

Is microhemorrhage in diffuse axonal injury associated with a poorer white matter condition? A multimodal MRI study on traumatic brain injury

Susceptibility weighted magnetic resonance imaging (SWI MRI) is the most sensitive method so far to detect microscopic bleedings related to DAI. However development of these microbleeds is not inevitable and their clinical relevance is unclear. To elicit whether the “microhaemorrhagic” or the “non-microhaemorrhagic” form of DAI represents poorer white matter conditions, diffusion tensor imaging (DTI) was applied, which is a reliable MRI technique to quantify axonal condition through diffusional parameters, but unfit for clinical use.

10 healthy and 38 mild, moderate or severe traumatic brain injured patients (GCS 15-3) underwent T1, T2, FLAIR, DTI and SWI MR imaging. In order to precise assessment, coregistration of different modalities (FSL FMRIB), and classification of our patients in groups as “microhaemorrhagic”, “non-microhaemorrhagic” lesioned and “MRI negative” was performed. Afterwards diffusional parameters as fractional anisotropy (FA) and mean diffusivity (MD) of predilection regions of DAI (corpus callosum, corona radiata and the brainstem) were measured in each group. Comparison of the FA and MD values with two sample T-test and examination of the correlation between the number of lesions and the DTI parameters via Spearman correlation was performed.

FA values of the corona radiata in “microhaemorrhagic” and “non-microhaemorrhagic” groups differed significantly from the values measured in MRI negative TBI and healthy patients ($p=0,003$). There was no significant difference of FA and MD values in the “microhaemorrhagic” and “non-microhaemorrhagic” groups ($p=0,1149$) and strong correlation could be found between the diffusion parameters of the corona radiata and the amount of “haemorrhagic” and “non-haemorrhagic” lesions ($p=0,0016$; $\rho=-0,49$).

Our study draws attention on the fact that, either the “microhaemorrhagic” and the “non-microhaemorrhagic” forms of DAI represent poorer condition of the white matter, but the FA values in the two forms do not differ significantly. Therefore the most reliable examination of DAI can only be performed through multimodal MRI examination.