Deep Gray Matter Atrophy in a Large Sample of Clinically Isolated Syndrome and Early Relapsing-Remitting Multiple Sclerosis Patients

N. Bergsland[1], M. G. Dwyer[1], D. Horakova[2], O. Dolezal[1], Z. Seidl[3], M. Vaneckova[3], E. Havrdova[2], and R. Zivadinov[4]
[1]University at Buffalo, Buffalo Neuroimaging Analysis Center, Buffalo, NY, United States, [2]Charles University, Department of Neurology, Prague, Czech Republic, [3]Charles University, Department of Radiology, Prague, Czech Republic, [4]Neurology, Buffalo Neuroimaging Analysis Center, Buffalo, NY, United States

Objectives: To quantify deep gray matter (DGM) atrophy in a large sample of clinically isolated syndrome (CIS) patients, early relapsing-remitting (RR) multiple sclerosis (MS) patients, and healthy controls (HC). To investigate the relationship between DGM atrophy and disability in CIS patients.
Background: While GM atrophy is implicated in all stages of MS, it is not completely elucidated whether differences exist in DGM structures between CIS and early RRMS patients.
Methods: Two-hundred and nineteen (219) CIS patients recruited at the time of first clinical event (mean age 29 yrs, median EDSS 1.5), one hundred and eighty (180) early RRMS patients (mean age 30.6 yrs, median EDSS 2.0, median disease duration 3.9 years) and 30 age- and sex-matched HC to RRMS were imaged on a 1.5T Philips scanner using a high-resolution 3D-T1-SPGR sequence. Volumetric data for DGM structures (caudate, putamen, globus pallidus, thalamus, hippocampus, amygdala, nucleus accumbens) was obtained via automated parcellation of the images using the FSL FIRST software. A multivariate regression model analysis controlled for age and sex was used to evaluate DGM volumes group differences.
Results: CIS patients presented significantly lower DGM volumes compared to the HC in following structures: left caudate (-6.7%, $p<0.001$), left amygdala (-4.8%, $p=0.039$), left thalamus (-3.5%, $p=0.048$) and right caudate (-2%, $p=0.019$). RRMS patients presented significantly lower DGM volumes compared to the CIS group for right caudate (-8.8%, $p<0.001$), right amygdala (-5.6%, $p<0.001$), right thalamus (-5.5%, $p<0.001$), left thalamus (-3.5%, $p=0.01$) and left caudate (-0.3%, $p<0.001$). The DGM volume differences between RRMS and NC were in expected direction. In CIS patients, caudate, putamen and thalamic atrophy was related to higher EDSS (all $p<0.0001$).
Conclusions: DGM atrophy in caudate, thalamus and amygdala is present from first clinical onset and accelerates significantly over first 4 years of the disease. DGM atrophy is an important predictor of disability at the first clinical event.

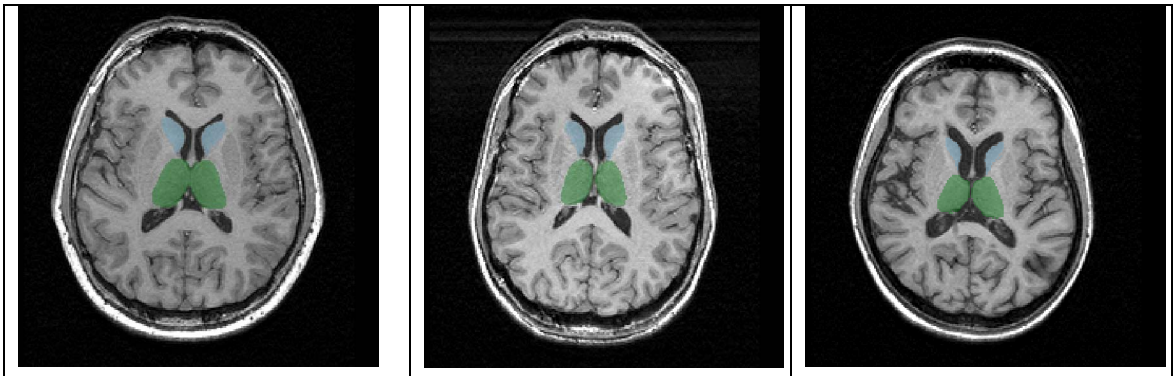

Figure 1: Differences in thalamic (green) and caudate (blue) volumes in representative healthy control, clinically isolated syndrome, and relapsing remitting participants.