INTRODUCTION

A two-hour course, covering the history, likelihood, recognition, prevention, and treatment of the most probable biological terrorist agents. It also covers the administrative challenge of who to call and when.

Objectives

By the end of this lecture, the participant should be able to...

1. Demonstrate basic knowledge of the risk of biological terrorism and the most likely agents to be used in a biological attack.
2. Describe the most common clinical presentation and treatment of Anthrax.
3. Describe the most common clinical presentation and treatment of the plague.
4. Describe the most common clinical presentation and treatment of small pox and other viral agents.
5. Explain the presentation of biological toxins.

Scenario

You arrive on scene for an unknown type of incident. You are guided to an office where a secretary hands you a letter that says "L" is for liberal and "A" is for Anthrax. She says when she opened it 10 minutes ago some white powder fell out. She looks at you and asks, "Is this bad?"

What do you do?

Right now.

Later.

By the end of this lecture you should be able to recognize the symptoms of the major biological agents likely to be used in a terrorist attack. You will also know how to properly react and treat real and suspected victims.
Q: Why should I care?

A: Because it has already happened on U.S. soil and will happen again.

Brief History

- 1970 Four Canadian college students were poisoned with the eggs of the pig parasite Ascaris Suum

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Sverdlosk 1979
Former Soviet Union

- There was an accidental atmospheric Anthrax release from a biological weapons facility in Sverdlosk. For a full day Anthrax was released into the air when a worker failed to install a new filter. Between 200 and 1000 citizens became infected and died. They all lived or worked down wind from the factory.

References:
3. Medical Management of Biological Casualties. 2nd ed. Frederick, MD: U.S. Army Medical Research Institute of Infectious Diseases; 1996.

Biological Terrorism

- In 1984, followers of the Bhagwan Shree Rajneesh, poisoned local salad bars with live salmonella in hopes of winning a local election. The incident occurred in rural Oregon and resulted in dozens of cases of salmonella gastroenteritis. No one died. It took several years to recognize and prove this was an intentional biological terrorist event.

References:
Aum Shinrinkingo Cult

In 1995, the Aum Shinrinkingo cult released Sarin nerve agent in the Tokyo subway system. Twelve died and thousands were affected. It is suspected they had Anthrax in their possession and had sent followers to Africa in an attempt to obtain Ebola virus.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Biological Terrorism

- In 1996, 12 Texas lab workers became infected with Shigella when they were intentionally given shigella-laden pastries.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
2. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)

Biological Terrorism

- In 1995, Larry Wayne Harris was arrested when he purchased freeze-dried plague through the U.S. mail. He was arrested again in 1998 for an Anthrax hoax.

References:

Anthrax

- As of November 14th
- Four People have died from inhalational Anthrax. Several people have gotten cutaneous Anthrax. Numerous others have been exposed without symptoms, but required antibiotics.

Biological Warfare

Iraq 1995, was found to have large stores of the following biological agents:
- Anthrax 8,500 liters
- Botulinum toxin 19,000 liters (the most toxic substance on Earth)
- Aflatoxin 2,200 liters

References:
2. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
3. Moran GL; Biological Terrorism are we prepared?: Emerg Med3:110-115, 2000
Why biological agents?

- They are cheap.
- They are easy to make.
- They are easy to conceal, transport, and deliver.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
2. Simon JD: Biological terrorism: JAMA 1997;278:428-30

Comparative Cost

- Nuclear $2000/casualty.
- Chemical $1800/casualty.
- Conventional $1600/casualty.
- Anthrax $1/casualty.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Types of Agents

- Bacterial
- Viral
- Toxins
- Others
Anthrax

Bacillus anthracis:

- Gram-positive, spore forming, rod

References:

1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Anthrax

There are three main clinical forms of Anthrax.

1. Cutaneous (wool sorters disease): from contact with infected wool or animal hides.
2. GI: from eating infected meat.
3. Inhalational: almost always an intentional attack.

References:

1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Anthrax

- Considered "Mother of all biological warfare agents"
- 3 microns in size, which makes it easy to inhale. Once inhaled, it sticks to alveoli and starts the infection.
- Easy to make (brewer's technology). Anyone who can brew beer, can grow Anthrax.
- Easy to access (Soil) It lives in the soil as a natural bacterium.
- Almost always fatal when left untreated.
References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

**Anthrax (inhalational)**

- Incubation 2-6 days before symptoms start.
- Fever, cough, and chest pain are the usual first signs.
- Most harmless upper respiratory tract infections have the same symptoms.
- Sepsis, hypotension, poor tissue perfusion, and multi-organ failure come quickly.
- Death almost always follows.
- It is NOT contagious person to person. If the individual was not in the area of first exposure, they are not at risk.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
6. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)
Anthrax (treatment)

- Cipro 500 mg BID
- OR
- Doxycycline 100 mg BID

If medication is started before the onset of symptoms, chance of survival is good.
Once symptoms have started, mortality approaches 95%, even with antibiotics and supportive care.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Anthrax Vaccine

- There is a vaccine available mostly to military personnel. It is very effective, but takes 6 doses to be considered vaccinated. Some controversy surrounds its use, but studies show no increase in adverse outcomes in the vaccinated population.

References:

Plague

- The black plague is caused by Yersinia pestis
- It is a gram negative, anaerobic, rod-shaped bacteria.
- It is usually a rodent disease, but in certain conditions it can become a human disease, with a high degree of mortality.
References:
2. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
3. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)

Plague
There are 3 main forms of the plague.

1. Bubonic, which is named for the typical large infected lymph nodes, is caused by the bite of an infected flea.
2. Septicemic, refers to an infection of the bloodstream, which bypasses the lymph nodes. Flea bites can also cause it.
3. Pneumonic is the most common form and is transmitted person to person by the respiratory route.

References:
2. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
3. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)

Plague
- It was first weaponized in the middle ages when the Turks catapulted the bodies of infected soldiers over the walls of the city Caffa. This may have started the plague that killed a large percent of Europe in the dark ages.
- Japanese used fleas as a vector in China in WWII. They infected the fleas and then air dropped them, causing an outbreak.
Plague

- Highly contagious.
- Respiratory spread.

Plague (diagnosis)

The diagnosis can be made several ways.

- Clinical diagnosis is possible but difficult, as several other pneumonias can present the same way.
- Epidemiologic diagnosis is the next most helpful, since few pneumonias present in epidemic form like the plague.
- Microbiology can be helpful if the gram stain shows a gram-negative coccobacillus, or when blood cultures grow the organism, although this usually happens when it is too late to help an individual patient.
References:
2. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
3. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)

Plague (treatment)

1. Respiratory precaution is critical for the health care worker. The plague is spread human to human by respiratory droplets.
2. **So wear a mask!**
3. Supportive care for the patient.
4. Fluids, pressors, pulmonary toilet.
5. Antibiotics
   - Streptomycin
   - Gentamicin
   - Doxycycline
   - Ciprofloxacin
   - Chloramphenicol

References:
2. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
3. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)
**Plague (prophylaxis)**

A vaccine is available for people who are likely to be exposed to the flea borne disease, but it is not effective against the pneumonic form. Antibiotics can be used to prevent infection in an exposed individual.

- Doxycycline
- Cipro

**References:**
2. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
3. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)

**Small Pox**

- Small pox is a viral infection caused by the Variola virus. It has not existed as a natural disease since the 1970's, wiped out by an extensive worldwide vaccination program. It now exists only in laboratories.

- It could be used as a biological weapon, and is probably in the possession of a number of terrorist organizations.

**References:**
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
2. CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)

**Small Pox**

It is highly contagious from person to person, and is spread by both the respiratory route and through physical contact.

**References:**
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
Small Pox

- It was used as a weapon against Native Americans by the British in the 1700's. They gave them contaminated blankets as a "peace offering." The ensuing outbreak may have killed up to 90% of the population.

- There are currently large stores in the former Soviet Union. The exact amount is unknown. It is thought that it has been widely sold to numerous terrorist states, by former lab workers and scientists.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Small Pox Course

- Incubation is 12 days.
- Symptoms start as fever, malaise, vomiting, headache, rigors, and myalgias
- 2-3 days later the small pox specific lesions develop. They are macules, papules, and pustules.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Small Pox

- Death can be from a variety of causes.
- Overwhelming viral sepsis may cause multi-organ failure.
- Mucous membrane sloughing may cause death from hypovolemia or GI bleeding.
- Skin disruption may cause fluid loss or secondary infection similar to a burn.
- Mortality is approximately 30% if left untreated.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook
Small Pox

- Can be confused with chicken pox (varicella)
- Small pox tends to be centrifugal, with the predominance of lesions on the face and extremities. Chicken pox tends to be most concentrated on the trunk.
- Lesions are all of the same stage in small pox. In chicken pox, the lesions are at different stages. Some will be starting and others will be crusting over.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Small Pox

- In classic small pox, the lesions scab over in 8-14 days.
- The patient is still contagious for another several days.

References:
1. Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Small Pox (diagnosis)

- Early diagnosis is difficult, as it starts as a flu-like illness before the rash erupts. Once the rash starts, it still may be several days before a definitive diagnosis is made.

- Epidemiologic diagnosis is key. If multiple individuals with the same syndrome appear, it helps narrow the diagnosis.

- Special stains are possible, but the investigator must specifically be looking for small pox.

- PCR or genetic matching may be the fastest in the future, but again, the investigator must specifically be looking for small pox.

Small Pox (treatment)

Quarantine is the cornerstone of treatment as the virus is highly contagious, and prevention of new contacts may be the only way to stop it. Unfortunately, even a relatively small outbreak would easily use every available isolation bed in an area, and other methods of quarantine may become critical.
Supportive treatment for the infected patient is probably the only treatment available.

Antiviral medication may be effective, but it is unknown as no antivirals existed when the last human became infected.

References:
Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

**Hemorrhagic Fevers**

Hemorrhagic fevers refer to a diverse group of unrelated viral illness that, in extreme form can cause a hemorrhagic illness. Hemorrhage is caused when a large viral blood infection interferes with the body's natural clotting mechanism, causing spontaneous, sometimes fatal bleeding.

**Hemorrhagic Fevers**

Many types of viruses can cause hemorrhagic fever.

Ebola is perhaps the best known, but most mysterious.
Marburg is related to Ebola.
Lassa, Argentine/Bolivian Hemorrhagic fever, Congo-Crimean, Rift valley fever, Yellow/Dengue, are examples of other viral infections that can turn hemorrhagic if severe enough.

**Ebola**

Courtesy of the CDC

They have a wide range of transmission and severity. Some are mosquito or tick borne. Others are respiratory or blood borne.

All have potential to be weaponized, although none are known to exist as weapons at this point in time.

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Hemorrhagic Fevers

Most cause an acute nonspecific viral syndrome, with fevers, malaise, nausea, vomiting, or upper respiratory tract infection.

If severe, the illness may progress to the hemorrhagic stage and even result in shock and death.

Hemorrhagic Fevers

Treatment

For the patient is supportive care, treating the symptoms as they arise.

For the provider is universal precautions, taking care not to become a patient.

Mask, Gloves, Face shield, and Gown are usually all that is required. It is the same precaution we should take every day with any potentially infectious patient.

Hemorrhagic Fevers Vaccines

There is a vaccine for yellow fever only, at this point.

Others vaccines are in the experimental phase.

Biological Toxins

Biological Toxins are chemicals derived from living organisms. They are not contagious by themselves. Bio toxins are usually produced using bio technology, but then dispersed like a chemical agent.

Bio Toxins

Some examples of biological toxins are:
Botulinum, the most deadly toxin known, comes from the bacteria Clostridium botulinum and causes botulism.
Ricin is a castor bean derived poison.
Staph enterotoxin B is a GI toxin that causes food poisoning type symptoms.
T2 Mycotoxins are the toxins thought to be in "yellow rain" used in the middle east and southeast Asia.
Botulism

Botulism is a disease produced by the bacterium Clostridium Botulinum. This is a natural bacteria. It causes disease in man when food contaminated with botulism is ingested. It can be used as a weapon by isolating the toxin and then dispersing it in the environment. It can be absorbed by inhalation or ingestion.

Signs and Symptoms

Botulism causes paralysis. Symptoms are usually double or blurred vision, difficulty speaking and generalized weakness. This is followed by respiratory muscle paralysis, respiratory failure, and death. Symptoms start 24-36 hours after inhalation, with death several days later. Botulinum toxin is the most toxic substance on earth, approximately 10,000 times more toxic than the most potent nerve agent.

Ricin

Ricin is a toxin derived from the castor bean which is found throughout the world, making it easy to produce. It can be absorbed through ingestion or inhalation. It causes multi organ injury, especially pulmonary damage. Rapid deterioration can lead to death in 36-72 hours. Treatment is supportive. There is no antidote. As damage is caused by a toxin, antibiotics are ineffective.

Staph Enterotoxin B

Staph enterotoxin B is a toxin produced by Staphylococcus aureus, a bacterium. It usually causes food poisoning. If the toxin is aerosolized, it can cause cough, chest pain and generalized fevers. Most cases are thought to be temporarily incapacitating, but severe cases could be fatal. When ingested by the GI route, it causes severe vomiting, diarrhea, and GI cramping.

T-2 Mycotoxins

Mycotoxins are produced by a variety of different molds. The toxins themselves can be absorbed through the skin, respiratory tract, or GI tract. The toxins are usually spread as a yellow tinged mist. It is thought that reports of "yellow rain" attacks in Laos (1975-81), Kampuchea (1979-81) and Afghanistan (1979-81), were T-2 Mycotoxin attacks. The toxins cause injury to any tissue they contact. Symptoms can include skin burning and necrosis (tissue death), nasal and respiratory
symptoms such as nose bleeds, wheezing, hemoptysis (bloody sputum) and respiratory distress. If absorbed through the GI tract, it can cause vomiting, bloody or watery diarrhea, and abdominal cramping. Systemic toxicity can occur leading to shock and death. Treatment is supportive. Exposure can result in both non-lethal and lethal casualties.

Summary

All BW agents start as a...

Flu-like illness

It is almost impossible to make an early diagnosis on 1 patient

Summary

Epidemiology and communication are the keys.

When multiple patients present at the same time with unusual symptoms or severity, suspect an epidemic, and perhaps an intentional biological attack.

Summary

What do I do?
- Universal precautions. Protect yourself. If you come in contact with a biological victim, you likely won't know it at the time. So anytime you suspect a contagious illness, you should:

  Wear your gloves
  Wear your mask
  Wear your eye protection
  Hand washing

Summary
Who do I Call?
Department of Health (Always). They are the agency that usually investigates potential epidemics.
FBI (Maybe). If it is a terrorist attack, the FBI is the agency in charge of investigation.

Key Points

It is not a question of "if" it will happen, but "when" and "where."
There have already been multiple biological attacks throughout history, even on U.S. soil.
Biological agents are easy to make and much less expensive than conventional weapons.

Key Points

Anthrax is almost always fatal once symptoms begin, regardless of treatment.
Anthrax is not contagious person to person.
Antibiotics started before symptom onset are effective.

Key Points

The plague is another bacterial illness with a high degree of mortality.
The Plague is contagious person to person.

Key Points

Small pox is a viral infection which does not exist as a natural entity, only in labs.
If you see a case of small pox, it is almost certainly a terrorist attack.
There is no specific treatment.
The individuals vaccinated 30 years ago are probably no longer immune.
Key Points

The hemorrhagic viruses are diverse and unrelated.

Ebola is a hemorrhagic virus.

Normal universal precautions will drastically decrease likelihood of transmission for all infections.

Key Points

Of the biological toxins, Botulinum is the most deadly.

Other bio toxins include ricin, mycotoxins, and Staph enterotoxin B.

References

Biological Warfare and Terrorism the military and public health response: CDC, FDA: 1999 Handbook

Moran GL; Biological Terrorism are we prepared?: Emerg Med3:110-115, 2000


CDC Case definitions for infectious conditions under public health surveillance. MMWR 1997;46 (no. 10)

Simon JD: Biological terrorism: JAMA 1997;278:428-30

CDC, APIC Bioterrorism Task Force,: Bioterrorism readiness plan a template for healthcare facilities: 1999