

**Hippocampal NAA as an evaluative
method for memory function:
Japanese normative database**

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Purpose: The aim of the study is to evaluate whether the hippocampal memory functional ability can be evaluated quantitatively with a proton magnetic resonance spectroscopy (1H-MRS), and to establish a 1H-MRS normative database to examine memory dysfunction.

Method: 100 healthy normal volunteers aged between 16 to 74 years old were undertaken to 1H-MRS and Wechsler memory scale-revised (WMS-R) study. Toshiba 1.5T MRI system was used to take 1H-MRS. The regions of interests (ROIs) were placed on both hippocampi. The quantities of N-acetyl aspartate (NAA), choline-containing compounds (Cho) and creatine/phosphocreatine (Cr) in the ROIs were statistically obtained to fit LC-Model analysis. The people who had abnormality in conventional MRI or scored under 85 point in WMS-R were eliminated. 87 were finally taken into account.

Results: The hippocampal NAA values gradually decreased with the age and their correlation coefficient were -0.46 in left and -0.40 in right hippocampus. The WMS-R score did not show any correlation to the MRS values. In raw scores before weighted, the correlation coefficient of NAA and verbal and visual memories showed a little correlations (0.23 to 0.37).

In the scatter diagrams plotted WMS-R subtest scores and MRS value, heterogeneity or discontinuous patterns were observed in score distribution. It is suggested that WMS-R has limited sensitivity for the person with high memory performances in normal adults.

Conclusion: There was a possibility that 1H-MRS could detect memory function according to the age and not related to WMS-R score.

Assigned speakers:

M.D., Ph. D. Nobuyuku Maruyama , Epilepsy
Center, National Hospital Organization,
Nara Medical Center , Nara , Japan

Assigned in sessions:

25.06.2013, 13:30–14:30, Poster Session,
Poster session: Neuropsychology A, Poster
Area



Hippocampal NAA as an evaluating method for memory function. --- from Japanese normative database.



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Objective

The aims of the study are to evaluate whether the hippocampal memory functional ability can be evaluated quantitatively with a proton magnetic resonance spectroscopy (1H-MRS), and to establish a 1H-MRS normative database to examine memory dysfunction.

Patients and Method

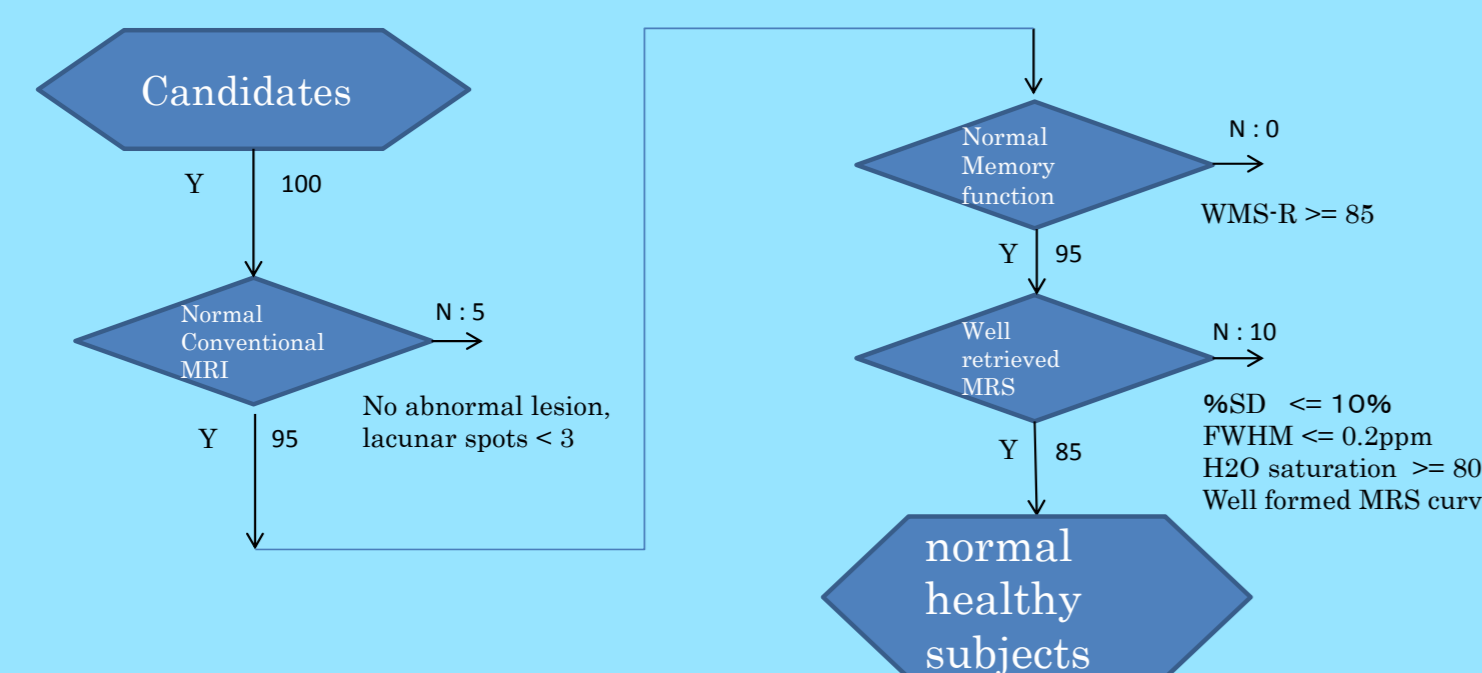
Patients :

Sample Number : 100 initially, and 85 finally
Age variation of the samples: 16 to 74 years old
Informed consent, which were approved with ethical committee in our hospital, were retrieved with written forms.

Methods :

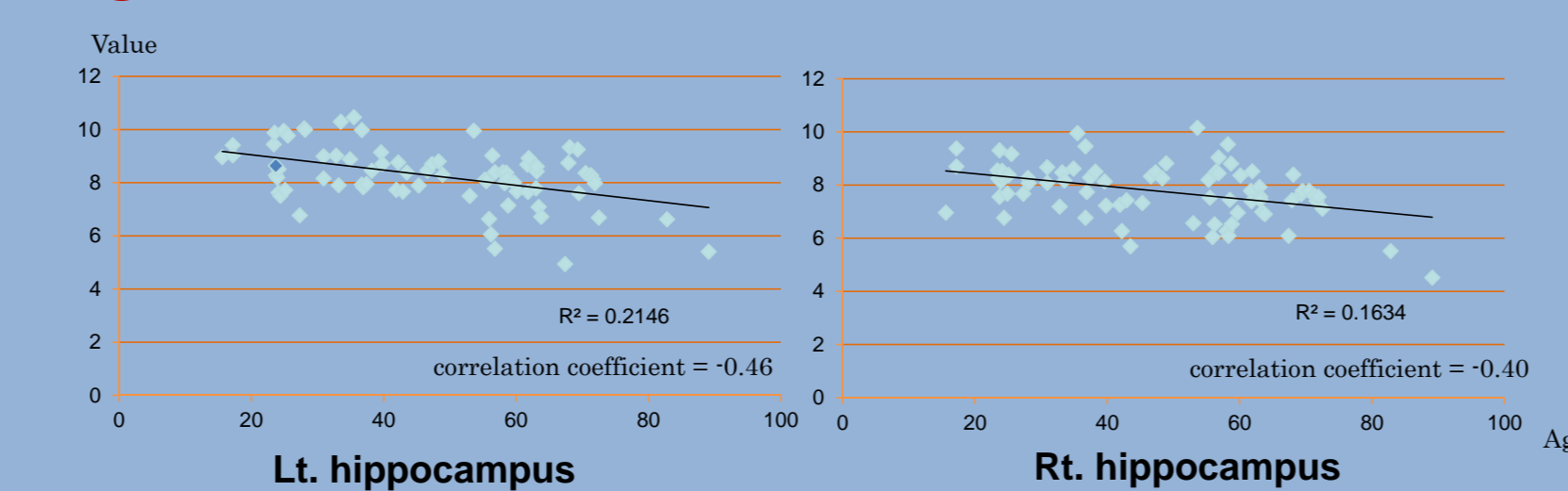
Neuroradiological study
Toshiba 1.5T MRI system
1H-MRS:
TR=1323msec, TE=136msec,
cumulated number 192 , flip angle 90 degree
The regions of interests (ROIs) :
bilateral hippocampi,
3.0cm (AP) X 1.5cm (height) X 1.5 cm (width)
Target substances :
N-acetyl aspartate (NAA),
choline-containing compounds (Cho)
creatine/phosphocreatine (Cr)
Quantitative study:
statistically obtained to fit LC-Model analysis
Memory Function:
Wechsler memory scale-revised (WMS-R)

Algorithm to estimate 'healthy normal volunteers'



Results

Age and NAA value



The NAA values that represent to hippocampal neural function decreased with age. The correlation coefficients were -0.46 in left hippocampus and -0.40 in right one.

correlation coefficients between NAA value and WMS-R score

WMS-R	Lt. hippocampus					Rt. hippocampus				
	Verbal memory	Visual memory	General memory	Attention / Concentration	Delayed recall	Verbal memory	Visual memory	General memory	Attention / concentrate	Delayed recall
Score	0.10	0.14	0.16	-0.01	0.13	0.10	0.18	0.15	0.15	0.19
Raw Data	0.23	0.35	0.29	0.28	0.37	0.27	0.37	0.33	0.21	0.36

The WMS-R scores showed no correlation to the NAA values. In raw scores before weighted, the correlation coefficient of NAA and both of verbal and visual memories showed a little correlations.

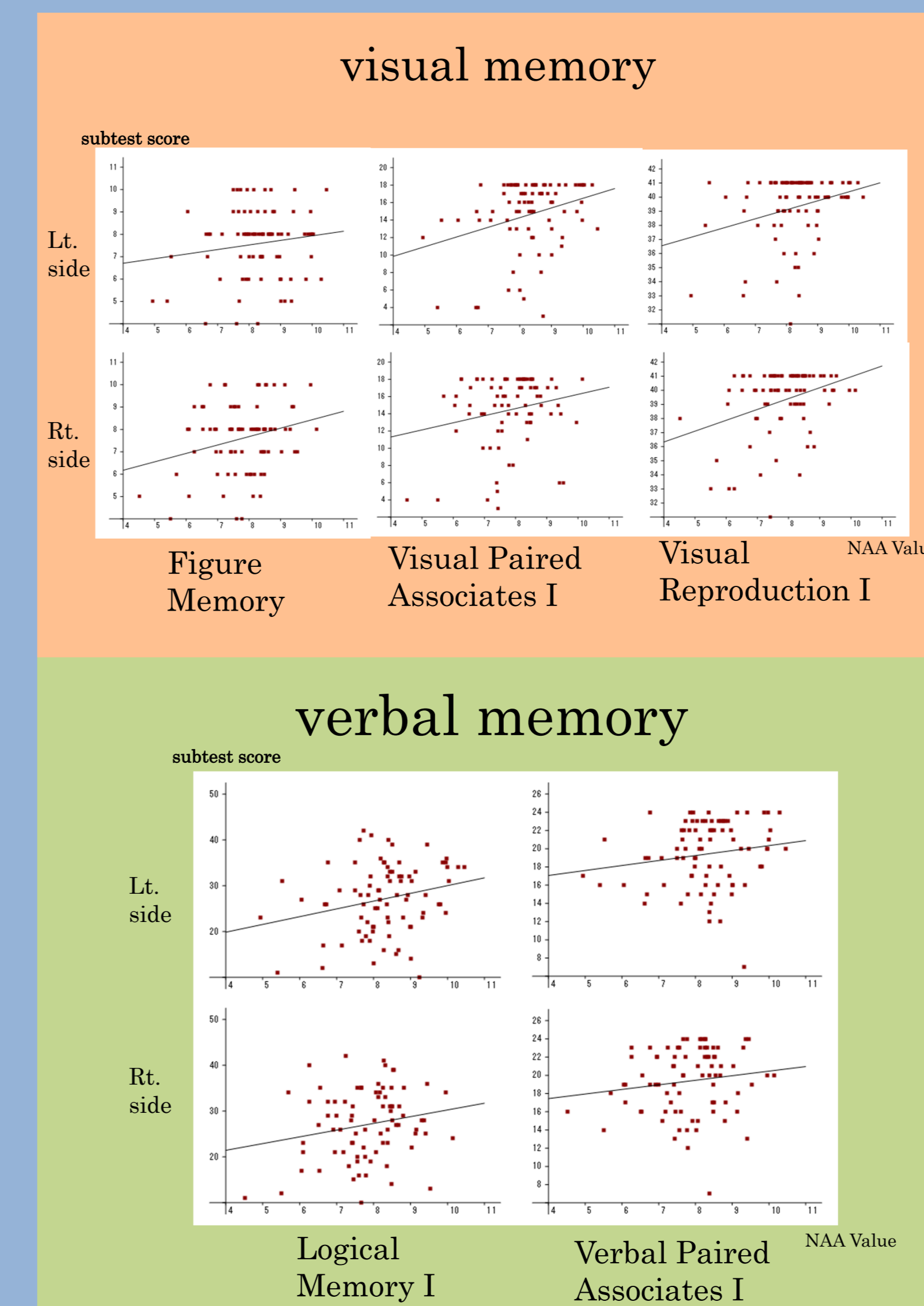
Distribution of the WMS-R subset sample

- Subtests used for Verbal memory evaluation
- Subtests used for Visual memory evaluation

	Information & Orientation	Mental Control	Figure Memory	Logical Memory I	Visual Paired Associates I	Verbal Paired Associates I	Visual Reproduction I	digit span	Visual Memory Span	Logical Memory II	Visual Paired Associates II	Verbal Paired Associates II	Visual Reproduction II
Normal distribution	Y	Y	Y	N	N	N	Y	Y	Y	N	N	N	N

The NAA values and the age of our sample was normally-distributed, however, most WMS-R raw scores were not.

Scattered diagrams of NAA values and WMS-R subtest scores



Right or left dominancy in the correlation coefficient of hippocampal NAA and WMS-R subtests

	Information & Orientation	Mental Control	figure memory	Logical Memory I	Visual Paired Associates I	Verbal Paired Associates I	Visual Reproduction I	digit span	Visual Memory Span	Logical Memory II	Visual Paired Associates II	Verbal Paired Associates II	Visual Reproduction II
Rt.	0.13	0.26	0.23	0.21	0.26	0.22	0.33	0.24	0.25	0.21	0.43	0.11	0.39
Lt.	0.05	0.22	0.20	0.26	0.32	0.21	0.29	0.13	0.21	0.21	0.39	0.03	0.44

The correlation coefficient of NAA and WMS-R subtests showed a little correlations (0.23 to 0.37).

Discussion

WMS-R score is a statistically calculated data that average score of each of nine subdivided age groups are supposed to be anchored at 100. The WMS-R score did NOT correlate with age and NAA value.

Thus, we have to use raw data to analyze absolute memory function.

In the scatter diagram plotted WMS-R subtest scores and NAA value, heterogeneity or discontinuous patterns were observed in score distributions.

WMS-R could have limited sensitivity for the person with high memory performances in normal adults.

The NAA values that represent to hippocampal neural function were correlated with age.

Conclusion

The hippocampal NAA values in a healthy person, which represent to hippocampal neural function, were correlated to his age.

WMS-R subtests and raw data showed a little correlations with NAA value.

There was a possibility that 1H-MRS could detect memory function more precisely than WMS-R score.