Orginal Article

Comparative Neurocognitive Functions of Schizophrenics and Temporal Lobe Epileptic Patients

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Abstract

Introduction: Shared neuropathology hypothesis in schizophrenia and temporal lobe epilepsy has been introduced long term ago. Similar neuropathology leads to the analogous clinical features like neuropsychological features as an example. The aim of this study was to examine this hypothesis by the means of comparing neuropsychological functions in these two patient groups.

Methods: Present study consisted of 28 DSM_IV_TR schizophrenics and 29 patients with temporal lobe epilepsy recruited from Roozbeh, Razi and khatamolanbia hospital in Tehran by convenient sampling method. SCID in schizophrenic group and EEG, MRI in epileptic patients were taken in regard to diagnostic determination. Neuropsychological tests were taken later. Package of neuropsychological tests consisted of Modified Wisconsin Card Sorting Test, Stroop Color- Word Test, Logic Memory, Visual Reproduction and Digit Span subscales of Wechsler Memory Scale- Revised and Block Design, Vocabulary and Symbol Digit subscales of Wechsler Adult intelligence Scale- Revised.

Results: there was no significant difference in two groups of patients with respect to demographic and clinical (Age, Depression, premorbid function and duration) variables. Analysis of MANOVA was taken to compare two groups of patients in neuropsychological functions. The results revealed no significant differences between schizophrenics and temporal lobe epileptic patients except for Symbol Digit subscale that was significantly lower in schizophrenic group ($p<0.05$).

Conclusion: the result of current study is consistent with shared neuropathology hypothesis in schizophrenia and temporal lobe epilepsy. Profile of neuropsychological functions in both groups was generalized and beyond temporal lobe.

Declaration of Interest: None.

Keywords: Schizophrenia, Temporal lobe epilepsy, Neuropsychological functions.

Introduction

Relation between epilepsy and psychosis has been known since ancient times but there was no systematic study to investigate this relationship until the 19thcenturywhenit became the interest of a number of disquisitions (1,2,3). These authors mentioned that psychological phenomena can be considered as epileptic equivalents. The increase risk of psychosis in patients with epilepsy provides a theoretical basis based on the same pathology's hypothesis of these disorders. The clinical similarities between epilepsy with chronic psychosis and schizophrenia led to the suggestion that the overlapping psychotic phenomena maybe associated with shared pathogenic features such as structural pathology that are not related to seizure generation

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(4).Therefore, if similar developmental dysfunctions are responsible for the pathology of schizophrenia and epilepsy, it is obvious that a number of epileptic patients will experience some episodes of schizophrenia-like psychosis. Inonestudy Sachdev (1998) suggested that schizophrenia-like psychosis is 6-12 times more likely to occur in epileptic patients than in other members of the general public (5). In another study, conducted by Qin (2005),the rate of schizophrenia in the epileptic population is twice that of normal people (6).Theresults coming from brain regions associated with the pathology of these two disorders are paradoxical. Prevailing hypotheses emphasize a predominant role of temporal lobe pathology versus more generalized or non- specific cortical or subcortical abnormalities (4,5). A great deal of researches has been conducted to examine these hypotheses, but the results are controversial. Since the relationship between schizophrenia and epilepsy has been the subject matter of researches for years and there is a body of literature about the similar pathology of these two disorders, it seems that the same neuropathology can bring the same cognitive dysfunctions related to the regions of the brain that are involved. In other words, shared neuroanatomical bases and clinical features between schizophrenia and TLE has motivated investigators to compare these two group of patients with each other because the cognitive impairment seen in TLE might provide a model for understanding impaired cognition in schizophrenia. In one comparison, Gold et al (1994, 1995) found that the schizophrenic group got lower scores in attention, delayed recall, verbal and visual memory compared to the epileptic patients. However with controlling attention, the performance of schizophrenics was higher in delayed recall. Regarding the results, these authors suggested that memory dysfunctions in schizophrenia come from areas beyond the temporal lobe, so temporal lobe epilepsy provides a poor model for understanding schizophrenic neuropsychological dysfunctions (7,8). In another study,Mellers et al (2000) found that the neuropsychological profiles of schizophrenic and schizophrenia-like epileptic patient are similar to each other. These patients had more problems in memory domain compared to epileptic patients without psychotic episodes and normal people (9). Drawing conclusion from these data, they pointed to the temporal lobe as a source of major deficiency, while concurrently there were other generalized deficits in other brain areas. Corresponding to this result, data come from other studies (4, 10,11,12,) are compatible with temporal and extratemporal lobe deficits. These studies indicated genrelized abnormality. In contrast, there is body of research which mentioned temporal lobe as a focus of major pathology (13,14,15,16). With regard to controversial findings, this study is designed to compare the cognitive profile of schizophrenia and epilepsy to examine the neuropathology of these disorders indirectly. Since schizophrenia- like psychosis has been reported to occur more frequently than expected in patients with complex partial seizures, especially seizures involving the temporal lobes (17), the existence of the same pathology between this kind of seizure and schizophrenia is more probable. Therefore this study is designed to compare the neurocognitive functions of schizophrenics and temporal lobe epileptic patients to examine the similar cognitive deficiency hypothesis.According to the hypothesis, there are no significant differences in neurocognitive functions (executive function, attention, working memory, verbal/visual memory, information processing speed, visual- spatial skills) of schizophrenics and TLE patients.

Methods

Participants are 28 patients with schizophrenia and 29 patients with TLE. In the schizophrenics group, Iranian version (Sharifi et al., 2004; Amini et al., 2007) of the structured clinical interview for DSM-IV (SCID-II)was administered at the initial assessment to determine diagnosis. Inclusion criteria for patients with DSM-IV-TR criteria were as follow: They must be 18 years or older, Have at least 8 years of formal education, Speak Persian as their primary language, be right-handed, Use prescribed anti-psychotic drugs at the time of enrollment, Have no evidence of neurologic damage or disease, Have no evidence of substance abuse (within the past 6 months), Have no history of head injury with loss of consciousness greater than 5 minutes or with documented neurologic sequelae, Have no evidence of mental retardation and medical illnesses that maybe associated with significant neurocognitive impairment, Have no evidence of auditory or visual problems, and score no higher than 3 in CGI1. In the epileptic group, diagnosis

1. Clinical Global Impression

was based on a neurologist's examination, MRI and EEG reports. The inclusion criteria for the temporal lobe epileptic patients were as follow: They have to be 18 years or older, Have at least 8 years of formal education, Speak Persian as their primary language, be right-handed, be using prescribed anti-epileptic drugs at the time of enrollment, Have had diagnosis of temporal lobe epilepsy for at least 1 year, Have been seizure-free during the past 24 h, Have no history of progressive neurologic disease or psychotic disorder, Have no history of alcohol or substance abuse during past 72 hours, Have no presence of clinical signs of cardiac failure, Have no history of brain surgery and have no evidence of impaired judgment or insight, No evidence of auditory or visual problems.

All Subjects were given a comprehensive battery of neuropsychological tests. The premorbid cognitive function was estimated with Vocabulary and block design subscales of Wechsler Adult Intelligence Scale-Revised (WAIS-R).Assessment comprised the measurement of executive function, attention, working memory, verbal/visual memory, information processing speed and visual/ spatial skills. Executive functions like cognitive flexibility and concept formation were evaluated using the Modified Card Sorting Test (MCST)- computerized form. The test asked subjects to sort a deck of cards on the basis of a series of unknown categories. In the area of attention, the Stroop Color-Word Test (SCWT) was administered. Memory performance was assessed by means of six subtests of the Iranian version of the Wechsler Memory Scale- Revised (WMS-R). In a measurement of working memory, digit span subscale(forward and backward)was administered. Verbal episodic memory performance was examined with the subtests Logical Memory I and II that require subjects to recall two short prose passages immediately after oral presentation and after a 30-minute delay. Similarly, the subtests Visual Reproduction I and II ask subjects to copy from memory four consecutively presented visual designs immediately after presentation and after a 30-min delay (assessment of visual episodic memory). Subtests of block design and symbol search from the Iranian version of WAIS-R was administered for the examination of information processing speed and visual/ spatial skills.

Shapiro-Wilks' measurement was done to determine normality. For clinical variables (age, duration of epilepsy, BDI score, Premorbid function), the Independent t test was used. The comparison of schizophrenia and TLE groups on cognitive measures was done by Multivariate Analysis of Variance (MANOVA) test (using a criterion of $P < 0.05$, two-tailed). If the variable did not meet the essential presumptions for parametric measurement, nonparametric statistic was done.

Results

The series of t tests were done to compare clinical variables (age, duration of disease, BDI score, and premorbid function). There were no significant differences between the two groups in clinical variable

For a comparison of neurocognitive functions of schizophrenic and TLE groups, the MANOVA test was done (table 2). The result obtained from the Wilks Lambada test was significant ($F=2.123$, $p=0.39$, partial $\eta 2=0.347$).

The result obtained from the multivariate test showed no significant differences between the schizophrenics and TLE patients in logical memory I ($F (1, 56) =2.19$ $p=0.14$ partial $\eta 2=0.039$). The result obtained from Mann-Whitney (table 3) showed no significant difference in logical memory II($U=377.500$ $p=0.63$). Moreover there is no

Table 1. Demographic and clinical characteristics of Schizophrenia and TLE patients

Clinical features	Schizophrenia Mean	TLE Mean
Age	36.29	32.44
Duration	9.50	14.17
BDI score	17.71	18.11
Premorbid function	47.14	49.48
Marital Status		
Married	6	12
Single	19	16
Sex		
Male	21	14
female	7	15
Educational status		
>12 years	13	11
12 years	7	8
>12 years	5	10

Table 2. Performance of Schizophrenic and TLE patients on neuropsychological tasks

Variable Name	Mean		df	F	P	Partial Eta squared
	Sch	TLE				
Visual memoryI	26.96	28.39	1	0.53	0.46	0.01
Logic memoryI	14.85	17.85	1	2.19	0.14	0.039
Digit span (forward)	5.67	5.46	1	0.22	0.63	0.04
Digit span (backward)	4.35	4.57	1	0.24	0.62	0.04
Block Design	24.007	28.14	1	2.8	0.1	0.049
Stroop	-5.97	-3.33	1	2	0.16	0.036
Symbol Digit	34.46	49.53	1	11.45	0.01	0.175
Visual memoryII	17.42	19.67	1	0.62	0.43	0.015
MCST (correct response)	23.78	23.15	1	0.093	0.76	0.002
MCST (Perseveration)	2.60	2.50	1	0.48	0.48	0.009
Vocabulary	23.07	21.99	1	0.11	0.73	0.002

difference in visual memory I (F (1, 56) =0.53 p=0.46 partial ŋ2=0.01) and visual memory II (F=0.62 p=0.43 partial ŋ2 =0.011) either. Regarding working memory, data coming from digit span (backward) showed no significant differences between Schizophrenics and TLE patients (F (1, 56) = 24 p=o.62 ŋ2=0.04).

As shown in table 2, there is no significant difference between the two groups in MCST performance in the number of corrected responses (F (1, 56) =0.93 p=0.76 partial ŋ2=0.002) and perseveration errors (F (1, 56) =0.48 p=0.48 partial ŋ2 = 0.009(. Data coming from table 4 showed no significant differences in the number of category either (U=336.000, p=0.26).

Data coming from digit span (forward) revealed no significant differences between the two groups (F (1, 56) =0.22 p=0.63 partial ŋ2 =0.004). In addition patients in both groups have no differences in the Strop test either (F (1, 56) =2 p=0.16 partial ŋ2=0.036).

According to table 2 there was significant difference between schizophrenia and TLE groups in information processing speed (F (1, 56) =11.45, p= 0.01, partial ŋ2= 0.17). In this test the schizophrenics, performed poorer that epileptic patients.

The MANOVA test revealed no significant differences in visual-spatial abilities of two groups (F (1, 56) =2.8 p=0.1 partial ŋ2= 0.049).

Table 3. Performance of Schizophrenics and TLE groups in Logical memory II

Group	N	RankMean	U	P
Schizophrenia	28	26.5		
Temporal Lobe Epilepsy	29	31.41	336.0	0.26

Table 4. Performance of Schizophrenics and TLE groups in number of category in MCST

Group	N	RankMean	U	P
Schizophrenia	28	30.02		
Temporal Lobe Epilepsy	29	28.02	377.5	0.63

Conclusion

This study compared the performance of schizophrenic patients with that of temporal lobe epilepsy patients, on a range of neuropsychological tasks. The groups did not differ statistically in age, duration of disease, premorbid function, and depression levels. The results showed no significant differences between schizophrenics and temporal lobe epileptic patients in executive function, attention, working memory, verbal /visual memory and visual- spatial skills. However, there was a significant difference in the Digit Symbol scale indicating the information processing speed. In this subtest, schizophrenics had poorer performance in comparison to temporal lobe epileptic patients. Results obtained from this subtest predicted 0.17 of variances. This study follows previous findings of impairments on digit span and verbal memory in a sample of schizophrenics and epileptic patients

with chronic Interictal psychosis (11) and also Yoo et al (2006) who found poorer performance of schizophrenic and TLE patients on visual and verbal memory compared with normal people (18). Moreover, another study found that schizophrenic patients have lower scores in arithmetic and symbol digit compared to temporal lobe epileptic patients (8). These authors concluded that the pathology of schizophrenia is not localized to the temporal lobe and their cognitive deficits involve extratemporal regions.

Congruent to previous findings, our results showed similarity between the neurocognitive functions of schizophrenics and TLE patients except for information processing speed. These findings are in a favor of generalized malfunction in schizophrenic patients. Given the fact that these patients had poorer performance in digit symbol, the possibility of generalized pathology is more probable as this test requires such a diverse range of abilities and high or low scores can potentially indicate a wide number of possibilities (19). Moreover, since the performance of both groups is alike in most domains of cognition, the possibility of extratemporal abnormality should be considered in TLE patients too. This hypothesis is mentioned in a number of studies (20,21,22). Two explanations are discussed in the literature about this finding. One considers extratemporal structural abnormalities (23,24,25)and the other emphasizes on the role of propagation of electrical discharge from seizure foci to extratemporal regions(26,27).

In summary, this study presented the temporal lobe epilepsy as a model for investigating neuropsychological abnormalities in the schizophrenia population. Similar neuropsychological malfunctions can provide sufficient information in investigating shared structural abnormalities. These results showed generalized pathology in schizophrenia. The possibility of generalized malfunction must be considered in TLE too.

This study is limited by the sample size. In addition, there was no control group to make it possible to compare the neurocognitive functions of patients with the normal population. All of the patients are under medication and this factor can have possible interaction with their neurocognitive abilities. Finally, the process of test-taking was not blind. Further studies that address these criticisms may result in a firmer conclusion being drawn concerning the impact of the variables outlined on neuropsychological functioning in schizophrenia and TLE patients.

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