

Introduction

Obsessive-compulsive disorder (OCD) is characterized by recurrent and intrusive thoughts and repetitive behaviors. Neuroimaging studies in OCD patients point to a cortico-striatal-thalamo-cortical (CSTC) network deficit. However, there are large differences between studies. This may reflect differences in patient recruitment leading to the differential influence of environmental and genetic risks for OCD among studies. The aim of this study is to make a distinction in brain regions affected by environmental risk factors and regions affected by genetic risk factors for OCD.

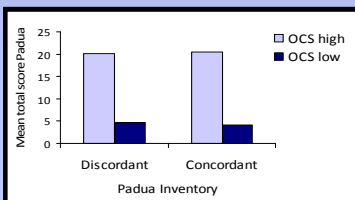


Figure 1. Mean scores on the 12-item Padua Inventory in discordant and concordant twin pairs.



Methods

Monozygotic (MZ) twins were selected for the study based on self-ratings on the Padua Inventory Revised Abbreviated Obsessive Compulsive Symptoms (OCS) scale (figure 1). To distinguish between the environmental and genetic neurobiology of OCD we assessed fMRI parameters during performance of the Eriksen flanker task in MZ twins who scored discordant or concordant for OCS. The high scoring twin of a discordant pair is considered at high environmental risk for OCD, while twin-pairs who score concordant high on this scale are considered at high genetic risk for OCD. Our sample consisted of 20 discordant, 23 concordant high and 28 concordant low twin pairs. The effect of interference (incongruent – congruent) in the Eriksen flanker task measures selective attention and inhibitory control (figure 2). It has been suggested that abnormal inhibitory networks are implicated in the pathophysiology of OCD.

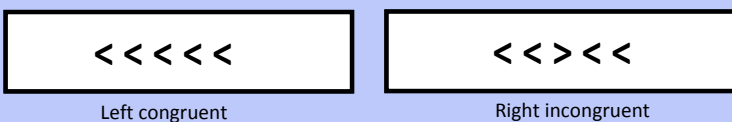


Figure 2. The Eriksen flanker task

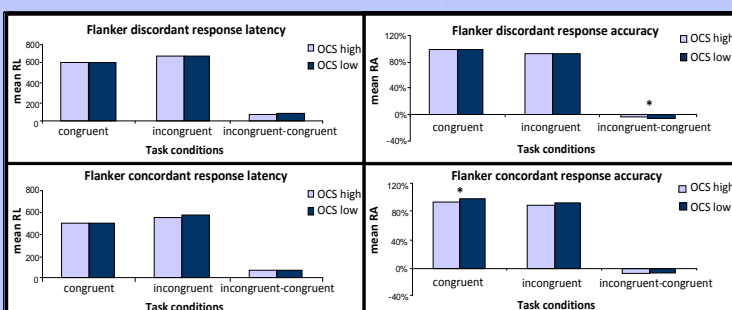


Figure 3. Task performance during the Eriksen flanker task for discordant and concordant twin pairs.

Results

The discordant twin sample showed a significant effect of interference ($t(69.80) = 2.19, p = .032$) between the high and low scoring twins in response accuracy (figure 3). The concordant twin sample did not show a significant effect of interference, but the concordant high twins did perform significantly worse on response accuracy in the congruent words condition ($t(71.39) = -2.47, p = .016$) (figure 3).

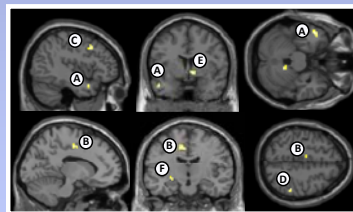


Figure 4. Brain regions showing increased fMRI signal to response interference in the discordant OCS high compared to OCS low group.



Figure 5. Brain regions showing decreased fMRI signal to response interference in the discordant OCS high compared to OCS low group.

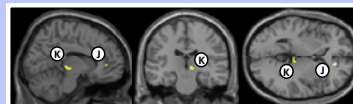


Figure 6. Brain regions showing increased fMRI signal to response interference in the concordant OCS high compared to concordant OCS low group.



Figure 7. Brain regions showing decreased fMRI signal to response interference in the concordant OCS high compared to concordant OCS low group.

Compared to their low scoring co-twins, discordant high twins showed increased fMRI signal to interference in the left middle temporal gyrus (A), left cingulate gyrus (B), left dorsolateral prefrontal cortex (DIPFC) (C), right inferior parietal lobule (D), right globus pallidus (E) and left putamen (F) (figure 4). Decreased fMRI signal was noted in the left superior frontal gyrus (G), right fusiform gyrus (H) and left superior parietal lobule (I) (figure 5). Relative to concordant low twins, concordant OCS high twins showed increased fMRI signal to interference in right cingulate gyrus (J) and right thalamus (K) (figure 6). Reduced fMRI signal was noted in the left inferior parietal lobule (L) and right middle temporal gyrus (M) (figure 7).

Conclusion

The observed locations of fMRI signal change in our twin samples are in line with the common hypothesis of a dysregulation of the CSTC network in OCD. The brain regions of the CSTC network that showed activation changes were partly distinct for OCS mediated by environmental risk (DIPFC, striatum) and genetic risk (thalamus). Interestingly however, increased fMRI activation of the cingulate cortex was noted in both environmental and genetic contrasts. This may be indicative of a common mechanism that acts to compensate for disturbances in the CSTC network, independent of the specific neurobiological changes underlying the CSTC deficit.

Acknowledgment

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