Localization of Wernicke's Areas Using Sentence Completion Task is More Robust than Using Word Generation or Category Naming Tasks

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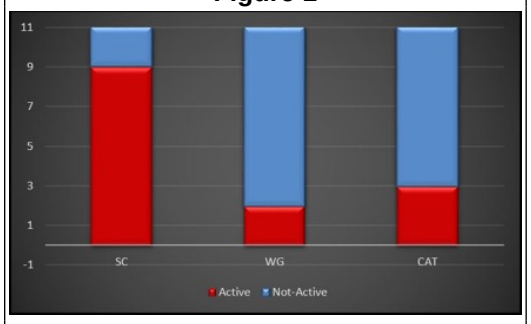
Figure 1



Number of participants who showed activity within Wernicke's area coordinates per individual (red) compared to participants who did not show activity at the same coordinates (blue) for the three tasks

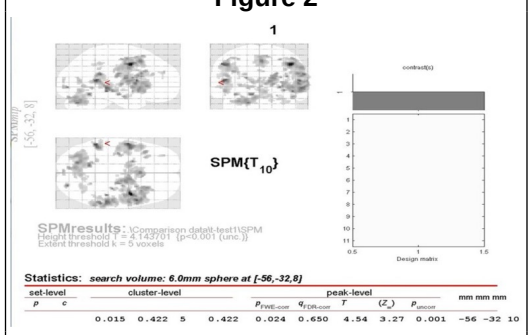
Introduction

Task selection is one of the pivotal steps for successful localization and activation of speech areas (Broca's and Wernicke's) using functional MRI. Multiple tasks are available, which can be used for activation of Broca's area. However, localization of Wernicke's area using fMRI is difficult. Here, we compare the results of three different activation tasks, sentence completion (SC), word generation (WG) and category naming (CAT) for localization of Wernicke's area.

Methods

11 right handed healthy volunteers (22 to 55y) were included. IRB approval was obtained. Subjects were trained on each task prior to scanning. GE Healthcare provided equipment. Scans were done on a GE 3.0T, 32 channel head coil. Experiments were block design. For SC, subjects were presented with incomplete sentences to complete. On WG and CAT, subjects were asked to generate words that either start with the alphabet shown on the screen or related to the category displayed. During rest, subjects were presented with a gibberish sentence during the first task and a picture of a hand on the second and third tasks. FMRI was acquired using EPI sequences.

Figure 2

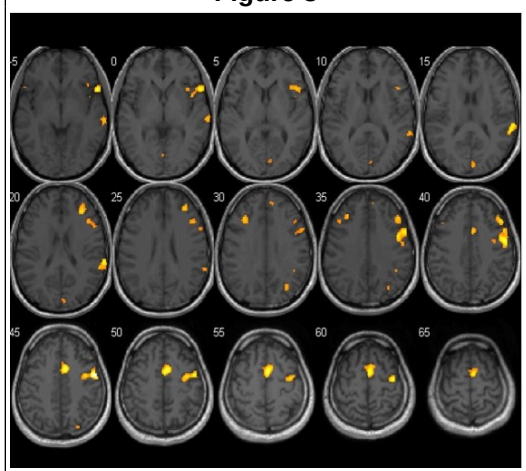


Maximum intensity projection (MIP) for the group analysis of sentence completion showing activity at 6.0mm sphere within Wernicke's spatial coordinates with a T value of 4.54

Results

Multiple uncorrected P-values of cluster probability were used, ranging from 0.05 to 0.001. ROI analysis of Wernicke's spatial co-ordinate revealed no activation in CAT and WG across different P-values. However, for Sentence Completion task with a cluster probability of an uncorrected P-value (<0.001), activation in Wernicke's area was detected with a T-value of 4.45. On individual analysis, during SC 9 out of 11 (82%) subjects shows activity in wernicke's spatial co-ordinates, compared to only 2 (18%) and 3 (27%) subjects with activity in the same co-ordinates in WG and CAT, respectively.

Figure 3



Graph for representative signal activation

Conclusions

Sentence completion task is a more effective task in localizing Wernicke's areas compared to Word generation and Category naming tasks.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of functional MRI localization of Wernicke's areas using sentence completion task, 2) Discuss, in small groups, the disadvantages of other tasks to localized Wernicke by fMRI 3) Identify an effective treatment option applying fMRI identified Wernicke areas