

Effect of Antipsychotic Drugs on the Cardiac Function of Patients with Schizophrenia and Analysis of Echocardiogram Results

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Abstract: *Objective:* To explore and analyze the effect of antipsychotic drug treatment on the cardiac function of patients with schizophrenia. *Methods:* From January 2021 to December 2022, 30 patients with schizophrenia were divided into three groups, group A (n = 10), group B (n = 10), and group C (n = 10), by random number table. Patients in group A were treated with risperidone, patients in group B were treated with quetiapine, and patients in group C were treated with aripiprazole. The Positive and Negative Syndrome Scale (PANSS) and Lowenstein Occupational Therapy Cognitive Assessment (LOTCA) scores, electrocardiogram results, and echocardiogram results were compared among the three groups. *Results:* There were no significant differences in PANSS and LOTCA scores among the three groups after treatment ($P > 0.05$). Electrocardiogram showed that the incidence of prolonged QT interval in group C was higher than that in groups A and B ($P < 0.05$); echocardiogram showed that the left ventricular ejection fraction (LVEF) and left ventricular end-diastolic volume (LVEDV) in group C were lower than those in group A and group B ($P < 0.05$). *Conclusion:* Risperidone, quetiapine, and aripiprazole can improve the symptoms and cognitive function in patients with schizophrenia. Aripiprazole has a greater impact on cardiac function, as evidenced on electrocardiogram and echocardiogram. Therefore, close monitoring must be done to ensure drug safety.

Keywords: Antipsychotic drugs; Schizophrenia; Cardiac function; Echocardiography

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1. Introduction

Schizophrenia is a chronic mental disorder. Its etiology is related to genetics, environment, and abnormal neuronal function. Patients with schizophrenia are unable to distinguish reality from imagination. They tend to behave abnormally and react slowly, and normal communication is an issue for them. Typical symptoms include hallucinations, delusions, abnormal thinking and behavior, depression, and anxiety; some patients may even display violent behaviors or have suicidal tendencies^[1,2]. Clinically, antipsychotic drugs are often used to treat schizophrenia. The commonly used drugs include risperidone, quetiapine, and aripiprazole. These drugs can effectively relieve positive and negative symptoms as well as control the progression of the disease^[3]. Several studies have pointed out that antipsychotic drugs can affect the cardiac function of patients, as evidenced by abnormal electrocardiogram results. Hence, they should be used with caution^[4]. In this study, 30 schizophrenia patients were selected to explore the effects of different antipsychotic drugs on the patients' cardiac function, as observed on electrocardiogram and echocardiogram.

2. Materials and methods

2.1. General information

The research process and patient selection plan were approved by the medical ethics committee of Zhangjiagang Fourth People's Hospital. From January 2021 to December 2022, 30 patients with schizophrenia divided into three groups by random number table: group A (n = 10), group B (n = 10), and group C (n = 10). Group A consisted of 7 males and 3 females, age ranging from 13 to 70, with a mean of 41.48 ± 2.66 years. Group B consisted of 6 males and 4 females, age ranging from 15 to 68, with a mean of 41.52 ± 2.62 years. Group C consisted of 8 males and 2 females, age ranging from 15 to 69, with a mean of 41.51 ± 2.74 years. The baseline data of the three groups of patients were comparable ($P > 0.05$).

Inclusion criteria: (i) patients who met the diagnostic criteria for schizophrenia based on the Chinese Mental Disorders Classification and Diagnostic Criteria after comprehensive examination; (ii) patients with no contraindications to medication; and (iii) patients who understood the research content and provided informed consent.

Exclusion criteria: (i) patients with hypersensitivity to the drugs used in the study; (ii) patients with heart disease; (iii) patients with organ dysfunction; or (iv) patients who were uncooperative.

2.2. Methods

Patients in group A were treated with risperidone, orally, once a day: 1 mg on the first day of treatment, 2 mg on the second day of treatment, and 3 mg on the third day of treatment, followed by a maintenance dose of 3 mg for 8 weeks.

Patients in group B were treated with quetiapine, orally, 150 mg after breakfast and dinner. Upon improvement in symptoms, the dosage was gradually increased to 300 mg/time, and the duration of treatment was 8 weeks.

Patients in group C were treated with aripiprazole, orally, 10–15 mg once a day after dinner. The dosage was gradually increased to 30 mg with improvement in symptoms, and the duration of treatment was 8 weeks.

2.3. Evaluation indicators

- (i) Positive and Negative Syndrome Scale (PANSS) and Lowenstein Occupational Therapy Cognitive Assessment (LOTCA) scores before treatment and after 8 weeks of treatment (PANSS score ranges from 30 to 210 points; the higher the score, the more severe the symptoms; LOTCA score ranges from 0 to 30 points; higher scores indicate better cognitive function).
- (ii) Electrocardiogram after 8 weeks of treatment: incidence of prolonged QT interval, abnormal T wave, sinus tachycardia, and ST depression.
- (iii) Echocardiography before treatment and after 8 weeks of treatment using an ultrasonic diagnostic instrument in our hospital: patients were kept in a supine position, the ultrasonic parameters were set, and their left ventricular ejection fraction (LVEF) and left ventricular end-diastolic volume (LVEDV) were determined.

2.4. Statistical analysis

SPSS 23.0 was used to calculate various data; measurement data were expressed as mean \pm standard deviation, and *t*-test was used; count data were expressed as percentage (%), and χ^2 test was performed. $P < 0.05$ indicated a significant difference between groups.

3. Results

3.1. PANSS and LOTCA scores before treatment and after 8 weeks of treatment

As shown in **Table 1**, there were no significant differences in PANSS and LOTCA scores among the three groups before and after treatment ($P > 0.05$).

Table 1. Comparison of PANSS and LOTCA scores between the three groups before treatment and after 8 weeks of treatment

Group	PANSS score		LOTCA score	
	Before treatment	After treatment	Before treatment	After treatment
Group A (n = 10)	69.75 ± 4.83	36.25 ± 2.71	14.26 ± 2.75	23.77 ± 2.08
Group B (n = 10)	69.88 ± 4.79	36.33 ± 2.68	14.29 ± 2.81	23.82 ± 1.98
Group C (n = 10)	69.64 ± 4.82	36.38 ± 2.66	14.21 ± 2.69	23.71 ± 2.04

Note: Data are shown as mean ± standard deviation.

3.2. Electrocardiogram results

As shown in **Table 2**, the incidence of prolonged QT interval in group C was higher than that in groups A and B ($P < 0.05$).

Table 2. Comparison of electrocardiogram results among the three groups

Group	Prolonged QT interval	Abnormal T wave	Sinus tachycardia	ST depression
Group A (n = 10)	1 (10.0)	0 (0.0)	1 (10.0)	0 (0.0)
Group B (n = 10)	6 (60.0)*	2 (20.0)	1 (10.0)	1 (10.0)
Group C (n = 10)	1 (10.0)	1 (10.0)	2 (20.0)	1 (10.0)

Note: Data are shown as n (%). * $P < 0.05$, comparing group A with group B.

3.3. Echocardiogram results

As shown in **Table 3**, the LVEF and LVEDV in group C were significantly lower than those in group A and group B ($P < 0.05$).

Table 3. Comparison of echocardiogram results among the three groups

Group	LVEF (%)		LVEDV (ml)	
	Before treatment	After treatment	Before treatment	After treatment
Group A (n = 10)	30.68 ± 3.75	40.59 ± 3.77	108.44 ± 12.79	141.75 ± 16.29
Group B (n = 10)	30.75 ± 3.69	34.68 ± 2.96*	108.49 ± 12.83	122.47 ± 10.87*
Group C (n = 10)	30.81 ± 3.64	40.62 ± 3.84	108.52 ± 12.74	141.69 ± 16.33

Note: Data are shown as mean ± standard deviation. * $P < 0.05$, comparing group A with group B.

4. Discussion

According to statistics from the World Health Organization, the total number of schizophrenic patients worldwide has exceeded 23 million, and the lifetime prevalence is about 5% [5]. The age distribution of schizophrenia is wide, and its causes include abnormal brain neurotransmitters, genetics, environment, *etc.* The main symptoms are delusion, hallucination, confusion, abnormal behavior, and inability to distinguish reality from imagination [6]. Drug therapy is the most fundamental intervention for patients with

schizophrenia. Physicians must choose antipsychotic drugs that have significant efficacy and safety based on the patient's condition.

The present study showed that there were no significant differences in PANSS and LOTCA scores among the three groups of patients after treatment, suggesting that all three drugs (risperidone, quetiapine, and aripiprazole) can improve the positive and negative symptoms of schizophrenia as well as the cognitive function of patients with schizophrenia. Analyzing the reasons, risperidone can bind to 5-hydroxytryptamine (5-HT) and α 2-adrenergic receptors, reduce central nervous system activity, inhibit dopamine receptor activity, and relieve schizophrenia-related symptoms [7]. Quetiapine, an antipsychotic drug that is widely used clinically, can specifically bind to dopamine D2 and 5-HT receptors and inhibit histamine, thereby reducing the severity of mental disorders and improving various symptoms and cognitive function. Aripiprazole can bidirectionally regulate the dopaminergic nervous system and has high affinity to 5-HT1A, 5-HT2A, D2, and D3 receptors, antagonizing 5-HT2A receptors and partially exciting 5-HT1A receptors, thereby alleviating schizophrenia-related symptoms [8]. Risperidone, quetiapine, and aripiprazole have similar binding receptors, mechanisms of action, and therapeutic effects on schizophrenia. Therefore, no significant differences in PANSS and LOTCA scores were observed among the three groups of patients after treatment.

The present study also showed that the incidence of prolonged QT interval after treatment in group C was higher than that in groups A and B, suggesting that aripiprazole may have adverse effects on the electrical activity of the heart. Analyzing the reasons, aripiprazole has anticholinergic effects and can block dopamine receptors. Long-term medication can weaken the negative feedback effect of dopamine receptors on the presynaptic membrane of cardiovascular nerve endings and induce the release of norepinephrine, causing abnormal coronary contraction and resulting in abnormal myocardial electrical activity. As a result, hypoxic-ischemic necrosis of myocardial tissue may occur, and prolonged QT interval can be observed on electrocardiogram [9,10]. Risperidone and quetiapine have weak anticholinergic effects and minimal effects on the function of the cardiovascular system through coronary artery contraction. Therefore, the incidence of prolonged QT interval was significantly lower in group C, as compared with group A and group B.

In the present study, the three groups of patients were examined by echocardiography. The results showed that the LVEF and LVEDV after treatment were lower in group C, as compared with groups A and B, suggesting that aripiprazole may have adverse effects on the cardiac function of patients with schizophrenia. The advantage of echocardiography is its simple operation and non-invasiveness. High-frequency ultrasonic probes are used by doctors to scan the patient's heart, allowing the arterial wall structure and blood flow to be observed and LVEF, LVEDV, and other indicators to be measured. Through these processes, the patient's cardiac function can be determined [11,12]. The anticholinergic effect of aripiprazole is stronger than that of risperidone and quetiapine. With long-term medication, the myocardial tissue may be partially necrotic, and the diastolic and systolic function may be abnormal, thus resulting in abnormal echocardiogram results [13]. This study postulates that risperidone, quetiapine, and aripiprazole have good therapeutic effects on schizophrenia, but aripiprazole may affect the patient's cardiac function. Hence, it is necessary to strengthen monitoring and evaluation during treatment, especially if the patient experiences chest discomfort; in such a case, the treatment plan needs to be adjusted immediately [14,15].

In conclusion, the use of risperidone, quetiapine, and aripiprazole in patients with schizophrenia can improve their symptoms and cognitive function, although aripiprazole has a greater impact on cardiac function, as evidenced by echocardiography. The sample size of this study is relatively small, improvement and adjustments need to be made to the analysis, and further research on the mechanism is required.

Disclosure statement

The author declares no conflict of interest.

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