MECHANISM OF ACTION OF SUBTHALAMIC NUCLEUS DEEP BRAIN STIMULATION IN PARKINSON'S DISEASE (PD): A REVIEW

B. Dagens[1]
[1]*University of Glasgow, Glasgow, UK*

The precise mechanism of DBS STN in PD remains controversial despite rapidly emerging data. A review of the current evidence is presented.
In PD Beta frequency oscillatory local field potentials from the STN resulting from over-active synchronized afferent local neuronal activity can be recorded on EEG and respond predictably to dopaminergic replacement therapy. Reduction in bradykinesia and rigidity (but not tremor) has been shown to be correlated to the degree of pharmacological suppression of this oscillation. DBS lead placement, guided by oscillatory emissions in this frequency bandwidth, has been suggested to improve surgical outcomes. Targeting of the over-active STN with DBS leads to increased activity in the pre-motor areas; this has been illustrated with regional blood flow using PET. Some studies have demonstrated a decrease in beta oscillations of the STN following DBS, suggesting impedance of postsynaptic afferents.
Conversely microdialysis studies have shown increased glutamate release in the globus pallidus and substantia nigra during DBS with increased GABA release in the substantia nigra. This may indicate an increased efferent discharge rate from subthalamic neurons. Activation of these STN efferents has been demonstrated to lead to stimulus-synchronized regular firing in the globus pallidus and to modulate neuronal firing patterns in the substantia nigra. The evidence suggests therefore that DBS acts by inhibiting the disordered firing of the STN with non-pathological, ordered, stimulus-led discharge.
A rough consensus has been reached on a mixed 'inhibitory-excitatory model' but the precise mechanism of deep brain stimulation remains controversial.