CHAPTER – III
ANTIMALARIAL, ANTIPROTOZOAL
AND ANTHELMINTIC
DRUGS

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Protozoal Infections

Parasitic protozoa: live in or on humans

- Malaria
- Leishmaniasis
- Amebiasis
- Giardiasis
- Trichomoniasis
Malaria

- Caused by *Plasmodium protozoa* – 4 different species

- **Cause:** the bite of an *infected* adult female anopheline mosquito

- Also transmitted by *infected individuals via blood transfusion, congenitally, or infected needles by drug abusers*
Malarial Parasite (*Plasmodium*)

**Two interdependent life cycles**

- Sexual cycle: occurs in the mosquito
- Asexual cycle: occurs in the human

- Knowledge of the life cycles is essential in understanding antimalarial drug treatment
- Drugs are effective only during the asexual cycle
Plasmodium Life Cycle

Asexual cycle: two phases

- Exoerythrocytic phase
  - Occurs “outside” the erythrocyte
  - Also known as the tissue phase

- Erythrocytic phase
  - Occurs “inside” the erythrocyte
  - Also known as the blood phase

Erythrocytes = RBCs
Fig. 42-1. Life cycle of the malarial parasite.
Antimalarial Drugs

- Attack the parasite during the asexual phase, when it is vulnerable
  - **Erythrocytic phase drugs:** chloroquine, hydroxychloroquine, quinine, mefloquine
  - **Primaquine:** kills parasite in both phases

- May be used together for synergistic or additive killing power
Antimalarials: 
Mechanism of Action

4-Aminoquinoline derivatives: chloroquine and hydroxychloroquine

- Bind to parasite nucleoproteins and interfere with protein synthesis; also alter pH within the parasite
- Interfere with parasite’s ability to metabolize and use erythrocyte hemoglobin
- Effective only during the erythrocytic phase
Antimalarials: Mechanism of Action

4-Aminoquinoline derivatives: quinine and Mefloquine (Lariam)

- Alter pH within the parasite
- Interfere with parasite’s ability to metabolize and use erythrocyte hemoglobin
- Effective only during the erythrocytic phase
Antimalarials: Mechanism of Action

Diaminopyrimidines (pyrimethamine (Daraprim) & trimethoprim)

- Inhibit protein synthesis essential for growth and survival
- Only effective during the erythrocytic phase
- These drugs may be used with sulfadoxine or dapsone or synergistic effects
Antimalarials:
Mechanism of Action

- **Primaquine**
  - Only exoerythrocytic drug (works in both phases)
  - Binds and alters parasitic DNA

- **Sulfonamides, tetracyclines, clindamycyin**
  - Used in combination with antimalarials to increase protozoacidal effects
Antimalarials

Drug Effects

- Kill parasitic organisms
- Chloroquine and hydroxychloroquine also have antiinflammatory effects

Indications

- Kills *Plasmodium* organisms, the parasites that cause malaria
- The drugs have varying effectiveness on the different malaria organisms
- Some drugs are used for prophylaxis against malaria
  - 2 weeks prior and 8 weeks after return
- Chloroquine is also used for rheumatoid arthritis and systemic lupus erythematosus
Antimalarials

Adverse Effects

- Many adverse effects for the various drugs
- Primarily gastrointestinal: nausea, vomiting, diarrhea, anorexia, and abdominal pain
Protozoal Infections

- Patients with compromised immune systems are at risk for acquiring these infections
  - Taking immunosuppressive drugs after a transplant
  - Leukemia
  - AIDS

- Protozoal infections are often fatal in these cases
Protozoal Infections

- Amebiasis
- Giardiasis
- Pneumocystosis
- Toxoplasmosis
- Trichomoniasis

**Transmission**

- Person to person
- Ingestion of contaminated water or food
- Direct contact with the parasite
- Insect bite (mosquito)
Antiprotozoals

- atovaquone (Mepron)- Pneumocystis jirovecii pneumonia

- **metronidazole (Flagyl)** – anti-bacterial / anaerobes

- pentamidine (Pentam-300) – P. jiroveci pneumonia

- iodoquinol (Yodoxin)- intestinal amebiasis; Giardia; Trichomonas vaginalis

- paromomycin (Humatin) – acute & chronic intestinal amebiasis; hepatic coma
Antiprotozoals: Mechanism of Action and Indications

**atovaquone (Mepron)**

- Protozoal energy comes from the mitochondria
- atovaquone: selective inhibition of mitochondrial electron transport
- Result: no energy, leading to cellular death
  - Used to treat mild to moderate *Pneumocystis jiroveci*

**Adverse Effects: atovaquone (Mepron)**

- Nausea, vomiting, diarrhea, anorexia, altered liver function, many others
Antiprotozoals

Mechanism of Action and Indications

Metronidazole (Flagyl)

- Disruption of DNA synthesis as well as nucleic acid synthesis
- Bactericidal, amebicidal, trichomonacidal
- Used for treatment of trichomoniasis, amebiasis, giardiasis, and antibiotic-associated pseudomembranous colitis
- Also has anthelmintic activity

Adverse Effects: Metronidazole (Flagyl)

- Metallic taste, nausea, vomiting, diarrhea, abdominal cramps, many others
Antiprotozoals

Mechanism of Action and Indications

**Pentamidine**
- Inhibits DNA and RNA
- Binds to and aggregates ribosomes
- Directly lethal to *Pneumocystis jiroveci*
- Mainly used to prevent & treat *P. jiroveci* pneumonia
- Used for other protozoal infections

**Adverse Effects: pentamidine**
- Bronchospasms, leukopenia, thrombocytopenia, acute pancreatitis, acute renal failure, increased liver function studies, hypotension, many others
Antiprotozoals
Mechanism of Action and Indications

**iodoquinol (Yodoxin)**
- Acts primarily in the intestinal lumen of the infected host
- Directly kills the protozoa
- Used to treat intestinal amebiasis

**Adverse Effects: iodoquinol (Yodoxin)**
- Nausea, vomiting, diarrhea, anorexia, agranulocytosis, many others
**Antiprotozoals: Mechanism of Action and Indications**

**paromomycin (Humatin)**
- Kills by inhibiting protein synthesis
- Used to treat amebiasis and intestinal protozoal infections, and also adjunct therapy in management of hepatic coma

**Adverse Effects: paromomycin (Humatin)**
- Nausea, vomiting, diarrhea, stomach cramps, hearing loss, dizziness, tinnitus
Anthelmintics

- Drugs used to treat **parasitic worm infections:** helminth infections

- Unlike protozoa, **helminths are large and have complex cellular structures**

- Drug treatment is **very specific to the organism**
Anthelmintics

- albendazole (Albenza)
- diethylcarbamazine (Hetrazan)
- ivermectin (Stromectol)
- mebendazole (Vermox)
- praziquantel (Biltricide)
- pyrantel (Antiminth)
- thiabendazole (Mintezol)

- **It is VERY IMPORTANT to identify the causative worm**
  - Done by finding the parasite ova or larvae in feces, urine, blood, sputum, or tissue

- Cestodes (tapeworms)
- Nematodes (roundworms)
- Trematodes (flukes)
- Platyhelminthes (flatworm)
**Anthelmintics: Mechanism of Action and Indications**

**diethylcarbamazine (Hetrazan)**
- Inhibits rate of embryogenesis of nematodes

**thiabendazole (Mintezol)**
- Inhibits the helminth-specific enzyme, fumarate reductase
- Both used for nematodes
  - (tissue and some roundworms)

**pyrantel (Antiminth)**
- Blocks acetylcholine at the neuromuscular junction, resulting in paralysis of the worms, which are then expelled through the GI tract
- roundworm infections, ascariasis, enterobiasis, nematodes (giant worm and pinworm), other helminthic infections
Anthelmintics: 
Mechanism of Action and Indications

**mebendazole (Vermox)**
- Inhibits uptake of glucose and other nutrients, leading to autolysis and death of the parasitic worm
- Used to treat cestodes and nematodes (hookworm, pinworm, roundworm, whipworm, tapeworm)

**oxamniquine (Vansil) and praziquantel (Biltricide)**
- Paralyze worms’ musculature and immobilize their suckers
- Cause worms to dislodge from mesenteric veins to the liver, then killed by host tissue reactions
- Used to treat trematodes; praziquantel is used to treat cestodes also
Anthelmintics

Adverse Effects

Effects will vary with each drug

- **Common adverse effects:**
  - Nausea, vomiting, diarrhea, dizziness, headache
  - **mebendazole**
    - May cause myelosuppression
Antimalarial, Antiprotozoal, and Anthelmintic Drugs: Nursing Implications

- Before therapy, thorough health history, medication history,
- Assess for allergies
- Collect specimens before beginning drug therapy
- Check baseline VS
- Check for contraindications and interactions
- Some drugs may cause the urine to have an asparagus-like odor, or cause an unusual skin odor, or a metallic taste; be sure to warn the patient ahead of time
- Administer all drugs as ordered and for the prescribed length of time
- Most drugs should be taken with food to reduce GI upset
Antimalarial Drugs

Nursing Implications

- Assess for presence of malarial symptoms
- When used for prophylaxis, these drugs should be started 1 to 2 weeks before potential exposure to malaria, and for 4 weeks after leaving the area
- Medications are taken with 8 ounces of water
- Instruct patient to notify physician immediately if ringing in the ears, hearing decrease, visual difficulties, nausea, vomiting, profuse diarrhea, or abdominal pain occurs
- Alert patients to the possible recurrence of the symptoms of malaria so that they will know to seek immediate treatment

Monitor for adverse effects

- Ensure that patients know the adverse effects that should be reported
- Monitor for therapeutic effects and adverse effects with long-term therapy