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Negative urgency, disinhibition and reduced temporal pole gray matter characterize the comorbidity of cocaine dependence and personality disorders☆

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ABSTRACT

Background: Individuals with cocaine dependence and co-occurring personality disorders are more likely to have increased impulsivity, dysfunctional beliefs, executive dysfunction and brain structural abnormalities by virtue of the conjoint impact of both pathologies.
Methods: We recruited 32 cocaine dependent patients with comorbid Cluster B personality disorders, 44 cocaine dependent patients without comorbidities and 34 non-drug-using controls. They completed the UPPS-P impulsivity scale, the Personality Belief Questionnaire, and executive function tests of working memory, attention/response inhibition and shifting. A subsample ($n = 61$) was also scanned using Magnetic Resonance Imaging. We used univariate ANOVAs for group comparisons, and tested the association between impulsivity, executive control and personality dysfunction and diagnoses using correlation and multivariate logistic regression analyses.
Results: Cocaine dependent patients with personality disorders had elevated negative urgency and borderline beliefs, decreased inhibition and attention regulation, and reduced temporal pole gray matter with respect to the rest of the sample. Trait and cognitive measures correctly classified 73% of comorbid patients (60% sensitivity and 82% specificity).
Conclusion: The co-occurrence of cocaine dependence and personality disorders is associated with negative-mood impulsivity and beliefs, executive dysfunction and temporal pole attrition.

1. Introduction

Cocaine dependence is frequently associated with comorbid psychiatric disorders, being the highest rates for mood, anxiety and personality disorders – especially Cluster B antisocial and borderline diagnoses (Chen et al., 2011). The co-occurrence of personality disorders is particularly influential for cocaine addiction severity and treatment outcomes; for example, the presence of comorbid personality disorders is associated with heavier cocaine intake, lower rates of treatment request, and decreased likelihood of cocaine dependence remission (Ford et al., 2009; Lopez-Quintero et al., 2011). However, little is known about the trait, cognitive and neurobiological characteristics that define the comorbidity between cocaine dependence and personality disorders. The upcoming classification approaches to psychiatric diagnosis have posited that the quest for these characteristics should rest upon dimensional traits and neurocognitive endophenotypes linked to the addiction and personality disorders clinical phenotypes (Livesley, 2011; Robbins et al., 2012). In accordance to existing evidence, these characteristics may include impulsivity and executive dysfunction (including disinhibition), which are associated with deficits in frontostriatal regions (Robbins et al., 2012).

Several studies have underscored the impact of impulsivity on both cocaine addiction and personality pathology (Verdejo-Garcia et al., 2008). More recently, multidimensional approaches to impulsive behavior have revealed that distinct facets of impulsivity are associated with particular forms of psychopathology (Whiteside and Lynam, 2003). In particular, the facet of negative urgency (i.e.,

☆ Supplementary material can be found by accessing the online version of this paper. Please see Appendix A.

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the tendency to act impulsively when under negative affect) is specifically increased in cocaine dependent patients compared to pathological gamblers (Albein-Urios et al., 2012). This facet, which is conceptually linked to the trait of negative affectivity, is also a significant predictor of externalizing and borderline psychopathology (Settles et al., 2012). With regard to executive control, factorial models describe at least three independent components, namely updating, inhibition and switching (Miyake et al., 2000), which are further assisted by fluent energization and allocation of attentional resources (Stuss, 2011). Both patients with cocaine dependence and patients with Cluster B personality disorders exhibit lower performance on cognitive tests of each of these components compared to healthy controls (Haaland et al., 2009; Verdejo-Garcia and Perez-Garcia, 2007). Both impulsivity and executive control are associated with gray matter deficits in frontostriatal, temporal and limbic brain regions among cocaine dependent patients (Moreno-Lopez et al., 2012). In the case of personality disorders, gray matter reductions have been observed in frontal, hippocampal and amygdala regions (Ruocco et al., 2012; Soloff et al., 2008).

The overlap between impulsive facet traits, executive control deficits and lower frontal, temporal and limbic gray matter in patients with cocaine dependence and patients with personality disorders suggests that the co-occurrence of both disorders may be associated with additive or synergistic deterioration of these neurocognitive characteristics. In addition, patients with personality disorders also exhibit marked dysfunctional beliefs associated with their disorders (Beck et al., 2001). These dysfunctional beliefs engage a narrowed set of overused emotional and behavioral dispositions that allegedly form the core clinical phenotype of personality disorders (Fournier et al., 2012). Although cognitive beliefs and cognitive functions are often regarded as separate constructs there is evidence to support a close linkage between dysfunctional beliefs and executive control and impulsivity. For example, higher executive control is associated with better intrusive thoughts suppression (Brewin and Smart, 2005) and there are significant correlations between impulsive traits and cognitive distortions in healthy volunteers (Mobini et al., 2007) and pathological gamblers (Michalczuk et al., 2011). There is also evidence that the intensity of dysfunctional beliefs is associated with amygdala gray matter volumes in individuals with obsessive-compulsive disorder (Nakamae et al., 2012). However, no studies to date have explored the association between personality disorder-specific beliefs and impulsivity, executive control and brain morphology.

The aims of this study were: (i) to compare impulsivity, executive control and gray matter volumes in cocaine dependent patients with vs. without Cluster B personality disorders, (ii) to explore the association between dysfunctional beliefs and impulsivity, executive control and gray matter in cocaine dependent patients with vs. without Cluster B personality disorders, and (iii) to explore if the combination of neurocognitive characteristics and cognitive beliefs predicts the presence of Cluster B personality diagnosis. We hypothesized that: (i) cocaine dependent patients with comorbid personality disorders would have increased negative urgency, decreased executive control, and reduced gray matter volumes in frontal, temporal and limbic regions; (ii) dysfunctional beliefs will be positively correlated with impulsivity and negatively correlated with executive control and brain volumes; and (iii) the neurocognitive characteristics and the dysfunctional beliefs would significantly predict the presence of comorbid personality pathologies.

2. Methods

2.1. Participants

Seventy-six cocaine users and 34 non-drug-using controls statistically matched for age and education distributions were recruited for study purposes. Cocaine users were classified in two groups based on personality disorders diagnosis: 32 participants met criteria for cocaine dependence and personality disorders (13 with histrionic diagnosis, 12 with borderline diagnosis, 6 with antisocial diagnosis and 1 with narcissistic diagnosis) and 44 participants met criteria for cocaine dependence without comorbidities.

Cocaine users were recruited as they started treatment in the clinic "Centro Provincial de Drogodependencias (CPD)" in Granada (Spain), which provides behavioral treatment for substance-related disorders in an outpatient setting. The inclusion criteria for the cocaine groups were defined as follows: (i) age range between 18 and 45 years old; (ii) IQ levels above 80 – as measured by the Kaufman Brief Intelligence Test (K-BIT) (Kaufman and Kaufman, 1990); (iii) meeting DSM-IV criteria for cocaine dependence, as assessed by the Structured Clinical Interview for DSM-IV Disorders, Clinician Version (SCID; First et al., 1997); (iv) being treatment commencers; and (v) abstinence duration > 15 days. Abstinence was confirmed by twice weekly urine tests plus an ad hoc test on the testing days. Inclusion criteria for cocaine dependent patients with comorbid personality disorders were restricted to diagnoses pertaining to Cluster B, which are the more prevalent among cocaine users (Chen et al., 2011). Axis II disorders were assessed using the International Personality Disorders Examination (Loranger et al., 1994). The exclusion criteria were: (i) the presence of any other Axis I disorders, with the exceptions of alcohol abuse, nicotine dependence and attention deficit and hyperactivity disorder (ADHD), as measured by the Conners' Adult ADHD Diagnostic Interview for DSM-IV (CAADID; Conners, 1999); (ii) history of head injury or neurological, infectious, systemic or any other diseases affecting the central nervous system; (iii) having followed other treatments within the two years preceding the study onset; and (iv) having entered treatment by court request. Comorbid Axis I disorders were assessed with the SCID.

Healthy controls were recruited from local employment agencies taking care to match them to the clinical groups in the main demographic characteristics. In addition to the former exclusion criteria, healthy controls could not meet any diagnosis of substance-related disorders – with the exception of nicotine dependence. Axis I and II disorders were also assessed in this group using the SCID, the IPDE and the CAADID.

All the diagnoses were conducted by a board clinical psychologist, whereas all subsequent tests were administered by an independent (blind to diagnosis) evaluator.

2.2. Instruments

2.2.1. Trait impulsivity: UPPS-P impulsive behavior scale (Whiteside and Lynam, 2001). This is a 59-item inventory designed to measure five personality pathways to impulsive behavior: Sensation Seeking, Lack of Perseverance, Lack of Premeditation, Negative Urgency, and Positive Urgency. The reliability of the different subscales (Cronbach's α) ranged from 0.75 (lack of perseverance) to 0.93 (positive urgency). We obtained the total scores of each of these UPPS-P dimensions for analyses.

2.2.2. Dysfunctional beliefs: Personality Belief Questionnaire; PBQ (Beck and Beck, 1991). The PBQ is a self-report questionnaire that consists of nine scales that measure specific beliefs and assumptions associated with the different personality disorders. Here we only used the four scales corresponding to Cluster B personality disorders: antisocial, borderline, histrionic and narcissistic. The Spanish version of the scale holds appropriate psychometric characteristics and the reliability of the different scales (Cronbach's α) in this sample ranged from 0.71 (narcissistic) to 0.88 (borderline).

2.2.3. Executive function tests. We used a cognitive battery designed to measure the three executive components plus attention allocation skills though well-validated tests:

2.2.3.1. Updating: Letter Number Sequencing (Wechsler, 2008) and 2-back task (Watter et al., 2001). The performance indices obtained from these tests were the number of hits.

2.2.3.2. Inhibition: Stroop Color-Word Interference Test (Delis et al., 2001). The performance index was the inhibition score (color-word interference time minus color-naming time).

2.2.3.3. Shifting: Category Test (DeFilippis, 1993). We used the computerized abbreviated version of this test (124 stimuli). The performance index was the total number of errors.

2.2.3.4. Attention: d2 Cancelation Test (Brickenkamp, 2002). This test includes 14 different lines of letters including targets (*d*'s with two dashes) and distracters (e.g., *d*'s with less than two dashes, *p*'s, etc.). Performance indices were: efficiency (total number of trials minus total number of errors), concentration (number of correct items minus commission errors), and fluctuation (maximum total items processed in a trial minus minimum total items processed in a trial). These indices measure selective attention, concentration and fluctuation of attentional resources respectively.

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