

Comparing SWI and R2' for the detection of iron deposition in MS

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INTRODUCTION: It has been shown that iron content measuring [1,2] and susceptibility weighted imaging (SWI) [3,4] are sensitive to the characteristics of multiple sclerosis (MS) lesions, in particular iron content. Based on the observation that SWI can detect lesions not apparent on conventional MS lesion screening protocols, it has been suggested that there may be additional clinical utility in characterizing lesions by their iron content. In addition, it has been shown that SWI is sensitive to increased iron in the basal ganglia and other subcortical regions in MS. We propose to study the clinical utility of SWI and other iron-content sensitive methods, such as R2' and T2 mapping, in MS. In this work, we show that, although both have a high sensitivity to iron content, R2' imaging provides more specificity to iron content in MS patients than SWI.

METHODS: All patient studies were performed on a 3T MRI scanner (TIM Trio, Siemens AG, Erlangen, Germany) with a 12-channel head coil. Three image data sets were acquired for each MS study: SWI, T2W for T2-mapping and T2*W for T2*-mapping. General imaging parameters were: voxel size = 0.5 x 0.4 x 2.0 mm, matrix = 380 x 512 x 40, no gap, phase=L/R, partial Fourier. For T2-mapping, a turbo spin echo (TSE) sequence was used with flow compensation in slice direction and with three different echo signals while for T2*-mapping, a gradient echo sequence was used with flow compensation in slice and readout direction. Four echo signals were used to calculate T2* map. To reduce potential misregistration during scanning due to patient movement, a specially designed bite-bar was used. T2-, T2*-map and finally R2' map were processed off-line by using MATLAB (MathWorks, Natick, MA).



Figure 1. A study of a MS patient. Left: SWI; Right: R2' mapping. Iron deposition in the bilateral globus pallidus interna.

RESULTS: Figure 1 shows SWI phase-filtered images and calculated R2' images in an MS patient with an apparent enhancement of iron deposition in the globus pallidus. The iron is manifested in the SWI image as a hypointensity in the globus pallidus interna. The iron is also clearly seen as a hyperintensity in the same region in the R2' map. However, the phase-filtered image has many additional areas of low intensity primarily due to the presence of vascular structures that make the determination of iron deposition less straightforward than the R2' image.

DISCUSSIONS & CONCLUSIONS: Iron deposition has been associated with pathologic changes in a variety of neurodegenerative diseases including multiple sclerosis. SWI has been shown to be sensitive to iron deposition, however, it is also sensitive to other sources of susceptibility including vascular structures. R2' imaging is a very sensitive and possibly more specific method in comparison to SWI for assessing iron deposition within the brain in multiple sclerosis.

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