Tiny Particles May Help Surgeons By Marking Brain Tumors

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(PhysOrg.com) -- Researchers have developed a way to enhance how brain tumors appear in MRI scans and during surgery, making the tumors easier for surgeons to identify and remove.

Scientists at Ohio State University are experimenting with different nanoparticles that they hope may one day be injected into the blood of patients and help surgeons remove lethal brain tumors known as glioblastomas.

In the journal Nanotechnology, researchers reported that they have manufactured a small particle called a nanocomposite that is both magnetic and fluorescent. These nanocomposites measure less than twenty nanometers in size (a nanometer is one billionth of a meter). One sheet of paper, for example, is about 100,000 nanometers thick.

"Our strategy is combining two particles that contain different properties to make one particle with multiple properties," explained Jessica Winter, assistant professor in chemical and biomolecular engineering and biomedical engineering at Ohio State.

The magnetic nanoparticles emphasize color contrasts within MRIs, allowing doctors to see potential or existing cancerous tumors before surgery. The fluorescent nanoparticles can change the color that the tumor appears in the brain when seen under a special light.

Neurological surgeons could benefit from a multi-functional particle that

would allow them to better see the tumor with an MRI before surgery, and then see it physically during surgery, Winter said.

"We're trying to develop a single nanocomposite that's magnetic - so you can do preoperative MRI - and that's fluorescent - so that when neurological surgeons go into surgery, they can shine a light on the tumor and it will glow a specific color such as green, for example. Then, the surgeon can simply remove all of the green," Winter said.

"With traditional magnetic contrasting agents, you'll get an MRI, but you won't see anything during surgery," she added.

Winter's study provided convincing proof that a particle with dual properties can be formed. However, these multi-functional particles can't be used for animal or human testing because the fluorescent particle, cadmium telluride, is toxic.

"We're currently working on an alternative fluorescent particle which is composed of carbon. This will eliminate the complications that arise with ingesting the cadmium telluride particles," Winter said.

Patients with a specific form of deadly brain tumor, glioblastoma, could benefit from Winter's work. Glioblastomas are usually located in the temporal, or frontal lobe of the brain, and tumors located there are difficult to see and remove.

Combining the two particles could provide doctors with help both before and during the surgery to remove a brain tumor, Winter said.

One of the successes in creating the new nanocomposite particle was how they did it, Winter said. It is normally difficult to combine particles like these, a process known as doping.

The Ohio State researchers pursued an approach which had not been attempted before. They chose to bind their fluorescent particle on top of their magnetic particle at extremely high temperatures.

The key is that our synthesis is done at pretty high temperatures - about 350 degrees Celsius (around 660 degrees Fahrenheit)," Winter explained. "The synthesis was unexpected, but cool at the same time, and we were excited when we saw what we got."

The primary neurological surgeon that collaborates with Winter and her team, an assistant professor with the Department of Neurological Surgery, Atom Sarkar, hopes to test the approach on animals at some point. But first they have to produce a particle that contains no toxic ingredients. If results continue to be encouraging, Winter is optimistic that similar multifunctional particles could become an innovative part of neurological surgery within the next five years.

More information: iopscience.iop.org/0957-4484/

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