

뇌신경재활

게시일시 및 장소 : 10 월 18 일(금) 13:15-18:00 Room G(3F)

질의응답 일시 및 장소 : 10 월 18 일(금) 15:53-15:57 Room G(3F)

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Usefulness of Probabilistic Diffusion Tensor Tractography in Planning Noninvasive Brain Stimulation.

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A 55-year-old male patient presenting bilateral complete hemiplegia was hospitalized for noninvasive brain stimulation treatment. He was diagnosed as bilateral pontine infarction due to bilateral vertebral artery occlusion 3 months before admission, and he had clinical symptoms of “Locked-in syndrome”. There was no visible muscle contraction of bilateral upper and lower limbs and the T2 weighted images showed severe encephalomalacic changes in the anterior portion of the brainstem, where the corticospinal tract(CST) is located. He was expected to have little motor recovery potential by conventional MRI.(Fig 1) We employed multi-modal evaluations including motor evoked potential(MEP), deterministic and probabilistic diffusion tensor tractography(DTT) to assess any motor recovery potential and structural integrity of the CST in this patient presenting chronic complete quadriplegia. MEPs recording key muscles of both upper and lower limbs showed no response. In deterministic DTT, the right CST was absent, while in the left CST, a few fibers from the primary motor cortex was observed.(Fig 2B) In probabilistic DTT, right CST was discontinued at the pontine level where the lesion was located, and more robust left CST originating from the primary motor cortex was found than that of deterministic DTT.(Fig 2A) Functional integrity of the CST evaluated by MEP was absent, but structural integrity of the CST evaluated by probabilistic DTT was confirmed. We performed facilitatory repetitive transcranial magnetic stimulation(rTMS) targeting left hand knob area of the primary motor cortex. After 10 sessions of rTMS(90% of motor threshold, frequency at 10 Hz, 5 sec stimulation/55 sec intertrain interval, 1500 pulses over 30 minutes), the patient acquired intermittent partial finger flexor motion. 3 months later, the patient was re-admitted for the followed-up assessments (including MEP, deterministic and probabilistic DTT). In deterministic tractography, left CST integrity was maintained compared to that obtained 3 months ago, and some evidence of regeneration was observed.(Fig 2C). Probabilistic tractography showed more robust CST originating from the premotor and primary motor cortices, compared to previous results.(Fig 2D) After 10 sessions of facilitatory rTMS, the patient could obtain a consistent finger flexor motion. Patients with “Locked-in syndrome” are usually deemed to be underestimated regarding motor recovery potential. Probabilistic tractography can build a spatial distribution of curves that mimics the overlapped results from multiple deterministic tracking on

multiple scans. In this case study, the probabilistic fiber tracking algorithm showed superiority in producing robust and reproducible CSTs than the deterministic tractography. In conclusion, CST integrity by probabilistic tractography is expected to be a useful method for identifying motor recovery potential in patients with severe motor impairment.

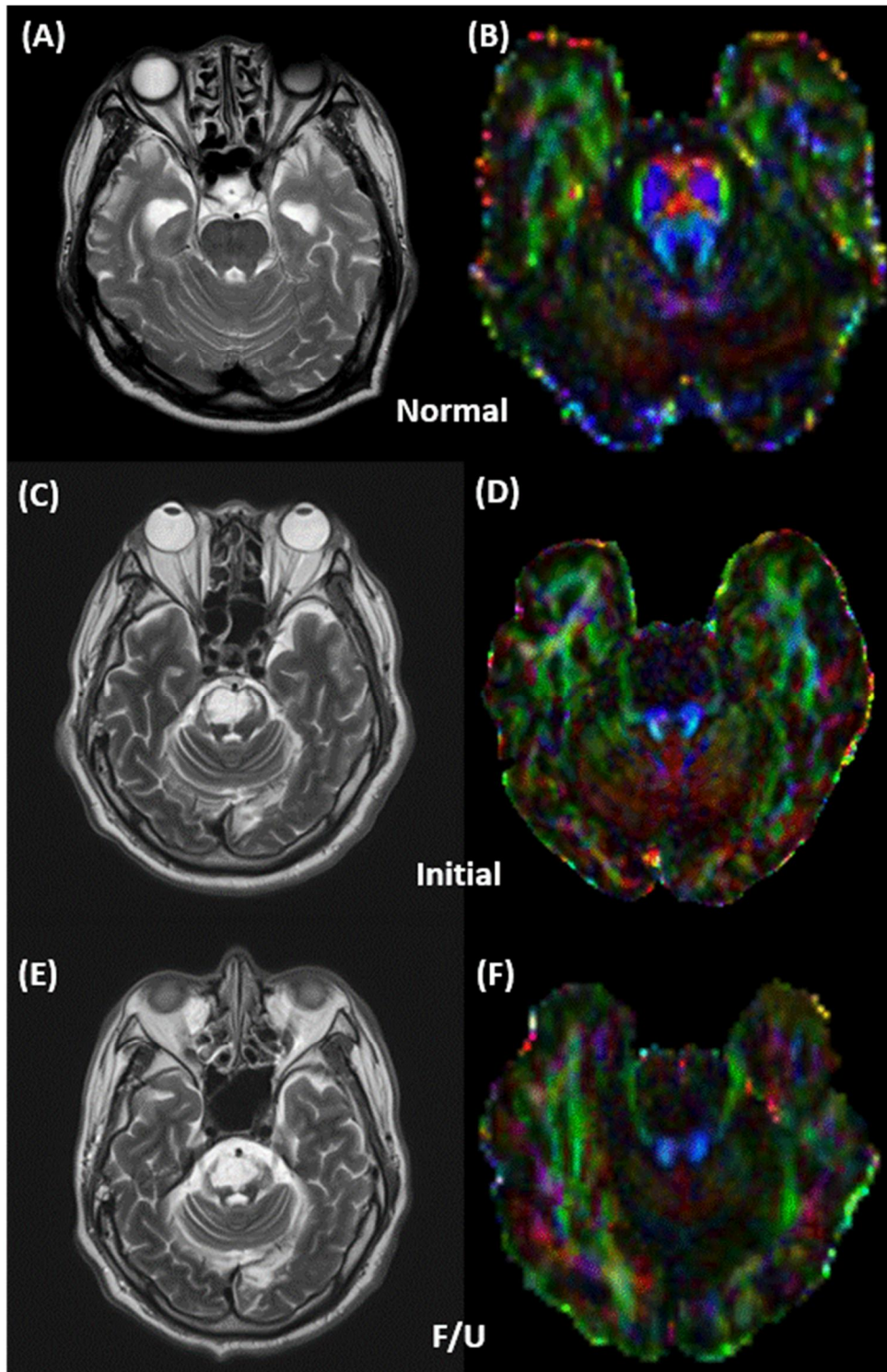


Figure 1. Brain MRI T2WI (left) and color FA map (right) of (A-B) healthy person, (C-D) our patient at 3 months after the onset, and (E-F) at 6 months after the onset. On T2WI, cystic encephalomalacic changes were observed in (C) and (E). On color FA maps, the location of CST represented by the blue fibers of the anterior pons in healthy person. (B) However, there were no clearly visible blue fibers in our patient. (D, F)