White Matter Tracts Involved In Executive and Communication Impairments Following A Right-Hemisphere Stroke: A MRI-DTI Case Study

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Distinct clinical profiles of communication and cognitive impairments are observed after right hemisphere (RH) stroke. No anatomical correlates have yet been described, suggesting contribution of a more widespread network. Nowadays, magnetic resonance imaging (MRI) techniques such as diffusion tensor imaging (DTI) can be used to study white fiber matter integrity in stroke patients and hence link these results with clinical manifestations.

The aim of this study is to describe the possible contribution of specific association pathways in executive and communicative behaviors in the RH. Executive functions and four domains of communication, such as lexical-semantics, prosody, pragmatic, and discourse have been assessed.

Five RH stroke patients and three healthy controls underwent a MRI-DTI acquisition to assess the integrity of four pathways: the uncinate fasciculus (UF), the arcuate fasciculus (AF), the inferior fronto-occipital (IOFO), and superior longitudinal fasciculus (SLF). A measure of fractional anisotropy (FA), which is a measure of directional diffusivity of water, was extracted for all fasciculi in and outside the lesion site to inform about the integrity of each pathway. Furthermore, probabilistic tractography was performed to visualize the different tracts under study.

Our results show that the integrity of the ventral pathways can be related to greater communicative performances, as a higher FA value was observed with UF and IOFO. Indeed, Right lateral prefrontal cortex and preservation of UF and IOFO are associated with high performance on executive semantic processing. Meanwhile, sole SLF disruption, as shown by probabilistic tractography and a lower FA value, seems to be linked with prosodic impairment. Regarding cognitive profiles, disruption of the SLF is correlated with hemineglect, while AF appears to contribute to the executive functions such as verbal response inhibition and flexibility, but only when lateral prefrontal cortex is damaged. Conversely, preservation of the IOFO does not impede the exhibition of cognitive impairments whether executive or communicational.

To the best of our knowledge, it is the first time that a study explores the association between cognitive impairments and white fibre matter integrity in RH stroke patients. This study highlights the fact that white fibre matter integrity can strongly contribute to communicative and executive functioning after stroke in addition to cortical damages assessment. A combined analysis of grey and white matter lesion site seems more appropriate to establish proper referral and intervention guidelines in cognitive rehabilitation.

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