Superior longitudinal fasciculus classification

Nakajima et al. collected and reassessed existing knowledge regarding the SLF, which they used to propose a four-term classification of the SLF based mainly on function: dorsal SLF, ventral SLF, posterior SLF, and arcuate fasciculus (AF); these correspond to the traditional SLF II, SLF III or anterior AF, temporoparietal segment of the SLF or posterior AF, and AF or AF long segment, respectively. Each segment has a distinct functional role. The dorsal SLF is involved in visuospatial attention and motor control, while the ventral SLF is associated with language-related networks, auditory comprehension, and articulatory processing in the left hemisphere. The posterior SLF is involved in language-related processing, including auditory comprehension, reading, and lexical access, while the AF is associated with language-related activities, such as phonological processing; the right AF plays a role in social cognition and visuospatial attention. This simple proposed classification permits a better understanding of the SLF and may comprise a convenient classification for use in research and clinical practice relating to brain function [1].

Traditional

Five subcomponents of the SLF have been described. The superior horizontal fibers connect the superior parietal lobe (SLF-I), the angular gyrus (SLF-II) and the supramarginal gyrus (SLF-III) to ipsilateral frontal and opercular areas. The fourth component is known to be the arcuate fasciculus which connects the superior temporal gyrus and the ventrolateral prefrontal cortex together. A fifth SLF component has also been described in some prior studies [2] [3] [4].

SLF I is the dorsal component and originates in the superior and medial parietal cortex, passes around the cingulate sulcus and in the superior parietal and frontal white matter, and terminates in the dorsal and medial cortex of the frontal lobe (Brodmann 6, 8, and 9) and in the supplementary motor cortex (M II).

SLF I connects to the superior parietal cortex which encodes locations of body parts in a body-centric coordinate system and with M II and dorsal premotor cortex. This suggests the SLF I is involved with regulating motor behavior, especially conditional associative tasks which select among competing motor tasks based on conditional rules.

SLF II is the major component of SLF and originates in the caudal-inferior parietal cortex and terminates in the dorsolateral prefrontal cortex (Brodmann 6, 8 and 46).

SLF II connects to the caudal inferior parietal cortex which controls spatial attention and visual and oculomotor functions. This suggests the SLF II provides the prefrontal cortex with parietal cortex information regarding perception of visual space. Since these bundles are bi-directional, working memory (Brodmann 46) in the prefrontal cortex may provide the parietal cortex with information to focus spatial attention and regulate selection and retrieval of spatial information.

SLF III is the ventral component and originates in the supramarginal gyrus (rostral portion of the inferior parietal lobe) and terminates in the ventral premotor and prefrontal cortex (Brodmann 6, 44, and 46).

SLF III connects the rostral inferior parietal cortex which receives information from the ventral precentral gyrus. This suggests that the SLF III transfers somatosensory information, such as language articulation, between the ventral premotor cortex, Brodmann 44 (pars opercularis), the supramarginal gyrus (Brodmann 40), and the laterial inferior prefrontal cortex working memory (Brodmann 46).

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