

HIV INFECTION AND AIDS: AN OVERVIEW

AIDS - acquired immunodeficiency syndrome - was first reported in the United States in 1981 and has since become a major worldwide epidemic. AIDS is caused by the human immunodeficiency virus (HIV). By killing or damaging cells of the body's immune system, HIV progressively destroys the body's ability to fight infections and certain cancers. People diagnosed with AIDS may get life-threatening diseases called opportunistic infections, which are caused by microbes such as viruses or bacteria that usually do not make healthy people sick.

More than 790,000 cases of AIDS have been reported in the United States since 1981, and as many as 900,000 Americans may be infected with HIV. The epidemic is growing most rapidly among minority populations and is a leading killer of African-American males ages 25 to 44. According to the U.S. Centers for Disease Control and Prevention (CDC), AIDS affects nearly seven times more African Americans and three times more Hispanics than whites.

How is HIV transmitted?

HIV is spread most commonly by having unprotected sex with an infected partner. The virus can enter the body through the lining of the vagina, vulva, penis, rectum, or mouth during sex.

HIV also is spread through contact with infected blood. Before donated blood was screened for evidence of HIV infection and before heat-treating techniques to destroy HIV in blood products were introduced, HIV was transmitted through transfusions of contaminated blood or blood components. Today, because of blood screening and heat treatment, the risk of getting HIV from such transfusions is extremely small.

HIV frequently is spread among injection drug users by the sharing of needles or syringes contaminated with very small quantities of blood from someone infected with the virus. It is rare, however, for a patient to give HIV to a health care worker or vice-versa by accidental sticks with contaminated needles or other medical instruments.

Women can transmit HIV to their babies during pregnancy or birth. Approximately one-quarter to one-third of all untreated pregnant women infected with HIV will pass the infection to their babies. HIV also can be spread to babies through the breast milk of mothers infected with the virus. If the mother takes the drug AZT during pregnancy, she can reduce significantly the chances that her baby will be infected with HIV. If health care providers treat mothers with AZT and deliver their babies by cesarean section, the chances of the baby being infected can be reduced to a rate of 1 percent.

A study sponsored by the National Institute of Allergy and Infectious Diseases (NIAID) in Uganda found a highly effective and safe drug regimen for preventing transmission of HIV from an infected mother to her newborn that is more affordable and practical than any other examined to date. Results from the study show that a single oral dose of the antiretroviral drug nevirapine (NVP) given to an HIV-infected woman in labor and another to her baby within three days of birth reduces the transmission rate by half compared with a similar short course of AZT.

Although researchers have found HIV in the saliva of infected people, there is no evidence that the virus is spread by contact with saliva. Laboratory studies reveal that saliva has natural properties that limit the power of HIV to infect. Research studies of people infected with HIV have found no evidence that the virus is spread to others through saliva by kissing. No one knows, however, whether so-called "deep" kissing, involving the exchange of large amounts of saliva, or oral intercourse increase the risk of infection. Scientists also have found no evidence that HIV is spread through sweat, tears, urine, or feces.

Studies of families of HIV-infected people have shown clearly that HIV is not spread through casual contact such as the sharing of food utensils, towels and bedding, swimming pools, telephones, or toilet seats. HIV is not spread by biting insects such as mosquitoes or bedbugs. HIV can infect anyone who practices risky behaviors such as

- Sharing drug needles or syringes
- Having sexual contact with an infected person without using a condom
- Having sexual contact with someone whose HIV status is unknown

Having a sexually transmitted disease such as syphilis, genital herpes, chlamydial infection, gonorrhea, or bacterial vaginosis appears to make people more susceptible to getting HIV infection during sex with infected partners.

What are the early symptoms of HIV infection?

Many people do not have any symptoms when they first become infected with HIV. Some people, however, have a flu-like illness within a month or two after exposure to the virus. This illness may include

- Fever
- Headache
- Tiredness
- Enlarged lymph nodes (glands of the immune system easily felt in the neck and groin)

These symptoms usually disappear within a week to a month and are often mistaken for those of another viral infection. During this period, people are very infectious, and HIV is present in large quantities in genital fluids.

More persistent or severe symptoms may not appear for 10 years or more after HIV first enters the body in adults, or within two years in children born with HIV infection. This period of “asymptomatic” infection is highly individual. Some people may begin to have symptoms within a few months, while others may be symptom-free for more than 10 years.

Even during the asymptomatic period, the virus is actively multiplying, infecting, and killing cells of the immune system. HIV’s effect is seen most obviously in a decline in the blood levels of CD4 positive T cells (also called T4 cells) — the immune system’s key infection fighters. At the beginning of its life in the human body, the virus disables or destroys these cells without causing symptoms.

As the immune system worsens, a variety of complications start to take over. For many people, their first sign of infection is large lymph nodes or “swollen glands” that may be enlarged for more than three months. Other symptoms often experienced months to years before the onset of AIDS include

- Lack of energy
- Weight loss
- Frequent fevers and sweats
- Persistent or frequent yeast infections (oral or vaginal)
- Persistent skin rashes or flaky skin
- Pelvic inflammatory disease in women that does not respond to treatment
- Short-term memory loss

Some people develop frequent and severe herpes infections that cause mouth, genital, or anal sores, or a painful nerve disease called shingles. Children may grow slowly or be sick a lot.

What is AIDS?

The term AIDS applies to the most advanced stages of HIV infection. CDC developed official criteria for the definition of AIDS and is responsible for tracking the spread of AIDS in the United States.

CDC’s definition of AIDS includes all HIV-infected people who have fewer than 200 CD4 positive T cells per cubic millimeter of blood. (Healthy adults usually have CD4 positive T-cell counts of 1,000 or more.) In addition, the definition includes 26 clinical conditions that affect people with advanced HIV disease. Most of these conditions are opportunistic infections that generally do not affect healthy people. In people with AIDS, these infections are often severe and sometimes fatal because the immune system is so ravaged by HIV that the body cannot fight off certain bacteria, viruses, fungi, parasites, and other microbes.

Symptoms of opportunistic infections common in people with AIDS include

- Coughing and shortness of breath
- Seizures and lack of coordination
- Difficult or painful swallowing
- Mental symptoms such as confusion and forgetfulness
- Severe and persistent diarrhea
- Fever
- Vision loss
- Nausea, abdominal cramps, and vomiting
- Weight loss and extreme fatigue
- Severe headaches
- Coma

Children with AIDS may get the same opportunistic infections as do adults with the disease. In addition, they also have severe forms of the bacterial infections all children may get, such as conjunctivitis (pink eye), ear infections, and tonsillitis.

People with AIDS are particularly prone to developing various cancers, especially those caused by viruses such as Kaposi's sarcoma and cervical cancer, or cancers of the immune system known as lymphomas. These cancers are usually more aggressive and difficult to treat in people with AIDS. Signs of Kaposi's sarcoma in light-skinned people are round brown, reddish, or purple spots that develop in the skin or in the mouth. In dark-skinned people, the spots are more pigmented.

During the course of HIV infection, most people experience a gradual decline in the number of CD4 positive T cells, although some may have abrupt and dramatic drops in their CD4 positive T-cell counts. A person with CD4 positive T cells above 200 may experience some of the early symptoms of HIV disease. Others may have no symptoms even though their CD4 positive T-cell count is below 200.

Many people are so debilitated by the symptoms of AIDS that they cannot hold steady employment or do household chores. Other people with AIDS may experience phases of intense life-threatening illness followed by phases in which they function normally.

A small number of people first infected with HIV 10 or more years ago have not developed symptoms of AIDS. Scientists are trying to determine what factors may account for their lack of progression to AIDS, such as particular characteristics of their immune systems or whether they were infected with a less aggressive strain of the virus, or if their genes may protect them from the effects of HIV. Scientists hope that understanding the body's natural method of control may lead to ideas for protective HIV vaccines and use of vaccines to prevent the disease from progressing.

How is HIV infection diagnosed?

Because early HIV infection often causes no symptoms, a doctor or other health care provider usually can diagnose it by testing a person's blood for the presence of antibodies (disease-fighting proteins) to HIV. HIV antibodies generally do not reach detectable levels in the blood for one to three months following infection. It may take the antibodies as long as six months to be produced in quantities large enough to show up in standard blood tests.

People exposed to the virus should get an HIV test as soon as they are likely to develop antibodies to the virus - within 6 weeks to 12 months after possible exposure to the virus. By getting tested early, people with HIV infection can discuss with a health care provider when they should start treatment to help their immune systems combat HIV and help prevent the emergence of certain opportunistic infections (see section on treatment below). Early testing also alerts HIV-infected people to avoid high-risk behaviors that could spread the virus to others.

Most health care providers can do HIV testing and will usually offer counseling to the patient at the same time. Of course, individuals can be tested anonymously at many sites if they are concerned about confidentiality.

Health care providers diagnose HIV infection by using two different types of antibody tests, ELISA and Western Blot. If a person is highly likely to be infected with HIV and yet both tests are negative, the health care provider may request additional tests. The person also may be told to repeat antibody testing at a later date, when antibodies to HIV are more likely to have developed.

Babies born to mothers infected with HIV may or may not be infected with the virus, but all carry their mothers' antibodies to HIV for several months. If these babies lack symptoms, a doctor cannot make a definitive diagnosis of HIV infection using standard antibody tests until after 15 months of age. By then, babies are unlikely to still carry their mothers' antibodies and will have produced their own, if they are infected. Health care experts are using new technologies to detect HIV itself to more accurately determine HIV infection in infants between ages 3 months and 15 months. They are evaluating a number of blood tests to determine if they can diagnose HIV infection in babies younger than 3 months.

How is HIV infection treated?

When AIDS first surfaced in the United States, there were no medicines to combat the underlying immune deficiency and few treatments existed for the opportunistic diseases that resulted. During the past 10 years, however, researchers have developed drugs to fight both HIV infection and its associated infections and cancers.

The U.S. Food and Drug Administration (FDA) has approved a number of drugs for treating HIV infection. The first group of drugs used to treat HIV infection, called nucleoside reverse transcriptase (RT) inhibitors, interrupts an early stage of the virus making copies of itself. Included in this class of drugs (called nucleoside analogs) are AZT, ddC (zalcitabine), ddI (dideoxyinosine), d4T (stavudine), 3TC (lamivudine), abacavir (ziagen), and tenofovir (viread). These drugs may slow the spread of HIV in the body and delay the start of opportunistic infections.

Health care providers can prescribe non-nucleoside reverse transcriptase inhibitors (NNRTIs), such as delavirdine (Rescriptor), nevirapine (Viramune), and efavirenz (Sustiva), in combination with other antiretroviral drugs.

More recently, FDA has approved a second class of drugs for treating HIV infection. These drugs, called protease inhibitors, interrupt virus replication at a later step in its life cycle. They include

- Ritonavir (Norvir)
- Saquinavir (Invirase)
- Indinavir (Crixivan)
- Amprenavir (Agenerase)
- Nelfinavir (Viracept)
- Lopinavir (Kaletra)

Because HIV can become resistant to any of these drugs, health care providers must use a combination treatment to effectively suppress the virus. When RT inhibitors and protease inhibitors are used in combination, it is referred to as highly active antiretroviral therapy, or HAART, and can be used by people who are newly infected with HIV as well as people with AIDS.

Researchers have credited HAART as being a major factor in significantly reducing the number of deaths from AIDS in this country. While HAART is not a cure for AIDS, it has greatly improved the health of many people with AIDS and it reduces the amount of virus circulating in the blood to nearly undetectable levels. Researchers, however, have shown that HIV remains present in hiding places, such as the lymph nodes, brain, testes, and retina of the eye, even in patients who have been treated.

Despite the beneficial effects of HAART, there are side effects associated with the use of antiviral drugs that can be severe. Some of the nucleoside RT inhibitors may cause a decrease of red or white blood cells, especially when taken in the later stages of the disease. Some may also cause inflammation of the pancreas and painful nerve damage. There have been reports of complications and other severe reactions, including death, to some of the antiretroviral nucleoside analogs when used alone or in combination. Therefore, health care experts recommend that people on antiretroviral therapy be routinely seen and followed by their health care providers. The most common side effects associated with protease inhibitors include nausea, diarrhea, and other gastrointestinal symptoms. In addition, protease inhibitors can interact with other drugs resulting in serious side effects.

A number of drugs are available to help treat opportunistic infections to which people with HIV are especially prone. These drugs include

- Foscarnet and ganciclovir to treat cytomegalovirus (CMV) eye infections
- Fluconazole to treat yeast and other fungal infections
- Trimethoprim/sulfamethoxazole (TMP/SMX) or pentamidine to treat *Pneumocystis carinii* pneumonia (PCP)

In addition to antiretroviral therapy, health care providers treat adults with HIV, whose CD4+ T-cell counts drop below 200, to prevent the occurrence of PCP, which is one of the most common and deadly opportunistic infections associated with HIV. They give children PCP preventive therapy when their CD4+ T-cell counts drop to levels considered below normal for their age group. Regardless of their CD4+ T-cell counts, HIV-infected children and adults who have survived an episode of PCP take drugs for the rest of their lives to prevent a recurrence of the pneumonia.

HIV-infected individuals who develop Kaposi's sarcoma or other cancers are treated with radiation, chemotherapy, or injections of alpha interferon, a genetically engineered naturally occurring protein.

How can HIV infection be prevented?

Because no vaccine for HIV is available, the only way to prevent infection by the virus is to avoid behaviors that put a person at risk of infection, such as sharing needles and having unprotected sex.

Many people infected with HIV have no symptoms. Therefore, there is no way of knowing with certainty whether a sexual partner is infected unless he or she has repeatedly tested negative for the virus and has not engaged in any risky behavior.

People should either abstain from having sex or use male latex condoms or female polyurethane condoms, which may offer partial protection, during oral, anal, or vaginal sex. Only water-based lubricants should be used with male latex condoms.

Although some laboratory evidence shows that spermicides can kill HIV, researchers have not found that these products can prevent a person from getting HIV.

The risk of HIV transmission from a pregnant woman to her baby is significantly reduced if she takes AZT during pregnancy, labor, and delivery, and her baby takes it for the first six weeks of life.

What research is going on?

NIAID-supported investigators are conducting an abundance of research on all areas of HIV infection, including developing and testing preventive HIV vaccines and new treatments for HIV infection and AIDS-associated opportunistic infections. Researchers also are investigating exactly how HIV damages the immune system. This research is identifying new and more effective targets for drugs and vaccines. NIAID-supported investigators also continue to trace how the disease progresses in different people.

Scientists are investigating and testing chemical barriers, such as topical microbicides, that people can use in the vagina or in the rectum during sex to prevent HIV transmission. They also are looking at other ways to prevent transmission, such as controlling sexually transmitted diseases and modifying people's behavior, as well as ways to prevent transmission from mother to child.

MORE INFORMATION

NIAID is a component of the National Institutes of Health (NIH). NIAID supports basic and applied research to prevent, diagnose, and treat infectious and immune-mediated illnesses, including HIV/AIDS and other sexually transmitted diseases, illness from potential agents of bioterrorism, tuberculosis, malaria, autoimmune disorders, asthma and allergies.

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