A Walk Through the Disease:

Syphilis

“The Great Imitator”
(Black 622)

(1905- Present)
(Black 621)
What causes the disease?

*Treponema Pallidum (T. Pallidum)*
- Spirochete (corkscrew shaped bacterium)
- Helical rods
- 0.1 - 0.4 micrometers in diameter
- 5-20 micrometers in length

(Bergey, 30)
**T. Pallidum**

- Consists of:
  - (Periplast)outer enveloping membrane - contoured to give between 4-14 spirals
  - axial filament (flagella) composed of several fibrils
  - outer envelope is between 70-90 micrometers thick
  - fibrils stretched from one end of treponeme to the other end and unwind in helical coils
  - flexible cell wall

(Monif, Giles, 2008)
T. Pallidum

T. Pallidum

- Tight, regular or irregular elongated spirals
- Unicellular
- Gram Negative
- Contains a multilayered outer membrane “envelope”
  - is an obligate internal bacterium

(Bergey, 27)
T. Pallidum

- Fragile bacteria - can only survive and reproduce in a living host
- Grows best at 34-35 degrees celsius
- Sensitivity to elevated temperatures
  - death of bacterium occurs at 40.5 degrees celsius
- Reproduce by way of Transverse Binary Fission
  - Constriction of cytoplasm is across the plane
  - Parent cell divides, and results in 2 equal daughter cells

(Journal of Clinical Investigation, 2011)
T. pallidum (cont.)

- Host associated, pathogenic organism
- Found in oral cavities, intestinal tracts, and genital areas of humans (Bergey, 30)
- Cannot be cultured in a lab using routine culture materials (antimicrobe.org)
- Has one or more flagella inserted at each end of the periplasmic space and it runs throughout (Bergey, 30)
T. Pallidum (cont.)

- Entire genome completely sequenced in 1998 (antimicrobe.org)
  - less than 1,000 genes ("Treponema Pallidum", Microbytes)
  - 1,138,006 base pairs (antimicrobe.org)
- Actively, motile
- Fastidious growth requirements (Black, 621)
- Doesn’t stain well with Gram’s method, stains best with silver impregnation technique
- Anaerobic or microaerophilic
- Chemoorganotrophs
- Catalase and oxidase negative (Bergey, 30)
Diagnosis of the disease

- Definitive method is visualizing the unique movement of the spirochete using dark field microscopy
- Blood tests:
  - Nontreponemal tests (VDRL and RPR)
  - Treponemal tests (FTA-ABS, TP-PA, various EIAs and chemiluminescence

(“Syphilis,” CDC Factsheet)
Transmission of Disease

- Contact with active lesions through:
  - Sexual means
  - Body fluids (saliva)
  - Kissing
- Passed from mother to fetus

(Black, 620)
Congenital Syphilis

- Treponemes cross the placenta, infecting the fetus (Black, 623)
- Many fetuses infected with syphilis are stillborn or die shortly after birth (Marieb, 1053)
- Those who survive may show the following symptoms: (Black 623)
Congenital Syphilis (Cont.)

- If left untreated in pregnant women, syphilis results in infant death in up to 40% of cases
- The rates of infant death due to syphilis in 2012 were as follows:
  - Whites- 2.1 cases per 100,000 live births
  - Hispanics- 3.8 times higher with 7.9 cases per 100,000 live births
  - Blacks- 14.1 times higher with 29.6 cases per 100,000 live births

("Syphilis," CDC Factsheet)
Typical Case of Syphilis

- Consists of Multiple Stages
  - Incubation period
  - Primary stage
  - Primary latent period
  - Secondary stage
  - Secondary latent stage
  - Tertiary stage

(Black, 621-622)
Incubation Period

- Occurs over a 2-3 week period after infection.
- Log/Lag phase of growth
  - Organisms are multiplying and spreading throughout the body.

(Black, 621)
Primary Stage

On average...

- Occurs about 3 weeks after infection
  - Inflammatory response at original entry site
  - Formation of first **chancre**
  - Additional chancrees appear
- After 4-6 weeks....
  - Lesions spontaneously go away without scarring

("Syphilis," CDC images)
Primary Latent Period

- All external signs of disease disappear
- Diagnostic blood tests appear positive
- Organisms are spreading throughout the circulation

(Black, 622)
Secondary Stage

- Carrier is highly contagious!!
- Symptoms can appear, disappear, and reappear many times over a 5 year span
- Symptoms include:
  - Copper colored rash
  - Various pustular rashes and skin eruptions
  - Cervical lesions
  - Painful, whitish mucous patches in oral cavity
- Eventually lesions spontaneously heal again

(Black, 622) images- (“Syphilis,” CDC images)
Secondary Latent Stage

- All symptoms disappear
- Diagnostic blood tests may appear negative
- Stage can last a lifetime or a highly variable amount of time. (May not occur at all)
- Can remain in this stage or progress further

(Black, 622)
Tertiary Stage

- Permanent damage occurs throughout various systems of the body
  - CNS, blood vessels, skeleton, and skin
- Damage is caused by formation of Gummas
- Neurosyphilis
  - Thickening of meninges
  - Ataxia
  - Paresis

(Black, 622)

(“Dermatology online journal”)
Tertiary Stage (cont.)

(“Syphilis-Tertiary”)

(“General Paralysis of the Insane”)
Treatment

- Benzathine benzylpenicillin (form of penicillin)
  ○ also known as Benzathine penicillin G
  ○ a cell envelope antibiotic
    (Beta Lactam antibiotic) - containing a beta lactam ring nucleus
    (merckmanuals.com)

- Combination of:
  ○ benzylpen - antibiotic
  ○ benzathine - penicillin stabilizer
    (cdc.gov)
Treatment (Cont’d)

● Intramuscular injection of Benzathine Penicillin
  (More common form of treatment)
  ○ single dose is used to treat primary and secondary stages
  ○ provides low concentrations of antibiotic over a period of 2-4 weeks after a single dose

(cdc.gov)
Treatment (Cont’d)

- Acts to:
  - inhibit cell wall synthesis
  - interrupting peptidoglycan synthesis
  - prevents cross linkages
    [merckmanuals.com]

- Treatment kills the bacterium
  - preventing further damage
  - cannot repair damage already done
    [cdc.gov]
Treatment (Cont’d)

- In addition to antibiotic treatment, it is extremely important to:
  - Abstain from sexual contact when active chancre(s) are present as well as during course of treatment
  - Advise any and all sexual partners of possible exposure, as to be tested/treated appropriately as a result of being infected
  - Non-compliance can result in infecting partners, as well as re-infecting yourself

(cdc.gov)
Treatment (Cont’d)

Benzathine Penicillin Intramuscular Injection (http://farm5.static.flickr.com)
Treatment (Cont’d)

● Additional treatments include:
  ○ Amoxicillin (semi-synthetic penicillin) given orally 2x daily in addition to
  ○ Probenecid (uricosuric drug) - increases uric acid excretion in urine
    (when used to treat syphilis, it inhibits renal secretion of both natural and semi-synthetic penicillin)

● This course of treatment can be utilized at any stage
  (antimicrobe.org)
Treatment (Cont’d)

● Recommended regimen to treat Neurosyphilis
  ○ Intramuscular injections of Benzathine Penicillin
    (every 4 hours for 10-14 days)

  This aids in reaching treponemical levels in the cerebrospinal fluid of the central nervous system

● Although regimens may fail, and re-treatment may be required especially in HIV infected patients
  (antimicrobe.org)
Treatment (Cont’d)

● Without adequate treatment:
  ○ Primary Stage → Secondary Stage
  ○ Secondary Stage
    - symptoms will go away with or without treatment, but without will result in → Tertiary Stage

● Tertiary Stage → Neurosyphilis → DEATH
  (“Syphilis,” CDC Factsheet)
Works cited


<https://www.youtube.com/watch?v=mfWO3s7Mv58>.


<http://www.youtube.com/watch?v=Klsfl50lrMU>. 

