PROTON MAGNETIC RESONANCE SPECTROSCOPY ALONG THE PYRAMIDAL TRACT OF PATIENTS WITH AMYOTROPHIC LATERAL SCLEROSIS

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Introduction
Amyotrophic lateral sclerosis (ALS) is a progressive neurodegenerative disease affecting motor neurons in the motor cortex, brainstem and spinal cord (pyramidal tract). Previous studies assessed 1H spectra in different brain areas in patients with ALS [1, 2]. In this work, we have chosen to compare the spectra from different brain regions along the pyramidal tract, and to correlate the data to different clinical manifestations of the disease.

Methods
11 patients with clinically proven ALS (10 male, 1 female, all right-handed, aged 52.2±13.9) and 11 volunteers matched for age, sex and educational level (aged 53.3±14.0) underwent single-voxel 1H-MRS examination of both left and right precentral gyri (3.4 ml), pons (5.2 ml), medulla oblongata (3.9 ml) and the occipital lobe (8 ml) in a 1.5T Siemens Symphony MR scanner (TE=135ms, TR=1500ms, 256 avgs, see fig. 1). By adjusting the first and second order shims, B0 field homogeneity was established in all the voxels for water FWHM being at most 7 Hz. Spectra were evaluated using LC Model [3]. In order to avoid partial volume effects of CSF, only ratios of metabolites to tCre (t standing for total) and tCho were used for calculations. We compared them to the values of the healthy volunteers and evaluated their correlation to the patients’ total ALSFRS score [4] and its subscores (bulbar, fine motorics, gross motorics and respiratory).

Results
Between the patients and the volunteers, significant differences were found in the tNAA:tCre ratio for the right precentral gyrus (p=0.046) and the pons (p=0.046). The ratio of tNAA:tCho was significantly different in the medulla oblongata (p=0.021). Other metabolite ratios in other areas did not show significant differences. Occipital lobe, which was chosen as a control region outside the pyramidal tract, has shown no differences at all.

In the right precentral gyrus, very good correlations were found between tNAA:tCre and patients’ ALSFRS score (p=0.92, p=0.0001, see fig. 2), fine motorics subscore (p=0.67, p=0.025) and gross motorics subscore (p=0.81, p=0.003).

Discussion
Our experiments compare MRS diagnostic values of different regions in the pyramidal tract and their relationship to the clinical manifestation of ALS. The data from our small group already show promising correlations to the patients’ clinical score. Due to low prevalence of the disease, our set is quite small and we observe that statistical significance of further metabolite ratios in other voxels increases as more patients are measured. Therefore, we expect that with a larger patient group, even more interesting relationships would be observed.