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Gender differences of neurocognitive functioning in patients with first-episode schizophrenia in China

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ABSTRACT

Aims: To investigate the gender differences in neurocognitive functioning in patients with first-episode schizophrenia (FES) in China.
Methods: A total of 449 Chinese patients with FES (210 males, 239 females) were included in this study. Participants' psychopathology was assessed by the Positive and Negative Syndrome Scale (PANSS). Neurocognitive functioning was assessed by 10 neuropsychological tests from a battery. Neurocognitive test scores were converted to scale scores and *t*-scores using normative data from Chinese populations.
Results: Males were younger and less likely to be married, had an earlier age of illness onset and a longer duration of untreated psychosis (DUP), and scored higher on the PANSS negative, general and total scales than females. After controlling for potential confounders, females performed better than males in the verbal learning and memory domain (p=0.016). While most neurocognitive domains were correlated with PANSS negative scores for male patients with FES, for female patients with FES, negative associations were found between scores on the PANSS general subscales and neurocognitive domains. We also performed a case-control comparison with a group of patients with clinically stable schizophrenia (CSS) (n = 60) who were matched by age, sex and education years with patients with FES (n = 58). After controlling for potential confounders, no significant differences were found between patients with FES and patients with CSS in all neurocognitive domains. Female patients still performed better in the verbal learning and memory domain (t = 2.14, p = 0.034). No interaction effects of gender and disease were found.
Conclusions: Gender was an independent influence factor for the verbal learning and memory domain. Both female patients with first-episode schizophrenia and female patients with clinically stable schizophrenia performed better than male patients.

1. Introduction

The lifetime prevalence of schizophrenia is estimated to be 1% worldwide and has increased in China from 0.39% in 1990 to 0.83% in 2010 [1–3]. Although schizophrenia tends to affect both genders equally, the risk of developing schizophrenia appears to be higher in males [4]. Males are reported to display inferior premorbid academic, occupational, interpersonal, and psychosocial functioning compared with females [5]. Literature reviews have suggested that gender differences are widely present in the clinical characteristics and illness course of schizophrenia. Differences have been identified in age of onset, symptom severity, treatment response, global functioning, and clinical outcomes [6–8]. Female patients appear to exhibit a later age of onset, fewer negative symptoms, fewer functional impairments, and better treatment outcomes than male patients. Robust evidence has documented that female patients with schizophrenia have a more favorable clin-

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ical prognosis than male patients with schizophrenia [9,10], which suggests that gender-related features may play an important role in the biological and sociological progress of schizophrenia [11,12].

Neurocognitive symptoms are core features of schizophrenia and have been demonstrated to contribute equally as positive and negative symptoms to disease burden and functional disability [13,14]. Neurocognitive functioning has been reported to be positively correlated with occupational, interpersonal, and social functioning and has been considered an important predictor of recovery [15]. Patients with schizophrenia demonstrate significant neurocognitive deficits in several cognitive domains, including learning, memory, attention, executive functioning, and processing speed [16,17]. In the general population, males are reported to be superior to females in visuospatial tasks, and females perform better than males in memory and language tasks [18].Several studies have attempted to investigate gender differences in neurocognitive functioning among patients with schizophrenia. These studies have shown that gender differences are present in the prodromal, acute, and chronic stages of schizophrenia [19–21]. Although previous studies have produced equivocal findings [22–24], evidence indicates that while males are superior to females in visuospatial functioning, females perform better in memory, verbal abilities, and executive functioning [9,18,25].

The majority of studies in this field have been conducted with heterogeneous samples of institutionalized and chronically ill patients. This approach may overlook the influence of illness duration and treatment on the nature of neurocognitive dysfunction [17]. Therefore, patients with first-episode schizophrenia (FES) should be the optimal population to investigate gender effects on neurocognitive functioning in patients with this debilitating disease [26]. Moreover, gender differences among patients with schizophrenia have been reported to be significantly different between developed countries and developing countries [7]. There is a great need for well-designed studies with large sample sizes from developing countries to examine gender differences in schizophrenia.

We designed this study to determine whether gender differences exist in clinical characteristics and neurocognitive performance among patients with FES in a large Chinese Han population. We enrolled a group of patients with clinically stable schizophrenia who were matched by age and sex with patients with FES to investigate the effects of gender and disease phase and the interaction between gender and disease phase on neurocognitive functioning. We used this approach to verify and validate the findings of gender differences in schizophrenia to test our hypothesis that female schizophrenia patients have better cognitive function (as do women in the general population), although this difference may be influenced by the duration of the illness.

2. Methods

2.1. Participants

This study was a multicenter cross-sectional experiment. Six psychiatric hospitals from six different provinces throughout China were selected as study sites. From January 2008 to December 2010, we randomly recruited 100 patients with FES from each study site. All participants were aged 18∼45 years and met the diagnostic criteria for schizophrenia, which was confirmed by the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorder-IV Axis I Disorder, patient edition (SCID-I/P) [27]. All participants with FES had a maximum illness duration of three years and had not been exposed to continuous antipsychotic treatments longer than four weeks. Participants who had a previous history of major physical conditions or other major psychiatric conditions (e.g., affective disorder, alcohol and/or drug abuse or dependence) were excluded from this study.

We also included 60 patients with clinically stable schizophrenia (CSS) who were matched by age, sex, and education years with 58 patients with FES in this study. Patients with CSS were aged 18∼60 years and met the diagnostic criteria for schizophrenia, had an illness duration longer than three years, were clinically stable for more than three months (with a maximum total score of three from P1 to P7 in the Positive and Negative Syndrome Scale), and had no significant changes in any antipsychotic treatments in the previous two months at study inception.

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2.2. Assessments

All research staff were psychiatrists who had been trained at Peking University Institute of Mental Health before participating in this study. The psychiatrists completed consistent training for all research instruments with an interrater reliability of 0.75. Three trained psychiatrists were responsible for clinical assessments in each study center. These psychiatrists collected sociodemographic characteristics and general clinical information using a detailed questionnaire designed for this study, and they assessed the participants' psychopathology using the Positive and Negative Syndrome Scale (PANSS)–Chinese Version [28].

Three other psychiatrists who were trained and certified by the HIV Neurobehavioral Research Center of the University of California at San Diego performed neurocognitive tests at each study center. Ten neuropsychological tests from a battery were administered to measure participants' neurocognitive functioning. The neuropsychological tests were provided by the HIV Neurobehavioral Research Center of the University of California at San Diego, and their clinical validity and test-retest reliability among patients with schizophrenia and healthy controls in China were verified [29]. The tests assessed six domains of neurocognitive functioning, including the speed of information processing [tested by the Trail Making Test–Part A (TRAIL_A), the Stroop Color and Word Test (word and color), the Animal Naming Test, and the Color Trail Test-1], verbal learning and memory [tested by the Hopkins Verbal Learning Test (HVLT)], visual learning and memory [tested by the Brief Visual-Spatial Memory Test (BVMT)], attention and working memory [tested by the Paced Auditory Serial Addition Task (PASAT)], executive functioning [tested by the Color Trail Test-2 and the Stroop Test-unconscious], and motor skills [tested by the Grooved Pegboard Test–dominant hand and the Grooved Pegboard Test—nondominant hand (PEG-SD and PEG-SN)].

The Personal and Social Performance Scale (PSP), which was adapted from the Social and Occupational Functioning Assessment Scale (SOFAS), was administered to assess participants' social functioning in this study [30].

2.3. Data management and statistical analysis

We established an online research database to transcribe, monitor and manage the research data. Two data managers double-entered data, which were collected from each study site, into the central database. The original scores of all neurocognitive tests were converted to scale scores (mean = 10, standard deviation = 3) according to normative data for the Chinese population [29].

Table 1
Sociodemographic and clinical features between male and female FES patients (N=439).

	Male (n = 210)	Female (n = 239)	Test	*p*
Age (year)	24.74 ± 6.75	26.19 ± 8.02	−2.046	0.041*
Education years	12.53 ± 3.00	12.54 ± 3.06	−0.028	0.978
Marriage[Single/Married/Divorced]	172/30/7	155/54/20	13.114	0.001**
Live alone [n (%)]	11(5.23)	13 (5.67)	0.040	0.841
Age of onset (year)	23.78 ± 6.80	25.44 ± 8.04	−2.326	0.021*
DUP [month, median(25%, 75%)]	8.64(4.44,15.8)	6.47(2.89,12.94)	3.354	0.001***
PANSS_Positive scores	23.85 ± 5.51	22.99 ± 5.10	1.708	0.088
PANSS_Negative scores	21.86 ± 7.54	19.56 ± 7.31	3.247	0.001**
PANSS_General scores	42.90 ± 9.01	40.84 ± 8.04	2.532	0.012*
PANSS_Total scores	88.61 ± 15.36	83.38 ± 14.84	3.627	<0.001**
PSP_Socially useful activities	4.29 ± 0.74	4.10 ± 0.74	2.695	0.007**
PSP_Personal and social relationships	4.06 ± 0.78	3.89 ± 0.79	2.280	0.023*
PSP_Self-care	2.74 ± 1.24	2.65 ± 1.10	0.819	0.413
PSP_Disturbing/aggressive behaviors	2.32 ± 1.35	2.20 ± 1.19	1.005	0.315
PSP_total scores	40.30 ± 13.50	43.32 ± 12.69	−2.416	0.016*

DUP: Duration of untreated psychosis;
Social function was measure by Personal and social Performance Scale (PSP), which measured 4 domains of social function: socially useful activities, personal and social relationships, self-care and disturbing and aggressive behaviors. The data were represented as mean ± SD.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

We conducted our data analysis using STATA 14.0 *(Statacorp, College Station, TX, US)*. Differences in measurement data were compared with a *t*-test for data with normal distributions and nonparametric tests for ratings that did not exhibit normal distributions. Differences in categorical data were compared with the chi-square test. Logistic regression analysis was applied to assess the relationship between possible predictors and neurocognitive functions. We included age, education years, and other potential clinical confounders as covariates in multivariate regression models to assess gender differences across dependent tests and all six neurocognitive domains. Odds ratios and 95% confidence intervals were applied to measure the degree of association. All *p*-values were two-tailed at a significance level of ≤0.05.

3. Results

3.1. Gender differences in sociodemographic characteristics, clinical features, and social functioning among patients with FES

After invalid data were deleted, 449 (210 male and 239 female) patients with FES were included in the final data analysis. Males were slightly younger than females (24.74 ± 6.75 vs. 26.19 ± 8.02, p=0.041). Of the male participants, 14.29% were married, which was significantly lower than the percentage for females (23.58%, p=0.001). A gender difference of approximately 1.5 years was found for age of illness onset and a difference of 2 years was found for the duration of untreated psychosis (DUP), with males having earlier onset (p=0.021) and longer DUP (p=0.001) than females. Male patients with FES had significantly higher scores on the negative (21.86 ± 7.54 vs. 19.56 ± 7.31; p=0.001) and general subscales (42.90 ± 9.01 vs. 40.84 ± 8.04; p=0.012) of the PANSS and higher PANSS total scores (88.61 ± 15.36 vs. 83.38 ± 14.84, p<0.001) than female patients. No gender difference was found in the scores of the PANSS positive subscale (males vs. females 23.85 ± 5.51 vs. 22.99 ± 5.10, p=0.088). Male patients had significantly lower PSP scores than female patients (40.30 ± 13.50 vs. 43.32 ± 12.69, p = 0.016) (see Table 1 for details).

3.2. Gender differences in neurocognitive functioning (dependent tests and domains) among patients with FES

Index scores of the neurocognitive tests are shown in Fig. 1. Compared to the normative data of the Chinese population, patients with FES exhibited deficits in all neurocognitive domains. Female patients with FES had significantly higher scores on several tests across the neurocognitive domains than male patients (Stroop_color: p=0.008; HVLT1: p=0.019; HVLT2: p=0.038; HVLT3: p=0.001; BVMT1: p=0.033; PEG_SD: p=0.029). Overall, female patients performed better in visual learning and memory (p=0.043), motor skills (p=0.046), and the verbal learning and memory domain than males (p=0.004). After controlling for age, years of education, PANSS_negative (PANSS_N) scores, and PANSS_general (PANSS_G) scores, multivariate regression analysis revealed a significant gender effect on the verbal learning and memory domain, with females performing better than males (t = 2.41, p=0.016). We did not find significant differences between male and female patients with FES for other neurocognitive domains (Table 2).

3.3. Gender differences in the relationship between neurocognitive functioning and clinical features

We further analyzed data from females and males separately to assess gender differences in the correlation between clinical characteristics and neurocognitive domains. For male patients with FES, a Pearson correlation analysis showed significant negative associations between scores on the PANSS negative subscale and the examined neurocognitive domains (all $p < 0.01$), except for visual learning and memory ($p = 0.065$). Scores on the PANSS general subscale were negatively associated with executive functioning ($p = 0.010$) and motor skills ($p = 0.035$). DUP was positively associated with verbal learning and memory ($p = 0.026$) and executive functioning ($p = 0.041$). However, we also found that PSP total scores were positively associated with the speed of information processing ($p = 0.004$) and visual learning and memory ($p = 0.014$). For female patients with FES, significant negative associations were found between scores on the PANSS general subscales and the examined neurocognitive domains (all $p < 0.05$), except for visual learning and memory ($p = 0.129$). The scores on the PANSS general subscale were negatively associated with the speed of information processing ($p = 0.001$) and motor skills ($p = 0.035$) (Table 3).

3.4. Gender differences in neurocognitive functioning in patients with schizophrenia at different disease phases

To investigate the effects of gender and disease phase on neurocognitive functioning, we performed a case-control comparison with a group of patients with CSS (n = 60) who were matched by age, sex and years of education with patients with FES (n = 58). Patients with CSS had lower scores than patients with FES on all PANSS subscales (PANSS_P: 8.80 ± 2.07 vs. 23.64 ± 4.69, p<0.001; PANSS_N:

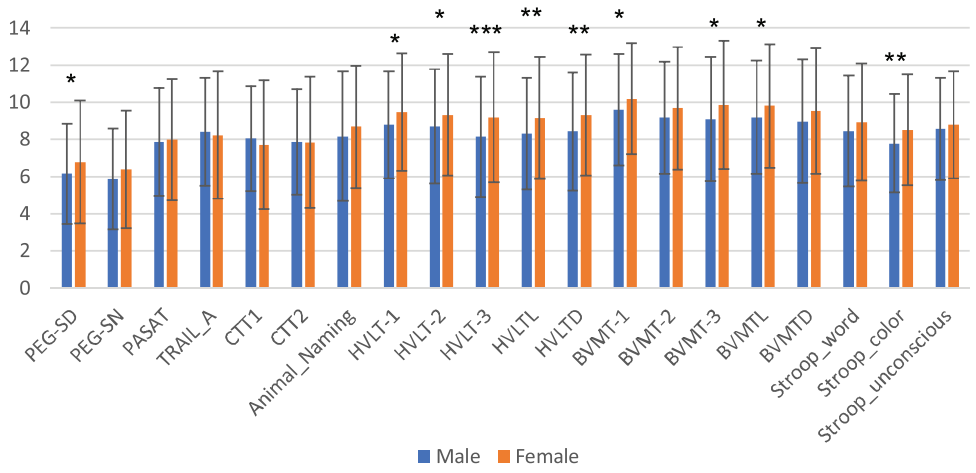

Fig. 1. Gender comparisons of specific neurocognitive tests among FES patients.
PEG-SD&SN: Grooved Pegboard Test, dominant hand and non-dominant hand; PASAT: Paced Auditory Serial Addition Task; TRAIL A: Trail Making Test Part A; CTT: Color Trail Test (1,2); HVLT: Hopkins Verbal Learning Test–Revised; BVMT: Brief Visuospatial Memory Test–Revised; Stroop: Stroop Color and Word Test. The bar charts were represented as mean ± SD.
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 2
Multivariate regression analysis of gender effects on neurocognitive domains in FES patients.

Neurocognitive domains	Coefficient[#]	95% CI	t	p
Speed of information processing	−0.196	(−0.407, 0.367)	−0.10	0.921
Verbal learning & memory	0.664	(0.122, 1.205)	2.41	0.016*
Visual learning & memory	0.485	(−0.606, 0.524)	1.73	0.084
Attention & Working memory	−0.041	(−0.657, 0.463)	−0.14	0.888
Executive function	−0.027	(−0.494, 0.440)	−0.11	0.909
Motor skill	0.275	(−0.241, 0.792)	1.05	0.296

* $p < 0.05$.
[#] Females compared to males.

Table 3
Correlations between the assessments of neurocognitive domains and clinical features and social function in FES patients.

	Speed of information processing	Verbal learning & memory	Visual learning & memory	Attention & Working memory	Executive function	Motor skill
Male (n = 210)						
DUP	0.096	0.156*	0.085	0.092	0.144*	0.107
PANSS_N	−0.275***	−0.288***	−0.065	−0.197**	−0.181***	−0.203**
PANSS_G	−0.124	0.003	−0.094	−0.081	−0.180**	−0.148*
PSP_total	0.202**	0.004	0.171*	0.140	0.103	0.118
Female(n = 239)						
DUP	0.070	0.040	0.064	0.066	0.122	<0.001
PANSS_N	−0.218**	−0.129	−0.093	−0.089	−0.074	−0.141*
PANSS_G	−0.245***	−0.141*	−0.129	−0.167*	−0.212**	−0.144*
PSP_total	0.050	0.027	−0.013	−0.026	−0.032	0.016

Pearson correlation analysis showed $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 4
Case-control comparisons of demographic and clinical features among FES and CSS patients.

	CSS (n = 60)	FES (n = 58)	Test	*p*
Age (year)	36.06 ± 9.24	35.38 ± 7.86	0.432	0.666
Sex (M/F)	31/29	25/33	0.867	0.352
Education years	11.48 ± 2.90	12.64 ± 4.69	−1.92	0.060
PANSS_Positive scores	8.80 ± 2.07	23.64 ± 4.69	−22.217	<0.001***
PANSS_Negative scores	12.02 ± 4.87	19.45 ± 6.43	−7.095	<0.001***
PANSS_General scores	22.46 ± 3.92	40.60 ± 7.65	−16.195	<0.001***
PANSS_Total scores	42.75 ± 7.95	83.69 ± 12.84	−20.906	<0.001***
Speed of information processing	9.30 ± 1.78	8.13 ± 2.58	2.887	0.005**
Verbal learning & memory	8.32 ± 2.43	8.97 ± 2.88	−1.342	0.182
Visual learning & memory	9.58 ± 3.07	9.34 ± 3.42	0.413	0.680
Attention & Working memory	8.90 ± 2.26	7.58 ± 3.42	2.455	0.016*
Executive function	8.93 ± 2.16	8.36 ± 2.75	1.258	0.211
Motor skill	7.88 ± 2.63	6.52 ± 2.82	2.713	0.008**

* $p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 5a
Multivariate regression analysis of disease phase (FES or CSS) effects on neurocognitive domains.

Neurocognitive domains	Coefficient*	95% CI	t	p
Speed of information processing	−0.240	(−1.938, 1.457)	−0.28	0.780
Verbal learning & memory	0.416	(0.122, 1.205)	0.37	0.711
Visual learning & memory	−0.212	(−2.857, 2.433)	−0.16	0.874
Attention & Working memory	−0.738	(−3.260, 1.785)	−0.58	0.563
Executive function	1.196	(−0.869, 3.261)	1.15	0.254
Motor skill	−1.471	(−3.907, 0.956)	−1.20	0.234

* FES patients compared to CSS patients.

Table 5b
Multivariate regression analysis of gender effects on neurocognitive domains among FES&CSS patients.

Neurocognitive domains	Coefficient#	95% CI	t	p
Speed of information processing	0.299	(−0.352, 0.951)	−0.10	0.921
Verbal learning & memory	0.920	(0.069, 1.771)	2.14	0.034*
Visual learning & memory	0.143	(−0.872, 1.158)	0.28	0.781
Attention & Working memory	−0.042	(−1.020, 0.936)	−0.09	0.932
Executive function	−0.101	(−0.894, 0.691)	−0.25	0.800
Motor skill	0.468	(−0.450, 1.386)	1.01	0.315

* $p<0.05$.
# Females compared to males.

12.02 ± 4.87 vs. 19.45 ± 6.43, $p<0.001$; PANSS_G: 22.46 ± 3.92 vs. 40.60 ± 7.65, $p<0.001$). Overall, patients with CSS performed better in terms of the speed of information processing, attention and verbal learning, and motor skills than patients with FES (Table 4). After controlling for age, sex, years of education, and PANSS subscale scores, we did not find any significant differences between patients with FES and patients with CSS in any neurocognitive domain (Table 5a). Multivariate regression analysis revealed a modest gender effect on verbal learning and memory (Table 5b), with males performing worse than females ($t = 2.14$, $p = 0.034$). We did not find any interaction effects of gender and disease in any neurocognitive domain.

4. Discussion

To the best of our knowledge, this is one of the largest studies to examine gender differences in unmedicated patients with schizophrenia in China. Our results were drawn from homogeneous patients with FES from psychiatric centers all over China and demonstrated gender differences across a number of clinical features, social functioning, and neurocognitive domains. After controlling for potential confounders, female patients with both FES and CSS performed significantly better on the verbal learning and memory domain than males. Moreover, we found that the association between clinical features and neurocognitive functioning was different for male and female patients with FES.

4.1. Clinical features

The gender difference in age of onset is the most replicated finding in schizophrenia research [6]. Consistent with previous studies [7,31], our results confirmed the earlier age of onset in male patients than in female patients. The relationship between gender and DUP remains controversial [32,33]. A previous meta-analysis, which mainly analyzed studies conducted in Western countries, reported that the average DUP did not differ between genders [34]. We found that in China, male patients with FES tended to have a longer DUP than females. Inconsistent results may be related to differences in the definition of onset, sample size, and cultural characteristics.

The influence of gender on symptoms present in patients with FES also remains unclear. Most studies have reported gender differences in psychopathology among patients with schizophrenia, with a higher presence of negative and disorganization symptoms present in males and a higher presence of affective and atypical positive symptoms present in females [35–38]. Our results confirm that males display more serious positive, negative, and general symptoms than females; however, we did not find significant gender differences in positive symptoms. Gender differences in psychopathology and age of onset have been suggested to disappear in familial schizophrenia [39,40]. We did not collect data about family history, which was one limitation of this study. Future studies with a large sample size from different cultural backgrounds are needed to understand the effects of gender on clinical features in patients with schizophrenia.

4.2. Social functioning

Personal and social functioning have been considered important outcome measurements in studies of schizophrenia [41]. In general, evidence has suggested that female patients with FES perform better in social functioning, based on both objective assessments (fertility, being married, and having a job) and social scale assessments, than male patients with FES [42–44]. In addition to cross-sectional studies, Chinese researchers conducted a 14-year follow-up study to explore gender differences in the long-term outcome of patients with schizophrenia in rural China [45]. These researchers reported that males had significantly higher rates of mortality, suicide, and homelessness, poorer families, and less social support than females. Consistent with most studies examining gender differences in social functioning, we also found that female patients with FES were more likely to be married and scored higher in social functioning (measured with the PSP) than male patients with FES.

4.3. Neurocognitive functioning

Neurocognitive impairments are reliably and broadly present in patients with FES, as demonstrated by numerous previous studies [17] as well as the present study. However, gender differences in neurocognitive functioning remain a controversial issue. A number of studies have found that female patients with FES had higher levels of cognitive functioning than males [16,46–49]; however, other studies have reported no gender differences in the assessment of neurocognitive functioning 46,50]. Zhang et al. compared gender differences in neurocognitive functioning among 262 Chinese patients with FES and found no gender differences in the

overall and specific neurocognitive test results [51]. We doubled the sample size and used a valid extended neurocognitive battery to assess different cognitive domains. Our results revealed an independent gender effect on the verbal learning and memory domain, with female patients with FES performing better than male patients with FES after controlling for potential confounders (e.g., disease severity).

Recently, researchers have attempted to explore the relationship between clinical features and neurocognitive functioning. Studies have indicated that clinical symptoms are associated with neurocognitive functioning differently in men and women [52,53]. Our results demonstrated that almost all neurocognitive indices were negatively correlated with PANSS negative symptoms in male patients with FES and with PANSS general symptoms in female patients with FES. Han et al. also found a gender difference in the corresponding association among Chinese patients with CSS [54]. Therefore, we suggest that the gender differences in the association between disease severity and neurocognitive functioning are similar for patients with schizophrenia at different disease phases and are not influenced by illness duration or long-term medications.

We further compared a group of patients with FES and patients with CSS to determine the interaction effects between gender and disease phase on neurocognitive functioning. We performed a case-control comparison to minimize the confounding effects of age and education level. The difference between males and females in verbal learning and memory persisted for schizophrenia as a whole. Together with previous studies, we suggest that the gender difference in neurocognitive functioning could be a 'trait index' that is not influenced by disease phase. After controlling for disease severity, we found no differences between patients with FES and patients with CSS and no interactions between gender and disease phase in any neurocognitive domain. Few studies have compared differences in neurocognitive functioning between patients with FES and patients with CSS. Our results indicate that the difference between patients with FES and patients with CSS is related to disease severity rather than disease duration.

This study has several limitations. First, we did not collect some demographic and clinical variables, including smoking history, family history, occupational status, and measurements of affective symptoms. Some studies have suggested that these variables might influence factors related to gender differences in schizophrenia. Second, we included a relatively small sample to complete the case-control comparison of patients with FES and patients with CSS, which might decrease the statistical power of our study. It is rather difficult to match patients with FES and patients with CSS by age because patients with CSS have a significantly longer illness duration. Third, patients with CSS had significantly lower scores on all PANSS subscales than patients with FES. Although we controlled for disease severity in the data analysis, this should be considered a potential confounder. Finally, we did not include a group of healthy controls in this study; therefore, we cannot determine whether the gender difference found in this study was specific to schizophrenia or healthy controls.

5. Conclusion

Gender differences were exhibited across a number of clinical features, social functioning, and neurocognitive domains for patients with first-episode schizophrenia. Gender was an independent influence factor for the verbal learning and memory domain, with both female patients with first-episode schizophrenia and female patients with clinically stable schizophrenia performing better than male patients. Furthermore, the association between clinical symptoms and neurocognitive functioning differed in male and female patients.

Declaration of Competing Interest

The authors declare no conflict of interest.

Author contributions

X.Y. and C.S. designed and supervised the study. C.P. and Y.Q. analyzed the data and wrote the manuscript, which was revised and approved by all of the authors.

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