Contribution of structural and functional connectivity in brain tumour retention: A narrative review

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ABSTRACT

Introduction: Brain tumours present significant challenges in neurosurgery due to their complex interactions with surrounding brain structures. Structural connectivity (SC) maps the physical pathways of the brain using techniques such as diffusion tensor imaging (DTI) and provides a detailed framework of neural pathways and white matter (WM) tracts. These maps are crucial for identifying critical brain regions to avoid during surgery, thus minimizing damage to essential neural circuits. Meanwhile, Functional connectivity (FC) examines the interactions between different brain regions during rest or task performance. This is often performed using functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG). Combining FC and SC data allows for a comprehensive understanding of individual patient neuroanatomy and network functionality. To date, the combined utility of DTI and resting state fMRI (rs-fMRI) has been established in mapping the networks in epilepsy, brain tumours, hydrocephalus, Alzheimer's disease, and Huntington's disease. The potential role of structural connectivity and functional connectivity analysis in neuro surgical planning (preoperative planning, intraoperative guidance, postoperative outcomes) has not been fully explored. **Materials and Methods:** A literature search was carried out to gather eligible studies from the following widely sourced electronic database, PubMed using the combination of the following keywords: structural connectivity, functional connectivity, and tumour. **Results:** There were only two research articles that investigated mapping of whole-brain FC and SC networks (preoperative planning) and only one study that further investigated the clinical applications the connectivity maps in post-operative monitoring. The findings of the studies suggest that brain tumours interfere with the network organization i.e., decrease in structural connectivity and tumour resection of related neural network could worsen the performance of brain networks. **Conclusion:** Combined use of SC and FC analyses in brain tumour surgery represents a transformative approach to neurosurgical practice. However longitudinal studies must be performed to evaluate the efficiency of connectivity-guided neurosurgery.