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Original Article

Study on the correlation between posttraumatic stress disorder and psychological resilience in pregnant women with possible preterm labor

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Abstract: Objective: This study aims to explore the influencing factors of posttraumatic stress disorder (PTSD) and its correlation with psychological resilience in pregnant women who are threatened with preterm labor. Methods: A total of 200 pregnant women with possible preterm labor who were treated in our hospital were included in this case-control study for retrospective analysis. The Connor-Davidson Resilience Scale (CD-RISC), Social Support Rating Scale (SSRS) and Pregnancy Pressure Scale (PPS) questionnaires were used to assess stress before delivery, and the baseline clinical data and peripartum data were collected at the same time. The PTSD checklist-civilian version (PCL-C) scale was used for evaluation and the incidence of PTSD in pregnant women was evaluated by follow-up at 6 weeks after delivery. According to the score of PCL-C scale, pregnant women were divided into the PTSD positive group and PTSD negative group. Univariate and multivariate logistics regression were used to analyze the influencing factors of PTSD in pregnant women who were threatened with preterm labor, and Pearson correlation coefficient was used to evaluate the correlation between PTSD and psychological resilience in pregnant women with possible preterm labor. Results: Among the 200 pregnant women, 43 had a PCL-C score ≥ 38, and the PTSD positive rate was 21.50%. The scores of CD-RISC and SSRS scale of PTSD positive group were significantly lower than those of PTSD negative group ($P<0.05$), while the score of PPS scale was significantly higher than that of PTSD negative group ($P<0.05$). Multivariate logistics regression analysis showed that the sleep status (OR=3.156), the pregnancy stress (OR=3.274) and the history of anxiety and depression (OR=5.174) were independent risk factors for PTSD in pregnant women with possible preterm labor, the while CD-RISC score (OR=0.259), social support (OR=0.468) and fetal weight (OR=0.568) were protective factors for PTSD in pregnant women with indicated preterm labor. Pearson correlation analysis showed that the total score of PCL-C in pregnant women with indicated preterm labor was negatively correlated with the total score of CD-RISC (0.428), toughness (0.475), strength (0.331) and optimism (0.465). Conclusion: Maternal sleep status, pregnancy stress, history of anxiety and depression are independent risk factors of PTSD in pregnant women with possible preterm labor, while the level of psychological resilience of pregnant women is the protective factor of PTSD in pregnant women with possible preterm labor. Active psychological intervention in pregnant women with predicted preterm labor is helpful to reduce the risk of PTSD in pregnant women.

Keywords: Predicted preterm labor, posttraumatic stress disorder, psychological resilience, pregnancy stress, correlation

Introduction

Predicted preterm labor refers to the situation of labor indicated in the middle and late trimester of pregnancy (28 weeks but less than 37 weeks), leading to premature labor in some pregnant women (20% to 30%) with serious adverse effects on both the mothers and infants [1]. Possible preterm labor is a major stress event for pregnant women causing strong mental stimulation. McDonald et al. have reported that pregnant women with predicted preterm labor generally experience emotions of anxiety, sadness and despair, heavy psychological pressure and increased dependence [2]. Posttraumatic stress disorder (PTSD) refers to a mental disorder caused by serious traumatic events, and it is characterized by recurrent traumatic experiences, avoidance, emotional numbness and persistent high vigilance for at least one month [3]. Researchers have classified mental stimulation caused by

preterm labor events into a PTSD psychological model to explore the psychological status of pregnant women with preterm labor [1]. Studies have shown that the incidence of PTSD in pregnant women with preterm delivery is as high as 77.8%, which is significantly higher than that of pregnant women with full-term delivery [4]. Feeley et al. found that mothers of the premature infants who had PTSD symptoms were insensitive to physiological and emotional needs of their babies, and showed poor interactions with their babies 6 months after delivery, which affects the normal development of their babies [5]. In addition, the occurrence of PTSD after preterm labor of pregnant women has a negative impact on the quality of life of premature infants, resulting in a significant reduction in the quality of infants' diet and sleep [6]. Therefore, it is of great significance to explore the postpartum psychological adjustment of women with premature labor from the perspective of delivery trauma stress in order to improve the quality of life of mothers and infants and promote the physical and mental health of newborns in the future.

Psychological resilience refers to the psychological strength or quality that individuals can actively adapt to when they encounter trauma, frustration or other stressful difficulties [7]. Psychological resilience is the protective resource of individual psychological adjustment, which plays a decisive role in the individual stress response to stress and crisis [7]. Mautner et al. showed that the higher the level of psychological resilience of pregnant women, the better their quality of life and the lower the risk of depressive symptoms [8]. Davydov et al. also considered psychological resilience as a protective factor for maternal depression [9]. This study analyzed the influencing factors of PTSD and its correlation with psychological resilience in pregnant women with possible preterm labor, in order to provide a reference for improving the mental health of pregnant women with predicted preterm labor, which is summarized as follows.

Materials and methods

The baseline data

A total of 200 pregnant women with possible preterm labor who were admitted in The First Affiliated Hospital of Nanjing Medical University from January 2019 to December 2019 were enrolled in this retrospective study. Inclusion criteria: (1) Pregnant women met the diagnostic criteria of possible preterm labor in 2018 "Obstetrics and Gynecology" (9th edition) [10]. (2) Pregnant women who were married with age ≥ 20 years old; (3) Pregnant women were a singleton pregnancy, and the fetus is without deformities or defects. Exclusion criteria: (1) Pregnant women with premature rupture of membranes with a dilatation of the uterine orifice ≥ 3 cm and vaginal bleeding; (2) Pregnant women who were complicated with preeclampsia, gestational hypertension and severe maternal diseases; (3) Pregnant women who had restriction growth of fetal, with oligohydramnios and chorioamnionitis, etc.; (4) Pregnant women with cognitive or mental disorders; (5) Pregnant women who experienced other major stress events or were taking antianxiety or antidepressants within one month prior to being in our study. According to the survey sample size, we took the standard of 5-10 times the number of items in the largest scale for analysis. The scale with the largest number of items in this study is the pregnancy stress scale (30 items), that is, the required sample size is n=30×5=150 cases. Considering a predicted estimation that some invalid questionnaires may be present in our data, we increased the sample size by 10%, that is, 165 cases. In this study, 215 patients were actually investigated, and 200 valid questionnaires were finally obtained, which met the requirements of sample size. This study has been approved by the Ethics Committee of The First Affiliated Hospital of Nanjing Medical University.

Methods

Research tools: (1) The questionnaire about baseline data: The questionnaire was self-compiled by the researchers, which included age, education, occupation, monthly per capita household income, time from delivery to investigation, whether the pregnancy was planned or not, the way of pregnancy, whether it was the first delivery, the sleep status, whether there was a history of anxiety and depression, etc. (2) Posttraumatic stress checklist-civilian version (PCL-C): the scale was revised by the American PTSD Research Center according to the diagnostic criteria of DSM-IV, it is currently the most widely used scale for screening PTSD [11]. A

total of 17 items are divided into three dimensions: re-experience (5 items), avoidance or numbness (7 items), and increased alertness (5 items). Each item is scored according to the Likert summated rating scale, with a score of 1 for "no occurrence", 2 for "mild", 3 for moderate, 4 for severe and 5 for extremely severe. The total score range is from 17 to 85, and the higher the score, the more serious the symptoms of PTSD. The scores of 17-37 is referred that there were no obvious PTSD symptoms; the scores of 38-49 referred that there was a certain degree of PTSD symptoms; and the scores of 50-85 is referred that there were obvious PTSD symptoms. The Cronbach's alpha coefficient of the scale is 0.888, which has good reliability and validity. (3) Connor-Davidson Resilience Scale (CD-RISC): It was revised by Connor et al. in 2003 to evaluate the psychological resilience of individuals [12]. The scale consists of 25 items, which are divided into three dimensions: (1) tenacity (13 items): strong will and sense of control in the face of challenges; (2) strength (8 items): being able to recover from setbacks and even achieve growth and progress; (3) optimism (4 items): treat difficulties and problems with optimism and maintain a positive attitude. Each item was scored by Likert summated rating scale, with 0 as "never like this" and 4 as "almost always". The total score ranged from 0 to 100. The higher the score was, the better the individual's psychological resilience. The Cronbach's alpha coefficient of the scale is 0.87, which has good reliability and validity. (4) Social Support Rating Scale (SSRS): was used to evaluate people's social support status [13]. The scale consists of 10 items, which are divided into 3 dimensions: objective support (including 3 items), subjective support (including 4 items), and utilization of social support (including 3 items). The total score of the scale ranged from 12 to 72. The higher the score was, the better the individual's social support. The reliability and validity of the scale were 0.802 and 0.893 respectively. (5) Pregnancy Pressure Scale (PPS): A total of 30 items are divided into 4 factors: (1) Parent role, that is, the sense of stress caused by identification with the role of parents (15 items) [14]. (2) Mother and child safety, that is, the sense of stress caused by ensuring the safety and health of mother and child (8 items); (3) Body shape, that is, the sense of stress caused by changes in body shape (4 items); (4) Other pressures (3 items). The scale was scored by Likert summated rating scale, with 0 as "no pressure" and 3 as "severe stress". The higher the score was, the greater the stress of pregnancy. The Cronbach's alpha coefficient of the scale is 0.84.

Investigation method: Five specially trained nurses in our department served as investigators. The pregnant women were investigated with questionnaire survey of CD-RISC, SSRS and PPS. At the same time, the clinical baseline data and perinatal data of pregnant women were collected. The incidence of postpartum PTSD in pregnant women was evaluated by the PCL-C after 6 weeks of postpartum follow-up. Before the investigation, the purpose of the study was briefly stated and the information was promised to be kept confidential so as to obtain the informed consent of the respondents. The survey was carried out one-on-one, and the unified instructions were used to explain the method of filling out the questionnaire, and the respondents completed the questionnaire independently. After the questionnaire was collected, a preliminary inspection was carried out on the spot, and the respondents were asked to complete the missing items on the spot. In this study, 215 pregnant women with possible preterm labor were investigated, excluding 10 cases of invalid questionnaire, 5 cases of refusal and loss of follow-up, 200 cases with complete data were obtained.

Statistical methods

The statistical software SPSS 23.0 was used to analyze the data. The χ^2 test with a test level of bilateral α=0.05 was used for the analysis of the enumeration data, which was expressed as the number of cases (percentage; n (%)). The Mann-Whitney U test was used for inter-group comparison for the measurement data that did not obey a normal distribution, which was expressed as the median (quartile range; M (QR)). The independent sample t-test was used for inter-group comparison for the measurement data that followed a normal distribution, which were expressed as mean ± standard deviation ($\bar{x}$ ± sd), with a test level of bilateral α=0.05. The univariate and multivariate logistics regression were used for the analysis of the influencing factors. The Pearson correlation coefficient was used for evaluation of the correlation. $P<0.05$ indicated that the difference was statistically significant.

Table 1. The comparison of baseline data between PTSD positive group and negative group

items	Grade	Positive group (n=43)	Negative group (n=157)	χ^2	P
Age (years)	<30	21 (17.36)	100 (82.64)	3.118	0.077
	≥ 30	22 (27.85)	57 (72.15)		
Educational level	High school and below	25 (18.12)	113 (81.88)	3.021	0.822
	Junior college or above	18 (29.03)	44 (70.97)		
Occupational condition	On the job	31 (20.26)	122 (79.74)	0.592	0.442
	Off the job	12(25.53)	35 (74.47)		
Monthly per capita household income (yuan)	<3000	27 (20.45)	105 (79.55)	0.251	0.616
	≥ 3000	16 (23.53)	52 (76.47)		
Postpartum time (Months)	≥ 3	22 (14.97)	125 (85.03)	14.032	0.000
	<3	21 (39.62)	32 (60.38)		
Planned pregnancy	Yes	23 (17.97)	105 (82.03)	2.627	0.105
	No	20 (27.78)	52 (72.22)		
Natural conception	Yes	41 (20.92)	155 (79.08)	1.964	0.161
	No	2 (50.00)	2 (50.00)		
First delivery	Yes	26 (14.77)	150 (85.23)	2.263	0.133
	No	17 (70.83)	7 (29.17)		
History of bad pregnancy	Yes	19 (73.08)	7 (26.92)	28.386	0.000
	No	24 (13.79)	150 (86.21)		
Fetal body mass (g)	≥ 1500	25 (14.04)	153 (85.96)	53.287	0.000
	<1500	18 (81.82)	4 (18.18)		
Sleep status (Self-evaluation)	Good	6 (12.24)	43 (87.76)	11.667	0.000
	Poor	37 (24.50)	114 (75.50)		
History of anxiety and depression	Yes	15 (78.95)	4 (21.05)	41.052	0.000
	No	28 (15.47)	153 (84.53)		

Note: PTSD: posttraumatic stress disorder.

Results

Comparison of baseline clinical data between posttraumatic stress disorder (PTSD) positive group and negative group

The total PCL-C score of 200 pregnant women was 30.52±11.38. The scores of each dimension were as follows: reexperience (8.75±4.34), avoidance or numbness (14.51±4.89), increased alertness (7.26±3.69). Among them, 43 cases had PCL-C score ≥ 38, and the positive rate of PTSD was 21.50%. The comparison of baseline data between the PTSD positive group and negative group is shown in **Table 1**.

Comparison of connor-davidson resilience scale (CD-RISC) scores between the PTSD positive group and negative group

The total score of the CD-RISC scale of patients in the PTSD positive group was significantly lower than that of patients in the PTSD negative group (t=8.108, P<0.001). The scores of toughness, strength and optimism of CD-RISC scale in PTSD positive group were significantly lower than those in PTSD negative group (t=2.428, 2.578, 4.504, all P<0.05), as shown in **Figure 1**.

Comparison of the scores of social support rating scale (SSRS) between the PTSD positive group and negative group

The total score of SSRS scale in PTSD positive group was significantly lower than that in PTSD negative group (t=8.766, P<0.001). The scores of objective support, subjective support and social support in PTSD positive group were significantly lower than those in PTSD negative group (t=7.455, t=10.035, t=5.513, P<0.001), as shown in **Figure 2**.

Comparison of the scores of pregnancy pressure scale (PPS) between PTSD positive group and negative group

The total score of PPS scale in the PTSD positive group was significantly higher than that in PTSD negative group (t=6.770, P<0.001). The scores of parental role, mother-child safety, body shape and other stress dimensions of

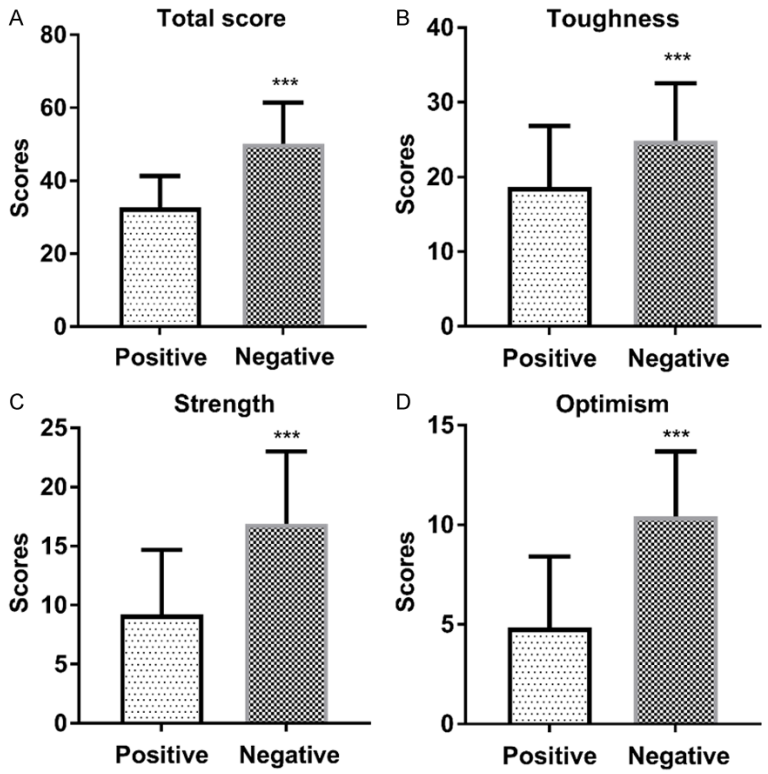

Figure 1. Scores of CD-RISC scale in PTSD positive group and negative group. A: CD-RISC total score; B: Toughness score; C: Strength score; D: Optimism score. Compared with PTSD positive group, ***P<0.001. CD-RISC: Connor-Davidson resilience scale; PTSD: posttraumatic stress disorder.

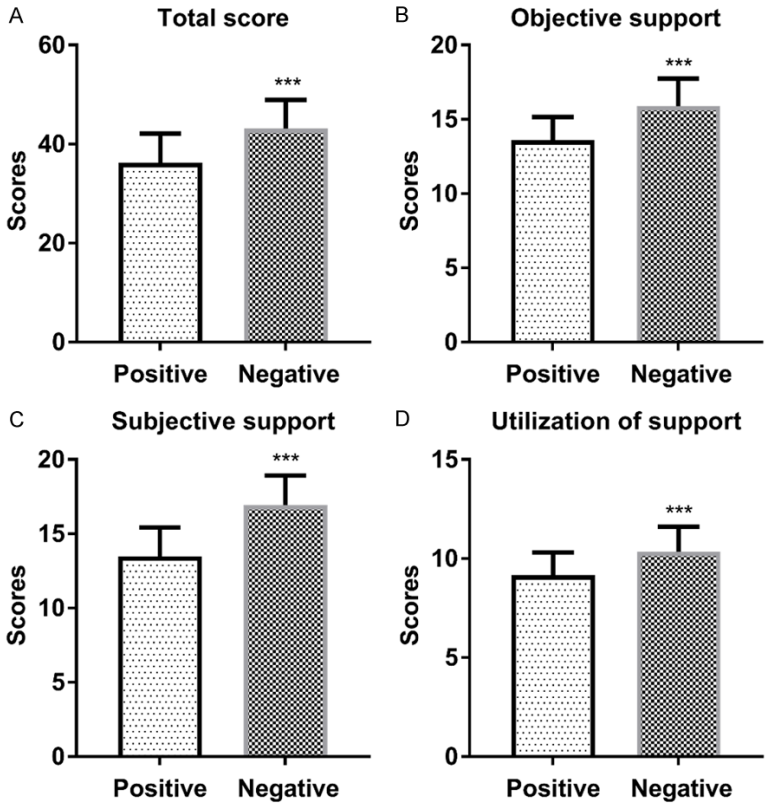

Figure 2. SSRS scale score in PTSD positive group and negative group. A: SSRS total score; B: Objective support score; C: Subjective support score; D: Support utilization score. Compared with the PTSD positive group, ***P<0.001. PTSD: posttraumatic stress disorder; SSRS: social support rating scale.

PPS scale in PTSD positive group were significantly higher than those in PTSD negative group (t=4.019, 2.975, 6.106, 2.503, all P<0.05), as shown in **Figure 3**.

Analysis of influencing factors of PTSD in pregnant women with possible preterm labor

Univariate logistics regression analysis showed that postpartum time, abnormal pregnancy, fetal weight, maternal sleep status, history of anxiety and depression, CD-RISC score, social support and pregnancy stress were the influencing factors of PTSD in women with possible preterm labor (all P<0.05; **Table 2**). Multivariate logistics regression analysis showed that maternal sleep status (OR=3.156), pregnancy stress (OR=3.274) and history of anxiety and depression (OR=5.174) were independent risk factors for PTSD in possible preterm labor (P<0.001), while maternal CD-RISC score (OR=0.259), social support (OR=0.468) and fetal weight (OR=0.568) were protective factors for PTSD in possible preterm labor (P<0.05), as shown in **Table 3**.

Correlation analysis between PTSD and psychological resilience of pregnant women with possible preterm labor

Pearson correlation analysis showed that the total PCL-C

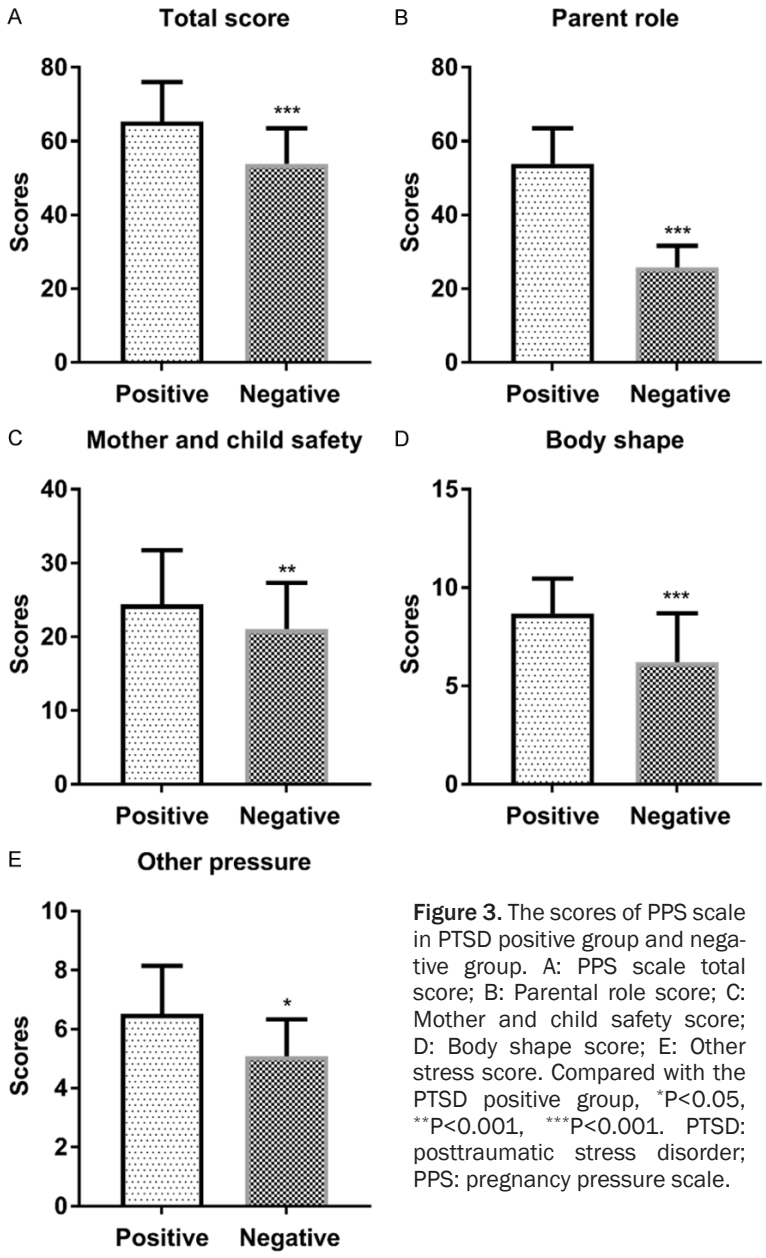

Figure 3. The scores of PPS scale in PTSD positive group and negative group. A: PPS scale total score; B: Parental role score; C: Mother and child safety score; D: Body shape score; E: Other stress score. Compared with the PTSD positive group, $^{*}P<0.05$, $^{**}P<0.001$, $^{***}P<0.001$. PTSD: posttraumatic stress disorder; PPS: pregnancy pressure scale.

score of pregnant women with possible preterm labor was negatively correlated with the total CD-RISC score and scores of all dimensions (P<0.001), as shown in **Figure 4**.

Discussion

The results of this study showed that 43 of the 200 pregnant women had PCL-C scores ≥ 38, with a 21.5% positive rate of PTSD. This was higher than the postpartum PTSD incidence (1%) of puerpera that was reported by Stramrood et al., and lower than the PTSD incidence (60%) of premature mothers admitted to the ICU that was reported by Aftyka et al. [15, 16]. This may be due to the inclusion criteria of the research subjects, and the differences in cultural background, assessment tools, time for the conduction of the survey, and so on [6]. Preterm labor is the leading cause of neonatal morbidity and death, which can lead to neonatal asphyxia, abnormal craniocerebral development and other diseases. About 15% of premature infants die in the neonatal period due to immature body organs and inability to survive well in the exterior environment [17, 18]. McDonald et al. pointed out that the risk of preterm labor can significantly increase the psychological stress of pregnant women and induce depressive symptoms [2]. Most of the pregnant women with possible preterm delivery were admitted to the hospital in the emergency department, and they experienced a strong psychological stress reaction due to sudden onset, lack of mental preparation, while facing the risk of preterm labor [1]. The admission of premature infants to NICU treatment is an especially important source of maternal mental pain, including the separation of mothers and infants caused by NICU management, the uncertainty of the prognosis of premature infants, and the high cost of treatment, all of which make pregnant women have great psychological pressure and can lead to the incidence of PTSD [16].

Logistics regression analysis showed that maternal sleep status, pregnancy stress and history of anxiety and depression were independent risk factors for PTSD in pregnant women with possible preterm labor. The quality of sleep subjectively felt by pregnant women

Table 2. Univariate Logistic regression analysis

Related factors	OR	95% CI	P
CD-RISC score	0.203	0.084-0.489	0.000
Maternal sleep status	4.563	3.356-6.639	0.000
Postpartum time	0.853	0.248-1.089	0.009
Pregnancy stress	4.063	2.449-6.789	0.000
History of anxiety and depression	6.374	3.646-9.433	0.000
Social support	0.453	0.056-0.189	0.006
Abnormal pregnancy	1.342	0.958-1.589	0.031
Fetal weight	0.402	0.239-0.758	0.037

Note: CD-RISC: Connor-Davidson resilience scale.

Table 3. Multivariate logistics regression analysis

Related factors	OR	95% CI	P
CD-RISC score	0.259	0.092-0.558	0.000
Maternal sleep status	3.156	1.863-6.344	0.003
Pregnancy stress	3.274	1.953-5.493	0.004
History of anxiety and depression	5.174	2.853-7.873	0.001
Social support	0.468	0.213-0.863	0.038
Fetal weight	0.568	0.393-0.843	0.007

Note: CD-RISC: Connor-Davidson resilience scale.

has a direct impact on the onset of PTSD. Pregnant women with good sleep quality had a lower risk of developing PTSD, while pregnant women with poor sleep quality had a significantly higher risk of developing PTSD. Sleep quality is a common problem that affects the physical and mental health of all pregnant women [19]. Studies have reported that there may be a two-way relationship between sleep quality and psychological stress, which is mainly related to the imbalance of the neuroendocrine system [20]. According to the physiological mechanism of stress, when an individual is in a stressed state, the neuroendocrine system can be overactivated to secret a large amount of neuroregulatory hormones to make the body and mind be in a state of preparation, leading to insomnia and a series of mental stress symptoms and continuous increased alertness [21].

Pregnancy pressure is an important factor that affects the pathogenesis of PTSD. This is consistent with the study of Dunkel et al. [22]. Pregnancy stress can aggravate anxiety, depression and other bad emotions of pregnant women to a certain extent, and it can reduce the level of mental health, impair their ability to effectively cope with adverse events such as preterm labor, thereby increasing the risk of PTSD [23].

The history of anxiety and depression of pregnant women can also increase their risk of developing PTSD. Jani et al. showed that negative emotions such as anxiety and depression are significantly and positively correlated with PTSD symptoms [24]. Anxiety and depression can enhance the activation level of sympathetic nervous system, leading to physiological reactions such as blood pressure fluctuation and increased heart rate, which can make the body be in a state of stress [25]. Ayers et al. also pointed out that among the various factors leading to PTSD, a history of mental illness accounts for a relatively high proportion of people who suffer from PTSD, especially preexisting anxiety, depression and other emotional disorders which were significantly related to PTSD [23]. Anxiety and depression are closely related to negative coping styles, and individuals with ineffective coping measures are more likely to develop PTSD [26]. Effectively alleviating the anxiety and depression of preterm pregnant women can reduce the occurrence of PTSD [27].

The results also showed that the CD-RISC score, social support and fetal weight were the protective factors of PTSD in pregnant women with possible preterm labor. The correlation analysis found that the total score of PCL-C in pregnant women with possible preterm labor was negatively correlated with the total score of CD-RISC and the scores of all dimensions. The higher the level of psychological resilience of pregnant women, the lower the risk of PTSD. This is consistent with the conclusions of many other studies [8, 28]. Psychological resilience is a positive psychological factor for individuals to cope with traumatic events. Mautner et al. pointed out that the higher the level of psychological resilience in pregnant women, the better their quality of life and the lighter their depressive symptoms [8]. Davydov et al. also reported that psychological resilience is a protective factor for individuals with depressive symptoms [9]. It is conducive to maintain positive emotions and adjust the relationship between psychological rehabilitation and stress, which may be an important reason for reducing the risk of PTSD.

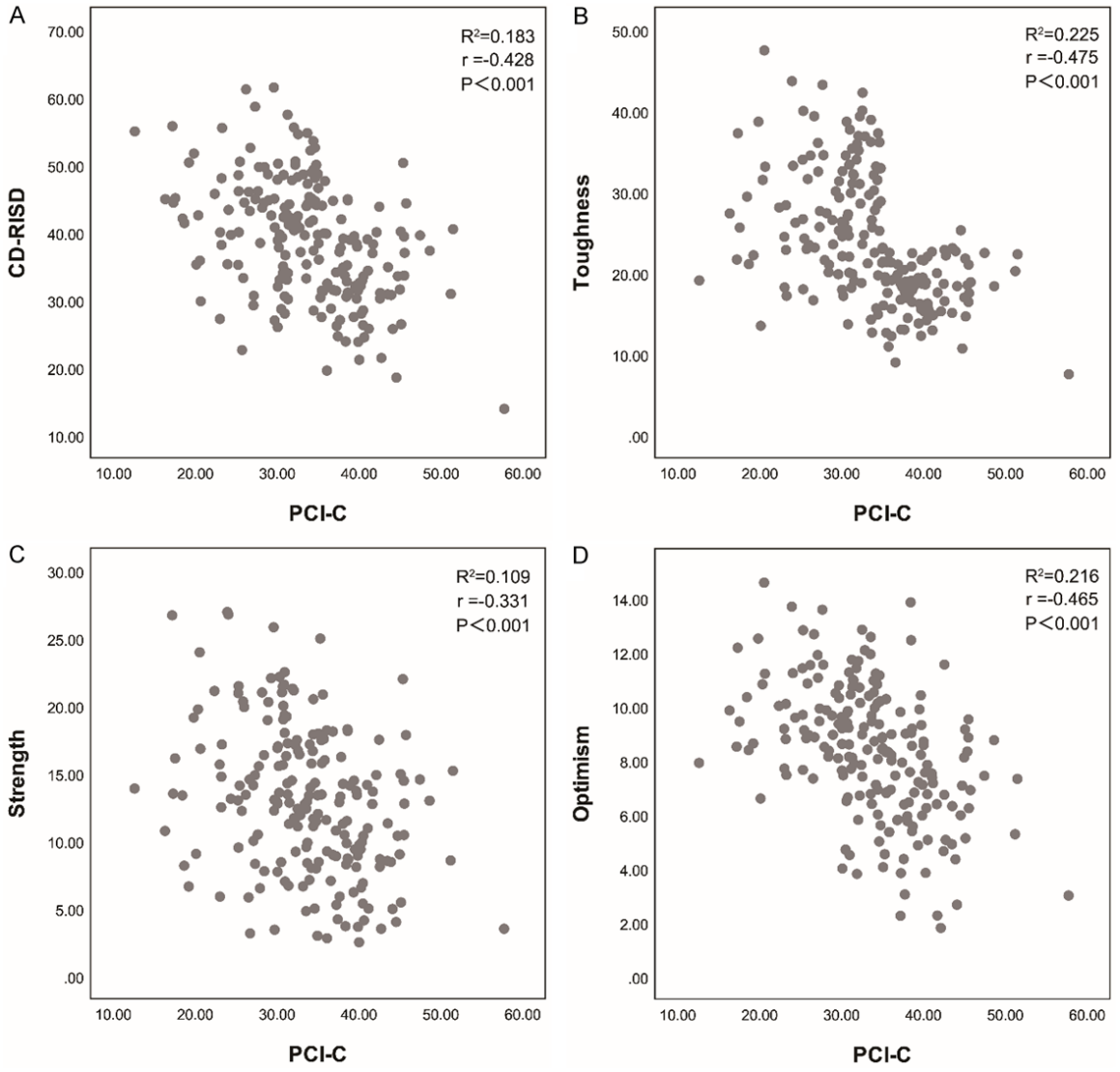

Figure 4. The correlation between PCL-C and CD-RISC scores in pregnant women with possible preterm labor. A: The correlation between PCL-C and CD-RISC total score, r=-0.428, P<0.001; B: The correlation between PCL-C and toughness score, r=-0.475, P<0.001; C: The correlation between PCL-C and strength score, r=-0.331, P<0.001; D: The correlation between PCL-C and optimism score, r=-0.456, P<0.001. CD-RISC: Connor-Davidson resilience scale; PCL-C: posttraumatic stress checklist-civilian version.

Our research shows that increasing the level of social support for pregnant women can also reduce their risk of developing PTSD. Social support is an important psychosocial resource for individuals to deal with life crises and traumatic events. Individuals can get help with emotional, psychological and information through contact with society, so as to alleviate stress [28]. Better social support can improve emotional experiences and adaptability, which is an important type of support for patients to face disease, overcome pain and enhance self-confidence. Individuals actively seek social support after trauma exposure, which can promote cognitive reconstruction and reduce the adverse effects of traumatic events [27].

Fetal weight is also an important factor affecting pregnant women's PTSD, which is consistent with the research conclusions of Chang et al. [29]. They believe that body weight is often a subjective index for most pregnant women to judge the birth of premature infants, and that too low of a premature birth weight will bring pessimistic expectations to pregnant women and increase the risk of PTSD. However, some

studies believe that maternal PTSD was unrelated to neonatal gestational age, birth weight, Apgar score and other factors, but was related to parental role adaptation and the uncertainty of prognosis of neonatal diseases [16]. The correlation between fetal health status and maternal PTSD and its specific mechanism needed to be further verified by more studies.

This study has limitations. First of all, the sample selection is limited as our study is retrospective, and there may be some bias in the baseline characteristics such as age, previous medical history and pregnancy in the patients between the two groups. Secondly, the level of PTSD and psychological resilience of parturients is still a dynamic process. The study evaluated the incidence of PTSD only 6 weeks after delivery, but in fact, some patients may have developed the disease before, while some patients may have it later. So there is a certain subjectivity and bias in our evaluation of PTSD.

To sum up, maternal sleep status, pregnancy stress, history of anxiety and depression are independent risk factors for PTSD from possible preterm labor, while the level of psychological resilience of pregnant women is the protective factor for PTSD with possible preterm labor. Active psychological intervention for pregnant women with possible preterm labor is helpful to reduce the risk of PTSD.

Disclosure of conflict of interest

None.

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