Corpus callosum involvement in language ability after left-hemispheric stroke

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INTRODUCTION

After left-hemispheric stroke, right hemisphere (RH) can be recruited for language (1). This makes interhemispheric communication a good candidate through which language abilities may recover. The Corpus Callosum (CC) could be involved in the transfer of (linguistic) information to the RH (2).

RESEARCH QUESTIONS

RQ - Is CC structural integrity associated with a better language outcome after stroke?

H1 - Properties of the anterior CC (genu) are associated with functional communication after stroke. (3)

H2 - Properties of the posterior CC (splenium) and anterior CC (genu and anterior midbody) are associated with semantic interference. (4,5)

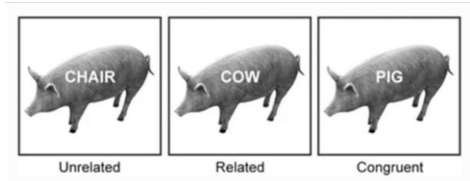
METHODS AND MATERIALS

Sample: 19 left-hemisphere post-stroke individuals (with and without aphasia) and 23 healthy controls

Structural data: Three portions of the CC: genu, anterior midbody and splenium were defined using probabilistic tractography (FSL Probtrackx) on high-resolution Diffusion Weighted Imaging (DWI) data using a region of interest approach with a set of waypoints and exclusions. These tracts were used to extract fractional anisotropy (FA) and volume values from each portion separately

Two **language tests** were used to assess language ability:

- **ANELT** (6)- efficiency and effectiveness in language
- **Picture Word Interference** (PWI)

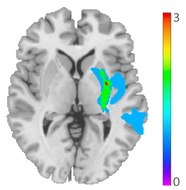


Reaction times (RT) were used to compute a measure of **semantic interference effect** = RT related – RT unrelated
Further corrected for overral naming speed

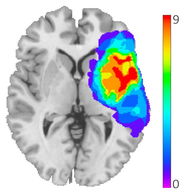
RESULTS

HIERARCHICAL CLUSTERING

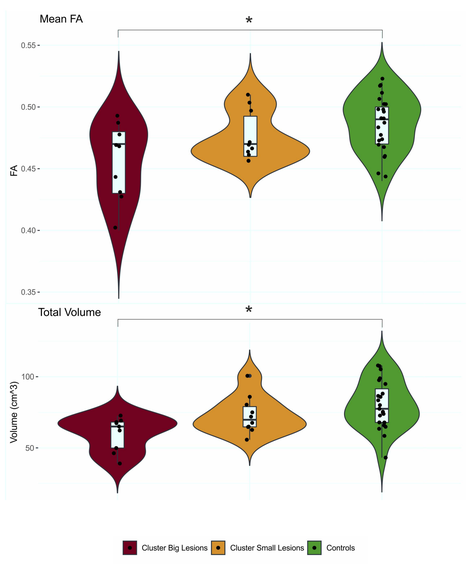
SMALL LESIONS CLUSTER
N=10



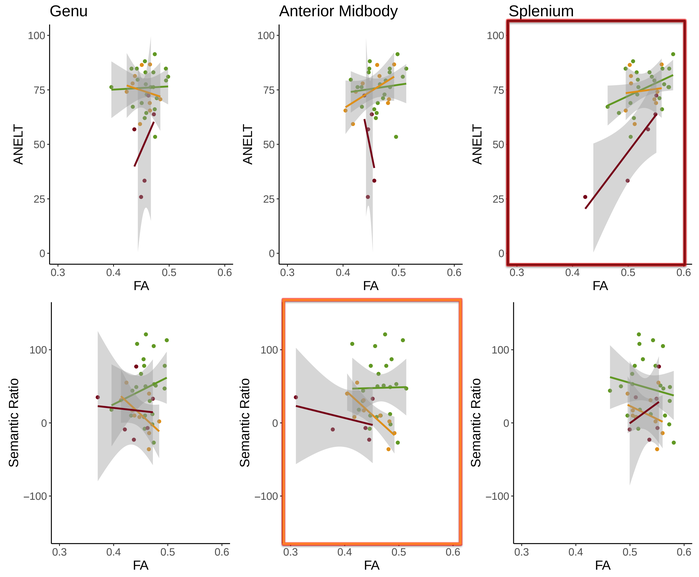
BIG LESIONS CLUSTER
N=9

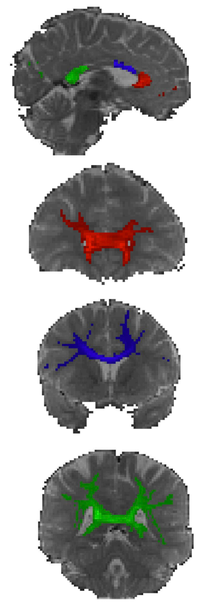


CC STRUCTURE



STRUCTURE TO FUNCTION RELATIONSHIPS





CONCLUSIONS

H1 - No associations with the genu, but positive correlation with splenium FA for people with big lesions

H2 - Higher integrity of anterior midbody in the patients associated with smaller semantic interference (which sometimes tended towards semantic facilitation) corrected for overall naming speed

REFERENCES

(1) Saur, D., et al., (2006). Dynamics of language reorganization after stroke. Brain.
(2) Piai, V., et al., (2017). Neuroplasticity of Language in Left-Hemisphere Stroke: Evidence Linking Subsecond Electrophysiology and Structural Connections. Human Brain Mapping.
(3) Fridriksson, J., et al., (2006). Functional communication and executive function in aphasia. Clinical Linguistics & Phonetics
(4) Roelofs, A., & Piai, V., (2011). Attention demands of spoken word planning: A review. Frontiers in Psychology
(5) De Zubicaray, G., et al., (2013). Differential processing of thematic and categorical conceptual relations in spoken word production. Journal of Experimental Psychology
(6) Ruiter, M., et al., (2011). Towards a quantitative measure of verbal effectiveness and efficiency in the Amsterdam-Nijmegen Everyday Language Test (ANELT). Aphasiology

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