The mediating effect of self-efficacy in the relationship between social support and post-traumatic stress disorder symptoms among patients with central system tumors in China: a cross-sectional study

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Abstract

Background: Post-traumatic stress disorder (PTSD) is a disorder that can affect people following the experience of a traumatic event. Few studies have researched on PTSD symptoms of patients with central nervous system tumors. In this study, we aim to examine the association between social support and PTSD symptoms and to explore the mediating effect of self-efficacy in this relationship among patients with central nervous system tumors in China.

Methods: Questionnaires consisting of the Post-traumatic Stress Checklist- Civilian Version, the Duke-UNC Functional Social Support Questionnaire, the General Self-Efficacy Scale, as well as demographic and clinical factors were used to collect information of patients with central nervous system tumors in Liaoning Province, China. A total of 222 patients (effective response rate of 66.1%) became our subjects. Hierarchical linear regression analyses were performed to explore the association between social support and PTSD symptoms and the mediating effect of self-efficacy.

Results: After adjusting for demographic characteristics and tumor type, social support was negatively associated with the total score of PTSD symptoms ($\beta = -0.342$, $P < 0.01$). Social support explained 8.8% of the variance in PTSD symptoms. Self-efficacy was found to partially mediate the relationship between social support and PTSD symptoms.

Conclusions: Self-efficacy partially mediated the relationship between social support and PTSD symptoms. Interventions focusing on both social support and self-efficacy might be more useful than interventions only targeting either of them.
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Introduction

The central nervous system (CNS), which consists of brain and spinal cord, is a complex system that controls our intentional thinking and essential body functions. Although CNS tumors are not as frequent as tumors of many other sites, their incidence rate had been increasing over time [1]. A report from the International Agency for Research on Cancer (IARC) revealed that the worldwide incidence rate of CNS tumors was 3.2/100 000 persons in 2002 and rose to 4.0/100 000 persons in 2008 [2]. CNS tumors are related with symptoms of headache, seizures, and altered mental status [3]. Although more than half of CNS tumors are benign, they can cause substantial morbidity, especially in children and adolescences. In addition, CNS tumors can also cause mental disorders, such as depression and anxiety [4,5].

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), post-traumatic stress disorder (PTSD) is a disorder that can affect people following the experience of a traumatic event [6]. According to Criterion A of PTSD in the DSM-IV, a qualifying trauma is defined as one which involves ' actual or threatened death or serious injury, or threat to the physical integrity of the individual or family member' and which invokes 'feelings of horror and intense fear' in those exposed to it [7]. For patients with CNS tumors, many of them have to bear functional, neurocognitive, and neuropsychological sequelae of the disease [8]. Most of patients have to accept surgery; therefore, the unpredictability and uncontrollability of the surgery itself and of the prognosis also contribute to the increase in the feelings of horror and fear. In DSM- IV, PTSD includes three groups of symptoms. One group of PTSD symptoms includes persistent re-experiencing of the trauma such as disturbing thoughts, nightmares, and flashbacks. The second group includes symptoms of avoidance and numbing reactions. Avoidance can assume many forms, including attempts to avoid speculations about the event, feelings, conversations, and activities that may remind the individual of the event, or the inability (or lack of desire) to engage in intimate relationships. The third and the last group of symptoms

comprise of conditions of increased arousal and irritability that were not present prior to the trauma. Symptoms include hypervigilance, inability to fall or stay asleep, lack of concentration, outbursts of aggression/hostility, and exaggerated startle response [7]. In 2013, the American Psychiatric Association revised the PTSD diagnostic criteria in the fifth edition of its Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [9]. Criterion A has been tightened with DSM-5. For medical conditions, the DSM-5 stipulates that '*A life threatening illness or debilitating medical condition is not necessarily considered a traumatic event. Medical incidents that qualify as traumatic events involve sudden, catastrophic events*' [9]. Hence, a diagnosis or being treated for CNS tumors *per se* with no adverse events is not necessarily sufficient to qualify for a PTSD diagnosis [9]. However, because of the special site of CNS tumors, patients may experience sudden loss or weakness of physical or cognitive functions, which may happen as traumatic events. In addition, high costs of treatment and insufficient insurance coverage always make a diagnosis or being treated for tumors a catastrophic event for the patients and their families in China, which may be different from that in developed countries. In China, even covered by medical insurance, patients with tumor need to pay a co-payment cap of six times the patient's annual salary [10]. In most cases, tumor treatment makes families of patients with tumor become desperately poor. In DSM-5, it pays more attention to the behavioral symptoms that accompany PTSD and proposes four diagnostic clusters instead of three. They are described as re-experiencing, avoidance, negative cognitions and mood, and arousal [9]. Avoidance is separated from numbing in the new edition.

Social support refers to social interactions that provide individuals with actual assistance and embed them into a web of social relationships perceived to be loving, caring, and readily available in times of need [11]. Accumulating evidence has indicated that social support is an effective emotional regulator under conditions of traumatic stress and, more particularly, contributes to the risk of or protection against PTSD [12,13]. Cohen and Will's stress buffering model posited that supportive social networks help individuals cope with stressful events and buffer against stress-related psychopathology [14]. Cai *et al.* also demonstrated that high levels of social support could help to alleviate symptoms of PTSD and improve compliance of treatment among patients with cancer [15]. However, little is known about the association between social support and PTSD symptoms among patients with CNS tumors.

Self-efficacy is the belief in one's ability to control one's environment and life circumstances [16]. It plays a key role in stress reactions and quality of coping in threatening situations [17]. A sense of strong self-efficacy can enhance possibility of personal accomplishments, reduce stress, and lower vulnerability to depression [18]. On the contrary, individuals with low self-efficacy doubt their abilities and have low aspirations and weak commitment to the goals they choose to pursue [19]. According to the transactional theory proposed by Lazarus and Folkman in 1984 [20], an individual's reaction to a stressful event is mediated by the subjective evaluation (i.e., appraisal) of the environment and the process of coping with the event. The appraisals and coping behaviors can be altered by one's external environment, such as perceived social support. Benight and Bandura have examined the relationships among social support, coping self-efficacy, and posttraumatic symptoms and found that social support reduced the likelihood of trauma-related stress by raising beliefs in one's coping self-efficacy rather than directly [19]. Based on the transactional theory and results from Benight and Bandura's research, we considered not only the possibility that social support predicts PTSD among patients with CNS tumors but also the possibility that the effect of social support on PTSD symptoms is mediated through the effect of social support on self-efficacy.

Self-efficacy is usually understood as being task specific or domain specific. For the majority of applications, self-efficacy should be conceptualized in a situation-specific manner [16]. However, some researchers have also conceptualized a generalized sense of self-efficacy that refers to a broad and stable sense of personal competence to cope effectively with a variety of stressful or challenging demands [21]. General self-efficacy might be useful when focusing on multiple behaviors simultaneously [22] or when studying the well-being or behavior of patients who have to adjust their lives to multiple demands owing to illness [23]. In the present study, we measured general self-efficacy of patients.

In this study, we have two specific aims. First aim is to examine the association between social support and PTSD symptoms among patients with CNS tumors in China. Second aim is to explore the mediating effect of self-efficacy in the relationship between social support and PTSD symptoms among patients with CNS tumors in China.

Methods

Ethics statement

The Ethics Committee on Human Experimentation of China Medical University reviewed and provided the ethics approval for this study, and the study procedures were in accordance with the ethical standards. All the patients gave their written informed consent to participate after being orally informed about the study protocol, and they were totally voluntary and anonymous. The privacy of patients was kept in processing personal data and maintained confidentiality of individual records.

Study design and study sample

From November 2012 to January 2014, a cross-sectional study was conducted in the Department of Neurosurgery, the First Hospital of China Medical University, which is an important provider of neurosurgery to the northeastern region of China. Patients who satisfied the following inclusion criteria were enrolled as potential subjects: (1) were at least 18 years old when they were diagnosed with the CNS tumor, (2) had clear consciousness and cognition, and (3) had received neurosurgery at this hospital during the period of the study. The majority of patients were recruited for this study within 2 weeks post-operatively. Patients with the following conditions were excluded from the study: (1) those with psychiatric or intellectual problems and (2) patients who had other types of tumors. After obtaining written consent from participated patients, clinical data were collected from their medical records and a structured questionnaire was distributed to patients. Of the 336 patients who were enrolled, 84 patients refused to participate, including 40 male patients and 44 female patients. Three patients were excluded because they had other types of tumors. Of the 249 eligible patients, 27 patients were excluded from analysis because missing data were larger than 30%. Finally, effective responses were received from 222 patients with effective response rate of 66.1%.

Demographic and clinical characteristics

Gender, age, marital status, education, household monthly income, and tumor type were obtained in this study. 'Marital status' was categorized as 'single', 'married/cohabitation', and 'divorced/separated/widow'. 'Education' was categorized as 'primary school', 'secondary school', and 'college or above'. Household monthly income was categorized as '≤1500 rmb (≈242 dollars)', '1501~3000 rmb(≈242~484 dollars)', and '>3000 rmb(≈484 dollars)'. Tumor type was categorized as 'benign, not recur', 'benign, possibly recur', ' low potential malignancy', 'moderate potential malignancy' , 'high potential malignancy', and 'uncertain'.

Measurement of post-traumatic stress disorder (PTSD)

PTSD symptoms were measured by the Post-traumatic Stress Checklist-Civilian Version (PCL-C) [24]. It consisted of 17 items that reflected the DSM-IV symptom criteria for PTSD. Each item was scored on a five-point Likert scale (1=not at all,; 5=extremely) on the basis of how much the symptom had bothered them in the past month with the total score ranging from 17 to 85. Higher score indicated more severe PTSD symptoms. In the present study, patients were asked to respond to PCL-C items in terms of their experiences with central nervous tumors and its surgery. The Chinese version of the PCL-C has been used in Chinese population and demonstrated satisfactory reliability and validity [25]. In the present study, the Cronbach's alpha for the total scale was 0.916.

Measurement of social support

Social support of patients was assessed by the Duke-UNC Functional Social Support Questionnaire [26]. It was an eight-item, multidimensional questionnaire that assessed the qualitative, or functional aspects of support. Responses were on five-point Likert scale, ranging from 5 (as much as I would like) to 1 (much less than I would like), and higher scores indicated greater satisfaction with perceived social support.

The Chinese version of the Duke-UNC Functional Social Support Questionnaire has been used in Chinese population and showed good reliability and validity. In the present study, the Cronbach's α value for the total scale was 0.885.

Measurement of general self-efficacy

The General Self-Efficacy Scale was created to assess a general sense of perceived self-efficacy with the aim to predict coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events [27]. This scale consisted of 10 items rated on a four-point scale, ranging from 1 (not at all true) to 4 (exactly true). Examples of questions in this scale included 'I can always manage to solve difficult problems if I try hard enough' and 'I am confident that I could deal efficiently with unexpected events'. The total score ranged from 10 to 40 scores, and higher scores indicated higher level of self-efficacy.

This scale showed good reliability and validity when used in Chinese population [28]. The Cronbach's α value for general self-efficacy in the current study was 0.932.

Statistical analysis

All analyses were conducted using SPSS 17.0 for Windows. Correlations among PTSD symptoms, social support, and self-efficacy were preliminarily examined by Pearson's correlation analysis.

Hierarchical multiple regression analysis was performed to test the incremental variance of any given set of independent variables and to examine the mediating role of self-efficacy. Scores of PTSD symptoms were used as dependent variable. The analysis was performed in stages by successively inputting three blocks of independent variables in the model. In block 1, all demographic variables were entered as control variables. Because marital status and educational level are categorical variables without a linear trend, we set dummy variables for the two variables respectively: in block 2, social support was added and in block 3, self-efficacy was added. All statistical tests were two-sided (α=0.05).

Baron and Kenny's analysis technique [29] was used for testing the hypothesis concerning the mediating effect of self-efficacy in the relationship between the social support and PTSD symptoms. According to Baron and Kenny, the following are the conditions for establishing mediation:(1) the independent variable (social support) is significantly related with the dependent variable (PTSD symptoms), (2) the independent variable (social support) is significantly related with the mediator (self-efficacy), and (3) the mediator (self-efficacy) is significantly related with the dependent variable (PTSD symptoms), with the effect of the independent variable (social support) on the dependent variable (PTSD symptoms) shrinking (partial mediator) or becoming statistically insignificant (full mediator) upon the addition of the mediator (self-efficacy) to the model.

All the continuous variables were standardized in order to avoid multicollinearity [30] before performing the regression analyses. Moreover, tolerance and variance inflation factor were used to check for multicollinearity.

Bootstrapping is an increasingly popular nonparametric method of testing mediation effect [31]. For the independent variable, when the bias-corrected and accelerated 95% CI (BCa 95% CI) of mediation effect (a*b product) excludes 0, it indicates that the mediating effect is statistically significant. To estimate the degree to which the effect of social support on PTSD symptoms is mediated through self-efficacy, we also calculated the proportion of the indirect effect of social support on PTSD symptoms to the total effect. The bootstrap estimate presented in our study was based upon 5000 bootstrap samples.

Results

Demographic and clinical characteristics of the participants are shown in Table 1. Of the 222 respondents in this study, the average age was 50.16 ± 13.57 years. The mean time since CNS diagnosis was 2.05 ± 3.76 months (range: 0–28 months).

Correlations among PTSD, social support, and self-efficacy

As seen in Table 2, both social support ($r = -0.208$) and self-efficacy ($r = -0.343$) were negatively related with PTSD symptoms. And, social support was positively related with self-efficacy ($r = 0.338$).

Association between social support and PTSD

Table 3 presented results of the hierarchical multiple regression models. Each block of the independent variables made a significant contribution to the variance of PTSD symptoms ($P < 0.05$). After controlling for demographic characteristics and tumor type, social support was negatively associated with PTSD symptoms ($\beta = -0.342$,

Table 1. Demographic and clinical characteristics of study subjects

Variable	N(%)
Gender	
Male	93 (41.9%)
Female	129 (58.1%)
Marital status	
Single	19 (8.6%)
Married/cohabitation	186 (82.9%)
Divorced/widow/separated	19 (8.6%)
Education	
Primary school	31 (14.0%)
Secondary school	134 (60.4%)
College or above	57 (25.7%)
Household monthly income	
≤1500 rmb	109 (49.1%)
1501 ~ 3000 rmb	70 (31.5%)
>3000 rmb	42 (18.9%)
Tumor type	
Benign, not recur	59 (26.6%)
Benign, possibly recur	107 (48.2%)
Low potential malignancy	12 (5.4%)
Moderate potential malignancy	11 (5.0%)
High potential malignancy	11 (5.0%)
Uncertain	22 (9.9%)

Table 2. Means, standard deviations (SD), and correlations of continuous variables

Variables	Mean	SD	1	2
1. PTSD symptoms	29.56	9.51		
2. Social support	30.19	7.44	0.68*	
3. Self-efficacy	28.36	7.30	0.57*	0.55*

$*P < 0.01$ (two-tailed).

Table 3. Hierarchical linear regression analysis results of PTSD symptoms

	PTSD symptoms		
Variables	step 1(β)	step 2(β)	step 3(β)
Block 1			
Gender	0.037	0.094	0.031
Age	0.041	0.154	0.155
Dummy_m1	0.163	0.155	0.136
Dummy_m2	−0.045	−0.096	−0.056
Dummy_e1	0.178	0.240	0.203
Dummy_e2	0.051	0.163	0.144
Household monthly income	−0.166	−0.115	−0.049
Tumor type	−0.124	−0.098	−0.094
Block 2			
Social support		−0.342**	−0.254*
Block 3			
Self-efficacy			−0.330**
R^2	0.078	0.166	0.257
ΔR^2	0.056	0.088	0.091

$*P < 0.05$.
$**P < 0.01$ (two-tailed).
Dummy_m1 means Single versus Married/Cohabitation, Dummy_m2 means Divorced/ Widow/Separated versus Married/Cohabitation;.
Dummy_e1 means Secondary school versus Primary school, Dummy_e2 means College or above versus Primary school.

$P < 0.01$) and explained 8.8% of the variance in PTSD symptoms. This made the first condition of Baron and Kenny's technique to test the mediating role of self-efficacy satisfied in the present study. Tolerance (range: 0.386–0.910) and variance inflation factor (range: 1.099–2.594) did not indicate a multicollinearity problem.

Association between self-efficacy and PTSD

As shown in Table 3, after controlling for demographic characteristics, tumor type, and social support, the effect of self-efficacy on PTSD symptoms ($\beta = -0.330$, $P < 0.01$) was significantly negative. Self-efficacy explained 9.1% of the variance in PTSD symptoms.

The mediating role of self-efficacy in the relationship between social support and PTSD

When controlling for demographic characteristics and tumor type, social support was positively associated with self-efficacy ($\beta = -0.291$, $P < 0.01$), which made the second condition of Baron and Kenny's technique to test the mediating role of self-efficacy satisfied in the present study.

After adding self-efficacy in the regression model of PTSD symptoms, the regression coefficient (absolute value of regression coefficient when it is negative) for social support diminished (from $\beta = -0.342$ to $\beta = -0.254$, $P < 0.01$). Based on the third condition of Baron and Kenny's technique, self-efficacy is a partially mediator in the relationship between social support and PTSD symptoms.

Results of bootstrapping method showed that path coefficient of indirect effects (a*b product) of social support on PTSD symptoms through self-efficacy was -0.106 (BCa 95% CI: -0.004, -0.257). The proportion of indirect effect of social support on PTSD symptoms was 25.54%.

Discussion

The role of social support in influencing mental health consequences of stressful life events has been examined in previous studies. Brewin *et al.* conducted meta-analyses to examine the effects of 14 separate risk factors on PTSD and found that social support was the strongest correlate of PTSD with a effect size of 0.40 [32]. Ozer *et al.* [33] included 21 studies that were not analyzed by Brewin *et al.* and also found that social support was a strong predictor of PTSD. Results of our study were consistent with these studies. Social support was negatively associated with the total score of PTSD symptoms among patients with CNS tumors in our study. Previous studies indicated that post-trauma distress was more greatly influenced by functional support than by structural support. Therefore, we measured functional social support, which refers to

subjective experience or perception of helpfulness from others, instead of structural social support, which refers to quantitative measure of social network and proved the significant association between functional social support and PTSD symptoms.

Recently, researchers also explored an alternative model wherein symptoms of PTSD contributed to the erosion of social support over time [34]. The erosion model suggested that symptoms associated with PTSD (e.g., social withdrawal, numbing, and excessive anger) resulted in a significant decline in the social network size as well as decline in various qualitative dimensions of social support. However, because of the cross-sectional design, the direction of the association between social support and PTSD could not be confirmed in our study.

Results of the present study showed that self-efficacy was negatively associated with PTSD symptoms. This was in accordance with results from previous studies. Patients' self-efficacy influence their involvement in the treatment, which in turn result in increased satisfaction, increased adherence to treatment, and positive treatment outcomes [35]. Studies have shown that patients with cancer who reported high levels of self-efficacy in symptom management had lower levels of psychological distress and better adjustment and enjoyed superior quality of life compared with patients with low self-efficacy [36]. Patients with low self-efficacy reported significantly higher levels of pain, fatigue, symptoms, depression and anxiety, and significantly worse physical and functional well-being [37]. These observations suggest that interventions aimed at increasing self-efficacy might also be useful for patients with CNS tumors.

Self-efficacy was found to partially mediate the relationship between social support and PTSD symptoms. Patients with higher levels of social support might have higher levels of self-efficacy, which in turn might lead to lower levels of PTSD symptoms. These findings suggested that interventions focusing on both social support and self-efficacy might be more useful than interventions only targeting either of them. Previous researches indicated that cognitive–behavioral therapies and hardiness training have been shown to be effective in enhancing perceptions of social support, adaptive types of coping and attenuating psychological distress [38]. Wang *et al.* conducted a 3-month self-efficacy intervention through health instruction, establishing role models, setting objectives, etc. among patients with maintenance hemodialysis and found it effective in promoting self-efficacy and preventing depression and anxiety [39]. Zhang *et al.* conducted a nurse-led self-efficacy enhancing intervention among patients with colorectal cancer in China and also found it effective in promoting self-efficacy and psychological well-being of patients [36]. Therefore, we suggest that self-efficacy promoting interventions should also be developed among patients with CNS tumors and the

provision of interventions need to be tailored to patients' specific needs and symptom presentation.

Several limitations of the present study have to be mentioned. First, this study was based on a cross-sectional design. It is impossible to draw causal relations among social support, self-efficacy, and PTSD symptoms. The direction of causality has not been established in this study. Second, there is potential for inflated relations because of common method bias. We tried to minimize this potential problem by allowing the respondents' answers to be anonymous and assuring respondents that there is no right or wrong answers and they should answer questions as honestly as possible [40]. Moreover, we only focused on the associations of social support and self-efficacy with PTSD symptoms; other factors such as psychiatric history, childhood abuse, trauma severity, and life stress, which are important to consider in the experience of PTSD symptoms, were not included [32].

Despite some limitations, this study provided important theoretical and clinical implications. It suggested a better way to reduce PTSD symptoms by changing both external (social support) and internal (self-efficacy) factors, instead of focusing on only one aspect. Social organizations and the family of patients with CNS tumors should provide the patients more social support, and health care professionals should develop self-efficacy promoting interventions based on patients' specific needs and symptom presentation to help reduce PTSD symptoms of patients with CNS tumors.

Conclusions

After adjusting for demographic characteristics and tumor type, social support was negatively associated with the total score of PTSD symptoms. Social support explained 8.8% of the variance in PTSD symptoms. Self-efficacy was found to partially mediate the relationship between social support and PTSD symptoms. Patients with higher levels of social support might have higher levels of self-efficacy, which in turn might lead to lower levels of PTSD symptoms.

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