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Appearance of transcallosal fibers from the injured corticospinal tract by intensive rehabilitation

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A 57-year-old, right-handed male patient was diagnosed as hemorrhagic transformation following an infarction in the region of the left middle cerebral artery. He underwent craniectomy at three days after onset and cranioplasty at six months after onset. In addition, he underwent rehabilitation from one month to two years after onset at several rehabilitation hospitals. At two years after onset, he was admitted to the rehabilitation department of our hospital for intensive rehabilitation. The patient showed severe weakness of his right upper and lower extremities including complete weakness of finger extensors and ankle dorsiflexors (Motricity Index [MI]: 38/100). Brain magnetic resonance imaging revealed leukomalactic lesions in the left fronto-parieto-temporal areas including the entire primary somatosensory-motor cortex (Fig. 1-A). He underwent intensive rehabilitation, including repetitive transcranial magnetic stimulation therapy (rTMS; MAGPRO, Medtronic Functional Diagnostics, Skovlunde, Denmark) using a precentral knob, 10 Hz frequency, 80% motor threshold intensity, and a total of 160 pulses for 8 minutes repeated in 14 sessions per week, for facilitation of the right (unaffected) corticospinal tract (CST) [1], neurotrophic drugs (pramipexole: 0.5 mg, ropinirole: 1.85 mg, amantadine: 300 mg, and levodopa: 750 mg), and muscle wash and motor branch blocking of the tibial nerve using alcohol were used to relieve spasticity of the right finger flexors and ankle plantaflexors, respectively. As a result, at five weeks after starting the intensive rehabilitation at our hospital, his motor weakness showed mild recovery, particularly his right finger extensors and ankle dorsiflexors (MI: 48/100; right finger extensor and ankle dorsiflexor: 2-/5). Diffusion tensor images were obtained twice (at 2 years, and at 2 years and 5 weeks after onset) by using a sensitivity-encoding head coil on a 1.5-T Philips Gyroscan Intera (Hoffman-LaRoche, Best, Netherlands). Three-dimensional reconstructions of the fiber tracts were obtained by using the PRIDE tracking tool (Philips, Best, Netherlands). The termination criteria were fractional anisotropy < 0.2 and angle < 60o [2]. Two regions of interest were drawn in the CST areas of the mid-pons and the upper medulla on the two-dimensional fractional anisotropy color maps. Diffusion tensor tracking revealed that the left CST was discontinued in the left subcortical white matter on the 2-year images, but, on the 2-year and 5-week images, the discontinued left CST was shown to be connected to the right hemisphere via the transcallosal fibers (Fig. 1-B). An ipsilateral motor pathway via the transcallosal fibers from the unaffected motor cortex to the affected extremities has been suggested as a motor recovery mechanism in stroke [3-5]. Motor outcome via this mechanism has been reported to be effective as patients have been able to perform grasp-release with the affected hand [3, 4]. In the present case, with intensive

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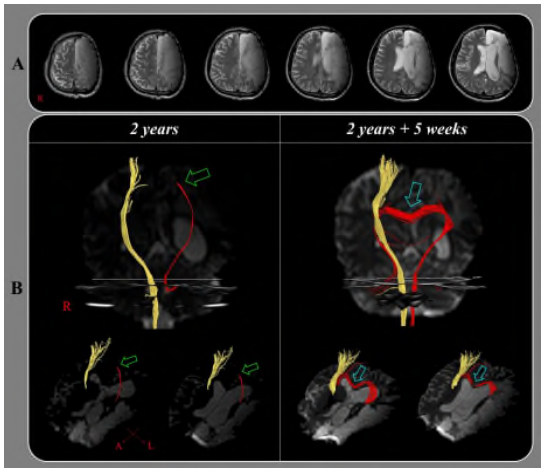

A: T2-weighted magnetic resonance images at two years after onset show leukomalactic lesions in the left fronto-parieto-temporal areas including the entire primary somatosensory-motor cortex.