

Section II

HIV

Overview

Human immunodeficiency virus (HIV) attacks and destroys the cells of the immune system. An HIV infection can weaken a person's immune system until it is no longer capable of fighting infection and disease. This state is known as **immune deficiency**. When someone is severely immunodeficient, the person becomes vulnerable to **opportunistic infections**, which are infections that take advantage of the weakened immune system. HIV is spread by the exchange of bodily fluids, most commonly through unprotected sexual intercourse. In its most advanced stages, HIV infections can lead to **acquired immunodeficiency syndrome (AIDS)**, defined by the occurrence of an opportunistic infection or HIV-related cancer. In the absence of treatment, AIDS takes on average ten years to develop. With treatment, though, people can live a near normal life span and never progress to AIDS. Although there is no cure for HIV/AIDS, the disease can be managed through effective medication.

History

In November of 1977, Dr. Grethe Rask, a forty-seven-year-old physician who had spent the last four years practicing in a run-down clinic in Zaire (now the Democratic Republic of Congo), flew home to Denmark. "I'd better go home to die," Rask told a friend, matter-of-factly. For over a year, she had been suffering from unexplained fatigue and weight loss, and her symptoms had become so severe that she had difficulty breathing. Upon arrival in Denmark, Rask was given a battery of tests that revealed she was severely immunodeficient and suffering from a progressive lung disease of unknown origin. Her



Protests in the 1980s called for more research to fight AIDS.

physicians were baffled: why had the immune system of this previously healthy woman suddenly ceased to function? Rask died on December 12, 1977. An autopsy revealed that she had **pneumocystis pneumonia**, an extremely rare fungal infection.

Over the next few years, more rare maladies from a mysterious new syndrome began sprouting up, mainly among homosexual men. In cities such as Copenhagen, New York, Los Angeles, and San Francisco, young men fell ill from an aggressive form of **Kaposi's sarcoma**, an uncommon cancer (cancers are diseases involving uncontrolled cell growth) usually characterized by flat, purple lesions. Some had serious health complications from toxoplasmosis, a parasitic infection that seldom affects those with healthy immune systems. Others died of pneumocystis pneumonia, similar to Grethe Rask. These puzzling infections would later be identified as opportunistic infections, arising from the immunodeficiency caused by HIV/AIDS.

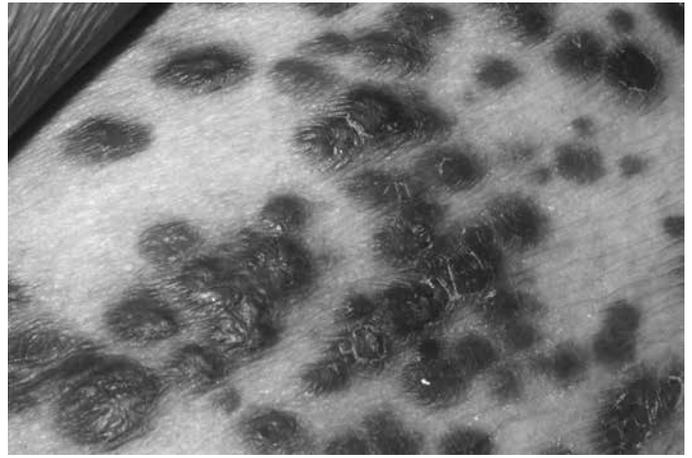
Despite the rising death toll from these oppor-

2. **Cryptococcal meningitis:** Meningitis is an inflammation of the meninges, that is, the protective membranes covering the brain and spinal cord. Cryptococcal meningitis is a fungal infection caused by breathing in the small spores of *Cryptococcus*, a fungus found in soil throughout the world. Worldwide, approximately 1 million new cases of cryptococcal meningitis occur each year, resulting in 625,000 deaths. HIV infection is the leading risk factor for cryptococcal meningitis, accounting for nearly 95 percent of cases in low and middle-income countries, and 80 percent of cases in high-income countries.

3. **Kaposi's sarcoma (KS):** Kaposi's sarcoma, a cancer that causes the growth of purple/red patches on skin and other areas in the body, was one of the first 'red flags' that led to the uncovering of the HIV epidemic. In the early 1980s, physicians in Los Angeles, New York, and San Francisco were startled to see hundreds of healthy young men falling ill with a rare cancer that was generally only seen among elderly men of Mediterranean descent. These physicians noted that most of the men were homosexual and all were immunosuppressed, leading them to conclude that there was some pathogen—later identified as HIV—which weakened the immune system and was spread through sexual contact.

4. **Pneumocystis Pneumonia (PCP):** Pneumocystis pneumonia is an infection of the lungs caused by the fungus *Pneumocystis jirovecii*. It is extremely rare in people with functioning immune systems, but can be fatal among individuals who are immunocompromised. Before the availability of treatment for HIV, PCP occurred in 70 to 80 percent of HIV-positive people. This proportion has dropped substantially over the past decade with the introduction of effective medications that protect the immune system against HIV.

5. **Toxoplasmosis:** Toxoplasmosis is a disease caused by the ingestion of the parasite *Toxoplasma gondii*, which can be found in contaminated soil, cat feces, and undercooked or raw meat. In general, people who are infected with this disease experience mild flu-like symptoms or no symptoms at all. Severe toxo-



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plasmosis may develop however, especially in persons with severely weakened immune systems, causing damage to the eyes, brain, and other organs.

Treatment and Prevention

HIV Testing

DIAGNOSIS

In order to diagnose someone with HIV, certain tests may be performed on their blood, saliva, or urine to check for the virus or other signs of infection. Rapid screening tests take as little as thirty minutes to see results; these tests usually are followed by a more reliable test to confirm the results. Three main types of HIV tests are available:

1. **Antibody tests:** When you're exposed to viruses and bacteria, your immune system may produce certain proteins called **antibodies**, which help neutralize the invading pathogen. Antibody tests check for the existence of HIV antibodies, which can be found in the blood or saliva of an infected person. Most HIV tests, including many rapid screening tests, are antibody tests.
2. **Combination or fourth-generation tests:** As you may remember from the previous section, certain immune cells (macrophages) can swallow up and digest invading pathogens, leaving behind parts of the pathogen called antigens. These antigens are what stimulate

of a disease

Incubation period – the interval between the receipt of the infectious agent and the onset of clinical disease

Indoor Residual Spraying (IRS) – the application of insecticides indoors, on walls and other surfaces where the mosquitoes rest from their feasting; the insecticide kills the mosquitoes when they come in contact with these surfaces

Infectious diseases – microbial diseases that are transmitted between individuals within a population

Infectivity – a pathogen’s ability to cause an infection in a susceptible host

Innate immunity – the non-specific defense response to antigens entering the body; these antigens may be microbial or non-living.

Insecticides – chemicals that repel and kill mosquitos as well as other insects.

Insecticide-treated mosquito nets (ITNs) – mosquito nets, a thin mesh with holes too small for mosquitoes to pass through, that are treated with insecticides

Integrase – the enzyme responsible for integrating viral DNA into the host cell’s DNA

Integrase strand transfer inhibitors (INSTIs) – the type of antiretroviral medication that blocks integrase

Intermittent preventive treatment (IPT) – the administration of a dose of an antimalarial drug to certain populations at distinct time intervals in order to prevent transmission without substantially increasing the probability of drug resistance; people who are especially vulnerable to severe disease, including pregnant women, infants, and children, are often the recipients of IPT.

Intracellular pathogens – pathogens that are able to grow and reproduce within eukaryotic host cells

Jenner, Edward (1749–1823) – the English physician credited with the discovery of the first vaccine; in 1796, through an experiment with a young boy, he showed that inoculation with cowpox provided immunity to smallpox

Kaposi’s sarcoma (KS) – an HIV-related cancer that causes the growth of purple/red patches on the skin and other areas in the body

Key affected populations (KAPs) – marginalized populations at higher risk of HIV infection; these

include sex workers, men who have sex with men (MSM), and people who inject drugs (PWID)

Koch, Robert (1843–1910) – known as the father of modern bacteriology, Koch designed experiments that demonstrated that the bacterium *Bacillus anthracis* was the cause of anthrax

L (large) protein – a viral protein responsible for generating a complementary RNA strand for the single strand of RNA contained within an Ebola virion

Latent period – a dormant period of time after infection by certain microorganisms when no symptoms or transmission to other hosts occurs

Lentivirus – a virus characterized by a long incubation period; HIV is a lentivirus.

Lymphatic system – the network of tissues and organs that helps our bodies fight infections and get rid of waste materials; immune cells typically travel throughout the body via the lymphatic system.

Lymphocyte – a type of white blood cell whose main purpose is to identify an invading pathogen and to stimulate the body for an appropriate immune response; there are two main types of lymphocytes: B-lymphocytes and T-lymphocytes; B-lymphocytes produce antibodies, and T-lymphocytes attack and kill cells in the body that have already been infected.

Macrophages – white blood cells that engulf and digest pathogens and other antigens in the body

Macropinocytosis – a process through which the Ebola virion is swiftly engulfed by the cell membrane of the host cell

Major histocompatibility complex (MHC) – cell surface proteins whose role is to display foreign antigens to a host’s immune system in order to stimulate an immune response; the MHC also plays a role in “self” recognition, so a host’s immune response does not attack uninfected cells.

Malaria – a vector-borne disease caused by *Plasmodium* parasites; symptoms of malaria often include high fever and flu-like illness, such as shaking chills, headaches, muscle aches, and fatigue; malaria can be fatal if untreated.

Mass drug administration (MDA) – strategy to eliminate the malaria parasite in a population by distributing antimalarials to everyone, regardless of the presence of symptoms and without first testing for infection; this approach is not recommended because