Bubonic Plague
By Prayas Patel

Outline
1. General information
2. Etiological agent and vector
3. Transmission
4. Human plague infections

Plague
1. Caused by *Yersinia pestis*.
2. Bacteria transmitted by:
   - Bites from fleas (usually *Xenopsylla cheopis*)
   - Handling an infected animal (rarely)
History

Pandemic of the mid-14th century was just 1 of 3 pandemics of the plague thus far (Kosoy 2004).

US and Global Incidence

1. Plague has not been eradicated.
2. Cases globally: 1,000 – 2,000 a year
3. Cases in US: 10 – 15 a year

Figure 1: Reported cases of human plague by counties in the US, 1970-1997. Produced by the CDC.
Figure 2. Countries with reported human plague infections between the years 1970-1998 and the distribution of animals infected with the plague bacterium around the world produced by the CDC.

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Etiology

*Yersinia pestis*

1. Classified in the family *Enterobacteriaceae*.
2. Evolved from a clone of *Yersinia pseudotuberculosis* (Achtman 14047).
Yersinia pestis
1. Coccobacillus
2. Gram-negative
3. Facultative anaerobe

Biovars
Y. pestis has 3 biovars (Achtman et al. 1999)
Biovar – “a strain of a strain”

3 Biovars (Perry 1997)
• Antigua – 6th century
• Medievalis – 14th century
• Orientalis – 20th/21st century
Virulence

Virulence factors

• Biofilms (Darby 2008)
• Interference of inflammatory response (Sun et al. 2007)
• Induce immunodeficiency (Bi et al. 2008)

Reservoirs

1. Most common reservoirs are wild rodents.
2. These would include
   • Rattus species
   • Rock squirrel
   • California ground squirrel
3. EVEN the soil (Infectious Disease Society of America)

Xenopsylla cheopis

Figure 3. A Xenopsylla cheopis.
**X. cheopis**

1. Ectoparasite
2. Found worldwide with a host (typically a species of *Rattus*).
   - Most commonly in tropical and subtropical climates.

**X. cheopis feeding**

1. *X. cheopis* feeds from the blood vessel of its host.
   - Injects salvia to prevent clotting (Andersen et al. 2007).
2. Proventriculus is a valve-like organ between esophagus and stomach.
3. Both sexes can transmit infection.

**Y. pestis’ impact on flea**

- Bacteria may occasionally block the flea’s digestive tract.
- Blockage is caused by biofilms (Perry 1997).
- Process aids in spread of disease.
Y. pestis’ impact on flea

To feed again, the flea must remove the blockage.

By removing the blockage the flea may inadvertently spread the infection.

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Transmission

1. Bites from infected fleas
2. The bacterium can enter through breaks in the skin.
Transmission (continued)

1. Contact with plague infected animal’s carcass.
2. Plague may be spread through the air by an animal with pneumonic plague.

Humans as “hosts”

- Humans are NOT the primary host of *Y. pestis.*
- They are INCIDENTAL hosts (Infectious Disease Society of America 2009).
Human bubonic plague

Bubonic plague occurrence in humans is related to: (Infectious Disease Society of America 2009)

- Percentage of hosts killed by infection
- Amount of human exposure to rodents

Human to Human Transmission

- Found ONLY in pneumonic plague.
- Droplets expelled may contain bacteria.

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Disease Progression

1. The bacteria enters into the body
2. Bacteria spreads to lymph tissue
3. The bacteria may also spread to infect the lungs (pneumonic plague).

Signs and Symptoms

- Fever, chills, headache
- Painful, warm, and swollen lymph node
  - Called a bubo (Bubonic plague)
- Death caused by endotoxic shock

Bubo

Figure 6. A bubo on the thigh of a person infected with Y. pestis.
Treatment

1. The best courses of treatment are the antibiotics Gentamicin or Streptomycin.
2. Vaccines were developed but were ineffective.

Review

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Literature Cited


