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Prolactin and Thyroid Stimulating Hormone (TSH) Levels and Sexual Dysfunction in Patients with Schizophrenia Treated with Conventional Antipsychotic Medication: A Cross-Sectional Study

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Background: This study aimed to investigate the relationship between serum profiles of prolactin and thyroid stimulating hormone (TSH) and sexual dysfunction in patients with schizophrenia treated with conventional antipsychotic medication.

Material/Methods: A hospital-based cross-sectional study included 118 patients, age range 18–57 years (55 men, 63 women), with a confirmed diagnosis of schizophrenia. All patients were stable after antipsychotic treatment. Serum levels of hormones, including prolactin, follicle-stimulating hormone (FSH), luteinizing hormone (LH), estradiol (E2), progesterone, testosterone, thyroid-stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), free triiodothyronine (FT3) and free thyroxine (FT4), were detected in venous blood. The Positive and Negative Syndrome Scale (PANSS) score was used to measure symptom severity of patients with schizophrenia. The Mandarin Chinese version of the Arizona Sexual Experience Scale (ASEX), a 5-item scale, was used to measure sexual function.

Results: There were 66 patients (55.9%) who had hyperprolactinemia, the prevalence of hyperprolactinemia was markedly higher in the sexual dysfunction group than the non-sexual dysfunction group (91.8% *vs.* 17.5%) (P<0.001). Mean prolactin levels were significantly increased in patients with sexual dysfunction compared with the patients without sexual dysfunction (P<0.001), with a higher incidence in female patients. Subclinical hypothyroidism and hyperprolactinemia were found to be independently associated with sexual dysfunction, and an increased PANSS negative score was an independent risk factor for the development of sexual dysfunction.

Conclusions: The incidence of sexual dysfunction was significantly increased in patients with schizophrenia. Hyperprolactinemia and subclinical hypothyroidism were associated with sexual dysfunction, especially in female patients.

MeSH Keywords: Antipsychotic Agents • Hyperprolactinemia • Schizophrenia • Sexual Dysfunction, Physiological

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Background

Worldwide, schizophrenia is a chronic and severe psychiatric disorder that has a prevalence of 1% of the population [1,2]. Schizophrenia is characterized by a range of symptoms with varying severity [1]. The psychotic symptoms include fixed, false beliefs (delusions) and altered perception, including hallucinations, with less severe symptoms that include apathy, lack of drive, disorganized thought and behavior, catatonic symptoms, altered mannerisms, and abnormal posture [3]. Recently, there have been attempts from psychiatrists and sociologists to find solutions that improve the quality of life for patients with schizophrenia [4].

Sexual dysfunction has been reported to be common in patients with schizophrenia and has several negative effects on quality of life [5–7]. Sexual dysfunction can also affect treatment compliance, and the ability to maintain relationships with partners and spouses, and can be associated with depression and suicide [8,9]. Normal sexual behavior and sexual function are considered to be markers of health and are components of personal and social quality of life, which have been difficult to achieve with current treatment regimes in patients with schizophrenia [10]. However, improved sexual function in patients with schizophrenia has been recognized to have a close relationship with improvements in personal and social quality of life [11].

In patients with schizophrenia, the components of sexual behavior and sexual function, including sex drive and sexual cognition, are affected by their negative symptoms, and these symptoms may be considered to be associated with or determinant of sexual function [12]. To improve sexual function, negative symptoms should be reduced or even removed in patients who have schizophrenia. This view was supported by Kumari et al. [13], who proposed that the Positive and Negative Syndrome Scale (PANSS) scores could be used to predict sexual dysfunction. Also, significantly increased serum levels of prolactin have been shown to be associated with sexual dysfunction, including lack of libido and erectile dysfunction, in both male and female patients with schizophrenia who were on antipsychotic treatment [14–17]. Therefore, in patients with schizophrenia, sexual dysfunction may occur as a result of antipsychotic medications and may be associated with the levels of specific sex hormones. However, few previous studies have investigated these mechanisms.

The close association between the occurrence of sexual dysfunction and antipsychotic medications is due to hyperprolactinemia resulting from the pharmacological effects of blocking dopaminergic D2 receptors in the pituitary tuberoinfundibular pathway [18,19]. Commonly used antipsychotics, including amisulpride, paliperidone, and risperidone, may result in hyperprolactinemia and sexual dysfunction. Chlorpromazine, ziprasidone, clozapine, sertindole, olanzapine, and lurasidone have smaller effects on prolactin, and aripiprazole and quetiapine have only a minimal effect on prolactin [20].

Sexual dysfunction, which reduced quality of life, is estimated to afflict the majority of patients with schizophrenia. Therefore, managing sexual dysfunction remains a difficult challenge for psychiatrists who wish to improve the quality of life for patients with schizophrenia. Subclinical hypothyroidism, which is another common complication of patients with schizophrenia treated with antipsychotic medications, is defined as a state of elevated serum thyroid stimulating hormone (TSH) accompanied by normal free fractions of thyroid hormones, with the absence of overt clinical symptoms. Subclinical hypothyroidism occurs more often in women with schizophrenia than in men, and its prevalence increases with age. The independent role of subclinical hypothyroidism as a risk factor for the development of sexual dysfunction is controversial [21–25]. Therefore, further studies are needed to evaluate the role of subclinical hypothyroidism and sexual function in patients with schizophrenia.

Based on the findings of these previous studies, this study aimed to investigate the relationship between serum profiles of prolactin and thyroid stimulating hormone (TSH) and sexual dysfunction in patients with schizophrenia treated with conventional antipsychotic medication.

Material and Methods

Ethical approval and patient consent

All experimental protocols in this study that involved human participants were approved by the Ethics Committee of Kunming Medical University, Kunming, China. Written informed consent was obtained from all patients included in this study, and all study participants indicated their agreement for the use of their clinical data for research and publication. The study methods used were carried out in accordance with the Declaration of Helsinki and the guidelines of the Ethical Committee of Kunming Medical University, Kunming, China. Patients were told that refusing to participate in the study would not affect future treatment. The Four-Item Abbreviated Mental Test (AMT-4) was used to measure the patient's capacity to give consent. Patients were included in this study only after a psychiatrist demonstrated their ability to provide informed consent.

All patients who met the inclusion criteria were recruited into the study. All selected individuals were informed of the study objectives and methodology and the collection of serum for the measurement of hormone levels in patients with schizophrenia

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was approved by the Ethics Committee of Kunming Medical University (Kunming, China).

Subjects

The study recruited 118 patients (55 men and 63 women), aged between 18–57 years, who had a diagnosis of psychosis spectrum schizophrenia and were hospitalized at Kunming Medical University Affiliated Mental Health Center between September 2017 and July 2018. A hospital-based cross-sectional study design was used according to both the inclusion and exclusion criteria.

The study inclusion criteria included: a diagnosis of schizophrenia according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-V) diagnostic criteria, based on a review of medical records and supplemented by a clinical interview; age between 18–57 years; treatment provided by a primary care physician; a history of sexual activity within the past four weeks; satisfactory completion of the Mandarin Chinese version of the Arizona Sexual Experience Scale (ASEX); and the ability to understand the content of the interview.

The study exclusion criteria included: current alcohol abuse or illegal drug abuse; pregnancy or lactation; significant cardiovascular, hepatic, renal, gastrointestinal, or metabolic systematic diseases; hypogonadotropic hyogonadism; concurrent neurological illness; hypothalamic lesions or pituitary tumors; organic mental disorders; seizure disorders; mental retardation; Parkinson's disease; or central nervous system depression.

Assessment of sexual function

The Mandarin Chinese version of the Arizona Sexual Experience Scale (ASEX), a 5-item scale, was used to measure sexual function, including the strength of sexual drive, ease of sexual arousal, penile erection or vaginal lubrication, the ability to reach orgasm and satisfaction with orgasm in the past week [26–28]. The ASEX is a self-reported scale with each item was rated from 1 (no impairment) to 6 (complete impairment), resulting in a total score between 5–30. Higher ASEX scores indicated greater sexual dysfunction. Sexual dysfunction was defined as a total ASEX total score of ≥19, and any item with a score of ≥5 or any three items with a score of ≥4. The Mandarin version of ASEX was used in this study because it has been shown to have good psychometric characteristics in Chinese patients with schizophrenia [26,29].

Serum levels of sex hormones

Serum levels of sex hormones, including prolactin, follicle stimulating hormone (FSH), luteinizing hormone (LH), estradiol (E2), progesterone, testosterone, thyroid stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), free triiodothyronine (FT3), and free thyroxine (FT4), were detected by venous blood collection performed in the morning at 07: 15 hrs in all recruited patients, The patients had not eaten, drunk or taken any medications since midnight. The patients were instructed to rest quietly before blood sample collection and to avoid exercise and other stress factors that might increase their serum prolactin level. The female patients had their blood collected 3–5 days after menstruation. Whole blood was harvested and centrifuged to separate the serum samples, which were stored in centrifuge tubes at –80°C.

Competitive immunoassays were used to detect serum levels of prolactin, testosterone, estradiol, LH, and FSH. Also, the thyroid hormone levels and blood biochemical indicators for each patient, including renal function, serum lipids, and routine blood parameters were detected. Hormone levels were interpreted according to the standardized ranges for each test. In this study, hyperprolactinemia was defined as an increased level of prolactin above the normal laboratory levels of ≤530 mIU/L or 25 ng/mL in women, and 424 mIU/L or 20 ng/mL in men [30,31]. Subclinical hypothyroidism was defined as the absence of a palpable goiter or symptoms related to hypothyroidism from the time of subclinical hypothyroidism identification to the beginning of the study, with a TSH level (>4.5 mIU/L) and an FT4 value within normal reference values [32].

Clinical assessment

The 30-item the Positive and Negative Syndrome Scale (PANSS) scale was used to evaluate patient symptoms, as well as general psychopathology associated with schizophrenia [33]. Briefly, each symptom was rated in the PANSS scale from 1 (symptom not present) to 7 (extremely severe symptom). The sum of all 30 items was defined as the PANSS total score and ranged from 30–210. The higher the score, the more serious the psychopathology. Also, data were extracted from the patient medical records that included the sociodemographic information and medical history of the study participants.

Statistical analysis

SPSS version 18.0 for Windows (IBM, Chicago, IL, USA) was used to evaluate the data. The Kolmogorov-Smirnov test was used to test the distributions of the parameters. Data with a non-normal distribution were expressed as the median (Q1–Q3). Normally distributed data were expressed as the mean ± standard deviation (SD). The chi-squared (χ^2) test was used to compare categorical variables. If the requirements for the chi-squared test were not met, Fisher's exact test was used. A t-test of two independent samples was used to compare variables that fit a normal distribution. The Mann-Whitney U test

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was used to compare variables that did not fit a normal distribution. Risk quantification for sexual dysfunction was conducted by using logistic regression models with stepwise variable selection (Wald test). A P-value <0.05 was considered to be statistically significant.

Results

One hundred and eighteen study participants (55 men and 63 women) completed the Arizona Sexual Experience Scale (ASEX) and were included in the study. The mean age of patients with sexual dysfunction was 36.6±11.8 years. The mean age of patients without sexual dysfunction was 38.7±11.5 years. The majority of the patients with sexual dysfunction (91.8%) had hyperprolactinemia, although only 17.5% of the patients with schizophrenia without sexual dysfunction had hyperprolactinemia, and the prevalence of hyperprolactinemia was markedly higher in the former group than in the latter group (P<0.01).

In terms of the demographic findings, most of the respondents (72.9%) had finished 12 or more years of education. Overall, 19.7% of the patients with sexual dysfunction and 1.8% of the patients with schizophrenia without sexual dysfunction met the criteria for the diagnosis of subclinical hypothyroidism, and the incidence of subclinical hypothyroidism was substantially higher in the former than in the latter group (P<0.01). There was a significant difference in the incidence of sexual dysfunction between the male and female participants (P<0.01). The Positive and Negative Syndrome Scale (PANSS) general scores, negative scores, and total scores were significantly higher in the sexual dysfunction group compared with the non-sexual dysfunction group (P<0.01). However, there were no differences in age, marital status, age at first onset, duration of illness or other clinical and demographic characteristics between the sexual dysfunction group and the non-sexual dysfunction group (P>0.05) (Table 1).

The total ASEX questionnaire score for sexual dysfunction in patients with schizophrenia was 23 (22–24), whereas that of the non-sexual dysfunction patients with schizophrenia was 13 (12–14). The score was significantly higher in the sexual dysfunction group compared with the non-sexual dysfunction group (P<0.01). The sexual desire score, sexual arousal score, erectile function and vaginal lubrication scores, ability to reach orgasm score, and the sexual satisfaction score were all significantly increased in the sexual dysfunction group compared with the non-sexual dysfunction group (P<0.01) (Table 2).

The median prolactin level was significantly increased in the sexual dysfunction group compared with the non-sexual dysfunction group (1018.0 *vs.* 226.70 mIU/L) (P<0.01), The median TSH level was significantly increased in the sexual dysfunction group compared with the non-sexual dysfunction group (2.70 *vs.* 2.06 mIU/L) (P<0.01). The median progesterone level was significantly increased in the sexual dysfunction group compared with the non-sexual dysfunction group (0.74 *vs.* 0.6 nmol/L) (P<0.01), whereas the median testosterone level was significantly lower in the sexual dysfunction group compared with the non-sexual dysfunction group (1.44 *vs.* 10.09 nmol/L) (P<0.01). The mean red blood cell value was significantly decreased in the sexual dysfunction group compared with the non-sexual dysfunction group (4.66±0.429 *vs.* 4.98±0.66×10^{12}/) (P<0.01) and mean hemoglobin level was significantly decreased in the sexual dysfunction group compared with the non-sexual dysfunction group (139.70±18.018 *vs.* 149.02±20.082 g/L) (P<0.05). The mean creatinine level was significantly decreased in the sexual dysfunction group compared with the non-sexual dysfunction group (58.49±12.124 *vs.* 64.58±16.159) (P<0.05).There were no significant differences found in the triiodothyronine (T3), thyroxine (T4), free triiodothyronine (FT3), free thyroxine (FT4), follicle stimulating hormone (FSH), luteinizing hormone (LH), estradiol (E2), blood urea, total cholesterol, triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), white blood cells (WBCs), and platelets (PLT) between the sexual dysfunction group and the non-sexual dysfunction group (P>0.05) (Table 3).

Finally, using the clinically relevant variables and those related to sexual dysfunction, a stepwise variable selection was used to perform a multiple logistic regression model. The model showed that negative PANSS scores, hyperprolactinemia, and subclinical hypothyroidism were independent risk factors associated with sexual dysfunction (Table 4).

Discussion

Patients with schizophrenia are more likely to have sexual dysfunction [11,34]. However, only a small number of patients spontaneously report sexual dysfunction to their physicians, which indicates that most patients are reluctant to discuss these problems, even though sexual dysfunction has an influence on the quality of life. This study, conducted at Kunming Medical University Affiliated Mental Health Center, investigated the relationship between serum levels of hormones, including prolactin, follicle-stimulating hormone (FSH), luteinizing hormone (LH), estradiol (E2), progesterone, testosterone, thyroid-stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), free triiodothyronine (FT3) and free thyroxine (FT4), and the incidence of sexual dysfunction. The findings of this study showed that hyperprolactinemia and subclinical hypothyroidism were associated with sexual dysfunction, especially in female patients.

It is still unclear whether sexual dysfunction in patients with schizophrenia is due to the disease itself or due to the effects

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Table 1. Clinical and demographic patient data in patients with schizophrenia with and without sexual dysfunction (SED).

	SED (n=61)	No SED (n=57)	P-value*
Age at inclusion (years)	36.6±11.8	38.7±11.5	0.334
Hyperprolactinemia (%)	56 (91.8%)	10 (17.5%)	0.000*
Subclinical hypothyroidism (%)	12 (19.7%)	1 (1.8%)	0.002*
Duration of illness (n):			
Ten years or fewer	38	31	0.384
More than ten years	23	26	
Gender:			
Male	22	33	0.018*
Female	39	24	
Marital status:			
Married	27	22	0.533
Unmarried	34	35	
Education status:			
Twelve years or more	43	43	0.546
Fewer than twelve years	18	14	
Second-generation antipsychotics:			
Clozapine	12	17	0.201
Risperidone	33	30	0.873
Olanzapine	38	41	0.266
Aripiprazole	18	21	0.397
Use of benzodiazepines	13	11	0.786
Use of antidepressants	4	3	0.538
Age at onset:			
10–20 years	16	13	0.571
20–30 years	32	27	
30–40 years	7	12	
>40 years	6	5	
Cigarettes (%)	12 (19.7%)	19 (33.3%)	0.092
Family history (%)	12 (19.7%)	8 (14.0)	0.415
Any employment (%)	22 (36.1%)	28 (49.1)	0.151
PANSS positive score	12.74±2.707	12.00±2.471	0.126
PANSS negative score	18.62±2.865	13.93±2.463	0.000*
PANSS general score	27.07±2.994	23.35±2.787	0.000*
PANSS total score	58.43±6.482	49.28±6.023	0.000*
Body mass index	23.59±2.495	23.88±2.343	0.518

SED – sexual dysfunction; PANSS – Positive and Negative Syndrome Scale. P-values with * are statistically significant.

of drug treatment. To determine whether antipsychotic drugs have a negative impact on sexual function, a comparison may be undertaken before and after treatment begins. However, it is often difficult for patients to complete questionnaires or provide detailed information about sexual function while the clinical symptoms of schizophrenia are untreated. The design of this study allowed the quantification of the degree of sexual dysfunction in patients with schizophrenia, but only after they began taking conventional medication. It also included the evaluation of changes in sex hormones and thyroid hormone levels in patients treated with antipsychotics, and identified possible risk factors for sexual dysfunction.

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Table 2. Arizona sexual experience (ASEX) scale questionnaire scores.

Variables	SED	No SED	P-value*
Sexual desire	4 (4–4)	3 (3–3)	0.000*
Sexual arousal	5 (5–5)	2 (2–3)	0.000*
Erection/lubrication	4 (4–4)	3 (2–3)	0.000*
Ability to reach orgasm	5 (5–5)	3 (2–3)	0.000*
Satisfaction	5 (4–5)	3 (2–3)	0.000*
Total score	23 (22–24)	13 (12–14)	0.000*

SED – sexual dysfunction; Data are presented as the median (Q1–Q3). P-values with * are statistically significant.

Table 3. Blood biochemistry and hormone levels of the two study groups of patients with schizophrenia, with and without sexual dysfunction (SED).

Variables	SED	No SED	P-value*
TSH (mIU/L)	2.70 (1.70–4.03)	2.06 (1.32–3.03)	0.003*
T3 (nmol/L)	1.61±0.343	1.63±0.341	0.795
FT3 (pmol/L)	4.31±0.913	4.29±0.776	0.891
T4 (nmol/L)	91.07±24.516	92.59±20.38	0.716
FT4 (pmol/L)	15.87±3.39	15.88±2.619	0.990
Testosterone (nmol/L)	1.44 (0.69–14.88)	10.9 (0.92–18.22)	0.022*
Prolactin (mIU/L)	1018.0 (702.4–1355.0)	226.70 (116.0–417.5)	0.000*
FSH (IU/L)	4.98 (2.89–9.33)	5.61 (3.49–8.94)	0.564
LH (IU/L)	5.94 (2.97–11.85)	5.95 (3.49–9.70)	0.857
E2 (pmol/L)	116.80 (78.78–239.65)	109.60 (74.75–184.1)	0.577
Progesterone (nmol/L)	0.74 (0.54–1.45)	0.60 (0.39–0.99)	0.025*
Urea (mmol/L)	4.15±1.402	3.91±1.499	0.371
Creatinine (μmol/L)	58.49±12.124	64.58±16.159	0.022*
Total cholesterol (mmol/L)	4.39±0.994	4.32±0.806	0.662
TG (mmol/L)	1.18 (0.76–1.59)	1.30 (0.99–1.84)	0.107
HDL-C (mmol/L)	1.23±0.262	1.17±0.242	0.190
LDL-C (mmol/L)	2.39±0.748	2.37±0.567	0.825
WBC (10^9/L)	6.48±1.689	6.92±1.905	0.194
RBC (10^{12}/L)	4.66±0.429	4.98±0.66	0.002*
Hb (g/L)	139.70±18.018	149.02±20.082	0.009*
Platelets (10^9/L)	254.43±79.090	236.47±63.034	0.177

Data are presented as the mean ±SD or the median (Q1–Q3), and P values with * are statistically significant. SED – sexual dysfunction; TSH – thyroid-stimulating hormone; T3 – triiodothyronine; FT3 – free triiodothyronine; T4 – thyroxine; FT4 – free thyroxine; FSH – follicle-stimulating hormone; LH – luteinizing hormone; E2 – estradiol; TG – triglycerides; HDL-C – high-density lipoprotein cholesterol; LDL-C – low-density lipoprotein cholesterol; WBC – white blood cell; RBC – red blood cell; Hb – hemoglobin.

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Table 4. Related variables affecting sexual dysfunction analyzed by multiple logistic regression.

Variables	Coefficient	SE	Wald test	Odds ratio	95% confidence interval (CI)		P- value*
					Lower	Upper	
PANSS negative symptom score	0.477	0.149	10.292	1.612	1.204	2.517	0.001*
Subclinical hypothyroidism	3.699	1.344	7.576	40.411	2.901	562.964	0.006*
Hyperprolactinemia	2.966	0.751	15.614	19.416	4.459	84.547	0.000*

SE – standard error; PANSS – Positive and Negative Syndrome Scale. P-values with * are statistically significant.

In the present study, sexual dysfunction was significantly associated with the presence of hyperprolactinemia and subclinical hypothyroidism, especially in patients with higher Positive and Negative Syndrome Scale (PANSS) scores. These findings showed that patients with schizophrenia who had increased serum prolactin levels were most likely have sexual dysfunction. Therefore, the detection of prolactin levels might be an approach to the identification of patients with schizophrenia and sexual dysfunction. If serum prolactin levels can be used to identify patients with sexual dysfunction, this may provide an easier and more convenient diagnostic approach that will facilitate psychotherapy and professional therapy for sexual dysfunction in a shorter period.

The findings of the present study support that sexual dysfunction in patients with schizophrenia may be diagnosed by measuring serum levels of prolactin. Also, subclinical hypothyroidism and hyperprolactinemia were associated with the occurrence of sexual dysfunction. Because sexual dysfunction was significantly increased in patients with hyperprolactinemia, especially in female patients, female patients with schizophrenia should be more concerned about issues of sexual dysfunction.

The findings of the present study, of the association between hyperprolactinemia and sexual dysfunction have been supported by previous studies [14–17]. However, to our knowledge, this was the first study to assess the relationship between sexual dysfunction and subclinical hypothyroidism in patients with schizophrenia. The proportion of patients with sexual dysfunction with subclinical hypothyroidism was 19.7%, which indicated that subclinical hypothyroidism and hyperprolactinemia were independently associated with the occurrence of sexual dysfunction in patients with schizophrenia. Analysis of the findings from the PANSS scores showed that PANSS negative score was an independent risk factor for the development of sexual dysfunction. These findings demonstrated a clear relationship between the presence of sexual dysfunction and the occurrence of hyperprolactinemia and subclinical hypothyroidism in patients with schizophrenia. In addition to prolactin, this study showed, for the first time, that TSH was another important hormone to measure in the serum of patients with schizophrenia. Both prolactin and TSH can be easily and rapidly identified in patients and may lead to an improvement in the quality of life for patients with schizophrenia.

In this study, a Mann-Whitney U test showed that the median progesterone level was significantly increased in the patient group with sexual dysfunction when compared with the patient group without sexual dysfunction. An independent sample t-test showed that the mean creatinine levels were significantly increased in the non-sexual dysfunction group compared with the sexual dysfunction group, but in both study groups, the progesterone and creatinine levels were in the normal range. These findings support that measurement of serum progesterone and creatinine might not be promising indicators of sexual dysfunction. An independent sample t-test showed that the number of red blood cells and hemoglobin level were significantly increased in patients with schizophrenia and without sexual dysfunction compared with patients with sexual dysfunction, but logistic regression analysis did not support a relationship between these two factors. Red blood cells contain a large amount of hemoglobin, and hemoglobin carries oxygen (O_2), which means that a high hemoglobin level might be a protective factor for sexual dysfunction. Also, following univariate analysis, testosterone levels were found to be significantly increased in patients without sexual dysfunction compared with patients with sexual dysfunction. However, logistic regression analysis did not indicate that a high testosterone level was a protective factor against sexual dysfunction. Therefore, further studies are required that include larger study sizes to determine the role of progesterone, creatinine, hemoglobin, and testosterone levels in patients with schizophrenia and sexual dysfunction.

The design of the questionnaire used in this study was practical and objective, and 67.3% of the male patients and 50.8% of female patients were not married, so the personal relationships were relatively simple to assess without confounding factors. All patients recruited were treated with antipsychotic medication, so that the absence of treatment and symptom control were not confounding factors in the data analysis of this study.

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Conclusions

This study showed that the incidence of sexual dysfunction was significantly increased in patients with schizophrenia. Hyperprolactinemia and subclinical hypothyroidism were significantly associated with sexual dysfunction, especially in female patients. Based on these findings, the measurement of serum levels of prolactin and thyroid-stimulating hormone (TSH) might be used for clinical and research purposes to identify sexual dysfunction in patients with schizophrenia. Psychiatrists may have an active role in screening and identifying factors that contribute to impaired sexual function in patients with schizophrenia, by combining the measurement of serum hormones with patient communication and appropriate psychotherapy. This combined management approach might improve sexual function and quality of life for patients with schizophrenia.

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