

# Brain function in monozygotic twins discordant for obsessive compulsive symptoms



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## Introduction

Obsessive compulsive symptoms (OCS) are characterized by recurrent, persistent, and intrusive anxiety-provoking thoughts or images (obsessions) and subsequent repetitive behaviors (compulsions). There is only limited information about the etiology and pathogenesis of OCS. Results from neuro-imaging studies suggest that the cortico-striatal-thalamo-cortical (CSTC) circuit plays an important role in OC pathology.

## Aim of the study

Perform a neuro-imaging study on monozygotic (MZ) twin pairs discordant for OCS to highlight brain regions that are susceptible to environmental factors.

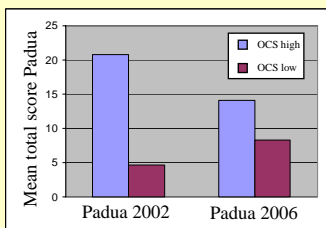


Figure 1. Mean scores on the 12-item PI in discordant twin pairs. Sample selection was based on data obtained from the 12-item PI in 2002 (left). The selected sample filled in the 12-item PI in 2006 to measure current OCS (right).

## Methods

11 MZ pairs discordant for OCS were selected based on a 12-item version of the Padua Inventory (PI) obtained in 2002 (figure 1). Twins took part in structural and functional magnetic resonance imaging (fMRI), and were administered diagnostic interviews and questionnaires. A parametric self-paced sequential event-related fMRI version of the Tower of London (ToL) task was used. This task consisted of a baseline condition and 5 planning conditions (figure 2). Group-by-task interaction effects were evaluated at an uncorrected threshold of  $P_{\text{cluster}} < .005$ .

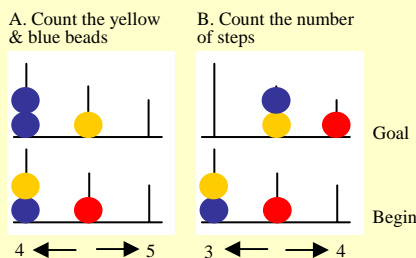


Figure 2. ToL task. A. Baseline condition. B. Planning condition, in which subjects had to count the number of steps needed to get from a starting configuration to a target configuration. The higher the number of steps needed, the more difficult the task (adapted from van den Heuvel; Arch Gen Psychiatry 62, 301-9 (2005)).

## Results

Planning performance was the same for both groups. Group-by-task interaction analysis showed:

- Increased task-associated activation in the OCS high twins compared to OCS low co-twins in the left insular cortex, bilateral cerebellum and left anterior cingulate cortex (ACC) (figure 3).
- Increased task difficulty-correlated activity in the OCS high twins compared to OCS low co-twins in left ACC and bilateral anterior prefrontal cortex (PFC) (figure 4).
- No significant decreases in brain activity patterns were found in the OCS high twins compared to their OCS low co-twins.

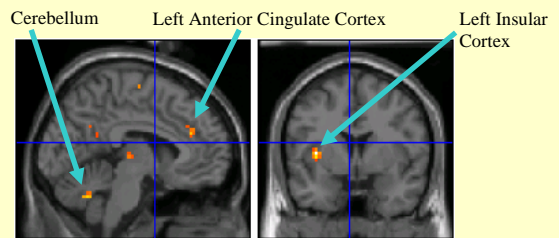


Figure 3. Brain regions showing increased blood oxygenation level dependent (BOLD) signal during planning compared to baseline in the OCS high compared to OCS low group (controls).

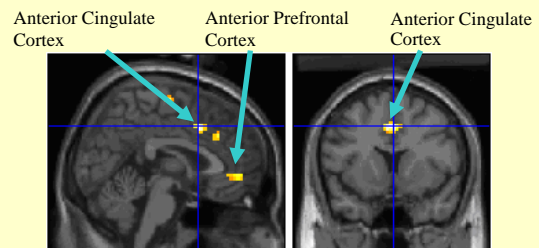


Figure 4. Brain regions showing increased BOLD signal correlating with increased task difficulty in the OCS high compared to OCS low group (controls).

## Conclusions

This study supports the involvement of the CSTC circuit in OCS development. The increased brain activity patterns during planning within the ACC and anterior PFC in the OCS high twins suggest a hyperactive state of these brain structures that might result from a self-perpetuating hyperactive CSTC circuit, which in turn leads to repetitive behavior. These processes point to environmentally mediated differences within MZ pairs.