

Cortical thickness

- Prospective neuroimaging and neuropsychological evaluation in adults with newly diagnosed focal epilepsy
- Construction of risk prediction model of sentinel lymph node metastasis in breast cancer patients based on machine learning algorithm
- Plasma biomarkers identify brain ATN abnormalities in a dementia-free population-based cohort
- Structural Imaging Measures of Cortical and Basal Ganglia Morphology in Insomnia
- Aging and dental loss impact on the cortical base resorption of the mandibular bone as a confounding bias in a radio-morphometric analysis using panoramic radiographs
- The relationship between cognitive function and cortical thickness in first-episode drug-naïve schizophrenia patients with agitation
- Abnormal Cortical Thickness Development in Young Adults With Heavy Cannabis Use: A Longitudinal Study
- Structural signatures of language reorganization after left hemispherotomy in patients with Rasmussen's encephalitis

Cortical thickness refers to the distance between the **pial** surface (the outermost layer of the cerebral cortex) and the underlying **white matter**.

Measuring cortical thickness is a common technique used in neuroimaging research, particularly in studies related to brain **structure** and **function**. **Magnetic Resonance Imaging** (MRI) is a commonly used method to assess cortical thickness. The analysis involves creating high-resolution structural images of the brain, and then software tools are used to measure the thickness of the cortex at different points across the brain.

Changes in cortical thickness have been associated with various neurological and psychiatric conditions. For example, research has shown that cortical thinning may be linked to aging, neurodegenerative disorders (such as Alzheimer's disease), and psychiatric disorders (such as schizophrenia or depression). Additionally, studies often investigate cortical thickness in specific brain regions to understand its relationship to specific functions or diseases.

It's important to note that cortical thickness is just one aspect of brain structure, and researchers often use multiple measures, including volumetric assessments and surface area, to gain a more comprehensive understanding of brain anatomy.

The clinical applications of the association of cortical thickness and white matter fiber with freezing of gait (FoG) are limited in patients with Parkinson's disease (PD). In this retrospective study, using white matter fiber from diffusion-weighted imaging and cortical thickness from structural-weighted imaging of magnetic resonance imaging, we investigated whether a machine learning-based model can help assess the risk of FoG at the individual level in patients with PD. Data from the Parkinson's Disease Progression Marker Initiative database were used as the discovery cohort, whereas those from the Fujian Medical University Union Hospital Parkinson's Disease database were used as the external validation cohort. Clinical variables, white matter fiber, and cortical thickness were selected by random forest regression. The selected features were used to train the support vector machine(SVM) learning models. The median area under the receiver operating characteristic curve (AUC) was calculated. Model performance was validated using the external validation cohort. In the discovery cohort, 25 patients with PD were defined as FoG converters (15 men, mean age 62.1 years), whereas

60 were defined as FoG nonconverters (38 men, mean age 58.5 years). In the external validation cohort, 18 patients with PD were defined as FoG converters (8 men, mean age 66.9 years), whereas 37 were defined as FoG nonconverters (21 men, mean age 65.1 years). In the discovery cohort, the model trained with clinical variables, cortical thickness, and white matter fiber exhibited better performance (AUC, 0.67-0.88). More importantly, SVM-radial kernel models trained using random over-sampling examples, incorporating white matter fiber, cortical thickness, and clinical variables exhibited better performance (AUC, 0.88). This model trained using the above mentioned features was successfully validated in an external validation cohort (AUC, 0.91). Furthermore, the following minimal feature sets that were used: fractional anisotropy value and mean diffusivity value for right thalamic radiation, age at baseline, and cortical thickness for left precentral gyrus and right dorsal posterior cingulate gyrus. Therefore, machine learning-based models using white matter fiber and cortical thickness can help predict the risk of FoG conversion at the individual level in patients with PD, with improved performance when combined with clinical variables ¹⁾.

The widely used [rubber hand illusion](#) (RHI) [paradigm](#) provides insight into how the [brain](#) manages conflicting [multisensory integration](#) regarding [bodily self-consciousness](#). Previous [functional neuroimaging](#) studies have revealed that the feeling of [body ownership](#) is linked to activity in the [premotor cortex](#), the intraparietal areas, the [occipitotemporal cortex](#), and the [insula](#). Matuz-Budai et al. investigated whether the individual differences in the sensation of body ownership over a rubber hand, as measured by the subjective report and the [proprioceptive drift](#), are associated with structural brain differences in terms of [cortical thickness](#) in 67 healthy young adults. Matuz-Budai et al. found that individual differences measured by the subjective report of [body ownership](#) are associated with the [cortical thickness](#) in the [somatosensory](#) regions, the temporoparietal junction, the intraparietal areas, and the [occipitotemporal cortex](#), while the [proprioceptive drift](#) is linked to the [premotor cortex](#) and the [anterior cingulate cortex](#). These results are in line with [functional neuroimaging](#) studies indicating that these areas are indeed involved in processes such as cognitive-affective perspective-taking, visual processing of the [body](#), and the [experience](#) of [body ownership](#) and [bodily awareness](#). Consequently, these individual differences in the sensation of [body ownership](#) are pronounced in both functional and structural differences ²⁾.

Younger [age](#) at first [exposure](#) (AFE) to repetitive [head impacts](#) while playing [American football](#) increases the risk for later-life neuropsychological [symptoms](#) and brain alterations.

Results suggest an association between younger AFE and decreased cortical thickness, which in turn is associated with worse neuropsychological performance. Furthermore, an association between younger AFE and signs of [neurodegeneration](#) later in life in symptomatic former American football players seems likely ³⁾.

Sixty-three former professional National Football League players (55.5 ± 7.7 years) with [cognitive](#), [behavioral](#), and [mood](#) symptoms underwent neuroimaging and neuropsychological testing. First, the association between cortical thickness and AFE was tested. Second, the relationship between clusters of decreased cortical thickness and verbal and [visual memory](#), and composite measures of mood/behavior and attention/psychomotor speed were assessed. AFE was positively correlated with cortical thickness in the right superior [frontal cortex](#) (cluster-wise P-value [CWP] = 0.0006), the left [parietal](#) cortex (CWP = 0.0003), and the occipital cortices (right: CWP = 0.0023; left: CWP = 0.0008).

A positive correlation was found between cortical thickness of the right superior frontal cortex and verbal memory ($R = 0.333$, $P = 0.019$), and the right occipital cortex and visual memory ($R = 0.360$, $P = 0.012$). In conclusion, the results suggest an association between younger AFE and decreased cortical thickness, which in turn is associated with worse neuropsychological performance. Furthermore, an association between younger AFE and signs of [neurodegeneration](#) later in life in symptomatic former American football players seems likely ⁴⁾.

Patients ($n=106$) with refractory MTLE-HS submitted to [corticoamygdalohippocampectomy](#) (CAH) (57 left mesial temporal lobe epilepsy (MTLE); 45 males) were enrolled. To determine if the IQ was a predictor of seizure outcome, totally seizure-free (SF) versus nonseizure-free (NSF) patients were evaluated. [FreeSurfer](#) was used for [cortical thickness](#) and volume estimation, comparing groups with lower (<80) and higher IQ (90-109) levels.

In the whole series, 42.45% of patients were SF (Engel Class 1a; $n=45$), and 57.54% were NSF ($n=61$). Total cortical volume was significantly reduced in the group with lower IQ ($p=0.01$). Significant reductions in the left hemisphere included the following: rostral middle frontal ($p=0.001$), insula ($p=0.002$), superior temporal gyrus ($p=0.003$), thalamus ($p=0.004$), and precentral gyrus ($p=0.02$); and those in the right hemisphere included the following: rostral middle frontal ($p=0.003$), pars orbitalis ($p=0.01$), and insula ($p=0.02$). Cortical thickness analysis also showed reductions in the right superior parietal gyrus in patients with lower IQ. No significant relationship between IQ and seizure outcome was found.

This is the first study of a series of patients with pure MTLE-HS, including those with low IQ and their morphometric magnetic resonance imaging (MRI) features using FreeSurfer. Although patients with lower intellectual scores presented more areas of brain atrophy, IQ was not a predictor of surgical outcome. Therefore, when evaluating seizure follow-up, low IQ in patients with MTLE-HS might not contraindicate resective surgery ⁵⁾.

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