Chapter 36
Drugs for Viral Infections

Characteristics of Viruses

- Nonliving agents that infect bacteria, plants, animals
- Intracellular parasite
  - Must be in host cell to replicate and cause infection
  - Many viruses infect specific host cell

Primitive Structure of Viruses

- Surrounded by capsid (protein coat)
- Contain a few dozen genes, either RNA or DNA
  - DNA contains information needed for replication

Therapy for Viral Infections

- Most self-limiting; require no pharmacotherapy
  - Example: rhinovirus that causes common cold
- Some viruses cause serious disease and require aggressive therapy
  - Example: HIV is fatal if left untreated
  - Example: herpesviruses can cause significant pain and disability if left untreated
Challenges of Antiviral Therapy

- Viruses mutate rapidly, and drug becomes ineffective
- Difficult for drug to find virus without injuring normal cells
- Each antiviral drug specific to one particular virus

Replication of HIV

- HIV targets CD4 receptor on T4 lymphocyte
  - Using reverse transcriptase, makes viral DNA from RNA
  - Virions bud from host cell
    - Enzyme protease enables virion to infect other T4 lymphocytes
    - Result is gradual destruction of immune system
- HIV called "retrovirus" because of reverse synthesis process

HIV Pharmacotherapy

- No cure yet, but many new drugs developed
- Some therapeutic successes
  - People live symptom-free longer.
  - Rates of transmission from mother to newborn reduced
  - 70% decline in death rate in US
  - Incidence of infections still very high in African nations

Phases of HIV Therapy

- Latent phase—virus lies dormant
  - People often unaware they have HIV
- Once diagnosis confirmed, decision made about starting or delaying treatment
- Current protocols: defer treatment in asymptomatic adults who have CD4 counts above 350 cells/mcL
- Therapy is initiated when CD4 is under 200 cells/mcL or symptoms appear

Therapeutic Goals

- Reduce HIV RNA load in the blood
  - To undetectable level or less than 50 copies/mL
- Increased lifespan
- Higher quality of life
- Decreased risk of transmission from mother to child
Initiation of Pharmacotherapy

- Pharmacotherapy may be initiated
  - In acute phase (symptomatic)
  - In chronic (asymptomatic) phase

Highly Active Antiretroviral Therapy (HAART)

- Five drug classes used in various combinations
  - Nucleoside reverse transcriptase inhibitor (NRTI)
  - Nonnucleoside reverse transcriptase inhibitor (NNRTI)
  - Protease inhibitor (PI)
  - Nucleotide reverse transcriptase inhibitor (NtRTI)
  - Fusion (entry) inhibitor

Treatment Failures

- Common with antiretroviral therapy
  - Client nontolerance of adverse effects
  - Client nonadherence to complex regimen

Treatment Failures (continued)

- Emergence of resistant strains
- Genetic variability
- Therapy always changing—stay current with latest treatments

Role of the Nurse

- Monitor client’s condition
- Provide client education
- Obtain medical, surgical, drug history
- Assess lifestyle and dietary habits
- Obtain description of symptomology and current therapies

NRTI, NNRTI, and PI therapy

- Nursing care similar for NRTIs, NNRTIs, and PIs
- Establish trusting, nonjudgmental relationship with client
- Assess client’s understanding of HIV disease process
NRTI, NNRTI, and PI therapy

- Assess for symptoms of HIV and any opportunistic infections
- Monitor plasma HIV RNA (viral load) assays, CD4 counts, complete blood count, liver and renal profiles, blood-glucose levels

(continued)

- Assess for bone-marrow suppression, liver toxicity, and Stevens-Johnson syndrome
- Client should not drive or perform hazardous activities until medication reactions are known
- Be aware of conditions and drugs that are problematic with antiretroviral therapy
- Teach clients how to practice blood and body-fluid precautions

Antiviral Therapy

- Use drugs with extreme caution with preexisting renal or hepatic disease
- Judicious use is warranted during pregnancy
- Emphasize compliance with antiviral therapy
- Some drugs cause GI distress and should be taken with food

Agents for HIV-AIDS—Nucleoside and Nucleotide Reverse Transcriptase Inhibitors

- **Prototype drug**: zidovudine (Retrovir, AZT)
- **Mechanism of action**: virus mistakenly uses zidovudine as nucleoside, thus creating defective DNA strand
- **Primary use**: with other antiretrovirals for symptomatic and asymptomatic HIV-infected clients
  - Also for postexposure prophylaxis in HIV-exposed health-care workers
  - To reduce transmission rate from HIV-positive mother to fetus

- **Adverse effects**:
  - Toxicity to blood cells at high doses
  - Anemia and neutropenia
  - Anorexia, nausea, diarrhea
  - Fatigue, generalized weakness
Agents for HIV-AIDS Nonnucleoside Reverse Transcriptase Inhibitors

- **Prototype drug:** nevirapine (Viramune)
- **Mechanism of action:** to bind directly to reverse transcriptase, disrupting enzyme’s active site
- **Primary use:** in combination with other antivirals in treatment using HAART
- **Adverse effects:** GI-related effects—nausea, diarrhea, abdominal pain; skin rashes; fever; fatigue

Agents for HIV-AIDS—Protease Inhibitors

- **Prototype drug:** saquinavir mesylate (Fortovase, Invirase)
- **Mechanism of action:** to inhibit HIV protease
- **Primary use:** in combination with other antiretrovirals for HIV-infected clients
- **Adverse effects:** nausea, vomiting, dyspepsia, diarrhea; general fatigue; headache

Saquinavir Mesylate Animation

Click here to view an animation on the topic of saquinavir mesylate.

Agents for Herpesviruses

- **Prototype drug:** acyclovir (Zovirax)
- **Mechanism of action:** to prevent viral DNA synthesis
- **Primary use:** limited to herpesviruses, for which it is drug of choice
- **Adverse effects:** nephrotoxicity is possible when medication is given IV

Acyclovir Animation

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

Antiretroviral Drugs for HIV-AIDS

- Five drug classes combined in pharmacotherapy of HIV-AIDS
- Two new drugs
  - Nucleotide reverse transcriptase inhibitors
  - Fusion inhibitors
Antiretroviral Drugs for HIV-AIDS (continued)

• Three other drugs
  – Nucleoside and non-nucleoside reverse transcriptase inhibitors
  – Protease inhibitors
• Most effective when used in combination therapy known as HAART

Antiretroviral Drugs for HIV-AIDS (continued)

• Two different drug classes act by inhibiting reverse transcriptase
  – NRTIs cause premature termination of growing viral DNA chain
  – NNRTIs bond to reverse transcriptase enzyme, inhibiting its function
• Protease inhibitors attach to viral protease enzyme and prevent cleaving of HIV proteins

Drugs for Herpes Viruses

• Lessen severity of acute herpes simplex infections
• Prolong latent period of disease
• Herpesvirus infections: HSV-types 1 and 2, cytomegalovirus, VZV, and EBV

Drugs for Herpes Viruses (continued)

• Oral antiviral therapy given for 7 to 10 days
• Topical forms of several antivirals are available

Drugs for Influenza

• Vaccination is best approach
• Antivirals available to prevent influenza
  – Most useful when combined with vaccines

Drugs for Influenza (continued)

• Neuroaminidase inhibitors
  – Shorten discomfort period for influenza symptoms
  – Have limited efficacy
Drugs for Hepatitis

• Viral hepatitis caused by HAV and HBV
  – Best prevented through vaccination
  – Only a few medications available for postexposure treatment
• Immunoglobulins sometimes used to confer passive immunity

Drugs for Hepatitis (continued)

• Antivirals such as interferon alpha-2a or lamivudine are available for HAV
• Interferon alpha-2b (Intron A) with ribavirin (Rebetol) is available for HCV

Drug Therapy for Viral Infections

• Assessment
• Obtain complete health history
• Obtain complete physical examination

Drug Therapy for Viral Infections (continued)

• Assess for presence/history of HIV infection
• Obtain HIV RNA assay/CD4 count, CBC, liver function, renal function, blood glucose

Drug Therapy for Viral Infections

• Nursing diagnoses
  – Risk for infection, related to compromised immune system
  – Decisional conflict, related to therapeutic regimen
  – Fear, related to HIV diagnosis
  – Risk for injury, related to side effects of drugs
  – Deficient knowledge, related to disease process, transmission, and drug therapy

Drug Therapy for Viral Infections

• Planning—client will
  – Exhibit decrease in viral load and increase in CD4 counts
  – Demonstrate knowledge of disease process, transmission, treatment
  – Demonstrate understanding of drug’s action
  – Complete full course of therapy, and comply with follow-up care
Drug Therapy for Viral Infections

• Implementation
  – Monitor for hypersensitivity reactions
  – Monitor vital signs and for symptoms of infection
  – Monitor WBC count
  – Monitor client for stomatitis
  – Monitor HIV RNA assay, CD4 counts, liver function, kidney function, CBC, blood glucose, serum amylase and triglyceride levels

• Evaluation—client will
  – Demonstrate decrease in viral load and increase in CD4 counts
  – Verbalize an understanding of disease process, transmission, and treatment
  – Accurately state drug’s action and side effects
  – Verbalize importance of taking medication as ordered and for follow-up care

Antiretroviral Drugs for HIV-AIDS

Table 36.1 Antiretroviral Drugs for HIV-AIDS

Table 36.1b Antiretroviral Drugs for HIV-AIDS
### Drugs for Herpesviruses

**Table 36.2 Drugs for Herpesviruses**

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acyclovir</td>
<td>Antiviral for herpes simplex and varicella-zoster infections</td>
</tr>
<tr>
<td>Valacyclovir</td>
<td>Increased bioavailability of acyclovir</td>
</tr>
<tr>
<td>Famciclovir</td>
<td>Additional treatment for herpes simplex and zoster infections</td>
</tr>
</tbody>
</table>

### Drugs for Influenza

**Table 36.3 Drugs for Influenza**

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oseltamivir</td>
<td>Antiviral for influenza A and B infections</td>
</tr>
<tr>
<td>Zanamivir</td>
<td>Neuraminidase inhibitor for influenza A and B infections</td>
</tr>
</tbody>
</table>

### Drugs for Hepatitis

**Table 36.4 Drugs for Hepatitis**

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interferon-alpha</td>
<td>Used for chronic hepatitis B and C infections</td>
</tr>
<tr>
<td>Peginterferon-alpha</td>
<td>Longer-acting form of interferon-alpha</td>
</tr>
<tr>
<td>Ribavirin</td>
<td>Used in combination with peginterferon for hepatitis C</td>
</tr>
<tr>
<td>Telaprevir</td>
<td>Approved for treatment of chronic hepatitis C</td>
</tr>
<tr>
<td>Boceprevir</td>
<td>Approved for treatment of chronic hepatitis C</td>
</tr>
<tr>
<td>Daclatasvir</td>
<td>Approved for treatment of chronic hepatitis C</td>
</tr>
<tr>
<td>Simeprevir</td>
<td>Approved for treatment of chronic hepatitis C</td>
</tr>
<tr>
<td>Ombitasvir</td>
<td>Approved for treatment of chronic hepatitis C</td>
</tr>
<tr>
<td>Incollection</td>
<td>Combination of three protease inhibitors</td>
</tr>
</tbody>
</table>

These tables provide a brief overview of the drugs used for the treatment of the respective viral infections.