

Deep Brain Stimulation for Parkinson's disease: anatomical location of effective contacts in the subthalamic area

François Caire^{1,3}, Philippe Derost², Jérôme Coste¹, Franck Durif²,
Emmanuelle Frenoux⁴, Jean-Jacques Lemaire^{1,4}

1 Service of Neurosurgery A, Clermont-Ferrand, Auvergne University, France

2 Service of Neurology, Clermont-Ferrand, Auvergne University, France

3 Service of Neurosurgery, Limoges, France

4 Research Unit on Medical Imaging (EA 3295), Clermont-Ferrand, Auvergne University, France

The location of effective contacts during deep brain stimulation (DBS) is still debated in particular in the sub thalamic area.

Objectives: To localise on 1.5 T MRI, the effective contacts in patients successfully treated for Parkinson's disease by bilateral DBS of the sub thalamic nucleus (STN).

Material and methods: Ten patients with excellent clinical outcome were analysed. The surgical procedure was based on direct targeting of the nucleus (anatomic targeting without reference to internal landmarks). The effective contacts were determined during the first 6 months following the implantation, i.e. those given the best efficacy on the clinical symptoms (mean improvement rate 82.5%, range 75.8–94.1%). The contact locations were retrospectively projected on the stereotactic 1.5 T MRI (3 sets, orthogonal plans), i.e. with a stereotactic frame. For each patient, we have distinguished the right and the left hemisphere. The location of the effective contacts was directly studied by visual comparison, between the 1.5 T images and an in-house 4.7 T MRI anatomic reference. The membership for a given structure was determined using the results for each orthogonal, independent plan.

Results: The effective contact were located within the STN in 4 cases, at the interface of the STN and the zona incerta (ZI) and/or the Forel's field (FF) in 12 cases, at the interface between ZI and FF in 3 cases, at the interface between the STN and the substantia nigra in one case.

Discussion: The dorsolateral part of the STN is usually considered as the target for DBS in Parkinson's disease. We discuss the role of adjacent structures, especially ZI and FF, in the clinical benefit. A largest study, including 56 patients is already in progress to assess and to refine these results.

Keyword: Parkinson's disease, location, contact