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ORIGINAL ARTICLE

Observational Study

Prevalence of depression and anxiety and associated factors among geriatric orthopedic trauma inpatients: A cross-sectional study

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Abstract

BACKGROUND

Common mental disorders such as anxiety and depression in geriatric orthopedic trauma patients have received little attention in research.

AIM

To investigate the prevalence of emotional disorders among geriatric orthopedic trauma patients and identify demographic, social and clinical risk factors.

METHODS

This cross-sectional study was performed in geriatric patients (aged ≥ 60 years, both sexes) with orthopedic trauma admitted to a level I trauma center between May 2015 and December 2017. Demographic, social, and clinical characteristics were described. Huaxi Emotional-Distress Index (HEI) was used to evaluate the severity of anxiety and depression status. Differences in continuous variables were tested using the *t*-test, and differences in categorical variables were assessed using the Pearson χ^2 test. Binary logistic regression analyses were used to identify the factors associated with a HEI score > 8.

RESULTS

Among the 966 patients, 487 were male and 479 were female, with a mean age of 70.2 ± 7.1 years. The age ranged from 60 to 90 years. Seventy-five patients had an HEI score > 8, accounting for about 7.8% of all patients. A higher Injury Severity Score (4.17 ± 3.10 *vs* 7.96 ± 6.68, $P < 0.001$), higher Visual Analog Score (5.05 ± 1.09 *vs* 6.89 ±1.23, $P < 0.001$), number of chronic diseases ($P < 0.001$), injury type ($P = 0.038$), and education level ($P = 0.001$) were significantly associated with HEI score > 8. On logistic regression, a higher education level was a protective factor for emotional disorders ($P = 0.047$), whereas Injury Severity Score ($P = 0.024$), Visual Analog Score ($P < 0.001$), two or more chronic diseases ($P < 0.001$) were the related independent risk factors.

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CONCLUSION

Emotional disorders are common in geriatric patients with orthopedic trauma. Clinicians should remain vigilant of emotional disorders in geriatric patients and screen for anxiety and depression in higher risk groups.

Key Words: Anxiety; Depression; Geriatric; Trauma; Orthopedic

Core Tip: Anxiety and depression in geriatric orthopedic trauma patients have received little attention in research. Therefore, in present study, we use Huaxi Emotional-Distress Index as a psycho-metrically screening tool for anxiety and depression in geriatric orthopedic trauma inpatients at a single center. The main finding is that emotional disorders are prevalent in geriatric orthopedic trauma inpatients. In addition, Injury Severity Score, Visual Analog Score, and two or more coexist chronic diseases are independent risk factors, whereas a higher education level is a protective factor. Clinicians should remain vigilant of emotional disorders in geriatric patients and screen for anxiety and depression in higher risk groups.

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INTRODUCTION

Throughout the lifespan, orthopedic trauma patients are often accompanied by anxiety and depression. In previous studies, the incidence of anxiety was 4.8%-39.8%[1-3] and the incidence of depression was 22.3%-87.6%[1,2,4,5]. From the perspective of age stratification, anxiety and depression are common in elderly people. The incidence of generalized anxiety disorder was reportedat 0.7%-12%[6-9] and depression was 9%-11%[7,8]. In addition, anxiety and depression can occur separately or often together in elderly people[8]. However, until the last decade, common mental disorders such as anxiety and depression in geriatric orthopedic trauma patients received little attention in research, not to mention the huge burden of mental illness on families, society and the economy[6]. Therefore, it is urgent to understand, develop and evaluate evidence-based treatments for anxiety and depression among this specific group of patients. Before treatment, it is a top priority to establish the psychological characteristics and related factors of geriatric orthopedic trauma patients.

There are currently many scales assessing anxiety and depression among various target groups, such as the 15-item Geriatric Depression Scale[8], State-Trait Anxiety Inventory[10], Hospital Anxiety and Depression Scale[11], EuroQol (Quality of life)-5 Dimensions[12] and 7-item Generalized Anxiety Disorder Scale[8]. However, due to the time-consuming and professional evaluation, they have not been widely used in clinical practice. Therefore, based on the large size and unique cultural characteristics of Chinese people, Wang *et al*[13] designed a new screening scale [Huaxi Emotional-Distress Index, (HEI)] for identifying emotional disorders such as anxiety, depression and suicidal tendency.

HEI is extensively used in the West China Hospital of Sichuan University, Chengdu, China. HEI has shown good effect when used in non-psychiatric clinical settings. Therefore, the purpose of this study was to investigate the prevalence of emotional disorders among geriatric orthopedic trauma patients and identify demographic, social, and clinical risk factors for anxiety and depression.

MATERIALS AND METHODS

Study design

This cross-sectional study was performed in geriatric patients with orthopedic trauma admitted to West China Hospital between May 2015 and December 2017. Inclusion criteria were as follows: (1) Aged ≥ 60 years, both sexes; and (2) Musculoskeletal injury (including closed or open fracture, joint isolation, muscle/vessel/nerve soft tissue injury). Exclusion criteria were: (1) Cognitive impairment or consciousness disorder; (2) Refusal to participate; (3) Incomplete questionnaire; (4) Unable to communicate; (5) Central nervous system disorder due to acute trauma; and (6) Significant symptoms or a history of mental illness. The demographic, social and clinical data including age, sex, marital status, education level, Injury Severity Score (ISS), Visual Analog Score (VAS), injury type, surgery type and number of chronic diseases were collected from the Hospital Information System of West China Hospital.

HEI was used to evaluate the severity of anxiety and depression. The Cronbach's α of HEI was 0.90, and sensitivity and specificity were 0.880 and 0.766, respectively[13]. There are nine self-reported items in total and all items are 5-point Likert-scaled with scale points 0-4. There are four grades based on the sum of the scores of nine items: normal (0-8 points), mild (9-12 points), moderate (13-16 points) and severe (17-36 points). The tenth and 11th item is not included in the total score (expanded to 11 items only in serious cases), but the results serve as a reference for medical staff. Details of HEI are presented in Supplementary material.

Assessment of variables

Age, sex, marital status, education level, and HEI were assessed using the standard version of questionnaires. Pain was measured with a VAS ranging from 0 (no pain) to 10 (worst pain). The VAS and HEI were calculated by trained nurses after patients filling in the results according to their actual situation. The ISS was used to measure the severity of the injury during the time of enrollment. Injury type, surgery type, and number of chronic diseases were determined by surgeons' reports and patients' reports of medical history–diagnosed hypertension, diabetes, cardiovascular disease, chronic lung disease, cerebrovascular disease, hepatic dysfunction, and renal dysfunction. For patients with an emotional disorder, psychological or psychiatric consultations were conducted for specialized treatment. The detailed process and response strategies are shown in Figure 1.

Statistical analysis

Continuous variables are expressed as mean ± SD, and categorical variables are expressed as absolute values and percentages. Differences in continuous variables were tested using the *t*-test, and differences in categorical variables were assessed using the Pearson χ^2 test. Binary logistic regression analyses were used to evaluate anxiety and depression, adjusted for age (continuous), sex (categorical), marital status (categorical), education level (categorical), ISS (continuous), VAS (continuous), injury type (categorical), surgery type (categorical), and number of chronic diseases (categorical). Odds ratios and 95% confidence intervals were calculated. All statistical analyses were carried out using SPSS version 21.0 (IBM, Chicago, IL, United States). A P value < 0.05 was regarded as statistically significant. The statistical methods of this study were reviewed by a member of the Clinical Study Design and Statistics Service from the West China Hospital, Sichuan University.

RESULTS

Patients' characteristics

Among the 966 patients, 487 were male and 479 were female, with a mean age of 70.2 ± 7.1 years. The age ranged from 60 to 90 years. Of this sample, 89.2% of patients were married. Nearly two-thirds of the patients were admitted to the hospital with fractures. The average ISS was 4.47 ± 3.65. Illiteracy (12.9%) and semi-illiteracy (33.6%) accounted for almost half of the total number of patients. The vast majority (87.3%) of patients required elective surgery. Almost two-thirds of elderly patients suffered from chronic diseases. The basic demographic, clinical and social characteristics of the enrolled patients are shown in Table 1.

Table 1 Baseline data of the enrolled patients

Variable		*n* (%)
Age (yr)	60-69	477 (49.4)
	70-79	397 (41.1)
	≥ 80	92 (9.5)
ISS (points)		4.47 ± 3.65
VAS (points)		5.20 ± 1.20
Sex	Male	487 (50.4)
	Female	479 (49.6)
Injury types	Fracture	645 (66.8)
	Joint dislocation[1]	65 (6.7)
	Soft tissue injury	256 (26.5)
Marital status	Married	862 (89.2)
	Unmarried	7 (0.7)
	Divorced or widowed	97 (10.0)
Educational level	Illiterate	125 (12.9)
	Primary school	325 (33.6)
	High school	407 (42.1)
	Junior college[2] and above	109 (11.3)
Surgery	Emergency	94 (9.7)
	Elective	843 (87.3)
	None	29 (3.0)
Number of chronic diseases	0	326 (33.7)
	1	438 (45.3)
	≥ 2	202 (20.9)
HEI score	≤ 8	891 (92.2)
	> 8	75 (7.8)
Total		966 (100)

[1]Joint dislocation: If fracture and joint dislocation occurred at the same time, it was considered joint dislocation.
[2]Junior college: general college and technical secondary school.
ISS: Injury Severity Score; VAS: Visual Analog Score; HEI: Huaxi Emotional-distress Index. Values are expressed as the mean ± SD or *n* (%).

Prevalence of anxiety and depression and related factors

Among the 966 elderly patients, 75 had an HEI score > 8, suggesting that about 7.8% of patients with orthopedic trauma had emotional disorders (Table 1). A higher ISS (4.17 ± 3.10 *vs* 7.96 ± 6.68, $P < 0.001$), higher VAS (5.05 ± 1.09 *vs* 6.89 ± 1.23, $P < 0.001$), number of chronic diseases ($P < 0.001$), injury type ($P = 0.038$), and education level ($P = 0.001$) were significantly associated with HEI score > 8 (Table 2). Binary logistic regression analysis indicated that a higher ISS ($P = 0.024$), higher VAS ($P < 0.001$), two or more chronic diseases ($P < 0.001$), and junior college education or above ($P = 0.047$) were independently associated with anxiety and depression (Table 3).

DISCUSSION

More than 70% of adults have experienced different traumatic events in their lifetime, and trauma such as traffic accidents, falling from height, and power tool injuries are common in China[14,15]. In addition, the global population is growing older.

Table 2 Association between Huaxi Emotional-distress Index score and related factors

Variable		HEI ≤ 8 (*n* = 891)	HEI > 8 (*n* = 75)	t/χ^2	*P* value
Age (yr)		70.15 ± 7.08	70.32 ± 7.46	-0.2	0.842
ISS (points)		4.17 ± 3.10	7.96 ± 6.68	-4.862	< 0.001
VAS (points)		5.05 ± 1.09	6.89 ± 1.23	-13.92	< 0.001
Sex, *n* (%)	Male	448 (50.3)	39 (52.0)	0.082	0.775
	Female	443 (49.7)	36 (48.0)		
Injury types, *n* (%)	Fracture	602 (67.6)	43 (57.3)	6.526	0.038
	Joint dislocation	62 (7.0)	3 (4)		
	Soft tissue injury	227 (25.5)	29 (38.7)		
Marital status, *n* (%)	Married	795 (89.2)	67 (89.3)	0.621	0.733
	Unmarried	7 (0.8)	0		
	Divorced or widowed	89 (10.0)	8 (10.7)		
Educational level, *n* (%)	Illiteracy	105 (11.8)	20 (26.7)	17.652	0.001
	Primary school	303 (34.0)	22 (29.3)		
	High school	376 (42.2)	31 (41.3)		
	Junior college and above	107 (12.0)	2 (2.7)		
Surgery, *n* (%)	Emergency	87 (9.8)	7 (9.3)	0.049	0.976
	Elective	777 (87.2)	66 (88)		
	None	27 (3.0)	2 (2.7)		
Number of chronic diseases, *n* (%)	0	325 (36.5)	1 (1.3)	213.385	< 0.001
	1	429 (48.1)	34 (12.0)		
	≥ 2	137 (15.4)	65 (86.7)		

Values are expressed as the mean ± SD or *n* (%). ISS: Injury Severity Score; VAS: Visual Analog Score; HEI: Huaxi Emotional-distress Index.

Table 3 Relationship of significant emotional distress predictors with Huaxi Emotional-distress Index score > 8

Variable	B	SE	Wald	*P* value	Exp (B)/OR	95%CI	
						Lower	Upper
ISS	0.105	0.047	5.074	0.024	1.111	1.014	1.218
VAS	1.335	0.194	47.287	< 0.001	3.8	2.597	5.559
Educational level							
Junior college and above	-1.778	1.032	3.959	0.047	0.169	0.029	0.974
Number of chronic diseases							
≥ 2	4.547	0.894	19.397	< 0.001	94.376	12.474	714.031
Constant	-13.545	1.59	72.583	< 0.001	< 0.001		

ISS: Injury Severity Score; VAS: Visual Analog Score; SE: Standard error; OR: Odds ratio; CI: Confidence interval.

According to a UN report, as of 2020, the total population > 60 years old exceeded 1 million and by 2050, the number will peak at 1.6 million[16]. Therefore, the number of elderly orthopedic trauma patients has also increased annually as the population has shifted to older age.

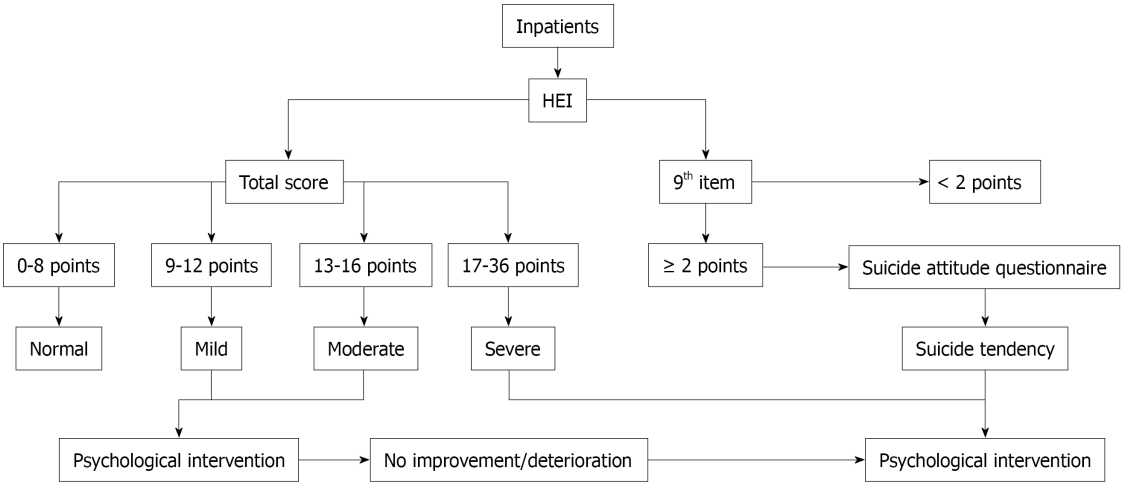

Figure 1 Huaxi Emotional-Distress Index evaluation process and response strategies. HEI: Huaxi Emotional-Distress Index.

Orthopedic trauma research in the past has been substantially focused on implant development and technique improvement involved in the treatment of these injuries [17]. The biopsychosocial model proposed by George Engel[18] in 1977 has not been fully applied in orthopedic trauma practice and research. Orthopedic trauma is often accompanied by various psychiatric symptoms, such as negative emotions, intrusion, and avoidance symptoms. According to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V), the psychiatric symptoms could manifest as acute stress disorder (ASD), post-traumatic stress disorder, depression, or anxiety[19]. Several studies have assessed the influence of the superimposed factors of old age and trauma on patients' emotions. A study found that a few social and biological factors were related to the occurrence of ASD in elderly patients with osteoporotic fractures [20]. Unfortunately, orthopedic surgeons have paid insufficient attention to this.

The present study offers an introduction to the understanding of anxiety and depression and their associated factors affecting the recovery and healing among geriatric patients with orthopedic trauma in China. In the present study, the prevalence of emotional disorders was 7.8%. Our result was lower than 12.4% in Australia among hospitalized orthopedic trauma patients using Generalized Anxiety Disorder Scale Two item instrument[21], and 31.2% in the United States among orthopedic trauma patients using State-Trait Anxiety Inventory-S instrument[10], but higher than 6.25% in the UK among pelvic trauma patients using EuroQol (Quality of life)-5 Dimensions instrument[22]. This was most likely due to differences in sample size, timing and instruments used to measure these psychological parameters. In addition, most studies included adults of all ages and did not individually screen out elderly patients.

It needs to be emphasized that the ratio of male to female patients was almost equalin the present study, which was different from the high proportion of male patients in many previous studies[12,22,23].Although a few studies indicated that the prevalence of depression and anxiety in women was higher than in men, no similar result was found in the present study[3,5]. This indicates that, in the Chinese elderly population, the prevalence of emotional disorders is not significantly different between men and women.

The present study revealed that independent variables like higher ISS, higher VAS, having two or more chronic diseases, and receiving a junior college education or above were statistically significant for HEI score > 8. The ISS score is often used to assess the severity of multiple traumas. A prospective cohort study found no association between depression and ISS[24]. However, the present study revealed that the severity of injury among geriatric orthopedic patients was significantly positively associated with HEI score > 8. The finding was in line with the study of Giannoudis *et al*[25] in the UK. The present study was conducted in a level I trauma center; therefore, this finding may be related to the various injury types, such as open fractures, polytrauma, and amputation, among the elderly patients. These severely injured patients often have to face multiple pressures of long hospitalizations, high costs, and even mutilation. Therefore, they are susceptible to negative emotions. Hawamdeh *et al*[26]. found that factors associated with a high prevalence of anxiety and depression among amputees, included female sex, lack of social support, unemployment, and traumatic

amputation.

Pain plays an important role in the quality of life. Many studies have found that pain is closely related to depression and anxiety[3,11,24,27]. Srahbzu *et al*[3] found that those who had pain within the last 24 h were 2.02 and 2.75 times more likely to develop depression and anxiety, respectively, than those without pain. In our study, those who had a higher VAS after orthopedic injury were 3.8 times more likely to develop anxiety and depression than those who had a lower VAS. In our experience, most elderly people have reduced tolerance to pain, so the severity and persistence of pain are more likely to lead to depression and anxiety. Most elderly people have sleep disorders. Pain can aggravate sleep disorders, which in turn exacerbate the pain. This vicious cycle is more likely to cause depression and anxiety.

Older adults with anxiety and depression frequently present with a variety of comorbid chronic illnesses[28,29]. In the present study, the number of chronic diseases was found to be associated with HEI > 8 on logistic regression. Those who had two or more chronic diseases had a higher risk of developing anxiety and depression when compared to those who did not have a chronic disease. A few studies indicated the presence of dysregulated homeostatic biological pathways in patients with depressed and anxiety, such as increased inflammation and disrupted energy-regulating neuroendocrine signaling (*e.g.*, leptin, insulin)[29-31]. However, the causal relationship between chronic diseases and emotional disorders seems to need clarification in the future. In addition, they are more like a pair of reciprocal relationships[28].

A few studies have found no association between education level and emotional disorders[24,32]. However, the present study revealed that the education level among geriatric orthopedic patients was significantly positively associated with HEI score > 8. Those with a junior college education or above had a lower risk of developing anxiety and depression than those who were illiterate. In China, receiving better education and skill training increases job opportunities, and work brings better economic and social support so that people have more strength and resources to counteract frustrations and difficulties. This may explain why a higher educational level was a protective factor for emotional disorders. Lack of socioeconomic support and unemployment are risk factors for depression and anxiety[3,5,26].

Depression involves an entire clinical spectrum from mild to severe[33]. Therefore, depression should be considered in the patients with HEI score < 8. Importance should be attached to the dynamic evaluation of emotions in elderly patients with orthopedic trauma as changes in disease progression or other serious stress events, such as loss of family members and appearance of malignant tumors, may occur during treatment.

This study had some limitations. First, it was a single-center study. Therefore, there must have been some selective bias. Second, this study did not investigate other possible risk factors, such as ethnicity, religion, insurance type, and substance abuse, that may have significantly affected the psychological condition of the patients. Third, this was a cross-sectional study, lacking longitudinal data, so it was difficult to confirm the causality. Hence, future studies need to be conducted to clarify these issues.

CONCLUSION

Emotional disorders, especially anxiety and depression, were common findings in geriatric patients who sustained orthopedic trauma. We would encourage clinicians to remain vigilant for emotional disorders and screen for emotional disorders in geriatric patients during the evaluation and treatment of other conditions. Psychological intervention or psychiatric treatment should be carried out.

ARTICLE HIGHLIGHTS

Research background

Common mental disorders such as anxiety and depression in geriatric orthopedic trauma patients have received little attention in research.

Research motivation

It is urgent to understand, develop and evaluate evidence-based treatments for anxiety and depression among geriatric orthopedic trauma patients. Before treatment, it is a top priority to establish the psychological characteristics and related factors.

Research objectives
This study aimed to analyze the data of geriatric orthopedic trauma patients from our hospital in order to investigate the prevalence of emotional disorders and identify demographic, social and clinical risk factors.

Research methods
This study was performed in elderly patients aged of 60 years or older with orthopedic trauma admitted to a level I trauma center between May 2015 and December 2017. Demographic, social, and clinical characteristics were described. Huaxi Emotional-Distress Index (HEI) was used to evaluate the severity of anxiety and depression status.

Research results
Among the 966 patients, 75 patients had an HEI score > 8, accounting for about 7.8% of all patients. A higher Injury Severity Score, higher Visual Analog Score, number of chronic diseases, injury type, and education level were significantly associated with HEI score > 8. On logistic regression, a higher education level was a protective factor for emotional disorders, whereas Injury Severity Score, Visual Analog Score, two or more chronic diseases were the related independent risk factors.

Research conclusions
Anxiety and depression are common in geriatric patients with orthopedic trauma. Clinicians should remain vigilant of emotional disorders in geriatric patients and screen for anxiety and depression in higher risk groups.

Research perspectives
Further investigations on larger samples are needed to confirm whether the results of our study are applicable on a broader scale.

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