Whooping cough: \textit{Pertussis}

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\cite{Alder2013}
What is it?

- Highly contagious acute respiratory disease (Mosby 2006)
- *Bordetella pertussis* (Black, 2008)

- Affects infants and younger children (CDC, 2014)
  - Fatal to babies >1yr
- Teens & adults are susceptible (CDC, 2014)
  - Mostly are the carriers
Domain- Bacteria  
Kingdom- Eubacteria  
Phylum- Proteobacteria  
Class- Betaproteobacteria  
Order- Burkholderiales  
Family- Alcaligenaceae  
Genus- Bordetella (7 sp.)  
Species- Pertussis  

(Brenner, Krieg, Garrity, & Staley, 2005)
Etymology

- **Bordetella**- Named after Jules Bordet -isolated pertussis with Octave Gengou
  (Brenner et al., 2005)

- Per- very, severe  Tussis- cough
  Pertussis = very severe cough
  (Brenner et al., 2005)

- Chinese call it the “cough of 100 days”
  (Black, 2008)
History

❖ 1578- Earliest description- G. Baillou
❖ 1813- First complete clinical description- Robert Watt
❖ 1906- Jules bordet & Octave Gengou isolated organism
❖ 1940s- vaccine made of inactivated whole cell suspension
❖ 1997- Acellular vaccine  (Alder, 2013)
❖ 2003- Genome sequenced  (Parkhill, et al., 2003)
➢ Strain: Tahoma I
➢ 4,086,186 base pairs & 3,816 genes
Parasitic and Pathogenic

- Require a human host (Bergey & Holt, 1994)
- Nicotinamide, organic sulfur (cysteine), and organic nitrogen (amino acids) (Bergey & Holt, 1994)
Growth

- Fastidious
- Only found in the respiratory tract of humans (Brenner et al. 2005)
- Susceptible to compounds such as unsaturated fatty acids and sulfides (Alder, 2013; Brenner et al., 2005)
- Can be grown on:
  - Bordet Gengou medium (potato-glycerol-blood agar) (Alder, 2013; Brenner et al., 2005)
  - Charcoal horse blood agar (Brenner et al. 2005)
  - Stainer-Sholte Broth (Brenner et al. 2005)
  - Cyclodextrin Solid Medium (Brenner et al. 2005)
Morphology & Physiology

❖ Colonies- smooth, convex, pearly, glistening, & surrounded by a zone of hemolysis without definite periphery (Bergey & Holt, 1994)
❖ Does not form a pellicle (Bergey & Holt, 1994)
❖ Minute .2-.5 x .5- 1 Micrometer (Brenner et al., 2005)
❖ Non-motile (Brenner et al., 2005)
❖ Coccobacillus (Black, 2008)
❖ Gram negative (Alder, 2013)
❖ surrounded by a slime sheath composed of extruded filaments or secreted blebs (Brenner et al., 2005)
Morphology & Physiology Cont’d

- Obligate aerobe (Brenner et al., 2005)
- Optimal temperature 35-37°C (Brenner et al., 2005)
- Reproduce by Lysis, not budding (Bergey & Holt, 1994)
- Negative for cysts (Bergey & Holt, 1994)
Morphology & Physiology Cont’d

- **Litmus Milk- Alkaline** (Bergey & Holt, 1994)
- **Chemoorganotrophic** (Bergey & Holt, 1994)
- **Does not produce** (Bergey & Holt, 1994)
  - Nitrate reductase (lab)
  - Urease
  - Indole from tryptophan (Lab)
- **Does Produce**
  - Oxidase  (Bergey & Holt, 1994)
  - Catalase  (Brenner et al., 2005)
In The Body…

- Infected respiratory droplet is inhaled (Black, 2008)
- Does not invade tissues or enter the blood (Black, 2008)
- Pertussis colonizes on the cilia in respiratory tract
  - Pertactin (Khanacademymedicine, 2014)
  - filamentous hemagglutinin (Khanacademymedicine, 2014)
- dermonecrotic toxin- causes inflammation & local necrosis (Todar, 2012)
In The Body…Cont’d

- Tracheal cytotoxin (TCT)
  - kills cilial cells & neutrophils (Khanacademymedicine, 2014)
  - stimulates release of cytokine IL-1 (Todar, 2012)

- Adenylate cyclase toxin (ACT) & Pertussis toxin (PT)
  - Prevent barrier cells and macrophages from signaling to other cells
  - Prevent breakdown by macrophages
  - Cause lymphocytosis (PT only) (Khanacademymedicine, 2014)
3 Stages (Black, 2008)

❖ Catarrhal
  ➢ Highly contagious
  ➢ 1-2 weeks

❖ Paroxysmal
  ➢ Most intense stage
  ➢ 4-6 weeks

❖ Convalescent
  ➢ Months up to 2yrs.
Stage I Catarrhal (Mosby, 2006)

- fever
- runny nose
- sneezing
- mild dry cough
- listlessness
- irritability
- anorexia
- vomiting
- apnea (infants)
- cyanosis
Stage II Paroxysmal (CDC, 2014)

- moist cough
- uncontrollable rapid coughing fits
- whooping sound
- vomiting
- dehydration
- electrolyte imbalance

- facial redness
- cyanosis
- exhaustion
- fractured ribs
- fainting
- weight loss
- loss of bladder control

http://youtu.be/JKUSKYdYo9w
Stage III Convolescents (Black, 2008)

- mild cough
- secondary infections
Transmission

- inhaling respiratory droplets from an infected person (CDC, 2014)
- one person can infect up to 15 other people (CDC, 2014)

http://www.superhomemeremdes.com/images/sneezing_spreads_flu_virus_800x535_pd.jpg
Diagnosis

❖ nasopharyngeal swab *(Black, 2008)*
❖ blood work *(CDC, 2014)*
Treatment

❖ Antibiotics
  ➢ Erythromycin
  ➢ Tetracycline
  ➢ Chloramphenicol
  ➢ Clarithromycin
  ➢ Azithromycin

❖ bed rest
❖ oxygen therapy
❖ fluid and nutritional encouragement

(CDC, 2014)
(Mosby, 2006)
Prevention

❖ Vaccinations *(CDC, 2014)*

➢ childhood - DTaP
  ■ 2, 4, 6 months
  ■ booster @ 15-18 months
  ■ booster @ 4-6yrs
  ■ last 5 years

➢ teens & adults - Tdap
  ■ last 10 years

❖ cover cough
❖ wash hands
❖ dispose of soiled articles
❖ public education

*(Leifer, 2007)*
Pertussis in the news...

- 2014 California Epidemic
- By June 10th California department of public health showed reports of 3,458 cases
- 800 reported in 3 week period
- 24% increase in reports from 2013 throughout the U.S.
- 23 fold increase in risk of getting sick if not vaccinated
- 225 deaths in U.S. from 2000-2012
  - 221 were babies <3 months
  - cocooning

(Crawford, 2014)
References


Questions?

(Weston, 2012)