

Voxel-Based Morphometric Investigations in Basal Ganglia Diseases: Structural Changes and Function

Kassubek J, Sperfeld, A.D. (Ulm)

By use of voxel-based morphometry (VBM) as a whole brain-based observer-independent technique to map local signal changes in the brain, it is possible to analyze patterns of structural alterations in neurological disorders at the group level. Investigations are presented in two different basal ganglia diseases, Huntington's disease (HD) and unilateral tremor-dominant idiopathic Parkinson's disease (IPDt). 3-D MRI data of IPDt patients (n = 10) and HD patients (n = 44), respectively, were studied by VBM in comparison to age-matched healthy controls. In IPDt, regional changes of gray matter density were found in thalamic nuclei strictly contralateral to the tremor; in additional functional analyses, these were shown to co-localize with the results of the SPM analysis of metabolic data gained from 18FDG-PET in the same patient sample. In HD patients, the characteristic topography of striatal changes could be mapped (besides less prominent extrastriatal changes) which co-varied with functional scores from UHDRS, but not with global atrophy. In a further assessment of correlation with brain function, a covariance analysis with cognitive abilities was performed, resulting in the novel finding of double lesions of cortico-basal ganglia-thalamic-cortical loops in HD. In summary, it could be demonstrated that VBM in conjunction with functional analyses, i.e., bi-modal combined voxel-based mapping including PET or co-variance analysis, respectively, has the potential both to illuminate morphological lesions in vivo and to improve the understanding of their association with functional deficits in extrapyramidal diseases.