Psychiatry Research 249 (2017) 58–64

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Relationships between neuropsychological variables and factor-analysed symptom dimensions in obsessive compulsive disorder

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ARTICLE INFO

Keywords:
Symptom categories
Subtypes
Neurocognition
Checking
Contamination/washing
Symmetry
Forbidden thoughts
Factor analysis

ABSTRACT

Despite mounting evidence for the distinctiveness of symptom dimensions in obsessive-compulsive disorder, neuropsychological studies have been few, focused on small samples, and relying on classification of participants based on mutually exclusive symptom categories, resulting in lack of concordance across neuropsychological and imaging studies. Neuropsychological assessment was undertaken with 150 individuals with DSM IV OCD, and neuropsychological variables were analysed in relation to symptom dimension scores derived from factor analysis. Five dimensions were derived from principal components analysis with varimax rotation – contamination/washing, doubts/checking, symmetry/ordering, forbidden thoughts, and hoarding. After controlling for severity of depression and OCD, antipsychotic and benzodiazepine use, and all other symptom dimensions, washing was associated with poorer attention/working memory, visuo-spatial construction and better planning time; checking was related to poorer alternation learning; symmetry linked with poorer verbal fluency; forbidden thoughts with better visuospatial scanning and working memory; hoarding with poorer immediate verbal recall and better visuospatial working memory. The neuropsychological associations are explained in the context of existing neuroimaging evidence, and the clinical picture of each symptom dimension. The use of factor-analysed symptom dimensions and a large sample of individuals with OCD are strengths of the study.

1. Introduction

Previous research in OCD has suggested that OCD is not a single entity, but possibly a heterogeneous condition. Heterogeneity potentially reduces power in studies on neuroimaging, genetics and clinical trials (Mataix-Cols et al., 2005), and in clinical settings contributes to differential responses to treatment (Mataix-Cols et al., 1999; Rück et al., 2012). Researchers have argued for classification based on age at onset, comorbidities, insight and symptom presentations (Leckman et al., 2010; Lochner and Stein, 2003; Mataix-Cols et al., 2005; McKay et al., 2004). Heterogeneity based on symptom presentations has been a particular focus of research attention, arising from the observation of distinctive associated clinical features, such as comorbid conditions, course, and degree of insight (Leckman et al., 2010; Prabhu et al., 2013). Multiple factor analytic studies over the years have mostly identified a similar set of dimensions (Feinstein et al., 2003; Hasler et al., 2007; Mataix-Cols et al., 1999; Pinto et al., 2008), and a metaanalysis of 21 studies (Bloch et al., 2008) identified four robust factors that include 1) symmetry (including symmetry obsessions and ordering, repeating, and counting compulsions), 2) forbidden thoughts (including aggression, sexual, and religious obsessions), 3) cleaning (including contamination obsessions and cleaning compulsions), and 4) hoarding (hoarding obsessions and compulsions).

Studies have provided evidence for neural correlates associated with different symptom dimensions in terms of structural volume differences (Pujol et al., 2004; Van Den Heuvel et al., 2009), differential brain activation (Harrison et al., 2013; Mataix-Cols, 2004) and white matter microstructure (Koch et al., 2012). A handful of neuropsychological studies have investigated differences between various symptom dimensions. In a study categorizing individuals with OCD by their current primary symptoms (Nedeljkovic et al., 2009), checkers exhibited poorer performance on pattern recognition compared to washers. Another study of 38 individuals with OCD found poorer set shifting in those with higher symmetry/ordering scores on the Obsessive-Compulsive Inventory-Revised (OCI-R), and poorer decision making in those with higher hoarding scores (Lawrence et al., 2006). In a

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http://dx.doi.org/10.1016/j.psychres.2016.12.044
Received 11 July 2016; Received in revised form 12 December 2016; Accepted 28 December 2016
Available online 29 December 2016

comparison of individuals with checking (n=27) vs. washing (n=26) symptoms (Omori et al., 2007), checkers were found to have deficits on Stroop, Go/No Go, category fluency, and Trail Making Test. From a factor analysis of the neuropsychological variables, the authors extracted a three-factor solution, which they termed inhibition, cognitive flexibility and multi-tasking, and found differences between washers and checkers on the first two factors. Another study examining response inhibition in individuals with scrupulosity (n=26) and contamination (n=18) found no deficits in either group compared to non-psychiatric controls (n=19) (Rasmussen et al., 2015).

Many of the above studies have selected specific symptom presentations for comparison, such as washers and checkers. However, research has argued that OCD is unlikely to consist of mutually exclusive subtypes, and that such divisions are likely to be artificial, since individuals in reality often have more than one category of symptom. Several reviews have suggested that symptom presentations are best conceptualized as overlapping dimensions that co-exist within a given individual, and may not necessarily be confined to OCD itself, occurring in various degrees as normal obsessive-compulsive phenomena, culture-specific behaviours (Dulaney and Fiske, 1994), and co-occurring with other disorders (Mataix-Cols et al., 2005).

Factor analysis has been widely used in many studies attempting to understand the heterogeneity of OCD (Katerberg et al., 2010; Mataix-Cols et al., 1999; Matsunaga et al., 2008). The method permits a dimensional approach to studying heterogeneity in contrast to an artificial categorisation of mutually exclusive subtypes. An investigation of the neuropsychological correlates of factor-analysed symptom dimensions would potentially expand our understanding of each *dimension*, while circumventing the problems associated with classifying *individuals*.

2. Method

2.1. Participants

Participants (n=150; 56 females) were recruited from the OCD Clinic, the Behaviour Medicine Unit, and the clinical services of the Department of Psychiatry, of the National Institute of Mental Health And Neurosciences (NIMHANS), Bangalore, India, between January 2008 and 2010. All participants had a diagnosis of OCD, based on a detailed clinical interview using a semi-structured proforma and the Mini International Neuropsychiatric Interview plus (MINI Plus version 5.0; (Sheehan et al., 1998). In all cases, the diagnosis was confirmed by a consultant psychiatrist after an independent clinical interview and review of the history and clinical examination. Individuals were included in the study if they had a minimum score of 20 on the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) (Goodman et al., 1989), an illness duration of at least 1 year, age between 18 years and 45 years, at least seven years of education, and were right-handed as per the Edinburgh Handedness Inventory (Oldfield, 1971). Exclusion criteria were a history of tic disorder, psychosis, bipolar disorder, substance abuse, traumatic brain injury, stroke, tumour, or epilepsy and clinical evidence of intellectual disability. All participants provided written informed consent to the study, which was approved by the National Institute of Mental Health And Neuro Sciences (NIMHANS) Ethics Committee. Of the 186 patients who met criteria 36 could not be included, and 150 participants formed the final sample (26 participants either declined or were unable to attend the assessment, three were deemed not amenable for assessment, two had recently been administered some of the tests as part of another research project with potential practice effects, and five chose to discontinue testing).

2.2. Assessments

The assessment included MINI Plus and YBOCS for evaluation of OCD, Clinical Global Impression (CGI) (Guy, 1976) for severity of OCD; the State Trait Anxiety Inventory (STAI) (Spielberger, 1983) Form Y for anxiety; the Hamilton Depression Rating Scale (HDRS-17) (Hamilton, 1960), for severity of depression, and Brown Assessment of Beliefs Scale (BABS) (Eisen et al., 1998) for insight.

A comprehensive battery of neuropsychological tests was administered as follows:

Attention:

- Colour Trails Test (CTT) (Maj et al., 1993)
- Digit Span (WMS III) (Wechsler, 1997a)

Intelligence:

- Matrix Test (WAIS III) (Wechsler, 1997b)

Memory:

- Auditory Verbal Learning Test (AVLT) (Maj et al., 1993) for verbal memory
- Complex Figure Test (CFT) (Meyers and Meyers, 1995) for non-verbal memory

Executive functions:

- Spatial Span (WMS III) (Wechsler, 1997a) for visuospatial working memory
- Controlled Oral Word Association Test (COWAT) (Strauss et al., 2006) for verbal fluency
- Five-point Test (Regard et al., 1982) for figural fluency
- Stroop Colour-Word Test (Golden, 1976) for conflict resolution and response inhibition
- Tower of Hanoi Test (ToH) (Welsh and Huizinga, 2005) for planning
- Wisconsin Card Sorting Test (WCST) (Heaton et al., 1993) for concept formation and set shifting
- Object Alternation Test (OAT) (Freedman, 1990) for alternation learning
- Iowa Gambling Task (IGT) (Bechara et al., 1994) for decision making

Visuospatial functions:

The Bender Gestalt Test (BGT) (Pascal and Suttell, 1951).

All subjects were tested individually in a quiet testing room. The clinical interview and testing session took approximately four to five hours. Within a general pre-determined order of test administration, allowances were made for individual variations relating to speed and fatigue, with breaks according to individual preference.

2.3. Statistical analysis

The data was analysed using the Statistical Package for Social Sciences (SPSS; Version 15.0). To generate factors (symptom dimensions), we performed principal component analyses with a Varimax rotation on the 14 symptom categories of the Y-BOCS checklist (excluding miscellaneous symptoms). For each participant, Y-BOCS symptom categories were coded as present or absent currently, if at least one symptom in each category was endorsed. The criterion used to select the number of factors was an eigenvalue of greater than 1. Factor loadings of greater than 0.50 were considered robust.

In view of the non-normative distribution of the data, we performed multivariate quantile (median) regression analysis using Stata 12.1 to examine the relation between individual symptom dimensions and neuropsychological performance. To examine the effect of an individual symptom dimension on each neuropsychological variable, we controlled for the effects of other symptom dimensions, severity score on