Intraoperative brain mapping indications

Indications

To avoid permanent neurologic deficits and preserve brain function in and near the eloquent area, intraoperative electrical stimulation mapping (IESM) is necessary.

Intraoperative monitoring has become a standard technique to predict postoperative neurological function during cranial and spinal surgery [1) 2) 3) 4)].

Language mapping

Subcortical stimulation mapping

Continuous dynamic monopolar motor mapping Preoperative brain mapping is vital to improve the outcome of patients with tumors located in eloquent areas.

Intraoperative electrical brain mapping is currently the most reliable method to identify eloquent cortical and subcortical structures at the individual level and to optimize the extent of resection of intrinsic brain tumors. The technique allows the preservation of quality of life, not only allowing avoidance of severe neurological deficits but also facilitating preservation of high neurocognitive functions. To accomplish this goal, however, it is crucial to optimize the selection of appropriate intraoperative tasks, given the limited intrasurgical awake time frame. In this review, the authors' aim was to propose specific parameters that could be used to build a personalized protocol for each patient. They have focused on lesion location and relationships with functional networks to guide selection of intrasurgical tasks in an effort to increase reproducibility among neurooncological centers [5)].

Direct Electrical stimulation is still the gold standard for brain mapping, its combination with new methods such as perioperative neurofunctional imaging and biomathematical modeling is now mandatory, in order to clearly differentiate those networks that are actually indispensable to function from those that can be compensated.

Brain mapping in patients with brain tumors and other lesions has shown us that the old idea of fixed function of the adult cerebral cortex is not entirely true. Improving care for patients with brain lesions in the future will depend on better understanding of the functional organization and plasticity of the adult brain. Advanced noninvasive brain imaging will undoubtedly play a role in advancing this understanding [6)].

see cortical mapping.

The technique of direct stimulation mapping of the cortex is used to identify regions of language representation in the dominant cerebral hemosphere and the Rolandic cortex in either hemisphere [7)].

Intraoperative brain mapping techniques are utilized in neurooncology to maximize the extent of tumor resection and seizure control, and minimize the operative morbidity. Direct stimulation mapping of the cortex and subcortical descending motor pathways will localize the rolandic cortex, dominant language speech zones and motor tracts in the internal capsule, cerebral peduncle and corticospinal tract/anterior horn cells. Electrocorticography identifies epileptogenic areas that histologically are distinctly devoid of neoplastic infiltration. Seizure control is maximal when seizure foci are resected in addition to the tumor nidus [8)].

Intraoperative mapping and monitoring techniques for eloquent area intracranial tumors are routinely used world wide. Very few data are available regarding mapping and monitoring methods and preferences, intraoperative seizures occurrence and perioperative antiepileptic drug management.

A questionnaire was sent to 20 European centers with experience in intraoperative mapping or neurophysiological monitoring for the treatment of eloquent area tumors. Fifteen centers returned the completed questionnaires. Data was available on 2098 patients. 863 patients (41.1%) were operated on through awake surgery and intraoperative mapping, while 1235 patients (58.8%) received asleep surgery and intraoperative electrophysiological monitoring or mapping. There was great heterogeneity between centers with some totally AW oriented (up to 100%) and other almost totally ASL oriented (up to 92%) (31% SD). For awake surgery, 79.9% centers preferred an asleep-awake-asleep anesthesia protocol. Only 53.3% of the centers used ECoG or transcutaneous EEG. The incidence of intraoperative seizures varied significantly between centers, ranging from 2.5% to 54% ($p < 0.001$). It there appears to be a statistically significant link between the mastery of mapping technique and the risk of intraoperative seizures. Moreover, history of preoperative seizures can significantly increase the risk of intraoperative seizures ($p < 0.001$). Intraoperative seizures occurrence was similar in patients with or without perioperative drugs (12% vs. 12%, $p = 0.2$). This is the first European survey to assess intraoperative functional mapping and monitoring protocols and the management of peri- and intraoperative seizures. This data can help identify specific aspects that need to be investigated in prospective and controlled studies [9)].

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