

Investigation of the Negative Emotions Exhibited in Patients with Coronary Heart Disease After PCI and Any Influencing Factors

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Purpose: To understand existing negative emotions in patients with coronary heart disease after percutaneous coronary stent implantation (PCI) and analyse its influencing factors.

Methods: Patients with coronary heart disease after PCI in three tertiary hospitals in Changsha City from April to September 2018 were selected as the research subjects. The self-designed general information questionnaire assessed irritability, depression and anxiety (IDA) on a self-rating scale. It was used to examine patients' existing negative emotions with coronary heart disease after PCI and analyse the influencing factors.

Results: 203 questionnaires were distributed, and 202 valid questionnaires were recovered, with an effective recovery rate of 99.5%. The IDA score of patients with coronary heart disease after PCI was 17.01 ± 7.60 points, the incidence of negative emotions was 63.8%, and the incidences of depression, anxiety and irritability were 39.6%, 8.4% and 15.8%, respectively. Negative emotion was taken as the dependent variable and a patient's general data, such as lifestyle and disease, as the independent variables. A univariate analysis was conducted to obtain gender, age, educational level, marital status, work status, per capita monthly household income, sleep status, etc. Seven factors were identified as the influencing factors of negative emotions in patients with coronary heart disease after PCI, and the difference was statistically significant ($P < 0.05$).

Conclusion: Most patients with coronary heart disease after PCI tend to exhibit negative emotions such as anxiety and depression. Medical staff should attach great importance to evaluating any negative feelings in this group and take timely targeted intervention measures to prevent and mitigate the occurrence and development of these adverse emotions in patients with coronary heart disease after PCI.

Keywords: coronary heart disease, postoperative PCI, negative emotions, influencing factors

Introduction

Coronary Atherosclerotic Heart Disease (CHD) refers to heart disease caused by myocardial ischemia, hypoxia or necrosis due to atherosclerosis of the coronary arteries, which narrows or blocks the vascular lumen and causes myocardial ischemia, hypoxia or necrosis. Coronary heart disease is also known as ischemic heart disease.¹ With the advent of an aging society in my country, the prevention and control of chronic non-communicable diseases have become a primary focus of medical care, particularly cardiovascular diseases such as coronary heart disease.²⁻⁴ CHD is a disease with a high mortality rate and adversely impacts general health. The treatment of CHD reached a recent milestone with a new era of interventional therapy.⁵ PCI can quickly and effectively achieve vascular recanalization and relieve symptoms and has become a necessary treatment

and rescue method for CHD blood flow reconstruction.^{6,7} It is considered one of the most important medical technology advances in the 20th century. However, PCI surgery is not the end point of CHD treatment since surgery can only relieve the mechanical stenosis of coronary arteries, which will only temporarily solve the most urgent symptoms in CHD patients. Therefore, the surgery is only a starting point,⁸ albeit one that improves patients' chances of survival.⁹ In addition, patients often need to take a large number of drugs for a long time after surgery, which can be a heavy financial burden to the patients' families and society.¹⁰ As a result, negative emotions such as anxiety and depression are common in patients with coronary heart disease after PCI, which adversely affects the recovery rate of patients after surgery.¹¹

Anxiety and depression are common in hospitalised patients, and these symptoms are closely related to various factors such as the patient's physiology, psychology and state of the disease. These are recognised risk factors for coronary heart disease¹² and directly affect the prognosis of patients with coronary heart disease.^{13–15} Negative feelings such as anxiety and depression can exacerbate the body's sympathetic nerve activity, leading to increased catecholamine secretion, disordered lipid metabolism, and release of angiotensin II, resulting in increased heart rates and blood pressure and decreased myocardial blood supply and oxygen supply. Increased oxygen consumption eventually leads to or aggravates the occurrence and development of various heart diseases such as hypertension, coronary heart disease and arrhythmia.¹⁶ However, according to epidemiological research, less than 20% of individuals with depression get adequate care.¹⁷ These rates were considerably lower in patients with cardiovascular disease. In a study of hospitalised patients with heart disease, only 11% of depressed individuals got sufficient antidepressant medication.¹⁸ Long-term outcomes and their relationship with competing risks have seldom been explored, and the distribution of anxiety and depression symptoms in patients with coronary heart disease have not been thoroughly defined. To further develop secondary preventive methods to enhance the quality of life of CHD patients and improve their long-term prognosis, it is essential to study depression and anxiety and the variables associated with these symptoms.

In this study, a questionnaire survey was used to understand the occurrence of negative emotions in patients after PCI. Additionally, the influencing factors of negative emotions were analysed from varying patient general data, such as lifestyle and disease level, to provide a basis for evaluating the psychological health status and treatment effects in postoperative patients.

Materials and Methods

Research Subjects

A random sampling method was used to select patients with coronary heart disease after PCI who were hospitalised in three tertiary hospitals in Changsha from April to September 2018. The inclusion criteria were patients: (1) aged >18; (2) in line with the clinical diagnostic criteria of the International Society of Cardiology and the World Health Organization (WHO), meaning they were diagnosed with coronary heart disease via coronary angiography and received PCI treatment, and in a stable condition; (3) gave informed consent and voluntarily participated. Those excluded had: (1) acute infection, severe liver and kidney insufficiency, severe congestive heart failure, severe cerebrovascular sequelae, malignant tumour, and critically ill or end-stage disease; (2) existing coronary heart disease, PCI patients who had received formal psychotherapy before, or had been previously diagnosed with anxiety or depression; (3) Cognitive dysfunction, unable to cooperate with the completion of the assessment. All selected participants signed informed consent, and the Ethics Committee approved our hospital study.

Research Methods

Random sampling was used to investigate 202 patients with coronary heart disease after PCI utilising a self-designed general information questionnaire measuring irritability, depression and anxiety on a self-rating scale. The available data questionnaire includes demographic data, lifestyle and disease-related questions. IDA is a self-rating scale proposed by Saith R. P. in 1978 to distinguish the irritability symptoms of patients suffering from depression and anxiety.¹⁹ In 2002, it was introduced to China by Yuan Yonggui²⁰ and other scholars. The questionnaire's content has proved to be reliable, valid and consistent. Our results show that the scale's test-retest correlation coefficient ranges from 0.488 to 0.761, and the homogeneity reliability Cronbach's coefficient is from 0.419 to 0.769. The scale has 18 items corresponding to four

choices on depression, anxiety, introverted irritability and extroverted irritability. Each object corresponds to a related symptom and is scored on a scale of 0 to 3, of which 1, 2, 5, 12, 13 and 17 are positive scores. The twelve items 3, 4, 6, 7, 8, 9, 10, 11, 14, 15, 16 and 18 are reverse scoring. Depression and introverted irritability scores are classified as normal if <4 , borderline when ranging from 4–6 and abnormal if >6 ; anxiety scoring <6 is normal, borderline if 6–8 and abnormal when >8 ; extroverted irritation is classified as normal with a score of <5 , borderline state when 5–7 and abnormal if >7 .

Statistical Processing

SPSS version 20.0 statistical software (IBM Corp., CA, USA) was used for data analysis and a two-tailed P-value of less than 0.05 was considered statistically significant. The categorical data were described as counts (frequency) and the numerical data were expressed as mean $\pm$ standard deviations. After the Kolmogorov–Smirnov analysis, all numerical data were in line with normal distribution. The Student's *t*-test or one-way variance analysis (ANOVA) was used to detect the differences between two or multiple independent groups. Univariate analysis was used to analyse the influencing factors of negative emotions in patients with coronary heart disease after PCI.

Results

The recovery rate was 99.5%, as 203 questionnaires were distributed in this study and 202 of those returned were valid. General information included three prominent parts: demographic data, lifestyle and disease-related data (Table 1–3). Most of the included population were male (69.8%) and 62.9% of the patients were over 60.

Overall Negative Emotion Scores

As shown in Table 4, the negative emotion, anxiety, depression, introverted irritability and extroverted irritability scores were 17.01 ± 7.60 , 6.08 ± 2.92 , 4.57 ± 2.73 , 2.51 ± 2.20 and 3.86 ± 2.28 , respectively. The incidences of anxiety, depression and abnormal irritability in patients with coronary heart disease after PCI were 8.4%, 39.6% and 15.8%, respectively. The

Table 1 Distribution of General Demographic Characteristics of Patients with Coronary Heart Disease After PCI (n=202, %)

Variables	Group	Case (n)	Percentage (%)
Sex	Male	141	69.8
	Female	61	30.2
Age	<60 years	75	37.1
	≥ 60 years	127	62.9
Educational level	Illiteracy	12	5.9
	Primary school	69	34.2
	Junior high school	55	27.2
	High school or secondary school	41	20.3
	College	15	7.4
	Bachelor's degree and above	10	5.0
Marital status	Married	174	86.1
	Others	28	13.9
Working status	Working	63	31.2
	Not employed	139	68.8
Per capita monthly household income	≤ 1000 yuan	32	15.9
	1001–3000 yuan	76	37.6
	3001–5000 yuan	60	29.7
	>5000 yuan	34	16.8
Payment methods	All at own expense	6	3.0
	Self-pay + medical insurance	193	95.5
	All medical insurance payment	3	1.5

Table 2 Lifestyle Data of Patients with Coronary Heart Disease After PCI (n=202, %)

Variables	Group	Case	Percentage (%)
Smoking	No	115	56.9
	Yes	87	43.1
Cigarettes per day	1~10	17	19.5
	11~20	44	50.6
	≥21	26	29.9
Drinking	No	160	79.2
	Yes	42	20.8
Drinking tea	No	93	46.0
	Yes	109	54.0
Frequency of drinking tea	Rarely	7	6.4
	Occasionally (1~2 times/week)	24	22.0
	Often (≥3 times/week)	21	19.3
	Frequent (almost every day)	57	52.3
Drinking coffee	No	188	93.1
	Yes	14	6.9
Frequency of drinking coffee	Rarely	7	50.0
	Occasionally (1~2 times/week)	6	42.9
	Often (≥3 times/week)	1	7.1
Exercise	No	82	40.6
	Yes	120	59.4
Exercise frequency	Rarely	7	5.8
	Occasionally (1~2 times/week)	30	25.0
	Often (≥3 times/week)	35	29.2
	Frequent (almost every day)	48	40.0
Main sports type	Running	7	5.8
	Walking	93	77.5
	Badminton	1	0.8
	Swimming	2	1.7
	Do exercises	2	1.7
	Dancing	9	7.5
	Cycling	2	1.7
	Others	4	3.3
Duration of each exercise	<30 minutes	29	24.2
	30 to 60 minutes	60	50.0
	>60 minutes	31	25.8
Stick to exercise time	<3 month	18	15.0
	≥3 month	102	85.0
Post-operative primary caregiver	NO	14	6.9
	Child	75	37.1
	Spouse	111	55.0
	Care workers	2	1.0
Level of family support	Very little support	0	0.0
	General support	16	7.9
	Very supportive	186	92.1
Level of friend support	Very little support	4	2.0
	General support	63	31.2
	Very supportive	135	66.8
Sleep	Normal	86	42.6
	Disorder	116	57.4
When sleep problems occur	Before PCI	10	8.6
	After PCI	31	26.7
	Presence before and after PCI	75	64.7

Table 3 Disease Data of Patients with Coronary Heart Disease After PCI (n=202, %)

Variables	Group	Case (n)	Percentage (%)
Elevated body temperature after PCI	No	201	99.5
	Yes	1	0.5
Reason for stent implantation	Acute myocardial infarction	94	46.5
	Prior myocardial infarction	30	14.9
	Unstable angina	47	23.3
	Acute coronary syndrome	21	10.4
	Others	10	4.9
Comorbidities	Arrhythmia	13	6.4
	Heart failure	5	2.5
	Others	184	91.1
Hypertension	No	64	31.7
	Yes	138	68.3
Diabetes	No	154	76.2
	Yes	48	23.8
Hyperlipidemia	No	169	83.7
	Yes	33	16.3
Number of stent implants	1 time	160	79.2
	2 times	38	18.8
	3 times	4	2.0
Number of stents implanted (pcs)	1	103	51.0
	2	70	34.6
	3	23	11.4
	≥4	6	3.0
Coronary artery distribution	Left Coronary Dominance	26	12.9
	Right Coronary Dominance	122	60.4
	Left and Right Coronary Balance	54	26.7
Coronary angiography diagnostic report	Single-vessel disease	14	6.9
	Double-vessel disease	43	21.3
	Three-vessel disease or more	145	71.8
Postoperative medication compliance	Basic law	108	53.5
	Occasionally forget	56	27.7
	Often forget	16	7.9
	Stop taking the drug after symptoms improve	18	8.9
	Discontinuation of medication due to stomach pain and other discomfort	2	1.0
	Discontinue medication as ordered	2	1.0
Type of medication	Chinese medicine and proprietary Chinese medicine	1	0.5
	Western medicine	200	99.0
	Western medicine + Chinese medicine and proprietary Chinese medicine	1	0.5
Follow-up	Regular follow-up	57	28.2
	Irregularly, go to the doctor when you have time	12	6.0
	Irregularly, do not go to the doctor if have no symptoms	116	57.4
Follow-up interval (months)	Little follow-up	17	8.4
	1	44	77.1
	2	3	5.2
	3	1	1.8
	6	1	1.8
	8	1	1.8
	9	6	10.5
	12	1	1.8

Table 4 Negative Emotional Status of Patients with Coronary Heart Disease After PCI (n=202, %)

Variables	Score	Emotional State (n/%)		
		Normal	Edge State	Abnormal
Total Negative Emotion Score	17.01±7.60			
Anxiety	6.08±2.92	143(70.8)	42(20.8)	17(8.4)
Depression	4.57±2.73	69(34.2)	53(26.2)	80(39.6)
Introverted agitation	2.51±2.20	164(81.2)	25(12.4)	13(6.4)
Extroverted agitation	3.86±2.28	152(75.2)	31(15.3)	19(9.4)

univariate analysis found that among patients' general data on lifestyle and disease, seven factors were associated with a negative emotion score after PCI in patients with coronary heart disease ($P<0.05$ for all).

Gender Effect on Negative Emotion Scores

As shown in Table 5, male patients had significantly lower anxiety (4.13 ± 2.64 vs 5.57 ± 2.70 , $P=0.001$) and IDA total score (16.19 ± 7.73 vs 18.92 ± 6.70 , $P=0.015$) than female patients. However, the two sexes had no significant differences in depression and introverted and extroverted agitation.

Age Effect on Negative Emotion Scores

As shown in Table 6, those ≥ 60 had significantly higher depression scores than the <60 group (6.45 ± 3.10 vs 5.45 ± 2.52 , $P=0.019$). There were no significant differences in other dimensions, such as anxiety, introverted and extroverted agitation, or IDA total score between these groups.

Effect of Education Level on Negative Emotion Scores

As shown in Table 7, compared with other groups, illiterate patients with coronary heart disease after PCI had the highest scores in depression (8.42 ± 2.84), anxiety (6.42 ± 3.12), introverted irritability (3.83 ± 2.12) and overall IDA score (22.50 ± 7.51), all with statistically significant differences ($P<0.05$).

Table 5 Comparison of Negative Emotion Scores in Patients with Coronary Heart Disease After PCI in Different Genders ($\bar{x} \pm s$)

Male	Depression	Anxiety	Introverted Agitation	Extroverted Agitation	IDA Total Score
Male	5.86±2.90	4.13±2.64	2.32±2.25	3.88±2.32	16.19±7.73
Female	6.59±2.94	5.57±2.70	2.95±2.02	3.80±2.20	18.92±6.70
t	-1.631	-3.497	-1.971	0.222	-2.463
P	0.106	0.001	0.051	0.824	0.015

Table 6 Comparison of Negative Emotion Scores in Patients with Coronary Heart Disease After PCI at Different Ages ($\bar{x} \pm s$)

Age	Depression	Anxiety	Introverted Agitation	Extroverted Agitation	IDA Total Score
<60 years	5.45±2.52	4.11±2.51	2.28±2.17	4.03±2.26	15.87±6.97
≥ 60 years	6.45±3.10	4.84±2.83	2.65±2.21	3.76±2.30	17.69±7.90
t	5.590	3.460	1.311	0.666	2.746
P	0.019	0.064	0.254	0.416	0.099

Table 7 Comparison of Negative Emotion Scores in Patients with Different Educational Levels of Coronary Heart Disease After PCI ($\bar{x} \pm s$)

Educational Level	Anxiety	Depression	Introverted Agitation	Extroverted Agitation	IDA Total Score
Illiteracy	6.42±3.12	8.42±2.84	3.83±2.12	3.83±2.12	22.50±7.51
Primary school	5.19±2.80	7.16±3.12	3.04±2.22	4.36±2.53	19.75±7.97
Junior high school	4.11±2.51	5.45±2.54	2.15±1.88	3.49±2.15	15.20±6.29
High school or secondary school	4.22±2.55	5.17±2.64	2.39±2.58	3.90±2.10	15.68±7.53
College	4.06±2.66	4.53±2.39	1.47±1.46	2.93±1.75	13.00±6.84
Bachelor's degree and above	2.80±2.10	5.30±1.34	1.30±1.42	3.60±2.17	13.00±2.79
F	3.379	6.464	3.506	1.501	5.973
P	0.006	<0.001	0.005	0.191	<0.001

Note: The numerical data among different groups were compared using the one-way ANOVA.

Marital Status Effect on Negative Emotion Scores

As shown in Table 8, the depression (5.89 ± 2.74 vs 7.25 ± 3.73 , $P=0.022$), introverted irritability dimension (2.36 ± 2.19 vs 3.46 ± 2.01 , $P=0.013$), and overall IDA score (16.56 ± 7.51 vs 19.86 ± 7.69 , $P=0.033$) of married patients were lower than those listed as “other”.

Effect of Employment Status on Negative Emotion Scores

As shown in Table 9, the unemployed patients had higher anxiety (4.85 ± 2.78 vs 3.95 ± 2.53 , $P=0.025$) and overall IDA scores (17.78 ± 7.83 vs 15.32 ± 6.82 , $P=0.032$) than those that were employed.

Effect of Income Level on Negative Emotion Scores

As shown in Table 10, the group with ≤ 1000 tuples had the highest negative scores, including depression (7.03 ± 2.98), introverted irritability (3.56 ± 2.22), and the overall IDA score (20.53 ± 6.70) with statistically significant differences ($P < 0.05$ for all).

Effect of Sleep States on Negative Emotion Scores

As shown in Table 11, those patients with a sleep disorder had significantly higher scores of depression (7.22 ± 2.88 vs 4.55 ± 2.20 , $P < 0.001$), anxiety (5.42 ± 2.70 vs 3.42 ± 2.34 , $P < 0.001$), introverted irritability (2.86 ± 2.20 vs 2.03 ± 2.11 , $P=0.007$), and overall IDA score (19.40 ± 7.49 vs 13.79 ± 6.51 , $P < 0.001$) than those with normal sleep.

Table 8 Comparison of Negative Emotion Scores in Patients with Coronary Heart Disease After PCI with Different Marital Status ($\bar{x} \pm s$)

Marital Status	Anxiety	Depression	Introverted Agitation	Extroverted Agitation	IDA Total Score
Married	4.48±2.76	5.89±2.74	2.36±2.19	3.83±2.24	16.56±7.51
Others	5.14±2.53	7.25±3.73	3.46±2.01	4.00±2.55	19.86±7.69
t	1.435	5.323	6.307	0.128	4.627
P	0.232	0.022	0.013	0.721	0.033

Table 9 Comparison of Negative Emotion Scores in Patients with Coronary Heart Disease After PCI in Different Working States ($\bar{x} \pm s$)

Working Status	Anxiety	Depression	Introverted Agitation	Extroverted Agitation	IDA Total Score
Not employed	4.85±2.78	6.32±3.05	2.69±2.36	3.92±2.31	17.78±7.83
Working	3.95±2.53	5.54±2.58	2.11±2.06	3.71±2.23	15.32±6.82
t	2.260	1.775	1.801	0.603	2.156
P	0.025	0.077	0.074	0.548	0.032

Table 10 Comparison of Negative Emotion Scores of Patients with Coronary Heart Disease After PCI with per Capita Monthly Income of Different Families ($\bar{x} \pm s$)

Income Level (Yuan)	Anxiety	Depression	Introverted Agitation	Extroverted Agitation	IDA Total Score
≤1000	5.44±2.61	7.03±2.98	3.56±2.22	4.50±2.17	20.53±6.70
1001~3000	4.83±2.84	6.72±3.19	2.74±2.29	3.85±2.34	18.14±8.12
3001~5000	3.98±2.64	5.45±2.45	2.03±1.96	3.63±2.33	15.10±6.96
>5000	4.21±2.57	4.85±2.43	1.85±1.96	3.65±2.14	14.56±6.74
F	2.478	5.646	4.958	1.139	5.664
P	0.062	0.001	0.002	0.334	0.001

Table 11 Comparison of Negative Emotion Scores in Patients with Coronary Heart Disease After PCI in Different Sleep States ($\bar{x} \pm s$)

Sleep State	Anxiety	Depression	Introverted Agitation	Extroverted Agitation	IDA Total Score
Normal	3.42±2.34	4.55±2.20	2.03±2.11	3.79±2.24	13.79±6.51
Abnormal	5.42±2.70	7.22±2.88	2.86±2.20	3.91±2.31	19.40±7.49
t	-5.635	-7.463	-2.705	-0.354	-5.564
P	<0.001	<0.001	0.007	0.724	<0.001

Discussion

In this cross-sectional study, we explored the occurrence and influencing factors of negative emotions in patients with coronary artery disease after PCI. The main findings can be summarised as follows: 1) patients with coronary heart disease after PCI often exhibited negative emotions such as anxiety and depression; 2) gender, age, educational level, marital status, work status, per capita monthly household income and sleep status can be associated with these negative emotions. Therefore, more efforts should be paid to evaluating negative emotions in high-risk groups and early prevention strategies in patients with coronary heart disease after PCI.

Current Situation of Negative Emotions in Patients with Coronary Heart Disease After PCI

This study showed that the incidence of negative emotions in patients with coronary heart disease after PCI was 63.8%, and depression, anxiety and irritability were 8.4%, 39.6% and 15.8%, respectively. Studies have reported that the incidence of anxiety in patients after PCI ranges from 25% to 37%,²¹ while depression can reach 67%.²² In our survey, 1461 people were selected as the research subjects, and follow-up times were controlled for 7 to 9 years. It was found that the mortality rate of patients with coronary heart disease and depression was significantly higher than that of patients with simple coronary heart disease, at an increased rate of 80%. At the same time, the more pronounced the depressive symptoms were in patients, the greater their risk of adverse cardiovascular events of coronary heart disease.²³ The low incidence of depression in this study may be attributed to the small sample size of this study. CHD is a chronic disease; if long-term chronic stress is not relieved or reduced over time, it will inevitably lead to anxiety and tension. Studies have shown²⁴ that the serum inflammatory marker IL-6 in patients with depression after PCI was uncommonly high, and the magnitude of the increase was positively correlated with the severity of depression. Therefore, anxiety, depression and coronary heart disease PCI are causal and mutually reinforcing, which is not conducive to the recovery of patients' health.

Influencing Factors of Negative Emotions in Patients with Coronary Heart Disease After PCI

This study showed that the negative emotions of patients with coronary heart disease after PCI significantly differed in the following seven aspects ($P < 0.05$).

Gender

The anxiety dimension score of female patients was (5.57 ± 2.70) points, and the total IDA score was (18.92 ± 6.70) points, which were higher than those of male patients, indicating that female patients with coronary heart disease after PCI were more likely to have anxiety symptoms than male patients. A study by some scholars found that the proportion of anxiety, depression and anxiety with depression in female patients with coronary heart disease after PCI was higher than that in males, and the difference was statistically significant ($P < 0.05$).²⁵ In a population at one month after myocardial infarction, compared with men, women were at higher risk for anxiety or depression and the severity of depression increased with age in men. In contrast, the severity of anxiety decreased.²⁶ These are consistent with the findings of this study. This phenomenon may result from the fact that women are more vulnerable physically and psychologically and have more sensitive, volatile emotions than men.^{27,28} Gonadal hormones may be the prominent factor in this difference. Women are more likely to experience mood disorders during hormonal flow, and testosterone may have a protective effect against anxiety and depression.²⁹ Therefore, personalised treatment should target the pathogenesis of negative emotions in patients undergoing revascularization.

Age

People over 60 had a higher depression score (6.45 ± 3.10) points, while those under 60 scored lower (5.45 ± 2.52) . The results showed that with increasing age, patients with coronary heart disease after PCI were more likely to have depression. The reason may be that health declines with age and the inevitable increase in chronic diseases. These diseases are prone to recur due to the long course of the disease and require long-term drug maintenance. In addition, a decreased sense of self-worth is common with psychological changes such as scepticism, withdrawal, anxiety and depression.^{30,31}

Educational Level

The results of this study showed that illiterate CHD patients had the highest scores in depression, anxiety, introverted irritability dimensions, and overall IDA score after PCI, which shows that patients with lower educational levels are more likely to have depression and anxiety. The reason may be that different levels of education manifest in differing viewpoints and cognition levels from the same disease. Patients with coronary heart disease after PCI with higher education levels often understand and learn more about their condition, treatment, and prognosis through mobile phones, computers and various apps, while having a confident psychological grasp of the disease. However, patients with low education levels often have inadequate disease-related knowledge and retain an elevated sense of uncertainty about the condition. This means they are more likely to have harmful psychological effects, such as stress and depression.^{32,33}

Marital Status

The results of this study showed that CHD patients with other marital identifications (including single, divorced and widowed) were more likely to have negative emotions after PCI than married patients with a spouse. The reasons may be that, on the one hand, when a patient with a spouse is facing the pressure of the disease, they can seek help or comfort from their partners or get help. From a psychological point of view, they have strong emotional support. Conversely, unmarried, divorced or widowed patients may suffer mental health discrimination from others or psychological traumas. When they experience additional pressure from a disease recurrence, their psychological endurance is often close to a breaking point, which may be difficult to endure and thus prone to extremely negative emotions.^{34,35}

Working Status

Unemployed patients with coronary heart disease after PCI are more likely to have anxiety than working patients. The reasons may be that working can ease the financial pressures on the family while acting as a distraction to a patient from their pain. Additionally, at work, patients can communicate with colleagues and share their thoughts, which can be a release for negative emotions. Therefore, work may play a particular role in promoting the improvement of negative emotions in patients with coronary heart disease after PCI.³⁶

Sleep Status

Patients with poor sleep quality after coronary heart disease PCI are more prone to depression and anxiety than patients with normal sleep. The reason may be that lack of sleep or sleep disorders in patients can lead to the lack of regular rest for the brain, and changes in hormone levels, making patients' emotions harder to regulate and resulting in anxiety and depression.^{37,38}

Limitations

This study has certain limitations. First, the sample size included in this study was relatively small, and we plan to increase the sample size in future studies. Secondly, there has been no follow-up on the prognosis of patients with negative emotions, and no definite conclusions can be drawn about the impact. In addition, we only provided an overview of the current situation and potential influencing factors of negative emotions in patients undergoing PCI due to a cross-sectional design. Further longitudinal studies are thus warranted to reveal any possible associations between negative emotions and other socio-economic factors in multicentre, large cohorts.

Conclusion

In conclusion, the results of this study showed that the negative emotions of patients with coronary heart disease after PCI were at moderate to severe levels. Seven factors, including gender, age, education level, marital status, work status, family monthly income and sleep status were the primary influencing factors of negative emotions in patients with coronary heart disease after PCI. Healthcare workers should take a series of interventions, including death education, cognitive behavioural education, collaborative nursing, health education, stress counselling and support, to help caregivers aid patients more effectively.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the Declaration of Helsinki and approved by the Medical Ethics Committee of Hunan People's Hospital, (Protocol number: No.70). We obtained signed informed consent from the participants in this study.

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Disclosure

The authors report no conflicts of interest in this work.

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