

5. Summary

Although conventional MR imaging techniques play a crucial role in the examination of the central nervous system (CNS), these techniques can not give any information about functional properties of the brain tissue. Besides conventional MRI techniques, however, there are some MR methods enabling evaluation of these functional properties. These methods include functional magnetic resonance imaging (fMRI), diffusion-weighted imaging (DWI) or diffusion tensor imaging (DTI), and voxel based morphometry (VBM). fMRI is a method monitoring the activity of the individual parts of the brain during specific tasks and thus clarifying their functions. fMRI has become the method of choice especially in neurosurgical procedures planning, when it is necessary to know the relative location of the pathological lesion and to localize functionally important areas of the cerebral cortex, and thereby to reduce the risk of damage associated with the neurosurgical operations. DWI and DTI are very important methods that may be used to assess the severity of cerebral ischemia and the integrity of white matter tracts based on diffusion properties of the brain tissue. Voxel-based morphometry (VBM) is an objective method and fully automated whole brain structural analysis. Neuropathological changes in the brain tissue of patients with neurodegenerative disorders often lead to atrophy. VBM is used to detect structural changes in the gray and white matter between the two groups (patients, controls) and has become a very important tool in research and in clinical applications in various neurodegenerative and neuropsychiatric disorders (e.g. Alzheimer's disease (AD), multiple sclerosis (MS) and obsessive compulsive disorder (OCD)). The above-mentioned methods were used in this thesis both in control subjects and patients with Alzheimer's disease (VBM, DTI), multiple sclerosis (DTI), and obsessive compulsive disorder (VBM) and in pediatric patients (fMRI, DTI) with CNS pathology.

In this thesis, VBM revealed a significant reduction of gray matter in the temporal lobes in patients with AD and confirmed volumetric abnormalities in the medial frontal area in OCD. DTI methods showed a significant reduction in FA and mean diffusivity in the corpus callosum in patients with AD and MS compared to control subjects. DTI and fMRI allow reconstructing white matter tracts or mapping the activity of brain areas and thus contribute to the planning of neurosurgical interventions