Can HIV Infection Be Cured?

WHAT HAVE WE LEARNED ABOUT HIV?

In 1981, several cases of rare pneumonia (pneumocystis pneumonia or PCP) and skin cancer (Kaposi sarcoma or KS) were reported among men who have sex with men (MSM) 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 to treat HIV until 1987 when a cancer drug called zidovudine (AZT, Retrovir) was found to slow down the multiplication of the virus.

Since then, well over 30 antiretroviral medications (ARVs) have been approved to treat HIV. None of these drugs kills the virus, but each of them slows it down at a specific point of the HIV life cycle.

HOPE FOR A CURE

In 1996, several research studies suggested that triple-drug combinations could drive HIV into remission. Many people taking combinations of ARVs have an undetectable viral load. 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 ARVs. Areas where the virus hides are called reservoirs. These include the gut, 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 one third of people 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 with HIV.

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 therapy (ART). In some cases, the virus returned years later.

Some HIV-positive infants were given ARVs soon after birth 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. 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 ARVs. Researchers are working with drugs that activate this latent virus (shock it). This might make it possible for existing ARVs 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 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 ART so researchers can see if the experimental treatment is working. There are risks to interrupting treatment, including drug resistance. It may therefore be challenging to find volunteers for such clinical trials.

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.

MORE INFORMATION

Avert: History of HIV and AIDS

Avert: Is There a Cure for HIV and AIDS?

HIV.gov: A Timeline of HIV and AIDS

CDC: HIV Treatment

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