

Accurate Deep Brain Stimulation targeting using three dimensional histological and MRI Atlas of Basal Ganglia, microrecording and macrostimulation in the operating room

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Initiated in France in the late 80s by Pr Alim L. Benabid, Deep Brain Stimulation (DBS) of Basal Ganglia has proven to be very effective in the treatment of movement disorders. For best clinical results to be achieved, a series of important criteria must be followed: first, a careful clinical selection of patients following precise inclusion and exclusion criteria; second, accurate surgical programming with the help of three dimensional stereotactic MR imaging and target coordinates computation or identification using image fusion or stereotactic atlas; third, stereotactic surgical procedure with electrophysiological guidance including micro recordings and clinical evaluation under high frequency stimulation; fourth, post operative management of patients by trained neurologists for contact selection and adjustment of electrical stimulation parameters.

Our multi disciplinary team (neuroanatomists, neuroradiologists, neurosurgeons, neurophysiologists and neurologists) performed more than 490 bilateral stereotactic DBS procedures in the last 15 years at La Pitié – Salpêtrière hospital with excellent long term clinical outcome in essential tremor (thalamus Vim), Parkinson Disease (Sub Thalamic Nucleus), Dystonias (posterior Pallidum), Tourettes' syndrome (anterior Pallidum) and Obsessive Compulsive Disorders (Sub Thalamic Nucleus).

The use of three dimensional MR imaging and stereotactic histological atlas was very efficient in surgical planning to define anatomical target coordinates sometime not visible on MR imaging (Vim, anterior Pallidum). Per operative multiple trajectory micro recordings allowed accurate identification of targets and of nuclei limits with one millimeter precision, while high frequency macro stimulation defined functional targets through best clinical responses and minimal stimulation adverse effects.

Video recordings performed before, during and after surgery illustrate clinical improvements under high frequency DBS. Per operative clinical electrophysiology also demonstrates the functions of basal ganglia in different pathologies and reveals a possible mechanism of high frequency stimulation for the treatment of movement disorders.

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