IJAE
Vol. 122, n. 1 (Supplement): 148, 2017
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

In-vivo anatomical reconstruction of the optic radiations in the human brain

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The optic radiations are major white matter pathways funneling visual information from the lateral geniculate nuclei to the visual cortex in the occipital lobe. Given their relevance in visual processing and in several brain disorders, the optic radiations have been extensively investigated by using magnetic resonance imaging and diffusion tensor imaging tractography [1]. Herein, we use a powerful diffusion signal modeling, namely Constrained Spherical Deconvolution, in order to provide an exhaustive connectivity profile of the connections between the lateral geniculate nucleus and the visual cortex in the healthy brain, as well as pulvinar connectivity with visual-related structures. In addition, taking into account that visual deficits may precede motor symptoms' onset in Parkinson's Disease [2], we assessed whether the intracranial visual system can be involved at the early stage of the disease. Our connectivity analysis revealed that the optic radiations are mainly distributed in V1 and V2. Furthermore, we found significant alterations of optic radiations connectivity distribution in Parkinson's Disease patients, with decreased lateral geniculate nucleus-V2 density as well as significant increase of optic radiations' mean diffusivity. Voxel Based Morphometry analysis also showed significant reduction of visual cortical volumes and of the optic radiation in the patients group. In conclusion, our findings provide a reliable connectivity profile of the optic radiations, suggesting extrastriate-lateral geniculate nucleus connections in human brain. Finally, we showed that visual system alterations can be detected at early stages of Parkinson's Disease.

References

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Keywords
Optic radiations, tractography, MRI, Parkinson's Disease, brain connectivity