METABOLITE T2 RELAXATION ABNORMALITIES IN BIPOLAR DISORDER AND SCHIZOPHRENIA

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OVERVIEW: There are substantial abnormalities in the number, density, and size of cortical neurons and glial cells in bipolar disorder and schizophrenia. Because molecule-microenvironment interactions determine metabolite MRS signal decay characteristics, these cellular abnormalities may impact transverse (T2) relaxation times.

METHODS: We measured T2 relaxation times for 3 intracellular metabolites [N-acetylaspartate + N-acetylaspartylglutamate (NAA+NAAG, termed tNAA), creatine+ phosphocreatine (Cr+pCr, termed tCr), and choline-containing compounds (termed tCho)] in the anterior cingulate cortex (ACC) and parieto-occipital cortex (POC) from 20 healthy subjects (NC), 15 patients with bipolar disorder (BD), and 15 patients with schizophrenia (SZ) at 4 Tesla. Spectra used in T2 quantification were collected from 8cc voxels. LCModel was used to measure metabolite peak integrals. For spectral fitting with LCModel, we utilized GAMMA-simulated theoretical basis sets; 48 theoretical, TE-stepped spectra ranging from 30ms to 500ms in 10ms increments. T2 relaxation constants for mono-exponential decay were obtained using an iterated Levenberg-Marquardt fit of metabolite integrals vs. echo time. (Figure 1.)

RESULTS: BD and SZ groups had shorter T2 relaxation times than the NC group for all metabolites in both regions; the most pronounced difference was in the ACC in BD. (Figure 2.) In the ACC, Choline T2 relaxation times were significantly reduced compared to NC for both the BD and SZ groups ($p<0.01$) and Creatine T2 times were significantly shorter for BP subjects vs controls. While not significant, tNAA showed a trend towards lower T2 for BP and SZ groups compared with NC.

DISCUSSION: Metabolite T2 relaxation time shortening is consistent with reduced cell volumes and/or altered macromolecular interactions, and may be consistent with the prolonged tissue water T2 relaxation times reported in BD and SZ. These findings suggest that metabolite concentrations reported in MRS studies of psychiatric conditions may be confounded by T2 relaxation effects, which require a correction factor when significantly different between groups. These findings highlight the importance of measuring metabolite T2 relaxation times which not only enable corrected concentrations measurements, but may also provide a useful probe of conditions in the intracellular environment.

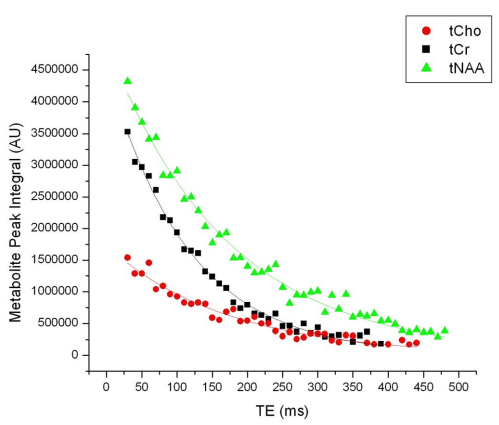

Figure 1. Metabolite T2 decay curves

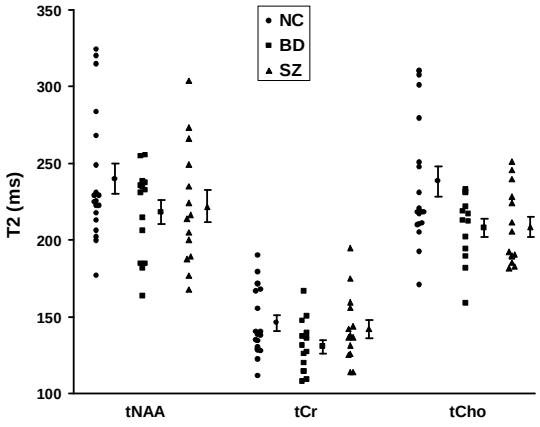

Figure 2. Metabolite T2 Relaxation Times