CAN HIV INFECTION BE CURED?

WHAT HAVE WE LEARNED ABOUT HIV?

In 1981, several cases of rare pneumonia (PCP, see Fact Sheet 515) and skin cancer (Kaposi's sarcoma, see Fact Sheet 511) were reported among men who have sex with men in Los Angeles and New York City. This was a mystery to researchers.

Human Immunodeficiency Virus (HIV), the virus that causes AIDS, was identified in 1983. No medications were available against it until 1987. In that year, a cancer drug called zidovudine (AZT, see Fact Sheet 411) was found to slow down the multiplication of the virus.

Since then, well over 30 medications have been approved to fight HIV. None of these drugs kills the virus. Each of them slows it down at a specific point of its life cycle (see Fact Sheet 106).

HOPE FOR A CURE

In 1996, several research studies suggested that triple-drug combinations could drive HIV into remission. Many people taking combinations of antiretroviral medications have an undetectable viral load (see Fact Sheet 125).

However, only a small portion of the virus is in the blood, where it can be measured. Even in people taking potent drug combinations, HIV is not eradicated.

WHERE DOES THE VIRUS HIDE?

Very early in HIV infection, the virus becomes part of the genetic code of millions of cells. Some of these cells are hidden from the immune system, and from antiviral medications. Areas where the virus is hiding are called reservoirs. These include the genital tract and the central nervous system.

THE BERLIN PATIENT

Another boost to hopes for an HIV cure came from the "Berlin patient." This was a person who lived in Berlin with both HIV and leukemia. Standard leukemia treatment failed. His immune system was wiped out to prepare for a bone marrow transplant. His bone marrow donor had a rare genetic mutation that made him resistant to HIV infection. After the leukemia treatments were completed, the Berlin patient had no sign of HIV in his body.

Bone marrow transplants are dangerous. As many as 1/3 of patients who get them die from the procedure. This procedure therefore is not a practical way to cure HIV. However, this case provides some clues about how HIV might be removed from a person living with the virus.

MORE GOOD RESULTS

Since then, a "functional cure" of HIV has been reported in several people. A functional cure means that measurable levels of HIV have not returned even without antiretroviral treatment. In some cases, the virus returned years later.

Some infants who became HIV positive at birth and were given antiretroviral drugs soon afterward appeared to be cured of HIV, including the "Mississippi baby." However, the virus has returned in that case.

CURRENT CURE RESEARCH

Most research is focused on a functional cure of the virus rather than a complete eradication of HIV from the body. Researchers are investigating different strategies for achieving this:

- "Shock and kill"
- Therapeutic vaccination
- Making cells resistant to HIV
- Gene therapy
- Modifying stem cells

Many researchers believe that a cure will require a combination of approaches.

"Shock and Kill" (or "Poke and Clear")

During initial HIV infection, millions of cells are infected. Much of the virus is latent, not producing new virus. It is invisible to the immune system and to antiretroviral medications.

Researchers are working with drugs that activate this latent virus ("shock" it). This might make it possible for existing antiretroviral medications to clear the virus ("kill" it).

Therapeutic Vaccinations

Most vaccines are given to prevent infection. Therapeutic vaccinations are given to boost the body's own ability to fight an existing virus. This may require multiple vaccines -- one to get the body's immune system ready ("prime" it) and another to strengthen the immune system ("boost" it).

Making Cells Resistant to HIV

In this approach, CD4 cells are taken from a person living with HIV. The cells are modified to make them resistant to HIV. Then they are returned to that person. The modified cells should then multiply and eventually replace the infected cells.

Gene Therapy

During infection, HIV inserts its own genetic material into a person's cells. Gene therapy uses a genetic editing technique to "snip out" the HIV genes from cells. So far this has only been tried in the laboratory.

Modifying Stem Cells

The "Berlin patient" received transplants of stem cells that were resistant to HIV infection. Stem cells can grow into various types of cells in the body. This approach requires first destroying a person's own immune system before it is re-established from the transplanted stem cells.

TREATMENT INTERRUPTIONS

Participants in cure research studies often must stop antiretroviral treatment so researchers can see if the experimental treatment is working. There are many risks to interrupting treatment (see Fact Sheet 406). It may therefore be difficult to find volunteers for such clinical trials (see Fact Sheet 205)..

THE BOTTOM LINE

There have been ups and downs in the search for a cure for HIV. So far, it seems that all approaches carry some risks. However, research in this area is ongoing.

Revised November 16, 2017