

A Relevant Research On the Neurotransmitter and Immune Level of First Aid Nurses' Post Traumatic Stress Disorders

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Abstract

Aim: The aim of the research is to discuss the current situation and related factors concerning first aid nurses' PTSD. This research also compares the neurotransmitter and immune-related factors of first aid nurses who went through PTSD to first aid nurses without PTSD and healthy people.

Method: This research conducts PTSD self-test form (PCL-C) on three groups of respondents: first aid nurses with PTSD, first aid nurses without PTSD and healthy control group. The research uses ABC-ELISA method to measure plasma monoamine neurotransmitters and serum cell factors with the ELISA provided by Shanghai Xitang Biology Limited Company.

Result

- The scoring difference of PTSD group, non-PTSD group and healthy control group has statistical sense ($P < 0.05$)
- The comparative levels of PTSD, non-PTSD and healthy group's IL-2, IL-6, IL-10 and TNF- α level in serum cell factors all have significance ($p < 0.05$).
- The comparative levels of PTSD, non-PTSD and healthy groups' plasma monoamine neurotransmitter norepinephrine, 5-hydroxytryptamine and dopamine all have significance.
- Conclusion: First aid nurses should be given mental intervention and guidance in the early stage to reduce the occurrence of PTSD.

Keywords: First Aid; Neuroimmunology; Nurses; PTSD

Introduction

PTSD (Post-Traumatic Stress Disorder) is a delayed and lasting mental disorder caused by extreme, threatening or disastrous psychological trauma [1]. PTSD is an important manifestation of post traumatic psychological and behavior disorder [2]. Its symptoms mainly appear as flashbacks of trauma (re-experiencing), avoidance of trauma-related clues (avoidance), lasting hyperarousal (hyperarousal) and selective Amnesia and emotional numbing toward traumatic experience (emotional numbing).

In recent years, more and more researches concerning PTSD emerge with increasing natural disasters, wars and terrorist accidents.

Research on PTSD's aetiopathogenesis is rather challenging and falls behind compared to that of PTSD's epidemiologic study. The particularity of pre-hospital rescue determines that department of emergency nurses have greater work intensity, higher risk, worse protective measures and more nurse-patient conflicts than ordinary nurses [3]. First aid nurses are exposed to higher risks and more conflicts with patients but with worse safeguard procedures. These traumatic events may cause nurses to have negative mental reactions, which can ultimately trigger PTSD. The aim of this study was to compare the differences in neurotransmitter and immune-related factors between pre-hospital emergency nurses who experienced traumatic events and pre-hospital emergency nurses who did not develop PTSD, and to explore their association with the severity of PTSD [4].

Information and Methodology

General Information

Inclusion criteria: All selected patients meet the criteria for PTSD diagnostic criteria; Ages fall between 22 and 55; All patients are self-conscious and have signed informed consent. Exclusion criteria: Patients with psychosis history or depression history; Patients with organic diseases; Pregnant and suckling women. Twenty first-aid nurses with PTSD working in Hainan medical college No.2 subordinate hospital (Hainan agricultural reclamation headquarter hospital) and Hainan people's hospital from Sep. 2016 to May 2017. The research adopts a random method to select a group of thirty non-PTSD first aid nurses and a group of thirty healthy people.

Methodology

The evaluation method of PTSD

This research adopted PCL-C (PTSD Checklist-Civilian Version) evaluation form, which is designed for measure the post traumatic experience of ordinary people in their daily life. This form asks the respondents to grade their disturbance by problems and complaints in the past month according to five levels: 1. 'Not at all', 2. 'A little bit', 3, 'Moderate'. 4. 'A great scale'. 5. 'Extremely severe'. The disturbances are categorized into four factors as the following: hyper arousal; avoidance; re-experiencing and lack of functional social reactions. The overall points of the form are summed up (17-85). The higher points a respondent gets, the more likely PTSD may happen to him or her. When the score is ≥ 50 , it is determined to have PTSD. This study used this scale to assess the distribution and status of PTSD in nurses in emergency hospitals.

The collection and index measurement of patient specimens

The serum cell factor measurement of plasma mono amine neurotransmitter by ABC-ELISA method with the enzyme linked immune absorbent assay kit provided by Shanghai Xitang Biology Technology Limited Company. The research studies and measures the monoamine neurotransmitter (norepinephrine and dopamine) and cell factors (IL-2, IL-6, IL-10 and TNF-a) of 55 PTSD nurses, 80 non-PTSD nurses and 80 healthy people.

Statistical Methodology

Analysis was performed using SPSS19.0 statistical software. First check whether the data conforms to the normal distribution, and the test level is $\alpha=0.05$. The PCL-C scores, serum cytokines, NE

and 5-HT levels of the three groups were recorded in SPSS. The skewness coefficient and kurtosis coefficient were compared. The skewness coefficients were Skewness=0.233, Skewness=0.389, Skewness= 0.541, the kurtosis coefficients were Kurtosis=0.799, Kurtosis=0.866, Kurtosis=0.913, and the two coefficients of the three groups of data were less than 1 in each group, which can be considered as a normal distribution. Therefore, the comparison between the data of each group is independent. Statistical method for analysis of variance, description of measurement data is expressed as mean \pm standard deviation ($\bar{x} \pm s$)

Result

The Comparison of Two Groups of Patients' General Information

There were 55 patients in the PTSD nurse group, 80 non-PTSD nurse groups and healthy people. PTSD nurse group: 4 males and 51 females with an average age of 41.60 ± 8.45 years and a disease course of 5 weeks to 1.5 years. Non-PTSD nurse group: 5 males and 75 females with an average age of 38.96 ± 8.57 years. Healthy people group: 8 males, 72 females, with an average age of 35.98 ± 5.80 years. There were no significant differences in gender and age between the three groups ($P > 0.05$). General demographic information is shown in the table below, see form No.1 (Table 1).

Project	Grouping	N	%
Gender	Female	198	92.00
	Male	17	8.00
Generation	31-39	107	49.76
	40-49	68	31.62
	≥ 50	40	18.62

Table 1: Form No.1: General demographic data characteristics (N=215).

The Grading Comparison Among the Three Groups

Pre-hospital first-aid nurses were assessed for post-traumatic stress disorder screening scale (PCL-C) 1 month after the traumatic event. This scale is internationally versatile and is designed to evaluate the post-traumatic experience of ordinary people in their daily lives. The assessment was conducted by a psychologist and assessed by two psychiatric clinicians. The score of the scale is 38-47. When the total score of PCL-C is greater than or equal to 50, it is diagnosed as PTSD. Statistic results: There was a significant difference in the total scores of PCL-C between the PTSD nurse group, the non-PTSD nurse group and the healthy group ($P < 0.05$). See form No.2 (Table 2).

Dimension	PTSD nurses group (N=55)	non-PTSD nurses group (N=80)	healthy people group (N=80)	P
PCL-C Scoring	54.55±5.67	41.68±3.59	29.55±3.86	0
Re-Experiencing	3.11±0.75	2.13±0.69	1.84±0.62	0
Avoidance/Numbing	1.99±0.78	1.69±0.70	1.52±0.64	0.072
Hyperarousal	3.11±0.92	1.92±0.81	1.82±0.88	0

Table 2: Form No.2: The scoring comparison of PTSD nurses group, non-PTSD nurses group and healthy people group ($\bar{x} \pm s$).

The Comparison of Serum Cell Factors Level

The different level of serum cell factors IL-2, IL-6, IL-10, TNF-a of PTSD group, non-PTSD group and the healthy control group has significance($p < 0.05$). See Form NO.3 (Table 3).

	PTSD nurses group (N=55)	Non-PTSD nurses group (N=80)	Healthy people group (N=80)	F	P
IL-2	39.83±13.12	33.94±12.75	28.33±12.12	5.052	0.009
IL-6	56.37±21.62	44.12±20.86	29.65±22.63	9.183	0.000
IL-10	62.48±34.19	42.56±24.18	13.090±11.13	27.791	0.000
TNF- α	37.61±4.41	39.13±5.17	19.26±4.32	29.08	0.000

Table 3: Form No.3 The comparison of IL-2, IL-6, IL-10, TNF-a level of PTSD group, non-PTSD group and healthy control group ($\bar{x} \pm s$, pg/ml).

The Comparison of Plasma Mono Amine Neurotransmitters

The different levels of plasma mono amine neurotransmitters (5-hydroxytryptamine and dopamine) all have significance($p < 0.05$). See Form No.4 (Table 4).

Dimension	PTSD group (N=55)	Non-PTSD group (N=80)	Healthy control group (N=80)	F	P
NE	0.96±0.59	0.65±0.41	0.57±0.36	4.711	0.012
5-HT	627.09±100.81	517.03±79.21	465.85±80.44	26.019	0.000

Table 4: Form No.4: The level comparison of PTSD group, non-PTSD group and healthy control group (ng/ml).

Discussion

Post-Traumatic Stress Disorders (PTSD) is also called delayed psychogenic reaction, the delayed reaction caused by critical events or situations. This diagnosis originated in the third edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-III) published in 1980. Along with the gradual accumulation of related study result, PTSD's diagnosis norm was considerably revised in DSM-III-R and DSM-IV. The books CCMD-II-R published in China in 1993 and the tenth edition of Medical Coding Reference (ICD-10) all include this category (Davidson JRT, 1995; Kessler RC, 1995; Stein MB, 1997). PTSD refers to the delayed or chronic mental disorder after patients experienced critical or disastrous mental strike. Such experiences usually take place several days or even several months (barely over six months) after the trauma. The course of disease of

PTSD can reach a length of many years.

Researchers besides J.C.Guo [5] Conducted a questionnaire on the Victims of the 5500 Typhoon-hit Disasters Victims in Hainan Province. This study indicates the occurrence rate of PTSD symptoms is 61.93% after Weimaxun Hurricane affected Hainan Province. 7.8% of all the victims showed obvious PTSD symptoms, which shows Weimaxun Hurricane causes relatively severe mental issues to Weimaxun victims. Our survey finds out that youth and middle-aged people have a higher prevalence rate, which indicates young people and middle-aged people have lower bearing capacities and are more likely to be attacked by mental issues. This finding suggests youth and middle-aged people should be given more attention when mental health services are conducted in disaster-affected regions. Some foreign researchers indicate first aid personnel have a higher occurrence rate of PTSD.

With the founding and perfection of Chinese Emergency Medical Social System (EMSS), more and more nurses devote themselves to first aid work. The complicated climate, state of illness and harmful visual stimulation and all kinds of traumatic events may trigger negative mental reactions to first aid nurses and ultimately induce PTSD. A large number of studies have shown that [6], lasting PTSD syndrome will not only cause harm to the physical conditions of first aid personnel but also have an adverse effect on their mental states, which will lead to the deterioration of their first aid work quality. With the founding and perfection of Chinese Emergency Medical Social System (EMSS), more and more nurses devote themselves to first aid work. First aid refers to a joint name of on-the-site rescue, transferring and monitoring to victims who suffered from life-threatening emergency, trauma, poisoning or disastrous events outside the hospital environment, namely the rescue of patients from the moment their diseases attack or trauma occurs. The features of first aid relief are more emergency incidents, high randomness, changing and complicated state of illness and poor rescue conditions. The environment where first aid nurses rescue patients and the patient they rescue are considerably different from those they face in a hospital environment. First aid personnel may face complicated climate, steep traffic routes, crowded population, narrow space, dim light and negative emotions of patients and their family members like anxiety and fear but still need to rescue with full use of every minute, which adequately reflects the feature of 'Time is life.'

Especially when victims appear in groups, first aid nurses must evaluate and make predictions about complicated situation in a short time and make timely and proper disposition of different traumatic conditions. First, aid nurses have to face traumatic incidents usually like the noxious vision stimulus of physical injuries in rescue site, patients' groaning, ambulance's noise, conflicts between personnel and patients or even humiliation or attack from patients' family members. The particularity of first aid rescue sets the tone that first aid nurses have more intense working force, higher risk but poorer safeguard procedures and more conflicts between personnel and patients compared to ordinary nurses. These traumatic incidents may cause first aid nurses to have negative mental reactions that may ultimately trigger PTSD. A large number of studies have shown that [7] the lasting occurrence of PTSD symptoms causes considerable damage to first aid personnel so that first aid personnel are more likely to show physical disease symptoms like a headache, ulceration, high blood pressure, anxiety, depression, insomnia, memory deterioration, attention deficit disorder or even sub-health status.

Meanwhile, PTSD is very likely to produce negative influence like mental issues such as negative emotions, low job satisfaction, high quit rate, early retirement or absence from duty, which will lead to the deterioration of first aid work quality. Although PTSD has relatively precise aetiology in psycho nosema,

but its pathogenesis remains unknown. Some researchers try to explore the pathogenesis by designing irritable animal modelling to induce PTSD and imitate the symptoms of human PTSD. Some researchers study the pathogenesis through clinic examples from the angle of biology and iconography. Through iconographical research, trauma or chronic stressors can induce functional changes of neuron - anatomic structure and neural network. The research on PTSD neural biology reveals PTSD is closely related to factors like hypothalamic-pituitary adrenocortical, HPA and norepinephrine, NE, serotonin/5-hydroxytryptamine, 5-HT, while the latter appears as an accommodative disorder. Animal data suggests [8] the usability of choric stress or gradual reduction of methyl epinephrine in locus ceruleous.

However, the relevancy of such PTSD modelling with human obstruction remains unclear. The Scientific result indicates that the usability of PTSD and its decreased net usability in locus ceruleous and broader network in these brain regions can be related to the severity of PTSD symptoms. Researchers including JW Mason discover the systematically associated value of Norepinephrine and Cortisol Ratio (N/C) provides an evident evaluation that PTSD groups are different from other groups of patients while in the hospital [9]. The groups of patients with N/C ratio over twice that of PTSD group vs. other patients' first sample after hospitalization vs. an average sample of hospitalized patients vs. final sample before hospital discharge. The average N/C ratio of PTSD group is 2.54, and the average of the other four groups is 99, which amounts to an overall average of 81-1.18. For the sample these researchers chose, the sensitivity of diagnosis is 78%, and specificity is 94%. These preliminary research result further encourage them toward diversity strategy, using hormone ratio or personal information to increase the diagnostic sensitivity of neuroendocrine norm concerning psychopath evaluation. Researchers including T Chen [10] indicate that the axis of hypothalamic-pituitary adrenocortical, HPA plays a significant role in the pathogenesis of PTSD.

Under normal conditions when brains are stimulated by the physical or mental stimulus, they will send signals to the hypothalamus, and paraventricular nucleus of hypothalamus will produce Corticotropin Releasing Factor (CRF). Then CRF will reach the hypophysis and stimulate the hypophysis to produce Adreno-Cortico-Tropic-Hormone (ACTH). Then ACTH will enter the adrenal gland and stimulate the adrenal gland to produce cortisol. Cortisol hormone will thus combine with internal corresponding recipient system, activate a series of enzymes and regulate the production and release of many chemical medias and inflammatory cytokines. Under stress, the organism will make a series of feedback protection reactions to prevent itself from suffering significant immune injuries. Activated immune cells will produce factors like IL-6 and TNF-a and stimulate the combination and secretion of hypothalamic corticotropin factor, which will cause ACTH increases, cortisol increases, and immune

suppression gives feedbacks.

There is no universal agreement on whether the severity of PTSD symptoms is related to plasma cortisol concentration. In this research, the concentration of the PTSD patients' serum IL-2, IL-8 and TNF- α all increase compared to that of the control group while the plasma cortisol concentration decreases compared to that of the control group, based on speculation, patients remain in irritable state for a long time (at least three months in average) after they experience emotional crisis thus showing lower cortisol concentration compared to the control group. Researchers including L LI [11] discuss the role platelet 5-hydroxytryptamine plays on the occurrence of PTSD by testing the platelet 5-hydroxytry concentration difference of PTSD sufferers of Li nationality and Han nationality in Hainan with LSD: Compared the two-two comparisons of platelet 5-HT level among Li nationality patients, Han nationality patients and two healthy control groups. These differences all have statistical meanings ($P < 0.01$). The platelet 5-HT concentration of Li nationality patients (120.56 ± 118.05) ng/109 is lower than that of Han nationality patients (271.43 ± 181.66) ng/109 and that of healthy Li nationality control group (338.54 ± 156.46) ng/109 as well as that of normal Han nationality control group (350.58 ± 169.19) ng/109. All these comparisons have statistical differences ($P < 0.01$). translation differences exist between PTSD patients of Li nationality and Han nationality and their control groups concerning avoidance, intrusion, hyperarousal. The hypofunction of PTSD patients' 5-HT may have to do with the biochemical mechanism. The ethical differences of PTSD patients of Li nationality may have to do with tropical ethnic habits, status and culture. Post-traumatic stress disorder (CR-PTSD) has to do with the dysregulation of different kinds of neurotransmitter system [12] We evaluate 17 untreated male PTSD patients' level of Platelet-Poor Plasma (PPP), Norepinephrine (NE) and 5-HT and the excretion level of Norepinephrine (NE), Dopamine (DA) and homovanillic acid (hva) in urine within 24 hours (ages 33.1 ± 7.4 years old) compared to 10 samples from normal control group (ages 35.8 ± 2.7 years old). Compared to control group, the PTSD patients' PPP 5-HT level significantly decreases and their PPP NE level increases. All the three catecholamines (NE, DA and HVA) urine excretion considerably increases within 24 hours in average.

The HVA value of CR-PTSD patients in 24 hours is positively proportionate to the event scale score and avoidance symptom's clustering and deviating score's overall influence. The level of PPP 5-HT is negatively proportionate to the Hamilton anxiety scoring form. The PPP NE/5-HT ratio of the research group is significantly larger than that of the control group. We believe that this strong combination of increased norepinephrine activity and decreased 5-HT activity can be related to the neurobiology of CR-PTSD. Researchers including J Fan [13] studied the relevance of immune functions and PTSD patients. Method: 15 samples of

PTSD patients without physical injuries (The PCL-C scoring for these patients is over 50 points, the scoring of 52 indicating 79 points and the average and standard deviation 62 ± 8); 15 samples of PTSD group; non-PTSD patients (patients who score from 0 to 11 points, namely less than 12 points for PCL-C evaluation, average and standard deviation 4 ± 4) as control group with enzyme linked immunosorbent assay to measure serum cell factors (IL-2, IL-6, IL-10 and TNF- α). The level differences between the two groups all have statistical meanings ($Z = -2.807$, $P = 0.05$). All the three immune indicators have no statistical meanings ($P > 0.05$). The four immune indicators of PTSD group has no relevancy to PCL-C scoring.

Conclusion

The biological level of interleukin IL-2's relevance to PTSD patients' disease symptoms, the immune level needs further research. The research by researchers including A Vidovic [14] suggests these variations may have to do with the endurance of PTSD. Our research goal is to survey the difference of endocrine and immune related variances between PTSD patients and control groups as well as the relevance of these differences to time.

Methodology: We evaluated 39 veterans from Croatian War with PTSD and 25 healthy volunteers (civilians without traumatic experience). All males deviate five to six years at two different time point (Median, quartile range: 5.4-6.3). We use radioimmunoassay to measure the level of cortisol and prolactin and use enzyme linked immunosorbent assay to measure IL-6 and TNF- α . We adopt Na-K-Cl cotransporter as a measure to evaluate immune functions and adopt three color flow cytometry to measure the number of lymphocytes, immune phenotypes and intracellular glucocorticoid receptor expression in different sub- lymphocyte groups. The result indicates and observes that the changes of PTSD's endocrine and immunity may be decided by the interrelated influence of the endurance of abnormal burden causes and its related immune system's critical reactions. PTSD has to do with the imbalance of different kinds of neurotransmitter system [15]. Researchers evaluate (urine excretion within 24 hours), norepinephrine(NE), 5-HT dopamine(DA) and homovanillic acid (hva) by comparing PTSD group and the normal control group, which indicates the significant difference of three catecholamine's (NE, DA and HVA) in urine excretion. The pathogenesis of PTSD to patients may have to do with neurobiology.

Many foreign scholars find out first aid nursing workers are the high-risk group of having PTSD within the medical industry, with more than 15% of all workers suffering from PTSD symptoms for all their life and cannot live as normal [16]. First aid rescue and rescue nurses can also be easily affected by the following factors: indirect mental trauma, mental violence, speech violence of violent family members of patients, lateral violence among co-workers, complicated working environment, overload of working

tasks, overpressure, irregular lifestyle, low social acceptance and gender factors. These can all be the possible triggers of PTSD. A large number of studies have shown that PTSD not only has to do with the properties and severity of traumatic events but also has to do with social psychological factors including personality features, cognitive factors, reaction factors, attribution factors and social acclaim. The above factors can all have some extent of influence on the occurrence, development and transformation of PTSD symptoms. Although the pathogenesis of PTSD remains unknown, most researchers support the changes of neuroendocrine and immunity as a basis other than other changes. Under pressure, mentality, neurology, neuroendocrine and immunity influence each other and react to return. Therefore, the study of PTSD and its immune level is a theoretical research and a scientific exploration which can provide a reference for further research. Based on the result of this research, it still needs further verification from various centers, dimensions and directions for it may lack some big samples from landmark research.

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