

Interictal epileptic activity correlates with metabolic alterations in 1H-MRS

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Introduction:

In the following study the degree of hippocampal metabolite alterations in ¹H-MR Spectroscopy (¹H-MRS) were correlated to the findings of intensive video-EEG monitoring and duration of clinical features in patients with TLE.

Patients and methods:

14 consecutive patients diagnosed with mesial TLE by clinical patterns and intensive 24h video EEG monitoring were investigated by high resolution MR Imaging and ¹H-MRS. All seizures were analysed systematically by: the number of clinical seizures in 24h, exact duration of clinical symptoms in 24h, frequency of interictal epileptiform discharges (IEDs) and ictal activity, duration of ictal activity and IEDs occurring within 24 h in intensive EEG monitoring. Short term (TE=30ms) Single Voxel Spectroscopy was carried out in temporomesial structures at 1.5 T in which the voxel comprised the head and anterior body portions of the hippocampus (Figure1). Spectral post processing was carried out by LCModel via water reference (Figure2).

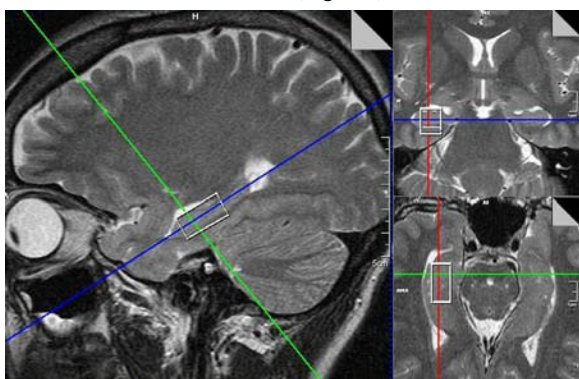


Figure 1

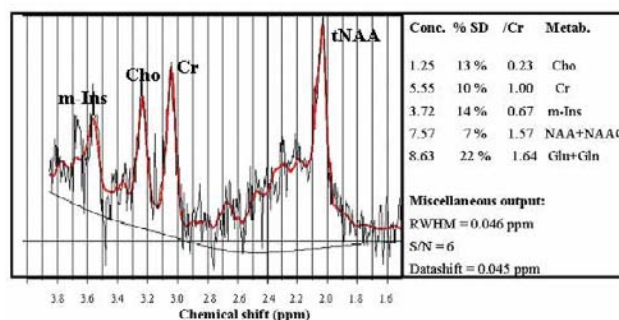


Figure 2

Pearson Correlation Coefficient (PCC) was calculated between alterations of tNAA, Creatin, Cholin, my-Ins and NAA/(Cr+Cho) ratio and frequency of IEDs, ictal activity, number of clinical seizures in 24h, exact duration of clinical symptoms in seconds/24h, and duration of ictal activity and IEDs occurring within intensive EEG monitoring. For all tests, statistical significance was accepted at $p \leq 0.05$. Statistical analysis was performed on SPSS 12.0.

Results:

In our study a significant negative correlation was found between tNAA values and degree of IEDs in 24 h intensive video EEG monitoring ($r = -0.65$; $p = 0.048$) (Figure 3).

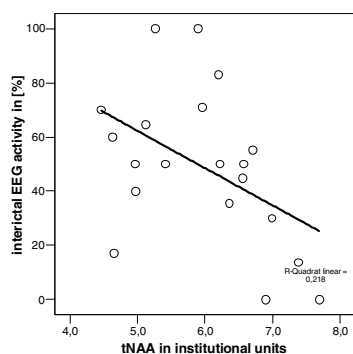


Figure 3

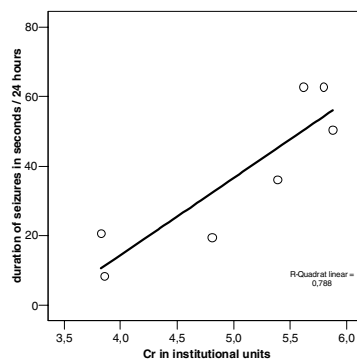


Figure 4

The duration of clinical features indicating temporomesial seizure activity registered by Video monitoring and tNAA/Cr ratio were inversely rated and showed significant correlation ($r = -0.801$; $p = 0.05$). It has to be mentioned here that correlation was not based on changes in tNAA in this case but on increased Cr levels ($r = 0.907$; $p = 0.013$) (Figure4). Neither the degree of ictal discharges in EEG in which ictal activity was related among hemispheres as described above nor duration of ictal patterns in Video EEG monitoring were significantly correlated to the investigated metabolites or metabolite ratios. No correlation was found between metabolite concentrations or metabolite ratios and: 1. Average number of seizures/24h, 2. Duration since last seizure and 3. Seizure frequency under antiepileptic therapy before admission to our epilepsy centre.

Discussion:

Our study supports that ¹H-MRS is able to refer severity of TLE. In our study the severity of tNAA reduction in ¹H-MRS is correlated with the degree of interictal spiking in intensive video EEG monitoring. The degree of interictal spike frequency, which probably classifies the severity of tissue damage correlates with neuronal metabolic dysfunction expressed by degree of tNAA reduction. Duration of clinical symptoms correlated with increased energy turnover and increased Cr signal probably reflects increased energy metabolism, in which Cr plays an important role in transfer of the phosphate group. The question how epileptic discharges abnormality are related to metabolic dysfunction or damage and how pathologic ¹H-MRS spectra are linked to this phenomena remains still unclear in detail especially in regard to grading of ictal EEG patterns.