Mesial temporal lobe

The mesial temporal lobe is, as the name suggests, located on the medial aspect of the temporal lobe and is distinct from the rest of the lobe which is comprised of neocortex.

The term encompasses five structures:

Amygdala

Hippocampus

Uncus

Dentate gyrus

Parahippocampal gyrus. The medial temporal lobe includes a system of anatomically related structures that are essential for declarative memory.

The system consists of the hippocampal region and the adjacent perirhinal, entorhinal cortex, and parahippocampal cortices.

This system (a) is principally concerned with memory, (b) operates with neocortex to establish and maintain long-term memory, and c ultimately, through a process of consolidation, becomes independent of long-term memory, though questions remain about the role of perirhinal and parahippocampal cortices in this process and about spatial memory in rodents. Data from neurophysiology, neuroimaging, and neuroanatomy point to a division of labor within the medial temporal lobe. However, the available data do not support simple dichotomies between the functions of the hippocampus and the adjacent medial temporal cortex, such as associative versus nonassociative memory, episodic versus semantic memory, and recollection versus familiarity [1].

The intraventricular elements are the hippocampus, fimbria, amygdala, and choroidal fissure; the extraventricular elements are the uncus and parahippocampal gyrus and dentate gyrus.

Not only is the knowledge of these relations useful to angiographically characterize the mesial temporal region, but it has also proven to be of extreme value during microsurgeries involving this region as applied to amygdalohippocampectomy [2].

Statistical analysis demonstrated that the left medial temporal lobe and right anterior temporal lobe were specifically associated with high expression of mutant p53. Kaplan-Meier curves showed that tumors located in these regions were associated with significantly worse progression free survival compared with tumors occurring elsewhere, providing new evidence that genetic changes during cancer may have anatomic specificity. Additionally, suggests that tumor location identified on structural MR images could potentially be used for customized presurgical outcome prediction [3].

Function

The involvement of the medial temporal lobe (MTL) in working memory is controversially discussed. Recent findings suggest that persistent neural firing in the hippocampus during maintenance in verbal working memory is associated with workload. Here, we recorded single neuron firing in 13 epilepsy patients (7 male) while they performed a visual working memory task. The number of coloured squares in the stimulus set determined the workload of the trial. Performance was almost perfect for low workload (1 and 2 squares) and dropped at high workload (4 and 6 squares), suggesting that high workload exceeded working memory capacity. We identified maintenance neurons in MTL neurons that showed persistent firing during the maintenance period. More maintenance neurons were found in the hippocampus for trials with correct compared to incorrect performance. Maintenance neurons increased and decreased firing in the hippocampus and increased firing in the entorhinal cortex for high compared to low workload. Population firing predicted workload particularly during the maintenance period. Prediction accuracy of workload based on single-trial activity during maintenance was strongest for neurons in the entorhinal cortex and hippocampus. The data suggest that persistent neural firing in the MTL reflects a domain-general process of maintenance supporting performance and workload of multiple items in working memory below and beyond working memory capacity. Persistent neural firing during maintenance in the entorhinal cortex may be associated with its preference to process visual-spatial arrays [4].

Pathology

see Mesial temporal lobe glioma.

1)
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2)
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3)
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4)
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