

The thesis contains a summary of research of the changes of diffusion parameters of the white matter performed using diffusion tensor imaging (DTI). Because of the diversity of topics discussed, the text is logically divided into chapters. In the first part, the thesis contains two studies concerning the measurement of the regional changes of the diffusion parameters. The second part is dedicated to the use of the method as an instrument to explore the topographic relationships of the pyramidal tract (and other large descending tracts contained within the same space – corticopontine, corticonuclear tracts etc.). Concerning the regional changes of diffusion, the manuscript discusses two problems. One is represented by the distant changes of the pyramidal tract in the brainstem caused by a tumor adjacent to the tract in its supratentorial course, where a significant decrease of the fractional anisotropy (FA) and the increase of the tensor trace value, corresponding to mean diffusivity (MD). The second discussed problem are the artificial changes in the diffusion parameters measured after gadolinium contrast administration, that were showed to be significant even in areas outside of the postcontrast enhancement areas. The second part of the thesis most importantly confirms the accuracy of the depiction of the pyramidal tract with the DTI by correlating the results with electrophysiology – subcortical stimulation during brain tumor resection. Additionally, the somatotopy of the pyramidal tract in its supraventricular portion is explored with the use of DTI correlated with anatomical dissections. A case report of a Chiari III malformation is included at the end of the thesis as an illustration of the utility of the method for preoperative delineation of the eloquent white matter.