RSNA Press Release

Ultra-High-Field MRI May Allow Earlier Diagnosis of Parkinson's Disease

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At A Glance

- Ultra-high-field 7-T MRI may allow an imaging-supported early diagnosis of Parkinson's disease.
- Parkinson's disease is a chronic, progressive disease characterized by shaking, stiffness, and impaired balance and coordination.
- Using 7-T MRI, the researchers correctly classified patients with Parkinson's disease with a sensitivity of 100 percent and specificity of 96.2 percent.

OAK BROOK, Ill. — New research shows that ultra-high-field magnetic resonance imaging (MRI) provides detailed views of a brain area implicated in Parkinson's disease, possibly leading to earlier detection of a condition that affects millions worldwide. The results of this research are published online in the journal *Radiology*.

Parkinson's disease is a chronic, progressive disease characterized by shaking, stiffness, and impaired balance and coordination. With no radiologic techniques available to aid in diagnosis, clinicians have had to rely on medical history and neurological examination. It is often difficult to distinguish Parkinson's disease from other conditions using these methods alone.

Mirco Cosottini, M.D., from the University of Pisa in Italy, and colleagues studied the brains of 38 individuals, including 17 Parkinson's disease patients and 21 healthy controls, as well as a brain specimen from a deceased individual, to help determine the accuracy of ultra-high-field 7-Tesla (7-T) MRI for identifying Parkinson's disease.

Using the 7-T MRI, the researchers were able to distinguish a three-layered

organization of the substantia nigra (SN), a crescent-shaped mass of cells in the midbrain. Parkinson's disease results from the loss of dopamine-producing cells located in this region of the brain. Dopamine is an important neurotransmitter involved in multiple brain functions, including motor and behavioral processes such as mood, reward, addiction and stress.

Based on abnormalities in the SN identified by the 7-T MRI, the researchers correctly classified patients with Parkinson's disease with a sensitivity of 100 percent and specificity of 96.2 percent.

According to Dr. Cosottini, the results show promise for earlier detection of the disease, which could speed the initiation of treatment.

"Parkinson's disease diagnosis remains clinically based, but with the introduction of 7-T MRI into clinical practice, a supporting radiologic diagnosis can be made," he said.

The researchers also are exploring the clinical utility of 7-T MRI in several other neurodegenerative diseases, including mild cognitive impairment, a precursor of Alzheimer's disease.

# # #

"MR Imaging of the Substantia Nigra at 7 T Enables Diagnosis of Parkinson Disease." Collaborating with Dr. Cosottini were Daniela Frosini, M.D., Ilaria Pesaresi, M.D., Mauro Costagli, Ph.D., Laura Biagi, Ph.D., Roberto Ceravolo, M.D., Ubaldo Bonuccelli, M.D., and Michela Tosetti, Ph.D.

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For patient-friendly information on MRI, visit *RadiologyInfo.org*.

Images

Figure 1. Top row: 7-T three-dimensional multiecho susceptibility-weighted in vivo images of SN in healthy 64-year-old man, located between the crus cerebri *(a)* and the red nucleus. Axial sections

Figure 2. Images show axial spin-echo proton density (on the right) and GRE (on the left) of the SN at level I of an ex vivo brain sample in a 67-year-old woman. There is a triple-layered organization of the SN comparable to

perpendicular to the floor of fourth ventricle are obtained at level of the inferior third of the red nucleus (level I), at the level of decussation of superior cerebellar peduncles *(e)* (level II), and at the level of the inferior colliculi (level III). At level I, SN appears as homogeneous hypointense structure in the medial part of the cerebral peduncle, and is laterally constituted by a hyperintense oval area between two hypointense layers *(c1)*. At level II, a trilaminar organization of the SN with a central hyperintense layer *(b)* between two hypointense tiers (c and d) is detectable. At level III, the dorsal hypointense lamina could be detected as a small residual lateral hypointense area, while the hyperintense layer fades into the isointense cerebral peduncle. Bottom row: 7-T three-dimensional multiecho susceptibility-weighted in vivo images of the SN in PD patients. The loss of normal anatomy of the SN in a 61-year-old man with PD is characterized by the disappearance of the oval-shape bright spot in the lateral part of the SN at level I and by the loss of the hyperintense intermediate layer of the SN at level II. *HC* = healthy subject.

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that showed in the in vivo images. Ventrally a low-signal-intensity layer *(b)* is attributable to the pars reticulata of the SN. In the middle part of the SN, a hyperintense band *(c)* corresponds to the ventral component of the pars compacta of the SN. The lateral part of this layer shows a high-signal-intensity spot *(c1)* corresponding to the oval shape hyperintensity of the in vivo three-dimensional multiecho susceptibility-weighted images that resemble the nigrosome formation. The dorsal hypointense layer visible on both spin-echo and GRE images *(d)* is re¬ferred to the dorsal component of the pars compacta of the SN. *a* = crus cerebri, *e* = brachjum conjunctivum, *f* = medial lemniscus, *g* = lateral lemniscus, *h* = central tegmental tract.

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