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The success of deep brain stimulation (DBS) of the internal segment of the globus pallidus (GPi) depends on accurately placing the electrode into the GPi motor territory. Direct targeting can be difficult as GPi laminar borders are not always clearly identifiable on MRI. Here, we report a method for using the putamen (PUT) as a surrogate anatomical marker to target the GPi.

We developed a PUT-based GPi targeting using the FGATIR (fast gray matter acquisition T1-weighted inversion recovery) MRI sequence and compared it with consensus coordinate-based indirect targeting. Stereotactic target coordinates were obtained and analyzed.

In our GPi DBS case sequences, GPi borders were unresolvable on T2-weighted MRI. However, in all cases, application of the PUT-based method resulted in consistently localized GPi targets, which were confirmed by merging the T2-weighted MRI with the FGATIR MRI. Significant differences were noted in the target coordinates between the PUT-based method and indirect targeting based on both the distance from the anterior commissure and the distance from the intercommissural plane. The mean differences for mediolateral distance and anteroposterior distance were 1.4 and 1.42 mm, respectively. In addition, the PUT-based method estimated a target that was closer to the nearest implanted electrode.

Our PUT-based method allows consistent and precise patient-specific GPi targeting. Further study is planned to correlate PUT-based GPi targeting with microelectrode recording, location of active contact of the DBS electrode and clinical outcome [1].

1)
Thompson JA, Yin D, Ojemann SG, Abosch A. Use of the Putamen as a Surrogate Anatomical Marker for the Internal Segment of the Globus Pallidus in Deep Brain Stimulation Surgery. Stereotact Funct Neurosurg. 2017 Jul 21;95(4):229-235. doi: 10.1159/000478105. [Epub ahead of print] PubMed PMID: 28728152.