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Regenerating spinal cord fibers may be treatment for stroke-related disabilities

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A study by researchers at Henry Ford Hospital found "substantial evidence" that a regenerative process involving damaged nerve fibers in the spinal cord could hold the key to better functional recovery by most stroke victims.

The findings may offer new hope to those who suffer stroke, the leading cause of long-term disability in adults. Although most stroke victims recover some ability to voluntarily use their hands and other body parts, about half are left with weakness on one side of their bodies, while a substantial number are permanently disabled.

The study is published in the current issue of *Stroke* and is available online. Discovering a treatment to improve or restore this lost motor function in stroke patients is a holy grail for neurologists, because none exists, primarily due to unsolved mysteries about how the brain and nerves repair themselves.

The new Henry Ford research was intended to solve some of those mysteries. It focused on changes in axons – the fibers, the nerve signal "transmission" lines within the spinal cord that affect voluntary movement after stroke.

Researchers used genetically modified mice in which the axons in the corticospinal tract, a bundle of nerves carrying signals from the brain to the spinal cord, were "stained" with fluorescent matter visible under a powerful microscope.

The researchers noted that Henry Ford's Institutional Animal Care and Use Committee approved all the experimental procedures.

The mice were trained for five days to use their left front paws to retrieve food pellets from a dispenser designed to test their dexterity. They were also given a "foot-fault test" to see how well they could walk on an unevenly spaced grid.

Next, the mice were divided into four groups. In one, the carotid arteries were blocked with a suture for one hour, much as a blood clot blocks the flow of blood to the brain in a stroke. After the suture was removed and blood flow was restored, they were given additional surgery to sever the axons of the corticospinal tract. The other groups were either given no surgery or "sham" surgery so they could be used as control groups for comparison to the first.

The single-pellet and foot-fault tests were then given three days after surgery, then weekly for 14 to 28 days to reassess dexterity, the amount of "stroke" damage to voluntary movements and the degree of recovery from the lab-induced "stroke."

"In both behavioral tests used in this study, the mice need to control the paw movement," explains Yi Li, M.D., a Henry Ford neuroscientist and lead author of the study. "Severe behavioral deficits of the left forepaw were evident in all of the mice three days after stroke.

"All animals showed significant improvement 14 days after surgery. This recovery progressed in those mice whose axons were not severed. However, in those whose axons had been eliminated, there was no significant recovery."

The researchers concluded that in the early stages after stroke, improvements in voluntary movement can be attributed to a reduction in

brain swelling because of the trauma and other spontaneous repairs, while later improvements result from "neuronal plasticity" – the reorganization or regeneration of nerve cells within the spinal cord in response to changes in the nerve network.

This "axonal remodeling in the spinal cord" may provide "a treatment target to develop rational therapeutic approaches to enhance neurological recovery for the mass of chronic stroke patients," says Dr. Li.

If such a treatment can be developed, it would address the single biggest concern of stroke victims, as well as those with chronic spinal cord damage.

The researchers cited a survey of such patients showing that "regaining arm and hand function is considered the highest priority for improving the quality of life."

Provided by Henry Ford Health System