

1  **Chapter 26**

Microbial Diseases of the Urinary and Reproductive Systems

2  **Q&A**

- Both *Leptospira interrogans* and the spirochete that causes syphilis penetrate deeply into the tissue of organs. What is it about their morphology that facilitates this?
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3  **Structure and Function of Urinary System**

26-1 List the antimicrobial features of the urinary system.

4  **Structure and Function of Urinary System**

- Urinary system:
  - Two kidneys
  - Two ureters
  - One urinary bladder
  - One urethra
- Infection prevented by:
  - Valves prevent backflow to kidneys
  - Acidity of urine
  - Mechanical flushing
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5  **Female Urinary System**

- Predisposition to infection
  - Short urethra
  - Proximity to anus
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6  **The Reproductive Systems**

26-2 Identify the portals of entry for microbes into the female and male reproductive systems.

7  **The Female Reproductive System**

- Female:
  - Two ovaries
  - Two uterine (fallopian) tubes
  - The uterus, including the cervix; the vagina
  - External genitals
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8  **Female Reproductive Organs**9  **Female Reproductive Organs**

10  **The Male Reproductive System**

- Male:
  - Two testes
  - Accessory glands
  - Penis
  - Epididymis
  - Ductus (vas) deferens
  - Ejaculatory duct
  - Urethra

▪

11  **Male Reproductive and Urinary Organs**12  **Normal Microbiota**

26-3 Describe the normal microbiota of the upper urinary tract, the male urethra, and the female urethra and vagina.

13  **Normal Microbiota**

- Urinary bladder and upper urinary tract are sterile
- Lactobacilli are predominant in the vagina
  - Produce  $H_2O_2$
  - Grow on glycogen secretions
- Infection is indicated by:
  - > 10,000 bacteria/ml
  - 100 coliforms/ml
  - Positive urine leukocyte esterase (LE) test

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- ✓ Does the pH of urine facilitate the growth of most bacteria? 26-1
- ✓ Look at Figure 26-2. Is a microbe entering the female reproductive system (the uterus, etc.) necessarily also entering the bladder, causing cystitis? 26-2
- ✓ What is the association between estrogens and the microbiota of the vagina? 26-3

15  **Bacterial Diseases of the Urinary System**

26-4 Describe the modes of transmission for urinary and reproductive system infections.

26-5 List the microorganisms that cause cystitis, pyelonephritis, and leptospirosis, and name the predisposing factors for these diseases.

16  **Urinary System Infections**

- Cystitis
  - An inflammation of the urinary bladder
- Urethritis
  - An inflammation of the urethra
- Pyelonephritis
  - An inflammation of one or both kidneys

17  **Cystitis**

- Usual causative agents:
  - *E. coli*
  - *S. saprophyticus*
- Symptoms:
  - Dysuria (difficult or painful urination)
  - Pyuria (pus in urine)
- Diagnosis: >100 CFU/ml potential pathogens and + LE test
- Treatment: Trimethoprim-sulfamethexazole
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18  **Pyelonephritis**

- Causative agent: Usually *E. coli*
- Symptoms: Fever; back or flank pain
- Diagnosis:  $10^4$  CFUs/ml and + LE test
- Treatment: Cephalosporin
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19  **Leptospirosis**

- Causative agent: *Leptospira interrogans*
- Reservoir: Dogs and rats
- Transmission: Skin/mucosal contact from urine-contaminated water

20  **Leptospirosis**

- Symptoms: Headaches, muscular aches, fever, kidney failure a possible complication
- Diagnosis: Serological test
- Treatment: Doxycycline
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21  **Diseases in Focus:****Bacterial Diseases of Urinary System**

- A 20-year-old woman felt a stinging sensation when urinating and felt an urgent need to urinate, even if very little urine was excreted.
- Can you identify infections that could cause these symptoms?

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- ✓ Why is urethritis, an infection of the urethra, frequently preliminary to further infections of

the urinary tract? 26-4

✓ Why is *E. coli* the most common cause of cystitis, especially in females? 26-5

✓

✓

### 23 **Bacterial Diseases of Reproductive System**

26-6 List the causative agents, symptoms, methods of diagnosis, and treatments for gonorrhea, nongonococcal urethritis (NGU), pelvic inflammatory disease (PID), syphilis, lymphogranuloma venereum (LGV), chancroid, and bacterial vaginosis.

### 24 **Sexually Transmitted Infections (STIs)**

- Prevented by condoms
- Bacterial infections are treated with antibiotics

### 25 **The U.S. Incidence of Gonorrhea**

### 26 **Geographical Distribution of Gonorrhea**

### 27 **Gonorrhea**

- Caused by *Neisseria gonorrhoeae*
- Attaches to oral or urogenital mucosa by fimbriae
- Opa proteins prevent CD4<sup>+</sup> T-cell proliferation
- Anal gonorrhea, pharyngeal gonorrhea
- If left untreated, may result in
  - Endocarditis
  - Meningitis
  - Arthritis
  - Ophthalmia neonatorum

### 28 **Gonorrhea**

- Symptoms:
  - Men: Painful urination and discharge of pus
  - Women: Few symptoms but possible complications, such as PID
- Diagnosis: Gram stain, ELISA, PCR
- Treatment: Fluoroquinolones
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### 29 ***Neisseria gonorrhoeae***

### 30 **Antibiotic Resistance in *N. gonorrhoeae***

### 31 **Nongonococcal Urethritis (NGU)**

- Nonspecific urethritis
  - *Chlamydia trachomatis*
  - *Mycoplasma hominis*

- *Ureaplasma urealyticum*
- Symptoms: Painful urination and watery discharge; in women, possible complications, such as PID
- Diagnosis: Culturing, PCR
- Treatment: Doxycycline, azithromycin
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### 32 **Pelvic Inflammatory Disease (PID)**

- Polymicrobial, usually
  - *N. gonorrhoeae*
  - *C. trachomatis*
- Salpingitis (infection of uterine tubes)
- Symptoms: Chronic abdominal pain
- Treatment: Doxycycline and cefoxitin

### 33 **The U.S. Incidence of Syphilis**

### 34 **Geographical Distribution of Syphilis**

### 35 **Syphilis**

- Caused by *Treponema pallidum*
- Invades mucosa or through skin breaks

### 36 **Syphilis**

- Primary stage: Chancre at site of infection
- Secondary stage: Skin and mucosal rashes
- Latent period: No symptoms
- Tertiary stage: Gummas on many organs
- Treatment: Benzathine penicillin
- Congenital: Neurological damage
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### 37 **Lesions of Primary Stage Syphilis**

### 38 **Lesions of Secondary Stage Syphilis**

### 39 **Lesions of Tertiary Stage Syphilis**

### 40 **Diagnosis of Syphilis**

- Direct diagnosis
  - Staining with fluorescent-labeled monoclonal antibodies
- Indirect, rapid screening
  - VDRL, RPR, EIA
- Confirming
  - FTA-ABS tests for anti-treponemal antibodies
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41  **Q&A**

- Both *Leptospira interrogans* and the spirochete that causes syphilis penetrate deeply into the tissue of organs.

What is it about their morphology that facilitates this?

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42  **Lymphogranuloma Venereum (LGV)**

- Causative agent: *Chlamydia trachomatis*
- Initial lesion on genitals heals
- Bacteria spread through lymph
- Symptoms: Swelling in lymph nodes in groin
- Diagnosis: Microscopic and culture
- Treatment: Doxycycline

43  **Chancroid (Soft Chancere)**

- Causative agent: *Haemophilus ducreyi*
- Symptoms: Painful ulcers of genitals swollen lymph nodes in groin
- Diagnosis: Culture
- Treatment: Erythromycin; ceftriaxone

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44  **Bacterial Vaginosis**

- Causative agent: *Gardnerella vaginalis*
- Symptoms: Copious fishy, gray-white, thin, frothy discharge
- pH: >4.5
- Diagnosis: Clue cells
- Treatment: Metronidazole

45  **Clue Cells**46  **Diseases in Focus:  
Vaginitis and Vaginosis**

Can you identify the infection caused by the organism in the photo?

47 

- ✓ Why is the disease condition of the female reproductive system, principally featuring growth of *Gardnerella vaginalis*, termed *vaginosis* rather than *vaginitis*? 26-6

✓

✓

✓

48  **Viral Diseases of the Reproductive Systems**

26-7 Discuss the epidemiology of genital herpes and genital warts.

49  **Genital Herpes**

- Caused by herpes simplex virus 2 (human herpesvirus 2, or HSV-2)
- Painful vesicles on genitals
- Neonatal herpes transmitted to fetus or newborns
- Recurrences from viruses latent in nerves
- Suppression: Acyclovir

50  **Genital Warts**

- Human papillomaviruses
- Warts in genital area
- HPV 16 causes cervical cancer and cancer of the penis
- Treatment: Podofilox; imiquimod
- Prevention: Vaccination against HPV strains
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- ✓ Both genital herpes and genital warts are caused by viruses; which one is the greater danger to a pregnancy? 26-7

52  **Fungal Disease of Reproductive Systems**

26-8 Discuss the epidemiology of candidiasis.

53  **Candidiasis**

- Causative agent: *Candida albicans*
- Grows on mucosa of mouth, intestinal tract, and genitourinary tract
- NGU in males
- Vulvovaginal candidiasis, yeasty discharge
- pH: <4
- Diagnosis: microscopic and culture
- Treatment: Clotrimazole; fluconazole

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- ✓ What changes in the vaginal bacterial microbiota tend also to favor the growth of the yeast *Candida albicans*? 26-8

55  **Protozoan Disease of Reproductive System**

26-9 Discuss the epidemiology of trichomoniasis.

26-10 List reproductive system diseases that can cause congenital and neonatal infections, and explain how these infections can be prevented.

56  **Trichomoniasis**

- Causative agent: *Trichomonas vaginalis*
- Found in semen or urine of male carriers
- Vaginal infection causes irritation and profuse foul, greenish yellow frothy discharge

- pH: 5–8
- Diagnosis: Microscopic identification, DNA probe
- Treatment: Metronidazole

57  ***Trichomonas vaginalis***58  **The TORCH Panel of Tests**

- Toxoplasmosis
- Other (such as syphilis, hepatitis B, enterovirus, Epstein-Barr virus, varicella-zoster virus)
- Rubella
- Cytomegalovirus
- Herpes simplex virus
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59  **Diseases in Focus:****Diseases of the Reproductive System**

- A 26-year-old woman had abdominal pain, painful urination, and a fever. Cultures grown in a high-CO<sub>2</sub> environment revealed gram-negative diplococci.
- Can you identify infections that could cause these symptoms?

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- ✓ What are the symptoms of the presence of *Trichomonas vaginalis* in the male reproductive system? 26-9
- ✓ What is the intent of the TORCH panel of tests? 26-10