in vivo spectroscopic imaging of glutamate.

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Glutamate is the main excitatory neurotransmitter in the CNS and plays together with glutamine an important role in brain physiology. A quantitative spatially resolved analysis of glutamate separate from glutamine is therefore of particular neuroscientific interest. In most MR Spectroscopic Imaging (MRSI) studies insufficient sensitivity or long echo times do not permit the quantification of glutamate+glutamine. At lower field glutamate and glutamine can't be separated due to limited spectral dispersion/resolution.

In a pilot \textsuperscript{1}H MRSI study it is demonstrated that maps of sufficiently high spectral and spatial resolution can be obtained to initially map areas of largely different glutamate concentration, in particular neural tissue vs. the ventricles in the rhesus monkey brain.

For enhanced sensitivity and spectral separation the study was performed on a 7T high field scanner, which has been described previously (Pfeuffer, 2003, ISMRM Proc). Automated shimming with FASTMAP led to a water line width of 13Hz in a selected 28x28x4mm\textsuperscript{3} axial slice through the ventricles. For MRSI, a STEAM sequence was used with an 8x8 phase encoding scheme, leading to a nominal in-plane resolution of 3.5x3.5mm\textsuperscript{2} (TE=TM=10ms, TR=4s, NA=35). Utilizing a surface coil setup (80mm diameter) for further enhanced sensitivity, it was possible to separate glutamate and glutamine and to measure a pure MRSI glutamate map in the macaque brain. Peak deconvolution and quantification were done voxelwise in frequency domain with LCModel. The results suggest that the obtainable resolution using implanted coils will permit differentiation of brain structures in the millimeter range (gray vs. white matter) and detection of concentration differences in the same structure (activated vs. non-activated cortex).

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