INFLUENCING FACTORS FOR DEPRESSION AND ANXIETY AMONG PATIENTS AND EFFECTS ON SHORT-TERM PROGNOSIS AFTER CARDIOVASCULAR INTERVENTIONAL TREATMENT

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ABSTRACT

Introduction: *Coronary heart disease (CHD) is a very common ischemic cardiovascular disease and the leading cause of death among patients with cardiovascular diseases. This research was conducted to investigate percutaneous coronary intervention (PCI) for short-term and the influencing factors for depression and anxiety among coronary heart disease (CHD) patients.*

Materials and methods: *the clinical data on 90 CHD patients undergoing PCI were included for 1-year follow-up. Patient health questionnaire-9 (PHQ-9) and generalized anxiety disorder-7 (GAD-7) scales were employed for scoring and grouping. They were enrolled into normal group (51 cases) and depression and anxiety syndromes (DAS) group (39 cases). The differences in cardiopulmonary functions and oxygen uptake after treatment were compared. Binary Logistic and COX proportional hazards models were utilized to analyze the influencing factors for postoperative anxiety, depression, and prognosis.*

Results: *PHQ-9 and GAD-7 scores of DAS group rose, while 6-min walking distance, left ventricular end diastolic diameter (LVEDd), and anaerobic threshold oxygen uptake declined versus those of normal group (P<0.05). Incidence of major adverse cardiovascular events (MACE) of DAS group was relatively higher (P<0.05). Female, body mass index (BMI), junior college degree and below, various medical histories, and two or more stents were the independent risk factors for postoperative anxiety and depression. Anaerobic threshold oxygen uptake ≥40% was the protective factor (P<0.05).*

Conclusion: *age ≥60, various medical histories, two or more stents, left ventricular ejection fraction (LVEF) between 50% and 70%, LVEDd≥50 mm, and postoperative anxiety and depression were the independent risk factors for MACE (P<0.05). After PCI, the incidence of anxiety and depression was high and the prognosis was poor.*

Keywords: *Coronary heart disease, percutaneous coronary intervention, anxiety and depression, major adverse cardiovascular events.*

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Introduction

Coronary heart disease (CHD) is a very common ischemic cardiovascular disease and the leading cause of death among patients with cardiovascular diseases. In recent years, the incidence and fatality rate of CHD apparently grow. Hence, the influencing factors for prognosis among CHD patients have become a research focus[1, 2]. Considerable epidemiological data demonstrate that CHD is closely associated with chronic adverse emotions and depression, anxiety, and anger are related to the occurrence of atherosclerosis and major adverse cardiovascular events (MACE)[3]. The incidence of depression ranges from 25% to 40% among patients with cardiovascular disease, which seriously affects postoperative rehabilitation progress and quality of life. A study verifies that the incidence of myocardial reperfusion injury notably grow among patients with acute myocardial infarction and depression, which increases the relapse and fatality rate of acute coronary artery syndrome[4, 5]. Frasure-Smith and Lespérance (2008)[6] revealed that anxiety could be viewed as the independent predictor for MACE among patients

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with stable CHD, suggesting that the occurrence and prognosis of CHD is closely correlated with anxiety and depression. Percutaneous coronary intervention (PCI) is an essential surgical method for CHD, which effectively alleviates the clinical symptoms, reduces mortality, and improves quality of life among CHD patients[7]. However, it is confirmed that PCI is risky and anxiety and depression occur during perioperative period. Negative emotions increase the incidence of postoperative MACE[8,9]. The incidence of anxiety and depression amounts to 5% to 75% and 10% to 65% during PCI[10]. In addition, inflammatory factor level dramatically increases among patients with anxiety and depression and inflammatory reaction increases the incidence of atherosclerosis, which further affects prognosis[11]. Therefore, the investigation into the relationship between psychological factors and cardiovascular diseases has received extensive attention from people.

To explore the risk factors for the occurrence of anxiety and depression and the effects on prognosis among CHD patients after PCI, the clinical data on 90 CHD patients undergoing PCI were included for 1-year follow-up. In addition, the influencing factors for postoperative anxiety and depression and the impacts on short-term prognosis were investigated to provide experimental basis for early screening, prevention, and treatment of anxiety and depression and the improvement of prognosis among CHD patients after PCI.

Data and methods

Clinical data

90 CHD patients undergoing PCI at cardiovascular internal medicine department of Second Affiliated Hospital of Qiqihar Medical College between March 2021 and March 2022 were included as the subjects, including 54 males and 36 females. Their average age and body mass index (BMI) amounted to 62.15±4.76 and 22.31±1.07 kg/m2, respectively.

The inclusion criteria were listed below:

• Patients aged over 18;

• Patients diagnosed with CHD in coronary angiography and performed with PCI;

• Patients who took drugs in strict accordance with therapeutic plans;

• Patients who have completed the 1-year follow-up with complete clinical data;

• Patients with normal cognitive function, mental state, and communicative ability;

The exclusion criteria were listed below:

• Patients with serious mental diseases;

• Patients with obvious cognitive dysfunctions;

• Patients with a history of previous coronary artery stenting;

• Patients with major organ failure;

• Patients with contraindications of cardiopulmonary exercise test (CPET):

• Patients with recent acute infection;

• Patients with malignant tumors;

• Women during pregnancy or lactation.

The implementation of this research had been approved by Second Affiliated Hospital of Qiqihar Medical College Ethics Committee and all included patients has signed informed consent forms.

Research methods

All patients orally took 300 mg aspirin (Bayer Medical Care Co., Ltd., size: 0.1 g, batch number: SFDA approval number: H20080332) and 300 mg clopidogrel sulfate (Hangzhou Sanofi Pharmaceutical Co., Ltd., size: 75 mg*28 tablets, batch number: SFDA approval number: J20180029) before the treatment. Routine heparinization was carried out during the treatment. If the stenosis of local blood vessels of coronary artery went beyond 75%, stenting therapy should be adopted. After the treatment, patients orally took aspirin (75 mg/d) and clopidogrel sulfate (75 mg/d). Besides, they could take statins lipid-lowering drugs. Depression and anxiety among patients were evaluated 6 months after the treatment.

• Patient health questionnaire-9 (PHQ-9) scale[12] was utilized for the screening of postoperative depression. The scale included 9 items and 5-rating method was employed. Scores between 0 and 4, 5 and 9, 10 and 14, 15 and 19, and 20 and 27 represented no, mild, moderate, moderate-severe, and severe depression, respectively.

• Generalized anxiety disorder-7 (GAD-7) scale[13] was utilized for the screening of postoperative anxiety. The scale included 7 items. Scores between 0 and 4, 5 and 9, 10 and 14, and 15 and 21 referred to no, mild, moderate, and severe anxiety, respectively. PHQ-9 score over 5 points suggested depression and GAD-7 over 5 points indicated anxiety. According to the scores, all patients were enrolled into normal group (51 cases) and depression and anxiety syndromes group (39 cases).

All patients received CPET before discharge[14]. Treadmill continuous incrementing power method was adopted for restriction exercise test. Firstly,

patients rested for 3 min. Then, load-free warm-up pedaling was carried out at 60r/min. The incrementing power was set between 10 and 20 W/min according to the actual condition. The researchers should try to enable exercise power to reach the maximum value within 10 min and rehabilitation period to last more than 5 min. When patients' heart rate (HR) amounted to 85% of the maximum, the experiment should be terminated.

The experiment needed to be terminated in advance if the following signs appeared.

• Progressive aggravated angina pectoris, asthma, vertigo, presyncope, and cyanosis;

• Power increased while blood pressure reduced by more than 10 mmHg;

• Ventricular tachycardia and other severe arrhythmia symptoms;

• Ischemic ST depression or elevation shown by ECG.

Anaerobic threshold and peak oxygen uptakes, clinical data, and clinical medication of all patients were recorded. After that, 6-min walking test (6MWT) was implemented for the evaluation on cardiopulmonary functions before and 6 months after treatment. What's more, imaging techniques were employed for the measurement of left ventricular ejection fraction (LVEF) and left ventricular end-diastolic diameter (LVEDd) before and 6 months after treatment. 1-year follow-up was carried out in the form of clinic, telephone, Wechat, or mobile medical APP. During the follow-up, the occurrence of MACE within 1 year after treatment was recorded, mainly including angina pectoris, ischemic stroke, myocardial infarction, severe arrhythmia, heart failure, revascularization, re-admission caused by cardiovascular events, and all-cause death.

Statistical methods

SPSS 19.0 was employed for statistical analysis. Measurement data conforming to normal distribution were denoted by mean±standard deviation and the differences were compared using t test.

Enumeration data were denoted by frequency or percentage and the differences were compared using chi-square test. Binary Logistic regression model was utilized for the analysis of the influencing factors for anxiety and depression. In addition, COX proportional hazards regression model was used for the analysis of the influencing factors for postoperative MACE. P<0.05 suggested that the differences revealed statistical significance.

Results

Comparison of the scores for anxiety and depression among CHD patients after PCI

As displayed in Figure 1, the differences in GAD-7 and PHQ-9 scores for CHD patients in two groups 6 months after PCI were compared. GAD-7 and PHQ-9 scores were both relatively higher in DAS group (P<0.05).

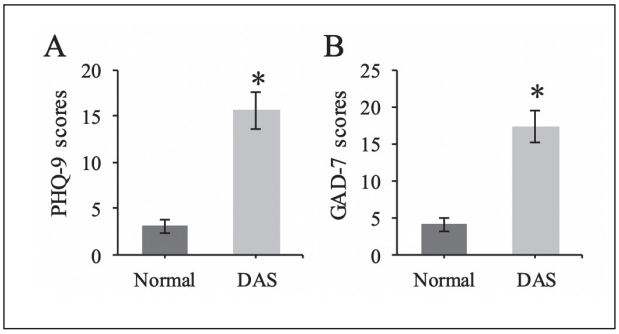

Figure 1: Comparison of the scores for anxiety and depression between two groups after PCI.
*(A. PHQ-9 scores. B. GAD-7 scores. *suggested that the differences between two groups revealed P<0.05).*

Comparison of cardiopulmonary functions of CHD patients after PCI

As presented in Figure 2, the difference in cardiopulmonary functions among CHD patients in two groups 6 months after PCI was compared. Versus those before PCI, 6MWT distance and LVEF notably rose, while LVEDd apparently declined in two groups after PCI (P<0.05). In addition, 6MWT distance of DAS group was relatively longer, while LVEDd was much lower after PCI (P<0.05). After PCI, no remarkable difference was detected in LVEF between two groups (P>0.05).

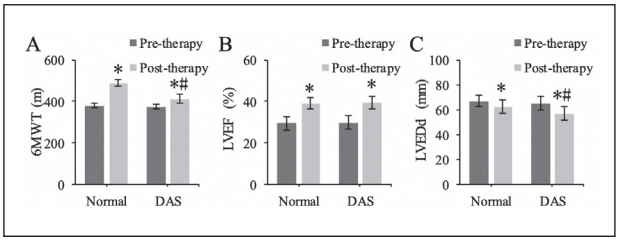

Figure 2: Comparison of cardiopulmonary functions among CHD patients in two groups before and after PCI.
*(A. 6MWT distance. B. LVEF. C. LVEDd. *revealed that the differences between two groups before PCI suggested P<0.05. #revealed that the difference between two groups suggested P<0.05).*

Comparison of oxygen uptakes among CHD patients in two groups after PCI

As illustrated in Figure 3, the difference in oxygen uptake of two groups 6 months after PCI

was compared. Anaerobic threshold oxygen uptake was relatively lower in DAS group (P<0.05). In contrast, no remarkable difference was detected in peak oxygen uptake between two groups (P>0.05).

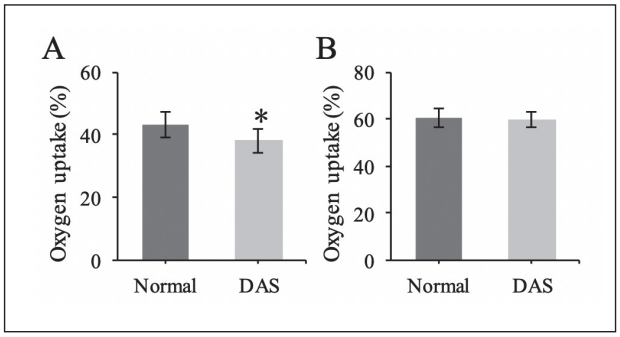

Figure 3: Comparison of oxygen uptake between two groups after PCI.
*(A. Anaerobic threshold oxygen uptake. B. Peak oxygen uptake. *revealed that the difference between two groups suggested P<0.05).*

Comparison of medication among CHD patients in two groups after PCI

As displayed in Figure 4, the difference in drug use probability among patients in two groups after PCI was compared. No remarkable difference was detected in the probability of use of aspirin, clopidogrel, ticagrelor, angiotensin receptor antagonist, β-receptor blocker, calcium ion antagonist, and statins between two groups (P>0.05).

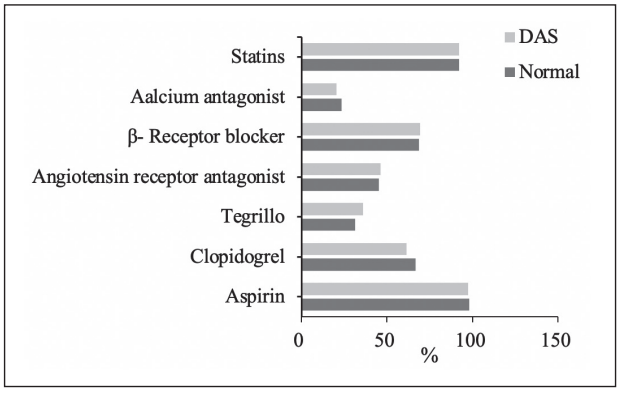

Figure 4: Comparison of drug use among patients in two groups after PCI.

Analysis of the influencing factors for anxiety and depression among CHD patients after PCI

As illustrated in Figure 5, the influencing factors for anxiety and depression among CHD patients in two groups 6 months after PCI were analyzed.

There were notable differences in gender, BMI, educational background, smoking and drinking histories, the histories of hypertension, diabetes, CHD, and cerebral infarction, and the number implanted stents among CHD patients with anxiety and depression (P<0.05). No obvious difference was detected in age (P>0.05).

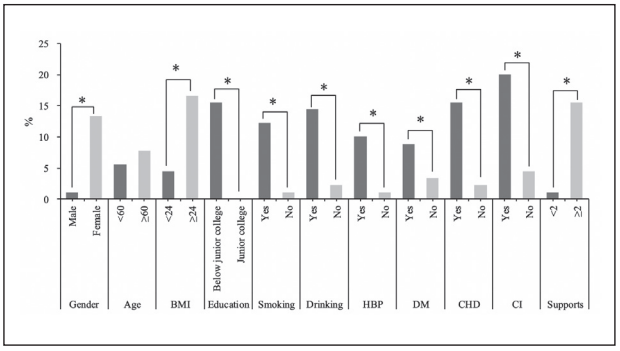

Figure 5: Analysis of the influencing factors for anxiety and depression after PCI.
*(BMI, HBP, DM, CHD, and CI referred to body mass index, high blood pressure, diabetes mellitus, coronary heart disease, and cerebral infarction, respectively. *suggested notable differences between two groups (P<0.05)).*

Binary Logistic regression model was further employed for the analysis of the influencing factors for anxiety and depression among CHD patients after PCI (Table 1). Female, BMI≥24 kg/m2, junior college degree and below, the histories of HBP, DM, CHD, and CI, and two or more implanted stents were the independent risk factors for postoperative anxiety and depression (P<0.05). Anaerobic threshold oxygen uptake≥40% was the protective factor (P<0.05).

Variables	β	S.E.	Wald	P	OR	95% confidence interval
Female	1.557	0.049	8.792	0.001	1.233	0.089~0.480
BMI≥24kg/m²	2.348	0.513	6.071	0.008	3.451	1.409~5.673
Junior college degree and below	2.092	0.672	6.614	0.012	5.443	1.567~9.832
Smoking	1.751	0.320	0.909	0.055	0.914	0.125~1.774
Drinking	1.109	0.479	5.182	0.069	0.893	0.070~1.745
HBP	1.334	0.058	4.330	0.002	1.137	0.289~2.114
DM	0.937	0.147	3.192	0.020	0.741	0.121~1.457
CHD	2.562	0.046	18.931	0.001	9.265	2.168~17.031
CI	2.180	0.501	7.676	0.005	2.560	0.783~3.310
Number of implanted stents ≥2	2.343	0.389	8.039	0.011	2.738	0.228~4.034
Anaerobic threshold oxygen uptake ≥40%	-1.829	0.172	5.743	0.018	0.980	0.507~1.342

Table 1: Binary Logistic regression analysis of the influencing factors for anxiety and depression among CHD patients after PCI.
Note: BMI referred to body mass index.

Analysis of the influencing factors for prognosis among CHD patients after PCI

As presented in Figure 6, the incidence of MACE among CHD patients in two groups within

1 year after PCI was compared. The incidence of target vessel revascularization, revascularization, arrhythmia, heart failure, angina pectoris, and all-cause death was much higher among CHD patients in DAS group than in normal group (P<0.05).

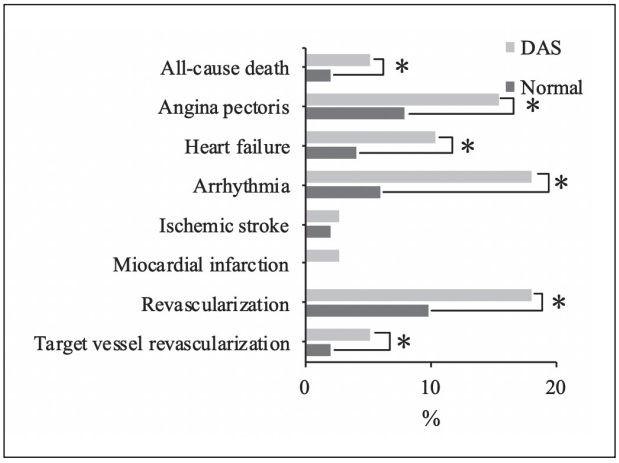

Figure 6: Comparison of the incidence of MACE among CHD patients in two groups after PCI.

COX proportional hazards regression model was employed for the analysis of the influencing factors for the occurrence of MACE after PCI (Table 2). All patients underwent the follow-up for at least 12 months. The occurrence of MACE among all included patients was recorded and COX proportional hazards model was established for the analysis of the influencing factors for MACE occurrence. Age≥60, the histories of HBP, DM, CHD, and CI, two or more implanted stents, LVEF between 50% and 70%, LVEDd≥50 mm, and postoperative anxiety and depression were the independent risk factors for postoperative MACE (P<0.05).

Variables	β	S.E.	Wald	P	OR	95% confidence interval
Female	0.042	0.423	0.012	0.069	1.021	0.224~1.837
Age≥60	0.730	0.252	5.337	0.008	2.138	1.060~3.342
HBP	1.178	0.301	6.130	0.001	2.212	1.192~3.250
DM	1.021	0.334	5.462	0.010	2.154	1.338~3.409
CHD	0.803	0.414	4.167	0.021	1.905	0.560~3.116
CI	0.915	0.328	4.334	0.018	2.137	0.902~3.428
Number of implanted stents ≥2	0.884	0.409	0.390	0.010	1.896	1.241~2.510
LVEF between 50 and 70%	0.413	0.361	6.408	0.001	0.709	0.141~1.562
LVEDd ≥50 mm	0.782	0.255	6.143	0.001	2.183	1.054~3.367
Anxiety and depression	0.981	0.149	5.093	0.012	1.389	0.895~1.907

Table 2: Influencing factors for the occurrence of MACE after PCI.

Note: LVEF and LVEDd referred to left ventricular ejection fraction and left ventricular end-diastolic diameter, respectively.

Discussion

CHD is a common cardiovascular disease, which increases the economic burden and the incidence of anxiety and depression among patients. The incidence of cardiovascular events and death among myocardial infarction patients with depression is 2 or more times higher among patients without depression within 1 to 2 years[15]. The incidence of anxiety and depression apparently grows among CHD patients and it is the independent risk factor for CHD progression[16]. In this research, 90 CHD patients undergoing PCI were included as the subjects. After PCI, the incidence of anxiety and depression amounted to 40%. PCI is a common clinical therapy for CHD, which can be adopted for fast improvement of hemadostenosis and vascular occlusion caused by coronary atherosclerosis. Consequently, myocardial ischemia and quality of life are improved[17]. Due to surgical risk, economic pressure, long-term medication, and regular biochemical indicator monitoring, the incidence of anxiety and depression during perioperative period after PCI is increased. Consequently, therapeutic effects and prognosis are affected.

Oxygen uptake refers to the amount of oxygen consumed or utilized by body per unit time. Anaerobic threshold objectively reflects the utilization capacity of maximum oxygen uptake[18]. In this research, anxiety and depression were evaluated according to PHQ-9 and GAD-7 scores for CHD patients after PCI. The research findings demonstrated that 6 min walking distance, LEVDd, and anaerobic threshold oxygen uptake were relatively lower among CHD patients with postoperative anxiety and depression.

It was suggested that anxiety and depression affected postoperative cardiopulmonary functions after PCI. Binary Logistic regression model was employed for the analysis of the influencing factors for postoperative anxiety and depression. It was found that female, BMI≥24 kg/m^2, junior college degree and below, the histories of HBP, DM, CHD, and CI, and two or more implanted stents were the independent risk factors for postoperative anxiety and depression. A great number of previous studies confirmed that the incidence of anxiety and depression was much higher in female CHD patients than in male CHD patients[19, 20].

Papazisis et al. (2019)[21] pointed out that educational background and smoking history were also the potential risk factors for anxiety and depression among CHD patients. The above

research outcomes were similar to the research findings. The histories of HBP, DM, CHD, and CI affected the incidence of anxiety and depression in CHD patients, which might be caused by long-term oral intake of drugs, the long-term effect of chronic diseases on body functions, and the increasing risk of autonomic nerve dysfunction. Exercise training improved anxiety and depression and quality of life after PCI[22]. What's more, it was suggested that high-level anaerobic threshold oxygen uptake was the protective factor for postoperative anxiety and depression, indicating that moderate postoperative exercise training could improve CHD patients' negative emotions and quality of life.

With the clinical promotion and application of PCI, a large number of studies have demonstrated that patients undergoing PCI suffered from severe psychological stress, which affected prognosis[23, 24]. Roest et al. (2022)[25] showed that anxiety was an independent risk factor for all-cause death among CHD patients.

According to the research findings, the incidence of target vessel revascularization, revascularization, arrhythmia, heart failure, angina pectoris, and all-cause death was much higher among CHD patients with anxiety and depression than among normal patients after PCI, because anxiety and depression resulted in automatic nerve dysfunction and increased cardiac load and the incidence of arrhythmia and other cardiovascular events[26]. After that, COX proportional hazards regression model was set up for the analysis of the influencing factors for postoperative MACE. It was revealed that age over 60, the histories of HBP, DM, CHD, and CI, two or more stents, LVEF between 50% and 70%, LVEDd ≥50 mm, and postoperative anxiety and depression were the independent risk factors for postoperative MACE.

Because the compensation ability of organ functions was attenuated in elderly patients under acute stress, multiple organ failures (lung, brain, and kidney) occurred very frequently. Moreover, vicious cycle and even death occurred[27]. Anxiety and depression might change body coagulation function and reduce the incidence of the excitability of parasympathetic nerve to promote the occurrence of MACE by increasing inflammatory factor levels[28].

Therefore, elderly patients should undergo mental nursing and exercise training based on routine drug therapy after PCI to alleviate anxiety and depression. Consequently, prognosis and quality of life were improved.

Conclusion

The research findings demonstrated that the incidence of MACE apparently increased among CHD patients with anxiety and depression after PCI. Hence, anxiety and depression affected the prognosis among CHD patients. Nevertheless, the sample size was small, the follow-up duration was short, and the type of assessment scale was single. Therefore, more data should be included in subsequent research, such as serum inflammatory factors.

The correlation between anxiety and depression and postoperative prognosis should be further investigated. The research findings provided some references for the improvement of postoperative prognosis and quality of life among CHD patients.

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