6th International Symposium on Focused Ultrasound 2018

Reston, Virginia | October 21-25, 2018

Abstract Book

Hyatt Regency Reston
Reston, Virginia, USA

Focused Ultrasound Foundation

P-BR-7

Topic: Brain
Presentation Type: Poster

Thalamic parcellation for target identification in trans-cranial MR-guided focused ultrasound (tcMRgFUS) thalamotomies: A preliminary probabilistc tractography study

Cesare Gagliardo[1], Giorgio Collura[1], Maurizio Marrale[1], Alessandro Napoli[2], Marco D'Amelio[1], Domenico Gerardo[1], Carlo Catalano[2], Massimo Midiri[3], Roberto Lagalla[1]

[1]University of Palermo, Palermo, Italy
[2]Sapienza University of Rome, Rome, Italy
[3]Universita Degli Studi Di Palermo, Palermo, Italy

Background: Trans-cranial MR-guided Focused UltraSound (tcMRgFUS) allows a neurofunctional exploration of thalamic nuclei to confirm and optimize the target before inducing a permanent brain lesion. However, the choice of the target is based on stereotactic coordinates that do not take into account the anatomical variability of each single patient. Thus, the optimization of the treatment target is based on the patient's feedback during lower power sonications. The aim of this work is to retrospectively evaluate the possible role of thalamic parcellation for the identification of the intermediate ventral nucleus (VIM) in patients undergoing tcMRgFUS.

Methods: A 1.5T MR scanner (GE Signa HDxt) was used to acquire morphological (3D-FSPGR T1w) and ultrastructural morphological sequences (Diffusion Tensor Imaging) in patients that subsequently underwent tcMRgFUS thalamotmy. A segmentation of the eloquent cerebral areas was then used as seed for a probabilistic tractography algorithm aimed at representing the cortical projections to and from the thalamus with particular reference to the primary and supplementary motor areas and the premotor cortex. The thalamic parcellation maps obtained were then compared with tcMRgFUS induced lesions.

Results: In all cases it was possible to represent the major groups of thalamic nuclei that receive from or project towards brain cortex. It was possible to identify a good overlap between the thalamic parcellation maps thus obtained (with particular reference to the VIM nucleus) and the lesions induced by tcMRgFUS.

Conclusions: These preliminary results are very encouraging. Even if the requested pre- and post-processing pipeline behind such an innovative approach are still extremely complex and time consuming, the use of such a technique could result very helpful during tcMRgFUS treatment target optimization, especially in that cases where the optimal treatment target does not perfectly match conventional stereotactic coordinates.

Acknowledgements: The installation of the tcMRgFUS equipment used in this work was funded by the Italian Ministry of Education, University and Research (MIUR) within the project "Programma Operativo Nazionale 2007-3013" (PONa3_00011; Project Leader: Prof. Carlo Catalano). The research leading to these results has received funding from the Italian Ministry of Health's "Ricerca Finalizzata 2016" (GR-2016-02364526; Principal Investigator: Dr. Cesare Gagliardo).