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NEWS

RSNA Press Release

Multiple Sclerosis Damage Found in 'Normal' Brain Tissue

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At A Glance

- Multiple sclerosis (MS) affects areas of the brain that show no visible signs of damage.
- The study found that the unseen damage may play a larger role than do visible lesions in the progression of atrophy and clinical disability.
- MS affects approximately 400,000 people in the U.S.

OAK BROOK, Ill. — The effects of multiple sclerosis (MS) extend beyond visibly affected areas into large portions of the brain that outwardly appear normal, according to a study appearing in the September issue of *Radiology*.

"This disease process in the normal-appearing brain tissue affects the brain globally and has substantial clinical impact," said the study's lead author, Hugo Vrenken, Ph.D., from the Multiple Sclerosis Center at VU University Medical Center in Amsterdam, The Netherlands.

MS is a chronic, autoimmune disease characterized by the destruction of myelin, the protective layers that surround nerve cells. It can affect numerous body functions, and symptoms may include visual and speech impairment, memory loss, depression, muscle weakness, loss of coordination, numbness or pain, bowel and bladder problems and sexual dysfunction.

MS affects approximately 400,000 people in the United States and as many as 2.5 million worldwide, mostly women between the ages of 20 and 50, according to the National Multiple Sclerosis Society.

"The areas of demyelination, or lesions, in patients with MS can be visualized with magnetic resonance imaging (MRI). However, the volume of lesions visible at MRI only correlates moderately with clinical disability measurements," Dr. Vrenken said. "This may be due to disease activity outside the visible lesions."

To gain a better understanding of the effects of MS on the whole brain, Dr. Vrenken and colleagues studied T1 changes in normal-appearing white and gray brain matter in patients with MS.

T1 is a measurement of proton relaxation after exposure to a magnetic field and a radiofrequency (RF) pulse. Due to this RF pulse, protons in the body first reach an excited state and then relax back to a state of equilibrium by funneling the excess energy to the

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surrounding tissues. T1 refers to the time required for protons to relax to the equilibrium state in this particular manner.

The researchers investigated T1 changes in 67 patients with MS and 24 healthy control volunteers. T1 graphs of normal appearing white and gray matter were significantly different for patients with MS than for controls. Moreover, these graphs differed among patients with MS based on the type of disease: secondary progressive (SP), relapsing-remitting (RR) or primary progressive (PP). The results were most pronounced in patients with SP disease, where at least 31 percent of normal-appearing white matter and 20 percent of cortical normal-appearing gray matter were affected. In RR disease, 16 percent of normal-appearing white matter and 9 percent of cortical normal-appearing gray matter were affected. In PP disease, the normal-appearing white and gray matter affected were 11 percent and 8 percent, respectively. These changes were found throughout the brain, including areas remote from localized lesions that are typically associated with MS.

"These findings demonstrate that in MS, disease processes outside MR-visible lesions are not limited to a few sites but act throughout the brain and affect large fractions of normal-appearing white and gray matter," Dr. Vrenken said.

The researchers also explored correlations between the areas of the brain being analyzed in the patients with MS and the level of atrophy or clinical disability present.

"The results suggest that the damage to normal-appearing brain tissue plays a larger role in the progression of atrophy and clinical disability than do the visible lesions," Dr. Vrenken said.

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"Whole-Brain T1 Mapping in Multiple Sclerosis: Global Changes of Normal-appearing Gray and White Matter." Collaborating with Dr. Vrenken on this paper were Jeroen J. G. Geurts, M.Sc., Ph.D., Dirk L. Knol, Ph.D., L. Noor van Dijk, M.D., Vincenzo Dattola, M.D., Bas Jasperse, M.D., Ronald A. van Schijndel, M.Sc., Chris H. Polman, M.D., Ph.D., Jonas A. Castelijns, M.D., Ph.D., Frederik Barkhof, M.D., Ph.D., and Petra J. W. Pouwels, Ph.D.

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