

Difference in the ARAS between vegetative and minimally conscious states following TBI

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Introduction

We investigated differences in the ascending reticular activating system (ARAS) between vegetative state (VS) and minimally conscious state (MCS) in patients with traumatic brain injury (TBI) by using diffusion tensor tractography (DTT).

Methods

We recruited 23 patients with TBI who showed disorders of consciousness (DOC) and 12 normal subjects. Ten patients were enrolled in the VS group, 13 patients in the MCS group, and 12 normal subjects in the control group. We reconstructed the lower ARAS and five parts of upper ARAS (prefrontal cortex [PFC], premotor cortex, primary motor cortex, primary somatosensory cortex, and posterior parietal cortex). Fractional anisotropy (FA) and fiber number (FN) values of the lower ARAS and each of the five parts of upper ARAS were estimated.

Results

Significant differences were observed in the FA and FN values of the five parts of upper ARAS between the VS and control groups, and between the MCS and control groups ($p < 0.05$), but no differences were detected in the lower ARAS ($p > 0.05$). The FA and FN values of the PFC in the upper ARAS were significantly different between the VS and MCS groups ($p < 0.05$). No other significant differences in FA and FN values were detected among the other segments of the upper ARAS or in the lower ARAS ($p > 0.05$).

Conclusion

The results indicate that that prefrontal portion of the upper ARAS is the critical area for distinguishing between VS and MCS in patients with TBI.

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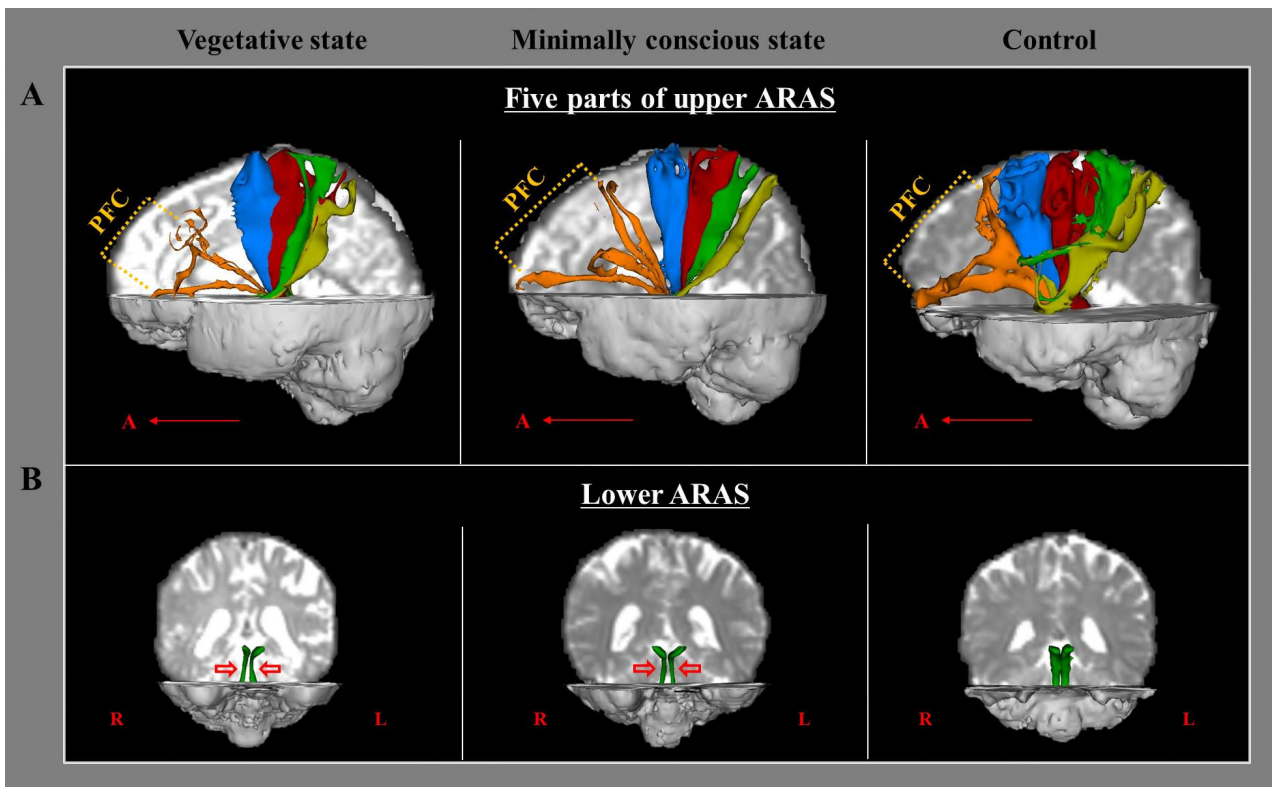


Fig.1. Results of diffusion tensor tractography (DTT) for the prefrontal cortex (PFC)-upper ascending reticular activating system (ARAS) (orange color), premotor cortex-upper ARAS (blue color), primary motor cortex-upper ARAS (red color), primary somatosensory cortex-upper ARAS (green color), and posterior parietal cortex-upper ARAS (yellow color) in representative subjects from each group (vegetative state: 41-year old female, minimally conscious state: 48-year old female, and control: 46-year old female). Narrowing of the PFC-upper ARAS is observed in the vegetative state (orange dotted line) compared with that in the minimally conscious state (orange dotted line). (B) Results of DTT for the lower ARAS show narrowing in the vegetative and minimally conscious states (red arrows) compared with control.