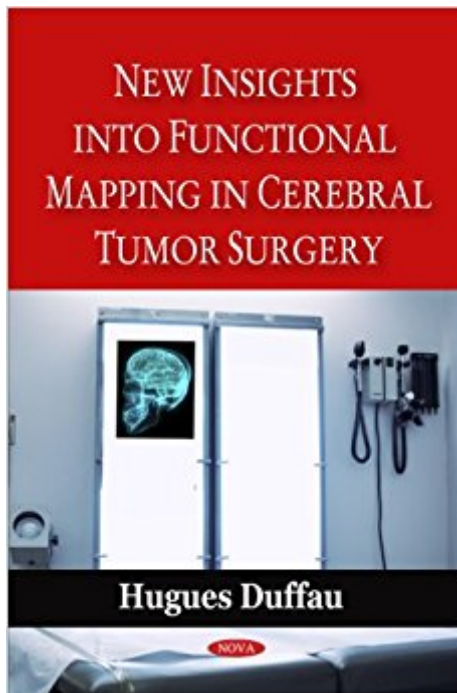




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New Insights Into Functional Mapping In Cerebral Tumor Surgery



Synopsis

The rationale of brain tumour surgery depends on two antagonist goals: on one hand, to optimise the quality of resection, on the other hand, to minimise the risk of permanent postoperative deficit. However, due to the physiological interindividual anatomo-functional variability, increased in cases of cerebral tumours because of the plastic potential of the brain, a study of the interactions between the lesion and the host seems mandatory - in order to understand the individual dynamic organisation of the brain, then with the goal to avoid postsurgical sequelae. In this way, new methods of functional brain mapping can be useful for the neurosurgeon. First, before surgery, non-invasive functional neuroimaging techniques (fMRI, PET, MEG) and invasive extraoperative electrical mapping (subdural grids) may allow to study the cortical organisation for each patient. Furthermore, Diffusion Tensor Imaging can help to understand the brain connectivity. Thus, the relationships between the tumour and the eloquent areas can be estimated, and these data applied to the surgical planning. Second, during surgery, direct intraoperative electrical stimulation permits to detect with accuracy and reliability, both the cortical sites and the white pathways essential for a given function, at each moment and each place of the tumour removal. Moreover, repeated stimulations all along the surgical act also allow to study the mechanisms of short-term plasticity, induced by the resection itself. This on-line mapping is used to tailor the resection according to cortico-subcortical functional boundaries. Third, postoperative neurofunctional imaging, combined to the precise evaluation of the clinical course and the objective assessment of the location and extent of resection, gives the opportunity to study the mechanisms underlying the functional compensation, i.e. the long-term plasticity. This potential may be used to perform a second surgery with a better quality of resection than the first one, thanks to possible brain remapping. Such a pre-, intra- and post-surgical longitudinal study of dynamic interactions between brain and lesion, allows to better apprehend the distinct patterns of functional redistribution for each patient, thus to apply this knowledge in order: to better select the surgical indication in brain tumours; to better inform the patient of the actual risk of transient postoperative deficit; to better plan the resection (surgical approach, cortico-subcortical boundaries); to optimise the quality of tumour removal while preserving the functional areas and tracts; and to plan a specific rehabilitation. Finally, on a fundamental point of view, the association of methods of functional mapping in neurosurgical patients allows to better understand the pathophysiology of brain areas, their connectivity, and the mechanisms of plastic potential of the glio-neurono-synaptic networks.

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