

HIV / AIDS: Transmission, Treatment & Prevention

2.5 Contact Hours

Presented by:

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HIV/AIDS: Transmission, Treatment & Prevention

By Mary Dunay, RN

Objectives:

At the completion of this course, the learner will be able to:

1. Recognize the pathophysiology of HIV/AIDS.
2. Identify modes of transmission of HIV.
3. Identify infection control measures for reducing transmission of HIV in the health care setting.
4. Identify treatment of HIV/AIDS.
5. Recognize Florida law on HIV/AIDS.

Introduction

There are two species of Human Immunodeficiency Virus (HIV) that affect humans worldwide. Most of those infected in the United States have HIV-1 (type 1). A few have HIV-2 (type 2). Both species are divided into numerous subtypes or clades, are transmitted in the same way, and affect T-cell and B-cell immunity in the host. However, HIV-2 has a lower risk of transmission and progresses more slowly to Acquired Immunodeficiency Syndrome (AIDS). AIDS is a chronic, progressive disease for which there is no current cure or vaccine. Death occurs as a result of opportunistic diseases that normally do not kill the uninfected or immunocompetent host.

Epidemiology

More than a million people have HIV/AIDS in the United States currently. Centers for Disease Control (CDC) estimates for 2006 are that 56,300 people were newly diagnosed with HIV during that year. Of these, the following was found:

- 49% were Black, 30% were white, and 18% Hispanic
- 73% were males
- The age group 35 to 44 years was the highest affected at 32%, ages 25 to 32 were next at 26%, ages 45 to 54 were 20%, and ages 13 to 24 were 15%.
- In men, male-to-male sexual contact was the mode of transmission in 50% of the cases, high-risk heterosexual contact with infected partners in 33% of the cases and drug injection in 13% of the cases.
- In women, the mode of transmission for 80% of the cases was high-risk heterosexual contact, and for 19% it was drug injection.

As of the end of 2006, the CDC has confirmed 57 cases of occupational exposure to HIV in healthcare personnel resulting in infection, of which 24 were nurses and 6 were physicians. Including all 57 cases, 48 were a result of punctures or cut injuries with contaminated sharps, 5 were via mucous membrane exposure, 2 involved both modes and 2 were unknown.

Pathophysiology

The retrovirus HIV most often enters the body via the bloodstream. It seeks out CD4⁺ T-cells and invades these cells leaving a proviral genome that lingers in the host cell. T-cells are responsible for recognizing antigens and for initiating the immune response to these antigens by the body. When T-cell counts decrease, the body is able to be invaded by microbes that are normally destroyed. B-cell antibody production is also affected. Cellular immunity is severely compromised allowing nonbacterial infectious agents such as fungi and viruses an advantage.

HIV infection occurs in 3 phases:

1. Acute seroconversion: The host is infected, the virus enters T-cells, and a reservoir of cells containing the provirus is created in the gut-associated lymphoid tissue (GALT). This process takes from a few weeks to several months. During this time 50 to 70% of all patients have symptoms beginning at 3 to 6 weeks post infection that can include fever, swollen lymph nodes, pharyngitis, lethargy, headache, pain behind the eyes, anorexia, weight loss, nausea, vomiting, diarrhea, rash, mucous membrane ulceration, peripheral neuropathy, encephalitis, and meningitis.
2. Asymptomatic HIV infection: The virus continues to be manufactured by infected cells but the body is able to mount an immune response that controls the number of viruses in the body. The CD4⁺ T-cell count is gradually depleted.
3. Symptomatic AIDS: When the CD4⁺ T-cells count declines to less than 200/microliter of blood and/or opportunistic infections develop, AIDS begins. This progression of the disease occurs an average of 8 to 10 years after infection. Wasting syndrome with diarrhea and weight loss and AIDS-associated encephalopathy and dementia occur independently as a result of the HIV infection itself. The patient has symptoms of the various opportunistic infections that take advantage of immune deficiency.

Transmission

HIV is a blood-borne pathogen that can also be present in body fluids other than blood. The patient can transmit the virus during all phases of HIV infection. While male-to-male sexual contact is the major mode of transmission in the United States, heterosexual contact is the major mode in the rest of the world and it is rising in the U.S. especially among minority women. The virus tends to concentrate in seminal fluid, and is even

more potent when there is a co-existing genital inflammatory condition or infection such as another sexually transmitted disease present. The fragility of the rectal walls makes receptive anal sex highly risky, especially if intercourse is rough and the walls are damaged providing a direct route to the bloodstream.

Vaginal and cervical mucosa is thicker and not as likely to be traumatized during intercourse. Conditions that increase the likelihood of transmission to females during intercourse include adolescence prior to maturity of the genital tract and cervical mucosa, oral contraceptives, or genital tract infections that render the mucosa more vulnerable to the virus. Females contract HIV more often than males during heterosexual contact since exposure to seminal fluid is prolonged. Female to male transmission occurs less often since the penis and urethra are so briefly exposed to infected vaginal and cervical secretions. Men who are uncircumcised are at higher risk due to a higher rate of inflammation in the moist tissues under the foreskin and minute tears in the foreskin and glans. They are also at higher risk when the woman is menstruating.

HIV is also transmitted by addicts who share contaminated intravenous drug paraphernalia. Early in the epidemic many were infected by contaminated transfusions of blood and blood components, or via infected transplanted tissues including artificial insemination. Since 1985 routine testing of blood, tissues, and semen and screening of donors has made these modes of transmission rare in developed countries.

Transmission of the virus from an untreated pregnant woman to her fetus can occur as early as the first or second trimester. Transmission more commonly occurs during birth. The risk of mother-to-child transmission is increased when prolonged rupture of membranes, chorioamnionitis, preterm delivery, sexually transmitted disease, amniocentesis, amnioscopy, fetal scalp electrode placement, or an episiotomy occurs. Infants who escape infection can later be infected by breast feeding, especially if breastfeeding is prolonged as it is in undeveloped countries.

Body fluids that can harbor the virus include blood, vaginal and cervical secretions, and seminal fluid. Other fluids that can contain the virus include cerebral spinal fluid, synovial, pleura, peritoneal, pericardial, and amniotic fluids. Body fluids that do not contain the virus unless they are contaminated with visible blood include urine, vomitus, feces, nasal secretions, sweat, sputum, tears, and saliva.

Healthcare workers have a definite but very small risk of acquiring HIV as an occupational hazard. Up to 800,000 workers are injured by sharps on a yearly basis. The risk of HIV infection from a contaminated sharps injury is approximately 0.3%. Workers can also contract HIV by transmission via mucous membranes (0.09%) and through non-intact skin (<0.09%). The risk of transmission via a sharps injury is increased if there is blood visible on the sharp, if the injury provides direct entry of the virus into a vein or artery, or if the injury is very deep. Mucous membrane transmission has a higher risk if the volume of blood is large, there is a long period of contact with the mucous membranes, or if the person has an opening such as a lesion of the mucous membrane. If the patient that the blood came from is in an advanced stage of the disease and the viral

titer is high, the healthcare worker has a greater chance of HIV infection from either of these two modes of transmission.

Diagnosis

Patients can be tested for HIV infection by using a rapid screening test that uses blood, plasma, or saliva. These tests can be performed in the doctor's office and results are available within 30 minutes. An ELISA or enzyme immunoassay (EIA) may also be used as a first blood test for HIV. Results can take days or weeks depending on the lab utilized. Nucleic acid testing is able to detect HIV infection as early as 12 days post infection. Antibodies to HIV are present in the body 2 to 12 weeks after infection.

When the above tests are negative, they may be repeated in a few weeks if there is a chance that the patient will convert to positive due to recent exposure. If the above tests are positive, further testing is done to confirm infection. The Western blot test is highly specific and is most often used to confirm infection.

When infection is confirmed, a CD4⁺ T-cell count and HIV RNA determination to reveal the serum viral load is performed to stage the infection. Further resistance testing of the patient's individual strain of HIV helps to determine which drugs can be used initially and in the future to control the virus in this person. CD4⁺ T-cell counts and viral counts are repeated every 3 to 6 months thereafter to monitor disease progression and efficacy of treatment regimes.

Treatment

Treatment actually begins with pre-testing counseling. The patient needs support as the result of testing is awaited with high anxiety. When the result is positive immediate counseling and referral to an HIV support network is a high priority. The patient must learn about the disease, routes of transmission, and ways to reduce risky behaviors that will cause the disease to spread or progress more rapidly in the individual. The side effects and actions of medications given for treatment are explained as well as the critical need for absolute compliance with the medical regime to allow the patient to control the disease for as long as possible.

Antiretroviral treatment aims to support the immune system and to prevent low CD4⁺ T-cell counts and high viral titers which cause increased susceptibility to opportunistic diseases and infections. Drugs are given in combinations to increase efficacy and discourage the formation of resistance to antiviral drugs. Guidelines serve to guide the treatment of children, adolescents, and adults and are changed with experience, and the appearance of new or mutated strains and new drugs. The decision to begin treatment rests with the physician and patient and depends on the individual's viral strain, viral load, CD4⁺ T-cell counts, and symptoms of the disease. Antiretroviral treatment usually begins when there are more than 100,000 copies of HIV RNA/ ml or the CD4⁺ T-cell

count reaches 500/ microliter and/or symptoms are present, and should begin prior to a CD4⁺ T-cell count of 200/ microliter to prevent depletion to the point that immune reconstitution is no longer possible.

Six classes of antiretroviral drugs are currently in use to combat HIV infection:

1. Nucleoside reverse transcriptase inhibitors
2. Protease inhibitors
3. Non-nucleoside reverse transcriptase inhibitors
4. Fusion inhibitors
5. Cellular chemokine receptor (CCR5) antagonists
6. Integrase inhibitors

These drugs act by interfering with the virus's entry into the uninfected cell, or with the replication cycle of the virus. There are several drugs comprising these classes and more are in clinical trial. HIV RNA determinations of the viral load guides treatment. Two determinations are used to make changes in the combination of antiretroviral drugs used. It takes about 6 months for the HIV load to decline to a steady level of <50 copies/ml. Guidelines for antiretroviral treatment of patients of all ages are continuously updated and available at <http://aidsinfo.nih.gov>

The prevention and treatment of opportunistic or HIV-related diseases and infections is a priority for the patient during the entire course of the disease. Preventative vaccines are given after diagnosis and testing is done at that time to determine hepatitis status and other infections that may be already present in the body. Prophylaxis is instituted when the CD4⁺ T-cell count reaches 200/microliter to prevent *Pneumocystis jiroveci* pneumonia. Prophylaxis for *Mycobacterium avium*, cytomegalovirus, and fungi begins cautiously at <50/microliter so that drug resistance does not develop if at all possible. Infections are treated as they occur. Antiretroviral therapy can be temporarily held during treatment of infections and diseases to prevent the complications of drug interactions and toxicity from developing. Guidelines for treatment of opportunistic infections in patients of all ages are also available at <http://aidsinfo.nih.gov>

All pregnant women should be voluntarily screened for HIV infection. Unless needed earlier due to symptoms, antiretroviral treatment begins at the start of the second trimester and continues until the postpartum period. The pregnancy and delivery is handled in ways that decrease the risk of transmission to the child. A cesarean section is desirable. The infant is also treated for 6 weeks after birth. Breast feeding is contraindicated. These measures have reduced the mother-to-child transmission to <5%. Women who become pregnant while taking antiretroviral drugs as well as those who receive them later in pregnancy should be added to the Antiretroviral Pregnancy Registry to track outcomes and teratology of these drugs. The CDC, Food and Drug Administration (FDA), and the National Institutes of Health (NIH) disseminate this information to drug companies, doctors, and individuals to help guide treatment of this at-risk population.

Prevention

The CDC and NIH encourage several measures by the health care community to prevent HIV infections:

- Routine healthcare screening of adolescents, adults, and pregnant women
- Reduction of barriers to testing for all
- Increased testing sites outside medical settings
- Education of HIV-infected people and their partners
- Persistence in reducing mother-to-child transmission

Individuals can prevent infection through various behavioral changes:

- Avoiding exposure to another person's blood and bodily fluids
- Safe sex-practices of avoiding infected partners, sexual acts causing trauma, and by using latex condoms correctly and consistently
- Avoiding the sharing of intravenous drug injection paraphernalia
- Avoiding contaminated tattoos and body piercing
- Avoiding substance abuse and malnutrition

Healthcare workers can prevent transmission to and from patients by consistently following infection control procedures and standard precautions with ALL patients. They include:

- Proper hand hygiene before and after care of each patient
- Use of personal protective equipment (PPE) such as gloves, gown, mask, and goggles or face shields when there is a chance of contact with body fluids
- Safe injection practices and sharps handling including not recapping needles
- Proper handling of contaminated equipment and supplies with attention to sharps
- Proper cleansing of equipment, environment, and supplies with approved detergents

Postexposure Prophylaxis (PEP)

Healthcare workers who are exposed to possible HIV infection should receive counseling and PEP treatment if indicated. PEP guidelines are available from the National Institutes of Health at <http://aidsinfo.nih.gov>. They involve testing, administration of antiretroviral prophylaxis, counseling, follow-up, and monitoring of all healthcare workers and others who are occupationally exposed to HIV through a sharps injury or mucous membrane exposure.

Florida State laws concerning HIV Testing

Laws concerning AIDS/HIV in Florida cover many areas. Healthcare providers should read the Florida Statutes that provide details about these laws. They can be accessed at http://www.doh.state.fl.us/disease_ctrl/aids/legal/hivindex.html

In Florida, HIV testing may not be done for employment purposes unless a negative HIV status is a requirement for the job. The release of preliminary test results is restricted. Testing is mandatory for all prison inmates, for those charged with a sex offense, those convicted of prostitution, those who have potentially infected a victim of their crime, and by court order or voluntarily when an officer has been exposed. Testing must be done on all blood, plasma, organs, tissues, and skin available for infusion or transplantation. Testing must be done when healthcare employees have been exposed to HIV. Verbal or written informed consent is required with certain exceptions. HMOs and insurance companies must obtain consent prior to testing. Testing offered should be both confidential and anonymous and the patient must be aware of this availability before testing. Minors may give consent for tests to check for sexually transmitted diseases including HIV.

The HIV positive patient is encouraged to inform partners of their status. If the partner's name is revealed, a health care provider can notify the partner only about an anonymous exposure. The partner is counseled about testing and resources available. HIV status of a criminal must be disclosed to the exposed victim of a crime. All new HIV diagnoses must be reported within 2 weeks. Counseling must be provided by healthcare providers to all patients with positive test results. HIV/AIDS information must be available from state universities and community colleges.

Pregnant woman should be tested at the initial exam and at 28-32 weeks of gestation and when presenting for initial prenatal care within 30 days of or at the time of delivery. Women may opt out of this testing with a written refusal placed in the medical record. Emergency departments can defer testing of pregnant women presenting for initial prenatal care after 12 weeks of gestation with a referral of the patient to the county health department for follow-up.

HIV/AIDS education must be given to providers, employees of health care facilities, those with certain health care licenses, embalmers and funeral directors, emergency medical technicians (EMTs), and paramedics. Health care providers must be provided with protocols for offering HIV testing as a part of routine primary health care and upon admission to health care facilities.

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