CHAPTER-X
CHOLERA
VIBRIO CHOLERAE

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HISTORY

- Origins in India, cases reported as early as 1563
- About 8 pandemics to date
  - 1817-`23: First Pandemic
  - 1829-`50: Second Pandemic
  - 1852-`60: Third Pandemic* Pacini
  - 1863-`79: Fourth Pandemic
  - 1881-`96: Fifth Pandemic * Koch
  - 1899-`1923: Sixth Pandemic
  - 1961-?: Seventh Pandemic
  - 1992-?: Eighth Pandemic
HISTORY

- First pandemic spreads from India to South, Central Asia, Middle East and Russia
- Second pandemic reaches England
- Pandemics in 1800’s deadly
- All pandemics reach Africa
- First pandemic reaches Latin America in 1991
Distribution
CAUSATIVE AGENT
DISCOVERY

- 19th Century: What is Cholera?
- Miasma Theory
- Blood Generation Theory
- Germ Theory
CAUSATIVE AGENT
DISCOVERY

- John Snow (1813-1858):

- Water borne transmission of Cholera (1855)
DISCOVERY

- **Filippo Pacini (1812-1883)**
  - 1854: Cholera reaches Florence, Italy. Pacini discovers causative agent.
  - Publishes “Microscopical Observations and Pathological Deductions on Cholera”.
**Discovery**

- Robert Koch (1843-1910)
- 1884: RedisCOVERS *Vibrio cholerae*
**Vibrio cholerae**

Morphology

- Gram negative
- Comma shaped
- Sheathed, polar flagellum
- 1.4-2.6μm x 0.5-3μm
**Physiology**

- Facultative anaerobic
- Asporogenous
- Growth stimulated by NaCl
- pH 6 - 10, Acid labile
- Temperature 18 - 37°C
**Virulence & Pathogenicity**

Ingestion of *V. cholerae*

*Resistant to gastric acid*

*Colonize small intestine*

॰ **Virulence of Non-toxigenic *V. cholerae* O1 strain not well understood**
Toxigenic *V. cholerae* Pathogenicity

- Colonization factors (the TcpA pilus)
- Production of enterotoxin
- Associated outer membrane proteins on enterocytes e.g. adenylate cyclase
Secrete enterotoxin

Enterotoxin binds to intestinal cells

Chloride channels activated

Release Large quantities of electrolytes & bicarbonates

Fluid hypersecretion

Diarrhea

Dehydration
TRANSMISSION

- Fecal-oral route
- Entry = oral
- Discharge = fecal
TRANSMISSION

- Humans only reservoirs
- Bacterium transmitted via contaminated water, food
- Carriers: houseflies and other insects
- Person to person transmission?
SYMPTOMS

- 1-3 day Incubation Period
- Mild diarrhea → Sudden severe diarrhea
- Mucus and intestinal tissue visible in feces
- Muscle cramps
- Scaphoid abdomen
- Vomiting
- Loss of skin turgor
- Weak pulse
**DIAGNOSIS**

- Clinical symptoms

- Isolation of *V. cholerae* from stool
  - Live *V. cholerae* in stool (ca. $1.0 \times 10^8$ cells per ml)
  - Identification via dark-field microscopy

- Measurement of serum antibodies using ELISA
  - Antibacterial antibodies: vibriocidal assays
  - Antitoxin antibodies
METHODS OF CURE

Chemotherapeutic

- Antibiotics (tetracycline)

Immunological

- Local mucosal immune response to *V. cholerae*
- Serological antivibrio antibodies
- Antitoxin antibodies

To Ease Symptoms

- Oral Rehydration
- Intravenous Rehydration
PREVENTION & CONTROL

- Immunization
  - Active Immunity induced by:
    - attenuated *V. cholerae*
    - Toxoid (not good antigen)

- Preventing contamination of food and water e.g. boiling water, covering food

- Education
  - Personal and domestic hygiene

- Prevention of contamination of water supplies
  - Improvement of sewage systems