Original Article

Relationship between white matter fiber damage and revised version of the ability for basic movement scale in patients with stroke: a diffusion tensor tract-based spatial statistic study

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Abstract. [Purpose] To clarify the relationship between white matter fiber damage and the Ability for Basic Movement Scale (ABMS) II in patients with stroke in a diffusion tensor tract-based spatial statistic study. [Subjects and Methods] Twelve patients with stroke (seven men and five women, mean age ± SD: 61.6 ± 8.5 years) were evaluated using the ABMS II. The patients were divided into the ABMS II good group and the ABMS II poor group. Tract-based spatial statistical analysis was performed using diffusion tensor images in both groups. [Results] Patients in the ABMS II good group had significantly higher fractional anisotropy values of the anterior thalamic radiation (ATR), superior longitudinal fasciculus (SLF), inferior occipitofrontal fasciculus (IOF), and uncinate fasciculus (UF) of the lesion-containing hemisphere than patients in the ABMS II poor group. [Conclusion] ATR, SLF, and IOF damage may affect ABMS II scores in patients with stroke.

Key words: White matter fiber, ABMS II, Stroke

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INTRODUCTION

Patients with acute stroke should start rehabilitation immediately after stroke onset for restoration of motor function. In addition, for better recovery of their motor function, rehabilitation should be smoothly transferred from the acute phase to the recovery phase. However, there is a tendency that the timing of transfer to a convalescent rehabilitation ward of another hospital is delayed. A study reported that the number of days of transfer from onset to a convalescent rehabilitation ward was approximately 43 days in the same hospital, but that of transfer to a convalescent rehabilitation ward of another hospital was approximately 63 days1). Therefore, it is important to predict the future motor function of the patient immediately after stroke onset, gauge whether it is necessary to transfer the patient to another hospital, and plan the timing of the transfer if necessary. Tanaka et al.2) reported that the revised version of the ability for basic movement scale (ABMS II) is an appropriate tool to evaluate the functional ability of patients with acute stroke to perform basic movements. ABMS II evaluates performance of five basic abilities in six grades. ABMS II of patients with acute stroke was reported to correlate with activities of daily living function after 4 weeks. However, the relationship between ABMS II and the position and size of brain damage was not reported. The most famous fiber tract related to motor function is the corticospinal tract. However, many brain regions are involved in motor function; hence, damage to nerve fibers different from corticospinal fibers may also affect ABMS II. TBSS is a newly developed method that allows voxelwise statistical comparison of individual subject’s diffusion tensor imaging...
In this study, the presence or absence of impaired neuronal integrity can be observed by noninvasively measuring and imaging water molecules in the body. The FA measured by DTI represents white matter integrity and is thought to reflect fiber density, axonal diameter, and myelination in white matter. Moreover, FA was reported to decrease when white matter is damaged by stroke. Generally, a series of functions of monitoring, building up, and updating the postural model of our limb, i.e., body schema, are necessary for smooth and efficient movement. Therefore, we believe that damage to different nerve fibers other than the corticospinal fibers could also affect ABMS II score. The ATR carries nerve fibers between the dorso-medial thalamic nuclei and the prefrontal cortex and therefore participates in the neural processing of cognition. In addition, the activity of the thalamo-cortical pathway modulates the information flow necessary for conscious cognitive processes. The SLF carries nerve fibers between the parietal cortex and the prefrontal cortex and thereby plays a relevant role in visuospatial attention, motor attention, motor planning, and action coding. The IOF carries nerve fibers between the ventral occipital cortex and lateral orbito-frontal cortex, thereby playing a role in multimodal sensory-motor integration. Therefore, damage to the ATR, SLF, and IOF may have an effect on the ABMS II score. Furthermore, the UF carries nerve fibers between the anterior temporal lobe with the orbital and polar frontal lobe, including the orbitofrontal area and inferior frontal gyrus. Recent studies have assumed that the UF functions in episodic memory, language, and social emotional treatment, but it is still incompletely understood. Therefore, it is difficult to consider the relationship between UF and ABMS II score in this study. Finally, this is a pilot study; hence, we must increase the number of subjects and need more detailed analysis.
Conflict of interest
None.

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