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Relationships between gait disorder and Forel's Field during chronic subthalamic stimulation for severe Parkinson's disease.

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Objectives: Chronic stimulation within the subthalamic region dramatically alleviates long term motor complications of severe Parkinson's disease. Gait disorder is still one of the most challenging symptoms because it is still poorly improved and its appearance during chronic stimulation limits the control of motor improvement. We hypothesized that stimulation-induced (SI) gait disorder could be related to modulation of structures involved in forebrain - basal ganglia - tegmentum circuitry implicated in locomotion.

Methods: One hundred contacts used for chronic stimulation were located in reference to the subthalamic nucleus (STN) in 50 consecutive parkinsonians implanted bilaterally. For each patient, coverage of subthalamic structures, STN, zona incerta, Forel's fields (FF), by the contacts was determined using co-registration of preoperative anatomic MRI and postoperative CT-scan and reconstruction of slices along electrodes. Walking falls, freezing, UPDRS part 3 (total), Hoehn and Yahr scale, before and 6 months after surgery, with electrical treatment alone, were analyzed retrospectively using multivariate analysis (ANOVA2).

Results: We found ($p < 0.05$) that walking and freezing worsen with partial coverage of left FF, whereas falls were increased if the contact doesn't cover left FF, whatever the coverage of right FF. The Hoehn and Yahr scale improved of 24.2% with a partial or a total coverage of left FF ($p < 0.05$).

Conclusions: It seems that FF is involved in SI gait disorders, in particular within the left hemisphere during bilateral chronic stimulation. This could be related to white matter tracks, located within the FF, that connect forebrain - basal ganglia and tegmentum implicated in locomotion.

Key-words: Deep Brain Stimulation, Parkinson's disease, Gait Disorder, Forel's Field.