Microbial Diseases of the Urinary and Reproductive Systems
LEARNING OBJECTIVES

Describe the normal microbiota of the upper urinary tract, the male urethra, and the female urethra and vagina.

Describe modes of transmission for urinary and reproductive system infections.

List the microorganisms that cause cystitis and pyelonephritis. Name the predisposing factors for these diseases.

List the causative agents, symptoms, methods of diagnosis, and treatments for gonorrhea, chlamydia, PID, and syphilis.

List reproductive system diseases that can cause congenital and neonatal infections, and explain how these infections can be prevented.

Discuss genital herpes, genital warts, candidiasis, and trichomoniasis.
Normal Microbiota

- Urinary bladder and upper urinary tract are sterile
- Women: Flora influenced by estrogen. Lactobacilli dominate vaginal microbiota during reproductive years
- Men: urethra normally sterile
- >1,000 bacteria/ml or 100 coliforms/ml of urine indicates infection
Cystitis

- Common in females. (Symptoms?) Contributing factors:
  - Microorganisms at the opening of the urethra and along the length of the urethra
  - Careless personal hygiene
  - Sexual intercourse
- Most common etiologies
  - *E. coli*
  - *S. saprophyticus*
  - May also be caused by *Proteus, Klebsiella, Enterococcus, Pseudomonas*
- Antibiotic-sensitivity tests may be required before treatment.
- Many nosocomial cases (how?)
- Bacteria can ascend to the kidney → ureteritis → *pyelonephritis*. (75% caused by *E. coli*)
Sexually Transmitted Diseases / Infections (STDs / STIs)

- Most diseases of reproductive system are STIs (15 million new cases each year)
- 8 billion dollars a year to control STIs
- > 30 different types of STIs (bacterial, viral, parasitic)
- Highly effective prevention (?)
Gonorrhea (“Clap”)

- *N. gonorrhoeae* (G –, dipploococci), reportable
- Attaches to mucosal cells of oral-pharyngeal area, genitals, eyes, and rectum by means of fimbriae.
- Males usually symptomatic (painful urination and pus discharge). Blockage of the urethra and sterility are complications of untreated cases.
- If left untreated, may result in endocarditis, meningitis, arthritis, ophthalmia neonatorum
- Diagnosed by ELISA or PCR.
- Antibiotic resistance increasing (R-plasmids)
- ~ 350’000 cases / year in US – only human reservoir
- No immunity build up / no vaccination
Most males symptomatic

With pus containing discharge from urethra

Females often asymptomatic unless the infection spreads to uterus and uterine tubes leading to

PID = Pelvic Inflammatory Disease (~ 1 mio women per year in US)
PID → tubal infection, salpingitis, scar tissue, adhesions, ectopic pregnancies and sterility, chronic abdominal pain.

50% of females asymptomatic
Nongonococcal Urethritis (NGU) - Chlamydia

- *Chlamydia trachomatis*, obligate intracellular bacterium
- Most common reported STI in US, ~ 4 mio cases/year
- “Silent disease”
  - 50% of males asymptomatic
  - 75% of females asymptomatic – PID possible!
- Chlamydial ophthalmia and/or pneumonia in newborn
- Diagnosis is based on the detection of chlamydial DNA in urine
- Annual screening tests recommended for sexually active women < 25 y
Syphilis

- **Treponema pallidum** (spirochete)
- Has not been cultured *in vitro* – can be grown in cell cultures
- Transmitted by direct contact – can invade intact mucous membranes or penetrate through breaks in the skin
- No animal reservoir
- The Great Imitator
- Three stages
  - Primary: hard chancre (painless) at site of infection
  - Secondary: flu-like symptoms, rashes
  - **Latent (possible symptoms of 2nd stage)**
  - Tertiary: gummas in skin and internal organs
Secondary syphilis:
Lesions can mimic almost anything. Often patient feels poorly and has flu like symptoms + wide spread rash

Lesion fluid still highly infectious! Can last weeks to months.
Latent for up to 30 years, then

Tertiary Syphilis

Neurosyphilis
Cardiovascular syphilis
Aortic aneurysms
Gummatous syphilis

“Gumma” becomes apparent after 15-30 years of untreated infection (can appear anywhere)
Congenital syphilis – *T. pallidum* crosses placenta → Hutchinson's triad in 63% of cases: Hutchinson's teeth (notched incisors), keratitis and deafness

**Diagnosis:** *T. pallidum* cannot be cultured → Darkfield microscopy and serological assays

**Treatment** successful in all stages, but damage done is irreversible
Genital Herpes – Herpes simplex virus

- HSV-1 (HHV1) and HSV-2 (HHV2)
- 16.2%, or about one out of six, people 14 to 49 years of age have genital HSV-2 infection.
- Symptoms: painful urination, genital irritation, and fluid-filled vesicles
- Neonatal herpes: contracted during fetal development or birth. Can result in neurological damage or infant fatalities
- Virus might enter latent stage in nerve cells (Life-long infection). Vesicle recurrences following trauma, stress, and hormonal changes
- Highly transmittable – subclinical shedding can be as high as in symptomatic infection
- Suppression: Acyclovir and others
Genital Warts

- Human papillomaviruses
- ~ 20 mio Americans currently infected. ~ 6 mio new infections each year.
- HPV 16 and 18 associated with cervical and penile cancer
- DNA test is needed to detect cancer-causing strains.
- Importance of pap smear
- Gardasil and Cervarix for boys and girls, 9 – 26 years old.
Trichomoniasis

- **Trichomonas vaginalis**
- Most common curable STI in young women. (7.4 mio new cases per year)
- Men usually asymptomatic carriers (reservoir).
- Women frequently symptoms of infection: frothy, yellow-green vaginal discharge with strong odor.
  - Diagnosis based on observation of motile protozoa in purulent discharges (wet mounts) from infection site.
  - Treatment: Metronidazole.
Trichomonas vaginalis

1. Trophozoite in vaginal and prostatic secretions and urine
2. Multiplies by longitudinal binary fission
3. Trophozoite in vagina or orifice of urethra

Sexual intercourse

i = Infective Stage
d = Diagnostic Stage
TORCH Infections or TORCH complex

- Medical acronym for a set of 5 congenital infections

  - **T** ______________________
  - **O** ther infections: namely hepatitis B, syphilis, HHV-3
  - **R** ______________________
  - **C** MV____________________
  - **H** ______________________