

Reproducibility of GABA Quantification in the Brain and the Difference of GABA Concentration by Female Genital Cycle Measured by MEGA-PRESS Using Clinical 3T MRI Apparatus

M. Harada¹, H. Kubo², N. Morita², H. Nishitani², and T. Matsuda³

¹Department of Radiologic Technology, University of Tokushima, Tokushima city, Japan, ²University of Tokushima, ³GE Yokogawa Medical Co. Ltd.

Introduction: The measurement of GABA in the brain by MRI may become a useful clinical tool to detect brain function and abnormality in some pathological status, because GABA is one of neurotransmitters mainly existed in suppressive neurons. However, the reproducibility or repeatability of quantified values using a clinical instrument is very important to apply this method to patients and compare values. Furthermore, in order to compare pathological status to normal subjects, it is also important to know the normal variation depending on the brain location and influence of female genital cycle. The purposes of this study are to evaluate reproducibility of GABA values measured by MEGA-PRESS at a clinical 3T machine and differences of GABA values by female genital cycle depending on the several brain locations.

Methods: The sequence of MEGA-PRESS was made following the previous literature and the instrument of MRI was a Signa 3T HD(GE, Milwaukee, US). The quantification of obtained spectrum was conducted using LCModel installed our original basis set measured by the same sequence and measurement parameters (Fig.1). The unsuppressed spectrum without frequency selective inversion pulses at 1.9 ppm was also quantified to evaluate major metabolites (NAA, Cr and Cho) by LCModel. The reproducibility of GABA measurement was conducted by the two measurements at the same portion in each normal volunteer and 20 sets of two spectra were evaluated by the calculation of intra-class correlation coefficient (ICC) and coefficient of variation (CV). Eight females were measured by the same method at both follicular and luteal states.

Results: The ICC of GABA measurement was 0.72 which was a little worse than that of major metabolites such as NAA (ICC=0.82) and Cr (ICC=0.87) (Table). However, the reproducibility of GABA was considered to be acceptable under the clinical measurement because the ICC was more than 0.7. The coefficient of variation of GABA was 4.6-7%, which was a similar value to NAA (CV=5%) and Cr (CV=6%). The GABA concentration in the normal male subjects was different depending in the brain locations. On female subjects, the GABA concentration in the follicular state at the basal ganglia and frontal lobe was higher than that in the luteal state ($P<0.05$) by pair t-test), but no significant difference was found at the cingulate gyrus (Fig.2). Though the GABA concentrations in the follicular state were statistically different ($P<0.01$) depending on the brain location, this regional difference became ambiguous in the luteal state ($P>0.05$).

Conclusion: It is considered that MEGA-PRESS at 3T can be used as a clinical valuable technique and the reproducibility is acceptable for the clinical setting. The GABA concentration in the normal brain would be different depending on the location and influential by the female genital cycle.

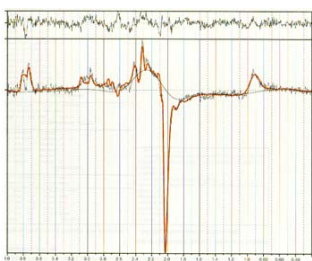


Fig.1 Curve fitting by LCModel

Table: Repeated measurement study

	1st measurement		2nd measurement		ICC
	mean	CV (%)	mean	CV (%)	
GABA	0.89	4.6	0.91	7.0	0.72
NAA	7.6	4.5	7.5	4.9	0.82
Cr	4.4	6.3	4.4	6.3	0.87
Cho	1.2	3.4	1.2	3.3	0.89

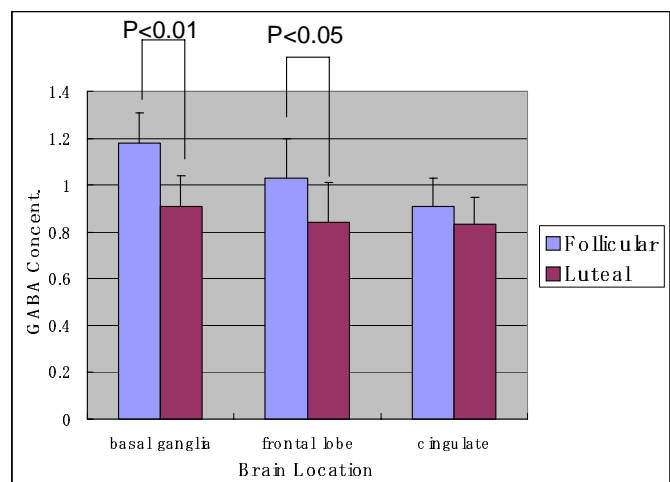


Fig.2 Difference of GABA concentration by female genital cycle