IJMS
Vol 27, No. 2, June 2002

Original Article

Chronic/Negative and Acute/Positive Schizophrenia and Attention Deficits

S. Toobaee, H. Hagh-Shenas, A. Makaremi

Abstract

Background: Schizophrenia is a psychiatric disorder that impairs several intellectual functions, including attention processes.

Objectives: To investigate attention deficit in a group of patients with schizophrenia.

Method: Thirty patients with schizophrenia hospitalized in three psychiatric wards in Shiraz and Isfahan and 30 normal healthy subjects matched for age, gender and years of education underwent the following tests: A computerized Continuous Performance Test (CPT), Stroop color-word test and Wisconsin Card Sorting (WCS) test.

Results: In the tests performed, patients with schizophrenia preformed poorer than control subjects. The acute/chronic classification did not predict differences in attention processes among subtypes of schizophrenia, while positive/negative classification predicted differences observed among the patient groups. The subtypes of schizophrenia (paranoid, undifferentiated and residual) had the same performance in CPT, while they were significantly different in error scores of (WCS) and reaction time in response to Stroop stimuli in incongruent color-word condition.

Conclusion: The paranoid patients preformed better in contrast to other subtypes on attention related tasks. The results of the present study suggest that CPT is a valuable test for differentiation of schizophrenia disorder in general, while Stroop test and WCS may have better diagnostic value for differentiating subtypes of the disorder.

Iran J Med Sci 2002; 27(2):90-94

Keywords • Schizophrenia • attention deficit • WCS • CPT • Stroop

Department of Psychiatry, Shiraz University of Medical University, Hafez Hospital, Shiraz 71935, Iran.

Correspondence: H. Hagh-Shenas, Department of Psychiatry, Shiraz University of Medical University Hafez Hospital.
E-mail: haghsheh@sums.ac.ir

Introduction

Cognitive impairment in schizophrenia include a spectrum of disabilities in problem-solving and task taking. Of particular interest is impairment of attention, a major function related to cognition and affect. The deficit in attention has been consistently postulated to be the major underlying deficit, which characterizes schizophrenia spectrum disorders. Hogarty and Flesher[1] classified various attention deficits of schizophrenia according to segmental set

theory. In order to classify the wide range of attention problems of patients, three components were postulatedforthe ory; failure to establish set or performing selective attention, failure to maintain set or retaining sustained attention, and failure to shift set or ability in switching attention.[1] Carter and Flesher showed how robustly these biologically originated abnormalities may results social vulnerability and functional disability in patients suffering from schizophrenia.[2] Barch, Carter and colleagues[3] using Stroop paradigm showed selective attention failure in these patients when compared with healthy subjects. A review of literature[4] shows that attention deficits are characteristically noted in schizophrenia, and are consistent with the notion that there is a frontal lobe system involvement with the disease. Non-paranoid and negative state schizophrenics demonstrate deficit consistent with reduced arousal and distractability, while paranoid and positive state schizophrenics may show better performance in relevant tasks compared to normal subjects.[4] The present study was designed to investigate the set theory components in groups of patients with schizophrenia. Performance of the patients was analysed according to groups of positive or type I, negative or type II, and chronic/ acute possibilities.

Patients and Methods

Thirty patients with diagnosis of schizophrenia hospitalized in three psychiatric wards in Shiraz and Isfahan were enrolled into this study. The inclusion criteria were 1) receiving agreement on diagnosis of schizophrenia confirmed by two psychiatrists according to DSM-IV criteria;[10] 2) a score of >25 in the Mini Mental State Examination (MMSE);[11] 3) age between 17 and 45 years; and 4) having >8 years of formal education. Thirty normal healthy subjects matched for age, gender and level of education served as controls in this study.

Several measures were used for diagnosis and evaluation of attention processes. The experimenter filled in a checklist for DSM IV criteria for the diagnosis of schizophrenia and categorized the patients to positive/negative[12] or chronic/acute schizophrenia. Those patients showing a 2-year duration of the symptoms without remission were regarded as having chronic schizophrenia.[13]

Three well-known paradigms were selected and adopted for Persian speaking subjects in order to test the three areas of attention deficit of the patients. The Standard Stroop Task was used for measuring selective attention in which the individual is presented with the names of colors printed in ink of a color that differs from the color name (*e.g.*, the word 'green' printed in blue ink), and asked to specify the color of the ink. Correct performance requires suppression of the conflicting tendency to respond to the color name. The Continuous Performance Test (CPT) was selected for measuring sustained attention.[6, 7] Following the original version of the test developed by Rovold et al.[8] The test consists of tachistoscopic presentation of random series of letter at a rapid fixed rate (*e.g.*, one second) over 15 minutes with instructions to respond to a pre-selected series of letters that appear each time. The Wisconsin Card Sorting (WCS) was considered for measuring the shifting in attention.[9] Patients were assessed individually in two or three successive sessions if necessary. These tests and measurements were carried out successively.

Using SPSS-10, data were analyzed by multivariate analysis of variance (MANOVA). The scores of the tests were dependent variables that included 1) the reaction time (RT) for the congruent condition of Stroop test (*i.e.*, naming color word written with the same color); 2) the RT for naming of color word for incongruent color (the color word, *i.e.*, red written with incongruent ink, *e.g.*, blue and the subject instructed to name color of the ink); 3) the CPT error scores; 4) the WCS perseveration error (PE) and total error scores (TE). The patients were all on antipsychotic medication. The daily dosage of the patients' medication was converted to chlorpromazine equivalent and entered into the analysis as co-variance variable when comparing patient groups.

Results

Table 1 represents the mean age of subjects and

Table 1: The mean age of subjects and other relevant demographic variables

Gender	Variable	Group	N	Mean	SD	SEM
Male	Age	Schizophrenia	18	29.6	7.97	1.88
Female			12	30.0	8.08	2.33
Male		Normal	21	29.1	7.19	1.57
Female			9	31.6	7.6	2.55
Male	Education	Schizophrenia	18	12.1	3.25	0.77
Female			12	11.8	1.70	0.49
Male		Normal	21	12.2	2.04	0.44
Female			9	12.1	0.78	0.26

Table 2: The means and standard deviations of the tasks scores the two types of splitting

		Stp Congt		Stp incongt		CPT		WCS PE		WCS TE	
Variables	**N**	**Mean**	**SD**	**Mean**	**SD.**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Positive	19	28.4	17.0	79.8	38.9	6.63	4.90	8.21	3.82	17.21	7.84
Negative	11	43.1	37.8	129.2	45.7	8.91	3.99	14.0	5.13	31.0	7.17
Acute	8	27.4	4.78	98.5	43.9	5.62	4.21	8.62	3.89	21.1	9.30
Chronic	22	36.1	31.1	97.7	49.6	8.1	4.7	10.9	5.4	22.7	10.5
Control-normal	30	20.7	1.55	41.7	3.29	1.43	.68	4.23	1.04	5.57	1.45

Stp= Stroop; Congt= Congruent condition; incongt= incongruent condition; CPT= Continuous Performance Test; WCS= Wisconsin Card Sorting; PE=Perseveration Errors; TE=Total Errors.

other relevant demographic variables. The total of 30 patients sample included twelve paranoids, eight undifferentiated and ten residual diagnoses (see Table 2). There was no patient with catatonia subtype of schizophrenia in the sample.

The groups were not different in terms of age and years of formal education. There was also no difference between gender type in terms of age and education. The between-subjects analysis consists of two levels of subjects (normal and patients) and gender. The results revealed that groups were different in performing the tasks ($p<0.001$). For the entire tasks presented, the patients had significantly lower performance in comparison to normal subjects. The gender had no effect on task scores. The interaction between the two independent variables was also not significant.

The next step of the analysis was carried out for the effect of the schizophrenia categories for two levels; positive/negative and acute/chronic. The chlorpromazine equivalent medication used daily by the patients was entered into the analysis as covariation for changes. The medication covariance did not have any effect. The positive/negative category had a significant effect on the test scores ($p<0.05$), but the illness status had no significant effects on the scores of the tests. According to these findings the chronicity of the illness had no effect on cognitive performances measured, however, the positive/negative splitting of patients group induced changes in the cognitive performances, i.e., interference effect of the Stroop incongruent test ($p< 0.05$), Wisconsin TE ($p<0.001$). The group showed marginally significant differences in Wisconsin PE ($P=0.059$). The interaction between positive/negative and acute/chronic had no significant effect on the tasks scores.

Table 2 represents the means and standard deviations of the task scores according to negative/negative and acute/chronic categorization.
The following step in the analysis was carried out using one-way analysis of variance (ANOVA) with Scheffe as the *post-hoc* test for comparing the scores of the tests among three different diagnoses of schizophrenia. The results revealed no difference between groups in Stroop congruent condition for three diagnosis groups and continuous performance test error scores. Further analyses revealed that paranoid patients did better in WCS perseveration errors in contrast to undifferentiated and residual types ($p<0.001$), while this parameter did not differ significantly between undifferentiated and residual types. Though not significant, the paranoid patients had lower scores of WCS total errors compared with undifferentiated type ($p<0.07$), however, residual type had higher error scores in comparison to paranoid type ($p<0.001$). The residual and undifferentiated types were not different in total perseveration error scores. The Stroop interference scores were lower for paranoid type in comparison to the two other types (undifferentiated $p<0.01$; residual $p<0.001$), while the undifferentiated and residual types had almost similar scores. Table 3 represents the means and standard deviations of the task scores for schizophrenia subtypes.

Discussion

The results of the present study reveal that subjects with schizophrenia performed poorer in the tasks in comparison to healthy control subjects. The chronic/acute category did not interfere with scores of the test, while positive/negative classifica-

Table 3: The means and standard deviations of the tasks scores for the 3 subtypes of schizophrenia

		Stp Congt		Stp incongt		CPT		WCS PE		WCS TE	
Variables	**N**	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std**	**Mean**	**Std**	**Mean**	**Std**
Paranoid	12	28.2	21.4	59.6	21.1	6.16	6.0	6.50	1.83	14.6	6.65
Undifferentiated	8	28.5	4.63	114.7	36.3	7.75	2.19	11.5	4.44	23.0	8.65
Residual	10	44.6	39.5	130.3	48.0	8.80	4.18	13.9	5.40	30.8	7.52
Control-normal	30	20.7	1.55	41.7	3.29	1.43	.68	4.23	1.04	5.57	1.45

Stp= Stroop; Congt= Congruent condition; incongt= incongruent condition; CPT= Contineous Preformance Test; WCS= Wisconsin Card Sorting; PE=Perseveration Errors; TE=Total Errors.

tion of the patients showed different degrees of attention impairment. The results of analysis for the patients' performance may reveal several inferences. Patients with different subtypes of schizophrenia were slower than normal subjects in RTs for Stroop congruent condition, nevertheless, they were not different from each other in this task. This finding suggests that the patient group has generally lower psychomotor activity than the normal group. The Stroop incongruent condition needs subject effort to direct attention to requested (voluntary) aspect of stimuli and ignore or inhibit the automatic process (*i.e.*, reading the word). The normal control subjects showed twice as much delay in incongruent conditions in contrast to congru ent one. The same pattern of response is observed in paranoid patients, while the delay for undifferentiated and residual types is tripled in contrast to their reaction times in congruent condition. This finding suggests that paranoid patients are remarkably better than the other forms of the disorder in controlling their attention process. Liddle[5] described volitional impairment in schizophrenia. Volition was defined as "an act as voluntary insofar as its performance is not dictated by external circumstances. Voluntary acts are self-initiated and follow a path that is planned by the individual." There are evidences in the literature on the involvement of left dorsolateral prefrontal cortex and right anterior cingulate cortex using verbal tasks measuring volitional control in contrast to other cortical areas .[15,16] The Pardo *et al*, rCBF study utilized Stroop paradigm and showed that paranoid type had lower degree of impairment in this task the other types. The systematic delusions observed in paranoid clinical feature may be described with these kinds of findings, while the other forms of schizophrenia are different in this aspect.

The second major inference from Table 3 is patients' scores on CPT, a test measuring the sustained attention. The task designed for the present study was so easy that the control subjects performed it with 1.4 mean errors (*i.e.*, missing target or a "go" response in a "no go" condition received an error score). The three patient groups are closed to each other in their errors. The performance on this task that is treated as the gold-standard test for measuring sustained attention and vigilance[6,7] did not differ among the patient groups, while they were different from control subjects. This finding confirms that schizophrenia spectrum-disorder show deficit in terms of sustained attention problem and the other test may have a composition of attention and other processes. The third inference from Table 3 is the data for Wisconsin card sorting test. WCS is a test for measuring ability and flexibility changing attention set or shifting attention when the signal of changing of setting is presented to the individual. Perseveration errors seems to be related to a deficit in working memory.[17] The results of the present study show that normal subjects produce 4.23 mean PE and 5.6 mean TE. This means that normal subjects missed only an average of 1.25 times the category of the response they have to remember, while paranoid patients had about 8, undifferentiated about 11 and residual type about 17 missings. The problem seems to anchor to working memory system.

References

1 Hogarty GE, Flesher S: Cognitive remediation in schizophrenia: Proceed with caution. *Schizophrenia Bul 1992;* **18:** 51-7.

2 Carter M, Flesher S: The neurobiology of Schizophrenia: Vulnerability and functional disability. *Psychiatry 1995;* **58:** 209-24.

3 Barch DM, Carter CS, Hachten PC, et al: The "benefits" of distractibility: mechanisms underlying increased Stroop effects in schizophrenia. *Schizophrenia Bul* 1999; **25:** 749-62.

4 Levin S, Yurgelun- Todd D, Craft S: Contributions of clinical psychology to the study of schizophrenia. *J Abnormal Psychology 1989;* **98:** 341-56.

5 Liddle PF: Volition and schizophrenia. In: Anthony S David, John C Cutting (eds): *The Neuropsychology of Schizophrenia*. UK: Lawrence Erlbaum Associates. **1994:**39-51.

6 Nuechterlein KH, Dawson ME: Information processing and attentional functioning in the developmental course of schizophrenic disorders. *Schizophrenia Bul 1984;***10:**160-203.

7 Fleming K, Goldberg TE, Gold JM: Applying working memory constructs to schizophrenia cognitive impairment. In Anthony S David & John C Cutting (eds): *The Neuropsychology of Schizophrenia*. UK: Lawrence Erlbaum Associates. **1994:**197-214.

8 Rosvold KE, Mirsky AF, Sarason I, et al: A continuous performance test of brain damage. *J Consult Psychol 1956;* **20:**343-50.

9 Fey E: The performance of young schizophrenics and young normals on the Wisconsin Card Sorting Test. *J Consult Psychol 1951;***15:** 311-9.

10 American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 4th ed. Washington DC: **1996**.

11 Folstein MF, McHugh PR: Mini-mental state: A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res 1975* **12:**189-95.

12 Crow TJ: Molecular pathology of schizophrenia: more than one disease process? *Br Med J 1980;* **280:**1-9.

13 Grebb JA, Cancro R: Schizophrenia: Clinical features. In: Horold I Kaplan, Benjamin J Sadock (Eds): *Comprehensive Textbook of Psychiatry.* 5th ed. Marylan, US, Williams & Wilkins, **1989:**757-77.

14 Stroop JR: Studies of interference in serial verbal reactions. *J Experiment Psychol 1935;* **18:**643-62.

15 Frith CD, Friston KJ, Liddle PF, et al: Willed action and the prefrontal cortex in man: a study with PET. *Proceedings of the Royal Society of London, Series B 1991;* **244:**241-46.

16 Pardo JV, Pardo PJ, Janer KW, et al: The anterior cingulate mediates processing selection in the Stroop attentional conflict paradigm. *Proceed Nat Acad Sci 1990;* **87:** 256-59.

17 Baddely AD: *Working memory. Science. 1992;* **255:**556-9.

18 Baddeley AD: *Working Memory.* Oxford: Clarendon Press **1986**.

19 Baddeley AD: *Human Memory: Theory and Practice.* London: Lawrence Erlbaum Associates LTD; **1990.**

20 Norman DA., Shallice T: *Attention or action: Willed and automatic control of behavior.* CHIP Report 99. San Diego: University of California **1980**.

21 Norman DA. Shallice T: Attention and Action. Willed and Automatic Human Control of Behavior. In RJ Davidson, GE Schwartz, D Shapiro (eds.): *Consciousness and Self-Regulation* New York: Plenum Press *1986;* **4:**1-18.