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Targeting the Pedunculopontine Nucleus: A New Neurophysiological Method Based on Somatosensory Evoked Potentials to Calculate the Distance of the Deep Brain Stimulation Lead From the Obex

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BACKGROUND: Pedunculopontine tegmental nucleus (PPTg) deep brain stimulation (DBS) has been used in patients with Parkinson disease.

OBJECTIVE: To verify the position of the DBS lead within the pons during PPTg targeting.

METHODS: In 10 Parkinson disease patients undergoing electrode implantation in the PPTg, somatosensory evoked potentials were recorded after median nerve stimulation from the 4 DBS electrode contacts and from 2 scalp leads placed in the frontal and parietal regions.

RESULTS: The DBS electrode recorded a P16 potential (latency at contact 0, 16.33 ± 0.76 ms). There was a P16 latency shift of 0.18 ± 0.07 ms from contact 0 (lower) to contact 3 (upper). The scalp electrodes recorded the P14 far-field response (latency, 15.44 ± 0.63 ms) and the cortical N20 potential (latency, 21.58 ± 1.42 ms). The P16 potentials recorded by the intracranial electrode contacts are generated by the volley traveling along the medial lemniscus, whereas the scalp P14 potential represents a far-field response generated at the Obex level. Considering that the distance between the electrode contacts 0 and 3 is 6 mm, the distance of the electrode contact 0 from the Obex (ΔObex) was calculated by the equation: ΔObex = 6 × Δlatency P14- PPTg0/ Δlatency PPTg0-PPTg3. The Obex-to-brainstem electrode distance obtained by the neurophysiological method confirmed that the electrode was located within the pons in all patients. Moreover, this distance was very similar to that issued from the individual brain magnetic resonance imaging.

CONCLUSION: Somatosensory evoked potentials may be a helpful tool for calculating the macroelectrode position within the pons during PPTg targeting.

KEY WORDS: Deep brain stimulation, Medial lemniscus, Pedunculopontine tegmental nucleus, Pons, Somatosensory evoked potential

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High-frequency stimulation of the subthalamic nucleus and the globus pallidum pars interna by intracerebral electrodes is an effective technique to improve the motor symptoms of Parkinson disease that are resistant to pharmacological treatment.[1-4]

ABBREVIATIONS: DBS, deep brain stimulation; **DCN,** dorsal column nuclei; **IOMER,** intraoperative microelectrode recording; **PPTg,** pedunculopontine tegmental nucleus

More recently, the pedunculopontine tegmental nucleus (PPTg) has been identified as a new possible target for deep brain stimulation (DBS) treatment,[5-13] although the limited number of patients undergoing PPTg DBS so far makes this procedure investigational compared with the far more common subthalamic nucleus DBS, which is an accepted intervention based on level I evidence.[14-17] In 6 bilaterally PPTg implanted patients with 1 year of follow-up, Ferraye et al[18] reported that the duration of freezing episodes in