Shared white matter correlates of language and memory impairments following ischaemic stroke

Introduction

Stroke can commonly cause cognitive impairments that increase the difficulty of life for patients persistently following the initial event (Peng, 2019).

- It can be difficult to distinguish between language and semantic deficits in stroke patients as they show similar symptoms (Peng, 2019; Jeffries & Lobo-Mardones, 2006).

- Increased MoCA and decreased FA of the bilateral arcuate and uncinate fasciculus are related to decreased performance in language fluency tests and the right arcuate has been linked to verbal memory (Nieminen-Malikia et al., 2016).

- Semantic fluency has been linked to bilateral structural changes, while phonemic fluency is typically lateralized to the left hemisphere (Meh et al., 2011) whilst semantic retrieval has been shown to be bilateral (Jeffries & Lobo-Mardones, 2006).

Methods

Participants:

- Data collected in the STRATEGIC study (O’Sullivan & Wright, 2020).
- Patients (n=49) recruited from a single hospital stroke unit within a week of suffering their first symptomatic ischemic stroke.
- Excluded patients with any history of major neurological or psychiatric disease, or impairment that would impede their ability to complete the cognitive tasks, including aphasia.

MRI Measurements:

- Measurements: Mean Diffusivity (MD) and Fractional Anisotropy (FA).
- Structures: Bilateral uncinate (UC) (see Fig. 1) and superior longitudinal fasciculus (SLF) (see Fig. 2).

Conclusions:

- Pearson’s correlations between the results of the separate cognitive tests and MRI measurements.

Results

Cognitive Findings:

- The Pyramids and Palm Trees task is associated with semantic tasks (Fig. 1.1) and phonemic (Fig. 2) fluency tasks.
- Semantic fluency is associated with the FCSRT free recall (Fig. 2.1) and FCSRT free to total recall ratio (Fig. 3.1).

Structural Findings:

- FCSRT immediate recall is associated with MD (Fig. 3.1.1) and FA (Fig. 3.1.2) of the right uncinate fasciculus.
- Pyramides and Palm Trees performance is associated with FA of the left superior longitudinal fasciculus (Fig. 4).

Discussion

- Association between the semantic fluency task and the FCSRT free recall and FCSRT ratio suggests semantic language production is linked to free recall.
- Association between phonemic fluency and PyP task but not FCSRT suggests distinct modality dependent pathways for language.

- Association between the LSIF and the PyP task suggests that it has a role in semantic retrieval as PyP requires the retrieval of semantic information for the purpose of visual language comprehension.

- Reinforces previous studies that have linked the RUC to semantic language and the right arcuate to verbal memory (Nieminen-Malikia et al., 2016).

- Numerous associations between language and semantic memory tasks support the theory that these processes are highly integrated and share multiple structural correlates, reinforcing the complexity of differentiating exactly how stroke affects cognition.

Conclusions

- Impairments in memory retrieval for the production of language were associated with the RUC.
- Impairments in the retrieval of semantic information for comprehension were associated with the LSIF.
- Variation in tract structure after stroke is affected both language and memory.
- Memory and language tasks are highly interrelated and share structural correlates.

References