Grey matter

Grey matter (or gray matter) (lat. Substantia grisea) is a major component of the central nervous system, consisting of neuronal cell bodies, neuropil (dendrites and myelinated as well as unmyelinated axons), glial cells (astroglia and oligodendrocytes) and capillaries.

Grey matter is distinguished from white matter, in that grey matter contains numerous cell bodies and relatively few myelinated axons, while white matter is composed chiefly of long-range myelinated axon tracts and contains relatively very few cell bodies.

The color difference arises mainly from the whiteness of myelin. In living tissue, grey matter actually has a very light grey color with yellowish or pinkish hues, which come from capillary blood vessels and neuronal cell bodies.

Despite robust postmortem evidence and potential clinical importance of gray matter (GM) pathology in multiple sclerosis (MS), assessing GM damage by conventional magnetic resonance imaging (MRI) remains challenging. This prospective cross-sectional study aimed at characterizing the topography of GM microstructural and volumetric alteration in MS using, in addition to brain atrophy measures, three quantitative MRI (qMRI) parameters-magnetization transfer (MT) saturation, longitudinal (R1), and effective transverse (R2*) relaxation rates, derived from data acquired during a single scanning session. Our study involved 35 MS patients (14 relapsing-remitting MS; 21 primary or secondary progressive MS) and 36 age-matched healthy controls (HC). The qMRI maps were computed and segmented in different tissue classes. Voxel-based quantification (VBQ) and voxel-based morphometry (VBM) statistical analyses were carried out using multiple linear regression models. In MS patients compared with HC, three configurations of GM microstructural/volumetric alterations were identified. (a) Co-localization of GM atrophy with significant reduction of MT, R1, and/or R2*, usually observed in primary cortices. (b) Microstructural modifications without significant GM loss: hippocampus and paralimbic cortices, showing reduced MT and/or R1 values without significant atrophy. © Atrophy without significant change in microstructure, identified in deep GM nuclei. In conclusion, this quantitative multiparametric voxel-based approach reveals three different spatially-segregated combinations of GM microstructural/volumetric alterations in MS that might be associated with different neuropathology [1)].

1)
Lommers E, Guillemin C, Reuter G, Fouarge E, Delrue G, Collette F, Degueldre C, Balteau E, Maquet P, Phillips C. Voxel-Based quantitative MRI reveals spatial patterns of grey matter alteration in multiple sclerosis. Hum Brain Mapp. 2020 Nov 6. doi: 10.1002/hbm.25274. Epub ahead of print. PMID: 33155763.