

DTI quantitative evaluation of motor and sensory areas in patients with amyotrophic lateral sclerosis

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Methods

Twelve patients with definite or probable ALS as defined by the El Escorial criteria and 18 age-matched normal controls without neurologic disorders were included in the study. The patients group included 6 males and 6 females, and their age ranged from 28 to 64 years (mean 41.6 years). The normal control subjects included 10 males and 8 females, and their age ranged from 25 to 67 years (mean 45.8 years).

A superconductive 1.5T MR scanner (Twin Speed, GEMS Milwaukee) was employed and the head coil was used. DTI was performed in all patients and normal controls. Axial and coronal images were scanned with single shot SE-EPI sequence by using the head coil. TR=8000ms and TE=70ms. The b value was 1000 s/mm², the number of diffusion sensitive gradient direction was 25, NEX=1, and the matrix was 128×128. Axial and coronal scans were obtained in both patient group and control group. The slice thickness was 6 mm and gap was 0.5 mm for axial scans, and thickness was 5 mm without gap for coronal scans.

DTI images were evaluated and measured by two neuroradiologists blinded to the diagnosis. For quantitative assessment, a ROI containing 20 pixels was employed. The values of FA and RA were measured in bilateral posterior third quarter of the posterior limb (PL) of the internal capsule (IC) for motor areas (CST) (Fig.1) and in the vpl nucleus of the thalamus for sensory areas (Fig.2), respectively. The statistical analysis was performed using ANOVA test.

Results

The measurement values of FA and RA were showed in Table 1. At the level of the PL of the IC, significant reduction of FA and RA was revealed in the patient group compared with that of control group ($P<0.05$). At the level of thalamic vpl, FA and RA values showed no significant differences between the patient group and the control group ($P>0.05$).

Discussion

As a neurodegenerative disease, ALS selectively involves the motor neurons and their axions, but it does not involve the sensory tracts or nuclei. Conventional MR imaging can't provide the quantitative values, so it can't be used to reveal the involvement of CST or the integrity of the sensory systems in most circumstances. By using DTI technique, the abnormal water anisotropic diffusion status within the CST induced by the neuronal degeneration and associated demyelination could be detected[3]. In this study, the decreased FA and RA values in CST in ALS patients were consistent with the degenerative changes, whereas FA and RA in thalamic vpl showed no significant differences between ALS and control groups, indicating the intact sensory route in ALS patients.

References

- [1] Kato Y et al, AJNR 1997;18:1541-1547
- [2] Sarchielli P et al, Neuroradiology 2001;43:189-197
- [3] Ellis CM et al, Neurology 1999;53:1051-1058

Table 1: FA and RA (mean±SD) in the PL of the IC and thalamic vpl

	PL of the IC		thalamic vpl	
	FA	RA	FA	RA
Patient group (n=12)	0.589±0.060	0.557±0.073	0.400±0.076	0.352±0.078
Control group (n=18)	0.625±0.037	0.599±0.050	0.411±0.068	0.361±0.069
P value	<0.05	<0.05	>0.05	>0.05

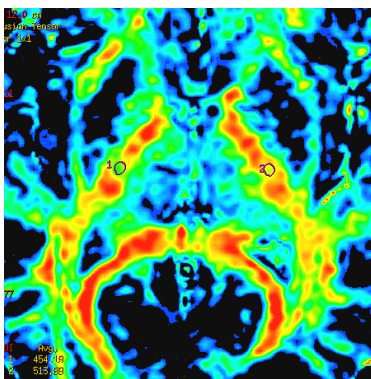


Figure 1: FA image and ROI measurements at the level of the PL of the IC.



Figure 2: Schematic for ROI position in vpl.