Regeneration after a stroke requires intact communication channels between the two halves of the brain

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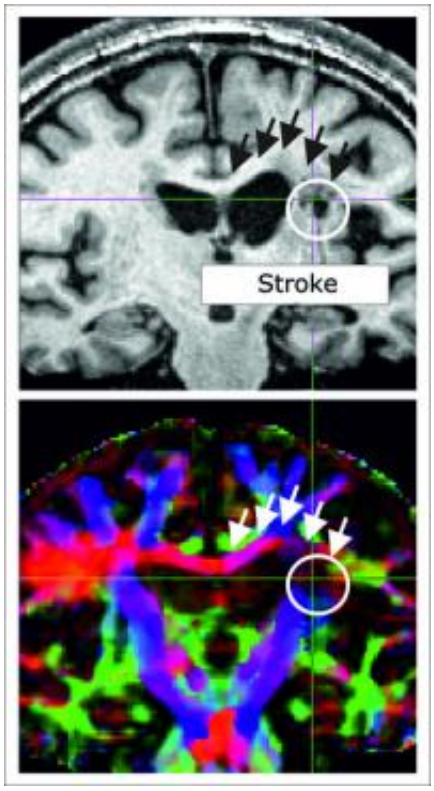

Stroke damage (white circle) can destroy the communication channels within the brain. This depiction of stretches of fibres show that the damage can also affect fibres between the hemispheres (red) which whither in the course of the illness, thus hindering the exchange of information between the hemispheres. Credit: MPI for Neurological Research

(Medical Xpress) -- The structure of the corpus callosum, a thick band of nerve fibres that connects the two halves of the brain with each other and in this way enables the rapid exchange of information between the left and right hemispheres, plays an important role in the regaining of motor skills following a stroke. A study currently published in the journal *Human Brain Mapping* has shown that in stroke patients with particularly severely impaired hand movement, this communication channel between the two brain hemispheres in particular was badly damaged.

In order to relate brain function and anatomical structure with each other, in this study the scientists from the Max Planck Institute for Neurological Research and the Department of Neurology at the University Hospital of Cologne combined two imaging methods. They asked stroke patients to make a simple tapping movement using the hand affected by the stroke and recorded their brain activity using functional magnetic resonance imaging. The data obtained in this way were then compared with data from healthy subjects. As expected from previous test results, compared with the control group, the stroke patients recorded a lower tapping speed and increased brain activity on both sides of the brain. "The increased activity in the healthy brain hemisphere, in particular, points to the impaired processing of motor programs between the two brain hemispheres," explains Christian Grefkes, head of the research study.

In order to demonstrate the structural connection between brain areas, the Cologne researchers used diffusion-based magnetic resonance imaging (dMRI), which can be used to reconstruct longer stretches of nerve fibres. dMRI is based on the principle that cell elements, such as the membrane or extensions, inhibit the spread of water molecules thereby preventing them from diffusing randomly in all directions. Consequently, parallel nerve fibres can be clearly identified using dMRI. Compared to the healthy control group, the stroke patients had lower diffusion values in the corpus callosum region. This would indicate that this interhemispheric communications connection was damaged by the stroke. The most significant deviations from the values of the control group were observed in patients with more severe motor

defects and increased activity in the healthy brain hemisphere.

Therefore, in addition to cell death in the actual stroke area, damage to a very distant connection structure plays a crucial role in the inability of stroke patients to fully regain their original motor capacities. "This is why, we are currently examining whether we can regenerate the communication between the brain hemispheres through early and regular stimulation treatment. Our long-term aim is to improve motor deficits in stroke patients," says Grefkes.

More information: *Ling E. Wang, et al. Degeneration of corpus callosum and recovery of motor function after stroke: A multimodal magnetic resonance imaging study, Human Brain Mapping, online publication, 22, Oct. 2011* | DOI: 10.1002/hbm.21417

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