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Research article

Anti-ribosomal P protein antibodies and insomnia correlate with depression and anxiety in patients suffering from systemic lupus erythematosus

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ABSTRACT

Objective: Anxiety and depression in patients with systemic lupus erythematosus (SLE) complicate clinical treatment and can seriously affect prognosis. The present study aims to investigate the effects of the anti-ribosomal P protein antibody (anti-RibP) in the peripheral blood and insomnia on the severity of anxiety and depression in case of SLE. The study compared both the results of the investigation on the objective perceptions of physicians concerning mood changes in patients with SLE and the results of self-rating scales that were completed by the enrolled patients. The conclusion of the comparation is used to determine the probability of the accurate detection of anxiety and depression by physicians. The study aims to assist in the early detection in clinical practice of abnormal emotions in patients with SLE and to summarize common clinical interventions for anxiety and depression.

Method: The relationship between anxiety and depression was evaluated by the Zung self-rating anxiety/depression scale (SAS/SDS). Basic information (e.g., blood type, smoking history, drinking history, educational background, duration of illness), the insomnia severity index (ISI) results, and anti-RibP in the peripheral blood, were investigated in 107 patients with SLE in northeastern China to further analyze the correlation between the severity of depression and anti-RibP, together with the consistency between results of the questionnaire for physicians and the self-rating scale for patients.

Results: Gender, smoking history, drinking history, educational background, and duration of illness were correlated with the SAS/SDS scores ($P < 0.05$). Family history had a significant effect on the SAS score ($P = 0.031$), while the SDS score was significantly correlated with blood type ($P = 0.021$). The ISI score was significantly and positively correlated with the SAS/SDS score ($P < 0.001$). The titer of anti-RibP showed a correlation with the SDS score ($P < 0.05$) but not with the

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SAS score (P = 0.198). The titer of anti-RibP was significantly higher in patients with major depression compared with those with no depression, patients with mild depression, and those with moderate depression (P < 0.001).
Conclusion: Anxiety and depression in patients with SLE were correlated with sleeping, educational background, blood type, smoking history, and alcohol consumption. Although anti-RibP was not significantly correlated with anxiety, it indicated a significant correlation with major depression. Clinicians were more accurate in assessing anxiety compared with depression.

1. Introduction

Following an increased focus on the biopsychosocial model in the medical field emotional and mental health factors have become aspects of the evaluation index for the clinical treatment of systemic lupus erythematosus (SLE). In clinical practice, patients with SLE often suffer anxiety and depression during the course of the disease. They may experience a range of different symptoms, including irritability, despair, defying doctor's orders, depression, and general discomfort, which makes clinical treatment difficult and seriously affects the prognosis of the disease. Accordingly, it become an important part of improving the quality of life of patients with SLE to find the anxiety and depression of patients as early as possible through the related factors of SLE emotional abnormalities, and to effectively intervene before and after the onset of emotional abnormalities with physical or drugs. Several studies have shown that healthy emotions play a crucial role in disease prognosis [1].

Systemic lupus erythematosus is an autoimmune disease that includes multiple organs and is mainly characterized by acquired immunodeficiency. There are a variety of SLE-specific autoantibodies. Among them, anti-ribosomal P protein antibodies (anti-RibP) have been confirmed as being associated with severe SLE pathogenesis, such as neuropsychiatric lupus and diffuse psychiatric/neuropsychological syndromes [2]. Unlike its occasional presence in other connective tissue diseases, anti-RibP is highly specific in SLE [3]. Additionally, anti-RibP also plays an important role in the pathogenesis of mood disorders. In animal experiments, the current authors discovered that mice injected with anti-RibP antibodies in vivo exhibited depressive behaviors in the evaluation of behavioral disorders (e.g., the forced swimming and open-air tests) [4]. Meanwhile, mice with elevated levels of Interleukin-6 (IL-6) displayed gradually developing anxiety. After anti-inflammatory treatment, the above behavioral disorders were alleviated [4]. Anti-ribosomal P protein, the surface of which can be directly recognized by the anti-RibP, comprised three phosphoproteins (P0, P1, P2) and form a pentameric complex [5]. When using anti-RibP to stimulate human monocytes in vitro, it can induce the production of inflammatory cytokines such as IL-6 by directly binding to anti-RibP protein on the surface of monocytes [5]. This indicates that anti-RibP protein can directly activate monocyte immunity, which provides a basis for the emotional impact of inflammatory cytokines on SLE patients.

Sleep disturbance is one of the primary clinical symptoms during the onset of SLE and in more than half of patients with the disease, insomnia is accompanied by symptoms such as active disease activity, weakness, and even depression [6]. Concerning the hypothesis that SLE is accompanied by insomnia, there is increasing evidence that sleep deprivation and even insomnia itself may act as a neural stressor, leading to the excessive activation of sympathetic nerves and the hypothalamic–pituitary–adrenal axis, which, in turn, promotes inflammatory responses contributing to depression, pain, and fatigue in cases of SLE [7,8]. In cases of SLE, anti-RibP and insomnia are both important factors that can give rise to abnormal anxiety and depression. However, few reports exist on the effect of anti-RibP in peripheral blood on the severity of anxiety and depression with SLE, particularly concerning insomnia severity index (ISI) scores and SLE-related mood disorders. Data related to these anomalies remain lacking, and there is currently no relevant survey indicating the level of consensus among clinicians in assessing mood disorders in patients with SLE. Therefore, studying the effects of anti-RibP and insomnia on anxiety and depression in patients with SLE will help support their treatment.

The present study investigated the prevalence of anxiety and depression in patients with SLE in the ward of the second affiliated hospital of Harbin Medical University (China) and analyzed the correlation between the degree of anti-RibP and sleep disturbance and the degree of anxiety and depression in SLE. It is noted that we added an evaluation scale for physician to judge the patient's emotional state, which compared and analyzed the consistency of the evaluation scale with the patient's self-rated anxiety/depression scale. In addition, it reviewed the reasons and manifestations of the patient's emotional abnormalities according to the doctor's subjective diagnosis and common measures in early intervention for mood disorders in patients with SLE. The study not only reminds rheumatologists to determine whether patients with SLE also have emotional abnormalities to provide an entry point, but also summarizes the commonly used clinical interventions for SLE with different levels of anxiety and depression. Additionally, it can help clinicians to adequate coping methods available for patients who are resistant to treatment or in poor condition. Combined with domestic-related research, the current authors designed a simple clinical evaluation scale, basing on the common patient status and the average subjective evaluation of patients by doctors [9].

2. Materials and method

2.1. General features

This research met the relevant ethical standards and was approved on December 17, 2016, by the Ethics Committee of the Second Affiliated Hospital of Harbin Medical University, China (no. KY2016-208). From August 2019 to April 2020, 107 adult patients with SLE (aged 18 years and older) were enrolled in the study. The flow of the research is shown in Fig. 1.

2.2. Inclusion criteria

The present study adopted the following inclusion criteria.

Patients had to be capable of in-depth communication and completing the questionnaire and had to meet the 1997 American College of Rheumatology diagnostic criteria for SLE [10].

2.3. Exclusion criteria

The present study adopted the following exclusion criteria.

- patients with delirium, deafness, and other speech communication disorders;
- patients with rheumatoid arthritis and systemic sclerosis (congenital or secondary); Sjögren's syndrome, other connective tissue-related diseases, and drug-related SLE;
- patients with severe cardiac insufficiency, liver or kidney injury, and other major organ damage;
- patients with central or peripheral nervous system diseases;
- patients with a disease that may cause brain shrinkages, such as stroke, kidney failure, and drug or alcohol dependence;
- patients with a history of epilepsy (excluding a history of pediatric convulsions).

2.4. Questionnaires and grouping

Following a definitive diagnosis of SLE, patients completed signed informed consent forms or inclusion in the study and were issued ISI and SAS/SDS surveys. The patients completed these evaluations via self-reporting or provided their corresponding answers after being assisted by an investigator who explained the table method. The investigators were trained in advance, including familiarization with all of the questionnaire questions, and were instructed how to provide "unasked-for explanations" when patients did not understand any of the questions. Researchers explained the instructions for completing the evaluations but avoided asking any suggestive or tendentious questions to ensure the accuracy and objectivity of the results. In the doctor survey, doctors must objectively and rationally evaluate the status of the investigated patients according to the questionnaire, it also needs to be guaranteed that they did not know the results of SAS/SDS scale of the investigated patients throughout the process. The self-rating scale was controlled within two days following patients' being diagnosed diagnosis with SLE, and the physician questionnaire was completed within three/five days after admission. Subsequently, the patients' general data were collected, including gender, age, education level, length of SLE history, family history, and medication history.

2.5. Evaluation criteria

The SAS/SDS survey applied the standard score in mental health assessment [11], i.e. the rounding of 1.25 times the original score. A score equal to or exceeding 50 indicated that the patient had anxiety/depression that required the attention of a clinician. A score less than 50 points demonstrated levels of anxiety/depression within the normal score range. According to the grouping assessment, 50–59 points was classified as mild anxiety/depression, 60–69 as moderate, and above 70 points indicated severe anxiety/depression. Conversely, patients with a score equal to or above 7 for the ISI-prescribed scale were considered to have insomnia requiring clinician

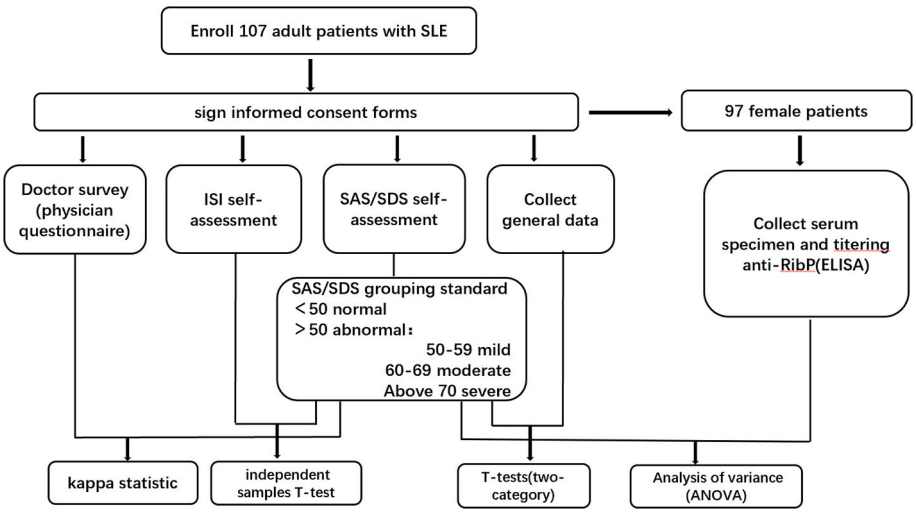

Fig. 1. Experimental flow chart.

intervention.

2.6. Serum specimen collection and testing

The participants fasted for at least 8–10 h and 5 ml of elbow venous blood was drawn using pyrogen- and endotoxin-free test tubes. Thereafter, the tubes were placed in a high-speed centrifuge for 10 min at a speed of 3000 rpm/min. The supernatant of the blood was dispensed and labeled in Eppendorf tubes, which were then placed into a −80 °C refrigerator for inspection. The entire process closely followed the operational requirements of the human Advanced Research Projects Agency for Health/Rib-P enzyme-linked immunosorbent assay (ELISA) kit.

2.7. Statistical analysis

The SPSS Statistics 22.0 software program was employed to calculate the basic data and survey results. Additionally, t-tests (two-category) were performed for SAS/SDS scores using baseline data belonging to categorical variables to compare the differences in anxiety/depression scores between patients, based on gender, educational background, drinking and smoking habits, the course of the disease, and family history. The independent samples *t*-test was conducted to compare differences in the SAS/SDS results of groups with different sleep-quality scores. Analysis of variance (ANOVA) was conducted to compare blood type with anxiety/depression level, and the correlation between the degree of depression and anti-RibP titer with $P < 0.05$ was considered statistically significant. The inter-observer reliability was calculated using the kappa statistic between the physician questionnaire and the patient SAS/SDS self-rating scale.

3. Results

The study included 107 patients with SLE, the vast majority (90.7%) of whom were female. Currently, the incidence rate of SLE in women is much higher than in men; nonetheless, emotional abnormalities do not rule out differences in gender and hormone levels between men and women. As a result, in addition to the basic data analysis, the authors eliminated male patients from the peripheral blood anti-RibP and ISI analyses.

3.1. General features

In the SAS and SDS score analyses, the average score among women was higher than among men. The significant statistical influencing factors included gender, smoking and alcohol consumption, education level, and medical history. Family history showed a statistically significant correlation with SAS, and there were differences in SDS scores according to blood types, based on ANOVA results. These were as follows: AB-type (51.0) scores were significantly higher than those of A-type (42.7) patients ($P < 0.05$); AB-type scores were also significantly higher compared with O-type (41.0) patients ($P < 0.05$). Concerning the level of education, patients with training matching a bachelor's degree or higher had an average SAS score (39.4), which was lower than the score (53.3) of patients with a high-school/lower-level education ($P < 0.05$). The SDS score (35.9) of patients with bachelor's degrees or above was lower than that of those with a high-school education (49.6) ($P < 0.05$). Patients with higher education generally have better communication capability and understanding of disease. These patients indicated strong medical compliance, based on a better understanding of their condition. The SAS scores of patients with a family history of SLE disease were lower than that of patients with no positive family history ($P = 0.031$). Basic information about the study participants is provided in Tables 1 and 2.

Table 1
Comparison of anxiety/depression scores between different basic data (n = 107).

Basic data		Percentage (%)	SAS scores			SDS scores		
			average	*t/F*	P-value	average	*t/F*	P-value
Gender	Male	9.3	39.6 ± 9.7	*0.56*	0.036	36.1 ± 10.7	*1.59*	0.261
	Female	90.7	48.3 ± 14.6			44.6 ± 12.7		
Smoking	Yes	21.5	57.8 ± 12.1	*1.01*	0.037	54.9 ± 11.1	*3.97*	0.253
	No	78.5	44.6 ± 13.7			40.8 ± 11.5		
Drinking	Yes	23.4	56.7 ± 8.2	*0.21*	<0.01	51.1 ± 9.6	*0.59*	0.011
	No	76.6	44.7 ± 14.7			41.6 ± 12.8		
Education background	Bachelor and above	42.1	39.4 ± 10.2	*1.39*	0.043	35.9 ± 7.6	*0.35*	<0.01
	Underhigh school	57.9	53.3 ± 14.2			49.6 ± 12.6		
Duration	Over 3 years	71.9	52.4 ± 12.9	*1.88*	0.041	48.1 ± 12.1	*0.31*	<0.01
	3 years and below	28.1	34.7 ± 8.9			32.9 ± 6.1		
family history	Yes	57.9	48.3 ± 13.3	*0.14*	0.031	43.9 ± 11.9	*0.03*	0.064
	No	42.1	46.4 ± 15.9			43.7 ± 13.9		

Table 2
Comparison of anxiety/depression scores between different blood types (ANOVA).

Blood type	Percentage (%)	SAS scores			SDS scores		
		average	*F*	P-value	average	*F*	P-value
O	33.6	45.8 ± 13.3	1.297	0.061	41.0 ± 11.7 *	2.589	0.021
A	25.2	46.9 ± 12.1			42.7 ± 10.1△		
B	25.4	46.3 ± 15.6			44.4 ± 13.3		
AB	15.8	53.7 ± 17.5			51.0 ± 15.9 ◊		

◊ *Compared with* △,◊, $P < 0.05$.

3.2. Anxiety/depression and sleep

The ISI score is an effective tool for assessing insomnia symptoms within a period including the preceding two weeks. In this study, patients with an ISI score greater than or equal to 7 were defined as having sleep disorders (according to the ISI criteria). A total of 97 returned questionnaires were tested, all of which were eligible for the research purpose. The independent samples *t*-test was used to compare the differences in SAS and SDS scores of groups with different sleep-quality scores. The results indicated that SAS($t = -15.054$, $P < 0.001$), and SDS ($t = -18.507$, $P < 0.001$), indicating that differences in the SAS and SDS scores of different sleep-quality groups were statistically significant. Additionally, ISI scores were considered to be positively correlated with SAS and SDS scores (Table 3).

3.3. Anti-ribosomal P protein levels and anxiety/depression

An independent samples *t*-test was conducted to compare the differences in anxiety SAS scores using serum anti-RibP titer. The results showed that $t/F = 0.13$, and $P = 0.198$, indicating that anxiety was not statistically significantly different in the anti-RibP titer (Table 4). Analysis of variance was used to compare the difference in the degree of depression using the anti-RibP titer. The results showed that $F = 81.407$, and $P < 0.05$, indicating that the difference in the degree of depression, based on the anti-RibP titer, was statistically significant. Pairwise comparison showed that the anti-RibP titer in cases of severe depression was significantly higher than in cases of no, mild, and moderate anti-RibP titers ($P < 0.001$) (Fig. 2). There was no significant difference in the anti-RibP titer between no/mild depression groups (Table 5).

3.4. Clinician questionnaire

Physician attending to 107 patients participated in current research evaluation of emotion. Excluding factors, such as incomplete answers missing selections, multiple selections, and failure to complete the adjustment form in time resulted in 98 valid questionnaires. All physician evaluation forms were completed by the attending physicians of the Rheumatology and Immunology ward of the Second Affiliated Hospital of Harbin Medical University. The questionnaire included 10 questions (Table 6).

In the feedback, the evaluation results of the doctor in charge as to whether the patient had anxiety (four items) and whether they had depression (five items) indicated $X^2 = 39.322$, $P < 0.01$. The data indicated that the assessed anxiety and depression in the same patient were correlated but somehow different, while the difference is that doctors identified patients with higher rates of anxiety than depression. There was high consistency in the evaluation of patients anxiety and depression (Kappa = 0.603, $P < 0.01$), indicating that anxiety and depression often occurred together. The SAS/SDS scores of the 98 patients were paired with the physician questionnaire the consistency test indicated that the number of anxiety cases assessed by clinicians was significantly higher than that assessed by the SAS scale (Kappa = 0.338, $P = 0.132$).

4. Discussion

The impact of mood disorders on the treatment of SLE is not perceived by patients in the early stages. Some doctors will not closely examine anxiety and depression when managing patients with SLE who suffer from mood swings. The current authors' survey of doctors' patient assessments concerning emotional disorders showed that 89.7% of patients who had been considered psychologically burdened, pessimistic, disappointed, or short-tempered were rated as veering toward being depressed. Additionally, 3.7% and 27.9% of patients, respectively, who had been classified as optimistic and average by doctors were also rated as tending toward being

Table 3
Comparison of SAS/SDS scores in different sleep quality score groups.

ISI group	SAS	SDS
Under 7	38.57 ± 9.83	35.45 ± 5.49
7 and above	62.74 ± 5.96	58.28 ± 6.59
t	−15.054	−18.507
P-value	<0.001	<0.001

Table 4
Comparison of Anti-P titers in different anxiety/depression groups.

Group		Anti-p titers	t/F	P
SAS	<50	36.84 ± 8.74	0.13	0.198
	≥50	37.34 ± 12.28		
SDS	<50	35.78 ± 8.56	0.28	0.016
	≥50	42.16 ± 23.15		

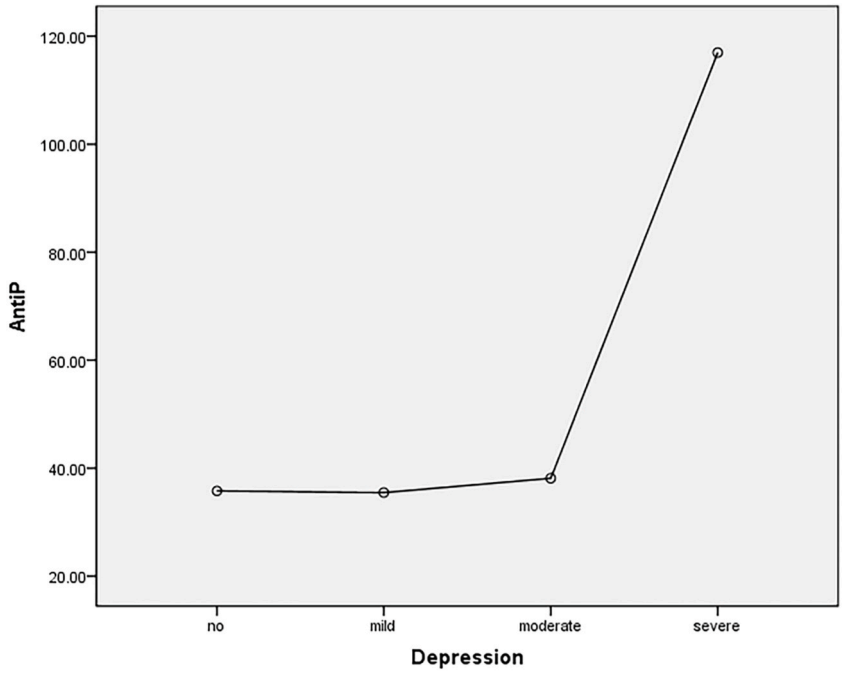

Fig. 2. Anti-P titers of severe depression are much higher than those of mild to moderate depression.

Table 5
Comparison of anti-p titers in the degree of depression.

Group		Anti-p titers	F	P
Depression	no	35.78 ± 8.56	81.407	<0.05
	mild	35.48 ± 9.44		
	moderate	38.14 ± 9.16*△		
	severe	116.78 ± 7.19*△◊		

*Compared with no depression, P > 0.05, △Compared with mild depression, P > 0.05, ◊Compared with no, mild, moderate depression, P < 0.05.

depressed. None of the patients used anti-anxiety drugs without clinical anxiety assessment. In addition, only 26.5% of anxiety-assessed patients were prescribed anti-anxiety drugs. indicating that the application of anti-anxiety drugs in general hospitals is more cautious and the dose more conservative than in specialized hospitals. Interestingly, only few doctors prescribed antidepressant drugs to patients with a tendency toward being depressed, which can be unfriendly potentially dangerous for patients. Almost all the doctors believed that patients who did not cooperate with medical staff had a tendency toward developing anxiety, and 81.7% of these patients were considered to have a tendency for developing depression. Of the less cooperative patients, 88.7% were rated as anxious, and 71.2% were considered to be depressed. Among the cooperative or extremely cooperative patients, only approximately half were rated as anxious, and less than half were rated as depressed. Concerning the degree of family cooperation, the patients who were evaluated as anxious and depressed reflected no obvious problems regarding family members' cooperation. Almost all of the patients with unhappy family relationships were considered to suffer from anxiety. Of the patients with normal relationships, 69.7% were rated as anxious and 55.9% were considered to have depression. Among the patients with harmonious family relationships, 43.2% were rated as anxious and 29.7% were rated as depressed. Among the patients with sleep disorders, 91.3% were evaluated for anxiety, which was in line with a study conducted by. Karimifar et al. [12], which showed the prevalence of sleep disorders in patients with SLE was higher than in healthy controls. The current study also demonstrated that the prevalence of sleep disorders in patients with SLE-related

Table 6
questionnaire of physician evaluation patient

topic	A	B	C	D	E
1. Does this hospitalization make you think he/she is an optimistic person?	optimistic (19.7%)	Medium (53.4%)	High psychological burden (10.2%)	Pessimism and disappointment (9.1%)	Impatience and other emotions (7.6%)
2. Did this patient use medication to relieve anxiety/depression while in hospital?	None (77.4%)	deanxit (9.6%)	Prozac (1.3%)	Valium (3.8%)	Chinese traditional medicine (7.7%)
3. How does the patient sleep?	Good (29.7%)	Fair (21%)	Day and night reversal (1.2%)	Difficulty falling asleep (43.5%)	Difficulty falling asleep and using Valium (4.6%)
4. Do you think this patient has anxiety?	Absent (39%)	Light (24.7%)	Moderate (19.3%)	Heavy (17%)	
5. Do you think this patient has depression	Absent (47%)	Light (36.4%)	Moderate (14.7%)	Heavy (1.9%)	
6. If anxiety or depression is present, do you think the cause is?	A normal accompanying emotion caused by illness, that only needs to treat (57%)	Although it will affect the diagnosis and treatment of the disease, the patient's anxiety/depression is mild with unnecessary treatment (39%)	With obvious emotion performance, that will affect the condition and treatment, requires drug intervention (4%)		
7. If patients exist anxiety/depression, with hospitalization for more than one week (choose 2 selections)	Illness getting better (84.6%)	No improvement in condition (15.4%)	Anxiety/depression did improved (61.8%)	Anxiety/depression did not improved (38.2%)	
8. Does the patient cooperate with the medical staff?	Very cooperative (9.7%)	Cooperate (74.8%)	Not very (10.4%)	Refuse (1.8%)	Not cooperating at first, then cooperating (3.3%)
9. Do the family members of the patient cooperate with medical staff?	Very cooperative (7.8%)	Cooperate (81.9%)	Not very (8.6%)	Refuse (0%)	Not cooperating at first, then cooperating (1.7%)
10. what is the relationship between the patient and his/her family?	Harmony (69.3%)	Fair (24.2%)	Patient is irritable with family (3.5%)	Family is indifferent to patient (1.5%)	Gradually get better as the condition improves (1.5%)

mood disorders was significantly higher than in patients without such disorders. However, whether these were caused by sleep disorders or emotional disorders requires additional investigation.

By questioning doctors, the current study found that almost no psychotherapy for anxiety and depression had been applied in the clinical treatment of SLE. The administration rate of anti-anxiety drugs in the hospital was significantly lower than the incidence rate, and antidepressant drugs were barely used for intervention. Commonly used clinical interventions for mood disorders were divided into drug and non-drug therapies. Deanxit (flupentixol and melitracen tablets), Prozac (fluoxetine), and traditional Chinese medicine were commonly used as drug therapies [13]. Drugs such as paeoniflorin have been shown to alleviate depressive behavior in SLE mice [14], and hydroxychloroquine also indicated an ability to alleviate anti-RibP-induced neurotoxicity [15]. However, drug treatment can have side effects and will cross-react with the multi-organ immunity to SLE. Therefore, clinicians will likely not use anti-mood-disorder drugs unless necessary, which is unfavorable for patients with SLE-related anxiety and depression. Non-pharmacological treatments, including physical exercise and psychological interventions, can be effective in improving fatigue, depression, pain, and quality of life in cases of SLE [16]. Navarrete-Navarrete [17] found that cognitive-behavioral therapy, training in relaxation techniques, and social skills training (cognitive behavioral therapy + relaxation techniques + social skill training, 120 min/week × 10 weeks) contributed significantly to improvements in anxiety, depression, and stress disorders in SLE compared with traditional medical care. Bogdanovic [18] conducted aerobic exercise training three times a week, 15 min each time, for 6 weeks among patients with stable SLE and discovered that more than half of the moderately depressive states had transformed into mild mood disorders. Clinicians are decision-makers in the evaluation and treatment of a patient's state at any given time. It is particularly important to understand the patient's emotional tendencies and to know when treatment is necessary. When confronting patients who suffer from SLE accompanied by mild emotional disorders, clinicians should not only provide non-drug interventions and detailed information but also implement exercise and relaxation training methods for patients. For patients with severe mood disorders, a psychiatrist should be consulted and active drug treatment should be implemented to control the deterioration of mental health.

The premise of providing physical/drug interventions is that the timely detection of the patient's emotional abnormality. In this context, the influencing factors are key to the detection of emotional abnormalities. The present study found that before the emergence

of anxiety and depression, almost all the patients suffered from sleep disorders to varying degrees; some of these were externally generated while others were the result of illness. Moraleda et al. [19] found that women with SLE generally suffered from poorer sleep quality, and this affected their psychological performance and disease progression to some degree. This coincided with the findings of the present study. However, other voices mentioned that there was no significant difference between disease progression and sleep disturbance in patients who had been newly diagnosed with SLE [20]. This may be because patients were in the early stages of the disease, who had not received long-term drug treatment and suffered from significant economic burdens. While in our research, 71.9% of the surveyed group had SLE for longer than three years. The differences noted above serve as inspiration for further research on the factors affecting SLE sleep quality.

In addition to the severity of insomnia, the current study also studied the effect of peripheral blood anti-RibP on anxiety and depression in cases of SLE and found that the anti-RibP titer in patients suffering from SLE with severe depression was significantly higher than in patients with mild to moderate depression. Systemic lupus erythematosus is a chronic inflammatory autoimmune disease. Autoimmune antibodies play an important role in targeting nuclear and cytoplasmic antigens, affect systemic organs, and produce diverse clinical responses. Studies indicate that anti-RibP is associated with neuropsychiatric lupus, lupus nephritis, and autoimmunity. It is also closely related to sexual hepatitis [21]. Heinlen et al. [22] posited that anti-RibP was present before the onset of SLE. Karimifar [23] found that the correlation between depression and autoantibodies occurred in the early stage of SLE and posited that anti-RibP antibodies may cause some of the symptoms of neuropsychiatric lupus. The target of anti-RibP is in anti-RibP in the 60S ribosomal subunit of the eukaryotic macromolecular structure, which includes P1 and P2 heterodimers, and a single P0 molecule (anti-RibP0). In serum, anti-RibP0 is a highly specific antibody for SLE. Patients who are anti-RibP0-positive have a low prevalence of cardiac involvement and have not been found to be associated with lupus nephritis and the nervous system's involvement in the disease [24]. In the future, the relationship between other subunits of anti-RibP and SLE neuropsychiatric diseases should be further studied to find targets for additional treatment methods.

In this study, the authors used a recombinant protein ELISA reagent to detect the anti-RibP titer, the results of which were consistent with the positive rate of anti-RibP in international patients with SLE (ranging from 10% to 47%) [25]. The incidence in Asian patients is generally higher [26]. In an international multi-center study using ELISA plates coated with recombinant proteins in immunoassays, the prevalence of the Chinese cohort was the highest (35%) [27]. The ELISA reagents using anti-RibP- labeled C22 epitope antibody synthetic peptides showed that a Canadian cohort had the highest prevalence of anti-RibP (29%) [28]. These two studies suggest that differences in anti-RibP detection methods, geographic location, and ethnicity could significantly affect the experimental results.

The present study had some shortcomings that must be considered. First, the sample size was limited and the selected patients were all from northeast China. Second, there is currently no uniform standard for the detection of anti-RibP antibodies. It was thus impossible to compare whether the anti-RibP titer could effectively predict SLE alongside the development of emotional anomalies. In the future, research should attempt to unify the anti-RibP detection standard, increase study sample sizes, and combine multi-center investigations involving different regions to evaluate the psychological impact of factors such as different regions and economic conditions.

5. Conclusion

Anxiety and depression in patients suffering from SLE were found to be related to sleep, level of education, blood type, smoking, and drinking. No significant correlation was indicated between Anti-RibP and anxiety. However, it was shown to have a significant correlation with severe depression. Clinicians have more accurate assessments on anxiety and general observation on depression.

Author contribution statement

Qi Leng: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.
Yang Li: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data.
Xiaolu Wang: Binyu Zhuang: Performed the experiments.
Li Liu: Analyzed and interpreted the data.
Xinyue Deng: Contributed reagents, materials, analysis tools or data.
Jianling Su: Performed the experiments; Contributed reagents, materials, analysis tools or data.

Data availability statement

No data was used for the research described in the article.

Declaration of interest's statement.

The authors declare no competing interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e15463.

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