Volumetric brain MRI measurements in a retrospective Belgian multi-center MRI biomarker study in dementia - REMEMBER

E. Niemantsverdriet[1], D. Smeets[2], C. Bastin[3], J.C. Bier[4], O. Deryck[5], P.P. De Deyn[1,6], D. De Surgeloose[7], C. Gilles[8], A. Ivanoiu[9], E. Mormont[10,11], P.M. Parizel[12], G. Picard[13], E. Salmon[3,14], K. Segers[15], A. Sieben[16], E. Thiery[17], J. Tournoy[17,18], E. Triau[19], R. Vandenberghe[20,21], M. Vandewoude[22], J. Versijpt[23], S. Engelborghs[1,6]

[1]Reference Center for Biological Markers of Dementia (BIODEM), Laboratory of Neurochemistry and Behavior, Institute Born-Bunge, University of Antwerp, Antwerp, Belgium
[2]icometrix, Louvain, Belgium
[3]GIGA-Cyclotron Research Center In Vivo Imaging, University of Liège, Liège, Belgium
[4]Department of Neurology, Hôpital Erasme, ULB, Brussels, Belgium
[5]Neurology Department and Centre for Cognitive Disorders, AZ Sint-Jan Brugge-Oostende, Belgium
[6]Department of Neurology and Memory Clinic, Hospital Network Antwerp (ZNA) Middelheim and Hoge Beuken, Antwerp, Belgium
[7]Department of Radiology, Hospital Network Antwerp (ZNA) Middelheim, Antwerp, Belgium
[8]Cognitive and Behavioral Geriatrics, Centre Hospitalier de l'Ardenne, Memory Clinic, Libramont-Chevigny, Belgium
[9]Department of Neurology, St Luc Hospital, Institute of Neuroscience, UCL, Brussels, Belgium
[10]Université catholique de Louvain, CHU UCL Namur, Department of Neurology, Yvoir, Belgium
[11]UCL Institute of Neuroscience (IoNS), Brussels, Belgium
[12]Department of Radiology, Antwerp University Hospital, University of Antwerp, Antwerp, Belgium
[13]Neurology Department, Clinique Saint-Pierre, Ottignies, Belgium
[14]Memory Clinic, CHU Liège, Liège, Belgium
[15]Neurology Department, University Hospital Brugmann, Brussels, Belgium
[16]Department of Neurology, Ghent University Hospital, Ghent University, Ghent, Belgium
[17]Department of Clinical and Experimental Medicine, KU Leuven, Louvain, Belgium
[18]Geriatric Medicine, University Hospitals Leuven, Louvain, Belgium
[19]Neurology Consult Leuven, Louvain, Belgium
[20]Department of Neurology and Memory Clinic, University Hospitals Leuven, Louvain, Belgium
[21]Laboratory for Cognitive Neurology, Department of Neurosciences, KU Leuven, Louvain, Belgium
[22]Department of Geriatrics, Hospital Network Antwerp (ZNA) Middelheim and University of Antwerp, Antwerp, Belgium
[23]Department of Neurology and Memory Clinic, UZ Brussel, Brussels, Belgium
All centers are part of the Belgian Dementia Council (BeDeCo)

Background

Hippocampal atrophy is a well-known feature of Alzheimer's disease (AD). Also, whole brain and (whole) grey matter (GM) volumes have been used as neuroimaging biomarkers for AD. Since these anatomical structures are considerably larger than the hippocampus, automated quantification of their volumes is less prone to measurement errors.

Methods

The Belgian Dementia Council (BeDeCo) initiated a retrospective, multi-center Belgian study on magnetic resonance imaging (MRI) as a biomarker for AD. Using advanced image analysis techniques, which generate automated and reproducible volumetric measurements, we will investigate hippocampal volume, cortical volume, (whole) GM volume, and whole brain volume in subjects with subjective cognitive decline (SCD), mild cognitive impairment (MCI) and AD dementia, as well as in

cognitively healthy elderly. Subanalyses related to disease progression will be performed in subjects who underwent MRI scans and neuropsychological evaluations at least two time points.

Results

Preliminary data, based on data from five out of ten centers, consist of 482 baseline MRI scans in cognitively healthy controls (n=45), SCD (n=80), MCI (n=178), and AD dementia patients (n=179). Thirty-six MRI brain volumetric measurements were excluded based on a quality check. Longitudinal MRI scans were available in 75 subjects, of which four SCD patients converted to MCI and 11 from MCI to AD dementia.

In contrast to gender, age was significantly different between diagnostic groups. AD dementia patients had a significantly smaller whole brain, GM, and WM volume than cognitively healthy controls, SCD, and MCI patients. Correction for age and center did not affect the significant differences .

Cerebrovascular lesion volumes were measured if FLAIR sequences were available (n=442). In total, 95 volumetric lesion volumes were rejected due to limited quality. Lesion volumes were not significantly different between diagnostic groups.

Discussion

The primary objective of this study was to assess the diagnostic value of automated MRI volumetric measures in the AD continuum as compared to healthy controls in a real-life clinical context. The secondary objective of this study will be to validate the volumetric techniques as an early diagnostic marker for AD and as a possible predictor for clinical progression. Also, we will calculate the correlation between hippocampal volume and total brain volume with disease duration (based on an estimation of the first disease symptoms).

Conclusion

Preliminary data suggest that volumetric MRI measurements, whole brain, GM, WM, and CSF could differentiate between AD dementia patients and cognitively healthy controls, SCD, and MCI patients.