Event-related functional magnetic resonance imaging in Parkinson's disease before and after levodopa.

Abstract:

Event-related functional MRI (fMRI) was used to study blood oxygen level dependent cortical signal changes associated with volitional limb movements off and on levodopa in Parkinson's disease. Eight patients with early stage akinetic Parkinson's disease and eight healthy volunteers underwent three functional imaging runs (high speed echo planar imaging with 600 scans/run) while performing paced single joystick movements in a freely chosen direction every 7-15 s. The non-magnetic joystick was linked to a monitoring system for on-line registration of performance parameters along with timing of the pacing tones and fMRI-scan acquisition parameters. This allowed correlation of movement onset, i.e. event-onset, to scanning time. We repeated the scanning procedure in the Parkinson's disease patients when akinesia improved 30 min after oral levodopa. Compared with the control group, patients both off and on levodopa showed movement-related impaired activation in the rostral supplementary motor area and increased activation in primary motor cortex (M1) and the lateral premotor cortex bilaterally. Levodopa led to a relative normalization of the impaired activation in the mesial premotor cortex and decreased signal levels in M1, lateral premotor and superior parietal cortex. We conclude that levodopa improves impaired motor initiation in the supplementary motor area and decreases hyperfunction of
lateral premotor and M1 associated with Parkinson's disease during simple volitional movements.

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