Chapter 7

Antibiotics and Antifungal, Antiviral, and Antiparasitic Agents
Chapter 7

Lesson 7.1
Learning Objectives

- Identify the antibiotics and give their general uses.
- Identify serious side effects of antibiotics.
- Distinguish between a broad-spectrum antibiotic and a narrow-spectrum antibiotic.
Learning Objectives

- Distinguish among first-, second-, and third-generation cephalosporins.
- Give examples of antibiotics that are used to treat specific conditions.
Antibiotic Agents

- Produced by living cells or the synthetic analog
- Kill or inhibit growth of microorganisms
- Come from molds, bacteria, and yeasts
- Many now synthetically manufactured
- Small changes in structure produce significant changes in drug.
Antibiotic Agents

- Each antibiotic agent has a characteristic “spectrum.”
  - Broad-spectrum antibiotic agents are effective against many microorganisms.
  - Narrow-spectrum antibiotic agents are effective against only a few microorganisms.

- Antibiotic agents must be taken for the full time prescribed or drug-resistant organisms may result.
Antibiotic Agents

- Allergic reactions to antibiotic agents are common; repeated exposure may cause a mild rash or severe or even fatal reactions.

- Antibiotic agents are placed in broad groups: penicillin agents, cephalosporin agents, tetracycline agents, macrolide agents, quinolone agents.
Penicillin Agents

- Any broad-spectrum antibiotic agent that is derived from *Penicillium* mold.
  - First antibiotic agent discovered
  - Many variants now available: penicillin G variations, Bicillin L-A variations, penicillin V

- Semisynthetic penicillin agents have broader spectrums and come in many variants.
- Allergic reactions are common.
Penicillin Agents

- Common treatment for the following:
  - Streptococcal and pneumococcal infections
  - Gonorrhea
  - Syphilis
  - Meningitis
  - Other infections

- Penicillin G—short duration, destroyed by stomach acids, must be injected

- Penicillin V—can be taken orally
Penicillin Agents

General toxicity and side effects are as follows:

- Allergy
- Abdominal cramping and diarrhea
- *Monilia* overgrowth; vaginal, perineal, or oral thrush infections result
Beta-Lactam Agents
(Cephalosporin Agents)

- They were originally developed from a mold (like penicillin agents) and have similar side effects.
- They act on young, dividing bacteria by interfering with cell wall formation.
- Be cautious of cross-sensitivity with penicillin agents because of structural similarities.
- Side effects include the following: gastrointestinal upset, skin rashes.
Beta-Lactam Agents
(Cephalosporin Agents)

- Divided into four groups by spectrum:
  - First-generation—effective against streptococci, some staphylococci, some urinary organisms
  - Second-generation—first-generation spectrum plus *Haemophilus influenzae*
  - Third-generation—more effective against gram-negative gastrointestinal and urinary infections; generally reserved for infections that do not respond to other agents
  - Fourth-generation—infections of urinary tract, pyelonephritis, skin, soft tissue, and abdomen
Chapter 7

Lesson 7.2
Learning Objectives

- Identify the antibiotics and give their general uses.
- Identify serious side effects of antibiotics.
- Give examples of antibiotics that are used to treat specific conditions.
Tetracycline Agents

- Broad-spectrum antibiotic agents
- Effective against many microorganisms, particularly those infecting respiratory system and soft tissues
- Most are oral, many parenteral
- Give on empty stomach
- Not given to children or during pregnancy (stains tooth enamel)
Macrolide Agents (Erythromycin Agents)

- These agents are bacteriostatic and effective only against multiplying organisms.
  - They have a relatively narrow spectrum.
  - Generally they are as effective as penicillin and often used in penicillin-sensitive patients.
    - Effective against gram-positive cocci (staph and strep)
    - Effective against *Bacillus anthracis* (anthrax)
  - Synthetic agents like azithromycin, clarithromycin, and dirithromycin have expanded spectrum activity and are more potent.
Quinolones and Other Antibiotic Agents

- These are orally effective agents that act differently from antibiotic agents with a broad spectrum.
- They may be used in infections resistant to older antibiotic agents.
- The drug is eliminated slowly.
  - Caution should be used in patients with kidney or liver impairment, as well as when used in combination with anticoagulant agents.
- Many antibiotic agents are ototoxic (they can cause auditory damage) and must be used with caution in children.
Chapter 7

Lesson 7.3
Learning Objectives

- Identify common antiparasitic agents.
- Identify antiviral agents and their general uses.
- List the current uses of sulfonamides.
- List the symptoms of toxic effects of sulfa drugs.
Sulfonamide Drugs

- Sulfa drugs are also used to treat infection.
  - Synthetic drugs that resemble PABA
  - Must not be used in patients taking medications containing PABA

- Increasing bacterial resistance limits its use.
Sulfonamide Drugs

- Uses
  - Chancroid
  - Trachoma
  - Inclusion conjunctivitis
  - Nocardiosis
  - Uncomplicated urinary tract infections caused by susceptible organisms
  - Toxoplasmosis
  - Malaria, as adjunctive therapy in some cases
  - *Haemophilus influenzae* infections of the middle ear
Sulfonamide Drugs, Long Acting

- Allergic reactions may occur; hypersensitivity reactions may develop, followed by cross-reaction with related drugs.
- Side effects are decreased because of lower doses and longer action.
- These drugs may react with thiazide diuretics and antidiabetic agents.
  - Sulfasalazine used orally for ulcerative colitis and Crohn disease
Antifungal Agents

- Fungi can survive as parasites because they do not contain chlorophyll.
- Infections may be simple, as in athlete’s foot fungal rash or thrush.
- In patients with impaired immune systems, fungal infections can be life threatening.
Antiviral Agents

- A virus enters an intact host cell and is able to massively reproduce and mutate.
- Hundreds of thousands of viral copies can be made in a single cycle of infection.
- Antiviral drugs are unable to kill viruses.
- Antiviral drugs are used to treat influenza, hepatitis, herpes virus, and AIDS.
Antiviral Agents

- Used in the treatment of influenza
  - Oseltamivir (Tamiflu) and zanamivir (Relenza)
- Reduce duration of symptoms by a few days
- Do not prevent infection from influenza virus
- Used in susceptible populations such as the elderly, the very young, and the immunocompromised
Antiviral Agents

- Types of hepatitis
  - A—short-lived, not treated with antiviral agents
  - B—may lead to cirrhosis
  - C—very chronic, end-stage liver disease

- Interferon alfa-2b (treats hepatitis and West Nile virus)
- Lamivudine (treats hepatitis B and acquired immunodeficiency syndrome [AIDS] virus)
- Peg-interferon
- Ribavirin
- Rebetron
Antiviral Agents

- Herpes virus
- Lie dormant in sensory neurons after infection
  - Herpes simplex and varicella zoster
- Drugs (topical or systemic)
  - Acyclovir
  - Famciclovir
  - Valacyclovir
  - Penciclovir
Antiviral Agents

- AIDS treatment has concentrated on drugs that interfere with viral RNA.
  - Progression of AIDS and drug-treatment decisions are based on two mechanisms:
    - Viral load—directly measured in copies per microliter
    - CD4 cell count—reduction corresponds to AIDS progression
Antiviral Agents

- Three major categories of antiviral drugs are used, and a fourth is used less often:
  - Nucleoside reverse transcriptase inhibitors
  - Nonnucleoside reverse transcriptase inhibitors
  - Protease inhibitors
  - Fusion inhibitors (used when the others are no longer effective)
    - Drugs act at various stages of reproduction.
    - They interfere with viral reproduction.
    - Drug resistance occurs easily.
Antiparasitic Agents

- A number of parasites, including helminths (worms), can invade the human body.
- Worm infestation is always spread by a feces-to-mouth route.
  - Good hygiene is the best preventive.
  - Some geographic areas are more prone.
  - Various drugs treat different infestations.
Antiparasitic Agents

- Goldenseal—Guardia, Trichomonas, Entamoeba, Salmonella, Shigella, and Klebsiella
- Albendazole—animal tapeworm control
- Ivermectin—hookworm, pediculosis, scabies
- Mebendazole—roundworm, hookworm, threadworm, pinworm, tropical parasites
- Praziquantel—tapeworms, Schistosoma
- Thiabendazole—larva migrans, threadworm
Antiparasitic Agents

- Head lice, pubic lice, and scabies (a mite that burrows beneath the skin) are treated topically with skin creams, shampoos, and rinses.
  - Crotamiton
  - Lindane (Kwell)
  - Malathion
  - Permethrin
  - Pyrethrins