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Scientists treat cancer as an infectious disease -- with promising results

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Researchers at the Albert Einstein College of Medicine of Yeshiva University have shown for the first time that cancers can be successfully treated by targeting the viruses that cause them. The findings, published in the October 31 issue of PloS One, also raise the possibility of preventing cancer by destroying virus-infected cells before they turn cancerous.

The Einstein researchers used a technique called radioimmunotherapy, in which radioisotopes are piggybacked onto antibodies. Once these precision-made molecules are injected into the body, the antibodies home in on a specific protein target…and the radioisotope "warhead" destroys the cell to which the protein is attached. In this research the targets were viral antigens: proteins expressed by virus-infected cells that can cause those cells to multiply out of control and become cancerous.

Nearly 20 percent of human cancers worldwide are caused by preexisting virus infections. Prime examples are liver cancer (caused by hepatitis B and C viruses), cervical cancer (caused by human papillomaviruses) and certain lymphomas (caused by the Epstein-Barr virus). But while antigens on the surface of cells are susceptible to attack by antibodies, the viral antigens associated with cancers typically lurk inside infected cells, so scientists had assumed that antibodies couldn't reach them.

"We had a hunch that rapidly growing tumors can "outgrow" their blood supply, resulting in dead tumor cells that might spill their viral antigens

amongst the living cancer cells," says Dr. Arturo Casadevall, Forchheimer Professor and Chair of Microbiology & Immunology at Einstein and co-senior author of the study. "So we hoped that by injecting antibodies hitched to isotopes into the blood that they'd be carried deep into the tumor mass and would latch onto these now-exposed antigens. Then the blast of radiation emitted by the radioisotope would destroy the live tumor cells nearby."

Testing their theory in mice, the Einstein researchers attached the radioisotope rhenium-18 to monoclonal antibodies made against E6, a viral antigen expressed by virtually all cervical-cancer cells. Similarly, they prepared radioimmunotherapy for liver cancer by attaching rhenium-18 to monoclonal antibodies against HBx, a viral antigen made by liver-cancer cells. Then, mice bearing human cervical-cancer tumors or human liver tumors were treated with the appropriate therapy.

For both types of cancer, the radioimmunotherapy resulted in significant slowing of tumor growth compared with tumors in untreated mice. For the cervical-cancer mice, the therapy not only stopped the growth of tumors but even caused them to regress.

"Radioimmunotherapy not only worked against these cancers, but in addition the radioactivity was confined entirely to the tumor masses, leaving healthy tissues undamaged,"says Dr. Ekaterina Dadachova, Associate Professor of Nuclear Medicine and of Microbiology & Immunology at Einstein and the study's other senior co-author.

During her seven years at Einstein, Dr. Dadachova has pioneered the use of radioimmunotherapy against infection-related diseases. In a series of animal studies beginning in 2001, she successfully used radioimmunotherapy against the major fungal pathogen Cryptococcus neoformans and against a streptococcal bacterium responsible for pneumonia. Last year, she and her colleagues showed that

radioimmunotherapy could help to halt HIV infection by targeting one of several viral proteins displayed on the surface of HIV-infected cells.

“Virus-associated cancers account for some 1.3 million cancer cases each year, so the need for new strategies in treating them is obvious and urgent,” says Dr. Dadachova. “Our study has shown in principle that radioimmunotherapy can help in treating cancers caused by viruses—and, just as exciting, the approach also holds promise for cancer prevention. In people chronically infected with hepatitis B or C, human papillomaviruses, or other viruses known to cause cancer, radioimmunotherapy could potentially eliminate virus-infected cells before they’re able to transform into cancer cells.”

Source: Albert Einstein College of Medicine