

MOTOR CONNECTOME MODIFICATIONS IN ESSENTIAL TREMOR. INDUCED EFFECTS OF TALAMIC VIM MRgFUS ABLATION.

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The causal mechanism behind essential tremor (ET) involves self-sustained cerebellar-thalamo-cortical dysfunction. The Vim has traditionally been regarded as the preferred neuromodulatory target for tremor relief in ET [1]. Promising results have been recently published on thalamotomy of the Vim using MRgFUS [2]. We used resting-state functional MRI (rs-fMRI) to longitudinally investigate functional interactions between different nodes of the cerebellar-thalamo-cortical "tremor-network" after MRgFUS Vim ablation. Thirty ET patients were assessed by the TETRAS, the iADL scale, and by 3T rs-FC fMRI before and after MRgFUS treatment with longitudinal evaluation (0, 3 months, 6 months). rs-fMRI data preprocessing and analysis were performed using SPM12 and the CONN toolbox (release 19.c). We first flipped scans

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of patients with right Vim thalamotomy so that all the treatments were considered on the left hemisphere (treated side -TS), thus comparing the untreated side (unTS). In order to describe a "single network"-based description of MRgFUS medium-term effects, we performed a ROI-to-ROI rs-fMRI analysis, exclusively looking at areas of the brain associated with tremors. All results were corrected at cluster-level by cluster threshold set at $p < 0.01$ uncorrected. The following effects were identified as significant only a 6 months after MRgFUS treatment: 1) Decreased FC between unTS Lob V of Cerebellum and TS Lingual Gyrus as the main effect; 2) Linear correlation between thalamic volume and FC increase between unTS SNr and TS Lob VIIb/VIIIa of Cerebellum; 3) Linear correlation between VIM lesion volume at 24hrs and FC decrease after MRgFUS between unTS Gpi and TS VIM as well as between unTS SNc with both unTS VIIb/VIIIa of Cerebellum and TS Lingual Gyrus; 4) Linear correlation between the n° of sonications and FC increase between TS SNc and SNr with unTS Lob VIIb/VIIIa of Cerebellum; 5) Linear correlation between the mean time of each sonication and FC increase between TS and unTS Dentate Nucleus with the VTA; 6) Linear correlation between the peak of Power (Watt) of each sonication and FC increase between TS and unTS Dentate Nucleus with the TS SMA; 7) Linear correlation between the TETRAS Score for the unTS Upper Limb and both FC increase between unTS SMA and unTS Gpe and TS SNc and unTS Lingual Gyrus. MRgFUS treatment effectively modulated rs-FC between cortical, subcortical, and cerebellar brain areas involved in tremor. Certainly, MRgFUS Vim ablation modified the balance of FC between ROIs far from the lesion at six months after the procedure.

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