Cingulate gyrus

The cingulate gyrus surrounds the corpus callosum in a belt-shaped manner at the mesial aspect of the cerebral hemispheres.

Function

see Cingulate gyrus function.

Divisions

It is divided into anterior (frontal lobe) and posterior (parietal lobe) portions in the area of the central sulcus. The rostral part surrounds the genu of the corpus callosum and ends in the subcallosal cortex; it continues posteriorly around the splenium of the corpus callosum to become the parahippocampal gyrus at the level of the cingulate isthmus. The adjacent areas of the hemisphere comprise the mesial and hemispheric surface of F1 with the SMA, the paracentral lobule, and the precuneus in the parietal lobe von Lehe and Schramm summarized the areas adjacent to the cingulate gyrus at the interhemispheric surface as “supracingular”). [1].

It begins below the rostrum, curves around in front of the genu, extends along the trunk, and then turns downward behind the splenium of the corpus callosum, where it is connected by the narrow isthmus of the cingulate gyrus to the parahippocampal gyrus. It is separated from the medial frontal gyrus by the cingulate sulcus and from the precuneus by the more variable suprasplenia sulcus. It has many connections with the anterior thalamic nucleus.

Tinnitus distress has been linked to increased beta oscillatory activity in the dorsal anterior cingulate cortex (dACC). The amount of distress is linked to alpha activity in the medial temporal lobe (amygdala and parahippocampal area), as well as the subgenual (sg)ACC and insula, and the functional connectivity between the parahippocampal area and the sgACC at 10 and 11.5 Hz.

see Anterior cingulate cortex.

see Posterior cingulate cortex.

see Subgenual cingulate gyrus.

May be adherent in the midline and confused with the corpus callosum.

see Cingulate gyrus glioma

see Cingulate herniation

The cingulate cortex is a part of the brain situated in the medial aspect of the cerebral cortex. The cingulate cortex includes the cortex of the cingulate gyrus, which lies immediately above the corpus callosum, and the continuation of this in the cingulate sulcus. The cingulate cortex is usually considered part of the limbic lobe.

It receives inputs from the thalamus and the neocortex, and projects to the entorhinal cortex via the cingulum.

It is an integral part of the limbic system, which is involved with emotion formation and processing,learning, and memory.

The combination of these three functions makes the cingulate gyrus highly influential in linking behavioral outcomes to motivation (e.g. a certain action induced a positive emotional response, which results in learning).

This role makes the cingulate cortex highly important in disorders such as depression and schizophrenia.

It also plays a role in executive function and respiratory control.

Anterior cingulate cortex

Whereas neuroimaging studies of healthy subjects have demonstrated an association between the anterior cingulate cortex (ACC) and cognitive control functions, including response monitoring and error detection, lesion studies are sparse and have produced mixed results. Due to largely normal behavioral test results in two patients with medial prefrontal lesions, a hypothesis has been advanced claiming that the ACC is not involved in cognitive operations. In a study, two comparably rare patients with unilateral lesions to dorsal medial prefrontal cortex (MPFC) encompassing the ACC were assessed with neuropsychological tests as well as Event-Related Potentials in two experimental paradigms known to engage prefrontal cortex (PFC). These included an auditory Novelty Oddball task and a visual Stop-signal task. Both patients performed normally on the Stroop test but showed reduced performance on tests of learning and memory. Moreover, altered attentional control was reflected in a diminished Novelty P3, whereas the posterior P3b to target stimuli was present in both patients. The error-related negativity, which has been hypothesized to be generated in the ACC, was present in both patients, but alterations of inhibitory behavior were observed. Although interpretative caution is generally called for in single case studies, and the fact that the lesions extended outside the ACC, the findings nevertheless suggest a role for MPFC in cognitive control that is not restricted to error monitoring [2)].

Pathology

see Cingulate gyrus glioma.

1)
von Lehe M, Schramm J. Gliomas of the cingulate gyrus: surgical management and functional outcome. Neurosurg Focus. 2009 Aug;27(2):E9. doi: 10.3171/2009.6.FOCUS09104. PubMed PMID: 19645564.
2)
Løvstad M, Funderud I, Meling T, Krämer UM, Voytek B, Due-Tønnessen P, Endestad T, Lindgren M, Knight RT, Solbakk AK. Anterior cingulate cortex and cognitive control: neuropsychological and electrophysiological findings in two patients with lesions to dorsomedial prefrontal cortex. Brain Cogn. 2012 Nov;80(2):237-49. doi: 10.1016/j.bandc.2012.07.008. Epub 2012 Aug 27. PubMed PMID: 22935543; PubMed Central PMCID: PMC4067454.