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Neuronavigation in epilepsy: Deploying that relevant information in the surgical field

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Introduction: Recent decades have shown substantial progresses in the development of adjunctive tools in epilepsy surgery, specifically, image-based neuronavigation and electrophysiological neuromonitoring. For many patients, surgery for intractable epilepsy provides freedom or significant relief from seizures, offering functional improvement that ameliorates their quality of life. The aim of this paper is to show how neuronavigation helps to improve the precision and safety of epilepsy surgery.

Methods: Despite the availability of noninvasive structural and functional neuroimaging techniques, invasive monitoring with depth electrodes, strips and grids is still often indicated in the management of intractable epilepsy. Neuronavigation is used as a common platform to merge complementary information obtained from the correlation of anatomic and structural details with functional information. During surgery, neuronavigation is a valuable tool in planning the best trajectory for inserting recording electrodes in the brain. Also, it will enhance the precision and accuracy of the surgery during the removal of the epileptogenic area without damaging any vital structures. Precise identification of the epileptogenic area in medically refractory epilepsy is of vital importance. The main benefits of neuronavigation in epilepsy surgery is the effective precision of targeting even in small and deeply seated lesions, safe manipulation in critical brain areas, accurate placement of electrodes, and correlation of electro-clinical information modalities with underlying structures. Furthermore, navigation provides individual tailoring of the craniotomy and reaches the target in the planned trajectory. Additionally, minimally invasive procedures are performed rather than traditional surgeries, which require more invasive craniotomies. The whole procedure is achieved, through a small incision, to remove the seizure-producing regions deep within the brain.

Conclusion: The neuronavigation concept proved its value in epilepsy surgery by linking anatomic and functional data of a specific patient. Enhanced by the integration of multimodal information, neuronavigation significantly improved the available treatment options. Neuronavigational imaging data combined with functional investigations can greatly help discussion within the multidisciplinary epilepsy surgery team helping in the shared decision making process. Finally, during surgery, an intraoperative acquisition can be acquired to refresh the navigation data. These intraoperative acquisitions allow the assessment of surgical results within the operating room while the patient still on the surgical table and before closing the craniotomy.

Biography

Lahbib Soualmi is an expert in Image Guided Neurosurgical Navigation. He has been, from 1998 until 2008, Director of Neuronavigation Unit, in Montreal Neurological Institute and Hospital, McGill University Health Center (MUHC) and Assistant Professor in the department of Neurology and Neurosurgery, McGill University, Montreal, Canada. He holds an MS and a PhD in Biomedical Engineering from Ecole Polytechnique of Montreal. In 2008, he relocated to the National Neuroscience Institute at King Fahad Medical City in Riyadh, Saudi Arabia, where he is currently, Consultant of Image Guided Neurosurgical Navigation and the Head of Neuronavigation Unit and Intraoperative Surgical Imaging. Furthermore, he has been a Consultant Faculty in the Biomedical Technology Department, King Saud University, Riyadh, Saudi Arabia from 2008 to 2013.

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