Effect of methamphetamine dependence on everyday functional ability

Brook L. Henry *, Arpi Minassian, William Perry

University of California San Diego, Department of Psychiatry, La Jolla, CA, United States

ARTICLE INFO

ABSTRACT

Background: Methamphetamine (METH) is an increasingly popular and highly addictive psychostimulant with a significant impact on public health. Chronic METH exposure has been associated with neurotoxic effects, profound neuropsychological deficits, and impaired quality of life, but few studies have examined the effect of the drug on the ability to carry out everyday activities. We assessed the effect of METH dependence on everyday functioning using the UCSD Performance-Based Skills Assessment (UPSA-2), a performance-based measure designed to evaluate real-life skills.
Method: UPSA-2 performance was quantified in 15 currently abstinent individuals with a history of METH dependence and 15 drug-free comparison subjects. The Positive and Negative Syndrome Scale (PANSS) and Wisconsin Card Sorting Task (WCST) were administered to assess psychopathology and executive function.
Results: METH-dependent participants exhibited significant impairment on the UPSA-2 total score and several UPSA-2 subscales, including comprehension, finance, transportation, communication, and medication management compared to drug-free comparison subjects. Lower UPSA-2 scores were associated with impaired performance on the WCST, higher PANSS scores, and drug use at an earlier age.
Conclusion: METH dependence may be associated with decreased everyday functioning ability potentially mediated by frontal cortex dysfunction or the emergence of psychopathology related to chronic drug use.

© 2010 Elsevier Ltd. All rights reserved.

1. Introduction

Methamphetamine (METH) is an extremely potent and highly addictive drug that is inexpensive, easy to synthesize, and one of the most widely abused drugs, with an estimated 35 million METH users worldwide (Romanelli & Smith, 2006). Recent studies have demonstrated that METH dependence is associated with significant impairment in health-related quality of life, including degraded physical and social functioning (Costenbader, Zule, & Coomes, 2007; Sommers, Baskin, & Baskin-Sommers, 2006), although these deficits can improve with treatment (Gonzales et al., 2009). In addition, increasing evidence suggests that chronic METH use can result in profound neuropsychological deficits (Nordahl, Salo, & Leamon, 2003), including impairment in executive function and response inhibition (Scott et al., 2007) that may persist after extended abstinence (Johanson et al., 2006; Salo et al., 2002). However, in contrast to the substantial body of literature reporting METH-induced impairment on conventional neuropsychological tests, relatively few studies have assessed the effect of chronic drug use on the functional ability to engage in everyday tasks of daily living (Verdejo-Garcia & Perez-Garcia, 2007).

There are a number of approaches to assessing everyday function, including 1) self-report measures, 2) caregiver or confidant reports, and 3) direct observation of behavior in home and work settings, but the validity of these methods is limited by a variety of factors (Patterson, Goldman, McKibbin, Hughs, & Jeste, 2001). Self-report measures such as quality of life scales (Heinrichs, Hanlon, & Carpenter, 1984; Lehman, Postrado, & Rachuba, 1993) or activities of daily living (ADL) questionnaires (Lawton & Brody, 1969) have been widely utilized, but are influenced by poor participant insight and cognitive deficits present in dementia or psychiatric illness. Many individuals are unable to provide the name of a contact person able to report on their daily functioning (Patterson et al., 1996) and long-term observation of subjects in their home or work environment is often not feasible.

In contrast to these methods, several performance-based measures have been developed to administer tasks that focus on real-life skills in a clinical setting (Kuriansky, Gurland, & Cowan, 1976; Loewenstein et al., 1989). A more recent scale, the UCSD Performance-Based Skills Assessment (UPSA-2) (Patterson, Goldman, et al., 2001; Patterson & Goldman, 2005), was designed to quantify everyday functioning across 6 domains, including: 1) planning recreational activities, 2) finance, 3) communication skills, 4) transportation, 5) household skills, and 6) medication management. The UPSA has demonstrated strong inter-rater and test–retest reliability (Patterson, Goldman, et al., 2001; Patterson, Moscona, McKibbin, Davidson, & Jeste, 2001) and is reported to be correlated significantly with independence of living and

* Corresponding author. UCSD Department of Psychiatry, 140 Arbor Drive, Mailcode 0851, San Diego, CA 92103-0851, United States. Tel.: +1 619 497 6642; fax: +1 619 543 5732.
E-mail address: blhenry@ucsd.edu (B.L. Henry).

neuropsychological deficits (Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006; Twamley et al., 2002). Although initially conceived as a measure to assess functional deficits in geriatric psychosis, the UPSA has been administered successfully to younger cohorts (Heinrichs, Statucka, Goldberg, & McDermid Vaz, 2006; Pietrzak et al., 2009), individuals with bipolar disorder (Depp et al., 2009), and has also been tested in Swedish and Latino samples (Harvey et al., 2009; Patterson et al., 2005).

While performance-based testing has been used to assess functional ability in a variety of populations, including individuals with HIV (Heaton et al., 2004), dementia (Razani et al., 2007), and schizophrenia (Heinrichs et al., 2006), this method has not been widely utilized to assess the potential of functional deficits associated with chronic drug use. Previous studies have reported that chronic METH-dependent individuals exhibit a decrease in everyday functioning as determined by self-report measures (Sadek, Vigil, Grant, & Heaton, 2007) and a prospective memory paradigm (Rendell, Mazur, & Henry, 2009), but the effect of chronic METH use on everyday task performance has not been studied extensively. The lack of research in this area is somewhat surprising in light of the neuropsychological deficits associated with chronic drug use and the demonstrated relationship between cognitive impairment and functional ability in real-world settings (McClure et al., 2007).

The objective of the current study was to assess everyday functional ability in abstinent individuals with a history of METH dependence and a drug-free comparison group using the UPSA-2 task. We hypothesized that UPSA-2 scores would be significantly lower among METH-dependent subjects when compared to a sample of comparable drug-free comparison subjects. In addition, we administered the Wisconsin Card Sorting Task (WCST) to assess executive function in these groups. Previous work has shown that impaired WCST performance in schizophrenia outpatients is associated with lower UPSA scores (Kurtz & Wexler, 2006). Therefore, we also examined the relationship between UPSA results and neuropsychological deficits as assessed by the WCST.

2. Methods

2.1. Participants

15 METH-dependent participants were recruited through the HIV Neurobehavioral Research Center (HNRC), an institute that collaborates with community organizations and drug treatment centers throughout the San Diego area. Subjects met SCID (Structured Clinical Interview for DSM-IV) criteria (First et al., 1994) for lifetime history of Substance Use Disorder for METH Dependence, reported symptoms of METH abuse or dependence within the past 2 years, and were also required to be abstinent from the drug for at least 7 days before testing. The history and pattern of drug use, including the length, frequency, and estimated quantity of METH use were obtained through a substance use questionnaire (Table 1). 15 drug-free comparison subjects who had never met SCID criteria for any substance use disorder were recruited from advertisements in the San Diego community. Comparison and METH groups were comparable for age, gender, education, ethnicity and had equivalent premorbid IQ as assessed by the Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 1997) (Table 1).

Participants from both groups were excluded if: 1) they met SCID criteria for schizophrenia, bipolar disorder, or current major depression, 2) any neurological conditions or head trauma, 3) treatment with electroconvulsive therapy, 4) a history of stroke, heart attack, or cardiac disease, 4) infection with HIV or hepatitis C, 5) a positive result for cocaine, amphetamine, PCP, opiates, or cannabis on a urine toxicology Rapid Drug screen (Pharmatic Inc., San Diego, CA) administered during the test session, 6) substance dependence on illegal drugs other than METH in the past 5 years, 7) alcohol abuse or dependence within the past 12 months, and 8) a remote (i.e., more than 5 years prior to study enrollment) but significant history of alcohol or other substance

dependence, as described in previous studies (Rippeth et al., 2004; Woods et al., 2005). After subjects were initially screened during a phone interview, 20 METH-dependent and 16 drug-free comparison participants were tested in our laboratory. In the METH-dependent group, 5 of these subjects were excluded from the current study due to meeting criteria for current major depression, recent alcohol abuse, or positive amphetamine toxicology. One individual in the comparison group who denied any drug use tested positive for cocaine and was excluded from the dataset, resulting in a final sample of 15 participants in each group. Three subjects included in the METH-dependent group did meet criteria for lifetime history of Attention Deficit Hyperactivity Disorder (ADHD).

Given that chronic METH exposure has also been associated with increased prevalence of psychotic symptoms (McKetin, McLaren, Lubman, & Hides, 2006), we administered the Structured Clinical Interview—Positive and Negative Syndrome Scale (PANSS) to assess for the presence of psychopathology. The PANSS consists of a 30 item rating scale that determines the extent of "positive" psychotic symptoms that include paranoia, hallucinations, or unusual thought content, "negative" symptoms that include flat affect, emotional withdrawal, and lack of spontaneity, and miscellaneous symptoms of general psychopathology that include anxiety, poor attention, and somatic concerns. All participants provided written informed consent to the current protocol approved by the UCSD institutional review board.

2.2. Measures

2.2.1. UPSA-2

Functional ability was assessed with the UPSA-2 (Patterson & Goldman, 2005). Participants were asked to perform tasks in 6 separate domains considered necessary for successful and independent functioning in the community: 1) comprehension and planning, 2) financial ability, 3) communication skills, 4) transportation, 5) household skills, and 6) medication management as described below.

In the first domain, comprehension and planning skills were assessed by having participants read a fictional article about the opening

Table 1
Demographic factors and drug use history for comparison ($n=15$) and METH-dependent ($n=15$) subjects. PPVT results are presented as age-adjusted standard scores. The PANSS total score ranges from 30 to 210, and the Positive and Negative symptoms subscales range from 7 to 49. Higher scores indicate more severe psychopathology. Data are represented as means ± S.E.M. Asterisks indicate significant group differences; ***$p<0.001$.

Parameter	Comparison	METH-dependent	Difference
Age (years)	37.8 ± 2.5	36.9 ± 2.2	ns
Gender	11 M, 4 F	12 M, 3 F	ns
Education (years)	14.1 ± 0.6	13.6 ± 0.6	ns
Ethnicity (n) ns			
Caucasian	11	11	
Latino	2	3	
African-American	2	1	
Peabody Picture Vocabulary Test scores	100.9 ± 3.2	97.6 ± 2.3	ns
Age at first METH use (years)	–	22.1 ± 2.0	
Duration of continuous METH use (years)	–	10.6 ± 1.7	
Frequency of METH use (per month)	–	23.4 ± 2.5	
Total amount of METH used (in grams)	–	6390.1 ± 1378.6	
Number of days METH used in past year	–	54.5 ± 24.2	
Duration of METH abstinence (days)	–	259.7 ± 57.4	
PANSS total score	33.6 ± 0.8	43.2 ± 1.7***	
PANSS positive symptoms	8.1 ± 0.3	12.3 ± 1.0***	
PANSS negative symptoms	7.7 ± 0.3	7.5 ± 0.2	