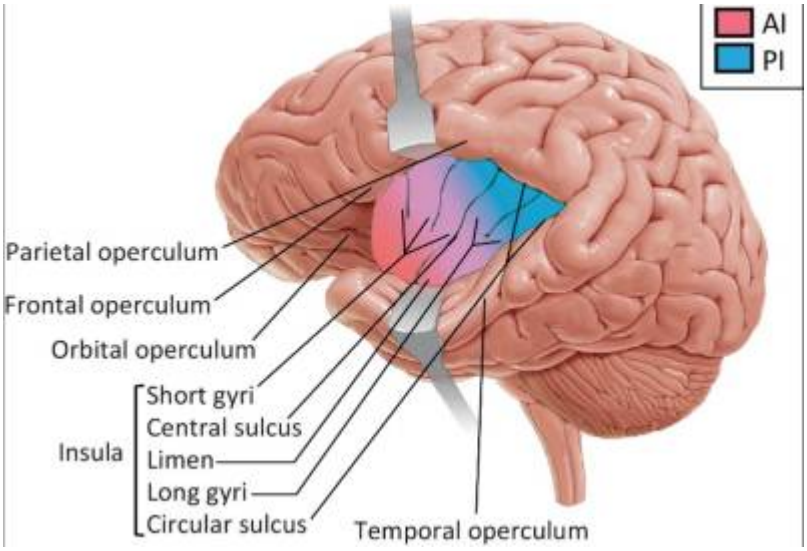
Insula



Although not related to any bone of the skull, the insular lobe has long been recognized as a distinct region since its original description by Reil in 1809 [1) 2)].

The insular cortex (often called insula, insulary cortex or insular lobe) is a portion of the cerebral cortex folded deep within the lateral sulcus.

The insula is the only cortical part of the brain which is not visible on the surface of the hemisphere. This is due to the fact that it is totally covered by the fronto-parietal and temporal operculum. It is a complex structure constituting the anatomic, cytoarchitectonic, and functional interfaces between the allocortex and the neocortex. This area is part of a larger system that includes the fronto-orbital, temporopolar, and insular regions. The area constitutes the paralimbic system or mesocortex.

The 3D structure of the insula constitutes a pyramid, and its apex represents the most lateral and superficial point of the structure, located 9–16 mm from the cortical surface.

Independent of the insular area treated, an understanding of the neuroanatomy related to the anterior frontal laser trajectory is essential to improve the ability to perform LITT of this challenging region [3)].

The insula has a triangular shape, and is separated from the opercula by the anterior, superior, and inferior periinsular sulci. The limen insulae is the antero-inferiorly located insular cortical surface which conjoins the inferior insular point, the anterior perforated surface, and the temporo-mesial surface. The insula is morphologically divided into two parts by the central insular sulcus. The anterior part of the insula bears 3 gyri: the anterior, middle, and posterior short insular gyri, separated by the anterior and precentral insular sulcus. The posterior part of the insula contains the anterior and posterior long insular gyri, separated by the postcentral insular sulcus.

see Insular apex.

see Insular surface.

Surgery

see Insular tumor surgery.

Parts

Dorsal anterior insula

Two important anatomical landmarks of the insular lobe are the insular stem, which is the anterobasal portion of the insula located in the depth of the proximal sylvian fissure, and the limen insulae, located within the insular stem.

The insular cortex is divided into two parts: the larger anterior insula and the smaller posterior insula in which more than a dozen field areas have been identified. The cortical area overlying the insula toward the lateral surface of the brain is the operculum (meaning lid). The opercula are formed from parts of the enclosing frontal, temporal, and parietal lobes.

Each insula has a trapezoid shape, surrounded by four periinsular sulcus (anterior, superior, posterior, and inferior).

Afif and Mertens differentiated the posterior peri-insular sulcus from the inferior peri-insular sulcus. These two sulci have two different axes separated by a clear angle. The central insular sulcus divides the insula into two parts. The anterior insula includes three short gyri and the anterior insular pole. The posterior insula includes two long gyri and the posterior insular pole. This structure defines two intra-insular opercula. In 60% of cases, the superior extremity of the central insular sulcus is in direct continuity with the inferior extremity of the cerebral central sulcus. The superior branch of the middle cerebral artery supplies the majority of the anterior insular gyri, and the inferior branch supplies the majority of the posterior insular gyri [4].

as, anterior short insular gyrus;

al, anterior long insular gyrus;

ac, accessory gyrus;

APS, anterior peri-insular sulcus;

H, Heschl's gyrus;

IPS, inferior peri-insular sulcus;

ms, middle short insular gyrus;

ps, posterior short insular gyrus;

pl, posterior long insular gyrus;

SPS, superior peri-insular sulcus. Photograph is courtesy of Professor Thomas P. Naidich, Mount Sinai Medical Center, New York.

see Superior precentral gyrus of the insula

Vascular supply

see Insula vascular supply.

Functions

see Insula functions.

Pathology

see Insular tumor

Epilepsy

see Insular lobe epilepsy

Approaches

Transcortical (TC) and transsylvian approach (TS) corridors have been described as the main surgical approaches to the insula, but there is insufficient evidence to support one approach versus the other.

Transinsular approach.

Transopercular approach.

Overall, the TC approach to the insula provided better insula exposure and surgical freedom compared with the TS with the superficial sylvian bridging veins cut. Cortical and subcortical mapping is critical during the TC approach to the posterior zones (II and III), as the facial motor and somatosensory functions (Zone II) and language areas (Zone III) may be involved [5)].`

Development

Insula Development

1)
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2)
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3)
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4)

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