

The susceptibility weighted magnetic resonance imaging (SWI MRI) in 3D reconstruction reveals atypical morphology white matter (WM) lesions in traumatic brain injuries (TBI)

Introduction

SWI MRI is the best imaging technique so far to detect the microscopic bleedings developing in relation to diffuse axonal injuries (DAI). However, the exact clinical relevance of these lesions is unclear.

Our original objective was to characterize DAI connected hypointensities (lesions) in different severity TBIs in a follow-up study. During the characterisation we found numerous lesions not fully appropriate to the definitive ones. Our further objectives were the examination of the occurrence and importance of these lesions in an available TBI data base.

Methods

In our study we examined the TBI related WM SWI lesions in 22 patients with moderate or severe TBI on T1 weighted and SWI images provided by a Siemens Magnetom Tim Trio 3T device. The control group contained five healthy patients. We performed a linear registration of the T1 and SWI images with software FSL (FMRIB, Oxford), so we were able to localise and coordinate the lesions in the differently weighted images precisely. We also performed the 3D reconstruction of these lesions with another software (3D Slicer), documented the size, the morphology, the localisation and number of them.

Results

Σ43 hypointensities were found in 15 patients. 23 of these were appropriate to the literature definition: WM localisation, 3-10mm diameter, rounded hypointensity (18 subcortical, 11 in the corpus callosum and 4 in the brain stem). We found 10 subcortical, atypical morphology lesions in 7 patients. These lesions were definitive in localization and size, but showed an extension reaching the grey matter or the surface of the brain.

Conclusion

The atypical lesion visualized by 3D reconstruction can be related to vascular or perivascular pathology. Its clinical relevance surely differs from the “classical” axonal injury related lesions’ but its differentiation from it in traditional horizontal plane, not T1 coregistered SWI images is nearly impossible.