

SUMMARY

The aim of this study was to assess the scope of exploitation of the diffusion weighted imaging and other quantitative MR methods in the clinical diagnostics. We calculated the **normal values of fractional anisotropy (FA)** in our group of healthy volunteers and proved **FA dependence on age** in some regions of brain using regression analysis. The relationship was quadratic in the splenium of callosal body, the left pre-central gyrus and in the pyramidal tract at the level of mesencephalon on the right. Linear decrease of FA with age was found in the rostrum of callosal body, in the white matter of frontal lobes, in the anterior limb of internal capsule on both sides and in the pyramidal tract at the level of mesencephalon on the left. In all measured parts of basal ganglia FA increased. Based on our data set, we propose a non-linear **colour look-up table (LUT)** to enhance the pathologic values. The use of this LUT is presented in patients with several neurological disorders.

Quantitative methods were used also for **assessment of the group of patients suffering from ALS**. The changes we expected in the posterior limb of internal capsule were not significant, therefore we suppose that the presence of T2 hyperintensity in this region is not a reliable marker of the disease. T2 relaxometry detected the decrease of T2 relaxation rate in the head of caudate nuclei in patients compared with healthy subjects, which suggests that the subcortical grey matter may play an important role in the pathogenesis of ALS. That is why this region should not be used as an internal reference. VBM analysis proved a correlation of decreased white matter intensity in the corona radiata and the limb component of ALS-FRS. DARTEL method further confirmed a lower intensity of white matter in this region in the ALS patients compared to the control group and turned out to be more sensitive method than optimized VBM protocol. Using TBSS we detected the decrease of FA in the corona radiata and in the rostrum of callosal body.

Preoperative planning represents a territory where quantitative methods only slowly evidence their use. On thirteen cases we present the possibilities of multi-modal fusion of fMRI, tractography and structural data which can be in some cases also combined with a segmentation of lesions in contrast-enhanced subtractions or even using CT data. Based on our experience we can conclude that a probabilistic tractography is a robust method, which allows preoperative fibre tracking even in the case of major pathological changes influencing the tract.