

Quantitative Comparison of Susceptibility-weighted Imaging Methods for Detection of Differences in Deep Grey Matter in Multiple Sclerosis

Li L, Frayne R, McCreary C

Abstract

Problem: Investigating signal changes in deep gray matter (DGM) structures is a novel approach to understanding the role of iron in the progression of multiple sclerosis (MS)^{1,2,3}. T2* weighted angiography (SWAN) is a new susceptibility weighted 3D imaging method offering less noise than the traditional T2* weighted gradient recalled echo (T2* GRE) method⁴. We assess the difference between SWAN and T2* GRE and their ability to detect signal changes in DGM structures and image quality.

Method: Five healthy controls and 13 MS patients were selected from an ongoing study. MRI was performed on a 3T MR scanner using the standard protocols for the following sequences: a 3D multi-echo SWAN, a 2D single-echo T2* GRE. Signal measurements were taken in DGM structures with the FMRIB software library and contrast-noise (CNR) and signal-noise (SNR) ratios were calculated. Statistical analysis was conducted with SPSS v19 using two-way ANOVA and post-hoc for weighted and un-weighted means.

Results: An interaction effect was observed between region and module. Controls consistently had a higher signal than MS patients in T2* GRE, however this only occurred in two out of the four regions in SWAN. SWAN demonstrated a higher SNR than T2* GRE offering a cleaner image. T2* GRE and SWAN offered equal contrast on two structures. T2* GRE was considerably superior to SWAN in the remaining two.

Conclusions: SWAN allows for a cleaner image which may provide a qualitative advantage for trained radiologists but is not significantly superior to T2* GRE quantitatively. T2* GRE offered superior contrast to SWAN, providing better separation of tissue. Larger differences in signal intensity between control and MS patients observed in T2* GRE make MS patients more distinguishable. Consistent pattern (control higher than MS) in T2* GRE makes it more reliable than SWAN for detecting changes in DGM structures.

References

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