

Neuroimaging correlates of postural instability in motor subtypes of Parkinson's disease

Andrea Quattrone¹, C. Calomino², A. Sarica², M.E. Caligiuri², M.G. Bianco², B. Vescio³, J. Buonocore¹, M.G. Vaccaro², A. Quattrone^{2,3}

¹Institute of Neurology, Department of Medical and Surgical Sciences, Magna Graecia University, Catanzaro, Italy

²Neuroscience Research Center, Department of Medical and Surgical Sciences, University "Magna Graecia", Catanzaro, Italy

³Neuroimaging Research Unit, Institute of Molecular Bioimaging and Physiology, National Research Council, Catanzaro, Italy

Objective: Neuroimaging correlates of postural instability (PI) in Parkinson's disease (PD) are largely unknown. We aimed to identify the brain structures associated with PI in PD subtypes using different MRI approaches.

Methods: We consecutively enrolled 142 PD patients (postural-instability-and-gait-difficulty [PIGD], n=66; tremor-dominant [TD], n=76) and 45 control subjects. PI was assessed using MDS-UPDRS-III pull-test item (PT). A whole-brain multi-regression analysis identified brain areas where grey matter (GM) volume correlated with the PT score in PD. Voxel-based morphometry (VBM) and Tract-Based Spatial Statistics (TBSS) were used to compare unsteady (PT³1) and steady (PT=0) PD patients. Associations between GM volume in regions of interest and several clinical features were then investigated using a multivariate regression analysis.

Results: PI was present in 65.1% of PIGD and 26.3% of TD patients. The whole-brain multi-regression analysis identified bilateral inferior frontal gyrus (IFG) and superior temporal gyrus (STG) as the only regions associated with the PT score. VBM showed reduced GM volume in fronto-temporal areas (superior, middle, medial and inferior frontal gyrus, and STG) in unsteady compared with steady PD patients, while TBSS did not show any difference between groups. GM volume in these fronto-temporal areas was significantly associated with the PT score, after correcting for confounding factors.

Conclusions: This study demonstrates a significant atrophy of the IFG and STG in unsteady PD patients, suggesting that these brain areas may play a role in the pathophysiological mechanisms underlying postural instability in PD. This result paves the way for further studies on postural instability in parkinsonism.