Evidence for a Decreased Activity of the Resting State Motor Network in Patients With ALS

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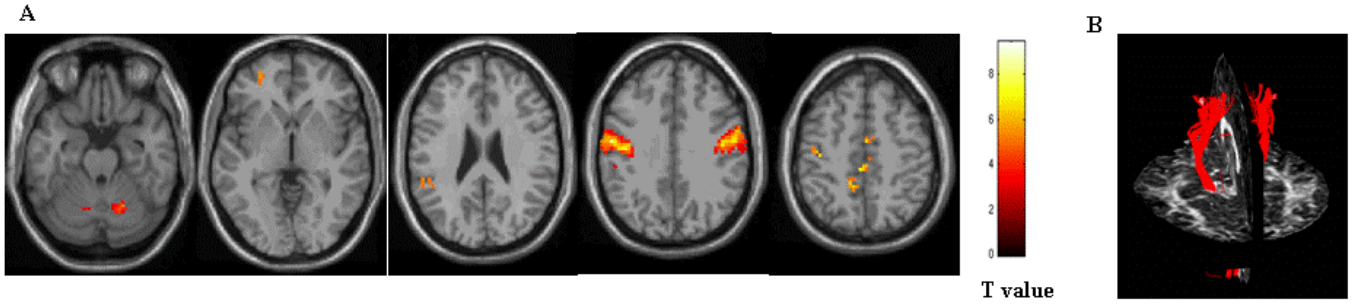
Introduction. In amyotrophic lateral sclerosis (ALS), the analysis of the resting state (RS) functional MRI (fMRI) demonstrated sensorimotor network changes in the premotor cortex [1]. In this study, we explored spontaneous functional connectivity within the sensorimotor networks during rest in patients with ALS, and investigated the relationship between RS fMRI changes and damage to the corticospinal tracts (CST).

Methods. RS fMRI and diffusion tensor (DT) MRI were obtained in 19 patients with probable or definite ALS and 15 healthy controls. Connected brain networks were defined using independent component analysis (ICA) as implemented in GIFT [2]. SPM5 was used to assess within- and between-group differences in RS pattern. The average percentage signal change of RS fluctuations of each significant SPM cluster was also compared between controls and patients. DT MRI-based tractography [3] was used to segment the CST. Mean diffusivity (MD) and fractional anisotropy (FA) of CST were obtained. The correlations between RS changes and DT MRI metrics were assessed using linear regression analysis.

Results. ICA analysis revealed two brain functional networks related to the sensorimotor system.

Figure. (A) Brain functional network relating to the sensorimotor system during RS in ALS patients and healthy controls. (B) Reconstruction of the CST in a healthy control.



The voxel-based comparison showed that ALS patients had regions of decreased RS connectivity in the left primary sensorimotor cortex (SMC). Compared with controls, ALS patients also showed decreased average percentage signal change of RS fluctuations in the SMC and the cerebellum bilaterally, in the supplementary motor area, and in the left inferior frontal gyrus and inferior parietal lobule. Significant correlations were found between decreased RS activity in the SMC and damage to CST, bilaterally.

Conclusions. ALS patients show dysfunction of RS connectivity of the sensorimotor network. This dysfunction is likely to be a response to a selective damage to the CST. RS analysis provides additional pieces of information on cortical reorganization in ALS patients which are complementary to those offered by a conventional analysis of fMRI.

References.

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