

TALK TITLE: Quantitative Imaging of White Matter Damage

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HIGHLIGHTS:

- Obtain insights into MS related tissue changes beyond T2-visible focal white matter lesions
- Understand MRI techniques for assessment of subtle damage comprising normal appearing white matter and the integrity of white matter tracts (Magnetic Resonance Spectroscopy, Magnetization Transfer Imaging, Diffusion Weighted Imaging and Diffusion Tensor Imaging)
- Learn about strengths and weaknesses of the different approaches

Within current diagnostic criteria, neurologists and neuroradiologists employ information obtained by conventional MRI on the configuration, number, and distribution of focal hyperintense and/or contrast enhancing white matter lesions to establish an early diagnosis of Multiple Sclerosis (MS).

However, the relationship between the T2-hyperintense lesion load and the clinical status of MS patients is moderate at best, which has been commonly referred to as the „clinico-radiologic paradox“. While focal T2-lesions may confer clinical eloquence if strategically located, they are unspecific in terms of underlying histopathology as they may represent inflammation, edema, gliosis, tissue loss, demyelination or remyelination.

Further, T2-hyperintense white matter lesions in MS only represent the “tip of the iceberg“, as suggested by findings obtained by more advanced MRI techniques such as Magnetic Resonance Spectroscopy (MRS), Magnetization Transfer Imaging (MTI) and Diffusion Weighted Imaging (DWI). These methods have been able to consistently demonstrate that widespread changes are present in the normal appearing white matter in MS and that these partly better correlate with clinical parameters. More importantly, using these techniques allows providing a more detailed picture of the amount and severity of MS-related tissue changes (e.g. extent of axonal loss and demyelination). Diffusion Tensor Imaging further complements this by information on the viability of white matter tracts. Lately, these techniques have consequently also been integrated in treatment trials, in part with the prospect of assessing the neuroprotective potential of drugs.

Knowledge on such techniques aiming to quantify white matter damage in MS should help neurologists, scientists, neuroradiologists, and physicists to obtain a better understanding of the pathophysiology of and of treatment effects on MS. Strengths, weaknesses, and practicability of the different methods will be discussed, to inform attendants how to best integrate these imaging techniques in their research or clinical work-up.

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