Correlation of Cognitive Functions with some Aspects of Illness, Treatment and Social Functioning in Recurrently Hospitalized Schizophrenic Patients

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A B S T R A C T

Cognitive deficits are found to be contributors to poorer psychosocial functioning, rehabilitation outcome and lack of treatment success in schizophrenia. Aim of the study was to examine correlation of cognitive functions with some aspects of illness, treatment and social functioning in a group of recurrently hospitalized schizophrenic patients (N=60). Deficient results on psychomotor processing speed, verbal fluency and verbal learning correlated with the longer duration of illness, higher number of hospitalizations and shorter duration of regular antipsychotic treatment. Deficient results on verbal fluency correlated with the younger age of onset, poor functional autonomy and organizational skills, whereas deficient results on psychomotor processing and verbal learning correlated with poor organizational skills alone. Score on verbal fluency was predictive of social skills impairment, whereas score on psychomotor processing was predictive of functional autonomy and organizational skills impairment. Functioning of different cognitive domains could be predictive of functioning in different social domains. Interplay of specific cognitive deficit and social functioning could be responsible for recurrent hospitalizations and unfavorable treatment choices.

Key words: cognition, schizophrenia, psychiatric hospitalization, social functioning

Introduction

Neurocognitive deficit is persistent and widely present in schizophrenia. Schizophrenia is found to be associated with a mild-to-moderate degree of a cognitive deficit approximately one standard deviation below normative mean[1]. Nuechterlein et al. defined seven separable cognitive factors that represent fundamental dimensions of cognitive deficit in schizophrenia: speed of processing, attention/vigilance, working memory, verbal learning and memory, visual learning and memory, reasoning and problem-solving and verbal comprehension[2]. Cognitive deficits reflect the pathophysiology of the development of psychotic illness and are regarded to be stable during the course of illness to some point. Interaction of cognitive deficits and other factors related to illness and outcome are special focus of schizophrenia research.

When substantial cognitive impairment occurs early in the course of illness it influences later social and occupational dysfunction[3]. Meta-analyses of Rajji et al. demonstrated that the onset of schizophrenia in younger age was associated with severe cognitive deficit, whereas those with later onset had some relatively preserved cognitive functions[4].

Cognitive deficits are found to be contributors to poorer psychosocial functioning, rehabilitation outcome and lack of treatment success in schizophrenia[5]. Studies on cognitive deficit and treatment adherence report on significant impact of cognition on adherence to medication which influences illness outcome[6]. Utilization of hospital services in correlation with cognitive status has

not been widely studied. Sota and Heinrichs did not find any neurocognitive predictors of rehospitalization rates[7]. Multiple and recurrent hospitalizations in a case control-study of Silva et al. were found to be correlated with younger age at first admission, higher number of previous hospitalizations and diagnosis of schizophrenia and psychotic symptoms, and non-adherence to antipsychotic treatment[8]. There is some evidence of different associations between specific cognitive deficits and impairments in specific dimensions of functional capacity or status[9]. Studies report that verbal fluency and executive functions were predictive of community outcome, and processing speed and attention predicted the degree of work impairment[1,3,9]. Milev et al. found that verbal memory, processing speed and attention were related to outcome[10]. Executive functions, verbal memory and cognitive flexibility were found to be associated to medication adherence in schizophrenic persons[11,12].

Aim of the study was to examine correlation of cognitive functions with some aspects of illness (age at first hospitalization, duration of illness and present symptoms), treatment (number of hospitalizations and stable use of antipsychotics), and social functioning (social skills, functional autonomy and organizational skills) in a group of recurrently hospitalized schizophrenic patients. Predictive value of each cognitive function for each of the social function domains was also examined.

Subjects and Method

Participants were male patients with schizophrenia (N=60), mean age 32 years, that were recurrently hospitalized because of schizophrenia. 70% of them were not working at the time of this study (sick-leave, retirement or unemployment). Majority of them were, at the time, not married (never married, divorced or widowed) and living alone. Mean duration of illness of the participants was 12 years. Participants' demography, illness and treatment characteristics are presented in Table 1. Finished high school was required for homogenization of the participants' education level. Patients with head trauma or epilepsy, acutely intoxicated or on chronic antipsychotic medication (longer than 5 years) were excluded. Assessment was made briefly after commitment to hospital. Study was naturalistic in design. Data on previous hospi-

TABLE 1
DEMOGRAPHY, ILLNESS AND TREATMENT CHARACTERISTICS
(N=60)

	Mean (SD)
Age	32.65 (8.103)
Age at first hospitalization	20.43 (2.664)
Duration of illness (years)	12.18 (8.102)
No. of hospitalizations	6.03 (3.546)
Duration of antipsychotic treatment (months)	3.28 (4.755)
BPRS	74.72 (6.722)

TABLE 2
RESULTS ON COGNITIVE TESTS AND SOCIAL FUNCTIONS

	Test	Result (SD)
Cognitive tests	TMTA	42.38 (11.994)
	TMTB	119.08 (40.518)
	FAS	25.284 (.752)
	RAVLT	41.15 (9.411)
Social functions questionnaire	Social skills	2.43 (.722)
	Functional autonomy	3.00 (.664)
	Organizational skills	2.67 (.816)

talizations and treatment were gathered from medical history. Diagnose of schizophrenia was confirmed according to DSM-IV criteria[13].

Participants were assessed with Brief Psychiatric Rating Scale (BPRS)[14] for severity of schizophrenia, with mean result 74 (SD=6.722).

Neurocognitive tests were chosen with criterion of short and brief assessment procedure that could be applied in everyday clinical setting. Neurocognitive assessment included Trail making tests A and B (TMTA, TMTB)[15] for psychomotor processing speed and attention, verbal (phonological) fluency (FAS)[16] and Ray Auditory Verbal Learning Test (RAVLT)[17]. Social functioning was assessed by simple three-item questionnaire in three categories: social skills, functional autonomy and organizational skills, each answer graded with scale (1=not functioning at all, 2=minimal functioning, 3=moderate functioning, 4=good functioning). Item social skills (SS) included assessment of the efficacy of social relations in everyday living. Item functional autonomy (FA) included assessment of efficacy in independent everyday living, including everyday personal activities. Organizational skills (OA) included assessment of efficacy in pursuing multiple tasks and planning in everyday living. Assessment was made by psychiatrist and included also information from the patient and careers. Results of cognitive testing and social function categories are presented in Table 2.

Statistics

Descriptive statistics including means, frequencies and standard deviations were calculated for all socio-demographic, clinical, cognitive and social function variables. Pearson Correlations were used for assessing associations between cognitive functions and other variables – age of first hospitalization, duration of illness, continuous antipsychotic treatment, number of hospitalizations, and social functioning scores. Regression analysis was used to investigate the possibility to predict social functioning in three domains on the basis of the cognitive test results of the patients. Analyses were made with the statistical package SPSS for Windows (version 15).

Results

Correlation of cognitive test results with illness and treatment characteristics

Duration of illness was significantly correlated with results on all cognitive tests performed in the study – positively with results on TMTA and TMTB, and negatively with results on FAS and RAVLT. Opposite correlation in different tests here was because of the different scoring method in applied cognitive tests. Higher score on TMTA and TMTB, but lower score on FAS and RAVLT implies poorer cognitive functions. Therefore, the longer the schizophrenia lasted the worse were results on cognitive tests.

Number of hospitalizations and duration of continuous antipsychotic treatment were also significantly correlated with results on all cognitive tests in the same way. Higher number of hospitalizations and shorter period of stable use of antipsychotic therapy were correlated with poorer results on cognitive tests. Age of first hospitalization was significantly correlated only with results on FAS. BPRS was correlated to results on TMTA, TMTB and FAS. Results are presented in Table 3.

Prediction of the social functioning based on cognitive test results

The aim was to investigate the possibility to predict social functioning in the three domains related to the cognitive test results of the patients. Regression analysis was done in order to establish what percent of variance of each social function score can be explained by predictors – cognitive test results.

Before regression analysis, correlations between cognitive test results and each of the social functions scores were calculated (Table 4). Scores on TMTA, TMTB and RAVLT were significantly correlated with score on organizational skills. FAS scores were significantly correlated with functional autonomy and organizational skills.

Regression analysis showed that social skills score was significantly influenced by results on cognitive test FAS ($\beta=0.545$, $t=2.183$, $p=0.033$). Other predictors (TMTA, TMTB, RAVLT) were not significantly connected to the criteria – social skills. Regression analysis showed that results on cognitive test accounted for 10% of total variance of social skills ($R=0.329$, $R^2=0.108$, $F=1.668$, S.S.= 4/55, $p=0.171$).

Regression analysis showed that functional autonomy was significantly influenced by results on TMTB ($\beta= 0.575$, $t=2.322$, $p=0.024$). Other predictors (TMTA, FAS, RAVLT) were not significantly connected to the criteria. Regression analysis showed that results on cognitive test account for 12% of total variance of autonomy score ($R=0.350$, $R^2=0.123$, $F=1.923$, S.S.=4/55, $p=0.120$).

Analysis shows that organizational skills were significantly influenced by results on cognitive test TMTB ($\beta=0.779$, $t=3.824$ $p=0.000$). Other predictors (TMTA, FAS, RAVLT) were not significantly connected to the criteria. Regression analysis showed that results on cognitive test account for 40% of total variance of organizational skills score ($R=0.638$, $R^2=0.406$, $F=9.416$, S.S.= 4/55, $p=0.000$).

Discussion

This study provides further evidence that cognitive deficit in schizophrenic patients is highly related to some aspects of illness and treatment, and elements of social functioning. In this study cognitive functions were more impaired in the patients who had longer duration of illness. Specifically, verbal fluency deficit was associated with both younger age at the first hospitalization and longer duration of illness. Tuulio-Henriksson et al. showed that impairment in verbal learning and memory was associated with earlier onset[18], while Bellino et al. showed compromised executive functions in association with early age of onset[19]. As deficits in cognitive functions are related to pathophysiology of schizophrenia, younger on-

TABLE 3
CORRELATION OF ILLNESS AND TREATMENT CHARACTERISTICS WITH COGNITIVE TEST RESULTS

	Duration of illness (years)	Age first hospitalization	No. hospitalization	Antipsychotic treatment (months)	BPRS	TMTA	TMTB	FAS	RAVLT
Duration of illness (years)	1	–0.154	0.840**	–0.123	0.003	0.671**	0.293*	–0.374**	–0.474**
Age first hospitalization		1	–0.290*	0.334**	–0.170	–0.051	–0.253	0.314*	0.151
No. hospitalizations			1	–0.292*	0.077	0.676**	0.543**	–0.613**	–0.559**
Antipsychotic treatment (months)				1	–0.284*	–0.468**	–0.508**	0.418**	0.501**
BPRS					1	0.285*	0.374**	–0.293*	–0.251
TMTA						1	0.624**	–0.629**	–0.800**
TMTB							1	–0.846**	–0.711**
FAS								1	0.614**
RAVLT									1

** $p<0.01$; * $p<0.05$

TABLE 4
CORRELATION OF COGNITIVE TESTS AND SOCIAL FUNCTION RESULTS

	TMTA	TMTB	FAS	RAVLT	SS	FA	OS
TMTA	1	0.624**	–0.629**	–0.800**	–0.055	–0.096	–0.357**
TMTB		1	–0.846**	–0.711**	–0.119	–0.146	–0.495**
FAS			1	0.614**	0.250	0.285*	0.628**
RAVLT				1	0.005	0.041	0.388**
SS					1	0.601**	0.479**
FA						1	0.438**
OS							1

** $p < 0.01$; * $p < 0.05$; SS – social skills; FA – functional autonomy; OS – organizational skills

set of schizophrenia could indicate worse biological and functional outcome[1,3,20].

We also found that deficits in verbal fluency, verbal learning and processing speed were significantly correlated with higher number of psychiatric hospitalizations. As Vauth et al. concluded that good cognitive functioning was required for one's perception of relapse vulnerability and treatment benefits, and anticipation of the negative consequences of the hospital readmission then cognitive status could be responsible for frequent utilization of hospital services in the treatment[11]. Average number of hospitalizations in this study was 6, with average duration of illness 12 years which accounted to average of one hospitalization *per* patient in two years. Such hospitalization frequency could also be partially a consequence of the lack of community services in Croatia while it is more or less common for the patient with schizophrenia to get hospitalized whenever and however illness worsens. In our previous study we found that involuntary commitment to psychiatric hospital treatment was associated with cognitive deficit as well[20]. As hospitalizations interfere with person's everyday living and bring delay in work, family and other activities, frequent hospitalizations are far from best treatment option for setting optimal illness outcome.

Cognitive functioning is also a strong patient-related predictor of medication adherence[21,22]. Our study showed that the participants with bigger cognitive deficit in verbal fluency, verbal learning and processing speed had shorter stable periods on antipsychotic treatment. To stay in therapy demands better insight and personal skills – characteristics that could be poorer in schizophrenic patients having cognitive deficit, because they imply memory, attention and executive functions[23]. Average stay on stable therapy in our study was three months which was surprisingly low but expected for schizophrenic patients with long duration of illness and frequent hospitalization rate[24]. Longer period on stable antipsychotic therapy was related to better performance on cognitive tests which points out also the potential benefits of antipsychotic therapy on outcome and possibly cognitive functions that have been reported in recent studies, particularly with new antipsychotics[1].

Regarding symptom assessment, the patients in the study were not severely psychotic. We found correlation of total BPRS score with verbal fluency and processing speed, suggesting that more psychotic patients had bigger deficits in processing speed and verbal fluency. It is generally considered that there is no correlation between intensity of psychotic symptoms and cognitive functions as cognitive deficit exists even in prodromal phase and in remission of schizophrenia. Some cognitive functions are considered to be more in relation with negative symptoms of schizophrenia. Still, testing verbal fluency and processing speed require psychomotor speed, attention and retrieving immediate memory which could be interfered by some acute psychotic symptoms. Intensity of schizophrenia in this study was not associated with social functioning. Some studies proposed stronger role of neurocognition in social functioning, some of psychopathology or equal but independent roles of both neurocognition and symptoms[25–27]. Mohamed et al. found that both psychotic symptoms and neurocognitive deficits appear to contribute independently to decreased quality of life in schizophrenia[28].

We also examined if there were correlations of specific cognitive functions like processing speed, verbal fluency and verbal learning with some categories of social functioning and if results in the categories of the social functioning differed in their cognitive predictors.

In the category of social skills, there was no correlation with cognitive test results. Even as our study included relatively young patients (mean age 32 years), social skills were assessed on average of minimal to moderate level of functioning. Social skills were also not related to age of first hospitalization, duration of illness, number of hospitalizations and antipsychotic treatment. That could imply that social skills belong to different neurobiological and psychosocial origin. There is an increasing interest on recently introduced cognitive domain, the social cognition, because of its evident relevance in social skills and outcome. Some studies reported relation of social skills performance with abstraction ability and social/communications skills with verbal ability, processing speed and memory[29,30].

In the category of functional autonomy, a correlation with verbal fluency score was found – impairment in ver-

bal fluency was correlated to poorer functional autonomy of the participant. As reported in other studies, verbal fluency could be specific correlate of community functioning and independent living, among other cognitive functions like verbal memory and executive functioning[31,32]. Assessed level of the functional autonomy of participants was moderate which was consistent with the fact that majority of our participants lived in the community independently but still were frequent users of hospitalization services. Functional autonomy was better in our participants with longer duration of stable antipsychotic treatment which confirmed that antipsychotic treatment provided important impact on autonomy of the patients.

In the category of organizational skills, a correlation was found with processing speed, verbal fluency and verbal memory. Better organizational skills were found also to be correlated with later first hospitalization and with lower number of psychiatric hospitalizations. Aubin et al. reported planning skills were necessary for efficient task performance[33]. Organizational skills, which include multitasking and planning activities, are important in everyday living in community and adherence to treatment. If better processing speed provides, among others, better organizational skills, it protects the patient from multiple returns to hospital treatment and therefore, enables longer stay in community which could bring better personal and life opportunities. Recognizing individual specific deficit could hopefully improve treatment strategies, whether they are only pharmacological or combined with cognitive enhancement methods or treatments.

Predictive value of cognitive testing was different for each of the social categories. Results on verbal fluency were predictive of social skills score, while results on verbal learning and speed processing were not. Altogether, cognitive deficit accounted for 10% of social skills score variance, which is consistent with other studies[3,34].

Processing speed was found to be significant cognitive predictor of both the functional autonomy and organizational skills in our study. Milev et al. found out that global psychosocial function and recreation impairment were predicted with verbal memory, processing speed and attention domains[10]. Processing speed and attention are found to predict the degree of work impairment[26]. Sanczes et al. found that processing speed is the best longitudinal predictor of the level of autonomy in patients

with chronic schizophrenia[35]. Altogether, cognitive deficit accounted for 12% of autonomy score variance, which is also consistent to other studies. Our results also showed that cognitive deficit in the category of organizational skills accounted for 40% of variance, meaning that organizational skills highly depend on cognition. Tabares-Seisdedos et al. found that global functioning in schizophrenic patients one year after first assessment was predicted by verbal memory, motor speed and vocabulary[36]. Generally, predictive value of cognitive deficits regarding different categories of social functioning were in consistency with other studies showing that cognition can explain from 10 to 50% of the variance in different categories of social functioning.

Limitation of the study is relatively small number of participants. Moreover, the aim of the present study was to examine an unselected sample of patients routinely treated in a psychiatric department. Patients were treated under naturalistic conditions and effects of medication were not controlled. Because of the gender differences in schizophrenia, only male participants were included in the study. Other neurocognitive tests could provide to some degree better analyses of cognitive deficits, yet we were interested in obtaining cognitive assessment with brief testing appropriate for everyday clinical situation, which we achieved.

Conclusion

In this study we have found significant correlations between specific cognitive deficits and the age at first hospitalization, duration of illness, number of psychiatric hospitalizations and duration of stable antipsychotic treatment in recurrently hospitalized schizophrenic participants. Significant correlations were also found between specific cognitive deficits and three categories of social functioning. Predictive value of cognitive deficits regarding different categories of social functioning are in consistency with other studies showing that cognition can explain from 10 to 50% of the variance in different aspects of social functioning. Functioning of different cognitive domains could be predictive of functioning in different social domains. Interplay of specific cognitive deficit and social functioning could be responsible for recurrent hospitalizations and unfavorable treatment choices.

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POVEZANOST KOGNITIVNIH FUNKCIJA VIŠESTRUKO HOSPITALIZIRANIH SHIZOFRENIH PACIJENATA S NEKIM ASPEKTIMA BOLESTI, LIJEČENJA I SOCIJALNOG FUNKCIONIRANJA

S A Ž E T A K

Brojne suvremene studije o shizofreniji nalaze široki raspon poremećaja kognitivnih funkcija u visokom postotku osoba sa shizofrenijom, koji utječe na sve aspekte kvalitete života i liječenja shizofrenih bolesnika. Ispitivali smo povezanost kognitivnog deficita s nekim aspektima bolesti, liječenja i socijalnog funkcioniranja u skupini shizofrenih bolesnika koji se višestruko hospitaliziraju. Koristili smo jednostavnu bateriju kognitivnih testova, BPRS, i skalu socijalnog funkcioniranja. Ispitanici, s lošijim rezultatom na kognitivnim testovima, odnosno, većim kognitivnim deficitom, ranije su započeli liječenje od shizofrenije, dulje su bolesni i češće se hospitaliziraju te neredovitije uzimaju terapiju. Značajnim su se pokazali testovi psihomotorike, verbalne fluentnosti i verbalnog pamćenja. Također smo pokazali da postoji specifična povezanost između nekih kognitivnih funkcija i nekih područja socijalnog funkcioniranja. Promjene kognitivnih funkcija pokazale su se kao značajni prediktori u područjima socijalnog funkcioniranja u rasponu od 10–40%. Međudjelovanje specifičnog kognitivnog deficita i smanjenog socijalnog funkcioniranja moglo bi utjecati na učestale hospitalizacije i neoptimalan izbor liječenja.