A better MRI marker for disability progression in multiple sclerosis

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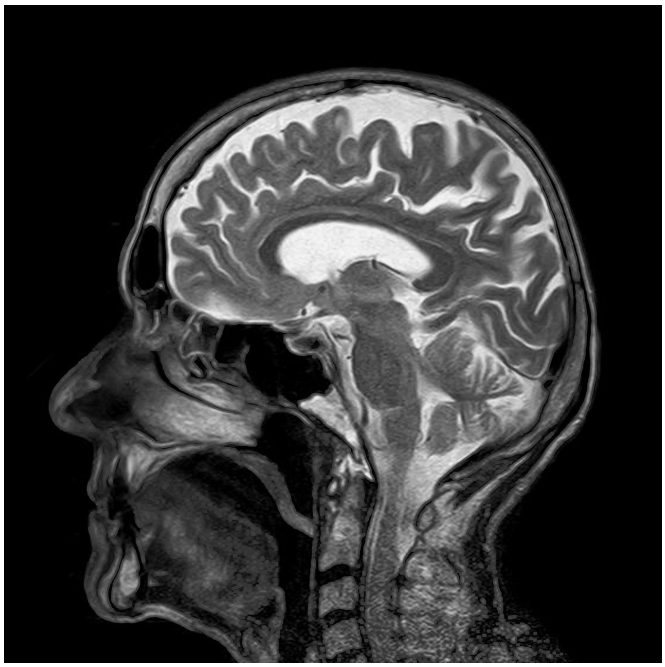

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A retrospective, five-year study of 1,314 patients with multiple sclerosis (MS) has found that atrophied brain lesion volume is the only marker from MRI scans that can accurately predict which patients will progress to the most severe form of the disease.

Secondary progressive MS, known as SPMS, typically appears 10 to 20 years after the initial onset and causes patients to become more physically and cognitively impaired.

Of the 1,314 patients in the study, published September 24 in *Radiology*, more than 1,000 were women with an average age of 46.

The study, by researchers in the Jacobs School of Medicine and Biomedical Sciences at the University at Buffalo, builds on previous work they did that determined that atrophied brain lesion volume was a better indicator of disease progression than the appearance of lesions or whole brain atrophy, both of which have long been used as predictors of disease progression.

Predicting disease progression

"This study corroborates initial reports from our group regarding using atrophied lesion volume as a potential MRI marker of disease progression in a large, population-based cohort of MS patients followed in clinical routine," said Robert Zivadinov, MD, Ph.D., professor of neurology in the Jacobs School, director of its Buffalo Neuroimaging Analysis Center (BNAC) and director of the Center for Biomedical Imaging at UB's Clinical and Translational Science Institute.

As part of their routine care, patients undergo MRI scans regularly, so that physicians can monitor new lesions or increased atrophy, which they see as indicators of more disease, or check for any reduction in lesions, generally seen as an indication that medications are working. Getting a new MS drug approved by the Food and Drug Administration requires, among other things, the ability of the new drug to reduce the number of brain lesions a patient has over 24 months.

But the UB research demonstrates that it is the atrophied brain lesion volume, which results from disintegration of lesions, and not creation of new lesions or progression of brain atrophy, that more accurately signals progression of the disease.

"Neither changes in number and volume of lesions nor the development of whole brain or central brain atrophy showed any predictive power in demonstrating which patients would progress to secondary progressive MS, either from initial presentation of the disease, called clinically isolated syndrome, or the next stage, relapsing remitting MS," said Zivadinov.

"The fact that atrophied lesion volume was the only measure that was predictive of conversion to progressive multiple sclerosis, and brain atrophy was not, is a major novel finding of this study."

Inflammation and neurodegeneration

According to Zivadinov, atrophied brain lesion volume is predictive of disease progression primarily because it reflects both inflammatory and neurodegenerative pathological processes, which together result in the disappearance of brain lesions into cerebrospinal fluid.

In their previous work, Zivadinov and his colleagues established an MRI marker, which measures brain lesions that have been replaced by cerebrospinal fluid. Lesions are signs of damage to the brain from physical trauma, a stroke, normal aging or chronic disease. It is the disintegration of these lesions into cerebrospinal fluid that the UB team has proven is the main indicator of disease progression in MS.

"This study showed that atrophied brain lesion volume represents a robust marker for predicting conversion from relapsing-remitting to secondary-progressive stages of MS," Zivadinov said.

The routine use of atrophied brain lesion volume as a marker for disease progression in MS depends on the completion of retrospective and prospective studies, some of which the UB team is already performing, on a large scale in clinical settings.

"Atrophied lesion volume can be measured with a pair of simple MRI scans," said Zivadinov. "What has not been done yet is to test how visual or qualitative assessment compares to quantitative assessment performed in this study and previous studies we conducted."

He added that a better understanding is needed of the pathophysiological differences between those lesions that disappear compared to those that do not. To begin to address this, advanced nonconventional MRI and positron emission tomography studies are beginning now at UB.

More information: Antonia Valentina Genovese et al. Atrophied Brain T2 Lesion Volume at MRI Is Associated with Disability Progression and Conversion to Secondary Progressive Multiple Sclerosis, *Radiology* (2019). DOI: 10.1148/radiol.2019190306

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