Bilateral subthalamic stimulation dissociates motor and cognitive performance

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Introduction. In Parkinson disease (PD), the subthalamic nucleus (STN) has proven to be an effective target for Deep Brain Stimulation (DBS). Bilateral stimulation of the STN has a good effect on motor performance but the effects on cognitive functions are still unclear. In patients, it has been demonstrated that motor and cognitive circuits share two anatomical structures within the basal ganglia, the STN and the GPi. Therefore, it has been suggested that STN-stimulation might influence motor, associative and limbic circuits. The aim of this study was to investigate the effects of bilateral STN stimulation on motor and cognitive performance in a rat model of PD.
Materials and methods. After training in a choice reaction time task (CRT), 20 out of 26 rats were made Parkinsonian by injecting 6-hydroxydopamine (6OHDA) bilaterally in the striatum. 10 6OHDA animals were implanted bilaterally with stimulation electrodes. Stimulations were performed at frequency 130Hz, pulse width 60 µs and varying amplitude of 1, 3, 30 and 150 µA, during the CRT. All rats were tested postoperatively. Finally, rats were sacrificed and the brains processed for histochemical staining in order to determine the lesion and electrodetip.
Results show an increased motor time (MT), premature responding (Pre) and reaction time (RT) in 6OHDA animals. STN stimulation with an amplitude of 3µA normalised 6-OHDA induced deficits in Pre and RT while MT was normalised with an amplitude of 30 µA.
Discussion and conclusion. Bilateral STN stimulation alleviates 6-OHDA induced motor deficits and has a beneficial effect on cognitive performance. However, this effect is dissociative. This is suggestive of a different excitability of the limbic and motor loops which are processed through the STN.

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