Operculum Function

Its complex functions include sensory, motor, autonomic and cognitive processing. In humans, these are extended with the addition of language. These functions are implemented by highly specialized neuronal populations and their widespread connections.

The dominant hemisphere frontal operculum may contain critical speech and language pathways, and due to these properties, patients with tumors of the opercular region may be at higher risk for postoperative speech dysfunction. However, the likelihood of incurring temporary or permanent language dysfunction is unknown.

The frontal operculum rostral to the ascending ramus of the lateral fissure is associated with the prefrontal association cortex and plays a role in thought, cognition, and planning behaviour.

The frontoparietal operculum caudal to the ascending ramus is thought to contain the gustatory cortex and govern discrimination of various taste qualities. As the parietal operculum contains inferior portions of the precentral and postcentral gyri, it also has a role in primary somatosensory and motor function.

The temporal operculum contains Heschl's gyrus which serves as the primary auditory complex. This is the termination of the afferent auditory pathway after having received fibres from the medial geniculate nucleus.

Mălîia et al. from Bucharest, studied a group of 31 patients that were explored with intracranial electrodes during the pre-surgical workup for drug resistant epilepsy.

They selected the subset of contacts implanted in non-epileptogenic opercular cortex and analyzed the neurophysiological and behavioral responses to direct electrical stimulation. The functional mapping was performed by applying 1 Hz and 50 Hz electrical stimulation on 252 contact pairs and recording the threshold for evoking clinical effects. The effective connectivity was assessed using cortico-cortical evoked potentials elicited by single-pulse electrical stimulation in a subset of 19 patients. The locations of the effects grouped in twelve distinct semiological classes were analyzed. The most frequent effects evoked by stimulation of the frontal operculum were language related (29%). The Rolandic area produced most often oropharyngeal symptoms (47%), the parietal operculum produced somatosensory effects (67%), while the temporal evoked auditory (58%) semiology. The connectivity pattern was complex, with these structures having widespread ipsilateral and contralateral projections. The local connections between the opercular subregions and with the insula, as well as with more distant areas like the cingulate gyrus, were distinguished by strength and between-subjects consistency. In conclusion, they demonstrated specific opercular functionality, distinct from the one of the insular cortex. The study is complemented by a literature review on the opercular functional connectome in human and non-human primates ¹⁰.

1)

Mălîia MD, Donos C, Barborica A, Popa I, Ciurea J, Cinatti S, Mîndruță I. Functional mapping and effective connectivity of the human operculum. Cortex. 2018 Sep 10;109:303-321. doi: 10.1016/j.cortex.2018.08.024. [Epub ahead of print] PubMed PMID: 30414541.

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