

VISUAL RATING AND VOLUMETRY OF HIPPOCAMPUS ON MAGNETIC RESONANCE IMAGING IN ALZHEIMER DISEASE

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BACKGROUND AND AIMS

The new proposal of revised diagnostic criteria for Alzheimer disease (AD) is based on early and significant episodic memory impairment. It should be supported by at least one or more abnormal biomarkers among structural neuroimaging with magnetic resonance imaging (MRI), molecular neuroimaging with PET and cerebrospinal fluid analysis of amyloid beta or tau proteins. The volume loss of hippocampi, entorhinal cortex, amygdala on MRI is common in AD (71-96 %, depending on disease severity) and can be measured with qualitative ratings using visual scoring or quantitative volumetry of regions of interest.

METHODS

In 20 patients with probable Alzheimer disease and 29 cognitively normal elderly medial temporal lobe atrophy (MTA) was measured by volumetry using manual tracing of the hippocampus. The volume of the hippocampus was also rated into five categories expressed as MTA scores ranging from 0 (no atrophy) to 4 (severe atrophy) (fig. 1) using a simple and quick semiquantitative method according to the published combined widths or the height of selected three mediotemporal structures (fig. 2).

Fig. 1

Representative magnetic resonance images showing medial temporal atrophy ratings. See fig. 2 for complete descriptions of the ratings.

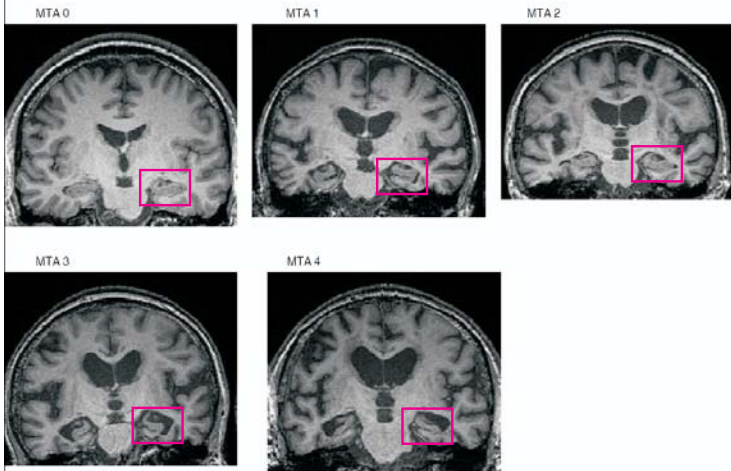


Fig. 2 Medial Temporal Atrophy Rating Algorithm

Score	Width of Choroidal Fissure	Width of Temporal Horn	Height of Hippocampus
0	Normal	Normal	Normal
1	Mildly widened	Normal	Normal
2	Moderately widened	Mildly widened	Mildly reduced
3	Markedly widened	Moderately widened	Moderately reduced
4	Markedly widened	Markedly widened	Markedly reduced

RESULTS

In comparison to controls, AD patients had significantly smaller volume of either hippocampus (median volume of the hippocampus in cm³):

	Controls	Alzheimer disease	p	figure
right hippocampus	2,23	1,81	0,001	3
left hippocampus	2,14	1,6	0,003	4
both hippocampi	4,31	3,40	0,0004	5

Fig. 3 Right hippocampal volumes in controls and Alzheimer disease patients

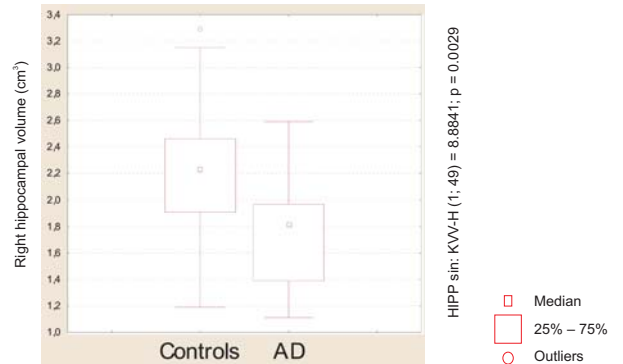


Fig. 4 Left hippocampal volumes in controls and Alzheimer disease patients

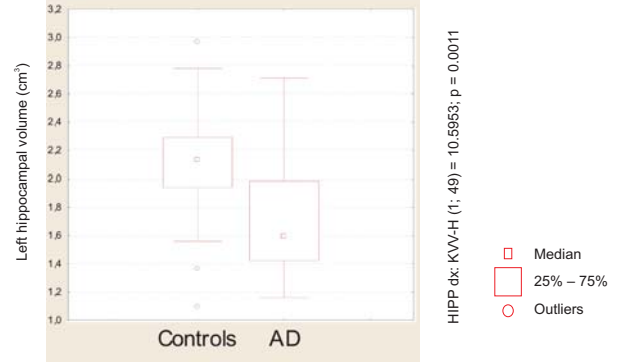
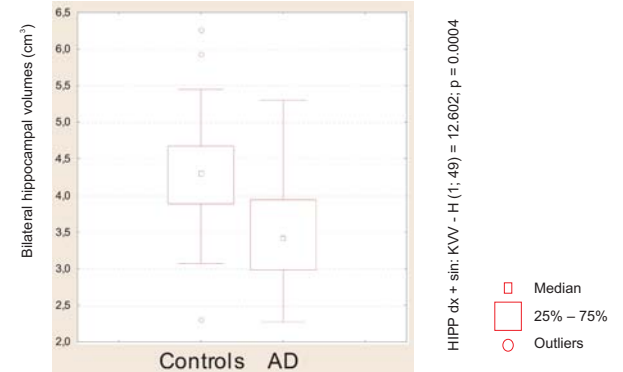


Fig. 5 Bilateral hippocampal volumes in controls and Alzheimer disease patients



The total MTA score of both sides were significantly higher in AD patients (median 4) than that in controls (median 1) (p=0,0004). Nearly 60 % cognitively normal seniors had the MTA score ≤ 0.5. A similar proportion of patients with AD (65 %) had the MTA score ≥ 2 (fig. 6, 7).

Fig. 6 MTA score in cognitively normal seniors

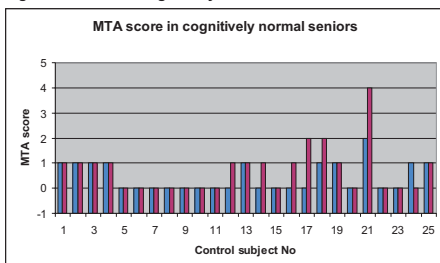
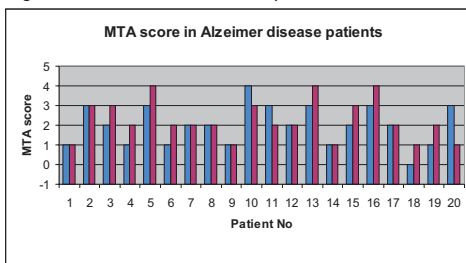


Fig. 7 MTA score in Alzheimer disease patients



CONCLUSION

Atrophy of medial temporal structures can be detected by visual rating and volumetry on MRI in patients with AD. Visual MTA rating is the easier and quicker method than more accurate and time consuming volumetry to support the diagnosis of AD on the brain MR imaging.

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