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The SAV001-H vaccine: A new hope for HIV patients

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Since the human immunodeficiency virus (HIV) was identified in 1983, it has generated fear, discrimination, and major changes to public health policy. Among the scientific community, it has also generated a great deal of curiosity because of its unique pattern of progression. Patients often spend years without any symptoms and then begin to suffer from a variety of diseases that are generally easily combatted by healthier immune systems. These patients are almost certain to die in the absence of antiretroviral drugs. Unfortunately, by the time the effort to change the effects of HIV began, there seemed to be little chance of finding patient zero (in epidemiology, the first recorded case of a condition).

Following the advancement of genetic tests, a possible candidate for patient zero was soon revealed in Gaetan Dugas, a Canadian flight attendant who acquired the virus in Africa and introduced it to Western society. It was later found that Dugas was not actually patient zero, and that the most likely origin of the disease was a chimpanzee (Abumrad n.d.). Scientists have since concluded that the virus probably made its way to humans in the late 19th century during the colonization of Africa. According to the Bushmeat theory, a hunter was most likely bitten or cut while "hunting or preparing" a chimp or a monkey (Rope 2004).

HIV infects host cells such as a CD4+ lymphocyte. CD4 receptors and co-receptors on the surface of CD4+ lymphocytes interact with glycoproteins on the viral envelope of HIV. When the glycoproteins of HIV bind to the CD4 receptors, the membranes of the virus and the lymphocyte fuse, allowing the nucleocapsid to enter the host cell and release two single-stranded RNA molecules and three replication enzymes. One of these enzymes, reverse transcriptase, starts to transcribe viral RNA into an RNA-DNA double helix. The RNA is then broken down and the DNA strand undergoes polymerization to complete the DNA helix. This virally derived DNA is then transported to the cell's nucleus and integrated into the host cell's DNA.

When the host cell becomes activated, its DNA undergoes transcription. The mRNA that results is then translated and the viral proteins are synthesized. Proteases cleave long viral amino acid sequences into smaller proteins. The small proteins, along with core replicating enzymes, come together to form a capsid, which eventually leaves the host cell enveloped in the host cell's proteins. The virus then goes on to infect other immune cells (Rajadurai n.d.).

Image source: Kaiser 2012.

From understanding transmission to developing effective treatments, the scientific and medical communities have been pushing to find a cure for this ever-changing virus. Drugs have come to target HIV replication in order to decrease the viral load in an infected individual, which also leads to a decrease in the rate of transmission. Among all advancements in HIV treatment, one stands alone in its potential towards finding a cure: the recently tested SAV001-H vaccine.

At Western University, Canada's Schulich School of Medicine and Dentistry, Dr. Chil-Yong Yang and his team developed the vaccine in collaboration with a biotech company (Mullins 2013). According to Dr. Yang, the SAV001-H vaccine—based on a genetically modified virus, which has been killed—is the only HIV vaccine that is in clinical trials. During phase I of its trials, it showed no adverse side effects. The randomized, observer-blind placebo-controlled study began in March 2012 and finished in August 2013 (HIV Vaccine 2013). It was important that this study was randomized and observer-blind in order to make sure that all participants received treatment without biases or judgment as well as to ensure generalizability among the participants. It was placebo-controlled so that investigators could ensure that patients in the experimental group were indeed showing improvement in comparison to those who were not on the actual vaccine, but believed otherwise.

Investigators studied the effects of the vaccine when it was administered directly into a muscle in HIV-infected,

asymptomatic men and women between 18-50 years of age. Participants were randomly assigned to one of two study groups, placebo or HIV-1 vaccine, and the investigators asked that any adverse side effects be recorded in a diary over a seven-day period. Afterwards, the volunteers were analyzed for chemicals in the body which were "indicative of HIV activity by principal investigators" (HIV Vaccine 2013). The investigators did not observe any serious side effects. HIV-1 antibody detections were performed and the investigators found that the increased antibodies "were maintained during the 52 week study period" (HIV Vaccine 2013). These findings and the lack of adverse side effects in phase I of the clinical trials provide investigators and HIV victims with a new sense of hope for a cure. Given the safety of the vaccine as found by phase I, findings predict high success rates in phase II of the trial, which will look at side effects and safety of the vaccine in a larger study group.

The US Centers for Disease Control and Prevention (CDC) has estimated that since June 1981, "1.7 million [people] in the U.S…have been infected with HIV, including over 619,000 who have already died and approximately 1.2 million adults and adolescents who were living with HIV infection at the end of 2008, the most recent year for which national prevalence estimates are available" (Mahon n.d.). Though it is only in its initial stages, the SAV001 vaccine seems to be a very promising hallmark in the history of HIV. If it lives up to the same success in phase II and phase III of the clinical trials, then the scientific and medical communities will have to deal with concerns that will arise from implementing the vaccine. These concerns include and are not limited to patenting of the vaccine by pharmaceuticals, implications for marketing it internationally, and screening for those who would be good candidates for the vaccine. More so, since the trials were performed using asymptomatic patients, further research is required to determine the vaccine's efficacy for people who are at-risk or symptomatic. Nonetheless, the SAV001-H vaccine seems to be a groundbreaking step towards a feasible treatment for one of the most pressing concerns in modern healthcare.

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