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ORIGINAL PAPER

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Reexamination of the characteristics of the deficit schizophrenia patients

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Abstract The aim of this study was to reexamine and compare the characteristics of the deficit and nondeficit schizophrenic patients. This cross-sectional study consisted of 62 in- and out-patients, 18–65 years of age, diagnosed with schizophrenia according to DSM-IV. The sociodemographic variables, premorbid adjustment, clinical course and general functioning level in the past five years were evaluated by utilizing the appropriate sections of Comprehensive Assessment of Symptoms and History (CASH). In addition, GAF, the Schedule for the Deficit Syndrome (SDS), Positive and Negative Syndrome Scale (PANSS), Montgomery Äsberg Depression Scale (MADRS), the Neurological Evaluation Scale (NES) and the Simpson Angus Extrapyramidal Side Effects (EPS) Rating Scale, Trail A and B, Verbal Fluency, Stroop, Block Design and Finger Tapper tests were administered. Using the SDS, 19 patients (30.6 %) were categorized as deficit; 43 (69.4 %) were categorized as nondeficit. The deficit patients were worse on the Functioning During Past Five Years score of CASH. The PANSS and MADRS mean scores were not significantly different between the two groups, except a higher level of negative symptoms observed in the deficit group. NES scores were also significantly higher in the deficit group. However, sociodemographic and other clinical variables, neurocognitive measures and EPS symptoms did not show any significant difference between the two groups. Our findings suggest that the deficit schizophrenia is a distinct subgroup comprised of patients who have more negative symptoms, neurological impairment and poor functioning which may have a common underlying pathology.

Key words schizophrenia · negative symptoms · psychopathology · cognitive impairment · neurology

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Introduction

The deficit schizophrenia has been defined by Carpenter and colleagues in an attempt to refine terminology regarding negative symptoms (1988). The term was proposed to refer to negative symptoms that are present as enduring traits and are not secondary to factors such as depression, anxiety, positive symptoms, mental retardation or extrapyramidal symptoms. The negative symptoms considered among the criteria of the deficit schizophrenia include restricted affect, diminished emotional range, poverty of speech with curbing of interest and decrease in curiosity and diminished sense of purpose and social drive. A combination of two or more of these symptoms is required to be present for the preceding 12 months which is a duration defined to underline the enduring quality. The deficit schizophrenia criteria and the Schedule for the Deficit Syndrome (Kirkpatrick et al. 1989) were developed to study primary negative symptoms. Since the concept has been introduced, intensive research has been conducted to determine whether the deficit group of schizophrenic patients differed in a variety of measures from the rest. Numerous studies have supported the view that the schizophrenic deficit group differs from the nondeficit group in a variety of measures including symptomatology, course of illness, risk and etiological factors, biological correlates such as neurocognitive, functional and structural imaging measures and response to treatment (Kirkpatrick et al. 2001).

Regarding symptomatology, the deficit schizophrenia patients were found to have more anhedonia (Kirk-

patrick and Buchanan, 1990), less depression and suicidal ideation (Kirkpatrick et al. 1994; Fenton and McGlashan 1994), suspiciousness (Kirkpatrick et al. 1996a), substance abuse (Kirkpatrick et al. 1996b) and more severe negative symptoms at long-term follow up (Tek et al. 2001a). The course of illness in the deficit schizophrenia has been defined with poor premorbid functioning before the onset of positive psychotic symptoms and the continuation of poor social and occupational functioning and quality of life after the onset (Fenton and McGlashan 1994; Kirkpatrick et al. 1996b, c; Tek et al. 2001a). Although most studies have found no difference in the age of onset between groups, some studies have suggested an earlier onset for the deficit schizophrenic patients (Mayerhoff et al. 1994).

Positive family history and summer births have been found as important risk factors for the deficit schizophrenia in most studies (Dollfus et al. 1998; Kirkpatrick et al. 2000; Messias and Kirkpatrick 2001; Tek et al. 2001b), although some studies have not suggested a difference in season of birth (Dollfus et al. 1999). Male gender was also found to be associated with deficit schizophrenia (Roy et al. 2001).

Among the biological correlates studied, smooth pursuit eye tracking disorder has been found to be correlated with the deficit schizophrenia in some (Ross, 2000), but not all studies (Nkam et al. 2001).

Structural imaging studies have pointed volumetric region of interest differences between deficit and nondeficit patients (DeQuardo et al. 1998). Lahti and colleagues (2001) have proposed that low activation in the middle frontal cortex and inferior parietal cortex may provide a marker of primary negative symptoms. Functional imaging studies point to a functional defect of the dorsolateral prefrontal basal ganglia-thalamo-cortical loop in the deficit group (Kirkpatrick et al. 2001). The neuropsychological tests suggest that deficit symptoms occur along with frontoparietal, rather than overall cognitive impairment (Tamminga et al. 1992; Putnam and Harvey 2000). On the other hand, Louchart and colleagues' (1998) electrophysiological data of P50 have not supported the deficit and nondeficit distinction.

Neurological signs have been another domain of interest in the deficit and nondeficit categorization. Schizophrenic patients exhibit neurological impairment in areas of integrative sensory function, motor coordination and sequencing of complex motor acts (Heinrichs and Buchanan 1998). The majority of studies indicate a significant correlation between negative symptoms and soft neurological signs (King et al. 1991; Wong et al. 1997; Yazıcı et al. 2002). The deficit schizophrenic patients have been shown to display more impairment in the sensory and auditory-visual integration compared to the nondeficit patients (Buchanan et al. 1990). Arango and colleagues (2000) have also found that primary negative symptoms defined through deficit/nondeficit categorization were significantly correlated with soft neurological signs; however, the correlation disappeared when negative symptoms were defined through the Brief Psychiatric Rating Scale (BPRS), which inevitably included secondary negative symptoms into the evaluation.

Finally, response to treatment is found to be poor in enduring primary negative symptoms and thus the deficit schizophrenia (Kirkpatrick et al. 2001). However, Tandon et al. (1998) have reported improvement of negative symptoms with treatment in both deficit and nondeficit patients, although the improvement was less in the deficit group.

Overall, the literature favoring the distinction between the deficit and nondeficit schizophrenia support the hypothesis that enduring negative symptoms represent a separate disease within the syndrome of schizophrenia (Kirkpatrick et al. 2001), while some studies do not support this view.

The aim of this study is to reexamine and compare the characteristics of the deficit and nondeficit schizophrenic patients regarding sociodemographic variables, premorbid adjustment, clinical course, symptomatology, level of functioning, soft neurological signs and cognitive functions. We believe that comparison of these variables in a different geographical setting would help to further explore the deficit schizophrenia concept.

Methods

Subjects

This cross-sectional study consisted of 62 in- and out-patients who were not acutely psychotic or recently out of a psychotic episode. Patients from the psychiatry clinics at the Hacettepe University Faculty of Medicine in Ankara and Bakırköy Mental and Psychological Health Hospital located in Istanbul participated in the study. Patients who gave consent to participate in the study during the 6 month long study period were interviewed by the same researcher (A. T.) in both clinics at different time periods. All patients were diagnosed with schizophrenia according to DSM-IV utilizing the Turkish version of Schedules for Clinical Assessment in Neuropsychiatry (SCAN, WHO 1990). The subjects included were 18–65 years of age. Only the patients who had at least 8 years of education were included in the study because of the neurocognitive assessments. History of head trauma, major neurological or medical disorder, alcohol and other substance abuse or mental retardation were considered as exclusion criteria. None of the approached patients who met the inclusion criteria refused to participate in the study.

Assessments

The sociodemographic variables, premorbid adjustment, clinical course, and general functioning level in the past five years were evaluated by utilizing the appropriate sections of the Comprehensive Assessment of Symptoms and History (Andreasen 1987). In addition, Global Assessment of Functioning (GAF) (APA, 1994; Endicott et al. 1976) for the past year was also scored.

The Schedule for the Deficit Syndrome (SDS)(Kirkpatrick et al. 1989; Çıtak 2001) was used to categorize patients as deficit/nondeficit. The reliability and validity of the Turkish version of the SDS in schizophrenia (Çıtak 2001) has been performed on 30 schizophrenic male patients. The SDS demonstrated a high internal consistency (Cronbach alpha:0.85). The interrater reliability was good for rating of global severity (kappa:0.88–0.93) and individual negative symptoms (kappa:0.51–0.61). A high validity for both categorization and individual negative symptoms (U.60.0, p:0.03) was observed.

Psychopathology was also evaluated utilizing the Positive and

Negative Syndrome Scale (PANSS, Kay et al. 1987; Kostakoğlu et al. 1999) and Montgomery Äsberg Depression Scale (MADRS, Montgomery and Äsberg 1979; Kara Özer et al. 2001). The Neurological Evaluation Scale (NES, Buchanan and Heinrichs 1989, Yazıcı et al. 2002) and Simpson Angus (S-A) Extrapyramidal Side Effect Scale (Simpson and Angus, 1970) were used to assess neurological signs and symptoms. The NES consists of four subscales, namely the motor coordination (MC), sensory integration (SI), sequencing of complex motor acts (SCMA) and others. The interrater reliability of the NES was assessed in a previous study of Yazıcı and colleagues (2002) by two raters jointly examining 20 independent subjects (10 schizophrenic patients and 10 healthy subjects), and the intraclass correlation coefficient for subscale scores and total scores was found to range from 0.97 (motor coordination) to 0.99 (total score). Frontal and parietal neurocognitive functions were assessed using Trail A and B (Reitan and Wolfson, 1985), Verbal Fluency (Spreen and Benton, 1969, Tumaç 1997), Stroop (Stroop, 1935, Karakaş et al. 1999) and Block Design (Wechsler Adult Intelligence Scale, WAIS, 1987) tests. Motor speed was measured with the Finger Tapper test (Reitan, 1969).

Statistical analysis

All statistics were performed with SPSS for Windows, 10.0. Comparative analyses of continuous variables were carried out using the Mann-Whitney *U* test, and of categorical variables, using the chi-square test. The Spearman's correlation coefficients were calculated to assess the relationship of negative symptom variables with the NES scores. Since the distributions of the NES total and subscores were normal in both patient groups, as well as in the total group (p values in Kolmogorov-Smirnov goodness of fit test varied between 0.114 and 0.213), multivariate analyses of covariance (MANCOVA) that controlled for negative symptom severity were conducted to test differences among NES scores. The stepwise logistic regression method was utilized to determine what features other than high level of negative symptoms predicted the deficit and nondeficit patients. Two tailed tests with a 5% level of significance were used throughout the analyses.

Results

Among the 62 patients included in the study, 28 (45.2%) were women and 34 (54.8%) were men ($\chi^2 = 0.581$, df = 1, p = 0.446). The mean age was 40.56 ± 11.08. Eighteen (64.3%) women and 25 men (73.5%) men had never married. When the current and past working status were cumulatively evaluated, 82.3% of the patients (67.9% women, 94.1% men) had been working when school attendance was included; when house work was included the overall rate increased to 88.7% (82.1% for women). During the previous month, 11.5% of the whole sample, 17.4% of women and 10.7% of men were found to be working.

Comparison of the deficit and nondeficit patients

Sociodemographic variables

Among the 19 deficit patients, 11 (57.9%) and among the 43 nondeficit patients 23 (53.5%) were male. Chi-square test revealed no significant differences between the frequencies regarding gender ($\chi^2 = 0.103$, df = 1, p = 0.748). No significant differences were found between the mean age (z = –1.223, p = 0.222), marital status ($\chi^2 = 5.909$, df = 6, p = 0.170) and years of education (z = –0.672, p = 0.502) between the two groups (Table 1). Current ($\chi^2 = 0.067$, df = 1, p = 0.795) and past work status (including the prior month) ($\chi^2 = 13.510$, df = 8, p = 0.095), duration of education (z = –0.672, p = 0.502), socioeconomic status ($\chi^2 = 2.817$, df = 4, p = 0.589), paternal level of education (z = –0.935, p = 0.350) and occupational status ($\chi^2 = 5.256$, df = 5, p = 0.385), the parents' age at the time of the patients' birth (paternal z = –0.949, p = 0.343, maternal z = –0.237, p = 0.812) did not show any significant differences between the deficit and nondeficit patients.

Premorbid adjustment and functioning

Premorbid Adjustment Scale scores for the childhood (z = –0.332, p = 0.740), adolescence and young adulthood (z = –1.079, p = 0.281) and total (z = –0.913, p = 0.361) and GAF scores (z = –1.101, p = 0.271) were not significantly different in the deficit and nondeficit patients. However, the mean scores for the Functioning During Past Five Years were significantly different (z = –1.978, p = 0.048), with a higher mean score (11.47±2.14) observed in the deficit compared to the nondeficit group (9.95±2.82), indicating a slightly worse level of functioning in the past 5 years for the deficit patients.

Clinical course, severity of illness and neuropsychological findings

There was a tendency for earlier onset of illness in the deficit group (z = –1.913, p = 0.056); the course of illness was chronic and similar (z = –0.428, p = 0.669) in the deficit and nondeficit patients (Table 1). The duration of time elapsed between the first appearance of psychotic symptoms and out- (z = –0.942, p = 0.346) and in-patient (z = –0.566, p = 0.572) treatment, age at first hospitalization (z = –1.389, p = 0.165), total number of hospitalizations (z = –0.459, p = 0.646) and psychotic exacerbations (z = –1.280, p = 0.201), total duration of hospitalizations

Table 1 Sociodemographic and clinical variables in the deficit and nondeficit schizophrenic patients

	Deficit (n:19)	Nondeficit (n:43)
	mean ± SD	mean ± SD
Age (years)	38.21 ± 10.32	41.60 ± 11.35
Education (years)	11 ± 2.85	11.58 ± 2.62
Onset of illness (age)	18.89 ± 3.14	21.37 ± 5.10
Duration of illness (years)	19.31 ± 9.01	20.23 ± 10.16
	n (%)	n (%)
Marital status		
Never married	16 (84.2%)	27 (62.8%)
Married at least once or divorced	3 (15.8%)	16 (37.2%)

($z = -0.954$, $p = 0.340$) were not significantly different between the two groups.

The PANSS and MADRS mean scores were not found to be significantly different between the deficit and nondeficit patients, except a higher level of negative symptoms observed in the deficit group. None of the neurocognitive test scores showed any significant differences between the groups (Table 2).

Neurological soft signs

All of the subscales of the Neurological Evaluation Scale (NES) were significantly higher in the deficit compared to the nondeficit group, indicating higher neurological impairment in the deficit schizophrenia patients (Table 3). Since a positive correlation between neurological soft signs and negative symptoms was observed (between NES total and PANSS negative subscale $r = 0.417$, $p = 0.001$), the NES total and subscores adjusted for negative symptoms were also compared between the deficit and non-deficit schizophrenic patients utilizing MANCOVA. The NES scores remained significantly higher in the deficit schizophrenia patients when controlled for negative symptoms [NES total $F[2,61] = 10,611$, $p = 0.000$; SI $F[2,61] = 8,658$, $p = 0.001$; SCMA $F[2,61] = 3,222$, $p = 0.047$; others $F[2,61] = 8,658$, $p = 0.001$)], except for the motor coordination subscore [$F[2,61] = 2,452$, $p = 0.095$)].

NES scores could also have been influenced by extrapyramidal side effects (EPS). However, no significant differences were found between the deficit and nondeficit patients regarding their S-A Extrapyramidal Side Effect Rating Scale scores ($z = -0.849$, $p = 0.396$).

The predictors of the deficit and nondeficit schizophrenia

All variables, excluding the total PANSS and total NES scores, were included in the stepwise logistic model. Only two variables, the PANSS negative subscore and the sequencing of complex motor acts subscore of NES, were found to be significant predictors of the deficit state. The results are shown in Table 4.

Table 2 Severity of psychopathology and neurocognitive performance

	Deficit (n:19) mean ± SD	Nondeficit (n:43) mean ± SD	z	p
PANSS				
Positive	11.00±2.78	13.51±4.82	−1.755	0.079
Negative	23.84±4.38	13.44±4.74	−5.604	0.000
General Psychopathology	27.05±5.89	28.93±6.67	−1.025	0.306
Total	61.89±10.73	55.88±13.39	−1.872	0.061
MADRS	7.84±3.65	11.41±8.28	−1.216	0.224
Trail Making A (sec)	65.4±21.6	72.8±32.9	−0.603	0.546
Trail Making B (sec)	204.1±81.1	175.9±88.7	−1.312	0.190
Block Design	6.2±2.8	7.3±2.6	1.579	0.114
Verbal Fluency				
Name	23.5±9.8	21.0±8.2	−1.025	0.305
Animal	17.3±6.5	18.4±6.3	−0.429	0.668
Alternation	7.6±3.7	7.3±2.7	−0.469	0.639
Stroop				
Word	81.5±17.6	90.4±17.5	−1.902	0.057
Color	56.1±16.7	62.2±17	−1.253	0.210
Word-Color	29.2±13.8	31.7±11.7	−0.779	0.436
Finger Tapper				
Dominant hand	30.8±9.3	36.0±9.2	−1.697	0.090
Nondominant hand	31.6±8.4	33.6±7.3	−0.915	0.360

Table 3 The Neurological Evaluation Scale (NES) scores of the deficit and nondeficit schizophrenic patients

NES	Deficit (n:19) mean ± SD	Nondeficit (n:43) mean ± SD	z	p
Integrative sensory function	3.05±1.87	1.88±1.57	−2.295	0.022
Motor coordination	1.05±1.12	0.55±1.00	−1.985	0.047
Sequencing of complex motor acts	3.63±1.89	2.32±1.84	−2.475	0.013
Others	8.05±3.67	4.72±2.77	−3.196	0.001
Total	15.78±6.25	9.48±4.83	−3.458	0.001

Table 4 The significant predictors of the deficit state in the stepwise logistic regression model

Predictors	b	95% CI	Exp (b)	p
PANSS Negative	1.097	1.297–6.921	2.996	0.01
NES SCMA	1.265	1.206–10.417	3.544	0.021
Constant	−24.508			0.008

SCMA Sequencing of complex motor acts

Discussion

The main findings of the study indicate that the deficit patients show a worse level of functioning in the past five years and have a higher level of negative symptoms and soft neurological signs.

The similarity between the deficit and nondeficit patients regarding clinical variables such as the duration of time elapsed between the first appearance of psychotic symptoms and out- and in-patient treatment, age at first hospitalization, total number of hospitalizations and psychotic exacerbations is consistent with the results of prior studies (Carpenter et al. 1988; Buchanan et al. 1990, 1994). A tendency for an earlier onset of illness in the deficit patients has been shown in one prior study (Mayerhoff et al. 1994) and not replicated in numerous others. In our sample, age of onset was earlier, though not at a significant level, in the deficit schizophrenia patients.

Poorer premorbid adjustment in deficit patients has been repeatedly reported (Buchanan et al. 1990; Fenton and McGlashan 1994; Mayerhoff et al. 1994; Tek et al. 2001a), yet was not found in this study. Since education is considered as an important predictor of premorbid adjustment (Buchanan et al. 1993, 1997), our finding might be due to the inclusion of patients with a minimum of 8 years of education for the purpose of neurocognitive assessment. This requirement of a minimum of 8 years of education might have resulted in a higher rate of exclusion of women from this study; however, the percentage of males and females in our study sample is similar. The level of functioning in the past five years has been found significantly worse in the deficit patients, pointing to decreased social functioning as found in other studies (Wagman et al. 1987; Carpenter et al. 1988; Fenton and McGlashan 1994; Mayerhoff et al. 1994; Kirkpatrick et al. 1996c). However, the functioning in the previous year did not differ. This finding may reflect the enduring state of the deficit schizophrenia.

In our study, the higher severity of negative symptoms (Kirkpatrick and Buchanan, 1990; Loas et al. 1996; Spaletta et al. 1997) and lower, though not significant, level of positive symptoms (Wagman et al. 1987; Carpenter et al. 1988; Fenton and McGlashan 1994; Mayerhoff et al. 1994; Turetsky et al. 1995; Spaletta et al. 1997; Bustillo et al. 1997; Thibaut et al. 1998) in the deficit patients is consistent with earlier findings. However, the similarity of the severity of depression scores between the two groups is unexpected, considering the literature commonly indicating a lower level of depression in the deficit schizophrenia. Yet, some studies utilizing different scales of depression and different methods of sample selection have found no difference (Carpenter et al. 1988; Kirkpatrick et al. 1994; Loas et al. 1996; Spaletta et al. 1997).

Our results indicate that the deficit schizophrenic patients have significantly higher scores on the total and subscales of the NES. Previous literature has pointed at a specific relationship between neurological soft signs and integrative sensory function in the deficit patients (Arango et al. 2000). We have found a more general neurological impairment in the deficit patients which is not only in sensory integration.

We found a positive correlation between the negative symptoms and neurological signs in the whole sample, as reported in many other studies (Merriam et al. 1990; Schröder et al. 1991; Wong et al. 1997). In the presented study, the neurological soft signs controlled for negative symptoms remained significantly different between the deficit and nondeficit patients. Therefore, the difference in the neurological findings was considered as a true group effect.

Although it is still a debated topic, the widely accepted view is that neuroleptic treatment and dosing does not influence neurological signs (Manshreck and Ames, 1984; Gupta et al. 1995; Kolakowska et al. 1985). In a previous study (Yazıcı et al. 2002) we found that 12% of neurological signs in schizophrenic patients could be explained by extrapyramidal side effects of antipsychotic treatment. In the presented study, no significant difference of EPS symptoms and motor speed which could confound the neurological signs was found between the deficit and nondeficit patients. Therefore, EPS do not seem to contribute to the difference in the neurological findings.

Finally, the neuropsychological variables examined in this study consist of tests which evaluate mainly frontal and parietal lobe functions. Other studies have suggested that the deficit schizophrenic patients show impairments in the Trail Making B and Stroop Tests which reflect frontal lobe, and the Mooney Faces Closure Test which reflects parietal lobe function (Buchanan et al. 1994; 1997). In this study, no difference in neurocognitive performance has been observed between the two groups, which is in contradiction with the above mentioned studies. However, the small sample size should be kept in mind for careful interpretation of this finding.

In summary, the deficit patients who were categorized according to Carpenter and colleagues' (Kirkpatrick et al. 1989) definition confirmed that indeed this group of patients have higher severity of negative symptoms. Among the other variables compared, the severity of neurological soft signs and level of functioning in the past five years differed significantly between the deficit and nondeficit schizophrenic patients, although no differences in sociodemographic variables, premorbid ad-

justment, clinical course, and functioning in the previous year were found between the two groups. The predictors for deficit schizophrenia were found to be negative symptoms and the sequencing of complex motor acts.

It should be noted that, although the deficit patients were not found to have more neurocognitive impairment assessed with the neurocognitive measurements used in this study, they functioned poorly in the past five years. To conclude, our findings suggest that the deficit schizophrenia is a distinct subgroup comprised of patients who have more negative symptoms, neurological impairment and poor functioning which may have a common underlying pathology. Since the premorbid adjustment in the deficit and nondeficit schizophrenic patients does not differ, it is difficult to speculate on the relative contribution of neurodevelopmental pathology or the disease process itself on the underlying mechanism.

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