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NEWS

RSNA Press Release

Stem Cells May Hold Promise as Multiple Sclerosis Cure

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At A Glance

- Italian researchers are using MRI to monitor transplanted stem cells in the brains of mice with a condition similar to MS.
- Infusing the cells with iron particles before injection makes them visible on MRI.
- The stem cells traveled to the brain and began to repair the damage caused by the disease within a day.
- MS affects more than 400,000 Americans, most of them women ages 20 to 50.

CHICAGO—Neural stem cells injected into mice can repair brain cells damaged by a disease similar to multiple sclerosis (MS), according to research presented today at the annual meeting of the Radiological Society of North America (RSNA). Researchers used magnetic resonance imaging (MRI) to monitor the cells' progress through the affected brain regions.

"Cell therapies are a promising true alternative in the treatment of previously untreatable central nervous system disorders, multiple sclerosis included," said co-author Letterio Politi, M.D., a clinical assistant in the Department of Neuroradiology at Ospedale San Raffaele in Milan, Italy.

Multiple sclerosis (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. Over 10,000 new cases are diagnosed each year.

"Stem cells have the potential to replace the function of damaged nerve cells," said the study's senior author, Giuseppe Scotti, M.D., professor and chairman of neuroradiology at the University and Scientific Institute San Raffaele and dean of the Medical School, University Vita-Salute San Raffaele in Milan. "In this case, stem cells increase the number of glial cells, the cells that produce myelin. Myelin is then restored."

The researchers used iron particles to magnetically label neural stem cells of adult mice. Iron particles interfere with a magnetic field and thus can be easily detected with MRI. The team intravenously injected the cells into the tail vein of mice with experimental

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autoimmune encephalomyelitis (EAE), an animal model of multiple sclerosis characterized by nearly identical brain lesions and symptoms.

While EAE is not the same as MS, it closely resembles the disease in many ways, including disease progression, lesions and behavior, according to Dr. Politi.

"The result in damaged tissue is very much the same," Dr. Scotti said. "Since the stem cells try to repair the damaged tissue, the model is absolutely superimposable."

Using MRI, the researchers observed homing of the transplanted cells to lesions in the EAE-damaged brain regions as early as one day after injection. As the myelin was repaired, symptoms in the mice improved.

The ability to monitor the migration of the transplanted cells is vital if the treatment is going to be adapted to MS patients. "The development if this MRI-based method to track labeled cells non-invasively represents a crucial step toward the application of this therapy to humans," Dr. Politi said.

While the results are promising, both authors caution that further studies need to be done, including work with human stem cells. "We know the potential therapeutic action of stem cells and have great hopes, but we do not yet know the possible side effects," Dr. Scotti said. "If and when stem cell therapy becomes available for humans, monitoring with MRI will become almost indispensable."

Co-authors of the paper are Stefano Pluchino, Ph.D., Marco Bacigaluppi, M.D., Marcello Cadioli, M.Sc., Nicoletta Anzalone, M.D., Andrea Falini, M.D., and Gianvito Martino, M.D. All experiments were performed in accordance with local ethical standards for animal studies.

Abstract:	• In Vivo MRI-based Tracking of Magnetically Labelled, Intravenously-Injected Adult Neural Stem Cells in Mice Affected by MOG35-55-induced Experimental Autoimmune Encephalomyelitis (EAE)

Images (.JPG format)

Fig 1: Confocal microscopy of magnetically labelled neural stem cells, showing co-staining of stem cells markers and iron particles.

Fig 2: Explicative picture showing the dimension of a mouse brain compared to a 1 euro cent coin.

Fig 3: Cartoon showing how intravenously injected neural stem cells migrate from the blood stream into the brain and differentiate in myelin-forming cells.

Fig 4: The mouse brain (A) has been analyzed on the coronal plane (as shown in B) both for histopathology (see myelin staining and conventional hematoxilin-eosin in C) and for in vivo MR images acquisition (see example in D). Thus, with MR it is possible to observe coronal slices of the brain of living mice.

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Fig 5: MR images of the brain of an EAE mouse before immunization (A), in the acute phase of the disease, with a demyelinating lesion in the olfactory bulb (B, bright lesion in the circle), and after intravenous injection of magnetically labelled neural stem cells homing to the lesion (C, dark area in the circle).

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