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Cedars-Sinai Researchers Target Cancer Stem Cells in Malignant Brain Tumors

Approach Aims to Prevent Brain Cancer Recurrence by Attacking Tumors at the Source

LOS ANGELES (Jan. 6, 2014) - Researchers at the Cedars-Sinai Maxine Dunitz Neurosurgical Institute and Department of Neurosurgery identified immune system targets on cancer stem cells - cells from which malignant brain tumors are believed to originate and regenerate - and created an experimental vaccine to attack them.

Results of laboratory and animal studies are published in the online edition of Stem Cells Translational Medicine, and will appear in the March 2014 print edition. A Phase I safety study in human volunteers with recurrent glioblastoma multiforme, the most common and aggressive brain tumor in adults, is underway.

Like normal stem cells, cancer stem cells have the ability to self-renew and generate new cells, but instead of producing healthy cells, they create cancer cells. In theory, if the cancer stem cells can be destroyed, a tumor may not be able to sustain itself, but if the cancer originators are not removed or destroyed, a tumor will continue to return despite the use of existing cancer-killing therapies.

The researchers identified certain fragments of a protein - CD133 - that is found on cancer stem cells of some brain tumors and other cancers. In the laboratory, they cultured the proteins with dendritic cells, the immune system's most powerful antigen-presenting cells, which are responsible for helping the immune system recognize and attack invaders.

Studies in lab mice showed that the resulting vaccine was able to stimulate an immune response against the CD133 proteins without causing side effects such as an autoimmune reaction against normal cells or organs.

"CD133 is one of several proteins made at high levels in the cancer stem cells of glioblastoma multiforme. Because this protein appears to be associated with resistance of the cancer stem cells to treatment with radiation or chemotherapy or both, we see it as an ideal target for immunotherapy. We have found at least two fragments of the protein that can be targeted to trigger an immune response to kill tumor cells. We don't know yet if the response would be strong enough to prevent a tumor from coming back, but we now have a human clinical trial underway to assess safety for further study," said John Yu, MD, vice chair of the Department of Neurosurgery, director of surgical neuro-oncology, medical director of the Brain Tumor Center and neurosurgical director of the Gamma Knife Program at Cedars-Sinai. He is senior author of the journal article.

With standard care, which includes surgery, radiation treatment and chemotherapy, median length of survival is 15 months for patients diagnosed with glioblastoma multiforme. Cedars-Sinai researchers have studied dendritic cell immunotherapy since 1997, with the first patient human clinical trial launched in 1998.

The dendritic cell vaccines are produced by the biotechnology company ImmunoCellular Therapeutics Ltd., which funded this study. Cedars-Sinai owns equity in the company, and certain rights in the vaccine technology and corresponding intellectual property have been exclusively licensed by Cedars-Sinai to ImmunoCellular Therapeutics.

Two members of the research team and authors of this article have ties to the company. Yu, senior author, owns stock in the company and is its founder, chief scientific officer and chair of the board of directors. James Bender, PhD, MPH, a co-author, is ImmunoCellular Therapeutics' vice president for product development and manufacturing.

Researchers from Torrey Pines Institute for Molecular Studies also participated in the study.

Citation: Stem Cells Translational Medicine, "Identification of novel HLA-A*0201-restricted, cytotoxic T lymphocyte epitopes on CD133 for cancer stem cell immunotherapy," Available online 12/27/13. To appear in the March, 2014, print edition.

http://stemcellstm.alphamedpress.org/content/early/2013/12/27/sctm.2013-0135.1.abstract

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