Regional fiber degeneration in the corpus callosum monitored by fractional anisotropy correlates to FLAIR hypodensities and black holes in MS patients

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Purpose: Corpus callosum (CC) white matter fiber integrity in Multiple Sclerosis (MS) can be monitored by Diffusion Tensor Imaging (DTI). T1 hypointense lesions represent chronical tissue damage, while FLAIR hyperdense areas in the CC are seen already in early MS. In this study correlations between DTI results, FLAIR hyperdense areas and black holes are assessed in 7 functional different callosal segments.
Methods and Materials: For 14 patients with secondary progressive MS (age: 32-59 years, mean: 46 years) and 16 matched healthy controls, axial EPI DTI datasets (6 gradient directions, 10 repetitions) and thin sliced sagittal T1 weighted and FLAIR images were acquired at 1.5 T and postprocessed using the MeVisLab© software. CC was subdivided into 7 segments to evaluate local fractional anisotropy (FA), mean diffusivity (MD), black holes and FLAIR hyperdensities. The segments correspond to the cortical regions:1,2,3 - frontal / prefrontal , 4, 5 – sensorimotoric, 6,7 - parietal/midtemporal/occipital areas. Correlations between conventional and DTI based quantitative results were assessed.
Results: In all segments age corrected values of FA were significantly reduced respectively increased in MD in patients compared to controls. FLAIR lesions were frequently found in all segments, compared to fewer black holes. Significant negative resp. positive correlations were shown between FA resp. MD and the relative areas of FLAIR hyperintensity in sections 2,3,4,6,7. In segments 2,3 black holes were significantly correlated to abnormal DTI results.
Conclusion: Hyperintense areas seen in FLAIR images are better predictors for abnormal regional FA and MD results than T1 hypointense lesions.