# SOMATOTOPIC IDENTIFICATION OF LANGUAGE-PREMOTOR AREA (PMA) IN LANGUAGE PROCESSING VIA FMRI: NOVEL LOCALIZATION APPROACH

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*Abstract:*

This report describes a novel localization method for fMRI brain mapping and a new finding of fMRI activation of the premotor area (PMA) during visually stimulated word and sentence generation and verbally stimulated word generation. These tasks constitute challenging, covert, and internally cued language tasks.

This is a retrospective study on seven patients who were referred for preoperative fMRI language mapping. We define the de facto language premotor area (L-PMA) as the portion of the PMA specifically associated with the language function. Subjects ranged in age from 20 to 34 years (26.8 ± 5.2, mean ± SD). The L-PMA was identified by using a) the central sulcus with the inverted omega sign, paired pars bracket, and the junction of superior frontal sulcus and precentral sulcus and b) by using hand motor maps as references. In addition to the commonly observed cortical activation in Broca's and Wernicke's areas, we consistently noted activation in the L-PMA for all seven patients. The observed L-PMA ranged from 33.8 to 41.3 mm (36.4 ± 2.8, mean ± SD) in the sagittal plane. It is predominantly on the left hemisphere of the brain. The top of the L-PMA is located 7.5 mm inferior to that of hand motor area. This study asserts that the L-PMA is activated with covert language protocols. The additional activation area of L-PMA is important and should not be overlooked in traditional language mapping. From a neuroscience perspective, this is part of a whole complex path of human language function, which has yet to be thoroughly and definitively laid out with fMRI and other brain mapping methods.

*Keywords*: fMRI, language lateralization, PMA

## 1. Introduction

Clinically, functional magnetic resonance image (fMRI) is a valuable tool for determining language lateralization, and is used preoperatively on patients who will undergo surgical resection of brain lesions as a noninvasive alternative to the Wada test. Its primary use in this realm is to lateralize Broca's and Wernicke's areas, which are located in the inferior frontal gyrus and the inferior parietal lobule, respectively. More specifically, Broca's area may