Published in final edited form as:

Drug Alcohol Depend. 2003 August 20; 71(2): 207–211.

Cognitive impairment, retention and abstinence among cocaine abusers in cognitive-behavioral treatment

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Abstract

Cognitive-behavioral therapy (CBT) depends on adequate cognitive functioning in patients, but prolonged cocaine use may impair cognitive functioning. Therefore, cognitive impairment may impede the ability of cocaine abusers to benefit from CBT. To begin to address this issue, we investigated the relationship between cognitive impairment and two treatment outcomes, therapy completion and abstinence. Eighteen carefully screened non-depressed cocaine-dependent patients in a psychopharmacological clinical trial were administered the MicroCog computerized battery to assess cognitive performance at treatment entry. *T*-tests were used to compare cognitive functioning between completers (patients remaining in treatment at least 12 weeks) and dropouts. The results indicated that treatment completers had demonstrated significantly better cognitive performance at baseline than patients who dropped out of treatment. Cognitive domains that significantly distinguished between treatment completers and dropouts were attention, mental reasoning and spatial processing. This study provides preliminary evidence that cognitive impairments may decrease treatment retention and abstinence in CBT of cocaine dependence.

Keywords

Cocaine; CBT; Cognitive impairment; Treatment; Retention

1. Introduction

According to the 1997 National Household Survey on Drug Abuse, approximately 1.5 million adults use cocaine in the US, signaling a widespread problem that can often lead to dependence requiring therapeutic intervention. To address this need, a variety of psychopharmacological and psychosocial treatments have been developed to treat cocaine dependence. The use of manual-guided psychotherapy in pharmacotherapy clinical trials has been advocated on theoretical grounds, and it appears to improve compliance and reduce unwanted variance due to therapist differences (Klein, 1991; Nunes, 1997). One of these,

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cognitive-behavioral treatment (CBT), has shown considerable promise (Carroll et al., 1991; Maude-Griffin et al., 1998). However, for a substantial proportion of patients its efficacy remains limited. Documented dropout rates from CBT treatments have been reported to range from 33 to 64%. (Carroll et al., 1991, 1994). Thus, it is important to identify factors associated with treatment drop-out or poor outcome.

A fundamental component of CBT is the use of cognitive processing as a mediator of behavioral change (Carroll, 1998). However, impairment in cognitive functioning has been found in a substantial proportion of cocaine dependent patients (Bolla et al., 1999, 2000). Specifically, attention, learning, memory, and cognitive flexibility are often impaired in cocaine abusers (Ardila et al., 1991; Berry et al., 1993; Horner, 1997). It is reasonable to hypothesize that treatment-seeking cocaine abusers who cannot comprehend the interventions presented to them within the CBT framework (e.g. functional analysis, skills developing) are more likely to drop out of treatment or do poorly.

Surprisingly, only a few studies have investigated the effects of cognitive functioning on treatment outcome among cocaine abusers (Fals-Stewart and Schafer, 1992; Teichner et al., 2001), and none has investigated this specifically as pertaining to CBT. To address this gap in knowledge, we conducted an initial study of the relationship between cognitive functioning at treatment entry on retention and level of abstinence. The study was conducted among cocaine dependent users in short-term psychopharmacotherapy that included weekly individual manualized-CBT. We hypothesized that treatment completers (those completing at least 12 weeks in CBT) would score higher on cognitive measures than dropouts and that greater abstinence would be associated with higher cognitive functioning at baseline.

2. Methods

2.1. Participants

Eligible patients consecutively enrolled during a 12-month period (from 6/00 to 6/01) in an ongoing clinical trial for non-depressed cocaine patients were approached about participation in the present study. The placebo-controlled clinical trial consisted of 15 weeks of CBT+ medication (either gabapentin or placebo). To evaluate eligibility for this trial, patients were administered an evaluation including the SCID I/P interview (DSM-IV version) administered by trained Ph.D. level psychologists. The evaluation also included self-reports and physical examinations conducted by research nurses, physicians and research psychiatrists. Patients were offered participation in this study if they met a number of inclusion and exclusion criteria. Inclusion criteria were: (1) cocaine dependence; (2) cocaine use within 72 h of assessment, verified by urine toxicology assay obtained the day of the neuropsychological assessment; (3) self-reported cocaine use at least four times in the month prior to admission and duration of cocaine use for at least 12 months preceding enrollment into the study. Exclusion criteria were: (1) any DSM-IV mood disorder, psychosis, or ADHD; (2) substance dependence other than cocaine; (3) history of seizure disorder or head injury with loss of consciousness longer than an hour; (4) prior diagnosis of learning disability; (5) HIV positive.

The study was described to patients as an assessment of the effects of cocaine on cognitive functioning. Of the 19 patients approached, 18 (94.7%) agreed to participate and signed an additional consent form approved by the New York State Psychiatric Institute Internal Review Board for this study. Eleven patients received active medication. Six patients (2 F) completed the treatment and 12 (1 F) failed to complete.

2.2. Measures

2.2.1. Neuropsychological battery—To measure cognitive functioning, all patients were given the computerized standard version of the Micro-Cog (MC) Assessment of Cognitive Functioning (Powell et al., 1993). This 45–60 min battery has been normed and standardized for adults (Powell et al., 1993), facilitating clinical implementation. The computerized administration eliminates examiner effects and increases reliability. The MC yields several levels of scores; three levels of summary scores are relevant to this report. The first level consists of a summary index generated for each of five cognitive domains: attention, abstract reasoning, memory, spatial processing, and reaction time. The second level consists of overall measures of accuracy and speed. The third level consists of two composite scores: general cognitive functioning, combining accuracy and speed with equal weights, and general cognitive proficiency, combining accuracy and speed with preferential weight to accuracy. The MC has been used in a number of studies of substance abusing patients (Di Sclafani et al., 2002; Harrington et al., 2001; Lopez et al., 2001; Smigielski and Doss, 1998).

Retention: therapy completion was defined as attendance of at least 12 out of 15 weeks of CBT treatment. The requirement of 12 weeks of treatment to indicate completion was designed to be compatible with the standard length of CBT treatment, which is 12 weeks (Carroll, 1998).

Level of abstinence: This was indicated by the proportion of urines negative for cocaine out of total possible urines. The standard National Institute on Drug Abuse cutoffs for positive/negative results (300 ng/ml for cocaine) was used. Missed urines were treated as positive.

2.3. Procedures

During the 15 weeks of treatment, patients participated in a weekly individual CBT session and gave observed urine specimens three times a week. Urine samples were semi-quantitatively analyzed for cocaine, cocaine metabolites and for other six common drugs of abuse. The MC was administered, during the placebo lead-in phase, in a single session after the first CBT session. Patients were paid \$20.00. To assure that patients were not high at the time of testing, patients reported on their last use and submitted an observed urine specimen. Their behavior during testing was also clinically observed. Staff who oversaw administration of the MC were blind to treatment assignment (gabapentin or placebo).

2.4. Statistical analysis

T-tests were used to compare cognitive functioning in the completers and dropouts on the five summary scores and the composite scores for Levels II and III. All scores were age and education adjusted, normally distributed, with minimum and maximum scores ranging well

below and above average. To address the relationship of cognitive functioning and abstinence, the proficiency composite score was dichotomized to represent high and low levels of functioning, using the median of the sample as the cut-off point. *T*-tests were then used to compare the mean proportion of negative urines in the high- and low-functioning groups. The proficiency test was chosen for this comparison because it combines accuracy and speed, but gives more weight to accuracy. This was considered important compared to the overall composite score, which gives equal weight to accuracy and speed. The alpha level was set at 0.05 for all tests. To evaluate whether medication effects appeared to confound the study findings, the Fisher's Exact test was used to test whether dropout differed between the medication and placebo groups.

3. Results

Completers and dropouts did not differ significantly on demographic variables or patterns of cocaine use. The mean age for completers was 41.8 (SD 6.6) vs. 37.1 (SD 6.6) for the dropouts; $t(1, 16) = 1.4$; $P = 0.17$. The mean years of education for the completers was 14.3 (SD 2.06) vs. 13.5 (SD 1.38) for the dropouts; $t(1, 16) = 1.02$; $P = 0.32$. African Americans constituted 66.6% of the completers vs. 58.3% of the dropouts; $\chi^2(2) = 2.04$; $P = 0.35$ and 27.7% of the completers vs. 38.8% of the dropouts were employed; $\chi^2(2) = 4.87$; $P = 0.08$. Of the completers, 33.3% were married vs. 16.6% of the dropouts; $\chi^2(3) = 1.68$; $P = 0.63$. The mean years of cocaine use for completers was 10.5 (SD 2.4) vs. 9.2 (SD 6.2) for the dropouts; $t(16) = 0.46$; $P = 0.64$, and the mean number of days of cocaine use per week in the past 30 days for completers was 4.6 (SD 1.8) vs. 3.1 (SD 1.9) for the dropouts; $t(16) = 1.53$; $P = 0.14$. Out of the 11 patients on medication, seven dropped out (63.6%), while five of the seven patients on placebo (71.4%) dropped out; Fisher's Exact test; $P = 0.57$. This last test suggests that medication effects did not confound the study results.

Treatment completers performed at higher cognitive levels than the dropouts across all cognitive domains (Table 1). Dropouts had significantly lower performance on tests of attention, mental reasoning and spatial processing. The general cognitive performance composite score was significantly better among treatment completers than the dropouts. Furthermore, completers performed significantly faster and with greater accuracy than dropouts on the proficiency composite score. Treatment completers required significantly less time overall to complete cognitive tasks than dropouts as indicated by the information processing speed score.

Retention rates

Patients in the low-cognition group ($n = 9$) on the general cognitive proficiency composite score were more likely to dropout early. In the first 4 weeks of treatment, five patients in the low-cognition group (55.6%) vs. two patients in the high-cognition (22.2%) dropped out (Fig. 1).

Abstention

On the general cognitive proficiency composite score, the average proportion of negative urines among patients in the high-cognition group ($n = 9$) was significantly higher ($M =$

36.5, SD = 34.8) than in the low-cognition group ($M = 7.44$, SD = 13.5, $t(16) = 2.33$, $P = 0.03$).

4. Discussion

This study provides preliminary evidence that levels of cognitive functioning differ between treatment completers and dropouts. The low cognitive scores of the treatment dropouts indicate that compared with completers, these patients may suffer from difficulties in ability to focus, hold and sustain attention. These patients with deficits in attention and mental reasoning may have difficulties participating in CBT. For example, some patients may have difficulties attending throughout the 60 min, a standard CBT session length. Furthermore, as treatment progresses to learning coping skills and generating alternatives to drug use, CBT requires higher-order mental reasoning and cognitive flexibility. Patients with lower scores on mental reasoning may suffer from inability to identify relevant triggers to drug use and to shift from one set of drug problem-solving alternatives to another. To benefit from the cognitive-behavioral intervention, adequate cognitive functioning is needed. Lack of comprehension and utilization of the CBT may cause frustration, leading to premature termination.

Abstinence from cocaine use also appeared related to cognitive functioning, as patients in the high-proficiency group had significantly more negative urines than patients in the low-proficiency group. Further work in a larger sample would allow more extensive exploration of the relationship of abstinence to different domains of cognitive functioning.

The results of the study should be considered in light of the methods used. With the small sample, the types of analyses that could be done were limited. Replication and extension of this research is clearly in order, among patients treated for cocaine dependence as well as dependence on other substances. Strengths of the study, however, should be noted as well. These include the excellent participation rate and the careful evaluation of inclusion and exclusion criteria, eliminating many potential sources of confounding or uncertainty about the study results.

The findings of this study suggests that cognitive impairments may play an important role in the treatment of cocaine dependent patients. This study suggests that chronic cocaine abusers with observed cognitive impairments are more likely to dropout of an outpatient CBT. If supported by further study, this would suggest that a modification of CBT to address the needs of cognitively impaired patients might improve treatment outcome.

Acknowledgments

The authors thank Ivana Huang for assisting in data collection and Valerie Richmond for manuscript preparation, Drs Suzanne Vosburg for her comments on an earlier draft and Adam Bisaga for sharing his data on these patients. This research was supported by NIDA grant (PI 50 DA09236, H.D. Kleber). Support for Dr Hasin is acknowledged from NIAAA grant AA K02 AA00151. The New York State Psychiatric Institute also contributed support to this work.

References

- Ardila A, Rosselli M, Strumwasser S. Neuropsychological deficits in chronic cocaine abusers. *Int J Neurosci*. 1991; 57:73–79. [PubMed: 1938157]
- Berry J, Van Gorp WG, Herzberg DS, Hinkin C, Boone K, Steinman L, Wilkins JN. Neuropsychological deficits in abstinent cocaine abusers: preliminary findings after two weeks of abstinence. *Drug Alcohol Depend*. 1993; 32:231–237. [PubMed: 8394237]
- Bolla KI, Rothman R, Cadet JL. Dose-related neurobehavioral effects of chronic cocaine use. *J Neuropsychiatry Clin Neurosci*. 1999; 11:361–369. [PubMed: 10440013]
- Bolla KI, Funderburk FR, Cadet JL. Differential effects of cocaine and cocaine alcohol on neurocognitive performance. *Neurology*. 2000; 54:2285–2292. [PubMed: 10881254]
- Carroll KM. Therapy manuals for drug addiction. Rockville, MD: National Institute of Drug Abuse; 1998. A Cognitive-Behavioral Approach: treating cocaine addiction.
- Carroll KM, Rounsaville BJ, Gordon LT, Nich C, Jatlow P, Bisighini RM, Gawin FH. Psychotherapy and pharmacotherapy for ambulatory cocaine abusers. *Arch Gen Psychiatry*. 1994; 51:177–187. [PubMed: 8122955]
- Carroll KM, Rounsaville BJ, Gawin FH. A comparative trial of psychotherapies for ambulatory cocaine abusers: relapse prevention and interpersonal psychotherapy. *Am J Drug Alcohol Abuse*. 1991; 17:229–247. [PubMed: 1928019]
- Di Scialfani V, Tolou-Shams M, Price LJ, Fein G. Neuropsychological performance of individuals dependent on crack-cocaine, or crack-cocaine and alcohol, at 6 weeks and 6 months of abstinence. *Drug Alcohol Depend*. 2002; 66:161–171. [PubMed: 11906803]
- Fals-Stewart W, Schafer J. The relationship between length of stay in drug-free therapeutic communities and neurocognitive functioning. *J Clin Psychol*. 1992; 48:539–543. [PubMed: 1325478]
- Harrington DE, Schwartz SH, Dailey K. Computerized cognitive assessment of persons with acquired brain injury utilizing MicroCog. *Arch Clin Neuropsychol*. 2001; 16:752.
- Horner MD. Cognitive functioning in alcoholic patients with and without cocaine dependence. *Arch Clin Neuropsychol*. 1997; 12:667–676. [PubMed: 14590660]
- Klein DF. Improvements of Phase III psychotropic drug trials by intensive Phase II work. *Neuropsychopharmacol*. 1991; 4:251–258.
- Lopez SJ, Ryan JJ, Sumerall SW, Lichtenberg JW, Glasnapp D, Krieschok TS, Van Fleet JN. Demographic variables and microCog performance: relationships for VA patients under treatment for substance abuse. *Psychol Rep*. 2001; 88:183–188. [PubMed: 11293027]
- Maude-Griffin PM, Hohenstein JM, Humfleet GL, Reilly PM, Tusel DJ, Hall SM. Superior efficacy of cognitive-behavioral therapy for urban crack cocaine abusers: main and matching effects. *J Consult Clin Psychol*. 1998; 66:832–837. [PubMed: 9803702]
- Nunes, EV. Methodological recommendations for cocaine abuse clinical trials: a Clinician-researcher's perspective. Vol. 175. Rockville MD: National Institute of Drug Abuse; NIDA Research Monograph; 1997. p. 73-95.
- Powell, DH., Kaplan, EF., Whitla, D., Catlin, R., Funkenstein, HH. Microcog: Assessment of Cognitive Functioning version 2.1. The Psychological Corporation; San Antonio, TX: 1993.
- Smigielski JS, Doss RC. MicroCog: use in an inpatient substance abuse treatment setting. *Arch Clin Neuropsychol*. 1998; 13:65–66.
- Teichner G, Horner MD, Harvey RT. Neuropsychological predictors of the attainment of treatment objectives in substance abuse patients. *Int J Neurosci*. 2001; 106:253–263. [PubMed: 11264924]

Fig. 1. Retention rates in patients receiving CBT treatment by levels of cognitive proficiency. High cognition-proficiency scores ≥ 80 ; low cognition-proficiency scores ≤ 79 .

Table 1

Completers vs. dropouts differences of cognitive functioning on major cognitive domains, and composite scores

	Mean (SD)		t-value	P
	Completers (n =6)	Dropouts (n =12)	df =16	
Major domains—summary scores				
Attention	104.00 (12.5)	84.83 (12.8)	3.00	0.008
Abstract reasoning	99.50 (21.6)	82.00 (12.4)	2.19	0.043
Memory	92.66 (20.1)	84.00 (18.8)	0.90	0.381
Spatial processing	94.83 (18.8)	79.58 (11.8)	2.77	0.013
Reaction time	98.66 (15.1)	92.16 (16.76)	0.80	0.433
Composite scores—level II				
Processing speed	104.00 (12.1)	82.75 (18.4)	2.54	0.021
Processing accuracy	90.00 (21.4)	79.66 (10.1)	1.41	0.177
Composite scores—level III				
General cognitive performance	96.66 (17.0)	76.41 (13.0)	2.80	0.012
General cognitive proficiency	95.33 (17.3)	75.33 (9.6)	3.17	0.005