

## White matter fibres and their relationship to language decline after temporal lobe epilepsy resection

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Language has been proposed to be separated and segmented into two streams. The dorsal stream, mapping sound onto articulatory-based representations, and the ventral stream, mapping sound onto meaning. White matter, interconnecting regions associated with these streams are anatomically arranged in fibre bundles. The function of these fibre bundles has typically been discussed in relation to their anatomical organisation. Here, we argue the need for increased specification within fibre bundles and their individual connections.

We studied 127 patients who underwent temporal lobe epilepsy surgery from 2010–2019. Neuropsychological testing included picture naming performed pre-operatively and 3 months post-operatively. The outcome was assessed using the reliable change index (RCI; clinically significant decline) and change across timepoints (post- minus pre-operative scores; clinically non-significant). Functional MRI was used to determine language lateralization. The arcuate (AF), inferior fronto-occipital (IFOF), inferior longitudinal, middle longitudinal (MLF), and uncinate fasciculi were mapped using diffusion MRI probabilistic tractography. Resection masks were drawn comparing co-registered pre- and post-operative T1 MRI scans and used as exclusion regions on pre-operative tractography to estimate the percentage of pre-operative tracts transected in surgery.

Language dominant and non-dominant resections were treated separately as post-operative outcomes were significantly different. In language dominant hemisphere resections, increased surgical damage to the IFOF was related to RCI-determined decline. Splitting the IFOF into 3 sub-fasciculus, only the inferior frontal gyrus sub-fasciculus of the IFOF was related to picture naming change. In language non-dominant hemisphere resections, increased MLF resection was associated with RCI-determined decline. Splitting the MLF into anterior and inferior sub-fasciculus, only the anterior connections of the MLF were related to picture naming change.

We demonstrate that while white matter fibres are anatomically arranged in bundles, these do not sub-serve a single function. It is likely, that individual connections between cortical regions sub-serve a specific function. We discuss these findings in the context of other cognitive domains.