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Titel des Beitrags:
Time-resolved fMRI of activation patterns in M1 and SMA during complex voluntary movement.

Abstract:
The aim of this study was to use time-resolved functional magnetic resonance imaging (fMRI) to investigate temporal differences in the activation of the supplementary motor area (SMA) and the primary motor cortex (M1). We report data from eight human volunteers who underwent fMRI examinations in a 1.5T Philips Gyroscan ACS-NT MRI scanner. While wearing a contact glove, subjects executed a complex automated sequence of finger movements either spontaneously or in response to external auditory cues. Based on the result of a functional scout scan, a single slice that included the M1 and the SMA was selected for image acquisition (echo planar imaging, repetition time 100 ms, echo time 50 ms, 64 x 64 matrix, 1,000 images). Data were analyzed with a shifting cross-correlation approach using the STIMULATE program and in-house programs written in Interactive Data Language (IDL(TM)). Time-course data were generated for regions of interest in the M1 as well as in the rostral and caudal SMA. Mean time between onset of the finger movement sequence and half-maximum of the signal change in M1 was 3.6 s for the externally cued execution (SD 0.5) and 3.5 s for the spontaneous execution (SD 0.6). Activation in the rostral section of the SMA occurred 0.7 s earlier than it did in the M1 during the externally cued execution and 2.0 s earlier during the spontaneous execution, a difference
significant at the $P < 0.01$ level. Our results indicate that rostral SMA activation precedes M1 activation by varying time intervals in the sub-second range that are determined by the mode of movement initialization. By applying a paradigm that exerts a differential influence on temporal activation, we could ensure that the observed timing differences were not the result of differences in hemodynamic response function.

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