LEARNING POTENTIAL IN SCHIZOPRENIA IS RELATED TO NEURONAL INTEGRITY OF THE ANTERIOR CINGULATE CORTEX AS MEASURED BY PROTON MR SPECTROSCOPY

H. Kugel[1], J. Bauer[2], A. Siegmund[2], A. Kersting[2], V. Arolt[2], T. Suslow[2], W. Heindel[1], A. Pedersen[2], and P. Ohrmann[2]

[1]Dept. of Clinical Radiology, University of Muenster, Muenster, NRW, Germany, [2]Dept. of Psychiatry, University of Muenster, Muenster, NRW, Germany
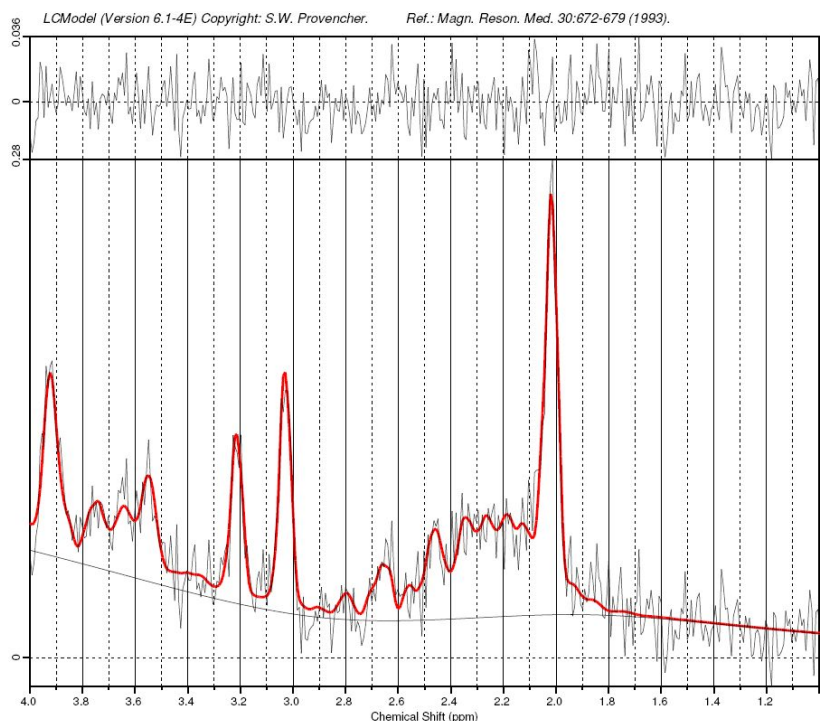
Introduction: Impairment in a variety of cognitive domains has been described as core feature in patients with schizophrenia, although specific patterns of functioning have been shown to vary across individuals. Cognitive functioning has also repeatedly been related to functional outcome in schizophrenia, and learning potential has been regarded as one of the important variables for cognitive remediation. A positive correlation of MR spectroscopically measurable N-acetylaspartate (NAA) levels in different brain regions and measures of cognitive functions has been disclosed in several studies, emphasizing NAA as a marker of neuronal functionality (1). Here the relation of prefrontal brain metabolites and cognitive functioning with a focus on learning potential was investigated.

Methods: Learning potential was assessed in 35 schizophrenic patients fulfilling DSM-IV criteria for schizophrenia and 23 age- and education-matched healthy controls using a dynamic version of the Wisconsin Card Sorting Test (WCST), and assigning subjects to groups of non retainers, learners, and high achievers based on their performance on the dynamic WCST (2). Cognitive performance was related to cerebral metabolism as assessed by single voxel proton magnetic resonance spectroscopy of volumes (cubic, 15 mm edge length) in the dorsolateral prefrontal cortex (DLPFC) and the anterior cingulate cortex (ACC), applying a short echo PRESS sequence (TE/TR 32ms/1896ms, 128 scans) in a 1.5 T MR scanner (Gyroscan 1.5 T, PMS, Best, NL). Spectra were evaluated using LCModel (3) and quantified using tissue water as internal reference (4).

Results: NAA as a marker of neuronal integrity was significantly reduced in the DLPFC of schizophrenic patients. The other metabolites showed no differences. In schizophrenic patients there was a positive correlation between learning abilities and NAA as well as glutamate/glutamine levels in the ACC, whereas in healthy volunteers a positive correlation between learning potential and NAA levels of the DLPFC was observed.

Discussion: These data imply a relation between neuronal functionality as measured by N-acetyl-aspartate and learning potential in schizophrenic patients and healthy subjects in different prefrontal cortex areas, and suggest the involvement of differential neuronal networks in executive functioning in schizophrenic patients compared to healthy controls.

LCModel fit to a spectrum from the DLPFC of a patient with schizophrenia

References: (1) Ross AJ and Sachdev PS, Brain Res Rev 44: 83-102 (2004); (2) Wiedl KH et al., Schizophrenia Bull 30: 703-711 (2004); (3) Provencher SW, Magn Reson Med 30: 672-679 (1993); (4) Keevil SF et al., Magn Reson Imaging 16: 1093-1106 (1998)