Use of quantitative magnetic resonance imaging techniques to stage white matter lesions in multiple sclerosis. MRI-pathology correlation study (pilot)

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Research question and background

The objective of this pilot project is to investigate if quantitative magnetic resonance imaging (qMRI) techniques, T1 relaxometry and magnetization transfer ratio (MTR), can be used to reliably stage white matter (WM) lesions in multiple sclerosis (MS).

WM lesions are classified histopathologically as preactive, active, chronic active, chronic inactive and shadow, depending on their degree of microglial responsiveness, inflammation and demyelination. For clinical purposes, it would be extremely useful if this pathological distinction could be made *in vivo*.

Quantitative MRI techniques have shown to be highly sensitive and are more pathologically specific than conventional MRI techniques.

In order to answer the research question, we use a well-described sample of *post mortem* MS cases with high quality freshly scanned tissue and different WM lesion types from these samples.

Methods and tissues used

Selection and histopathological classification of MS lesions: 26 WM lesions of 9 MS cases scanned with the same qMRI protocol between 2006 and 2007.

Calculation of qMRI maps.

Matching of the selected tissue blocks and lesions to corresponding postmortem T2-weighted MR images.

Lesions, regions of interest (ROIs), are outlined on the T2 images and copied to qMRI (T1 and MTR) maps. ROIs are also placed in the normal-appearing WM of each scan to act as a control measurement for all comparisons.

Analysis of data and results

Mean T1 and MTR values are extracted from the ROIs of WM lesions, and these data will be correlated to histopathologically defined lesion stages. Sensitivity and specificity of the different techniques individually, as well as the strength of their combined detection of underlying histopathological lesion types will be analysed.