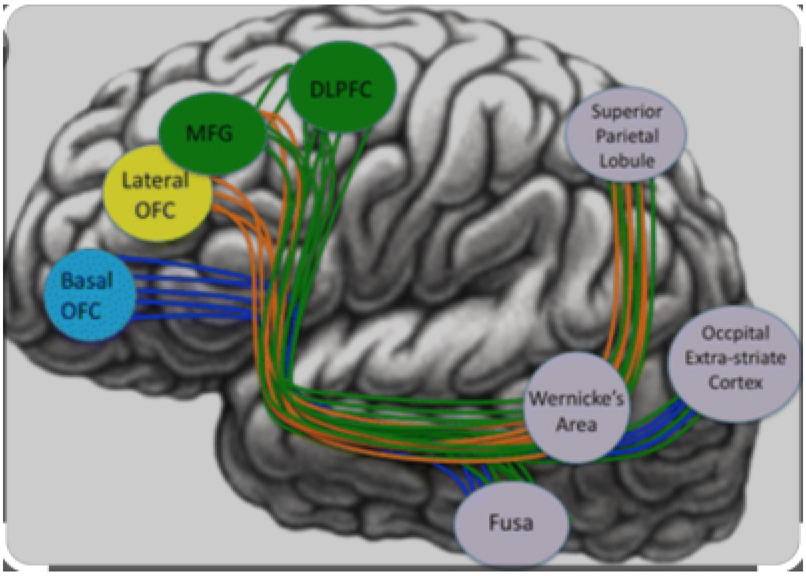
Inferior fronto-occipital fascicle



The inferior Occipitofrontal fasciculus (IFOF) is a large white matter tract of the human cerebrum with functional connectivity associated with semantics processing and goal-oriented behavior.

The earliest description of the Inferior frontooccipital fascicle dates back to Burdach (1819–1826) [1)] who described direct fronto-occipital connections although he misattributed them to the inferior longitudinal fasciculus.

Both inferior fronto occipital (IFOF) fascicle and uncinate fasciculus are crucial for the ventral intra-hemispheric transfer of information between the frontal cortex and the occipital, temporal and parietal cortices, and knowing their cortical terminations is fundamental for understanding their role in mediating language semantics [2)].

Dissection studies have provided in-depth descriptions of its anterior [3)] and posterior [4)] terminations.

Classification

Sarubbo et al., accurately analyze its course and the anatomical distribution of its frontal terminations and propose a classification of the IFOF in different subcomponents. Ten hemispheres (5 left, 5 right) were dissected with Klingler's technique. In addition to the IFOF dissection, we performed a 4-T diffusion tensor imaging study on a single healthy subject and identified two layers of IFOF. The first one is superficial and antero-superiorly directed, terminating in the inferior frontal gyrus. The second is deeper and consists of three portions: posterior, middle and anterior. The posterior component terminates in the middle frontal gyrus (MFG) and dorso-lateral prefrontal cortex. The middle component terminates in the MFG and lateral orbito-frontal cortex. The anterior one is directed to the orbito-frontal cortex and frontal pole. In vivo tractography study confirmed these anatomical findings. We suggest that the distribution of IFOF fibers within the frontal lobe corresponds to a fine functional segmentation. IFOF can be considered as a “multi-function” bundle, with each anatomical subcomponent subserving different brain processing. The superficial layer and the posterior component of the deep layer, which connects the occipital extrastriate, temporo-basal and inferior frontal cortices, might subserve semantic processing. The middle component of the deep layer could play a role in a multimodal sensory-motor integration. Finally, the anterior component of the deep layer might be involved in emotional and behavioral aspects [5].

Findings provide direct support for a critical role of the right IFOF in non-verbal semantic processing. Based upon these original data, and in connection with previous findings showing the involvement of the left IFOF in non-verbal semantic processing, Herbert et a., hypothesize the existence of a bilateral network underpinning the non-verbal semantic system, with a homotopic connectional architecture [6].

Brain tumors can result in displacement or destruction of important white matter tracts such as the inferior fronto-occipital fascicle (IFOF). Diffusion tensor imaging (DTI) can assess the extent of this effect and potentially provide neurosurgeons with an accurate map to guide tumor resection; analyze IFOF displacement patterns in temporoinsular gliomas based on tumor grading and topography in the temporal lobe; and assess whether these patterns follow a predictable pattern, to assist in maximal tumor resection while preserving IFOF function.

Methods: Thirty-four patients with temporal gliomas and available presurgical MRI were recruited. Twenty-two had insula infiltration. DTI deterministic region of interest (ROI)-based tractography was performed using commercial software. Tumor topographic imaging characteristics analyzed were as follows: location in the temporal lobe and extent of extratemporal involvement. Qualitative tractographic data obtained from directional DTI color maps included type of involvement (displaced/edematous-infiltrated/destroyed) and displacement direction. Quantitative tractographic data of ipsi- and contralateral IFOF included whole tract volume, fractional anisotropy, and fractional anisotropy of a 2-dimensional coronal ROI on the tract at the point of maximum tumor involvement.

Results: The most common tract involvement pattern was edematous/infiltrative displacement. Displacement patterns depended on main tumor location in the temporal lobe and presence of insular involvement. All tumors showed superior displacement pattern. In lateral tumors, displacement tendency was medial. In medial tumors, displacement tendency was lateral. When we add insular involvement, the tendency was more medial displacement. A qualitative and quantitative assessment supported these results.

Conclusions: IFOF displacement patterns are reproducible and suitable for temporoinsular gliomas presurgical planning [7]

1)
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