Optimizing deep brain stimulation for essential tremor: comparison of different targets stimulation

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Introduction: Essential Tremor (ET) is the most common movement disorder and an important cause of disability and social distress for patients. Deep brain stimulation (DBS) is an effective treatment of drug-refractory cases of ET, but the outcomes can vary. DBS has proven to induce an improvement both in performances and activity of daily living (ADL). The optimal DBS target is still debated and different nuclei are currently implanted, namely the ventralintermediate nucleus of the thalamus (VIM), the subthalamic nucleus (STN), the zona incerta and the subthalamic area (STA).

Objective: The aim of this study was to compare different DBS targets (VIM, STN and STA) and their efficacy in the treatment of ET and to understand the functional and structural determinants of the DBS clinical outcome.

Methods: From January 2018 to January 2020, we enrolled seven consecutive ET patients who underwent DBS: 2 VIM-DBS, 3 STN-DBS and 2 STA-DBS. All the patients were evaluated pre- (T0) and post-op (T1 six months after surgery), using TETRAS for clinical assessment and QUEST for quality of life. At T1 presurgical MRI acquisition and post-surgical CT images were used to reconstruct the VTA, axonal tracts and target in order to optimize stimulation and to reduce side effects.

Results: We observed an improvement of TETRAS of 46.5% in VIM-DBS, 55.4% in STN-DBS, and 60.7% in STA-DBS. QUEST mean improvement was 77.7%, 96.7% and 92.0% in VIM-DBS, STN-DBS and STA-DBS respectively.

Conclusions: Our data suggest that STA-DBS better controls the tremor in ET patients. Quality of life improvement was similar in STA-DBS and STN-DBS patients (better in STN-DBS). Perhaps the clinical outcome was correlated to the distance of active electrode contacts to the dentato-rubro-thalamic tract. In VIMDBS, quality of life could be poorer because of adverse effects, more frequent in the stimulation of this target.