Regional gray matter volume abnormalities in obsessive-compulsive disorder: a study with the automated region-of-interest measurement method.

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Regional gray matter volume abnormalities in obsessive-compulsive disorder: a study with the automated region-of-interest measurement method.

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Introduction

Although the pathophysiology of obsessive-compulsive disorder (OCD) remains controversial, there is substantial evidence suggesting that disturbances in the frontal-striatal-thalamic circuits may be implicated. Some morphological study revealed abnormalities of gray matter (GM) volume in such regions, however, these studies to date have not yielded consistent findings. Individual brain atlases using statistical parametric mapping software (IBASPM) (Cuban Neuroscience Center) is a free soft ware that can measure regional GM volume automatically on statistical parametric mapping software using the standardized brain atlas. The advantage of this technique is to be free from man-made technical bias, which is frequently seen in manual region-of-interest (ROI)-based method. The purpose of this study was to assess regional GM volume abnormality in OCD using this automated ROI method.

Materials and Methods

Subjects consisted of 24 outpatients with OCD (9 males and 15 females, mean 32.9 years old) and 27 age- and sex-matched normal controls (12 males and 15 females, mean 31.1 years old). Three-dimensional T1-weighed MR images (T1WI) were obtained in all subjects: TR/TE=4000/22ms, TI=1100ms, flip angle=15, matrix=256x256, FOV=230, voxel size=0.9x0.9x1mm. IBASPM divided GM of individual image into 110 regions according to a standardized brain atlas. In IBASPM, high resolution T1WI of individual subject is normalized to the Montreal Neurological Institute (MNI) space and the transformation matrix for the normalization is obtained. The T1WI in the native space is segmented into GM, white matter (WM) and cerebrospinal fluid segments. Each individual GM voxel is anatomically labeled based on MNI atlas and the transformation matrix obtained in the previous step. Then, GM volume of each region was calculated automatically. In our analysis, 90 GM regions were selected out of the 110 predefined regions excluding those in cerebellum. Based on these measurements, we compared following values between OCD patients and normal control subjects: 1) Total intracranial volume (TIV), total GM volume, and total WM volume, 2) Total GM volume of frontal, temporal, parietal, and occipital lobe, and deep GM, 3) The GM volume of apriori regions: orbitofrontal cortex (OFC), anterior cingulated cortex (ACC), caudate nucleus, putamen, and thalamus. 4) The GM volumes of all 90 regions in the cerebrum. Analysis of covariance (ANCOVA) was used to detect the statistically significant difference between OCD and normal groups. The TIV and subject's age were entered as nuisance variables in ANCOVA models. Findings were considered significant at $p < 0.05$.

Results

Among the apriori regions, GM volumes of bilateral OFC (left; p=0.01, right; p<0.01) and right ACC (p<0.05) were significantly decreased in OCD group in comparison with normal group (**Figure 1**). In the evaluation of all 90 cerebral GM regions, GM volumes of orbital aspects of bilateral inferior frontal gyri were significantly decreased in OCD group in comparison with normal group (p<0.05) (**Figure 2**). No other comparison yielded significant difference.

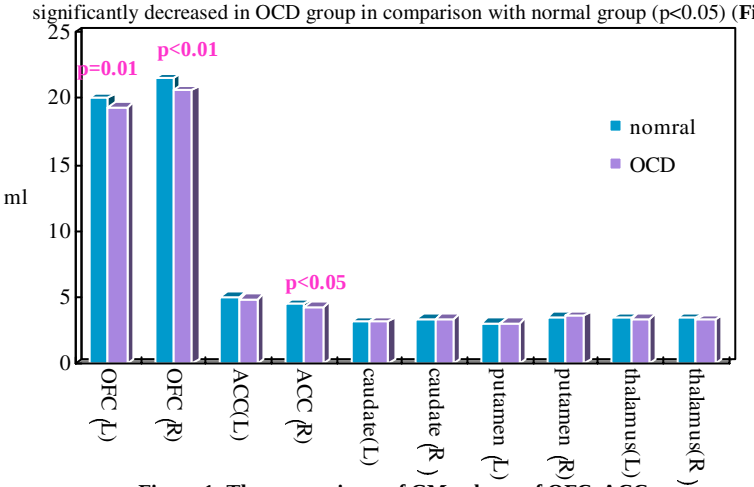

Figure 1: The comparisons of GM volume of OFC, ACC , caudte nucleus, putamen, and thalamus.

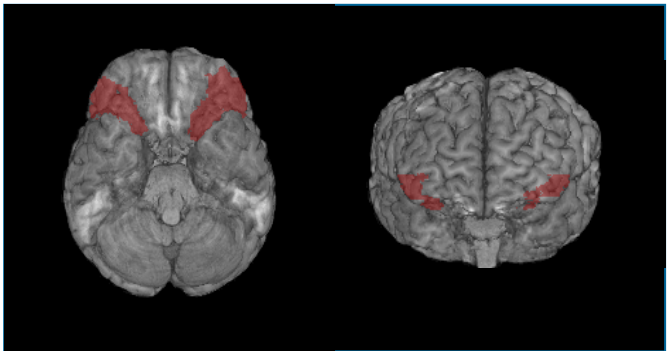

Figure 2: The regions of decreased GM volume in the evaluation of all 90 regions.

Discussion

This study revealed the GM volume abnormalities in the bilateral OFC and the right ACC. Results indicated that these structural abnormalities would be related to the pathophysiology of OCD.

Reference

Atmaca M, Yildirim H, Ozdemir H, et al. Volumetric MRI study of key brain regions implicated in obsessive-compulsive disorder. (2007): Prog Neuropsychopharmacol Biol Psychiatry. 31:46-52.