View Abstract

The pSTG is associated with prolonged language impairment following neurosurgical resection

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Despite its long-established role in language, the left posterior superior temporal gyrus/sulcus (pSTG/S) remains an area of much debate. Two questions are of particular interest: first, does the pSTG/S have a specific role in language – i.e., is it functionally different from other regions of the putative language network, such as the middle temporal gyrus (MTG) and the inferior frontal gyrus (IFG)? And second, what is the specific role of the pSTG/S in language – is it sensorimotor transformation, phoneme perception, single word comprehension, syntactic comprehension, or something else? There is broad agreement overall that the pSTG/S region is important for language function; indeed, recent findings in stroke have suggested that the degree of damage and/or dysfunction in the pSTG/S may be the factor most crucially related to chronic aphasia severity. However, the stroke cohort is limited by stereotyped patterns of damage; therefore investigations in complementary populations are of interest. Prior work in neurosurgical cohorts has demonstrated systematic

patterns of resection-based language deficits, though these were predominantly described in the immediate post-acute period, as the vast majority of patients recover most of their language function within one month. However, not all patients recover fully to baseline by the one month time point, and in those cases little is understood about the factors that contribute to their prolonged language impairment. Here, we present a series of analyses probing the neural and clinical factors that contribute to prolonged language impairment following left hemisphere resective surgery. 177 patients were included in this study, approximately 10% of whom scored below normal limits on a language evaluation conducted at one month post-surgery. Using VLSM, a small region in the pSTS was identified as associating with prolonged overall language impairment. A follow-up hierarchical linear regression indicated that resection in this pSTG/S region, as well as patient age, were independent contributors to prolonged language impairment, while resection in the MTG and IFG were not (effect of adding age: $F = 7.45$, $p < 0.01$; effect of adding pSTG damage: $F = 3.59$, $p = 0.02$; effect of adding MTG/IFG damage: $F = 1.71$, $p = 0.08$). Correlational analyses between damage in the pSTG and various language evaluation subscores at one month then showed that damage in the pSTG was entirely un-correlated with single word comprehension ($r = 0.01$, $p = 0.92$), while significant negative correlations were observed with repetition ($r = -0.31$, $p < 0.001$) and sentence comprehension ($r = -0.27$, $p < 0.001$). Overall, our findings suggest that the pSTG/S does play a different functional role than other putative language regions, by independently contributing to long-term language impairment while other regions do not. Furthermore, we did not find evidence to suggest that single word comprehension drives the impairment profile of patients with pSTG/S damage. With this and follow-up work, we aim to expand scientific understanding of neural mechanisms that contribute to language processing and recovery, and provide clinically informative findings on factors influencing outcomes following neurosurgical intervention.

The following information is not published.

Submission Type: Poster Only
Consider for Sandbox Series: No
Consider for Poster Slam: No
Primary Topic: Disorders: Acquired
Secondary Topic: Language Production

Method: Structural (e.g. VLSM, VBM)

Accessibility: None.

Notes: None.

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