Deep grey matter atrophy predicts longitudinal worsening of gait dynamics in progressive MS; a gait biosensor subgroup analysis of the MS-SMART clinical trial [NCT01910259]

D. Paling[1], L. Angelini[2], C. Mazza[2], F. De Angelis[3], G. Brittain[1], E. Buckley[2], S. Nair[1], B. Sharrack[1], J. Chataway[3]

[1]Sheffield Teaching Hospitals NHS Foundation Trust, Department of Neurology, Sheffield, United Kingdom, [2]The University of Sheffield, Department of Mechanical Engineering and INSIGNEO, Sheffield, United Kingdom, [3]University College London (UCL), Queen Square Multiple Sclerosis Centre, Department of Neuroinflammation, London, United Kingdom

Background: Gait impairment is recognised as a key feature of progression in MS. The ethology is complex and includes spasticity, weakness, sensory impairment, and alteration in higher cortical control. Whilst deep grey matter (DGM) volume loss is particularly associated with disability progression, the neuroanatomical and functional sequelae of DGM loss with respect to gait dynamics in MS is not known

Objectives: In this sub-project of the main MS-SMART clinical trial, we performed a longitudinal analysis of data collected by gait biosensors over 96 weeks, using 5 conceptual domains and correlated these with baseline MRI DGM volume.

Methods: Twenty-three people with MS taking part in the MS SMART trial (age: 57±6; 7 males; EDSS at baseline: 5±1; EDSS at 96 week: 6±1) completed gait assessments at baseline and at 96 weeks while wearing inertial biosensors (OPAL sensors, ADPM) on the shanks and lower trunk and walking for 6 minutes. Twenty gait metrics were derived and grouped in 5 conceptual domains.

DGM was segmented from baseline volumetric MRI scans using the Geodesical Information Flows (GIF) algorithm, which is part of theNiftySeg software (TIG, http://cmictig.cs.ucl.ac.uk) (Cardoso et al., 2015) to automatically extract and parcellate deep grey matter structures.

Pearson's correlation tested associations between longitudinal gait change and baseline volumetric MRI normalized DGM volume.

Results: Lower baseline DGM volume was associated with progressive worsening in stride regularity over 96 weeks (rho =0.56, P=0.0071). Grey matter volume did not predict alteration in gait speed, forward and lateral balance and symmetry domains.

Conclusions: Low deep grey matter volume predicts deterioration in gait timing, but not other gait parameters. This may reflect the effect of neurodegeneration in thalamo-cortico-striatal motor circuits controlling gait motor programs and interval timing. The documented effect of deep grey matter loss on disability in MS may be particularly mediated through its effect on deterioration of higher cortical control of gait dynamics.

Disclosure