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Biopreparedness

M1 Infectious Diseases Sequence
Sandro Cinti

Spring 2009
What is Bioterrorism?
• Bioterrorism is the malevolent use of viruses, bacteria, fungi or toxins to produce death or disease in humans, animals or plants.
Any Examples of Bioterrorism?
• 1360 – Plague victims’ bodies thrown over besieged city’s walls
• 1763 – Europeans give smallpox infected blankets to Native Americans
• 1984 – Bhagwan Shree Rajneesh contaminates food with Salmonella to win election
• 1994 – Shoko Assahara group attack Tokyo subway with sarin gas
• 2001 – Anthrax
The 1979 Sverdlovsk Anthrax Outbreak

Why use biological weapons?
Why Use Biological Weapons?

• Cheap-800 X less than nucs
• Easy to acquire
  – Dual use
  – Web-based information
• High Fatality
  – 100 kg anthrax could kill 3 million (OTA report, 1993)
• High Panic factor
What makes a good bioweapon?
Category “A” Biological Agents

- Variola major (Smallpox)
- *Bacillus anthracis* (Anthrax)
- *Yersinia pestis* (Plague)
- *Francisella tularensis* (Tularemia)
- Botulinum toxin (Botulism)
- Filoviruses and Arenaviruses (Viral hemorrhagic fevers)
Anthrax - *Bacillus anthracis*

- **Cutaneous**
- **Inhalational**
- **Gastrointestinal**

Sources Undetermined (All other images)
Anthrax

- Spore former
- Not transmissible person-person
- Inhalational-high mortality (50-90%)
  - 2-3 IV antibiotics
- Prophylaxis- ciprofloxacin, doxycycline-60 days
Tularemia

Cutaneous

• G(-) Coccobacillus
• 1-2 organisms can cause infection
• Not person-person spread
• Tx-aminoglycosides, cipro, doxycycline
Botulinum Toxin

- Made by the bacterium *Clostridium botulinum*
- Most toxic substance on earth - food poisoning (0.1 ug lethal dose)
- Weaponizable and aerosolizable (air & food supplies)
- *BoTox* also used to medically, anti-wrinkle
- Secreted protein neurotoxin causing flaccid paralysis
- Death due to asphyxiation

*C. botulinum*  
Image available here: [www.stylelist.com/blog/tag/anti-aging/](http://www.stylelist.com/blog/tag/anti-aging/)
Hemorrhagic Viruses

- Ebola, Marburg, Yellow Fever, Lassa
- Viral syndrome with hemorrhagic complications
- High fatalities with Ebola (80%)
- No treatments, few vaccines (YF)
- Person-person spread
Plague—*Yersinia pestis*

Bubonic
Septicemic Plague
Pneumonic Plague

- Most likely form in BT
- Mortality 80-90%
- Person-person transmission
- Tx- Streptomycin, IV ciprofloxacin or doxycycline
- Prophylaxis- oral cipro or doxy
THE VIRTUE and USE OF COFFEE,
With Regard to the
PLAGUE,
And Other
Infectious Distempers:
CONTAINING
The most Remarkable Observations of
the Greatest Men in Europe concerning
it, from the first Knowledge of it,
down to this Present Time.
To which is Prefix'd,
An Exact Figure of the Tree, Flower, and
Fruit, taken from the Life.

By R. BRADLEY, Fellow of the
Royal Society.

LONDON,
Printed by ÉMAN. MATTHEWS, at the Bibble in
Peter-miller-row ; and W. MEARS, at the Lamb
without Temple-bar. M.DCC.XXI.
(Price Six-Pence)
How would BT agents be disseminated?
• Food

• Water

• Zoonotic

• Aerosol
How would a BT attack be detected?
Clues to a BT Attack

• A large number of ill persons presenting at the same time with a similar disease, especially the following syndromes:
  o Flaccid paralysis (botulinum toxin)
  o Hemorrhagic fevers (Ebola, Lassa fever)
  o Vesicular/pustular rash with considerable mortality (smallpox)
  o Influenza-like illness associated with a widened mediastinum on chest X-ray and/or meningitis (anthrax)
  o Pneumonia with painful lymphadenopathy (plague)
Clues to a BT Attack

- Illness in animals and humans concurrently
- A large number of unexplained deaths, especially in young healthy adults
- A single case of an uncommon organism (e.g., smallpox, pulmonary anthrax, Ebola)
- Multiple disease entities presenting in one patient
- An unusual disease presentation (e.g., pneumonic instead of bubonic plague)
Clues to a BT Attack

- An unusual geographic distribution (e.g., Ebola in the U.S.)
- An unusual seasonal pattern (e.g., influenza in summer)
- An illness that fails to respond to usual antimicrobials or vaccines (e.g., engineered antibiotic/vaccine resistant anthrax)
- Clusters of a similar illness in non-contiguous areas, domestic or foreign
36 yo female with rash and fever
Smallpox: Overview

- 1980 - Global eradication
- Humans were only known reservoir
- Person-to-person transmission (aerosol/contact)
- Up to 30% mortality in unvaccinated
Smallpox: Clinical Features

• Prodrome (incubation 7-17 days)
  – Acute onset of fever, malaise, headache, backache, vomiting, occasional delirium
  – Transient erythematous rash

• Exantheme
  – Begins face, hands, forearms
  – Spread to lower extremities then trunk over ~ 7 days
  – Synchronous progression: macules --> vesicles --> pustules --> scabs
  – Lesions on palms / soles
Smallpox Enanthem

Illustration of smallpox rash in throat removed
<table>
<thead>
<tr>
<th></th>
<th>SMALLPOX</th>
<th>CHICKENPOX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEVER</strong></td>
<td>2–4 days before the rash</td>
<td>At time of rash</td>
</tr>
<tr>
<td><strong>RASH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>Pocks at same stage</td>
<td>Pocks in several stages</td>
</tr>
<tr>
<td>Development</td>
<td>Slow</td>
<td>Rapid</td>
</tr>
<tr>
<td>Distribution</td>
<td>More pocks on arms &amp; legs</td>
<td>More pocks on body</td>
</tr>
<tr>
<td>On palms &amp; soles</td>
<td>Usually present</td>
<td>Usually absent</td>
</tr>
<tr>
<td><strong>DEATH</strong></td>
<td>More than 10%</td>
<td>Very uncommon</td>
</tr>
</tbody>
</table>
- Smallpox vaccine production using cows
Normal Reactions

Normal reactions include a wide spectrum of cutaneous presentations:

Normal Reaction

Normal Reaction

Normal with Lymphangitis

Normal with Satellite Lesions

Source Undetermined
Staph Infection at Site
Erythema Multiforme
Accidental Inoculation

Diaper implantation

To sites of acne
Eczema Vaccinatum

Dr. H. Kempe

Dr. H. Kempe

Arthur E. Kaye CDC PHIL #3305
Generalized Vaccinia
Progressive Vaccinia

Child with Hypogam  Child with Hypogam  Lymphosarcoma

Child with SCID  Child with SCID  Lymphoma
Vaccinia Keratitis

Dr. V. Fulginiti

Dr. V. Fulginiti
Congenital Vaccinia

3rd Trimester has the highest risk
Contraindications to Vaccination

- Pregnancy
- Immunodeficiency
- Eczema or Atopic Dermatitis
- Active Skin Conditions
- Active Eye Disease
- Allergy to Components
- Heart Problems

Slide 8: Admin-2000, Wikimedia Commons, [http://commons.wikimedia.org/wiki/File:40ef87e4e8.jpg](http://commons.wikimedia.org/wiki/File:40ef87e4e8.jpg), CC:BY-SA 3.0, [http://creativecommons.org/licenses/by-sa/3.0/](http://creativecommons.org/licenses/by-sa/3.0/)


Slide 17: Lesion: Source Undetermined, Thumb: CDC, [http://www.cdc.gov/Tularemia/Tul_Signssymptoms.html](http://www.cdc.gov/Tularemia/Tul_Signssymptoms.html) X-Ray: Cornell University Medical College


Slide 19: Dr. Lyle Conrad, Joel G. Breman, CDC PHIL #7201; Source Undetermined

Slide 20: (From left to right) Source Undetermined; World Health Organization, CDC PHIL #463; CDC PHIL #2047; Source Undetermined

Slide 21: Sources Undetermined

Slide 22: Source Undetermined

Slide 23: 18th century London newspaper

Slide 31: Source Undetermined

Slide 32: Source Undetermined


Slide 40: Source Undetermined

Slide 41: Source Undetermined


Slide 43: Source Undetermined

Slide 44: CDC, [http://emergency.cdc.gov/training/smallpoxvaccine/reactions/download_pocket_guide.htm](http://emergency.cdc.gov/training/smallpoxvaccine/reactions/download_pocket_guide.htm)

Slide 45: Logical Images (All Images), [http://emergency.cdc.gov/training/smallpoxvaccine/reactions/tl_view.htm](http://emergency.cdc.gov/training/smallpoxvaccine/reactions/tl_view.htm)

Slide 46: Source Undetermined

Slide 47: Dr. V. Fulginiti

Slide 48: Dr. V. Fulginiti; Dr. V. Fulginiti; Dr. V. Fulginiti; Arthur E. Kaye CDC ID#:3286; Arthur E. Kaye; J. Michael Lane, M.D. CDC PHIL #3318

Slide 49: Dr. H. Kempe; Dr. V. Fulginiti; Dr. V. Fulginiti; Dr. V. Fulginiti; Dr. V. Fulginiti;

Slide 50: Dr. H. Kempe; Dr. H. Kempe; Arthur E. Kaye CDC PHIL #3305

Slide 51: Dr. H. Kempe (All Images)

Slide 52: Dr. V. Fulginiti (All Images)

Slide 53: Dr. V. Fulginiti; Dr. V. Fulginiti

Slide 54: Sources Undetermined

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