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Early tests find nanoshell therapy effective against brain cancer

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Rice University bioengineers and physician-scientists at Baylor College of Medicine and Texas Children's Hospital have successfully destroyed tumors of human brain cancer cells in the first animal tests of a minimally invasive treatment that zaps glioma tumors with heat. The tests involved nanoshells, light-activated nanoparticles that are designed to destroy tumors with heat and avoid the unwanted side effects of drug and radiation therapies.

The results of the new study are available online in the *Journal of Neuro-Oncology*. The researchers reported that more than half of the animals that received the nanoshell treatment for glioma tumors had no signs of cancer more than three months after treatment.

"This first round of in vivo animal tests suggests that photothermal therapy with nanoshells may one day be a viable option for glioma patients," said study co-author Jennifer West, the Isabel C. Cameron Professor of Bioengineering at Rice and chair of Rice's Department of Bioengineering. West cautioned that follow-up work in the laboratory is needed before any human testing of the therapy can begin. She said human clinical trials of nanoshell phototherapy for glioma are likely at least a year away.

Glioma is among the most aggressive and difficult-to-treat of all brain cancers. Fewer than five percent of glioma patients survive beyond five years. The disease is particularly difficult to treat because glioma tumors are often highly invasive and inoperable.

Study co-authors include pediatric oncologist Susan Blaney, deputy director of Texas Children's Cancer Center and Baylor College of Medicine professor and vice chair for research in the department of pediatrics, and Rebekah Drezek, professor in bioengineering at Rice. West, Blaney, Drezek and colleagues tested mice with abdominal tumors of human glioma cells. The researchers injected the mice with nanoshells and waited 24 hours for the nanoparticles to accumulate in the tumors. A laser of near-infrared light -- which is harmless to healthy tissue -- was shined at the tumor for three minutes. The nanoshells converted the laser light into tumor-killing heat. All seven animals that received the nanoshell treatment responded, but cancer returned in three. The other four remained cancer-free 90 days after treatment.

"The results of this study are encouraging, and we are cautiously optimistic that this process may bring us closer to finding a cure for glioma," said Blaney, also associate director for clinical research at Baylor College of Medicine's Dan L. Duncan Cancer Center and co-director of The Institute for Clinical and Translational Research. "This is very exciting, especially given the poor prognosis of the disease and the importance of finding brain tumor treatment alternatives that have minimal side effects."

Gold nanoshells, which were invented by Rice researcher Naomi Halas in the mid-1990s, are smaller than red blood cells. Nanoshells are like tiny malted milk balls that are coated with gold rather than chocolate. Their core is nonconducting, and by varying the size of the core and thickness of the shell, researchers can tune them to respond to different wavelengths of light.

Houston-based biomedical firm Nanospectra Biosciences, which holds the license for medical use of Rice's nanoshell technology, began the first human clinical trial of nanoshell phototherapy in 2008.

West, a co-founder and director of Nanospectra Biosciences, said the new glioma study is part of a larger ongoing effort within the Texas Medical Center to adapt nanoshell phototherapy for use against a variety of cancers. Researchers at Rice, Texas Children's Hospital, M.D. Anderson Cancer Center, Baylor College of Medicine and other institutions are working to develop nanoshell-based treatments for prostate cancer and pancreatic cancer.

Provided by Rice University