LANGUAGE-RELATED RESTING STATE CONNECTIVITY IN APHASIA

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Introduction

Language processing is supported by a network of perisylvian neural regions involving the frontal, parietal and temporal lobes. Functional connectivity analyses have identified several language networks in healthy controls, and have shown altered patterns of connectivity critical to language recovery in individuals with post-stroke aphasia [1,2]. The current study, however, sought to identify differences in resting state connectivity between language-related regions in unimpaired speakers and individuals with aphasia. Based on the fact that individuals with aphasia have damage to left-hemisphere language regions and may have disrupted connectivity between cerebral hemispheres, we hypothesized that there would be greater connectivity between both ipsilateral and contralateral language regions in control participants.

Methods

7 (3 males, AV 56.4 years) participants with aphasia and 15 controls (7 males, AV 61.5 years) took part in the study. A 4T Bruker Medpsec system was used to acquire echo-planar images (TE 30ms; TR 2100ms), with 150 brain volumes acquired over a 5 minute resting condition. Each brain volume consisted of 36 planes, in-plane resolution 3.6mm and slice thickness 3mm (0.6mm gap). A point-spread function mapping sequence was acquired prior to the EPI acquisition to correct geometric distortions in the time series data [3]. Preprocessing of the data was identical to those reported in Kelly et al. [4]. A mean time series was extracted for each region of interest (ROI) and correlated with every other voxel in the brain. Group level significance was calculated and corrected for multiple comparisons ($Z > 2.3$, cluster significant $p < 0.05$, corrected).

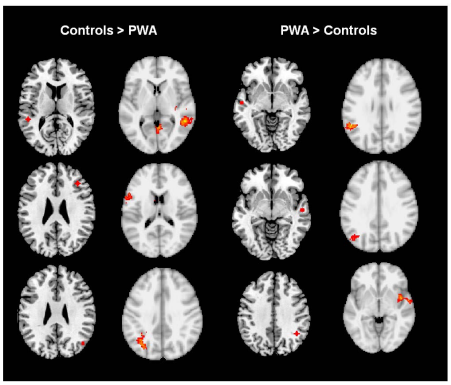
Results

When compared to individuals with aphasia, control participants showed greater contralateral connectivity to areas within the same lobe in the opposite cerebral hemisphere across the entire perisylvian network. However, greater ipsilateral and contralateral connectivity was identified for participants with aphasia between two specific language-related areas in different lobes: the inferior parietal region and the anterior portion of the superior temporal gyrus. Refer to Table 1 and Figure 1.

Table 1

ROI	Label	Voxels	Z	x	y	z
Controls > Participants with Aphasia						
L posterior STG	R posterior MTG	399	4.82	52	-46	4
R IFG	L IFG	655	4.18	-58	10	4
R AG	L SMG	349	3.76	-32	-48	32
Participants with Aphasia > Controls						
L anterior STG	L SMG	388	4.17	-56	-46	32
R anterior STG	L AG	375	4.92	-38	-60	22
R SMG	R anterior STG	328	3.86	66	-2	4

STG = superior temporal gyrus; MTG = middle temporal gyrus; IFG = inferior frontal gyrus; AG = angular gyrus; SMG = supramarginal gyrus



Discussion

As expected, controls and participants with aphasia showed different connectivity patterns between language-related regions. Partly in line with our initial hypothesis, control participants showed greater connectivity than participants with aphasia between contralateral regions in the opposite cerebral lobe, however, not within ipsilateral language regions within the left-hemisphere. This may indicate that the major disruption in connectivity for individuals with aphasia is between homologous regions in the two cerebral hemispheres. This finding is supported by the fact that participants with aphasia showed greater connectivity than controls in both ipsilateral and contralateral regions, but restricted to two specific regions in different cerebral lobes.

References

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