

# GLUTAMATE ALTERATIONS IN ALCOHOL DEPENDENT PATIENTS DURING EARLY DETOXIFICATION

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## Introduction

The purpose of this study is to determine whether there are significant changes in glutamate concentrations in the anterior cingulate gyrus (ACC) and frontal white matter (fWM) in alcohol dependent patients during early detoxification in comparison to healthy controls. Whether these changes parallel well described deficits in NAA and tCho concentrations was a second goal of this study [1,2].

## Methods

In a pilot study 16 alcohol dependent patients (age  $45.9 \pm 4.2$ ; 5 f) on the first day of detoxification when the blood alcohol concentration approached 0 as well as 16 healthy controls (age  $39.1 \pm 8.9$ ; 6 f) underwent single voxel MR spectroscopy in a 3T Siemens Magnetom TIM Trio. The position of the two voxels was defined based on anatomical images from an isotropic 1 mm<sup>3</sup> mprage data set (acquired in sagittal planes and reconstructed in orthogonal transverse and coronal planes). One was positioned in the frontal white matter (fWM) ( $10 \times 40 \times 10 \text{ mm}^3$ ) and the second in the anterior cingulate gyrus (ACC) ( $15 \times 30 \times 12 \text{ mm}^3$ ). Two spectra from each location were acquired with a PRESS sequence using the following parameters: TE = 30 ms & 80 ms [3], TR = 3000 ms, BW = 2400 Hz, 2048 data points and 100 averages. Figure 1 shows the locations and exemplary spectra for both TEs. Spectra were evaluated with LCModel using simulated data set for TE = 30 and 80 ms. Glutamate fits were accepted when the Cramer Rao Lower Bounds of the fit were 20% or less. The results were scaled with the interpolated water signal at TE=0. We also accounted for the different amount of grey matter (GM), white matter (WM) and CSF in the measured voxel and their different water concentration (GM: 45 mM, WM: 39.4 mM, CSF: 54.4 mM) by image segmentation of a T1-weighted MPRAGE. Metabolite data were corrected for CSF content. Chemical shift displacement results in a different measured voxel position for the different metabolites. This was accounted for in the in house developed segmentation

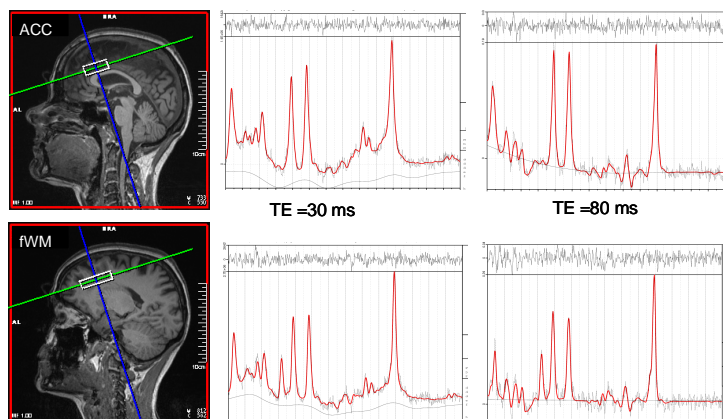


Figure 1

tool which is based on the SPM2 algorithm [4].

## Results

The group comparisons corroborate previous results of decreased concentrations of tNAA and tCho in both brain regions in patients compared to healthy controls.

Significant differences between patients and controls could be detected for Glu from the fWM in the 30 ms analysis. The same trend of a reduced Glu was observed for the fWM 80 ms and ACC 30ms evaluations without reaching significance. A comparison of the TE = 30 ms results with TE = 80 ms results yields good agreement for NAA, tCho, tCr, but not glutamate or glutamate & glutamine (Glx) For TE = 30 ms and for the slightly larger ACC voxel more glutamate data were within the SD limit. For the correlation of TE = 30 ms with TE =80 ms only Glu values within SD for both TEs were included – thus the number of subjects is further decreased (Figure 2a -c).

## Conclusions

Alcoholic patients during early detoxification show reduced levels of Glu in fWM in addition to reduced tNAA and tCho. A TE of 80 ms yields better separation of Glu from Gln and less contribution of macromolecules but due to the lower SNR also requires larger voxel sizes and/or longer acquisition times in order to reach sufficient quality for spectral quantification. The rather weak correlation of Glu values acquired at TE = 30 and TE =80 ms gives rise to the suspicion that the separation of Glu from Gln, GABA and maybe other resonances is not reliable.

## References

1. Ende G, et al.; Biol Psychiatry, 15;58(12):974-80, 2005; 2. Bendzus M, et al. AJNR Am J Neuroradiol. 22(10):1926-32, 2001; 3. Schubert F, et al.; H. Neuroimage. 21(4):1762-71, 2004 ; 4. Weber-Fahr W et al Neuroimage 16, 49-60, 2002

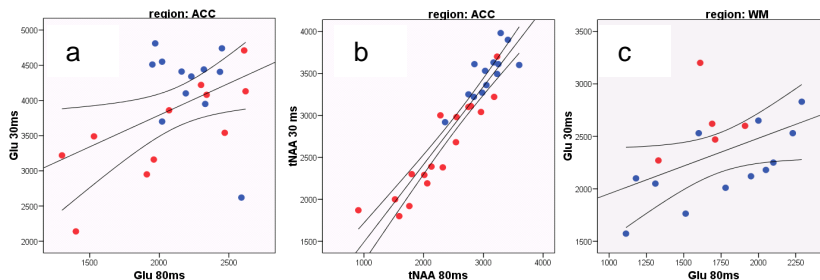


Figure 2 : red patients, blue controls