

Working memory and Go/NoGo Task in Gilles-de-la-Tourette Patients

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Introduction: Tourette-Syndrome (TS) is a neuropsychiatric disorder with motor and vocal tics as prominent symptoms. The origin of tics is attributed to a dysfunction of the cortico-striato-thalamo-cortical circuitry. One result of the disturbed circuit is decreased motor inhibition. Clinical observations show a reduction of tic frequency during tasks which demand attention. Neuropsychological findings show decreased sustained attention and response inhibition.

Methods: In 13 Tourette patients (6 women, 7 men) aged 20-50 years (mean 32.0 SD 10.2 years) and in 13 age- and sex-matched healthy volunteers we acquired a 3D MP-RAGE data set and T2*-weighted echo-planar images (TE=60ms, TR=3200ms, FOV=200, 32 slices @ 4mm) using a 1.5T MR scanner (Siemens Sonata). In a blocked design, subjects performed a working memory (WM) task and a Go/No-Go task. The working memory task consisted of a continuous performance test using letters in 0-back, 1-back, and 2-back conditions and a fixation baseline. This was combined with a Go/No-Go task using the WM condition 0-back as Go and an additional block "press the button at any letter but X" as the No-Go task. With a custom-made, MR-compatible camera system, the face and body of the person lying in the scanner was videotaped during fMRI. We calculated random effects based on one and two sample t-tests, thresholded at $P < 0.001$ uncorrected, using SPM2 (www.fil.ion.ucl.ac.uk/spm/spm2.html).

Results: The one sample t-test in both groups showed a bifrontal, biparietal network for the contrast 2-back vs. 0-back (Figure 1: left; Tourette patients, right; controls).

In comparison to the Tourette patients, controls showed less frontal activation. The contrast 2-back vs. 0-back for the comparison controls vs. Tourette patients shows a cluster centred at MNI coordinates [-46 24 -6] in the left inferior frontal gyrus. In analogy, controls showed more frontal activation in the condition 2-back vs. 1-back than Tourette patients in the right and left inferior frontal gyrus, the right middle frontal gyrus and the right supramarginal gyrus. However, in the contrast No-Go vs. Go, patients demonstrated more activation than controls in the right and left middle frontal gyrus, the left superior frontal gyrus and the left claustrum. The tic frequency during scanning did not differ significantly between the Go/No-Go-Task and the WM-task.

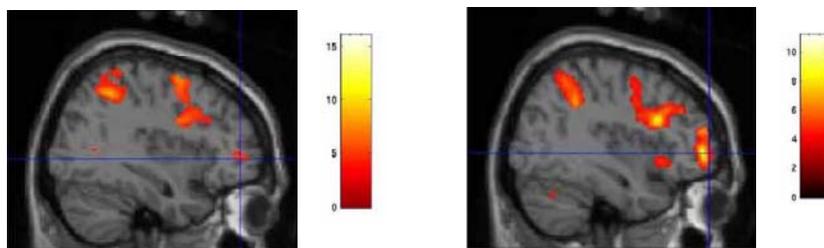


Figure 1: contrast 2-back vs. 0-back, Tourette patients left side, controls right side.

Discussion: The results indicate complex frontal dysfunction in Tourette-Syndrome. The task-dependent and varying patterns of deactivation or activation of frontal areas distinguish Tourette patients from controls. The different level of frontal activity seems not to affect the tic frequency during the different tasks. The integration and cross talk of the prefrontal circuits with the sensorimotor circuits in the basal ganglia, thalamus and supplementary motor, premotor or cingulate cortices needs further evaluation.