Brief report

Continuous performance test in drug-naïve patients with obsessive–compulsive disorder: A case-controlled study

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ABSTRACT

Twenty drug-naïve patients with obsessive–compulsive disorder (OCD) were compared with matched controls on their performance of the Continuous Performance Test (CPT). There was no difference on any measure of the CPT in the two groups. Higher obsession scores, rather than compulsion scores, were associated with poorer sensitivity of the CPT in drug-naïve OCD patients.

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1. Introduction

The cognitive model of obsessive–compulsive disorder (OCD) (Salkovskis, 1985) suggests that intrusive thoughts increase the processing priority and the efforts toward neutralization and related behaviors may present as attentional deficit. The Continuous Performance Test (CPT) is a validated instrument for detecting sustained attention deficits (Chen et al., 1998), and requires participants to respond selectively to a series of briefly presented stimuli and to discriminate signal (target) and noise (non-target).

Although patients with OCD are considered to have attentional deficits, findings with the CPT are inconsistent. Adult patients with OCD performed similarly to normal controls on the low-processing auditory (Nordahl et al., 1989) and visual versions of the CPT (Zielinski et al., 1991), which might result in a ceiling effect. A higher level of CPT processing may obviate this effect. Mataix-Cols et al. (1999) found a significant attentional disturbance using a version of the CPT requiring higher processing in subjects with high OC symptoms. However, no significant disturbance in sustained attention in mixed medicated and unmedicated OCD patients was found with the degraded-stimulus version of the CPT

(Milliery et al., 2000), although compulsion scores correlated positively with sensitivity scores and negatively with false alarm scores.

There have been no reports on CPT performance in drug-naïve patients with OCD despite the fact that medication might influence attentional performance (de Geus et al., 2007a). The aim of the present study was to examine whether drug-naïve patients with OCD had poorer performance on the CPT compared with normal controls. Whether attention in OCD patients was correlated with the severity of symptomatology and whether these correlations were more prominent in versions of the CPT demanding a higher level of processing were also explored.

2. Method

2.1. Subjects

Twenty subjects who visited the outpatient services and met the DSM-IV criteria (American Psychiatric Association, 1994) for OCD by structured interview (First et al., 1995) were enrolled. All were drug naïve and had not received any previous psychiatric treatment. Patients with comorbid axis I disorder were excluded. Additional exclusion criteria were a below 8 on the Chinese version of the Yale-Brown Obsessive-Compulsive scale (C-Y-BOCS) score, which has good reliability and validity among Chinese people in Taiwan (Tang et al., 2006); left-handedness; and impaired vision. Twenty control subjects matched with the clinical subjects on age, gender, educational level were recruited from hospital staff. Psychiatrists and psychologists were excluded. Potential participants with present psychiatric or neurological disorders, previous history of mental illness, or family history of mental illness were excluded.

This study was approved by Taipei City Hospital and written informed consent was obtained from all participants prior to participation. The C-Y-BOCS and the Hamilton Depression Rating Scale (HAM-D) (Hamilton, 1960) were administered by an experienced psychiatrist, and the CPT was administered by a psychologist.

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2.2. Material

Sustained attention was measured with an automated version of the CPT (Sunrise Systems, version 2.20, Pembroke, MA, USA), which presented a time series of visual stimuli to the subject. Participants were instructed to press a switch button in response to a critical stimulus and the responses were recorded automatically. The procedure was described in detail elsewhere (Chen et al., 1997). Each subject underwent two CPT sessions, undegraded and degraded.

Two signal-detection indices for studies with small sample size, A' and $B''d$, were derived from hits (probability of response to target trials) and false alarms (probability of response to nontarget trials) (Donaldson, 1997). The signal detection parameter A', sensitivity between signal and noise, was calculated using the following formula:

$$A' = 1/2 + (\text{hits} - \text{false alarms})(1 + \text{hits} - \text{false alarms})/4 \cdot [\text{hits}(1 - \text{false alarms})].$$

Higher A' values indicated better discriminability and ranged from -1.0 to 1.0. The parameter $B''d$, the distribution of the response criterion of the subjects (liberal to conservative), was calculated as follows:

$$B''d = [(1 - \text{hits})(1 - \text{false alarms}) - (\text{hits})(\text{false alarms})]/[(1 - \text{hits})(1 - \text{false alarms}) + (\text{hits})(\text{false alarms})]$$

High $B''d$ values indicated the use of more conservative response strategies and ranged from -1.0 to 1.0.

2.3. Statistics

The difference between the two groups was analyzed by paired-t test. Pearson's correlation was applied to assess the correlation between two continuous variables. The relationship between severity of symptomatology and CPT performance was further analyzed by linear regression, which used A' or $B''d$ as the dependent variable and the C-Y-BOCS total scores, obsession scores, or compulsion scores as independent variables separately, with age, sex, educational years, and HAM-D scores as covariates. Partial correlations on the C-Y-BOCS scores for obsessions and compulsions were applied to see if their association with CPT performance remained significant when one type of symptomalology (obsessions, compulsions) was controlled for the other. A value of $P < 0.05$ was considered statistically significant.

3. Results

3.1. Sociodemographic data and distribution of CPT measures

All of the subjects completed the assessments, but only 14 subjects had data for $B''d$ based on a mathematical formula. The OCD group had significantly higher C-Y-BOCS obsession, compulsion, total scores and HAM-D scores than controls. No significant differences were found between OCD patients and controls in sensitivity (A') and response criterion ($B''d$) for both the undegraded and degraded CPT (Table 1). In both groups, the scores on the degraded version of the CPT were

Table 1
Demographic data, scores of C-Y-BOCS and CPT measures in OCD group and controls.

	OCD patients	Healthy controls	t	df	P
Gender (men/women)	11/9	11/9	–	–	–
Age (years)	30.8 ± 8.8	32.1 ± 8.6	0.689	19	$P = 0.499$
Education (years)	15.3 ± 1.9	15.7 ± 2.1	1.267	19	$P = 0.220$
C-Y-BOCS total	24.7 ± 8.0	0.5 ± 0.7	-16.384	19	$P < 0.001$
C-Y-BOCS obsessions	12.9 ± 3.5	0.4 ± 0.5	-10.130	19	$P < 0.001$
C-Y-BOCS compulsions	11.8 ± 5.2	0.2 ± 0.4	-13.668	19	$P < 0.001$
HAM-D	7.8 ± 3.8	3.1 ± 1.6	-4.128	19	$P < 0.001$
Undegraded CPT					
Hit rates (%)	93.55 ± 5.03	94.52 ± 5.02	0.671	19	$P = 0.510$
False alarm rates (%)	6.29 ± 4.73	5.16 ± 4.61	-0.791	19	$P = 0.439$
A'	0.9646 ± 0.0280	0.9706 ± 0.0271	0.734	19	$P = 0.472$
$B''d$	0.0081 ± 0.0325	0.0229 ± 0.1031	2.038	13	$P = 0.062$
Degraded CPT					
Hit rates (%)	90.64 ± 5.82	92.26 ± 5.86	0.934	19	$P = 0.362$
False alarm rates (%)	8.55 ± 5.05	7.10 ± 5.79	-0.910	19	$P = 0.374$
A'	0.9490 ± 0.0322	0.9579 ± 0.0304	0.897	19	$P = 0.381$
$B''d$	0.0406 ± 0.0658	0.1091 ± 0.2652	0.924	13	$P = 0.372$

df: Degree of freedom.

Table 2
Coefficients for the regression analysis of the CPT performance index on the scores of C-Y-BOCS with age, education, sex, and HAM-D scores as covariates.

CPT index	Regression coefficient		
	C-Y-BOCS total scores	Obsession scores	Compulsion scores
Undegraded			
A'	-0.373	-0.490^*	-0.228
$B''d$	0.385	0.323	0.322
Degraded			
A'	-0.599^*	-0.581^*	-0.517
$B''d$	0.356	0.495	0.348

* $P < 0.05$.

significantly lower than those on the undegraded CPT. There was no correlation between A' and $B''d$ in the undegraded CPT and the degraded CPT. Gender, age, and years of education were not associated with A' or $B''d$.

3.2. Symptom severity and CPT performance

The results of linear regression analysis of the association between symptom severity and CPT performance are shown in Table 2. In undegraded version of the CPT, only the "obsession" scores on the C-Y-BOCS were negatively correlated with A'. In the degraded version of the CPT, the "obsession" scores and total scores of the C-Y-BOCS were correlated with A'. When compulsion scores on the C-Y-BOCS were controlled for, obsession scores still correlated with A' ($r = -0.43$, $P = 0.04$) in the degraded version of the CPT, but not in the undegraded version. There was no significant correlation between compulsion scores with any index of CPT performance after controlling obsession scores.

4. Discussion

In this study, drug-naïve OCD patients showed no significant differences from healthy controls on all measures of the degraded and undegraded CPT. Higher C-Y-BOCS obsession scores, rather than compulsion scores, were associated with poorer sensitivity (A') of the CPT in drug-naïve OCD patients. The degraded CPT was more sensitive than the undegraded CPT on detecting the association.

The negative findings in the between-group comparison suggested that drug-naïve OCD patients might not have a deficit in sustained attention compared to healthy controls, which is similar to previous results of no significant impairment on CPT performance in unmedicated OCD patients (Rapoport et al., 1981; Nordahl et al., 1989; Zielinski et al., 1991) as well as in mixed medicated and unmedicated patients (Milliery et al., 2000).

In the undegraded CPT, only the C-Y-BOCS obsession scores, rather than total scores or compulsion scores, had a significantly negative correlation with A' in drug-naïve OCD patients. These findings suggest that the obsession score of the C-Y-BOCS is a stronger predictor in the sensitivity of CPT in drug-naïve OCD patients. Combined with the negative findings of the comparison with normal controls, it appears that CPT performance is associated with obsessionality as a symptom, but not with OCD itself. In the degraded version of the CPT, the findings also indicate that the C-Y-BOCS obsession scores and total scores, compared with the compulsion scores, show the strongest relationship to CPT parameters. After controlling for compulsive scores, the obsession scores are still associated with sensitivity (A') in the degraded CPT. Our results are in conflict with a previous finding (Milliery et al., 2000) of a positive correlation between CPT sensitivity and the Y-BOCS compulsion score in patients with OCD. This might be attributable to the selection of drug-naïve OCD patients who had more obsessional symptoms due to a shorter duration of illness compared with those with a longer duration of illness (Nakao et al. 2005).

In this study, the C-Y-BOCS total score was correlated with lower sensitivity (A') in the degraded CPT, but not the undegraded CPT, in drug-naïve OCD patients. After compulsion scores were controlled for, the obsession scores still showed an association with A' in the degraded CPT but not in the undegraded CPT. These findings suggest that the version of the CPT with higher processing demands (the degraded version) is more sensitive than the undegraded CPT These implied that the higher processing CPT (degraded) is more sensitive than the undegraded CPT to detect correlations between symptomatology and attentional parameters. This finding could reflect the fact that patients with OCD may have some deficits in spatial memory and visual perception (Nelson et al., 1993; Kim et al., 2007), which become apparent with the increased demands imposed by the degraded CPT. The different degrees of sensitivity of versions of the CPT that place low vs. high demands on processing may be one of the reasons why previous studies have inconsistent results.

Several limitations should be considered when interpreting the results. First, the sample size was small due to limitations on drug-naïve patients with OCD. Second, participants were recruited only from outpatient clinics, which may exclude some patients with more severe symptomatology. There are four subjects with total scores on the C-Y-BOCS less than 16. Enrolling subjects with milder symptomatology may make it more difficult to demonstrate significant differences in between-group comparisons. Third, only the CPT was assessed in these patients. Other types of cognitive dysfunctions, such as those indexed by verbal memory tasks and by the Wisconsin Card Sorting Test (de Geus et al., 2007a,b), as well as tests of emotional cognition (Aigner et al., 2007), which have been reported in patients with OCD, were not evaluated in this study. Further research in drug-naïve patients with OCD using a larger sample size, more comprehensive evaluation of cognitive function, including visuospatial acuity, and longitudinal follow-up is warranted.

Acknowledgements

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