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Magnetic resonance imaging in acute and chronic courses of multiple sclerosis diagnosis and therapy

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Multiple Sclerosis (MS) is characterized by inflammatory and neurodegenerative changes in the brain and spinal cord. Measurement of disease activity can be considered at two levels: Clinical parameters which include relapse rate, disability measures and cognitive deficits, as well as physiological parameters which include lesion load and cerebral atrophy. Magnetic Resonance Imaging (MRI) is used to monitor disease activity as it highlights the evolving pathology of the disease. Based on their signal intensities in different MRI sequences, MS lesions show special characteristics: Gd-enhancing lesions in T1-weighted sequences relate to acute disturbances of the blood-brain-barrier and may represent demyelination and axonal deficit; Hyper-intense lesions in T2-weighted sequences are related to unspecific inflammatory changes which can be graded by volume measurements over time and Hypo-intense areas (black holes) in T1-weighted sequences may represent water deposits, myelin loss and axonal loss in the acute phase; 30% become chronic if they persist longer than 6 months. MRI is used in mono or multicenter studies based on evaluations according to common quality standards. The talk will give an overview on the radiological appearance of MS related features. Lesions will be demonstrated and their correlation with clinical parameters will be explained. Guidelines for the interpretation of the MRI data will be discussed. Advanced MRI methods like double inversion recovery (DIR) and Magnetization Transfer (MT) will be demonstrated as they give more detailed information about the status of water content and myelination. Further new attempts to analyse disease activity will be introduced.

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Magnetic resonance imaging in multiple sclerosis: The relevance of brain atrophy in MS

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Multiple Sclerosis (MS) is an inflammatory and neurodegenerative disease which is associated with marked brain atrophy. The magnetic resonance imaging (MRI) is a means of predicting subsequent disability. Brain atrophy occurs early in MS, progresses throughout the course of the disease and affects both gray matter and white matter. Advances in MRI techniques and image processing software improve data quality and allow new outcome measures such as whole brain and local atrophy measurements with acceptable processing times. Measurements of brain atrophy are likely to play an increasing role in MS research and in the diagnosis and staging of the disease. The talk will give an overview on the analysis methodology/software available to study structural changes related to brain atrophy in MR images. In addition, it will be discussed how cortical and deep gray matter atrophy in MS is related to neurodegeneration and how this eventually could lead to clinical and to cognitive problems in relapsing and progressive MS. The talk will also include topics as the relevance of brain volume and atrophy quantification in the context of new emerging treatments and clinical trials. Special emphasis will be placed on multivariate classification techniques which are a promising way to assist in early detection of neurodegenerative brain diseases.

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