

Memory performance in multiple sclerosis patients correlates with central brain atrophy

H Hildebrandt^{1,2}, HK Hahn³, JA Kraus¹, A Schulte-Herbrüggen^{1,2}, B Schwarze⁴ and G Schwendemann¹

Objective To assess whole brain and central brain atrophy as well as their differential relation to memory, cognitive performance, fatigue, depression and quality of life in patients with relapsing-remitting multiple sclerosis (RRMS).

Methods A 3D flow compensated gradient recalled T1-weighted MRI was acquired in 45 RRMS patients. An automated analysis tool was used to calculate brain parenchymal fraction (BPF) and ventricular brain fraction (VF). All patients were assessed with neuropsychological tests focusing on memory and self-rating scales for depression, fatigue and quality of life. Age corrected partial correlations between brain atrophy, motor performance, psychological scales and test scores were calculated.

Results BPF correlated moderately ($0.3 \leq r < 0.5$) with duration of symptoms and disease, the Expanded Disability Status Scale (EDSS), the upper extremity motor performance, and with mental aspects of quality of life. VF correlated moderately with EDSS, upper and lower extremity motor performance and memory functions. Neither BPF nor VF correlated with fatigue and depression. Results of several cognitive tests correlated moderately with depression and fatigue, the Paced Auditory Serial Addition Test (PASAT) showing the largest correlation.

Conclusions Memory performance shows a correlation with relative ventricular size in RRMS patients, indicating the strategic location of the ventricle system along the structures of the limbic system and its vulnerability in MS. The PASAT and several other cognitive tests show moderate correlations with depression and fatigue, arguing for an inter relation between the cognitive functioning and the emotional state of patients. However, this relation is independent of measurable brain atrophy. *Multiple Sclerosis* 2006; 12: 428–436. www.multiplesclerosisjournal.com

Key words: brain atrophy; depression; memory; MRI; multiple sclerosis; quality of life

Introduction

Previous studies revealed weak to moderate correlations between brain atrophy and cognitive functions in multiple sclerosis (MS) (for a review see Benedict *et al.* [1]). However, the methods to estimate brain atrophy varied considerably (from manual measurement of ventricular size in one slice

of a CT scan to semi-automated programs for the analysis of high resolution structural MRI). In addition, authors focused on different regions of interest: some analysed third ventricle width [2], others analysed bicaudate ratio [3], or corpus callosum thickness [4], and their relation to cognitive functions. More recent studies used high resolution structural MRI and encompassing mea-

¹ Department of Neurology, Klinikum Bremen-Ost, Züricher Str. 40, 28325 Bremen, Germany

² University of Oldenburg, Institute for Psychology, 26111 Oldenburg, Germany

³ MeVis, Center for Medical Diagnostic Systems and Visualization, Universitätsallee 29, 28359 Bremen, Germany

⁴ Department of Radiology, Klinikum Bremen-Ost, Züricher Str. 40, 28325 Bremen, Germany

Address for correspondence: Helmut Hildebrandt, Ph.D., Department of Neurology, Klinikum Bremen-Ost, Züricher Str. 40, 28325 Bremen, Germany. E-mail: helmut.hildebrandt@uni-oldenburg.de

Received 9 April 2005; accepted 2 August 2005