



Longitudinal bilateral hippocampal N-acetyl-aspartate values obtained using magnetic resonance spectroscopy over more than three years in patients with epilepsy

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<Purpose>

Our aim was to evaluate the variation patterns in the hippocampal N-acetyl-aspartate (NAA) value by using single-voxel proton magnetic resonance spectroscopy (MRS) in a longitudinal study over a period of **more than 3 years**.

<Methods>

A total of **1,661** consecutive MRS studies performed on **787** patients with epilepsy. Quantitative MRS was conducted at 1.5 T with a sequence of TR/TE = 1,323/136 milliseconds and a voxel size of 30 x 15 x 15 mm in both hippocampi.

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

Longitudinal changes were studied in **64 patients** who had been **seizure-free** including **28 cases** of idiopathic generalized epilepsy (**IGE**) and **36 cases** of partial epilepsy (**PE**).

We studied the coefficient of variation (**CV**) of hippocampal NAA values over a period of **more than 3 years**, and the various factors in patients who demonstrated a **CV value of more than 10%**.

The bilateral NAA, choline, and creatine values were the same in 1 patient. The NAA values on the right side were the same in 3 patients. These data showed **the reliability of the position setting** of the region of interest in the hippocampus.

In the evaluation of **3 healthy volunteers**, CV of hippocampal NAA values measured three times showed **7.2%** (5.0~9.2%). We assumed that a CV value of more than 10% was meaningful.

<Results>

	GE (n=28, 125 studies)		PE (n=36, 159 studies)	
Onset	2-39 y.o.		2-69 y.o.	
Age	11.5±7.3 **		26.8±19.1	
Age	18.0-60.9 y.o. 33.5±12.3 *		13.4-78.5 y.o. 41.9±17.1	
MRI studies	3-7 times 4.5±1.3		3-7 times 4.4±1.1	
Follow up	3.0-6.4 years 4.4±0.93		3.0-6.4 years 4.3±0.88	
MRS	right	left	right	left
NAA	4.6-10.3 mM 7.8±1.0 **	6.5-10.7 8.6±0.9	3.1-10.8 mM 7.6±1.5 **	3.9-10.4 7.9±1.3
CV	1.9-18.0% 7.5±4.4 *	2.4-11.8% 5.7±2.5	1.7-14.0% 7.2±3.6	1.2-16.5% 6.1±3.7

** : P<0.01 * : P<0.05

<Discussions>

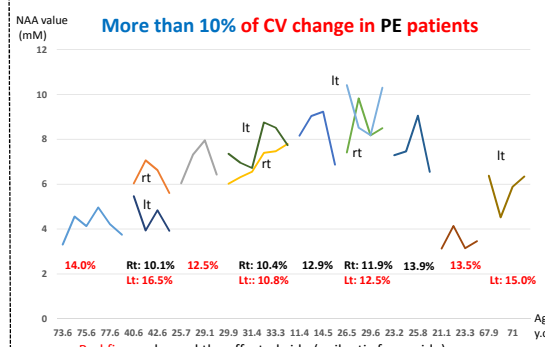
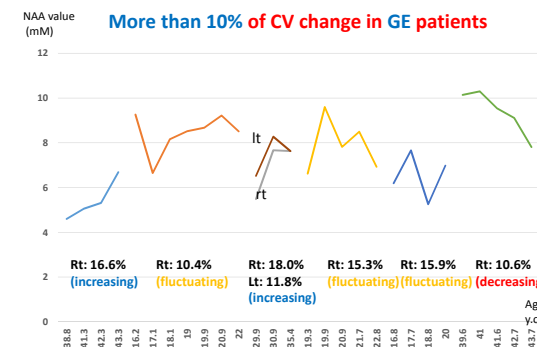
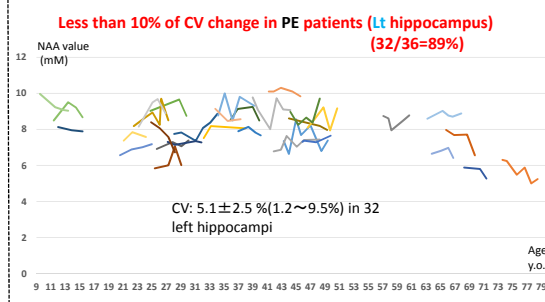
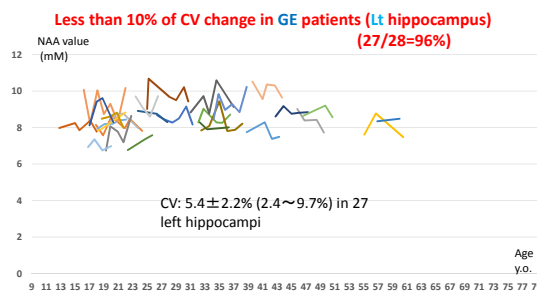
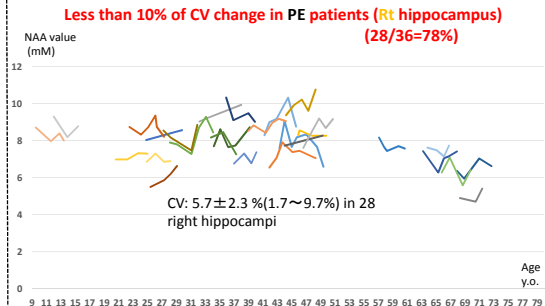
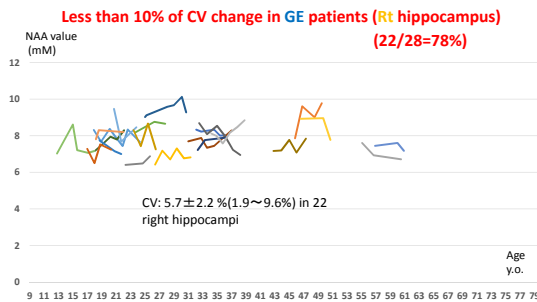
There were **three variation patterns**, including a tendency of **decrement or increment** in NAA values **within 10% CV**, which we assumed were within the **normal range**, and **fluctuating** NAA values with **more than 10% CV**, which we assumed to be an **abnormal pattern**.

A gradual increase in NAA values over more than 3 years might demonstrate **an improvement in hippocampal function** due to seizure control or decrease in antiepileptic drugs.

Decreased NAA values might reflect the **aging effect or impairment in memory function** due to unknown causes.

An increase or decrease in NAA values **within 10% CV** might include the **normal variance of NAA measurements**.

<Results>



<Conclusions>

Fluctuating patterns with more than 10% CV demonstrated the **seizure focus side in the PE group** and the effect of the emotional or social environmental change, such as divorce, especially on the right hippocampus in the IGE group.

NAA value measurement using MRS studies was a useful, stable, and reliable approach to estimate hippocampal function.

Longitudinal NAA measurements are needed to estimate the seizure focus side and to exclude the normal variance for evaluation of ideal hippocampal function.

- ◆ Seven out of 9 patients demonstrating more than 10% of CV showed a larger CV on the epileptic focus side than the unaffected side.
- ◆ Seizure foci were not detected in another two patients.