Is primary progressive multiple sclerosis an independent disease entity? – An ultrahigh field MRI lesion analysis

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Target audience: Neurologists, clinicians and scientists interested in multiple sclerosis.

Purpose: Differences in clinical, therapeutic, histopathological, but also magnetic resonance imaging (MRI) features have been described between primary progressive (PPMS) and relapsing remitting multiple sclerosis (RRMS). Hence, the question was raised whether primary progressive MS is part of the MS disease spectrum or rather a disease entity of its own.[1] This work investigates differences between relapsing remitting and primary progressive multiple sclerosis lesions using ultrahigh field MRI to provide further insights into PPMS lesion morphology. These efforts are designed to help to answer the question whether primary progressive MS is part of the MS disease spectrum or rather a disease entity of its own. To meet this goal PPMS patients are matched with RRMS patients.

Methods: Nine patients with PPMS (median Expanded Disability Status Scale (EDSS): 5.5) and nine age- and gender-matched RRMS patients (median EDSS: 2.0) underwent 7 Tesla MRI. The study was approved by the local ethics committee All participants gave informed written consent prior to the study. The acquisition protocol included T_2* weighted fast low angle shot (FLASH, echo time [TE] 25 msec, repetition time [TR] 1820 msec). Images were analyzed regarding gray and white matter lesion morphology, distribution and appearance. Imaging was performed with a 7.0 T whole body MR system (Magnetom, Siemens, Erlangen, Germany) using a 1/24-channel Tx/Rx coil (NovaMedical, Wakefield, MA, USA). Visual image analysis was performed using OsiriX (OsiriX Foundation, Genève, Switzerland, version 4.0) and its integrated region of interest (ROI) function.

Results: We detected 362 brain parenchymal lesions in patients with PP MS and 490 lesions in RR MS patients. Grey and white matter lesions in RRMS and PPMS patients did not significantly differ in terms of MR morphological characteristics: a small central vein was visible (Figure 1) in the majority of both, primary progressive (n=277, 79%) and relapsing remitting (n=394, 69%, p= 0.863) MS lesions. T_2* weighted FLASH depicted characteristic hypointense rims at the edge of PPMS (n=97, 23%) and RRMS (n=99, 21%, p=0.796) plaques. In addition to white matter damage, T_2*w FLASH imaging at 7.0 T visualized 72 MS lesions affecting the grey matter. Further statistical testing revealed no significant group differences neither in GML count (p=0.730), GML frequency (p=0.436) nor in GML subtype distribution between both MS subtypes.

Conclusion: In this ultrahigh field MRI study we analysed the frequency, morphology and distribution of brain white and grey matter pathology in patients with PPMS compared to RRMS. In alignment with previous reports, [2] no significant group differences were found in terms of quantity, localisation, spatial distribution or morphological appearance of both white and grey matter lesions. To conclude, our study supports the hypothesis that PPMS is part of the MS disease spectrum and does not represent a disease entity of its own.

References: 1. Antel J et.al. Acta Neuropathol. 2012 May;123(5):627-38. 2. Tallantyre EC et.al. Neurology. 2011 Feb 8;76(6):534-9.

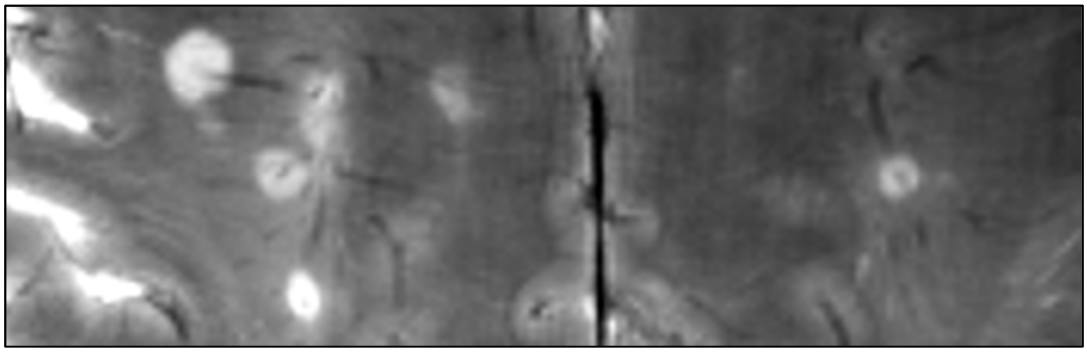

Figure 1. T_2*weighted FLASH imaging at 7.0 T. Lesions in primary progressive MS are typically centered on a small brain vein. Infrequently, a small hypointense rim is visible at the edge of a PPMS plaque.