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NIH Grant Funds Efforts to Improve Glioblastoma Detection

Collaborative project with Emory University will refine groundbreaking spectroscopic MRI technology to make it easier to use.

Eric A. Mellon, M.D., Ph.D.

Researchers at Sylvester Comprehensive Cancer Center at the University of Miami Miller School of Medicine will share a five-year, $3.3 million National Institutes of Health grant with Emory University to study spectroscopic MRI (sMRI) and make it easier to use. This advanced imaging tool can help clinicians detect and potentially eradicate glioblastoma, an extremely deadly brain tumor.

"Spectroscopic MRI, which was mostly developed at the University of Miami, is a way to probe metabolites in the brain and create maps of those metabolites," said Eric A. Mellon, M.D., Ph.D., co-leader of Sylvester's Neurologic Cancer Site Disease Group, associate professor of radiation oncology and biomedical engineering at the Miller School, and co-principal investigator on the grant. "We know that glioblastomas have a specific metabolic alteration that makes them detectable by spectroscopic MRI, uncovering hidden cancer that other techniques can't find."

With a five-year survival rate below 10%, glioblastoma is one of the deadliest cancers. These tumors can be particularly challenging because they are difficult to fully locate and treat. As a result, small remnants can seed the brain for future relapse. Spectroscopic MRI gives physicians a better tool to see more cancer and remove it surgically or kill it with radiation therapy.

'A Readout of What's Actually Happening'

For Dr. Mellon, a radiation specialist, sMRI could expand his ability to provide more comprehensive therapy, boosting radiation doses to newly detected tumor sites. Even at higher doses, healthy brain tissue can withstand radiation better than tumors can. But first, radiation oncologists must locate all the cancer – and sMRI could be the answer.

Sulaiman Sheriff

“Theoretically, spectroscopic MRI could provide a signature for every chemical in the brain, which is basically what a surgical biopsy can do,” said Sulaiman Sheriff, a senior project manager on Sylvester’s sMRI team. “That's what spectroscopy can provide: a readout of what's actually happening in the brain.”

Still, the same precision that makes sMRI such a powerful tool to detect brain tumors also makes it difficult to deploy. The technique produces large, multi-gigabyte files that must be processed and interpreted, a major computational effort. As a result, only a small number of cancer centers, like Sylvester, Emory, and Johns Hopkins, have these capabilities.

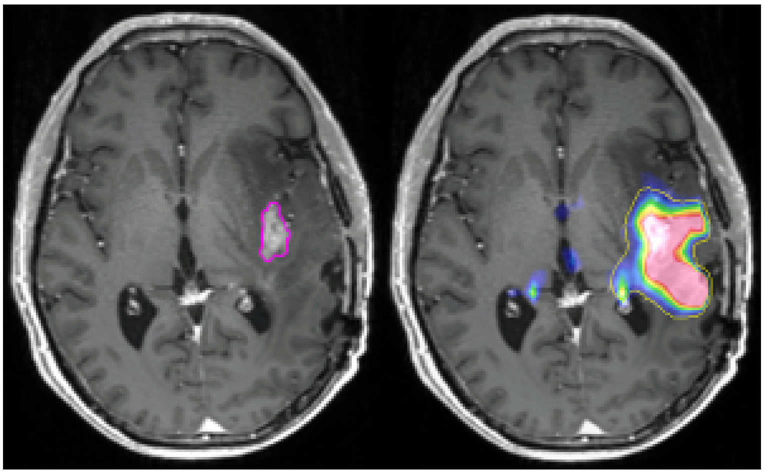
“The grant is about increasing the usability of this technique so more institutions can adopt it,” said Dr. Mellon.

"Acquiring and processing the data takes significant training and experience. We are working with scanner manufacturer Siemens to simplify the process as much as possible. Ideally, manufacturers would build it into their scanners, and teams with minimal training could just push a button."

Improving Detection and Treatment

The research team has already made great progress, reducing processing times from hours to minutes. They have adopted advanced computational approaches to lower those times even further.

"We are taking a process that was purely statistical and iterative and applying deep learning," said Sheriff, referring to one of the key steps of the process, which is also the most time- and computationally intensive. "We can now process these files in about a minute or even seconds, getting equal results and sometimes better."



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This work dovetails with several clinical trials Dr. Mellon and colleagues are conducting to improve glioblastoma detection and treatment. A recent study by Sylvester, Emory, and Johns Hopkins showed that increased radiation doses, informed by sMRI, improved patient survival. The researchers plan to conduct a larger follow-up study to validate these results.

Dr. Mellon is also enrolling patients in a clinical trial that combines the anti-cancer drug Avastin with proton radiation, which can be more precisely focused on tumor tissue, leaving healthy cells relatively unscathed. The sMRI readouts will be essential to expand treatment areas and hopefully eliminate all cancer cells.

“Using the spectroscopic MRI guidance, we want to treat as much of the disease as we can find to improve survival,” said Dr. Mellon. “Radiation oncologists have been reluctant to apply larger doses because of the potential side effects. But glioblastoma kills everyone it affects. We have to push the envelope.”

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