

Localization of Frontal and Temporal Speech Areas in Brain Tumor Patients by Their Structural Connections with Probabilistic Tractography

Authors : B.Shukir, H.Woo, P.Barzo, D.Kis

Abstract : Preoperative brain mapping in tumors involving the speech areas has an important role to reduce surgical risks. Functional magnetic resonance imaging (fMRI) is the gold standard method to localize cortical speech areas preoperatively, but its availability in clinical routine is difficult. Diffusion MRI based probabilistic tractography is available in head MRI. It's used to segment cortical subregions by their structural connectivity. In our study, we used probabilistic tractography to localize the frontal and temporal cortical speech areas. 15 patients with left frontal tumor were enrolled to our study. Speech fMRI and diffusion MRI acquired preoperatively. The standard automated anatomical labelling atlas 3 (AAL3) cortical atlas used to define 76 left frontal and 118 left temporal potential speech areas. 4 types of tractography were run according to the structural connection of these regions to the left arcuate fascicle (FA) to localize those cortical areas which have speech functions: 1, frontal through FA; 2, frontal with FA; 3, temporal to FA; 4, temporal with FA connections were determined. Thresholds of 1%, 5%, 10% and 15% applied. At each level, the number of affected frontal and temporal regions by fMRI and tractography were defined, the sensitivity and specificity were calculated. At the level of 1% threshold showed the best results. Sensitivity was 61,6□31,4% and 67,15□23,12%, specificity was 87,2□10,4% and 75,6□11,37% for frontal and temporal regions, respectively. From our study, we conclude that probabilistic tractography is a reliable preoperative technique to localize cortical speech areas. However, its results are not feasible that the neurosurgeon rely on during the operation.

Keywords : brain mapping, brain tumor, fMRI, probabilistic tractography

Conference Title : ICNCNS 2024 : International Conference on Neurosurgery and Central Nervous System

Conference Location : Athens, Greece

Conference Dates : October 17-18, 2024