Original Article

A study of the relationship between mental health and menstrual abnormalities in female middle school students from post-earthquake Wenchuan

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Summary **The present field investigation sought to explore the relationship between mental health and abnormal menstruation in female middle school students from post-earthquake Wenchuan following the 2008 Sichuan earthquake (the earthquake's epicenter was in Wenchuan County, Sichuan Province). A total of 587 female middle students from post-earthquake Wenchuan were given the PCL-C, SCL-90, and a menstruation questionnaire. Outcomes were measured by diagnostic criteria. The general incidence of PTSD was 60.8%, and D symptoms were the most prevalent PTSD symptoms (49.6%). Of symptoms indicated by the Symptom Checklist, obsessive-compulsive traits were most prevalent (94.6%), followed by interpersonal sensitivity (91.9%). The incidence of abnormal menstruation was 76.6%. Incidence of abnormal menses among students who screened positive for PTSD was significantly higher than among students who did not (χ^2 = 4.015, p = 0.045). The incidence of abnormal menses was higher among students who screened positive for somatization, obsessive-compulsive traits, phobic anxiety, and diet and sleep disorders than among those who did not (p < 0.05). In conclusion, there was a relationship between mental health and physical health in female middle school students in a post-earthquake area. A higher incidence of abnormal menstruation may occur in students with PTSD, somatization disorder, obsessive-compulsive disorder, phobic anxiety, and diet and sleep disorders. Therefore, psychological intervention is particularly necessary for female students who have survived a natural disaster like an earthquake.**

Keywords: Earthquake, abnormal menstruation, post-traumatic stress disorder (PTSD), mental health, female middle school student, relationship

1. Introduction

The 8.0 degree earthquake that occurred in Wenchuan County and surrounding areas of Sichuan Province on May 12th, 2008 resulted in an enormous loss of life and property for residents and also seriously affected the physical and mental health of survivors. History has shown that a massive disaster will result in varying degrees of impacts to people's mental health (*1*). Posttraumatic stress disorder (PTSD) is an anxiety disorder that occurs in the aftermath of a traumatic event (*2*). Examples are combat, rape and natural disasters. There are three major types of PTSD symptoms. First, the traumatized person generally develops a heightened startle response and easy arousability and irritability. Second, they are vulnerable to having memories of the trauma come flooding back into their minds at unexpected moments (flashbacks). Third, they will go to great lengths to avoid thinking about the trauma. These avoidance measures vary from not going near anything that reminds them of the trauma to dissociation. PTSD is the most common psychopathological symptom after

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disaster and may seriously affect the regular lives of survivors (*3*). PTSD can also cause survivors various psychological problems such as fear, helplessness, horror, depression, anxiety, hostility, paranoia, and diet and sleep disorders accompanying the threat of injury and death (*4,5*). An earthquake, as a strong stress factor, can lead to functional disorders by affecting the pituitary *via* the cerebral cortex and hypothalamus. Adolescent female students are in a period of dramatic physiological and psychological changes and may have emotional changes, feel powerless, have premature mental processes, and lack the ability to deal with stress. They may thus be more prone to develop psychological disorders, subsequently leading to physiological abnormalities. This study sought to ascertain how mental health affects the physical health of female students by analyzing psychological stress, mental health disorders, and menstrual abnormalities and their relationship to psychological states.

2. Methods

2.1. *Subjects*

A cluster sampling method was used to select 587 female middle school students in grades seven and eight who transferred from Wenchuan to Chengdu to continue their studies. This study took place 9 months after the Wenchuan earthquake on May 12, 2008.

2.2. *Instruments of the survey*

2.2.1. *Questionnaire on general condition*

To collect personal data and ascertain the general status of subjects, subjects were given a questionnaire asking about their sex, age, grade, ethnicity, residence before the earthquake, injuries, and property damaged by the earthquake.

2.2.2. *Questionnaire on general condition*

Symptoms of PTSD were evaluated using the PTSD Checklist-Civilian Version (PCL-C) including 3 symptoms and a total of 17 items. B symptoms of intrusion were indicated by 5 items, C symptoms of avoidance were indicated by 7 items, and D symptoms of high-alertness were indicated by 5 items.

2.2.3. *NOSIMH mental health self-rating scale (Symptom Checklist 90, SCL-90)*

Symptom Checklist 90 (SCL-90) is an instrument to assess mental health and consists of 90 items concerning aspects like emotions, thoughts, consciousness, behavior, living habits, interpersonal relationships, diet, and sleep.

2.2.4. *Menstruation questionnaire*

To collect menstruation-related information on subjects, students were given a menstruation questionnaire asking their age of menarche and whether they had signs of abnormal menstruation (epimenorrhea, oligomenorrhea, irregular menstruation, hypermenorrhea, amenorrhea, and dysmenorrheal).

2.3. *Survey methods*

A survey of female middle students was conducted by trained research assistants (with onsite supervision by psychologists) with a pre-structured questionnaire. The questionnaires were self-administered to classes as a whole and collected on the spot.

2.4. *Diagnostic criteria*

2.4.1. *PTSD diagnostic criteria according to the PCL-C*

According to the U.S. Diagnostic and Statistical Manual of Mental Disorders: 4th Edition (DSM-IV) (*6-8*), the PCL-C contains 17 yes/no items, with answers on a 4-point scale from 1 ("mild") to 2 ("moderate"), 3 ("severe"), and 4 ("very severe"). An "asymptomatic" answer was given a score of 0. A total PTSD symptom score was obtained by tallying all items. A higher total score suggests a greater possibility of PTSD occurring. A score sheet provides instructions for tabulation of the total score, and B, C, and D symptom subscale scores. An individual with a score higher than 38 was classified as screening positive for PTSD. If the individuals has a score ≥ 2 points for one or more items in the five items for group B symptoms, she is classified as screening positive for group B symptoms. If the individual has a score ≥ 2 points for three or more items in the seven items for group C symptoms, she is classified as screening positive for group C symptoms. If the individual has a score ≥ 2 points for two or more items in the five items for group D symptoms, she is classified as screening positive for group D symptoms.

2.4.2. *SCL-90 diagnostic criteria (9,10)*

The Symptom Checklist-90 (SCL-90) is a 90-item self-report symptom inventory with ten scales for symptoms (F1-F10) including somatization, obsessive-compulsive traits, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and diet and sleep. Each symptom scale consisted of several items. The questionnaire contains 90 yes/no items with a 5-point scale to measure responses ranging from 1 ("asymptomatic") to 5 ("very severe").

2.4.3. *Abnormal menstruation (11)*

An individual who comply with any one of the following symptoms, can be sentenced for abnormal menstruation: *i*) Epimenorrhea: Menstrual cycle shorter than 24 days. *ii*) Oligomenorrhea: Menstrual cycle longer than 35 days. *iii*) Irregular menstruation: Irregular menstrual cycle, heavy/little menstruation or longer menstrual period (≥ 7 days). *iv*) Hypermenorrhea: Regular metrorrhagia with heavy menstruation or long menstrual period (amount of bleeding ≥ 80 mL). *v*) Amenorrhea: Cessation of menstruation for 6 months or more than 3 months after the original self-menstrual cycle. *vi*) Dysmenorrhea.

2.4.4. *Data analysis*

The initial data was input using Epi Data 3.0 and the prevalence rates of symptoms of PTSD and SCL-90 and other characteristics were calculated and analyzed using SPSS version 13.0. Comparison of the rate used Chi-square test with the inspection level $\alpha = 0.05$.

3. Results

3.1. *Demographic characteristics*

A total of 587 middle students were surveyed; 586 questionnaires were collected with 569 valid responses. The valid response rate was 97.1%. Of 569 students participating in the survey, 246 (43.2%) were in grade seven and the remaining 323 (56.8%) were in grade eight. Two hundred and sixty-one (45.9%) were living in town before the earthquake and 308 (54.1%) were living in the country. Two hundred and ninety-one students (51.1%) were of the Qiang ethnic minority, 178 (31.3%) were of the Tibetan ethnic minority, 62 (10.9%) were of Han ethnicity, and 38 (6.7%) were of another ethnic minority. Of the students, 25 (4.4%) who were injured and 404 (71.0%) students suffered serious loss in household property in the earthquake.

3.2. *PTSD screening results*

Results of screening students for PTSD indicated that 346 (60.8%) were positive for symptoms, and the prevalence of D symptoms of PTSD was significantly higher among the students (49.6%) (Table 1).

3.3. *Mental health*

Of 569 students participating in the survey, their maximum score on the SCL-90 was 450, their minimum was 90, and the median was 141. The SCL-90 indicated that the most prevalent symptoms were obsessive-compulsive traits, followed by interpersonal sensitivity (Table 2).

Table 1. Results of screening 569 female students for PTSD

Group of symptoms	Total	Positive students	Prevalence (%)
B group (re-experience)	569	255	44.8
C group (avoidance)	569	106	18.6
D group (high-alertness)	569	282	49.6

Table 2. Results of mental health screening of 569 female students with the SCL-90

SCL-90 symptom scales	Total	Positive students	Prevalence (%)
Somatization	569	429	75.4
Obsessive-compulsive	569	538	94.6
Interpersonal sensitivity	569	522	91.9
Depression	569	507	89.3
Anxiety	569	490	86.1
Hostility	569	462	81.2
Phobic anxiety	569	488	85.8
Paranoid ideation	569	457	80.3
Psychoticism	569	480	84.4
Diet and sleep	569	496	87.2

3.4. *Abnormal menstruation in female middle school students*

There were 436 students who had a problem for abnormal menses among the 569 students participating in the survey (the incidence of abnormal menstruation was 76.6%). The incidences of abnormal menstruation among different grade, nationality, habitual residence before the earthquake, injuries and damage of property in earthquake were not statistically significant ($p > 0.05$).

3.5. *Relationship between PTSD and abnormal menstruation*

The prevalence of abnormal menses among students who screened positive for PTSD and those who did not was 79.5% (275) and 72.2% (161), respectively ($\chi^2 = 4.015$, $p = 0.045$). The difference in the prevalence of abnormal menses among students who screened positive for B, C, and D symptoms and those who did not was not statistically significant ($p > 0.05$) (Table 3).

3.6. *Relationship between mental health and abnormal menstruation*

Among the 569 students participating in the survey, the prevalence of abnormal menses was higher among students who screened positive for somatization, obsessive-compulsive traits, phobic anxiety, and diet and sleep disorders than among those who did not ($p_{somatization} < 0.05$, $p_{obsessive\ -\ compulsive} = 0.038$, $p_{anxiety} = 0.002$, $p_{diet\ and\ sleep} = 0.019$) (Table 4).

4. Discussion

Health is not only the absence of disease and illness but is also a comprehensive state of physical, mental, and

Table 3. Distribution of PTSD and abnormal menstruation in 569 female students

Variable	Result	Students	Cases of abnormal menses (%)	χ^2	p
PTSD	negative	223	161 (72.2)	4.015	0.045
	positive	346	275 (79.5)		
Group of symptoms					
PTSD-B	negative	314	233 (74.2)	2.294	0.130
	positive	255	203 (79.6)		
PTSD-C	negative	463	351 (75.8)	0.923	0.337
	positive	106	85 (80.2)		
PTSD-D	negative	287	211 (73.5)	3.120	0.077
	positive	282	225 (79.8)		

Table 4. Distribution of mental health disorders and abnormal menstruation in 569 female students

Variable	Result	Students	Cases of abnormal menses (%)	χ^2	p
Somatization	negative	140	88 (62.9)	19.654	< 0.05
	positive	429	348 (81.1)		
Obsessive-compulsive	negative	31	19 (61.3)	4.305	0.038
	positive	538	417 (77.5)		
Interpersonalsensitivity	negative	47	34 (72.3)	0.525	0.469
	positive	522	402 (77.0)		
Depression	negative	62	42 (67.7)	3.066	0.080
	positive	507	394 (77.7)		
Anxiety	negative	79	57 (72.2)	1.025	0.311
	positive	490	379 (77.3)		
Hostility	negative	107	76 (71.0)	2.305	0.129
	positive	462	360 (77.9)		
Phobic anxiety	negative	81	51 (63.0)	9.843	0.002
	positive	488	385 (78.9)		
Paranoid ideation	negative	112	81 (72.3)	1.442	0.230
	positive	457	355 (77.7)		
Psychoticism	negative	89	64 (71.9)	1.310	0.252
	positive	480	372 (77.5)		
Diet and sleep	negative	73	48 (65.8)	5.527	0.019
	positive	496	388 (78.2)		

social adaptability. Since the concept of stress was put forward by Selye, the relationship between psychosocial factors as a stressor and physical and mental health has garnered widespread attention (*12*). Cannon WB (*13*) found that the state of emotion significantly affects the physiological processes of individuals. He also pointed out that release of the hormone endocrine can be affected by intense changes in emotion *via* the nervous system by way of the hypothalamus. As a result, the cardiovascular system will be affected. This tends to lead to physiological dysfunction and eventually worsens into a pathological change if the harmful emotion is repeated experienced.

This survey used a PTSD self-rating scale (PCL-C) and self-reported symptoms checklist (SLC-90) to evaluate the mental health of female students from an area stricken by the Wenchuan earthquake. Results indicated that the prevalence of PTSD was 60.8% and that the prevalence of each symptom on the SLC-90 was between 75.4%-94.6%. The students suffered a significant psychological trauma, especially in areas such as re-living the event, avoidance, high-alertness, somatization, obsessive-compulsive traits, phobic anxiety, sleep, and diet, since they have experienced the process of evacuation and awaiting rescue, some have witnessed the deaths of loved ones, and many lost their homes in the earthquake. A report by World Health Organization noted that victims of disasters have a serious physical and psychological reaction to the event (*14*).

A study by Hu and Liang found that the prevalence of PTSD was about 7.8%-80.0% in individuals who suffered severe trauma (*15*). Another study of the survivors of the 6.8 earthquake in Marathwada, India on September 30th, 1993 noted that 59% had problems like mental disorders (*16*).

The current study found that the prevalence of abnormal menses was higher among students who screened positive for PTSD and somatization, obsessive-compulsive traits, phobic anxiety, and diet and sleep disorders than among those who did not. This suggests that a strong stress response may lead to impaired regulation of psychological processes and the nervous and endocrine systems or of psychological processes and the nervous and immune systems. This thus leads to abnormal menstruation according to theories that blame activation of the hypothalamus-pituitary-adrenal axis (HPA), consistently increasing serum cortisol, consistently decreasing growth and sex hormones, impaired ovulation, or a poor response to estrogen and progestin (*17*).

5. Conclusion

One of the most significant causes of an endocrine disorder in female students is a strong stress response. Some physical problems caused by psychological problems may affect adolescent female students' lives for a long time and may even become incurable. Post-disaster psychological intervention has become an essential part of disaster relief work in many countries. Therefore, in light of the physical and psychological problems noted after the Wenchuan earthquake positive intervention should be considered in order to relieve PTSD and other physical/psychological problems, helping victims recover psychologically and physically and restoring their mental health (*18*).

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