뇌신경재활

발표일시 및 장소: 10 월 18 일(금) 14:35-14:45 Room B(5F)

OP2-2-3

Mechanism of Functional Impairment after Anoxic Brain Injury: a Tract Based Spatial Statistics study

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Purpose

The aim of this study was to investigate degeneration of 48 neural tracts on the white matter in patients with anoxic brain injury (ABI) using a tract based spatial statistics study(TBSS). Vulnerable area and degree of severity of neural tract according to functional level were analyzed. Relation between microstructural integrity of neural tract and functional level was also studied.

Methods

Twenty one patients (14 males; mean age 55.2± 10.8; range 31-74) with subacute late ABI (onset 36.2±15.3) and 22 sex- and age- matched normal controls (10 male, mean age 57.0±11.7, range 30-75) were enrolled. According to the modified Rankle Scale (mRS), the patients were divided into good group (10 with mRS, 4-5) and poor group (11 with mRS, 1-3). All the DTI data were processed using the Functional Magnetic Resonance Imaging of the Brain (FMRIB) Software Library (FSL) program (http://www.fmrib.ox.ac.uk/fsl/). A whole-brain analysis was conducted by TBSS and values DTI parameter including fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD) and radical diffusivity (RD) were extracted from 48 tract-specific region-of-interest. We used the FA value as an indicator for the evaluation of neural tract degenerationand the formula of neural tract degeneration (%) was as follows; [1-(average value FA of neural tracts in patient)/ (that of the neural tract in control)].Based on the above method, we calculated FA values of 27 neural tracts, which consist of 21 pair neural tracts on the right and left hemisphere and 6 single neural tract. The average values of DTI parameters for the neural tracts and its correlation with mRS were compared between the control, good, and poor group.

Results

We found that significant differences in the DTI maps with an exception of the AD map were observed in the extensive range of the WM skeletons between the poor and good group and between the control and good as well as with the poor group(Figure 1). An average degeneration rate of the WM was 8.3% (range, 1.5%~23.5%) in the good group and 27.7% (range, 17.8% ~ 41.2%) in the poor group, respectively (Figure 2). The fornix was the highest degenerated neural tract in the good and poor groups with a rate of 23.5%; 41.2%, respectively. Among the most tolerable neural tracts, cingulum-hippocampus (1.5%), retrolenticular part of internal capsule (1.9%) and external capsule (2.5%) were observed in the good group. Regarding on the relation between neural tract integrity and mRS, Most of the average DTI values were significantly correlated with mRS as follows (Figure 3); FA: r= -0.819, P <0.001; MD: r =0.760, P<0.001; RD: r =0.778, P<0.001). No correlation was observed between average AD value and mRS (r =0.294, P<0.196).

Conclusions

Our findings suggest that combined study of a quantitative analysis of DTI parameters and maps may be useful to elucidate the mechanism for the degeneration of neural tract integrity and predication of the function.

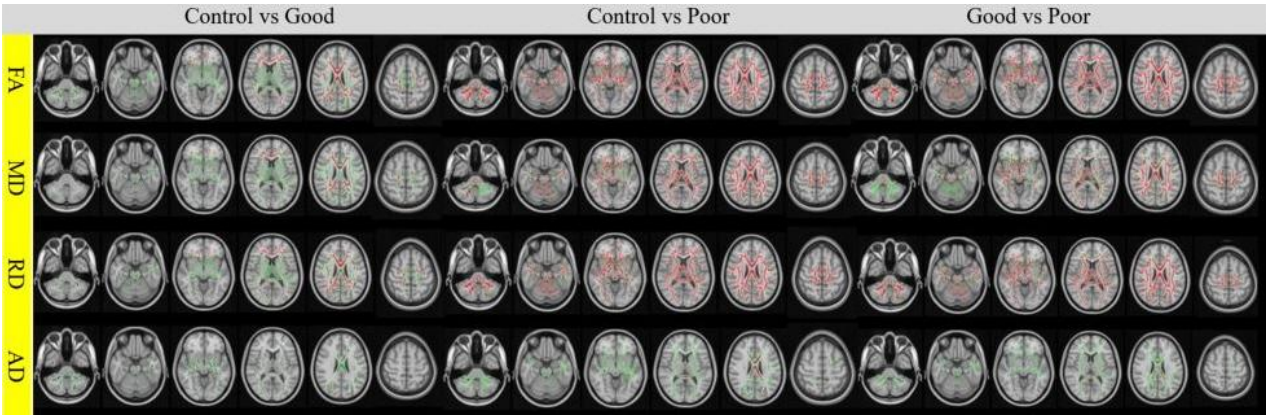
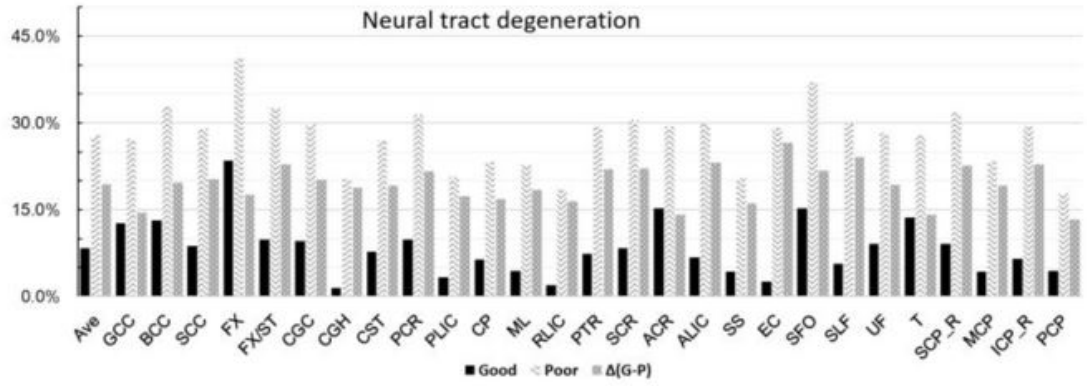


Figure 1However, significantly different changes were limited in a small area for AD maps.



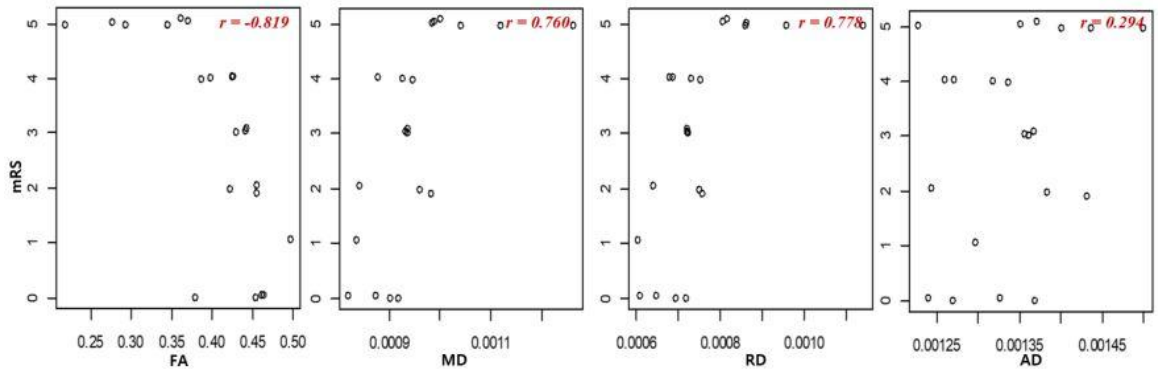
	Ave	GCC	BCC	SCC	FX	F_ST	CGC	CGH	CST	PCR	PLIC	CP	ML	RLIC	PTR	SCR	ACR	ALIC	SS	EC	SFO	SLF	UF	T	SCP	MCP	ICP	PCP
Good	8.0	12.7	13.1	8.7	23.5	9.8	9.5	1.5	7.7	9.8	3.3	6.4	4.4	1.9	7.3	8.4	15.3	6.7	4.3	2.5	15.2	5.7	9.0	13.7	9.1	4.3	6.5	4.4
Poor	27.7	27.3	32.8	29.0	41.2	32.6	29.8	20.3	26.9	31.5	20.7	23.2	22.8	18.5	29.4	30.5	29.4	29.8	20.4	29.1	37.0	29.8	28.3	27.8	31.8	23.4	29.3	17.8
Δ	19.7	14.5	19.7	20.3	17.6	22.8	20.2	18.8	19.2	21.7	17.3	16.8	18.4	16.5	22.0	22.1	14.1	23.1	16.1	26.6	21.7	24.1	19.3	14.2	22.7	19.1	22.8	13.3

Δ, difference % between good and poor groups; Ave, average.

GCC, genu of corpus callosum; BCC, body of corpus callosum; SCC, Splenium of corpus callosum;FX, Fornix (column and body of fornix); F_ST, Fornix (cres) / Stria terminalis; CGC, Genu of corpus callosum; CGH, Cingulum (hippocampus); CST, Cingulum (hippocampus); PCR Posterior corona radiate; PLIC, Posterior limb of the internal capsule; CP,Cerebral peduncle; ML, Medial lemniscus; RLIC, Retrolenticular part of the internal capsule; PTR, Posterior thalamic radiation; SCR, Superior corona radiate; ACR, Anterior corona radiate; ALIC, Anterior limb of the internal capsule; SS, Sagittal stratum; EC, External capsule; SFO, Superior fronto-occipital fasciculus; SLF, Superior longitudinal fasciculus; UF, Uncinate fasciculus; T, Tapetum; SCP, Superior cerebellar peduncle; MCP, Inferior cerebellar peduncle; PCP, Posterior cerebellar peduncle

Note: Anatomical label abbreviations for the JHU-ICBM-DTI-81 atlas (Oishi et al., 2008).

Figure2. The fornix was the highest degenerated neural tract in the good and poor groups with a rate of 23.5%; 41.2%, respectively. Among the most tolerable neural tracts, cingulum-hippocampus (1.5%), retrolenticular part of internal capsule (1.9%) and external capsule (2.5%) were observed in the good group.



Figur3.FA,fractional anisotropy; MD,mean diffusivity; AD, axial diffusivity; RD, radical diffusivity., Most of the average DTI values were significantly correlated with mRS as follows (Figure 3); FA: r= -0.819, P <0.001; MD: r =0.760, P<0.001; RD: r =0.778, P<0.001). However, no correlation was observed between average AD value and mRS (r =0.294, P<0.196).