

# Atrophy of the thalamus is an important predictor of clinically definite MS, study shows

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Research by UB's Zivadinov and colleagues has demonstrated that the thalamus region, in particular, is key to a host of issues involving MS. Credit: Douglas Levere, University at Buffalo

A growing body of research by multiple sclerosis (MS) investigators at the University at Buffalo and international partners is providing powerful new evidence that the brain's gray matter reflects important changes in the disease that could allow clinicians to diagnose earlier and to better monitor and predict how the disease will progress.

Over the past three years, the UB researchers and their partners around the world, supported by an active fellowship program at UB's Buffalo [Neuroimaging](#) Analysis Center (BNAC), have published journal papers and given presentations demonstrating that the thalamus region, in particular, is key to a host of issues involving [MS](#).

"The thalamus is providing us with a new window on MS," says Robert Zivadinov, MD, PhD, UB professor of neurology, BNAC director and leader of the research team. "In our recent studies, we have used large [datasets](#) to investigate the evolution of [atrophy](#) of the thalamus and its association with clinical impairment in MS, starting with the earliest stages of the disease. The location of the thalamus in the brain, its unique function and its [vulnerability](#) to changes wrought by the disease make the thalamus a critical [barometer](#) of the damage that MS causes to the brain."

At the annual meeting of the American Academy of Neurology today, Zivadinov will discuss a study he performed in collaboration with colleagues from Charles University in Prague. The study found that atrophy of the thalamus, determined with MRI, can help identify which [patients](#) with clinically isolated syndrome (CIS), a patient's first episode of MS, are at risk for developing clinically definite MS. Such a tool would be immensely helpful to clinicians, Zivadinov notes.

"This study, which included more than 200 patients, shows that thalamic atrophy is one of the most important predictors of clinically definite MS," says Dana Horakova, MD, PhD, the principal investigator at Charles University.

"Therefore, based on these findings, we think MRI should be used to determine which patients are at highest risk for a second attack," explains Zivadinov.

MS is traditionally viewed as a disease of the brain's white matter, in which myelin, the fatty material surrounding neurons that allows them to signal effectively, is gradually destroyed. The UB researchers are now revealing how the thalamus and other parts of the brain's [gray matter](#), play a key role as well.

Central to a wide variety of neurologic functions, the thalamus is involved in motor and sensory function, the regulation of sleep and wakefulness, memory, emotion, consciousness, awareness and attention. It functions as a kind of relay center in the brain, taking in sensory information and sending it to the cerebral cortex; it also processes information coming from the cortex.

Another study, which the UB researchers conducted in collaboration with Stavanger University Hospital in Norway, is the first to look at the evolution of thalamic atrophy over a 10-year period in MS patients. Results also will be presented at the AAN meeting.

This study of 81 patients found that atrophy in the cortex and subcortical deep grey matter, including the thalamus, was significantly related to patients' declining cognitive abilities. "We found that cognitive dysfunction appears early in the course of MS and that thalamic atrophy plays a central role in predicting cognitive deterioration over the long-term," says Zivadinov.

In a review paper published earlier this year in *Neurology*, Zivadinov and co-authors note that gray matter injury can not only be detected in the disease's earliest stages but that this injury is associated with a wide range of symptoms from cognitive decline and motor deficits to fatigue and chronic pain.

The UB findings reveal that atrophy of the thalamus, determined through routine magnetic resonance imaging (MRI), can be an important tool in

detecting, evaluating and predicting the course of MS in children and adults; it also may become a valuable method of evaluating new MS treatments.

Loss of thalamic volume and its tissue integrity can also predict cognitive impairment in MS patients, according to a study recently published in *Multiple Sclerosis Journal* led by UB neurology professor Ralph Benedict in collaboration with Jeroen JG Geurts, PhD, from VU University Medical Center in Amsterdam, the Netherlands.

Research currently in press by the UB team and performed in collaboration with colleagues from Charles University in Prague also was the first prospective, longitudinal study to investigate and find associations between grey matter atrophy and physical disability progression in patients with relapsing-remitting MS, the most common and most disabling type of MS.

The five-year study, which covered 180 patients, also found that thalamic atrophy has potential as a way to evaluate novel therapies for MS, according to Eva Havrdova, MD, PhD, principal investigator.

"Since progressive pathology of the thalamus has been shown in all different MS disease types, including in pediatric MS patients, we must look at the thalamus as a biomarker for assessing new therapies," says Zivadinov. "Measurement of thalamic atrophy may become an ideal [MRI](#) outcome for MS clinical trials.

"Atrophy in [MS patients](#) happens in the [thalamus](#) more rapidly than in other brain structures," Zivadinov continues. "It is detectable very early in the disease and it is less affected by fluid shifts in the brain, an effect of anti-inflammatory drugs used in MS. This feature in particular, makes thalamic atrophy an ideal candidate for assessing novel therapies."

These findings, says Zivadinov, are just the beginning. "Until now, existing information about thalamic involvement in MS has stemmed mainly from neuropathologic and neuroimaging studies with a limited number of subjects that contain no clear practical implications for clinicians. The team at UB, of researchers and fellows, together with our global partners, is planning to undertake larger, longitudinal studies in order to comprehensively determine how best to apply these very promising findings."

The BNAC, part of the UB Department of Neurology, is located in the Buffalo General Medical Center on the Buffalo Niagara Medical Campus.

Provided by University at Buffalo

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