Memorial Sloan Kettering Cancer Center

# Imaging Technology Enables Doctors to Analyze Low-Grade Glioma

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on **Tuesday, October 13, 2015**

MR spectroscopy combines standard MRI images with tests of the chemical reactions inside tumors.

## Summary

*Doctors are now able to use a type of scan called MR spectroscopy to study genetic abnormalities in brain tumors. In some cases this noninvasive technique allows patients to avoid invasive brain biopsies while still enabling them to enroll in clinical trials of drugs that target specific mutations in their tumors.*

## Highlights

- MR spectroscopy uses an MRI machine to look at the composition of molecules in a tumor.
- About 80 percent of low-grade glioma brain tumors have a mutation in a metabolic enzyme called IDH.
- IDH-mutant cancers produce a compound called 2HG that can be measured with MR spectroscopy.
- MSK has several clinical trials for drugs that target mutated IDH.

An imaging technology called MR spectroscopy is allowing doctors to diagnose brain tumors without putting patients through the rigors of a brain biopsy. These noninvasive scans can identify molecules associated with the genetic mutations known to drive cancers, opening up personalized treatment options for patients based on their tumor's molecular characteristics. They can also be used to monitor patients who may not need immediate treatment.

MR spectroscopy combines the precise anatomical imaging of MRI with tests that can look at the chemical reactions occurring inside tumors. "Traditional MRI looks at anatomy, generating images of structures that might show things like the tumor size and the amount of swelling," explains Memorial Sloan Kettering neuroradiologist **Robert Young**. "Spectroscopy uses the same MRI machine, but it looks at the composition of what's in the tumor, including things like metabolites, the molecules that are the products of metabolic processes in the body."

## Looking for a Biomarker of Low-Grade Glioma

One cancer for which the imaging technique has shown particular promise is **low-grade glioma**, a common type of brain tumor in young adults. Around 80 percent of these tumors have a mutation in a metabolic enzyme called isocitrate dehydrogenase (IDH). (Research conducted at MSK and elsewhere over the past several years has shown **how IDH mutations might lead to cancer**.) These so-called IDH-mutant cancers produce a compound called 2-hydroxyglutarate (2HG) that can be identified and measured by MR spectroscopy.

> The ability to scan brain tumors regularly may allow some patients to delay treatment.

In collaboration with MR physicist **Sunitha Thakur** and neuro-oncologist **Ingo Mellinghoff**, Dr. Young has developed MR spectroscopy scans optimized to detect 2HG and integrated these scans into routine clinical MRI brain scans for MSK patients.

> "Patients are able to receive truly precise diagnosis, imaging, and treatment for their tumors."

Robert J. Young
neuroradiologist

"The presence of 2HG in an MR spectroscopy scan tells us that the tumor has an IDH mutation," Dr. Young says. "2HG isn't found in normal cells. In patients with a brain mass of uncertain diagnosis, this strongly indicates that the mass is a low-grade glioma even before surgery."

Keeping tabs on 2HG can also guide doctors in making treatment recommendations. Not all low-grade gliomas require treatment, Dr. Young says, so the doctor might perform an initial scan and delay treatment if the tumor is stable, following it over time with additional imaging.

"Spectroscopy may help us more accurately monitor the glioma," he adds, "avoiding giving treatment before it's needed and providing patients with a better quality of life while still keeping an eye on the tumor."

And for patients who do require treatment, MR spectroscopy can be used to identify those who would most likely benefit from drugs that work against tumors by targeting IDH mutations. Currently, MSK is participating in early-stage clinical trials of several of these IDH-mutant inhibitors available in **basket trials**. During active treatment, MR spectroscopy can be used to help determine the efficacy of treatment and guide clinical decision-making.

## Precision Oncology

"By noninvasively quantifying the 2HG, spectroscopy offers MSK patients the unique opportunity for precision imaging," Dr. Young says, which means their treatment can be tailored to them. "With these IDH-mutant inhibitors in clinical trials, patients are able to receive truly precise diagnosis, imaging, and treatment for their tumors."

Dr. Young and his colleagues are currently studying whether an increase in 2HG could be used as a sign of tumor progression and are also developing new strategies to improve the sensitivity of the spectroscopy technique.

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