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Original Article

Comparing Cognitive Functions in Patients with Schizophrenia and Methamphetamine-Induced Psychosis with Healthy Controls

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Abstract

Background: There are similar findings about the similarities and differences of cognitive dysfunctions in patients with schizophrenia and methamphetamine-induced psychosis (MIP). This study aimed to compare cognitive functioning in schizophrenia and MIP patients, using a performance-based cognitive assessment battery and an interview-based assessment of cognition.

Methods: Three groups participated in this study including, (a) 30 patients with MIP, (b) 30 patients with schizophrenia, and (c) 30 healthy individuals. All participants received the Brief Assessment of Cognition in Schizophrenia (BACS), a standardized performance-based cognitive battery, the Schizophrenia Cognition Rating Scale (SCoRS), and the interview-based assessment of cognition.

Findings: Both groups of patients with schizophrenia and MIP performed poorly on all the BACS cognitive domains compared with the healthy controls. The two patient groups were significantly different on the three BACS subscales including verbal fluency, verbal memory, and speed of information processing. Schizophrenia patients performed worse than the MIP group concerning these three subscales. However, the two patient groups were similar in executive function, working memory, and motor speed. Moreover, the SCoRS-informant, SCoRS-global, and PANSS-negative significantly differed between schizophrenia and MIP patients.

Conclusion: Although cognitive dysfunctions are mostly similar in patients with MIP and schizophrenia, there are some differences especially in the functions related to prefrontal and temporal lobes.

Keywords: Schizophrenia; Methamphetamine-induced psychosis; Brief assessment of cognition in schizophrenia; Schizophrenia cognition rating scale

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Introduction

Methamphetamine (Meth; N-methyl-alpha-methylphenethylamine) as a synthetic substance has a significant stimulant effect on the central nervous system (CNS), and is the second most commonly used substance worldwide.[1] Methamphetamine abuse induces negative structural and functional effects in the brain. Chronic methamphetamine abuse or use of high amounts of methamphetamine usually leads to psychosis which is associated with positive symptoms and with less intensity of negative symptoms.[2-4] According to a meta-analysis, methamphetamine-induced psychosis (MIP) is associated with cognitive deficits in attention, executive function, language, verbal memory, learning, visual memory, and working memory.[5] Cognitive impairment is a marker for predicting recurrence and poorer adherence to treatment.[6] Cognitive deficit, as a common symptom in schizophrenia, is considered a core feature of this disorder. Many studies have found a relationship between cognitive efficacy and daily function in schizophrenia.[7] On neuropsychological tests, social cognition, information processing, and appropriate response generation in situations obviously demonstrate impairments in schizophrenia. Working memory, information processing speed, attention, visual and verbal learning, problem solving, planning, reasoning, and abstract thinking are

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also impaired in schizophrenia.[8] Studies have shown that methamphetamine abusers usually experience psychotic symptoms similar to schizophrenia patients (clinical and cognitive).[9] Importantly, there is strong evidence showing that the clinical and cognitive symptoms persist even after methamphetamine abstinence, hence, MIP and schizophrenia are partly clinically similar.[6,10,11] Several studied have compared psychotic symptoms and cognitive functions in schizophrenia and MIP, and have reported inconsistent results. While some studies have found impaired cognitive function in MIP comparable to schizophrenia, others have reported better performances in patients with MIP than schizophrenia.[12-14] Duration of methamphetamine abuse and related psychosis as well as cognitive assessment may have led to these inconsistencies.

This study aimed to compare the cognitive dysfunctions in patients with schizophrenia and MIP (after the elimination of psychotic symptoms) with cognitive functions in a healthy group, using an interview-based assessment of cognition (the Schizophrenia Cognition Rating Scale, SCoRS) and a performance-based cognitive assessment battery (the Brief Assessment of Cognition in Schizophrenia, BACS).

Methods

Study Population and Design

The study sample consisted of 30 patients with MIP, 30 patients with schizophrenia, diagnosed based on DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition) diagnostic criteria approved by two psychiatrists, and 30 healthy controls, with the age range of 18-55 years and a minimum education of the fifth grade of elementary school. None of the participants had a history of brain damage, head trauma, physical anomalies, visual and hearing impairment, and mental retardation and current dependence on other stimulants (cocaine, cannabis, LSD).

Patients with MIP had no history of other psychotic disorders before taking methamphetamine, and patients with schizophrenia had no history of methamphetamine use. MIP patients were assessed after elimination of psychotic symptoms (at least one week after admission and negative urine test). To evaluate the consumption of methamphetamine, the urine test was performed at the patient's admission time and repeated one week later.

Study Measures

a) The Persian-BACS[15] and SCoRS[16] were used to evaluate cognitive impairments. The BACS is a performance-based cognitive assessment battery which is sensitive to cognitive impairment including verbal fluency, verbal memory, executive function, working memory, attention, and motor speed in schizophrenic patients. Lower scores in any of the mentioned subscales shows more impairment related to that function.

b) The SCoRS (an interview-based battery for detecting cognitive impairments with 20 items) was answered by patients, informants (family members, friends, etc.), and the interviewers. Interviewers read the questions for patients as well as informants separately, and they rated the answers on a Likert scale ranging from 1-4. Lower scores show better function. At the end, a total score of 1 to 10 was calculated by the interviewer.

c) Positive and Negative Symptoms Scale (PANSS) was used to investigate the severity of psychopathology in patients.[17]

Data were expressed as mean (standard deviation, SD) or frequency (percentage). Normal distribution assumption was checked by Kolmogorov–Smirnov test. Continuous variables ware analyzed via one-way ANOVA. The obtained data were analyzed using Statistical Package for Social Sciences (SPSS) version 24 (IBM Inc., Chicago, IL, USA), independent test, chi-square test, and correlation coefficient statistical tests at the significant level of $P<0.05$. Logistic regression and risk relative were used to determine the effects.

Results

Demographic and clinical variables are shown in Table 1. There was no significant difference between MIP and schizophrenic patients on PANSS-positive ($P=0.126$) scores while there was an obvious difference between the two groups in PANSS-negative ($P<0.0005$) and

Table 1. Demographic characteristics of the study groups

	Groups			*P* value
	Schizophrenia	MIP	Control	
Gender/Male, No. (%)	26 (87.7)	26 (87.7)	26 (87.7)	0.8
Age, Mean ± SD	35.70 ± 7.97	34.37 ± 7.54	34.50 ± 8.03	0.83
Education, Mean ± SD	10.90 ± 2.24	10.30 ± 2.29	12.10 ± 0.54	0.001
PANSS				
Positive	12.23 ± 2.32	8.86 ± 1.59,		0.126
Negative	13 ± 2.13	8.86 ± 1.09		<0.0005
Other	25.46 ± 3.99	8.76 ± 1.35		<0.0005

PANSS-other scores ($P<0.0005$). The three groups were not significantly different in age and gender, but different in education (Table 1). The results of ANOVA showed that there were significant differences between the three groups in all the BACS cognitive domains and the total scores ($P<0.001$). Follow-up analysis showed that both groups of patients with schizophrenia and MIP showed significantly lower scores than controls on all cognitive domains. Moreover, there were significant differences between patients with schizophrenia and MIP on the three subscales including verbal memory, verbal fluency, and symbol coding, and schizophrenic patients performed more poorly than MIP group. However, the two patient groups performed similarly in the tower of London, token motor, and serial number tests. Finally, there was a significant difference between the two patient groups on SCoRS-informant and SCoRS-Global, with higher scores for schizophrenia group (Table 2).

Discussion

This study aimed to compare the cognitive functions in patients with schizophrenia and MIP with healthy controls. Overly, the results showed that both groups of patients with schizophrenia and MIP had poorer cognitive functions (BACS composite score) than the control group. The findings suggested a probable common underlying brain pathology in MIP and schizophrenia.

Specifically, both patient groups were worse than controls, and similar to each other, on speed of information processing, motor speed, and executive function. This implies similar impairments of cognitive functions mediated by the prefrontal and temporal lobes, particularly the prefrontal cortex, in both MIP and schizophrenic patients. This finding is consistent with the study by Jacobs et al, who compared the cognitive functions of MIP and schizophrenic patients across eight cognitive domains. They showed no significant differences between the two groups in any cognitive domain.[18] Similarly, it has been shown that patients with schizophrenia and MIP had more deficits in selective attention, executive functions, sustained attention and memory than controls.[19,20]

Regardless of the similarities in cognitive dysfunction between schizophrenic and MIP patients, this study revealed that MIP patients had higher scores on verbal memory, verbal fluency, and working memory than schizophrenic patients. Similarly, Jacobs et al found MIP patients had better performances than schizophrenic patients on visual search and attention.[18] These findings indicate cognitive dysfunction in MIP is somewhat comparable to schizophrenia, and dysfunction of the parietal (visual search and attention) and prefrontal (verbal fluency and working memory) cortex may be more pronounced in schizophrenic than MIP patients.

Chen et al showed that all the BACS cognitive domains were comparable in MIP with persistent psychosis and schizophrenia groups, and were worse than controls, while there were no significant differences between MIP with brief psychosis and controls.[13] In contrary, in the present study, the two patient groups were similar only on the three BACS cognitive domains. This difference is related to the length of psychosis in MIP patients.

For the first time, the SCoRS was used in this study to find whether the two groups were different in daily cognitive function or not. It is important that cognitive batteries like BACS evaluate cognitive functions based on patient's performance during doing specific tasks.

SCoRS is an interview-based instrument which reflects patients' function in their real life. It is rated based on the answers given by the patient, people in close contact with the patient (informant), and the interviewer. Interestingly, the results showed that the SCoRS-informant and SCoRS-global were significantly different between MIP and schizophrenia. This indicates that daily functioning is more impaired in schizophrenic than MIP patients, reflecting the grater severity of the underlying disorder and longer course of disorder in schizophrenia.

Consistent with previous studies, there were obvious differences between the two groups of patients in PANSS-negative symptoms with lower scores in MIP patients,

Table 2. The mean scores of BACS subscales for the three groups

		Groups			*P* value
		Schizophrenia	MIP	Control	
BACS	Verbal memory	25.87±11.05	31.87±10.94	39.57±10.95	C>MIP>SCZ
	Serial number test	11.20±4.03	12.60±5.25	15.40±4.75	C>MIP=SCZ
	Verbal fluency	13.18±5.60	15.96±6.63	18.36±4.19	C>MIP>SCZ
	Token motor test	35.86±2.82	34.25±2.90	64.14±2.94	C>MIP=SCZ
	Symbol coding test	17.90±11.03	20.33±9.56	32.93±7.69	C>MIP>SCZ
	Tower of London	4.30±2.43	4.30±2.43	11.93±6.60	C>MIP=SCZ
	BACS composite	18.77±6.86	20.17±6.20	32.84±5.85	C>MIP=SCZ
SCoRS	SCoRS-patient	38.70±9.34	36.63±10.34		0.2
	SCoRS-informant	55.53±10.55	45.30±11.84		0.001
	SCoRS-global	5.83±1.21	4.33±1.58		0.01

but not for positive symptoms. This finding indicates high concordance of positive symptoms in MIP and schizophrenic patients, suggesting that it could be difficult to differentiate the two groups only based on positive symptoms.[21] Higher prevalence of negative symptoms in schizophrenic patients is supported by previous studies that proposed negative symptom is a central feature in schizophrenia as well as a diagnostic criterion.

One of the limitations of this study was that all patients took antipsychotic medications. Future studies are required to examine cognitive functions in different groups of MIP and drug naïve MIP patients.

Generally, while there is substantial overlap in positive and cognitive symptoms between MIP and schizophrenia, there are distinctive aspects to each condition that help to differentiate the two disorders.

Conclusion

Although cognitive dysfunctions of patients with MIP are mostly similar to those of patients with schizophrenia, some differences seem to exist, especially in those functions that are primarily dependent on prefrontal and temporal lobe function.

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Conflict of Interests

The authors declare no conflict of interest regarding the publication of this paper.

Ethics Approval

This study was approved by the Ethics Committee of Kerman University of Medical Sciences (Ethics No. IR.KMU.AH.REC.1397.72).

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