Chapter 35

Drugs for Fungal, Protozoal, and Helminth Infections

Characteristics of Fungi

- Are single-celled or multicellular organisms
  - More complex than bacteria
  - Include mushrooms, yeasts, molds
- Purpose is to decompose dead organisms
- Humans exposed by handling contaminated soil or inhaling spores

Fungal Infections

- Superficial
  - Affect hair, skin, nails, mucous membranes
  - Treated with topical agents
- Systemic
  - Affect internal organs
  - Are less common
  - Can be fatal in immunosuppressed clients
  - Treated with oral or parenteral agents
- Fungi unaffected by most antibiotics

Clients at Risk for Fungal Infections

- Human body quite resistant to fungi
- Most serious fungal infections occur in clients with suppressed immune defenses
  - Example: client with HIV

Clients at Risk for Fungal Infections (continued)

- Community-acquired infections
  - Can affect those with intact immune systems
- Opportunistic infections
  - Are nosocomial infections that occur in immunosuppressed client
Protozoan Infections

- Are single-celled animals
- Cause disease in Africa, South America, and Asia
- Thrive in areas of poor sanitation
- Travelers may transmit organisms
- Drugs used to treat bacterial and fungal infections are ineffective

Pharmacotherapy of Malaria

- Most common protozoal disease
- Second most fatal infectious disease in world
- Caused by protozoan *Plasmodium*
- Transmitted by bite of female *Anopheles* mosquito

Pharmacotherapy of Malaria (continued)

- Requires multidrug therapy due to complicated life cycle of parasite
- Drugs administered for prophylaxis, as therapy for acute attacks, and to prevent relapses

Goals of Antimalarial Therapy

- Prevention
  - Centers for Disease Control recommends prophylactic antimalarials
  - Use prior to, during, and for one week after visits to infested areas
- Treatment
  - Interrupts erythrocytic stage
  - Eliminates merozoites from red blood cells

Goals of Antimalarial Therapy

- Prevention of relapse
- Eliminate latent forms of *Plasmodium* residing in liver
Nonmalarial Protozoan Infections

- Thrive in unsanitary conditions
- Other protozoal diseases
  - Amebiasis, toxoplasmosis, giardiasis, cryptosporidiosis, trichomoniasis, trypanosomiasis, and leishmaniasis
- Treatment of non-*Plasmodium* protozoan disease requires different set of medications from those used for malaria

Helminth Infections

- Helminths: parasitic worms that cause significant disease in certain regions of world
  - Roundworms (nematodes)
  - Flukes (trematodes)
  - Tapeworms (cestodes)
- Enterobiasis (pinworm)
  - Most common helminth infection in US
- Most helminths enter body through skin or gastrointestinal tract

Goals of Pharmacotherapy

- Kill parasites locally
- Disrupt their life cycles
- Resistance not yet a problem

Goals of Antimalarial Therapy

- Prevention
  - CDC recommends prophylactic antimalarials prior to, during, and for one week after visits to infested areas.
- Treatment
  - Interrupts erythrocytic stage
  - Eliminates merozoites from red blood cells

Goals of Antimalarial Therapy (continued)

- Prevention of relapse
  - Elimination of latent forms of *Plasmodium* residing in liver

Role of the Nurse

- Monitoring of client's condition
- Providing client education
- Obtaining medical, surgical, drug history
- Assessing lifestyle and dietary habits
Role of the Nurse (continued)

- Obtaining description of symptomology and current therapies
- Obtaining baseline culture and sensitivity tests
  - Contraindicated in clients with known hypersensitivity

Systemic Antifungal Therapy

- Use cautiously with renal impairment, severe bone-marrow suppression, and pregnancy
- Amphotericin B (Fungizone) can cause kidney damage
  - Closely monitor fluid and electrolyte status
- Amphotericin B can cause ototoxicity
  - Assess for hearing loss, vertigo, unsteady gait, tinnitus

Azole Therapy

- Contraindicated with chronic alcoholism
  - Toxic to liver
- Assess for nausea, vomiting, abdominal pain, diarrhea
- Monitor for signs and symptoms of hepatotoxicity

Azole Therapy (continued)

- May affect glycemic control in diabetic clients; monitor blood sugar
- Monitor for alcohol use
  - Raises risk of nausea, vomiting, increased blood pressure

Superficial Antifungal Therapy

- Assess for signs of contact dermatitis
  - If present, withhold drug and notify primary health-care provider
- Do not use superficial antifungals intravaginally during pregnancy to treat infections caused by Gardnerella vaginalis or Trichomonas species
  - Use cautiously for lactating clients

Superficial Antifungal Therapy

- Medications may be “swished and swallowed” or “swished and spit” to treat candidiasis
- Monitor for nausea, vomiting, diarrhea with high doses
**Antiprotozoal Drugs**

- Contraindicated with hematological disorders, severe skin disorders, pregnancy
- Use cautiously with preexisting cardiovascular disease, lactating clients
- Test for G6PD deficiency
  - Chloroquine (Aralen) may potentiate anemia, bone-marrow depression
- Obtain baseline ECG because of potential cardiac complications
- Monitor for GI side effects such as vomiting, diarrhea, abdominal pain
- Oral antimalarials can be given with food to reduce GI distress
- Monitor for signs of toxicity

**Nonmalarial, Antiprotozoal Drug Therapy**

- Contraindicated in clients with blood dyscrasias, active organic disease of CNS, during first month of pregnancy
- Contraindicated in alcoholics
- Closely monitor vital signs and thyroid function during therapy
- Monitor for GI distress; oral medications can be given with food
- Metronidazole (Flagyl) may cause dry mouth and metallic taste
- Monitor for CNS toxicity

**Antihelminthic Drugs**

- Use cautiously in clients who are pregnant or lactating, have preexisting liver disease, or are younger than age 2
- Identify specific worm before initiating treatment
- Monitor lab results
  - Leukopenia, thrombocytopenia, agranulocytosis associated with albendazole (Albenza)
- Educate client on nature of worm infestation
  - Some types of worms will be expelled in stool.
  - Take showers rather than baths
  - Change undergarment, linens, and towels daily
Antifungal Drugs—Agents for Systemic Infections

- **Prototype drug:** amphotericin B (Fungizone)
- **Mechanism of action:** binds to ergosterol in fungal-cell membranes
  - Causes them to become permeable or leaky
- **Primary use:** has wide spectrum of activity
  - Includes most fungi pathogenic to humans

**Adverse effects:**
- Fever, chills, vomiting, headache at beginning of therapy
- Phlebitis common during IV therapy
- Nephrotoxicity, electrolyte imbalances common
- Cardiac arrest, hypotension, dysrhythmias possible

Antifungal Drugs—Agents for Systemic Infections (continued)

- **Adverse effects:**
  - Nausea, vomiting, diarrhea reported at high doses

Antifungal Drugs—Agents for Systemic Infections

- **Prototype drug:** fluconazole (Diflucan)
- **Mechanism of action:** to act by interfering with synthesis of ergosterol
- **Primary use:** to treat fungal infections in CNS, bone, eyes, urinary tract, respiratory tract
  - Not effective against nonalbicans *Candida* species
- **Adverse effects:** nausea, vomiting, diarrhea

Fluconazole Animation

Click here to view an animation on the topic of fluconazole.

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Antifungal Drugs—Agents for Superficial Infections

- **Prototype drug:** nystatin (Mycostatin)
- **Mechanism of action:** binds to sterols in the fungal-cell membrane, allowing leakage of intracellular contents
- **Primary use:** *Candida* infections of intestines, vagina, skin, mouth
  - Also treats candidiasis of intestine
- **Adverse effects:** minor skin irritation, nausea, vomiting, diarrhea

Antiprotozoal Drugs—Antimalarial Agents

- **Prototype drug:** chloroquine (Aralen)
- **Mechanism of action:** concentrates in food vacuoles of *Plasmodium* residing in red blood cells
  - Believed to prevent metabolism of heme, which then builds to toxic levels within parasite
Antiprotozoal Drugs—Antimalarial Agents (continued)

- **Primary use:** as prototype medication for treating malaria for over 60 years
- **Adverse effects:** nausea, diarrhea—CNS and cardiovascular toxicity at higher doses

Antiprotozoal Drugs—Nonmalarial Antiprotozoal Agents

- **Prototype drug:** metronidazole (Flagyl)
- **Mechanism of action:** to act as antiprotozoal drug that also has antibiotic activity against anaerobic bacteria
- **Primary use:** Treats most forms of amebiasis
- **Adverse effects:** anorexia, nausea, diarrhea, dizziness, headache, dry mouth, unpleasant metallic taste

Antihelminthic Drugs

- **Prototype drug:** mebendazole (Vermox)
- **Mechanism of action:** as broad-spectrum antihelminthic drug
- **Primary use:** to treat wide range of helminth infections
- **Adverse effects:** as worms die, abdominal pain, distension, and diarrhea may be experienced

Drugs for Systemic Mycoses

- Require intensive pharmacotherapy for extended periods
- Act by disrupting aspects of growth or metabolism
- **Examples:** amphotericin B (Fungizone) and fluconazole (Diflucan)

Azole Antifungal Drugs

- Consist of imidazoles and triazoles
- Both types of drug interfere with biosynthesis of ergosterol
- **Examples:** clotrimazole (FemCare, Gyne-Lotrimin, Mycelex) and fluconazole (Diflucan)

Drugs for Superficial Infections

- Superficial mycoses generally not severe
- Treated with topical agents; safer than systemics
- Act by disrupting aspects of growth or metabolism
- **Examples:** nystatin (Mycostatin, Nilstat, Nystex) and griseofulvin (Fulvicin)
Pharmacotherapy of Malaria

- Attempts to interrupt complex life cycle of *Plasmodium*
- Therapy becomes increasingly ineffective as parasite continues life cycle
- Goals: prevention, treatment of acute attacks, prevention of relapse
- **Examples:** chloroquine hydrochloride (Aralen) and hydroxychloroquine sulfate (Plaquenil)

Drugs for Nonmalarial Protozoan Infections

- Act toxicologically, directly on amebas in intestine
- Have systemic effects on liver and other organs
- **Examples:** metronidazole (Flagyl) and iodoquinol (Yodoxin)

Drugs for Helminth Infections

- Helminth infections in United States and Canada
  - Neither common nor fatal
- Drugs have toxic effect on helminths
- **Examples:** albendazole (Albenza) and mebendazole (Vermox)

Clients Receiving Amphotericin B

- Assessment
  - Obtain complete health history
  - Obtain culture and sensitivity of suspected area of infection
  - Obtain baseline vital signs
  - Obtain renal function, including blood tests

Clients Receiving Amphotericin B

- Planning—client will
  - Report reduction in symptoms
  - Have negative results for laboratory and diagnostic tests
  - Demonstrate understanding of drug’s action
  - Verbalize potential complications related to azole use
  - Report fever, chills, fluid retention, dizziness, or decrease in urine output

Clients Receiving Amphotericin B

- Nursing diagnoses
  - Risk for injury, related to adverse effects of drug
  - Risk for infection, related to drug-induced leucopenia
  - Deficient knowledge: drug therapy related to lack of prior exposure
  - Risk for deficient fluid volume, related to nausea and vomiting
Clients Receiving Amphotericin B

• Implementation
  – Monitor vital signs frequently
  – Monitor kidney function and for GI distress
  – Monitor for fluid overload and electrolyte imbalance
  – Monitor for signs/symptoms of toxicity and hypersensitivity
  – Monitor IV site frequently

• Evaluation
  – Laboratory values indicate decrease in fungal infection
  – Client accurately verbalizes side effects and precautions
  – Client verbalizes signs and symptoms requiring notification of health-care provider

Clients Receiving Pharmacotherapy for Superficial Fungal Infections

• Assessment
  – Obtain complete health history
  – Obtain culture and sensitivity of suspected area of infection
  – Obtain baseline liver-function tests

• Nursing diagnoses
  – Risk for injury, rash related to side effect of drug
  – Deficient knowledge, related to lack of experience with drug therapy
  – Impaired skin integrity

• Planning—client will
  – Report reduction in symptoms related to diagnosed infection
  – Have negative results for laboratory and diagnostic tests
  – Verbalize understanding of drug’s action
  – Report effects such as hepatotoxicity, GI distress, rash, or decreased urine output
  – Verbalize correct technique for application of medication

• Implementation
  – Monitor for possible side effects or hypersensitivity
  – Encourage compliance with instructions
  – Monitor topical application; avoid occlusive dressings
  – Monitor for contact dermatitis.
  – Encourage infection-control practices
Clients Receiving Pharmacotherapy for Superficial Fungal Infections

**Evaluation**
- Client demonstrates correct application of topical drugs
- Client reports reduction in symptoms
- Client has improved laboratory results
- Client verbalizes understanding of drug’s action

Drugs for Systemic Mycoses

**Table 35.2 Drugs for Systemic Mycoses**

Azole Antifungals

**Table 35.3 Azole Antifungals**

Drugs for Superficial Mycoses

**Table 35.4 Drugs for Superficial Mycoses**

Antimalarials

**Table 35.5 Antimalarials**

Selected Drugs for Nonmalarial Protozoal Infections

**Table 35.7 Selected Drugs for Nonmalarial Protozoal Infections**
## Table 35.8 Selected Drugs for Helminthic Infections

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Description</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ivermectin</strong></td>
<td>Effective against a wide range of helminthic infections</td>
<td>Oral dose: 200 mcg/kg in a single dose</td>
</tr>
<tr>
<td><strong>Albendazole</strong></td>
<td>Broad-spectrum antihelminthic</td>
<td>Oral dose: 400 mg twice daily for 3 days</td>
</tr>
<tr>
<td><strong>Paromomycin</strong></td>
<td>Antibacterial and antihelminthic</td>
<td>Oral dose: 200 mg three times daily for 7 days</td>
</tr>
<tr>
<td><strong>Mebendazole</strong></td>
<td>Effective against enteric nematodes</td>
<td>Oral dose: 500 mg twice daily for 3 days</td>
</tr>
</tbody>
</table>

*Note: Please consult a healthcare professional for specific dosage recommendations.*