Hippocampal volume

To compare the hippocampal volume and local surface morphology changes in patients with mesial temporal lobe (mTLE) using the voxel-based morphometry and spherical harmonic methods respectively. A total of 66 patients (31 males and 35 females, age range from 17 to 48 (28±8) years) with mTLE and 80 age-and gender-matched controls (38 males and 42 females, age range from 19 to 46 (27±7) years) were retrospectively collected from July 2009 to February 2019 at Jinling hospital.. High resolution structural MRI of the whole brain, three-dimensional T1-weighted data(3DT1) were acquired from each subject. The changes of hippocampal volume and surface morphology were evaluated between mTLE groups and controls for observing the hippocampal atrophy pattern by using voxel-based morphometry and spherical harmonic shape descriptions point distribution model respectively. Pearson correlation coefficient analysis was conducted for observing the relationship between the morphological changes of hippocampus and disease duration. Results: Compared with the controls, hippocampal volume on the affected side in patients with mTLE was significantly reduced (Z-score:-1.55±0.57 vs 0.38±0.58, P<0.001) and negatively correlated with disease duration (r=-0.297, P=0.016). Furthermore, surface morphology analysis subtly showed that the atrophy of the affected hippocampus in patients with mTLE mainly located in the head, mesial lateral part and posterior tail of the hippocampus. Their displacement values were negatively correlated with disease duration (r=-0.336, P=0.006) and positively associated with the hippocampal grey matter volume (r=0.336, P=0.006). Conclusions: Voxel-based morphometry analysis reveals a global reduction in hippocampal volume, while the morphological measurement method based on surface shape can describe the local morphological changes of hippocampal atrophy [1)].

Hippocampal volume was assessed by manual segmentation of high-resolution 3D magnetic resonance images. Pohlack et al. found a significant positive correlation between putatively hippocampus-dependent memory measures like short-delay retention, long-delay retention and discriminability, and percent hippocampal volume. No significant correlation with measures related to executive processes was found. In addition, percent amygdala volume was not related to any of these measures. Our data advance previous findings reported in studies of brain-damaged individuals in a large and homogeneous young healthy sample and are important for theories on the neural basis of episodic memory [2)].

Gender and left hippocampal volumes are the main predictors for verbal memory function in normal aging. APOE genotype did not affect the results in any part in an analysis of Ystad et al. [3)].

There was a significant relationship between the radiotherapy dose and a decrease in hippocampal volume. However, at the lowest doses, the hippocampi seem to exhibit an adaptive increase in their volume, which could indicate a plasticity effect. Consequently, shielding at least one hippocampus by delivering the lowest possible dose is recommended so that cognitive function can be preserved. Trial registration Retrospectively registered [4)].

Jardim et al. published the first study correlating hippocampal volume on MRI submitted to FreeSurfer processing with ILAE patterns of HS and neuronal loss within each hippocampal subfield, a fundamental finding to anticipate surgical prognosis for patients with drug-resistant MTLE and HS [5].

1)
Liu RT, Zhang ZQ, Hao JR, Weng YF, Xu Q, Zhang QR, Yang F, Sun KJ, Lu GM. [The analysis of structural magnetic resonance imaging manifestation of hippocampus based on voxel and spherical harmonic surface morphometry in mesial temporal lobe epilepsy]. Zhonghua Yi Xue Za Zhi. 2021 Oct 12;101(37):3024-3028. Chinese. doi: 10.3760/cma.j.cn112137-20210203-00337. PMID: 34638195.
2)
Pohlack ST, Meyer P, Cacciaglia R, Liebscher C, Ridder S, Flor H. Bigger is better! Hippocampal volume and declarative memory performance in healthy young men. Brain Struct Funct. 2014 Jan;219(1):255-67. doi: 10.1007/s00429-012-0497-z. Epub 2012 Dec 27. PMID: 23269366; PMCID: PMC3889822.
3)
Ystad MA, Lundervold AJ, Wehling E, Espeseth T, Rootwelt H, Westlye LT, Andersson M, Adolfsdottir S, Geitung JT, Fjell AM, Reinvang I, Lundervold A. Hippocampal volumes are important predictors for memory function in elderly women. BMC Med Imaging. 2009 Aug 22;9:17. doi: 10.1186/1471-2342-9-17. PMID: 19698138; PMCID: PMC2743662.
4)
Le Fèvre C, Cheng X, Loit MP, Keller A, Cebula H, Antoni D, Thiery A, Constans JM, Proust F, Noel G. Role of hippocampal location and radiation dose in glioblastoma patients with hippocampal atrophy. Radiat Oncol. 2021 Jun 22;16(1):112. doi: 10.1186/s13014-021-01835-0. PMID: 34158078.
5)
Jardim AP, Corso JT, Garcia MT, Gaça LB, Comper SM, Lancellotti CL, Centeno RS, Carrete H Júnior, Cavalheiro EA, Scorza CA, Yacubian EM. Hippocampal atrophy on MRI is predictive of histopathological patterns and surgical prognosis in mesial temporal lobe epilepsy with hippocampal sclerosis. Epilepsy Res. 2016 Oct 24;128:169-175. doi: 10.1016/j.eplepsyres.2016.10.014. [Epub ahead of print] PubMed PMID: 27842262.