A Study on Post-Traumatic Stress Disorder and Its Influencing Factors in Patients with Spinal Cord Injury

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Abstract: *Objective:* To investigate on post-traumatic stress disorder (PTSD) and its influencing factors in patients with spinal cord injury. *Methods:* From January 2019 to December 2021, 168 patients with spinal cord injury in The First Affiliated Hospital of Xi'an Medical University were selected as the research subjects. Among the patients, 77 were female patients, with an average age of 56.39 ± 13.98, and 91 were male patients, with an average age of 58.12 ± 14.01. Clinical data were collected, and the factors influencing PTSD in patients with spinal cord injury were analyzed and observed. *Results:* The patients were divided into two groups according to diagnosis (98 cases with PTSD, and 70 cases with non-PTSD). Among them, there were 62 male and 36 female patients in the PTSD group, and 29 male and 41 female patients in the non-PTSD group; in the PTSD group, 62 patients were $\geq$ 50 years old, while 36 patients were < 50 years old, whereas in the non-PTSD group, 31 patients were ≥ 50 years old, while 39 patients were < 50 years old; 46 and 52 patients in the PTSD group and 33 and 37 patients in the non-PTSD group were single and married, respectively; in the PTSD group, the number of patients that fall under each demographic factor can be summarized as follows: education level (29 junior high school and below, 12 high school/secondary school, 57 college and above), religious belief (69 none, 29 yes), personality (31 introverted, 24 ambiverted, 43 extroverted), complications (52 yes, 46 no), type of injury (34 complete, 64 incomplete), post-traumatic coma (25 yes, 73 no), degree of pain (51 mild, 14 moderate, 33 severe), resilience (36 low, 62 high), and social support (12 low, 39 moderate, 47 high); in the non-PTSD group, the number of patients that fall under each demographic factor can be summarized as follows: education level (7 junior high school and below, 37 high school/secondary school, 26 college and above), religious beliefs (53 none, 17 yes), personality (18 introverted, 47 ambiverted, 5 extroverted), complications (32 yes, 38 no), type of injury (45 complete, 25 incomplete), post-traumatic coma (49 yes, 21 no), degree of pain (31 mild, 38 moderate, 1 severe), resilience (55 low, 13 high), and social support (51 low, 13 moderate, 6 high); there was statistical difference between the two groups in terms of gender, age, education level, personality, injury type, post-traumatic coma, degree of pain, resilience, and social support ($p < 0.05$). *Conclusion:* PTSD in patients with spinal cord injury is positively correlated with gender, education level, degree of pain, psychological resilience, and social support. Clinically, more emphasis should be on its influencing factors, and early intervention should be reinforced to reduce the risk of PTSD.

Keywords: Spinal cord injury; Post-traumatic stress disorder; Anxiety; Depression

1. Introduction

Spinal cord injury is a common type of major trauma, but there is still no effective treatment for it [1,2].

Although studies have shown that methane has good anti-oxidative stress effect, and it has been preliminarily verified in the clinical treatment of various diseases [3-5], the effect of methane on spinal cord injury and its related mechanisms have not yet been reported. Spinal cord injury occurs as a traumatic event that damages the central nervous system. According to an epidemiological survey, there are more than 1 million spinal cord injury patients in China, with 120,000 new cases every year. The injury is mainly caused by the compression or rupture of the spinal cord caused by an external force acting on the spine, which may lead to structural and functional damage of the spinal cord, causing various degrees of motor, sensory, and autonomic dysfunctions below the level of injury. In severe cases, it may develop into paraplegia or even a life-threatening event, which poses a serious threat to the quality of life of patients. In addition, spinal cord injury may also lead to psychological stress response, which is also known as stress disorder. Post-traumatic stress disorder (PTSD) refers to a delayed and long-standing mental and psychological disorder of an individual after experiencing a sudden, threatening, or catastrophic life event. Foreign reports show that the incidence of PTSD in patients with spinal cord injury is about 20%. In turn, PTSD may lead to anxiety, depression, or even suicidal tendency, which seriously affects patients' treatment compliance and clinical outcomes [6]. Studies have shown that the suicide risk in PTSD patients is as high as 19% compared with the general population [7]. Therefore, it is of great significance to identify the risk factors of PTSD in patients with spinal cord injury and assume targeted intervention measures as soon as possible. This study investigated on post-traumatic stress disorder and its influencing factors in patients with spinal cord injury.

2. Materials and methods

2.1. Study population

A total of 168 patients with spinal cord injury in The First Affiliated Hospital of Xi'an Medical University between January 2019 and December 2021 were selected as the research subjects. Among them, 77 were female patients, with an average age of 56.39 ± 13.98, while 91 were male patients, with an average age of 58.12 ± 14.01. Clinical data were collected.

Inclusion criteria: (1) patients who met the international criteria for neurological diagnosis and classification of spinal cord injury, including those with loss of sensation below the level of spinal cord injury, decreased back pain, thoracolumbar tenderness and pain upon percussion, as well as confirmed by CT imaging or MRI; (2) patients with stable condition and no further aggravation of neurological signs; (3) patients ≥ 18 years old; (4) patients who have full mental capacity and given informed consent to this study.

Exclusion criteria: (1) patients with severe mental illness or history of mental illness; (2) patients with other serious stressful events during treatment; (3) patients with speech, hearing, and visual impairments who are unable to communicate normally.

2.2. Study design

In this study, the diagnostic criteria for post-traumatic stress disorder were patients who completed the Stanford Acute Stress Response Questionnaire with a total score of ≥ 40 points and met the diagnostic criteria based on a psychiatric evaluation. The patient information in the medical records was collected, which included gender, age, education level, marital status, underlying diseases, Stanford Acute Stress Reaction Questionnaire (SASRQ) score, spinal cord injury classification, visual analog scale (VAS) score, and Hospital Anxiety and Depression Scale (HADS) score. By diagnosis, 168 patients were divided into two groups, with 98 cases in the post-traumatic stress disorder group, and 70 cases in the non-post-traumatic stress disorder group.

2.3. Observation indicators

The factors affecting PTSD in patients with spinal cord injury were observed and analyzed.

2.4. Statistical analysis

SPSS 19.0 was used for quantitative data analysis. The data of normal distribution were compared between multiple groups by analysis of variance; the comparison of two independent samples was by t test, and the comparison of non-normally distributed data between two groups was by nonparametric rank sum test. The scientific test level was $p < 0.05$. For measurement data, normal distribution test was carried out, and the data conforming to normal distribution were expressed as mean ± standard deviation. T test was performed, and $p < 0.05$ indicated that the difference was statistically significant.

3. Results

According to the diagnosis, 168 patients with spinal cord injury were divided into 98 cases of post-traumatic stress disorder and 70 cases of non-post-traumatic stress disorder. Among them, there were 62 male and 36 female patients in the PTSD group, and 29 male and 41 female patients in the non-PTSD group. In the PTSD group, 62 patients were ≥ 50 years old, while 36 patients were < 50 years old, whereas in the non-PTSD group, 31 patients were ≥ 50 years old, while 39 patients were < 50 years old; in terms of marital status, 46 and 52 patients in the PTSD group and 33 and 37 patients in the non-PTSD group were single and married, respectively. The number of patients in the PTSD group that fall under each demographic factor can be summarized as follows: education level (29 junior high school and below, 12 high school/secondary school, 57 college and above), religious belief (69 none, 29 yes), personality (31 introverted, 24 ambiverted, 43 extroverted), complications (52 yes, 46 no), type of injury (34 complete, 64 incomplete), post-traumatic coma (25 yes, 73 no), degree of pain (51 mild, 14 moderate, 33 severe), resilience (36 low, 62 high), and social support (12 low, 39 moderate, 47 high). The number of patients in the non-PTSD group that fall under each demographic factor can be summarized as follows: education level (7 junior high school and below, 37 high school/secondary school, 26 college and above), religious beliefs (53 none, 17 yes), personality (18 introverted, 47 ambiverted, 5 extroverted), complications (32 yes, 38 no), type of injury (45 complete, 25 incomplete), post-traumatic coma (49 yes, 21 no), degree of pain (31 mild, 38 moderate, 1 severe), resilience (55 low, 13 high), and social support (51 low, 13 moderate, 6 high). There was no statistical difference between the two groups in terms of marital status, religious beliefs, and complications, but gender, age, education level, personality, type of injury, post-traumatic coma, degree of pain, psychological resilience, and social support were all significantly different between the two groups ($p < 0.05$), as shown in **Table 1**.

Table 1. Analysis of factors influencing post-traumatic stress disorder in patients with spinal cord injury

Group		Number	PTSD (n=98)	Non-PTSD (n=70)	χ^2/T	p
Gender	Male	91	62	29	7.8429	0.0051
	Female	77	36	41		
Age	≥ 50	93	62	31	5.9520	0.0147
	< 50	75	36	39		
Marital status	Single	79	46	33	0.0007	> 0.05
	Married	89	52	37		
Education background	Junior high school and below	36	29	7	34.0572	0.0000
	High school/secondary school	49	12	37		
	College and above	83	57	26		
Religious beliefs	None	122	69	53	0.3686	> 0.05
	Yes	46	29	17		

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Group		Number	PTSD (n=98)	Non- PTSD (n=70)	χ^2/T	*p*
Personality	Introverted	49	31	18		
	Ambiverted	71	24	47	37.3540	0.0000
	Extroverted	48	43	5		
Complications	Yes	84	52	32	0.8816	> 0.05
	No	84	46	38		
Type of injury	Complete	79	34	45	14.3536	0.0002
	Incomplete	89	64	25		
Post-traumatic coma	Yes	74	25	49	29.5122	0.0000
	No	94	73	21		
Degree of pain	Mild	82	51	31		
	Moderate	52	14	38	42.5890	0.0000
	Severe	34	33	1		
Resilience	Low	91	36	55	28.7884	0.0000
	High	77	62	15		
Social support	Low	63	12	51		
	Moderate	52	39	13	66.0273	0.0000
	High	53	47	6		

4. Discussion

Traumatic spinal cord injury (SCI) is one of the common major spinal traumas and serious complications in spinal surgery. Injuries from falls, sports, and violence have brought physical and mental pain to the patients, significant economic burden to their families, and medical strain to the society. With the rapid development of construction and transportation industries, the incidence of SCI is increasing. According to epidemiological surveys, the incidence of traumatic SCI in China has shown an upward trend year by year, making it one of toughest medical challenges. Societal attention has now shifted to post-traumatic SCI care. Scholars at home and abroad have tried to solve this problem. At present, the focus is mainly on surgical decompression, high-dose endocrine therapy, inhibition of cell apoptosis [6], application of neurotrophic factors [7], genetic engineering [8], and other approaches. There has been some progress, and at the same time, traditional Chinese medicine has also achieved some success in the treatment of traumatic SCI [9,10].

A series of pathological changes with secondary SCI occurs in a few minutes to several days following the primary injury, which causes a continual damage to residual nerve cells. This is responsible for the difficulty in limb function recovery following traumatic SCI. Relieving or inhibiting secondary injury helps protect residual nerve cells following primary injury, which is of great significance for the recovery of limb function after traumatic SCI. Following traumatic SCI, local homeostasis is disrupted, blood-spinal cord barrier (BSCB) is damaged, and local edema, oxidative stress, and inflammatory response occur under the mediation of a series of vascular permeability-related factors, cytotoxic factors, and inflammatory factors [11-16]. Spinal cord edema, oxidative stress, and inflammation following traumatic SCI will further aggravate neuronal ischemia, hypoxia, and even cause neuronal death.

In conclusion, post-traumatic stress disorder in patients with spinal cord injury is positively correlated with gender, education level, degree of pain, psychological resilience, and social support. Clinically, more emphasis should be on its influencing factors, and early intervention should be reinforced to reduce the risk of PTSD.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Huang L, Ye C, 2022, Application of Supportive Psychological Nursing in the Prevention of Post-Traumatic Stress Disorder in Patients with Spinal Cord Injury. Chinese and Foreign Medical Research, 20(07): 112–115.

[2] Xie F, 2021, The Effect of Staged Psychological Nursing on the Resilience and Post-Traumatic Growth of Patients with Spinal Fracture and Spinal Cord Injury. International Journal of Nursing, 40(24): 4478–4482.

[3] Zhu Z, Wang X, Zuo X, et al., 2021, Photobiomodulation Promotes Spinal Cord Injury Repair by Inhibiting Oxidative Stress and Secondary Inflammation. Medical Contention, 2021: 1–14.

[4] Wang X, Huan Y, He Y, 2021, Research Progress of Neuronal Apoptosis After Spinal Cord Injury. Inner Mongolia Medical Journal, 53(08): 945–947.

[5] Zhu Q, Hu G, Li Q, et al., 2021, Application of Mouse Nerve Growth Factor, Mild Hypothermia Combined with Methylprednisolone in Acute Spinal Cord Injury and Its Effect on Oxidative Stress Level. China Journal of Modern Medicine, 31(23): 79–83.

[6] Cui J, Liu M, 2021, Research Progress on the Protective Effect of Acetyl-L-Carnitine on Mitochondria After Spinal Cord Injury. Shaanxi Medical Journal, 50(03): 374–376.

[7] Zhao Z, Zhao Z, Feng F, et al., 2020, Research Progress on the Protective and Repairing Effects of Valproic Acid in Acute Central Nervous System Injury. International Journal of Neurology and Neurosurgery, 47(04): 459–462.

[8] Yu F, Wang J, Xiong Y, et al., 2020, Clinical Observation of Electroacupuncture Based on Jiaji and Du Meridian Combined with Hyperbaric Oxygen Therapy on Acute Spinal Cord Injury. Shizhen Chinese Medicine and Chinese Medicine, 31(04): 1022–1024.

[9] Cheng J, Li H, Li X, 2019, Intervention of Pepper Leaf Extract Can Reduce Oxidative Stress and Inflammatory Response in Rats with Acute Spinal Cord Injury. Chinese Tissue Engineering Research, 23(31): 5010–5016.

[10] Tang T, Sun P, Yao B, et al., 2019, Effects of Edaravone on Serum-Related Indexes in Rats with Acute Spinal Cord Injury. Trauma and Critical Care Medicine, 7(03): 164–166.

[11] Dou H, 2018, Study on the Mechanism of American Ginsenosides Regulating Endoplasmic Reticulum Stress and Inflammatory Pathways to Promote the Repair of Spinal Cord Injury in Rats. Soochow University.

[12] Wang W, Huang X, Fan C, 2018, Therapeutic Effect and Dose Effect of Methane-Rich Saline on Acute Spinal Cord Injury in Rats. Chinese Journal of Bone and Joint Injury, 33(09): 937–939.

[13] Zhao L, Zhou S, Zhang X, et al., 2018, Effects of bFGF on the Expression of Endoplasmic Reticulum Stress Protein CHOP in Spinal Cord Tissue of Rats with Acute Spinal Cord Injury. Journal of Shanxi Medical University, 49(09): 1037–1040.

[14] Wang W, 2018, Methane and Hypoxic Preconditioning of BMSCs in the Treatment of Acute Spinal Cord Injury in Rats and Related Mechanisms. Chinese People's Liberation Army Naval Medical University.

[15] Zhu Z, Li J, Sun Q, et al., 2018, Effects of Polygoniside on Oxidative Stress and Inflammation in Rats with Acute Spinal Cord Injury. Journal of Clinical Military Medicine, 46(04): 435–438.

[16] Qi Y, Tan M, Wang Y, et al., 2018, Study on the Effect of Buyang Huanwu Decoction on Endoplasmic Reticulum Stress-Related Factors in Rats with Acute Spinal Cord Injury. China Journal of Traditional Chinese Medicine Orthopedics, 26(02): 8–12.