Researchers use heated nanoprobes to destroy breast cancer cells in mice

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In experiments with laboratory mice that bear aggressive human breast cancers, UC Davis researchers have used hot nanoprobes to slow the growth of tumors -- without damage to surrounding healthy tissue. The researchers describe their work in the March issue of the *Journal of Nuclear Medicine*.

"We have demonstrated that the system is feasible in laboratory mice. The next step will be clinical testing in patients," said Sally DeNardo, a professor of internal medicine and radiology at UC Davis and lead author of the study.

Many researchers have studied heat as a potential treatment for cancer, but the difficulty of confining heat within the tumor and predicting an effective heat dose has limited its use. The UC Davis research, carried out in collaboration with scientists from Triton BioSystems in Boston, seeks to solve this problem.

The experimental system uses bioprobes created by wedding magnetized iron-oxide nanospheres to radiolabeled monoclonal antibodies. The bioprobes are cloaked in polymers and sugars that render them nearly invisible to the body's immune system.

DeNardo and her colleagues infused trillions of the probes -- more than 10,000 can fit on the end of a straight pin -- into the bloodstreams of laboratory mice bearing human breast tumors. Once in the bloodstream, the probes began to seek out and latch onto receptors on the surface of

malignant cells.

Three days later, the team applied an alternating magnetic field to the tumor region, causing the magnetic nanospheres latched onto the tumor cells to change polarity thousands of times per second, instantaneously generating heat. As soon as the AMF stopped, the bioprobes cooled down.

Mice in the study received a series of AMF bursts in a single 20-minute treatment. Dosing was calculated using an equation that included tumor concentration of bioprobes, heating rate of particles at different amplitudes, and the spacing of AMF bursts.

Tumor growth rate slowed in the treated animals, a response that correlated closely with heat dose. No toxicity related to the bioprobes was observed.

"Using heat to kill cancer cells isn't a new concept," DeNardo said. "The biggest problems have been how to apply it to the tumor alone, how to predict the amount needed and how to determine its effectiveness. By combining nanotechnology, focused AMF therapy and quantitative molecular imaging techniques, we have developed a safer technique that could join other modalities as a treatment for breast and other cancers."

Source: University of California, Davis