Posterior cingulate cortex

The posterior cingulate cortex (PCC) is the backmost part of the cingulate cortex, lying behind the anterior cingulate cortex. This is the upper part of the “limbic lobe”. The cingulate cortex is made up of an area around the midline of the brain. Surrounding areas include the retrosplenial cortex and the precuneus.

Cytoarchitectonically the posterior cingulate cortex is associated with Brodmann areas 23 and 31.

The posterior cingulate cortex forms a central node in the default mode network of the brain. It has been shown to communicate with various brain networks simultaneously and is involved in various functions.

Along with the precuneus, the posterior cingulate cortex has been implicated as a neural substrate for human awareness in numerous studies of both the anesthesized and vegetative (coma) state. Imaging studies indicate a prominent role for the posterior cingulate cortex in pain and episodic memory retrieval.

Increased size of posterior ventral cingulate cortex is related to the working memory performance decline.

The posterior cingulate cortex has been strongly implicated as a key part of several intrinsic control networks.

Using direct intraoperative electrostimulations, Herbet et al. showed in a rare patient that disrupting the subcortical connectivity of the left posterior cingulate cortex (PCC) reliably induced a breakdown in conscious experience. This acute phenomenon was mainly characterized by a transient behavioral unresponsiveness with loss of external connectedness. In all cases, when he regained consciousness, the patient described himself as in dream, outside the operating room. This finding suggests that functional integrity of the PPC connectivity is necessary for maintaining consciousness of external environment [1].

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see cingulate gyrus glioma

Neuroimaging studies have identified the posterior cingulate gyrus (PostC) as a cortical region affected early in the onset of AD. This association cortex is involved in a variety of different cognitive tasks and is intimately connected with the hippocampal/entorhinal cortex region, a component of the medial temporal memory circuit that displays early AD pathology. We quantified the total number of synapses in lamina 3 of the PostC using unbiased stereology coupled with electron microscopy from short postmortem autopsy tissue harvested from cases at different stage of AD progression. Individuals in the early stages of AD showed a significant decline in synaptic numbers compared to individuals with no cognitive impairment (NCI). Subjects with MCI exhibited synaptic numbers that were between the AD and NCI cohorts. Adjacent tissue was evaluated for changes in both pre and postsynaptic proteins levels. Individuals with MCI demonstrated a significant loss in presynaptic markers synapsin-1 and synaptophysin and postsynaptic markers PSD-95 and SAP-97. Levels of [3H]PiB binding was significantly increased in MCI and AD and correlated strongly with levels of synaptic proteins. All synaptic markers showed a significant association with Mini-Mental Status

Examination scores. These results support the idea that the PostC synaptic function is affected during the prodromal stage of the disease and may underlie some of the early clinical sequelae associated with AD [2].

1)

Herbet G, Lafargue G, de Champfleur NM, Moritz-Gasser S, le Bars E, Bonnetblanc F, Duffau H. Disrupting posterior cingulate connectivity disconnects consciousness from the external environment. Neuropsychologia. 2014 Apr;56:239-44. doi: 10.1016/j.neuropsychologia.2014.01.020. Epub 2014 Feb 4. PubMed PMID: 24508051.

2)

Scheff SW, Price DA, Ansari MA, Roberts KN, Schmitt FA, Ikonomovic MD, Mufson EJ. Synaptic change in the posterior cingulate gyrus in the progression of Alzheimer's disease. J Alzheimers Dis. 2015;43(3):1073-90. doi: 10.3233/JAD-141518. PubMed PMID: 25147118; PubMed Central PMCID: PMC4313125.

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