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Reliability and reproducibility of single-voxel spectroscopy of the hippocampus in 1,342 consecutive studies of 670 patients with epilepsy

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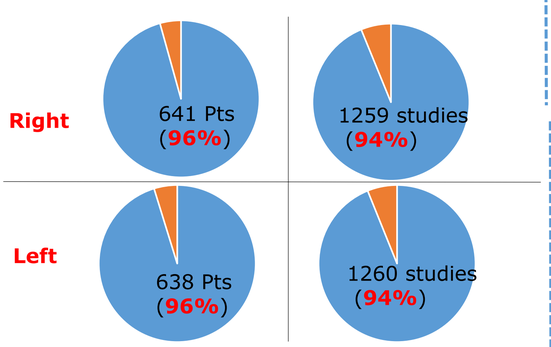
<Purpose>

Proton magnetic resonance spectroscopy (MRS) of the hippocampus has demonstrated neuronal dysfunction in patients with various types of epilepsy and other neurological diseases.

Our aim was to evaluate the **reliability** and **reproducibility** of single-voxel spectroscopy of the hippocampus.

<Reliability 94% >

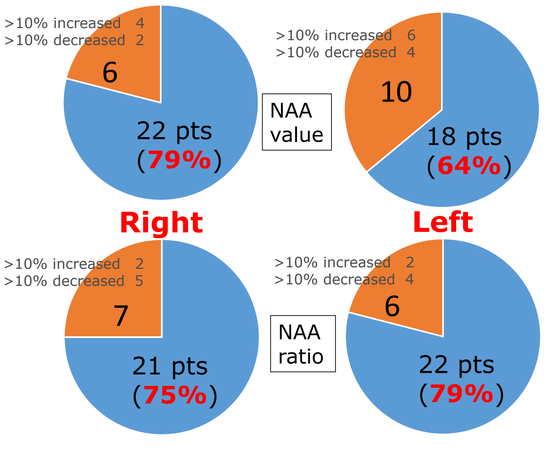
The number of evaluated NAA value and ratio in 670 pts with 1342 studies



<Reproducibility in longitudinal change>

- Longitudinal metabolic changes were studied in 28 IGE of 86 patients who had more than 3 MRS studies over more than 3 years.
- In 28 IGE patients, 20 had no seizures and 8 only had a few seizures per year.
- They had no organic lesions and seemed to be less affected directly within the hippocampus.
- Longitudinal reproducibility means less than 10% change in comparing the final with initial MRS study in NAA values and ratios.
- There were no differences in longitudinal change of NAA values and ratios between patients with no or a few seizures on both sides of the hippocampus.

<Longitudinal reproducibility>



<Methods>

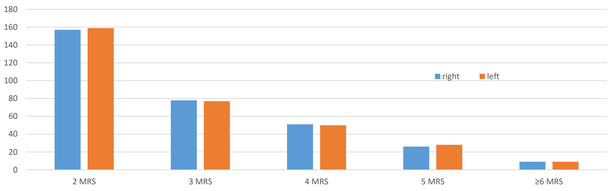
A total 1,342 consecutive magnetic resonance spectroscopy (MRS) studies performed on 670 patients with epilepsy and associated disorders from May 2010 to November 2015 were evaluated.

Quantitative single-voxel MRS was conducted at 1.5 Tesla with a sequence of TR/TE =1,323/136 milliseconds and a voxel size of 30x15x15 mm in both hippocampi.

LC-Model was used to estimate the absolute concentrations of *N*-acetyl-aspartate (NAA), choline (Cho), and creatine (Cr), and the ratio of NAA to Cho+Cr (NAA ratio).The results with less than 10% standard deviation of full width at half maximum were evaluated as accepted data.

The ratio of accepted data to performed studies represents **reliability**. Longitudinal metabolic changes were studied in 28 patients with idiopathic generalized epilepsy (IGE) who had more than 3 MRS studies over more than 3 years to evaluate **reproducibility**.

<More than 2 MRS studies>

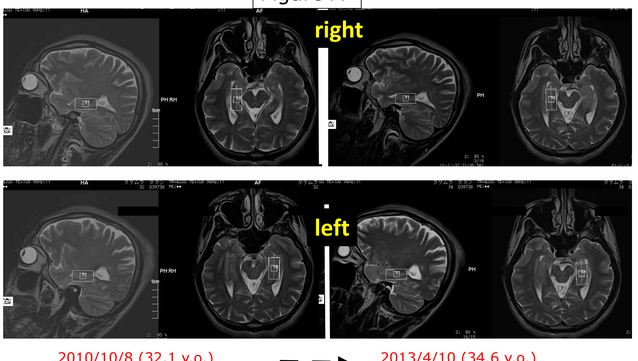


<Individual reproducibility >

- bilateral NAA, Cho, and Cr values were the same in 1 patient in studies 2.5 years apart (Figure A, B)

→This data showed perfect reproducibility of the position setting of the region of interest in the hippocampus in studies more than 2 years apart.

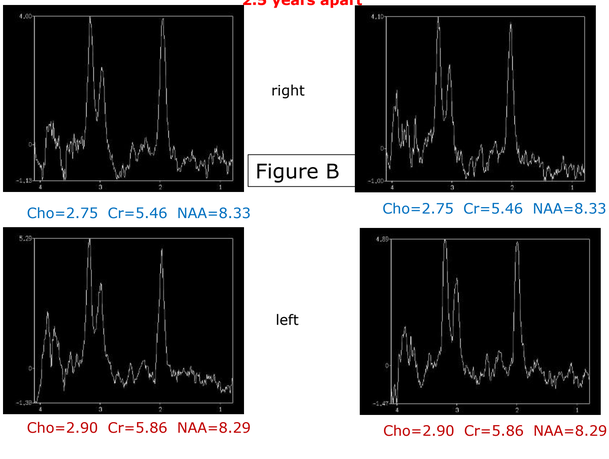
Figure A



2010/10/8 (32.1 y.o.) → 2013/4/10 (34.6 y.o.)

2.5 years apart

Figure B



Cho=2.75 Cr=5.46 NAA=8.33

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Cho=2.90 Cr=5.86 NAA=8.29

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<Discussions and Conclusions>

- Our study showed that NAA values and ratios using MRS measurement methods were useful, stable, and reliable, and were able to evaluate hippocampal metabolic function in 95% of patients.
- Longitudinal MRS data after more than 3 years revealed 75% reproducibility with this method. MRS changes including more than a 10% increase or decrease did not affect the frequency of seizures.
- Differences between initial and final MRS data may be attributed to age of epilepsy onset, epilepsy pathogenesis with an abnormal excitation network, or individual variations within each measurement.
- Further longitudinal study of various types of epilepsy and other neurological disorders is needed.