Clinical Application of Motor Pathway Mapping Using Diffusion Tensor Imaging Tractography and Intraoperative Direct Subcortical Stimulation in Cerebral Glioma Surgery: A Prospective Cohort Study.


1Shanghai Medical College, Fudan University, Shanghai 200040, China 2Glioma Surgery Division, Department of Neurologic Surgery, Huashan Hospital, Shanghai Medical College, Fudan University, Shanghai 200040, China 3Department of Biostatistics, Medical School of Shanghai Jiaotong University, Shanghai, 200040, China 4Department of Radiology, Huashan Hospital, Shanghai Medical College, Fudan University, Shanghai, 200040, China.

Abstract

BACKGROUND: Glioma surgery in eloquent areas remains a big challenge for the risk of postoperative motor deficits.

OBJECTIVE: To prospectively evaluate the efficiency of using a combination of diffusion tensor imaging (DTI) tractography functional neuronavigation and direct subcortical stimulation (DsCS) to yield the maximally safe resection of cerebral glioma in eloquent areas.

METHODS: A prospective cohort study was conducted in 58 subjects with an initial diagnosis of primary cerebral glioma within or adjacent to the pyramidal tract (PT). The white matter beneath the resection cavity was stimulated along the PT, which was visualized using DTI tractography. The intercept between the PT border and DsCS site was measured. The sensitivity and specificity of DTI tractography for PT mapping was evaluated. The efficiency of the combined use of both techniques on motor function preservation was assessed.

RESULTS: The postoperative analysis showed gross total resection in 40 patients (69.0%). 17 patients (29.3%) experienced postoperative worsening; one-month motor deficit was observed in six subjects (10.3%). DsCS verified a high concordance rate with DTI tractography for PT mapping. The sensitivity and specificity of DTI were 92.6 and 93.2%, respectively. The intercepts between positive DsCS sites and imaged PTs were 2.0-14.7 mm (5.2±2.2 mm). The 6-month Karnofsky performance scale scores in 50 postoperative subjects were significantly increased compared with their preoperative scores.

CONCLUSION: DTI tractography is effective but not completely reliable in delineating the descending motor pathways. Integration of both techniques favors patient-specific surgery for cerebral glioma in eloquent areas.

PMID: 22986591 [PubMed - as supplied by publisher]