

Quantification of Cortical Thickness and Cortical Surface Area Abnormalities in Patients Affected by Migraine

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Introduction. Structural^{1,2} and functional³ magnetic resonance imaging (MRI) techniques have contributed to improve the understanding of the pathophysiology of migraine, by showing that, despite its episodic nature, migraine can result in abnormalities of central nervous system morphology and function.

Objective. Aim of this study was to quantify abnormalities of cortical thickness (CT) and cortical surface area (CSA) in patients suffering from migraine and to assess how they differ according to patients' clinical (migraineurs with [MWA] or without [MWoA] aura) and radiological (presence or absence of white matter lesions [WMLs]) characteristics.

Methods. Using a 3.0 Tesla scanner, T2- and 3D T1-weighted images were acquired from 63 migraine patients and 18 healthy controls. Cortical reconstruction and CT/CSA were performed using FreeSurfer analysis suite (<http://surfer.nmr.mgh.harvard.edu/>). A vertex-by-vertex statistical analysis was used to perform between-group comparisons (migraineurs vs. controls, MWA vs. MWoA, patients with WMLs vs. those without WMLs), as well as the correlations between CT/CSA and clinical (disease duration, number of attacks) and radiological (T2 lesion load) characteristics.

Results. Compared to controls, patients with migraine experienced distributed CT and CSA abnormalities. A decreased CT and CSA in lateral frontal lobes and an increased CT in medial fronto-parietal regions was detected in areas belonging to the “pain matrix”.

CT increase was also detected in the temporal lobe, including MT/V5, and V1. Conversely, CSA of MT/V5 was decreased (**Figure 1**). The regional distribution of cortical abnormalities differed according to patients' clinical and radiological characteristics. Compared to MWoA, MWA showed an increased CSA in the central sulcus that was significantly correlated with disease duration and the number of attacks (**Figure 2**).

Conclusions. Abnormalities of CT and CSA (which are partially independent) occur in patients with migraine and involve areas which are part of the visual and the “pain matrix” networks. These abnormalities may be the consequence of recurrent neuronal activation, due to the repetition of migraine attacks, or represent a phenotypic biomarker of the disease.

References.

1. Rocca MA et al., Stroke 2003;34:665-670.
2. Granziera C et al., PLoS Med. 2006;3(10):e402.
3. Kim JH et al. Cephalalgia 2008; 28:598-604.

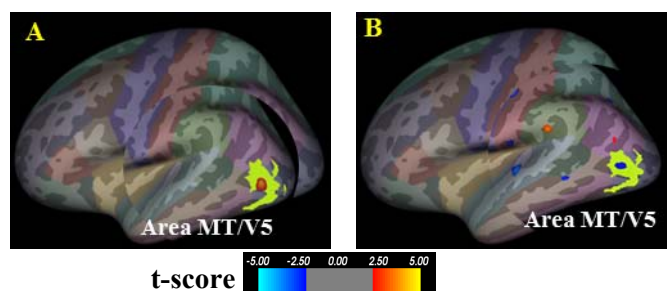


Figure 1. CT increase (A) and CSA decrease (B) in MT/V5 area.

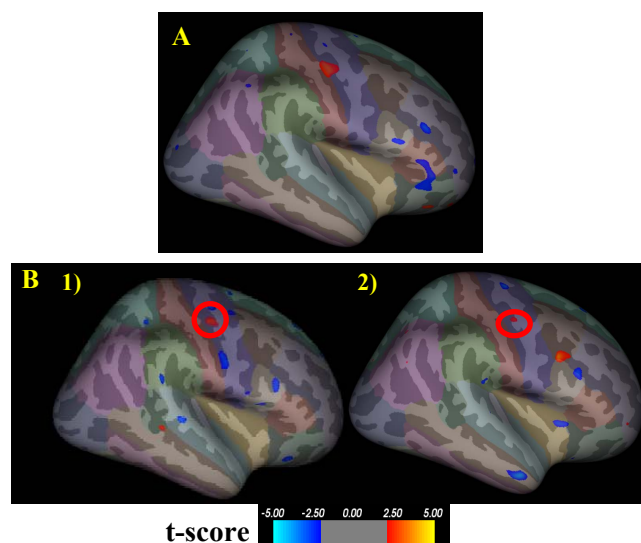


Figure 2. A) MWA vs. MWoA differences of CSA. B) Correlation analysis between CSA and disease duration (1) and the number of attacks (2) in MWA. Red circles: corresponding regions where the CSA increase was correlated to the clinical characteristics.