

Connectivity-based Functional Parcellation and Localization of the Human Supplementary Motor Area Based on Rest-fMRI and its Utility in Brain Tumor Surgery

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Introduction

To investigate the utility of restingstate functional MRI (R-fMRI) in the functional parcellation and localization of SMA in healthy subjects and patients with glioma. The utility of this novel technique in brain tumor surgery around SMA was also assessed

Methods

R-fMRI was acquired from 249 healthy and 8 patients. Defined by AAL template, SMA was parcellated into three subregions according to functional connectivity (FC) patterns based on R-fMRI among healthy subjects. The function of each subregion was characterised by assessing whole-brain FC and metaanalysis of existing functional imaging studies.

In areas consist of voxels within and around (2-voxel expansion) SMA, FC was calculated between each voxel and the SMA subregions. SVM was used to discriminate voxels in or outside each subregion. Then, the accuracy of this technique was validated on an independent sample (67 subjects) and used to localize the SMA in 8 patients with glioma.

The method has successfully

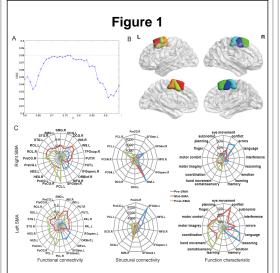
Results

parcellated SMA into three subregions, including Pre-, Mid- and Post-SMA. The function of Pre-, Mid- and Post-SMA was supposed to be correlated with conflict, eye movement, and hand movement and coordination respectively. The accuracy of localizing the SMA in the contralateral hemisphere was 87.4% with onevoxel error by 10-fold cross-validation in the healthy subjects. The mapping accuracy in an independent sample was 82%.

SMA localization was validated in all patients. Complete surgical resection was achieved in 6 patients and subtotal in 2 patients. In the shortterm period, 3 patients experienced postoperative worsening, however, all recovered to normal at 1-month follow -up.

Conclusions

Connectivity-based technique based on R-fMRI is effective to parcellate and localize the SMA. Integration of R-fMRI and DCS is useful to identify and protect the SMA in patientspecific surgery for cerebral glioma around SMA.



Subdivisions of supplementary motor area and its multimodal characteristics

Figure 1. Subdivisions of supplementary motor area and its multimodal characteristics.

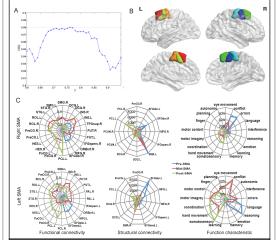


Figure 2. Diagrams of the functional mapping algorithm for SMA and performance.

References

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