Stem cell therapy shows promise for treating multiple sclerosis—new study

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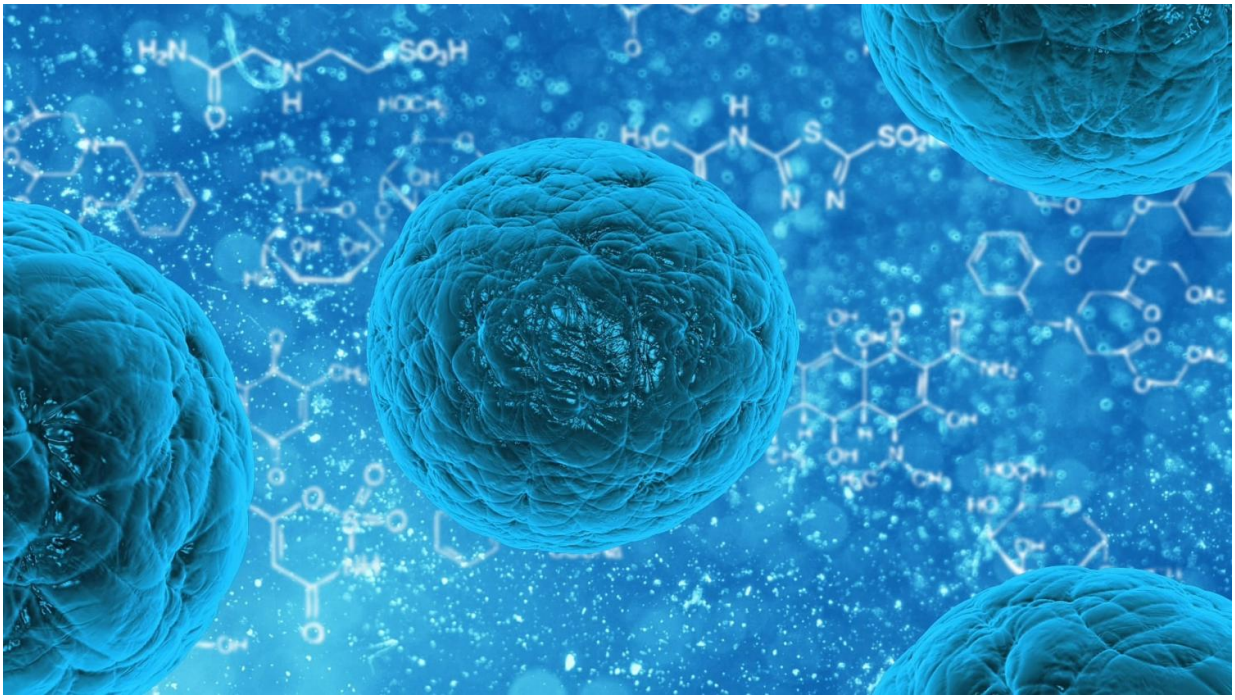

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Over 2 million people globally have multiple sclerosis (MS), a disease that affects the nervous system and can lead to problems moving, seeing and thinking.

While there are treatments that can help reduce the number and severity of MS attacks, many people with MS eventually develop a more severe

form of the disease called secondary progressive MS. Unfortunately, there are few treatments for secondary progressive MS. And there are no drugs approved for the most advanced forms of disease.

Recent data has raised expectations that using stem cells, the body's "master cells", might help diminish this damage. This involves transplanting brain stem cells, which can develop into almost any other type of brain cell and possibly repair those damaged by MS.

In our new study, we show the promising results of a first-in-human, early-stage clinical trial that involved injecting brain stem cells directly into the brains of 15 patients with secondary progressive MS.

Brain stem cells were obtained from a single miscarried fetus. The stem cells were extensively screened for anomalies to ensure a safe and practically boundless cell reservoir for transplantation.

Before the procedure, participants underwent a comprehensive assessment of their disability level and disease activity over three months. At transplantation, most of the treated patients showed high levels of disability (most required a wheelchair, for example).

We tested four doses of brain stem cells coupled with drugs to suppress the immune system—to avoid the graft being rejected. Encouragingly, participants experienced no severe adverse events in the 12 months after the treatment, although there were some short-lived side-effects (such as flu-like symptoms and respiratory infections).

Crucially, neither relapse-like symptoms of MS, nor significant deterioration in movement or cognitive function (which would be expected without treatment) were reported in patients during the study.

In an analysis of a small group of the participants using advanced

magnetic imaging, we noted an association between higher stem cell doses and a reduction in brain volume. Similar effects have been seen with potent drugs used for patients with early MS, suggesting a possible role of the cells in preventing brain inflammation and swelling.

Measuring the brain's response to the transplant

How do we know if brain stem cells work?

In MS, the immune system targets and damages myelin, the protective coating around nerve fibers, disrupting vital communication within the brain and spinal cord. Central to this process are macrophages, immune cells that typically eliminate unwanted intruders. Among them, microglial cells, found throughout the brain and spinal cord, play a pivotal role.

Our earlier research in mice showed that skin cells reprogrammed into brain stem cells, when transplanted into the central nervous system, can reduce inflammation and potentially repair MS-induced damage.

Also, brain stem cells can tweak the metabolism—how the body produces energy—and reprogram microglia from bad to good.

In this study, we investigated how the brain's energy production processes were affected by the brain stem cell treatment. We monitored changes in the fluid surrounding the brain and in the blood over time and discovered persistent alterations induced by the transplant.

Specifically, a class of molecules called acylcarnitines, which are crucial for maintaining a good cellular energy metabolism, showed increased levels in patients receiving higher stem cell doses.

While these findings are exciting, it's important to be prudent, given that

they were obtained from a small group of patients who were also receiving drugs to suppress the immune system. However, this study provides the first compelling evidence in humans that a single brain stem cell transplant directly into the brain is safe and can induce long-lasting effects in people with secondary progressive MS.

Further studies are needed to validate and expand on our findings. Still, this study shows promising indications that this approach could become a valuable treatment option for addressing the advanced stages of MS.

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