P97

Neurophysiological differentiation between essential and parkinsonian tremor

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Introduction: The cortical network of both the basic and first ''harmonic'' frequency of Parkinsonian and essential tremor were compared. The basic frequency and the first 'harmonic' frequency have been shown to have a coherent correlate in the EEG recorded from the contralateral cortex. There is converging evidence that these two frequencies may not be simple harmonics but separate oscillations. Thus the interaction between the cortex and the periphery at these frequencies may be different. In a successive study, the mean harmonic power was used as a simple diagnostic tool to discriminate these two tremors in a larger cohort of patients.

Methods: In the first study, 10 Parkinson's disease (PD) patients with a classical rest tremor and 10 essential tremor (ET) patients were analyzed. EMG was recorded from the forearm extensors in parallel with a standard 64 channel EEG. The power spectra of EEG and EMG and the coherence between the two signals were estimated using the Welch periodogram method. The Dynamic Imaging of Coherent Sources (DICS) was used to find the complete cortical network for both these frequencies separately. In a subsequent study, the mean harmonic power of the accelerometer signals from the most affected side was estimated for 41 ET patients and 39 PD patients.

Results: In all the patients the corticomuscular coherence was present at the basic and the first harmonic frequency of the tremor. In the PD patients the sources for the basic frequency were found in a network comprising primary motor cortex, pre-motor cortex and thalamus. The first harmonic frequency comprised primary and secondary sensory motor cortex and parietal cortex on the contralateral side for all the PD patients. The sources were not different for both the frequencies in the case of ET patients. The network comprised primary motor cortex, pre-motor cortex and the thalamus. Thus in PD, the generation of these two oscillations involves different cortical areas compared to the ET patients. In the subsequent study of a larger cohort of patients, 94% of all patients could be assigned to the correct diagnosis by the difference in the mean power of the harmonic peaks.

Conclusion: The first study indicate that the network involved in the generation of ET is distinct compared to the network in PD with respect to the first harmonic frequency. In the subsequent study, we show this difference can be utilised in a simple test to separate clinically difficult cases of ET and PD.

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