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Difference in ARAS between persistent vegetative and MCS following putaminal hemorrhage

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Objectives

We investigated differences in the ascending reticular activating system (ARAS) of persistent vegetative state (PVS) and minimally conscious state (MCS) patients following putaminal hemorrhage (PH).

Methods

We recruited 17 patients with PH, and classified them into PVS (7 patients) and MCS (10 patients) groups. Eight parts of the ARAS were reconstructed: the dorsal lower ARAS, ventral lower ARAS, whole upper ARAS, prefrontal cortex (PFC)-upper ARAS, premotor cortex-upper ARAS, primary motor cortex-upper ARAS, primary somatosensory cortex-upper ARAS, and posterior parietal cortex-upper ARAS. For each ARAS part, diffusion tensor tractography (DTT) parameters (fractional anisotropy [FA] and tract volume [TV]) were estimated.

Results

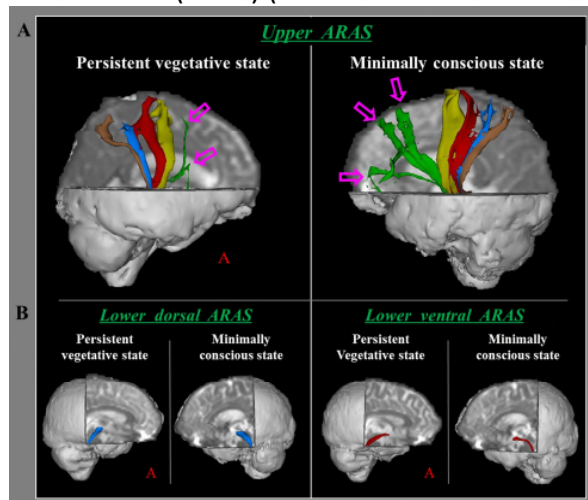
The FA value did not differ significantly among the eight parts of the ARAS between the PVS and MCS groups ($p > 0.05$). The TV value of the PFC-upper ARAS was significantly lower in the PVS group than in the MCS group. There were no other significant TV differences in other parts of the ARAS ($p < 0.05$).

Conclusions

The sole ARAS difference between PVS and MCS patients following PH was a decrement in neural fibers in the PFC-upper ARAS in PVS patients compared to MCS ones. Based on the results, it appears that the prefrontal portion of the upper ARAS is a critical area when discerning between PVS and MCS in patients with PH.

Acknowledgment

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean Government(MSIP) (No. 2018R1A2B6000996).



Results of diffusion tensor tractography (DTT) for the eight parts of the ascending reticular activating system (ARAS) of two representative patients, one in a persistent vegetative state (PVS 51-year-old male) and the other in a minimally conscious state (MCS 56-year-old male)

Table 1. Demographic data of the patients in the persistent vegetative state and minimally conscious state groups.

	PVS	MCS
Patient number (Male:Female)	7 (3:4)	10 (7:3)
Mean age (years)	55.71 ± 13.23	58.21 ± 10.23
GCS	7.71 ± 1.80	13.38 ± 2.26
CRS-R	5.86 ± 1.02	19.63 ± 3.21
Mean duration to DTI (months)	4.29 ± 1.39	6.50 ± 3.65

Values indicate mean ± standard deviation, PVS: persistent vegetative state, MCS: minimally conscious state, GCS: Glasgow Coma Scale, CRS-R: Coma Recovery Scale-Revised, DTI: diffusion tensor imaging.

Demographic data of the patients in the persistent vegetative state and minimally conscious state groups

Table 2. Comparison of diffusion tensor tractography parameters between the persistent vegetative state and minimally conscious state groups.

		PVS	MCS	<i>p</i> -value
Dorsal ARAS	FA	0.19±0.21	0.29±0.14	0.41
	TV	76.29±99.01	283.43±213.19	0.69
Ventral ARAS	FA	0.18±0.17	0.30±0.14	0.79
	TV	63.44±85.10	257.50±182.74	0.53
Upper ARAS	FA	0.23±0.05	0.26±0.06	0.21
	TV	4486.20±1741.38	5301.60±2067.14	0.30
PFC	FA	0.15±0.17	0.21±0.18	0.35
	TV	148.75±229.61	493.56±607.61	0.04*
PMC	FA	0.17±0.13	0.20±0.18	0.45
	TV	756.45±334.51	1102.23±645.48	0.31
M1	FA	0.19±0.18	0.23±0.20	0.28
	TV	721.11±411.31	1217.54±774.51	0.16
S1	FA	0.15±0.14	0.19±0.11	0.11
	TV	564.88±313.46	841.56±311.64	0.17
PPC	FA	0.16±0.15	0.20±0.18	0.21
	TV	664.49±345.65	911.57±546.66	0.41

PVS: persistent vegetative state, MCS: minimally conscious state, ARAS: ascending reticular activating system, PFC: prefrontal cortex, PMC: premotor cortex, M1: primary motor cortex, S1: primary somatosensory cortex, PPC: posterior parietal cortex, FA: fractional anisotropy, TV: tract volume.

Values indicate mean ± standard deviation

*: indicates significant difference between the persistent vegetative state and minimally conscious state groups, $p < 0.05$

Comparison of diffusion tensor tractography parameters between the persistent vegetative state and minimally conscious state groups