

Follow-up susceptibility weighted (SWI) MRI study on traumatic brain injuries (TBI): revealing the lesions' dynamics

Susceptibility weighted magnetic resonance imaging (SWI MRI) is the most sensitive imaging technique so far for detection of cerebral microbleeds (CMBs) developing in relation to diffuse axonal injuries (DAIs) in TBI. The number, the volume and the localisation of the lesions help to estimate the severity of the injury or the prognosis. We started a short-term and a long-term follow-up study to reveal the lesions' temporal development.

Our criteria of inclusion were the following: diagnosed severe, moderate or mild TBI, without any neurological, psychiatric diseases or regular medication. Six patients' acute (first MRI within 72 hours from the trauma, the second one week later), and 9 patients' long-term following (first MRI in a week, the second and further acquisitions months or even years later) could be carried out. In all cases high resolution T1 and SWI acquisitions were performed. We performed „linear registration“ of the different images (sequence and date) for the best comparability in time with the software FSL FLIRT FMRIB- Oxford. We recorded the lesions' (white matter localisation, 3-10 mm diameter, round hypointensities on SWI) visual coordinates and size, examined their appearance, disappearance and volume changes in time.

We noticed the fusion and increase in total volume of lesions located in groups and the volume increase of individual lesions in the acute- subacute period, while some of them remained constant. New lesions did not appear. In the Long-term follow-up, the lesions were detectable years after the trauma in every patient.

Our findings suggest that DAI related microbleed development is not limited to the moment of injury, but microbleeds might progress in days after TBI. This implies that a single time point SWI microbleed status might not to be fully informative to assess DAI severity or patient outcome. Microbleed progression is possibly related to clinical deterioration and poorer prognosis.