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Short communication

Differences in performance on the Wisconsin card sorting test (WCST) between patients with tic related OCD and non-tic related OCD: A preliminary investigation

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ABSTRACT

Executive dysfunction has been implicated in the neurobiology of obsessive–compulsive disorder. Few studies have examined differences between individuals with OCD with or without tics. In this study executive functioning was compared between patients with obsessive–compulsive disorder with and without a history of tics. Participants diagnosed with OCD, with and without tics ($n=10$ per group) were administered the Wisconsin card sorting test (WCST) along with a measures of symptom severity for OCD, tics and depression. The groups did not differ in demographic variables or depression. Results indicated differences in performance on the WCST. Specifically, patients with past or current tics made more non-perseverative and total errors on the WCST and also demonstrated significantly more difficulty with conceptual level responding as compared to a normative sample, whereas the group without a tic history did not. Our findings, along with supporting evidence from imaging research and clinical trials, suggests that the presence of tics may be a valid means for subtyping individuals with obsessive–compulsive disorder.

1. Introduction

Numerous studies have examined executive functioning in obsessive–compulsive disorder (OCD) using the Wisconsin card sorting test (WCST). The WCST, one of the most often used tests to evaluate frontal function (Milner, 1963), is an abstract reasoning test and involves shifting in cognitive set (Stuss & Benson, 1986). Multiple studies indicate that OCD patients have an impaired capacity for shifting cognitive set and a subsequent tendency to perseverate on the WCST (Lacerda et al., 2003; Sanz, Molina, Calcedo, Martin-Loeches, & Francisco, 2001; Schultz & Searleman, 2002; Tukel et al., 2012). Problematic in the extant executive functioning research on OCD, however, has been the inconsistency in findings. In the case of the WCST, the findings have been mixed in revealing executive functioning deficits in OCD (Abbruzzesse, Ferri, & Scaron, 1995, 1997; Fenger et al., 2005; Greisberg & McKay, 2003; Simpson et al., 2006).

Neuropsychological inconsistencies in OCD may be due to the heterogeneity of the disorder (Mataix-Cols, Rosario-Campos, & Leckman, 2005; McKay et al., 2004). More specifically, the broad range of symptoms and neuropsychological dysfunction in OCD, as well as differential response to treatments, has led researchers and clinicians to seek to identify and establish subtypes of the disorder (McKay et al., 2004). The majority of researchers seeking to identify subtypes in OCD have attempted to use symptom clusters as subtyping schemes (e.g. Hodgson & Rachman, 1977; Sanavio, 1988), but this approach has not consistently yielded distinct neuropsychological profiles (e.g. Abbruzzesse et al., 1995). McKay et al. (2004) point out that different profiles may be related to etiology, comorbidity, or other mechanisms of action and there may be different pathways or mechanisms that could give rise to this disorder (Taylor, McKay, & Abramowitz, 2005).

The presence of tics in OCD may be related to distinctive etiology (Pauls, Alsobrook, Goodman, Rasmussen, & Leckman, 1995), and neurobiology (Moriarty, Eapen, Costa, & Gacinovic, 1997) as well as differential treatment outcome with selective serotonin reuptake inhibitors (SSRIs) (Geller et al., 2003; March et al., 2007). For example, Moriarty et al. (1997) found that regional cerebral blood flow in individuals with OCD with a personal/family history of tics differed from other patients with OCD in that they are not characterized by the typical pattern of frontal striatal hyperperfusion in OCD, but rather abnormal hypoperfusion of striatal and frontal areas.

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Furthermore, studies of tic disorders such as Tourette's Syndrome (TS) also reveal hypoperfusion of striatal (Chase, Geoffrey, Gillespie, & Burrows, 1986; Moriarty et al., 1995) and cortical areas (e.g. Braun et al., 1993) in contrast to the hyperperfusion of frontal and striatal areas generally demonstrated in OCD. In a comprehensive review and meta-analysis of extant data related to early compared to later onset OCD, Taylor (2011) showed that early onset individuals with OCD were more likely to be male, have higher OCD severity, more likely to have comorbid tics, as well as a greater prevalence of OCD in first degree relatives. Kichuk et al. (2013) also found that comorbid tics in adult OCD patients were associated with earlier age of onset. Moreover, they found a significant interaction between comorbid tics and primary symptom dimensions. Specifically, OCD patients without comorbid tics reported an earlier age of onset for symptoms in the symmetry dimension than those with comorbid tics; and OCD patients with comorbid tics had an earlier age of onset of cleaning and hoarding symptoms compared to OCD patients without comorbid tics.[2] It therefore seems plausible that the presence of tics may be related to distinct neuropsychological profiles in OCD patients, with executive functioning serving as a potential endophenotypic marker of this variant on the disorder. Few studies, however, have specifically examined the role of tics in neuropsychological functioning in OCD. It has been suggested that identification of valid endophenotypes could streamline psychopathology and treatment research in OCD (Taylor, 2012). Therefore, evaluation of specific measures such as the WCST, which is a well-established and widely used measure of executive functioning, with specific reference to potential endophenotypes, may elucidate factors that account for prior inconsistencies in the literature.

The purpose of the current study was to compare neuropsychological profiles over the adult life span of OCD patients with and without tics. As TS, other tic disorders, and tic-related OCD seem to share an etiological link; and appear to be variant expressions of the same underlying genotype (American Psychiatric Association, 2000; Schultz, Carter, Scahill, & Leckman, 1999; Taylor, 2011), the present study examined OCD patients with a history of tics, including those who met diagnostic criteria for TS or another tic disorder. This included examination of group comparisons against the established normative values for the WCST as well as direct comparisons between the groups. Moreover, we examined age-associated changes in neuropsychological functioning in cohorts of patients with and without tics to examine potential group differences in neurodevelopmental aberrations in frontostriatal circuitry (Rosenberg & Keshavan, 1998). We hypothesized that OCD patients with history of tics would demonstrate more global deficits on the WCST compared to OCD patients without tics and that the groups would display significantly different age-associated changes over the life span reflecting aberrations in cortical–striatal circuitry.

2. Methods

2.1. Subjects

A clinical sample was recruited through two outpatient treatment centers in New York specializing in the treatment of anxiety and mood disorders. Diagnoses were determined using the Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition with psychotic screen (SCID-I/P W/PSY SCREEN; First, Spitzer, Gibbon & Williams, 2002). A primary diagnosis of OCD was necessary for inclusion in the study. Exclusion criteria included DSM-IV schizophrenia, schizoaffective disorder, delusional disorder, brief reactive psychosis, psychotic disorder NOS, bipolar disorder, substance use disorder, or mood disorder with psychotic features. This study included 10 patients with OCD who reported current or past tics (tic-related OCD) (M age = 33.8, SD = 14.77, range 17 to 59; M education = 14.0, SD = 3.1). Half (n = 5) of these patients had no treatment history, with the remaining half recently enrolled in treatment. There were 10 patients with OCD without any history of tics (non-tic related OCD) (M = 35.90, SD = 15.39, range 17 to 57; M education = 15.4, SD = 2.2), or whom n = 3 had no prior treatment and n = 7 recently enrolled in treatment. There was no significant difference in age between the groups or education (both $t(18) < 1$). Further comparisons between the groups for demographic information revealed no significant differences between the groups in marital status: $\chi^2(2) = 2.067$, $p = .356$ or treatment status: $\chi^2(1) = .833$, $p = .361$. Participants who reported current or past tics differed in the severity and history of their tics. Specifically, two patients met DSM-IV criteria for Tourette's Syndrome, three had significant tic histories, but no current tics, three had several tics, past and present, but did not meet criteria for Tourette's Syndrome, one patient reported past tics and one current tic and another patient reported only one tic, past and present. The OCD only group was characterized by additional comorbid diagnoses as follows: major depressive disorder (n = 2), dysthymia (n = 1), panic disorder (n = 2), social anxiety disorder (n = 3), and specific phobia (n = 1). The OCD without tic history group was also characterized by additional comorbid diagnoses as follows: major depressive disorder (n = 3), depressive disorder NOS (n = 1), panic disorder (n = 2), and social anxiety disorder (n = 2) All procedures were approved by the local IRB and written informed consent was obtained from all participants.

2.2. Procedures

All patients received the Yale-Brown obsessive–compulsive scale-clinical version-revised (Y-BOCS, Goodman et al., 1989) and Yale Global tic severity scale (YGTSS; Leckman et al., 1989). Patients also received the beck depression inventory-2nd edition (BDI-II; Beck, Steer, & Brown, 1996). As prior research has shown that depression can influence executive functioning on the WCST (e.g. Martin et al., 1991; Must et al., 2006), we examined the groups on depression and found that there was no significant difference ($t(18) = 0.71$, p = ns). Therefore, to conserve statistical power depression was not used as a covariate in subsequent analyses. Executive functioning was assessed using the Wisconsin card sorting test-64: Computer Version 2-Research Edition (WCST; Grant & Berg, 1948). Dependent measures included: conceptual level responses, perseverative errors, non-perseverative errors, total errors, and perseverative responses. The WCST-64 normative, reliability and validity data are derived from the same samples described in the WCST Manual-Revised and Expanded (Heaton, Chelune, Talley, Kay, & Curtis, 1993). This normative sample includes 899 normal subjects between the ages of 6 and 89 aggregated from six samples (Kongs, Thompson, Iverson, & Heaton, 2000). The accepted Cohen metric was utilized in all relevant analyses.

3. Results

Independent samples t tests revealed no significant differences between the two groups in total obsessions on the Y-BOCS $t(18) = -0.28$, $p = .780$, and total compulsions on the Y-BOCS $t(18) = -0.93$, $p = .363$. Mean total Y-BOCS scores were 19.1 and 21.7 for the group without and with tics, respectively, placing both groups in the moderate range of symptom severity ($t(18) = -0.69$, $p = .500$). As a result of these findings, we did not control for severity in the analyses of differences between the groups for the WCST. Table 1 displays the means and standard deviations for the major assessments.

Independent samples t tests indicated that there were no significant group differences regarding performance on the WCST measures. Single sample t tests revealed that the entire sample's performance was significantly below age corrected norms, with large effect sizes demonstrated for perseverative errors [$t(19) = -2.23$, $p = .038$, partial $\eta^2 = .21$] and conceptual level responses [$t(19) = -2.15$, $p = .045$, partial $\eta^2 = .20$].

We further examined performance of the two groups against the normative sample. We chose this approach to conserve statistical power, and because the WCST has well developed and representative norms. Posthoc analyses indicated that for the non-tic related OCD group there were no significant differences in performance from the normative group. For the tic-related OCD group, performance with regard to conceptual level responses was significantly below the age corrected norms [$t(9) = -2.42$, $p = .039$, partial $\eta^2 = .39$], with a very large effect size demonstrated. Additionally, there were strong trends for significance in the tic-related OCD group regarding total errors [$t(9) = -2.25$, $p = .051$, partial $\eta^2 = .36$] and non-perseverative errors [$t(9) = -2.22$, $p = .054$, partial $\eta^2 = .35$] with very large effect

[2] It is possible that the distinctions between individuals with or without tic is subtle, as Lewin, Chang, McCracken, McQueen, and Piacentini (2010) showed, in a large sample, no significant differences for major clinical severity measures.