



Why is HIV/AIDS so hard to treat?

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Abstract

The HIV/AIDS is a global pandemic and remains the world's leading infectious killer. Death of HIV/AIDS patients worldwide is a powerful reminder that there is no cure for HIV/AIDS. However, Anti Retroviral drug treatment can slow down the course of disease and may lead to near normal life expectancy. But HIV drug resistance highlights the need for new and more powerful drugs. Across the globe, researchers are working hard to make an HIV vaccine. Gene editing to prevent HIV is innovative hypothesis to prevent HIV/AIDS which has generated hope to prevent and cure it.

HIV/AIDS is a global pandemic and still remains the world's leading infectious killer. About 37 million people have HIV/AIDS worldwide and deaths due to it are a powerful reminder that there is no cure for HIV/AIDS. Maximum number of deaths due to HIV found in countries were Nigeria, South Africa, India, Tanzania, Mozambique, Zimbabwe, Cameroon, Indonesia, Kenya, Uganda, Malawi, DR Congo, Ethiopia, and other countries (UNAIDS, 2015). Opportunistic infections in HIV patients differ from country to country. The TORCH infections in HIV positive women are an ambient observation from India (Karad and Kharat, 2015).

There is no cure or vaccine for HIV however, anti-retroviral treatment can slow down the course of disease and may lead to near normal life

expectancy. While antiretroviral treatment reduces the risk of death and complications from the disease, these medications are expensive and have side effects.

HIV differs from many viruses in that it has very high genetic variability. This diversity is a result of its fast replication cycle, with the generation of about 10^{10} virions every day, coupled with a high mutation rate of approximately 3×10^{-5} per nucleotide base per cycle of replication and recombinogenic properties of reverse transcriptase. This complex scenario leads to the generation of many variants of HIV in a single infected patient in the course of one day. This recombination is most obvious when it occurs between subtypes of HIV. Reverse transcriptase enzyme makes mistakes in the process of

formation of RNA in each cycle; hence HIV virus is more prone to do mutations. The ability of HIV to mutate and reproduce itself in the presence of antiretroviral drugs is called HIV drug resistance. Consequently, it will lead to treatment failure, need to start more costly second- and third- line treatments, increased health costs associated with these, spread of drug resistant HIV, and need to develop new anti-HIV drugs. Awareness grows that the HAART has serious side effects. Treatment failures highlight the need for newer, more powerful drugs. The FDA later approves new classes of drugs that make HIV treatment safer, easier, and more effective. But the drugs do not cure AIDS. Treatment is still totally unavailable to the vast majority of people living with HIV. In sub-saharan African and India, only 1% of the 4.1 million people with HIV receive anti HIV-drugs. (Dutta et al., 2015)

Researchers have explored a number of strategies that they hope will produce protective immune responses by vaccine against HIV. Across the globe, researchers at universities, drug and biotech companies and government agencies are working very hard to make an HIV vaccine a reality. More money has been spent on finding an HIV vaccine than on any other vaccine in history. After more than the 25 years of the discovery of HIV virus vaccine development is not possible today. In fact developing a vaccine is almost always a long process. It took 47 years for example to develop a polio vaccine. Developing an HIV vaccine is even more difficult. It is forecasted that an effective HIV vaccine might not be available in 15 to 20 years from now (Hai-Bo Wang et al., 2015). Initially treatment to HIV/AIDS is typically a non-nucleoside reverse transcriptase non-nucleoside reverse transcriptase inhibitor (NNRTI) plus two nucleoside analogue reverse transcriptase inhibitors (NRTIs) and protease inhibitors (PI). There are 25 approved anti-retroviral drugs in market. The World Health Organization and United States recommends antiretroviral in people of all ages including pregnant women as soon as the diagnosis is made regardless of CD4 count.

The first and only person ever to be cured of HIV/AIDS was a leukemia patient treated in Berlin with HIV-resistant stem cells popularly known as Berlin Patient. (Gero Hütter et al., 2009). The implications of this extraordinary medical achievement are many. If indeed, the patient has been functionally cured of his HIV infection, he then has provided us with a blueprint from which to work. In fact, much of our ongoing research endeavors were inspired by the biological mechanisms likely exploited to bring about this breakthrough. There is still no available cure for HIV, but the finding that it is really possible finally to cure AIDS has revitalized the research. In the future there will be a method of making space for these new HIV-resistant stem cells, so that they grow out and repopulate the immune system. That is the goal of scientists today. It may take a long time to get to that, but it will happen (TAG, 2015).

In all regions of the world, some groups of people are still not able to access HIV prevention and treatment. Prevention of HIV/AIDS strategy should include HIV testing services, male circumcision for HIV prevention, mother to child transmission of HIV, post-exposure prophylaxis, pre-exposure prophylaxis, treatment and care, and treatment of children living with HIV. Adherence to treatment, types of medicines used, supply of drug to every HIV patient, education and awareness, will help to slow down the spread of HIV (Eholié et al; 2012).

Due to sexual transmission and drug resistance of HIV virus, it is still a matter of concern throughout the world. The disease also has significant social and economic impacts. Sub-Saharan Africa is the most affected region. There is no cure for HIV infection. However, effective antiretroviral (ARV) drugs can control the virus and help prevent transmission so that people with HIV. Between 2000 and 2015, new HIV infections have fallen by 35% AIDS-related deaths have fallen by 24% with some 7.8 million lives saved as a result of international efforts that led the global achievement of the HIV targets. Many governments and research institutions

participate in HIV/AIDS research. These studies drug development, HIV vaccine development, drug resistance and new antiretroviral drugs. Traditionally vaccination is the only strategy that has ever led to the worldwide elimination of viral diseases like Small pox and near elimination state of Polio. Due to inability to produce such vaccine in case of HIV it will take long time to eliminate HIV/AIDS. But gene editing to prevent HIV is innovative hypothesis to prevent HIV/AIDS which has generated hope to prevent and cure it.

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