Somatotopic organization of acupoints in human primary somatosensory cortex - A fMRI study

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Introduction

The purpose of this study was to investigate somatotopic organization of acupoints in human primary somatosensory cortex (S1). There are some papers which determine brain area activated by manual-acupuncture, electro-acupuncture, moxibustion, or laser acupuncture stimulation at single acupoint; however, it is still unknown that somatotopic organization of acupoints in the somatosensory cortex. In this study, we compared somatotopic represenation of 6 acupoints in somatosensory area using scrubbing stimulation with fMRI.

Materials and Methods

Eleven healthy volunteer were examined on 1.5T clinical MR scanner (Signa Horizon, GE, USA.) with standard head coil. The fMRI were performed using gradient echo EPI (TR/TE/FA=3s/50ms/90degree, 64x64matrix, 5mm slice thickness, FOV=22cm, 30slices). The scraping stimulation using scrubbing sponge was conducted in the acupoint right Shangyang(LI1), Shaoze(SI1), Hegu(LI4), Shousanli(LI10), Zusanli(ST36) and Taichong(LV3) (see fig.1) with block design. Each experimental session was composed 9 blocks lasting 30s each: Rest (R)-Stimulation (S)-R-S-R-S-R-S-R. All data were analyzed on SPM99 (Welcome Department of Cognitive Neurology, London, UK).

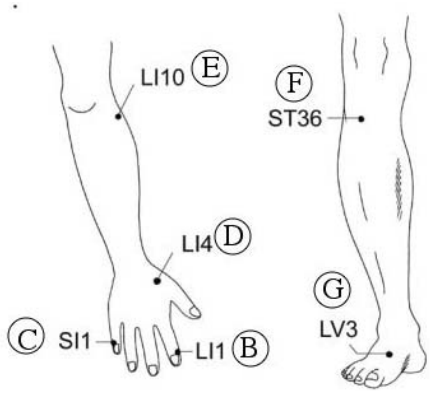

Figure 1. Illustration of location of 6 acupoints. (B-G are consistent with figure 2.)

Results and Discussion

We could detect significantly activation at left somatosensory area during stimulation on all acupoints. The activated area of all acupoints were within the postcentral gyrus(PG) (see fig.2). The activated area during Shangyang (LI1) and Shaoze (SI1) stimulatinon were located on most lateral part of PG. The activated area of Hegu (LI4) was located on medially adjacent to Shangyang (LI1)/Shaoze (SI1) and on that of Shousanli (LI10) subsequently. Activated area of Taichong (LV3) was located on most medial part of PG. Activated area of Zusanli (ST36) was located on between that of Shousanli (LI10) and that of Taichong (LR3). These results were consistent with somatotopic representation in S1 reported by Penfield W et al. We also found significant activation in secondary somatosensory area for all acupoints, but regions of activation corresponding to the different stimulation sites were overlapped. This study reveals somatotopic mapping of acupoints and gives basis for understanding the mechanisms of acupuncture treatment.

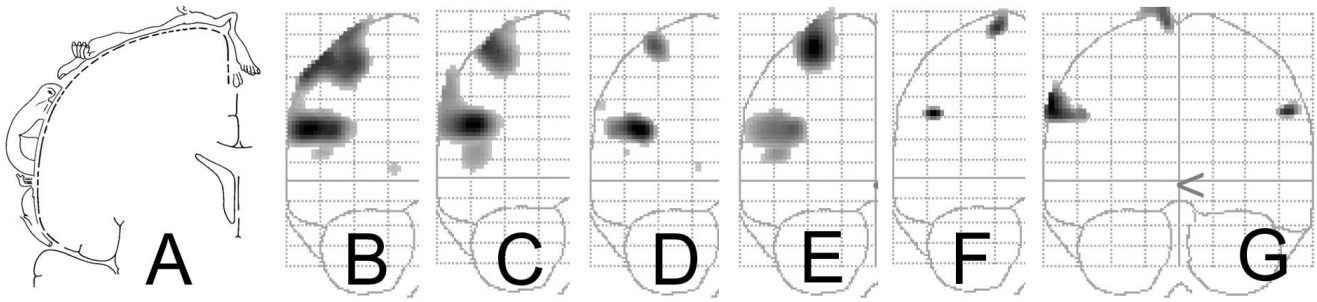

Figure 2. Illustration of somatotopic organization reported by Penfield et al (A). Comparison of the location of cortical activations during scraping stimulation on each acupoints (B-G).

Reference

[1] Penfield W and Jasper H, Epilepsy and the Functional Anatomy of the Brain (1954)., [2] Gareus IK et al., *J Magn Reson Imag* 15:227-232 (2002)., [3] Siedentopf CM et al., *Neuroscience Letters* 327:53-56 (2002)., [4] Kong J et al., *J Alt Comp Med* 8:411-419 (2002)., [5] Wu MT et al., *NeuroImage* 16:1028-1037 (2002).