Language Maps in Chinese-speakers: Assessment with Electrocortical Stimulation Mapping, Task- and Resting-state Functional MRI

Jin-song Wu MD, PhD; Junfeng Lu; Dongxiao Zhuang MD PhD; Chengjun Yao; Tianming Qiu M.D.; Jie Zhang; Ying Mao MD; Liang-Fu Zhou

Introduction

An increasing body of functional neuroanatomical evidence suggests that Chinese language processing requires brain areas distinct from those used when processing the English. However, existing studies of Chinese processing are limited to functional neuroimaging studies. Data from intraoperative stimulation provide a unique opportunity for mapping the distribution of language. Our purpose is to establish the patterns of language in Chinese-speakers with multimodality techniques.

Methods

Intraoperative language mappings were obtained from 55 patients with gliomas. Positive sites associated with speech arrest, anomia, and alexia were categorized and used to generate language maps, which were also compared with those obtained from task functional MRI (fMRI). In addition, by defining the positive sites as the seed regions, we computed the functional connectivity in 11 patients to generate language networks.

Results

A total of 112 language sites associated with speech arrest were identified from 1402 sites. 69.6% were located in the ventral precentral gyrus(VPCG) (50.9%) and pars opercularis (18.7%), followed by 10.7% in the middle frontal gyrus. Language maps were also generated from fMRI data of three different tasks in 15 patients. Convert Recitation activated the left ventral precentral and postcentral gyrus. The tasks of picture naming and verb generation have the same patterns, that activations in left inferior frontal gyrus and posterior middle frontal gyrus were detected. The language networks from resting fMRI demonstrated that the left inferior frontal gyrus, the VPCG, the Wernickes' area and superior parietal lobe were involved.

Conclusions

Our electrophysiological evidence suggests that VPCG (ventral part of BA6) and the pars opercularis (BA44) play a critical role in speech production. Additionally, by comparing stimulation maps of Chinese and English-speakers, the left middle frontal gyrus may be unique to Chinese, which was also supported by the task fMRI. The resting language network generated from golden standard may display a more real pattern.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) know the importance of VPCG; 2) understand the distribution of language in Chinese-speakers

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