Therapeutic Effect and fMRI Study on the Acupuncture combined with Language Rehabilitation to Aphasia Patients from Brain Stroke

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Introduction: Sudden changes of the brain could signify some underlying dangers for the patients with aphasia from apoplexy. Therefore, rapid detection of sudden changes of the brain is crucial for survival. Acupuncture is a complementary and alternative medicine (CAM) modality that is practiced in many parts of the world for a variety of ailments[1]. The efficacy of acupuncture is already accepted for postoperative and chemotherapy nausea and vomiting and in postoperative dental pain. The acupoints are arranged on so-called "meridians", which represent a network of channels each connected to a functional organic system. However, the scientific basis of acupuncture remains unclear. Functional MRI (fMRI) is an established clinical diagnostic method as well as an indispensable tool in clinical research[2]. It has been utilized for language and other cortical function localization[3], which can significantly improve our understanding of the functions of different language center. This work focused on analyzing the rehabilitative action involved in acupuncture and the early phase fMRI signal to evaluate the underlying neural recovery.

Material and Methods: Of 20 patients, who provided informed, written consent, with aphasia from apoplexy, 10 were administered language rehabilitation treatment only (singular treatment group), while the other 10 received acupuncture rehabilitation therapy additionally (combined treatment group). Functional data and Aphasia Battery of Chinese (ABC) respectively were recorded from these 20 subjects pre-treatment and post- one month, who were also enrolled in an ongoing study of patients undergoing evaluation and treatment. All MR data were acquired on a GE Signa HDxt 3.0T MRI scanner using an 8-channel head coil. Participants were asked to lie quietly and stared at the screen where there were some phrases they should read out gently. After the T1W anatomic scan, a BOLD measurement was performed (gradient echo EPI, flip angle=90 degrees, matrix = 64 × 64 on a 240 cm × 240 mm FOV, 32 slices, 5 mm thickness parallel to the AC-PC line extending down from the top of the brain, TR=3s). The phrases were alternately delivered in the screen in four minute blocks (read gently-quiescence-read gently-quiescence-read gently-quiescence-read gently- quiescence) during the scan. Data was dealt with statistical parametric mapping 5 of Matlab for statistics. In the preprocessing, it contained realignment, coregistration, normalization and smoothing. These GE-EPI images were registered, Gaussian smoothed (FWHM=0.5mm) and detrended to remove the linear drift.

Results and Discussion: Few of activated encephalic regions could be found in the 20 subjects before treatment, Fig.1a. The activated voxels after treatment compared with pretreatment in the singular treatment group were observed mainly in the bilateralis medial frontal gyrus, bilateralis middle frontal gyrus, bilateralis inferior frontal gyrus, bilateralis precentral gyrus, left angular gyrus and left superior temporal gyrus, Fig.1b. The activated voxels after treatment compared with before treatment in the combined treatment group include the bilateralis medial frontal gyrus, bilateralis superior frontal gyrus, bilateralis middle frontal gyrus, bilateralis inferior frontal gyrus, bilateralis precuneus, posterior cingulate gyrus, left angular gyrus, left superior temporal gyrus, bilateralis cuneus, bilateralis lingual gyrus, bilateralis inferior occipital gyrus, bilateralis basal ganglia, splenium of corpus callosum, right posterior quadrangular lobule of the cerebellum, Fig.1c. The activated voxels in the combined treatment group compared with the singular treatment group after treatment include the left superior frontal gyrus, left middle frontal gyrus, bilateralis inferior frontal gyrus, left precentral gyrus, left postcentral gyrus, left paracentral lobule, left superior temporal gyrus, posterior cingulate gyrus, bilateralis precuneus, bilateralis cuneus, left angular gyrus, bilateralis lingual gyrus, right hippocampus, right parahippocampus gyrus, bilateralis superior occipital gyrus, bilateralis inferior occipital gyrus, right posterior quadrangular lobule of the cerebellum, left superior semilunar lobule, splenium of corpus callosum, Fig.1d. The active extent of the language center was compared between the two groups of patients. Through statistical analysis, Both of the two groups showed increased active volume and extent in language center pre- and post-treatment ($P<0.05$). The activated area in the right lateral cerebrum was obviously more than that of the left lateral cerebrum in combined treatment group, and with more significant strength and scope ($P<0.05$), mainly including the bilateral frontal lobe, cuneus, posterior cingulate gyrus, lingual gyrus, occipital lobe, splenium of corpus callosum, cerebellar hemisphere, and the left precentral gyrus, postcentral gyrus, paracentral lobule, temporal lobes, angular gyrus, precuneus, and the right hippocampus, parahippocampus gyrus.

Conclusion: Acupuncture combined with language rehabilitation therapy to aphasia patients from brain stroke could activate specific language center, which might be related with the recovery of language function. Our findings can help us better understand the sophisticated role of BOLD fMRI in language center and may guide future studies of cerebral functional changes.

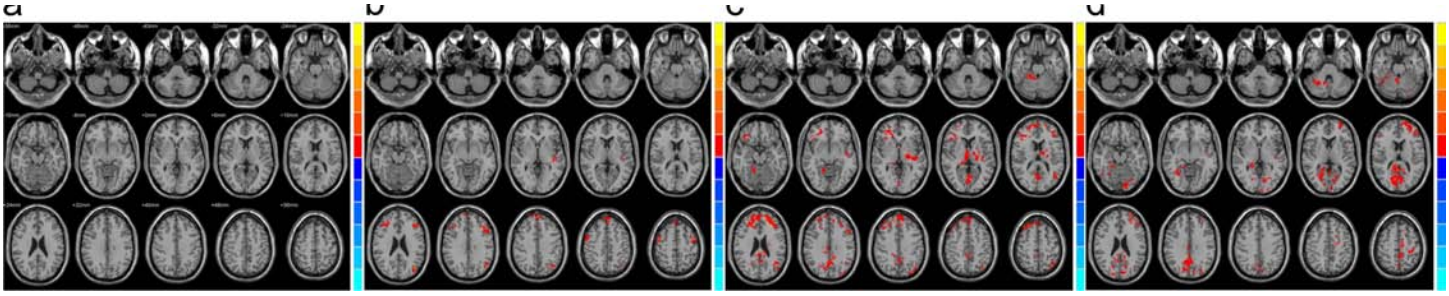

Fig.1 (a) the different activated encephalic region in the 20 subjects before treatment. Few of activation could be found. (b) the activation maps after treatment compared with before treatment in the singular treatment group. (c) the activation maps after treatment compared with before treatment in the combined treatment group. (d) the activation maps after treatment in the combined treatment group compared with the singular treatment group.

References: 1. Deng G, et al. BMC Complement Altern Med 2008, 8: 37. 2. Yu N, et al. Int J Comput Assist Radiol Surg 2011, 6: 447-455. 3. Kim KK, et al. Epileptic Disord 2011, 13: 368-374.