toxin produced by *Clostridium botulinum* is one of the most toxic substances known. It can be produced and distributed in an aerosol, thus making it ideal for a bio-terrorism weapon. Illness results from the toxin irreversibly binding to peripheral neuromuscular synapses, preventing the release of acetylcholine. Iraq and the former Soviet Union produced large quantities of weaponized Botulinum toxin. Illness from the toxin does not

create communicable illness in the patient. Botulinum toxin can also be distributed by contaminating food.

### **Signs and symptoms:**

Regardless of mode of transmission, Botulinum toxin results in the same clinical picture of acute, afebrile flaccid paralysis. Bulbar nerves are particularly involved, resulting in difficulty speaking and seeing. They will have ptosis, diplopia, blurred vision, enlarged pupils, dysarthria, and dry mouth. Sensory nerves are generally not affected. Naturally occurring infection by *C. Botulinum* results in a similar illness, but is preceded by abdominal cramps, vomiting and diarrhea.

## **TULAREMIA**

Tularemia is an infection with *Francisella tularensis*. It can be aerosolized and as few as 10 organisms can result in clinical illness. It may have been used as a bio-weapon by the Soviet Union against German troops during World War II.

### **Signs and symptoms:**

Infection with *F. Tularensis* would result in fever, pneumonia, pleuritis, and hilar adenopathy. Incubation period is 3-5 days. Without aggressive early treatment, pneumonia can progress to respiratory failure, shock and death.

## **CHEMICAL AGENTS**

Chemical agents can be classified in four main groups: blister agents, nerve agents, choking agents, and blood agents. An attack with chemical agents would be more overt than a bio-terrorism attack; most agents would be immediately noticeable. Besides actual chemical weapons, terrorists could use a multitude of industrial chemicals in an attack. Most chemical weapons are distributed as a liquid vapor or even as a gel-like material, thus it is not correct to think of them as "gases".

## **BLISTER AGENTS**

Mustard agent is the prototype of this class. Generally, blister agents have an odor of garlic or mustard. Typically, they will be yellow to brown in color and oily appearing. They are vesicants and result in blistering and irritation to any exposed surface. The eyes are particularly affected with pain, lid-swelling, tearing, blepharospasm, and photophobia. Skin exposure results

in a pruritic rash 2-4 hours later and blistering 2-18 hours after that. The respiratory tract may have an inflammatory reaction several hours after exposure that may progress for several days. Gastrointestinal tract may have chemical burns and inflammation. High doses can cause convulsions.

Medical attendants need to take great care to avoid exposure from victims. "Off-gassing" from the victims clothes or direct contact of agent on the victim will result in illness. Rescue personnel will need to have full personal protective equipment including respirator and butyl rubber gloves to avoid exposure.

## **NERVE AGENTS**

Typical nerve agents include tabun, sarin, soman, GF, and VX. In appearance they are typically clear liquids, although they may have thickening agents added to increase persistence of the agents. They are closely related to organo-phosphate insecticides and symptoms resemble acute organo-phosphate poisoning. They affect both muscarinic and actinic receptors, and work by inhibiting acetylcholinesterase. Route of contamination may be through respiratory tract, GI tract or directly through skin.

### **Signs and symptoms:**

Signs and symptoms are dose related. Onset of symptoms is immediate if inhaled but may take up to 20 minutes for exposure through skin. Mild symptoms include: difficulty seeing, rhinorhea, chest tightness, salivation, sweating, nausea, vomiting, and localized muscular twitching. Severe symptoms include: generalized muscular twitching, dyspnea, vomiting, urination, defecation, pinpoint pupils, respiratory failure, and seizures. Treatment with atropine and 2-Pam chloride may be effective. Medical and rescue personnel may become contaminated from off-gassing or by touching nerve agent on victim's clothes, thus use of full personal protective equipment necessary until victim can be decontaminated.

## **CHOKING AGENTS**

These include chlorine and phosgene. Odors are typical of chlorine or like new mown hay or green corn. These agents are absorbed only through the respiratory tract. Persistence in attack area is minutes to hours, depending on wind conditions. All choking agents are vapors.

### **Signs and symptoms:**

Symptoms include coughing, chest tightness, nausea, headache, watering eyes, dyspnea, and fatigue.

## BLOOD AGENTS

Blood agents include hydrogen cyanide and cyanogens chloride. They are extremely toxic and are immediately active. They work by poisoning the intracellular respiratory chain. These agents only persist in the attack area for seconds to minutes, thus decontamination of victims is less problematic than other agents. They may be in a vapor or aerosol form. Route of entry is through the respiratory tract.

### Signs and symptoms:

Symptoms include dizziness, headache, convulsions, nausea rapid breathing or dyspnea, loss of consciousness, and cyanosis.

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