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HIV patients with lymphoma given new hope

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(PhysOrg.com) -- The Human Immunodeficiency Virus (HIV) is widely treated using highly active antiretroviral therapy (HAART), which patients must continue throughout their lives. Now a new study suggests the patients' own stem cells could be genetically modified and then transplanted back into their bodies to give them a single administration therapy, given once and lasting for life. This could avoid the costs and the toxic side effects of the traditional HAART.

Gene therapy had been investigated before but the new genetic material lasted only a few months to a year. The new research, carried out by a team led by John Rossi, a molecular geneticist from the City of Hope cancer center in Duarte, California, has found the new genetic material was still in the blood up to two years after the transplants.

The research results follow a report last year of the "Berlin patient," who received a stem cell transplant to treat leukemia. The transplant came from the bone marrow of a donor who was found to have a mutation in the CCR5 gene, which codes for a receptor that allows HIV to enter immune cells. After the transplant the patient appeared to be completely cured of the leukemia and of AIDS, which makes it the only known case of AIDS being cured. It is not certain that the mutation caused the cure, but it seems likely.

The proof-of-principle research was carried out on four HIV patients who needed bone marrow transplants because of a blood cancer called AIDS-related lymphoma. As part of the normal treatment, the patients' bone marrow was removed and they then received chemotherapy to

destroy the cancer cells in the remaining marrow and blood system. Blood stem cells were extracted from the marrow.

Ordinarily, the stem cells would be transplanted back after the chemotherapy, but in the experiment the researchers genetically manipulated a small number of them, inserting three therapeutic genes, including one that cripples CCR5, before returning the cells to the patients. Dr Rossi said the combination of three genes was intended to increase the effectiveness since it would make it more difficult for the virus to escape, but as a safety precaution they did not implant a large number of cells.

The number of cells expressing the modified genes was too low to provide a therapeutic benefit, but the research did prove the principle that genetic manipulation of stem cells may be a valuable way of treating patients with HIV and AIDS in the future without having to find rare donors who already have a beneficial genetic mutation. The research found no evidence of adverse effects for any of the patients and all four are still free of lymphoma two years after the treatment.

Dr Rossi said the next step is to determine the proportion of stem cells that need to be modified for each patient. Animal studies may provide some answers, but eventually, “if done right,” genetic therapy could replace daily antiretroviral therapy. The current therapy is effective and allows patients to live relatively normal lives, but it is financially out of reach for millions of patients in developing countries, and has side effects that can still shorten patients’ lives.

Rossi’s team are also working on ways to make the transplant procedure less risky and toxic, to enable it to be used for HIV patients who do not have cancer.

The City of Hope research institute is a non-profit organization based

near Los Angeles. The results of the research were published in the journal *Science Translational Medicine*.

More information: RNA-Based Gene Therapy for HIV with Lentiviral Vector-Modified CD34+ Cells in Patients Undergoing Transplantation for AIDS-Related Lymphoma, Sci Transl Med 16 June 2010: Vol. 2, Issue 36, p. 36ra43, DOI:10.1126/scitranslmed.3000931