Intraoperative, High-resolution ECoG Mapping in Parkinson's Patients During a Reaching Task Supports a Compensatory Role for Sensorimotor Cortical Oscillations in the Low-dopamine State

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Introduction

In Parkinson's patients in the OFF medication state, basal ganglia local field potentials exhibit characteristic changes in beta and gamma oscillations that may be directly related to the symptoms of rigidity and bradykinesia. However, magnetoencephalography and low-resolution electrocorticography (ECoG) studies of sensorimotor cortex suggest that changes in cortical oscillations in Parkinson's patients may differ from those of the basal ganglia during the OFF medication state.

Methods

To further explore sensorimotor cortex oscillatory activity in Parkinson's disease (PD), we performed high-resolution ECoG (2-6 contacts per gyrus and 1-2 contacts per sulcus) recordings intra-operatively in patients undergoing deep brain stimulator placement in the awake state. We analyzed ECoG potentials during a computer-controlled task designed to separate movement preparation from movement execution and compared findings to similar invasive recordings in patients with essential tremor (ET), a condition not associated with rigidity or bradykinesia.

[Default Poster]

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of spectral changes in local field potential recordings in patients with Parkinson's disease, 2) Discuss, in small groups, the differences between spectral changes in basal ganglia and cortex in local field potential recordings in patients with Parkinson's disease, and 3) Identify an effective treatment using neuromodulation based on the spectral changes discussed in 1 and 2 above.

Results

We show that 1) cortical beta spectral power is not different between PD and ET patients, 2) motor preparation in Parkinson's patients in the OFF medication state is associated with increased cortical beta reactivity compared to patients with ET, and 3) cortical broadband gamma power is elevated compared to ET patients during both rest and task recordings.

Conclusions

Our findings are suggestive of an inverse oscillatory profile in sensorimotor cortex of Parkinson's patients that, in contrast to basal ganglia, may act to facilitate movement in the face of an antikinetic bias inherent in the dopamine-depleted state.

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