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Original Article

The effects of mindfulness-based stress reduction on the mental states, sleep quality, and medication compliance of patients with acute myocardial infarction after percutaneous coronary intervention

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Abstract: Objective: To assess the effects of mindfulness-based stress reduction (MBSR) on the mental states, sleep quality, and medication compliance of patients with acute myocardial infarction (AMI) after percutaneous coronary intervention (PCI). Methods: Altogether 116 patients with AMI after PCI were prospectively studied and randomized into a control group and a research group (n=58 each). Patients in the control group were given conventional nursing, while those in the research group were given MBSR based on conventional nursing. Before intervention and at 7 days after intervention, the patients' mental states, sleep quality, and satisfaction with life were assessed using the Self-Rating Anxiety Scale (SAS), the Self-Rating Depression Scale (SDS), the Pittsburgh Sleep Quality Index (PSQI), and the Satisfaction with Life Scale (SWLS). Meanwhile, the medication compliance and nursing satisfaction were compared between the two groups. Results: After intervention, the SAS, SDS, and PSQI scores in the research group were lower than those in the control group (all P<0.05), but the SWLS scores were higher than they were in the control group (P<0.05). After intervention, the scores of no drug abuse, medication according to the doctor's advice, and no unauthorized drug withdrawal in the research group were higher than those in the control group (all P<0.05), and the nursing satisfaction was also higher than it was in the control group (P<0.05). Conclusion: MBSR applied in patients with AMI during the perioperative period of PCI is beneficial to regulating their negative emotions, improving their sleep quality, medication compliance, and satisfaction with life, and it enhances the patient-nurse relationship.

Keywords: Acute myocardial infarction, percutaneous coronary intervention, mindfulness-based stress reduction, mental states, sleep quality, medication compliance

Introduction

Acute myocardial infarction (AMI), which is the most serious manifestation of coronary heart disease (CHD), refers to the vascular occlusion induced by plaque hemorrhage during the progress of coronary atherosclerosis that leads to local ischemic myocardial necrosis [1, 2]. The disease has a rapid onset and fast progression, seriously threatening patients' quality of life and even endangering their lives [3]. It mostly occurs among the middle-aged and elderly, and in China there are 5,500 cases of AMI in every 10,000,000 people, so the incidence of AMI is about 0.055%, and the incidence has annually increased with the aging of the population [4]. Currently, AMI is mainly treated by percutaneous coronary intervention (PCI), which is effective in eliminating embolisms and relieving myocardial ischemia within 2 hours after the onset of the disease [5, 6]. However, after PCI, patients are usually affected by myocardial infarction, surgical trauma, high medical expenses, and other factors, and then they experience psychological stress reactions such as depression and anxiety. As a result, their sleep quality, postoperative rehabilitation, and quality of life are seriously affected [7]. Therefore, nursing staff should pay attention to the mental states of patients with AMI after PCI, actively prevent the emerging problems, and relieve the patients' negative emotions, which helps to improve their physical and mental health.

Studies have shown that effective nursing intervention can relieve anxiety and depression in patients with AMI after PCI, improve their compliance to treatment, and enhance

treatment efficacy, reducing the incidence of major adverse cardiovascular events. Mindfulness-based stress reduction (MBSR) was previously used to treat mental illness. It can help to eliminate negative emotions through meditation and other methods, and can help patients establish correct concepts [8]. According to recent studies, it also achieves a good therapeutic effect in the treatment of cancers, hepatic cirrhosis, and chronic pain [9-11]. Ye et al. have found that MBSR significantly relieves the anxiety and depression of patients with AMI after stenting, and it improves their quality of life and satisfaction with life [12]. Therefore, in this study, 116 patients with AMI after PCI were grouped and received nursing to assess the effects of MBSR on their mental states, sleep quality, and medication compliance. The report is as follows.

Materials and methods

General information

A total of 116 patients with AMI who underwent PCI in Ganzhou People's Hospital from July 2016 to September 2018 were prospectively studied and divided into a control group and a research group (n=58 each) according to a random number table. The patients consisted of 65 males and 51 females, with an average age of (55.34 ± 6.97) years. According to the New York Heart Association (NYHA) classification, there were 59 cases of grade I cardiac function and 57 of grade II cardiac function. According to their educational levels, there were 35 cases with primary school education, 33 with secondary school education, 31 with a college degree, and 17 with a bachelor's degree and above. This study was reported to and approved by the Medical Ethics Committee of Ganzhou People's Hospital.

Inclusion and exclusion criteria

Inclusion criteria: Patients who met the diagnostic criteria and the indications for the interventional treatment of AMI formulated by the American College of Cardiology and the World Heart Federation in 2013 [13]; patients who had a high level of compliance; patients who had not received psychological intervention before; patients who had no severe postoperative complications.

Exclusion criteria: Patients with complications such as severe dysfunction of the liver, kidneys, or other organs; patients with psychosis or a psychiatric history; patients with cognitive impairment and thus unable to cooperate with the treatment.

Methods

Patients in the control group were given conventional nursing, which included psychological nursing, pain nursing, rehabilitation guidance, etc. Patients in the research group were given MBSR. According to the recovery of the patients, MBSR was started at 3-5 days after PCI, 1 hour/time and once/d, for 7 consecutive days. The specific steps were as follows: (1) Body scanning: After they lay down and kept their eyes closed to relax the whole body, the patients scanned all parts of the body from foot to head by their attention, so as to effectively connect their body and mind. The procedure was repeated 3-4 times, 5 min each time. (2) Mindfulness-based breath training: The patients took a sitting position and were in a quiet state. After that, they were guided to breathe and feel the airflow passing through the nasal cavity as well as the ups and downs of the abdomen during breathing. They were also instructed to get rid of distractions and to maintain concentration. The training was conducted 3-4 times, 5 min each time. (3) Mindfulness-based meditation: The patients were guided to self-perceive their emotions and thoughts, and their occurrence and disappearance. They objectively evaluated this psychological examination and accepted the current situation. Additionally, the patients were guided to control their emotions, to objectively evaluate their negative emotions, and to give correct responses. (4) Walking meditation: After entering the state of mindfulness-based meditation, the patients walked slowly, during which they carefully felt the contact between the foot and the ground as well as the movement of the foot, so as to train their ability to observe subtle changes. (5) Mindfulness-based introspection: The patients sensed minor changes in their bodies, and felt and summarized the occurrence and disappearance of their emotions and thoughts, so as to improve their ability to control emotions and enable them to correctly deal with negative emotions.

In order to ensure the effects of training, the following points should be valued during conducting MBSR: (1) Before MBSR, the nursing staff presiding over the training should be trained in the relevant knowledge and skills, so that they can master MBSR. Due to the heavy

Table 1. Comparison of the general information ($\bar{x}$ ± sd, n)

Group	Control group (n=58)	Research group (n=58)	χ^2/t	P
Male/female	32/26	33/25	0.035	0.852
Age (year)	55.41 ± 6.25	55.12 ± 6.17	0.252	0.802
NYHA classification			0.035	0.853
Class I	29	30		
Class II	29	28		
Education level				
Primary school	17	18	0.041	0.840
Secondary school	16	17	0.042	0.837
Junior college	16	15	0.044	0.837
Bachelor or above	9	8	0.069	0.793

Note: NYHA, New York Heart Association.

workload and pressure of nursing staff in the department of cardiology, the training time should be reasonably arranged. (2) During the training, the patients should keep their attention focused. Those with low educational levels should be educated using decent and easy-to-understand language, not professional terms. The number of the patients receiving face-to-face teaching in each class should be limited to 5-10, and the teaching time should be less than 1 h, to prevent fatigue. After 20-30 min of knowledge explanation, the patients should be led to practice and guided one by one to strengthen communication. (3) MBSR is designed to expand the content on the basis of psychological nursing and has the independence of training time. Therefore, the patients' anxiety and depression can be relieved by this method, so as to help them form good habits. In spite of this, conventional psychological nursing cannot be ignored.

Outcome measures

(1) Mental states: The patients' mental states were assessed before the intervention and at 7 days after the intervention using the Self-Rating Anxiety Scale (SAS) and the Self-Rating Depression Scale (SDS) [14]. Both scales had a total score of 100 points, and their scores were positively correlated with the severity of anxiety and depression. (2) Sleep quality: The patients' sleep quality was assessed before the intervention and at 7 days after intervention using the Pittsburgh Sleep Quality Index (PSQI), which mainly included 7 dimensions such as sleep latency, sleep duration, and sleep efficiency. Each dimension had 0-3 points to form 4 ratings, and the total score (PSQI score) reflected sleep quality. The PSQI score was negatively correlated with sleep quality [15]. (3) Satisfaction with life: The patients' satisfaction with life was assessed before intervention and at 7 days after intervention using the Satisfaction with Life Scale (SWLS), which included 5 dimensions. Each dimension had 7 ratings and the total score (SWLS score) reflected satisfaction with life [16]. The higher the score was, the higher the satisfaction with life was. (4) Medication compliance: The patients' medication compliance was assessed before intervention and at 7 days after intervention. The scale had 1-4 points and 4 ratings, including medication according to the doctor's advice, no unauthorized drug withdrawal, and no drug abuse. The scores were positively correlated with medication compliance [17]. (5) Nursing satisfaction: The patients' nursing satisfaction was assessed using self-made nursing satisfaction questionnaires, which included very satisfied, satisfied, generally satisfied, and dissatisfied. Overall nursing satisfaction rate = the number of (very satisfied + satisfied + generally satisfied) cases/total number of cases * 100%.

Statistical methods

SPSS 24.0 was used for the statistical analysis. The measurement data were expressed by ($\bar{x}$ ± sd), and for the measurement data consistent with a normal distribution, an independent sample *t* test was used for the inter-group comparisons, and a paired sample *t* test was used on the intra-group comparisons. The count data were expressed by the number of cases/percentage (n, %) and analyzed using an χ^2 test. P<0.05 indicated a statistically significant difference.

Results

Comparison of the general information

There were no statistically significant differences between the study and control groups in terms of gender, age, NYHA classification, or educational level (P>0.05), indicating comparability. See **Table 1**.

Table 2. Comparison of the SAS and SDS scores ($\bar{x}$ ± sd)

Group	Control group (n=58)	Research group (n=58)	t	P
SAS				
Before intervention	52.18 ± 8.37	51.96 ± 8.44	0.141	0.888
After intervention	50.41 ± 7.65	47.18 ± 7.37	2.316	0.022
t	1.189	3.240		
P	0.237	0.002		
SDS				
Before intervention	49.29 ± 8.83	49.16 ± 8.75	0.080	0.937
After intervention	48.66 ± 6.74	45.53 ± 6.88	2.475	0.015
t	0.432	2.516		
P	0.667	0.013		

Note: SAS, self-rating anxiety scale; SDS, self-rating depression scale.

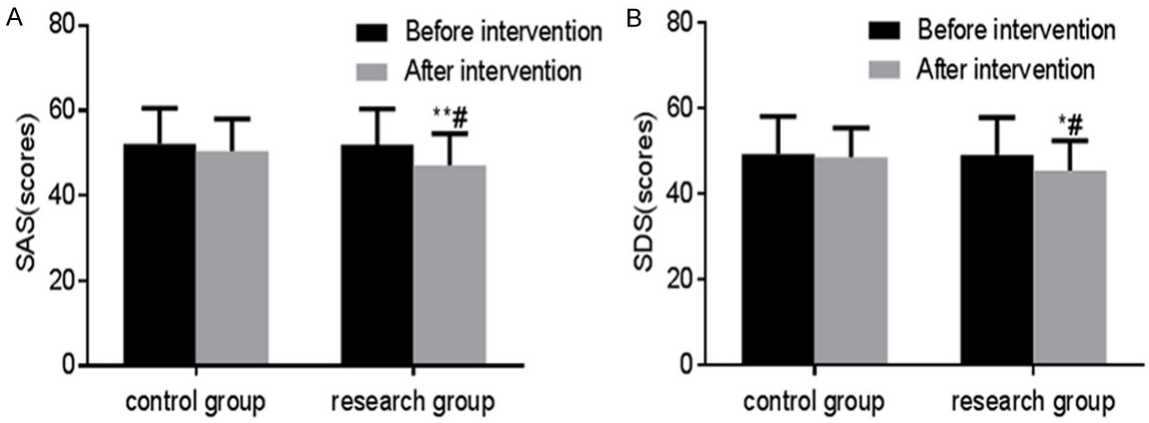

Figure 1. Comparison of the SAS scores and SDS scores. A: SAS scores; B: SDS scores. *P<0.05, **P<0.01, compared within the same group before intervention. #P<0.05, compared with control group. SAS, self-rating anxiety scale; SDS, self-rating depression scale.

Table 3. Comparison of PSQI ($\bar{x}$ ± sd)

Group	Before intervention				After intervention			
	Control group (n=58)	Research group (n=58)	t	P	Control group (n=58)	Research group (n=58)	t	P
Sleep latency	1.72 ± 0.62	1.75 ± 0.64	0.256	0.798	1.70 ± 0.56	1.51 ± 0.42*	2.067	0.041
Sleep duration	1.65 ± 0.73	1.69 ± 0.75	0.291	0.772	1.59 ± 0.51	1.41 ± 0.40*	2.115	0.037
Sleep quality	1.71 ± 0.58	1.73 ± 0.56	0.189	0.851	1.67 ± 0.46	1.50 ± 0.37*	2.193	0.030
Sleep disorder	2.18 ± 0.78	2.21 ± 0.80	0.205	0.838	1.97 ± 0.69	1.71 ± 0.45*	2.404	0.018
Sleep efficiency	1.70 ± 0.81	1.71 ± 0.79	0.067	0.947	1.65 ± 0.57	1.45 ± 0.48*	2.044	0.043
Disfunction	1.83 ± 0.61	1.81 ± 0.66	0.170	0.866	1.80 ± 0.54	1.61 ± 0.34*	2.268	0.025
Total score	10.24 ± 2.09	10.36 ± 2.13	0.817	0.416	9.92 ± 1.78	9.23 ± 1.94**	1.996	0.048

Note: *P<0.05, **P<0.01, compared within the same group before intervention. PSQI, Pittsburgh sleep quality index.

Comparison of mental states

Before intervention, there were no statistically significant differences between the study and control groups in their SAS and SDS scores (P>0.05). After the intervention, the scores in the research group were significantly lower than those before intervention (P<0.05). But before and after the intervention, the scores in the control group showed no statistically signifi-

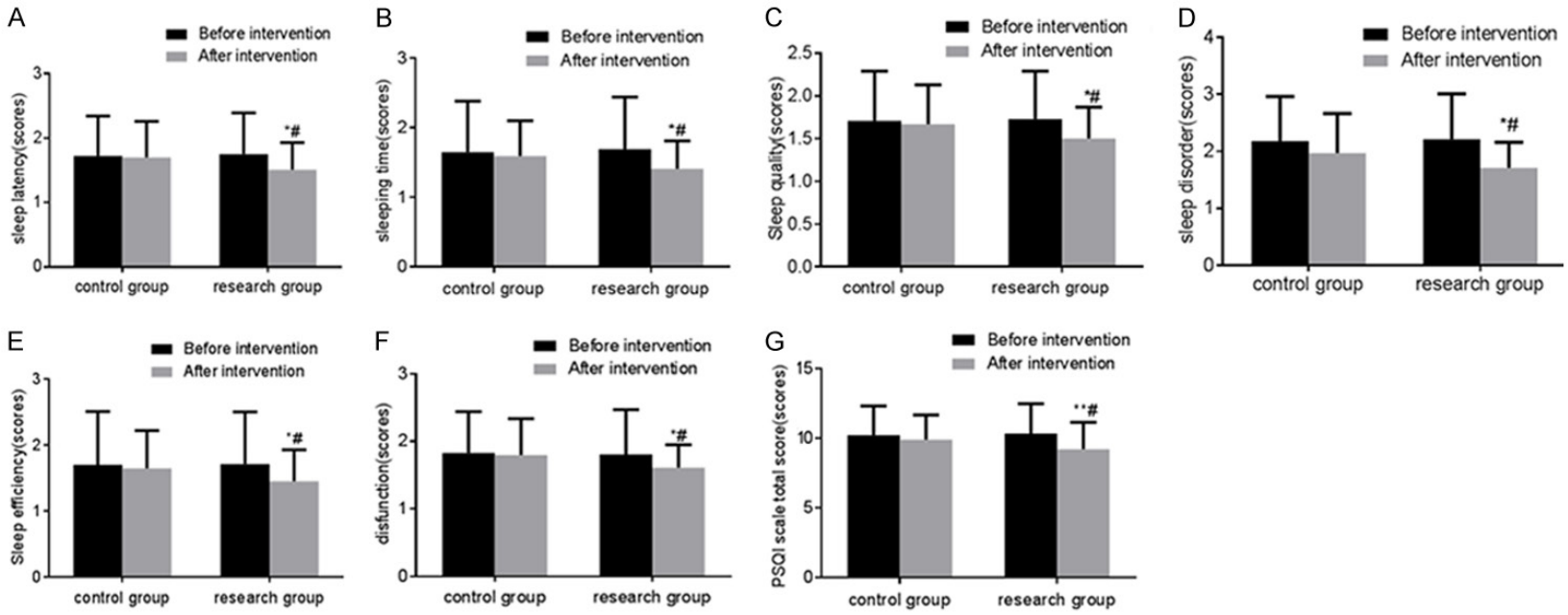

Figure 2. Comparison of the PSQI scores. A: Sleep latency; B: Sleep duration; C: Sleep quality; D: Sleep disorder; E: Sleep efficiency; F: Disfunction; G: PSQI scale total score. *P<0.05, **P<0.01, compared within the same group before intervention; #P<0.05, compared with control group. PSQI, Pittsburgh sleep quality index.

Table 4. Comparison of SWLS scores ($\bar{x}$ ± sd)

Group	Control group (n=58)	Research group (n=58)	t	P
Before intervention	21.44 ± 4.15	21.03 ± 4.19	5.530	0.598
After intervention	23.52 ± 4.71	27.38 ± 5.20	4.190	0.000
t	2.523	7.242		
P	0.013	0.000		

Note: SWLS, satisfaction with life scale.

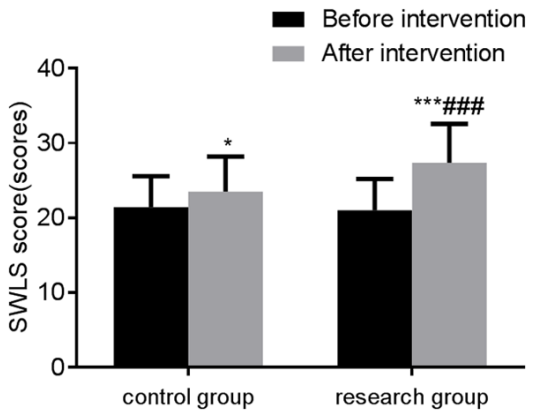

Figure 3. Comparison of the SWLS scores. *P<0.05, ***P<0.001, compared within the same group before intervention; ###P<0.001, compared with control group. SWLS, satisfaction with life scale.

cant differences (P>0.05). After intervention, the scores in the research group were lower than those in the control group (P<0.05). These findings suggest that MBSR can significantly relieve patients' anxiety and depression. See **Table 2** and **Figure 1**.

Comparison of sleep quality

Before the intervention, there was no statistically significant difference in the PSQI score between the study and control groups (P> 0.05). After the intervention, the research group showed a significantly lower score than before intervention (P<0.05). Before and after the intervention, the scores in the control group showed no statistically significant difference (P>0.05). After the intervention, the scores in the research group were lower than the scores in the control group (P<0.05). These findings suggest that MBSR can significantly improve patients' sleep quality. See **Table 3** and **Figure 2**.

Comparison of satisfaction with life

Before the intervention, there was no statistically significant difference in the SWLS scores between the study and control groups (P>0.05). After the intervention, the scores in the two groups were significantly higher than they were before the intervention (P<0.05). After the intervention, the scores in the research group were higher than those in the control group (P<0.05). These findings suggest that MBSR can significantly improve patients' satisfaction with life and quality of life. See **Table 4** and **Figure 3**.

Comparison of medication compliance

Before the intervention, there were no statistically significant differences between the study and control groups in the no drug abuse, medication according to the doctor's advice, and no unauthorized drug withdrawal scores (P>0.05). After the intervention, the scores in the groups were significantly higher than they were before the intervention (P<0.05). After the intervention, the scores in the research group were higher than those in the control group (P<0.05). These findings suggest that MBSR can significantly correct patients' behaviors such as drug abuse, medication that did not follow the doctor's advice, and unauthorized drug withdrawal, improving their medication compliance. See **Table 5** and **Figure 4**.

Comparison of nursing satisfaction

The overall nursing satisfaction rate in the research group was higher than it was in the control group (94.83% VS 82.76%) (P<0.05). This suggests that MBSR can significantly improve patients' nursing satisfaction and the nurse-patient relationship. See **Table 6**.

Discussion

With the development of PCI technologies, in recent years we have witnessed an increase of patients with CHD receiving PCI, and the proportion of patients over 80 years old has increased to 11.6%. As a result, the incidence of complications after PCI is then increased. According to Gu et al., among 206 patients after PCI, about 2% had vasovagal reflex, ab-

Table 5. Comparison of medication compliance ($\bar{x}$ ± sd)

Group	Control group (n=58)	Research group (n=58)	t	P
Medication according to the doctor's advice				
Before intervention	2.68 ± 0.47	2.73 ± 0.50	0.555	0.580
After intervention	2.89 ± 0.59***	3.44 ± 0.62***	4.894	0.000
No unauthorized drug withdrawal				
Before intervention	2.39 ± 0.46	2.42 ± 0.45	0.355	0.723
After intervention	2.82 ± 0.53***	3.39 ± 0.62***	5.322	0.000
No drug abuse				
Before intervention	2.51 ± 0.39	2.53 ± 0.40	0.273	0.786
After intervention	2.90 ± 0.55***	3.37 ± 0.58***	4.478	0.000

Note: ***P<0.001, compared within the same group before intervention.

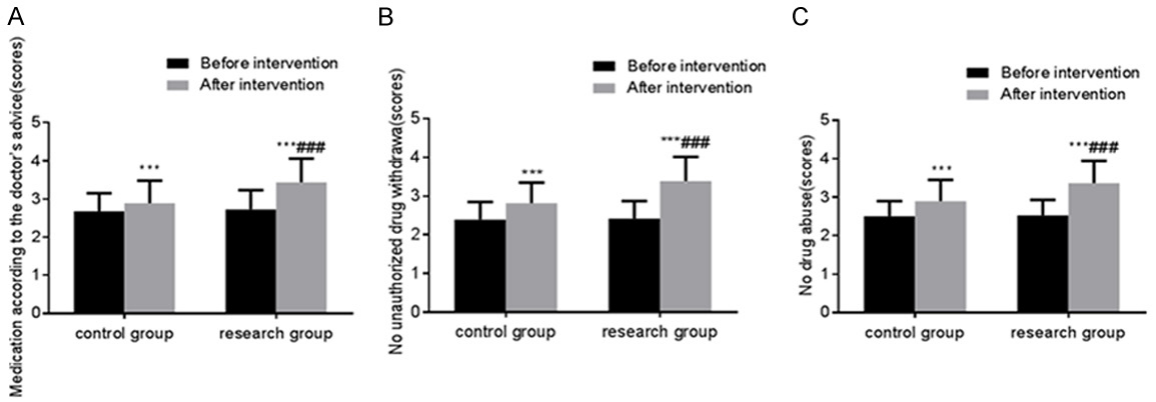

Figure 4. Comparison of medication compliance. A: Medication according to the doctor's advice; B: No unauthorized drug withdrawal; C: No drug abuse. ***P<0.001, compared within the same group before intervention; ###P<0.001, compared with control group.

Table 6. Comparison of nursing satisfaction (n, %)

Group	Control group (n=58)	Research group (n=58)	t	P
Very satisfied	12 (20.69)	17 (29.31)		
Satisfied	16 (27.59)	21 (36.21)		
Generally satisfied	20 (34.48)	17 (29.31)		
Dissatisfied	10 (17.24)	3 (5.17)		
Overall nursing satisfaction rate	48 (82.76)	55 (94.83)	4.245	0.039

out 4% had postoperative urinary retention, and 3% had hemorrhage at the puncture site, without cases of acute or subacute thrombosis [18]. In China, due to the lack of mental health resources, the patients usually receive intervention by means of health education and psychological support, but they are untargeted on some occasions [19]. In addition to the rapid onset and fast progression of AMI, under the conditions of precordial pain, critical illness, and senile multiple, it's easy to bring psychological pressure, anxiety, fear, and other negative emotions to the patients [20]. Psychological stress that produces negative emotions aggravates coronary artery spasms, the incidence of which after PCI is about 5% [21].

MBSR is a method of relieving negative emotions by diverting attention [22]. The current mechanism of action of mindfulness has many models, among which the re-perception model is an important one. This model makes a patient feel stress responses from inside and outside the body through respiratory training and perceptual acuity training, thus improving the patient's stress state after PCI [23]. In this study, after intervention, the SAS, SDS, and PSQI scores in the research group were lower

than they were in the control group, but the SWLS scores were higher than they were in the control group. This indicates that MBSR can relieve the negative emotions of patients with AMI after PCI and improve their sleep quality and satisfaction with life. This is because MBSR is self-control training and aims to improve the concentration of patients through continuous practice. During the practice, with the self-supervision and self-control, the patients' bodies and minds get relaxed and their ability to control emotions is improved, which is helpful in correcting their cognitive bias. MBSR can enhance the activity of the left prefrontal cortex of the patients' brains and regulate emotions, contributing to the generation of positive emotions. Moreover, this method activates the patients' neural networks, prevents them from being deeply psychologically troubled, and relieves their perceived stress, thereby improving their sleep quality [24, 25].

The sense of self-efficacy refers to the ability of patients to deal with various pressures [26]. Generally speaking, patients with AMI after PCI suffer from negative emotions due to various factors. As a result, their confidence and self-efficacy are reduced, and then they negatively cope with the disease, which are mainly reflected in a reduction of satisfaction with life and treatment compliance [27, 28]. In this study, after intervention, compared with those in the control group, patients in the research group had a higher SWLS score, scores of no drug abuse, medication according to the doctor's advice, and no unauthorized drug withdrawal, and nursing satisfaction. These findings suggest that MBSR applied in patients with AMI during the perioperative period of PCI is conducive to improving their medication compliance, satisfaction with life, and nursing satisfaction. This is because the explanations and demonstrations during the training enable the patients to feel the power of mindfulness and to actively accept the current situation, thus alleviating their negative emotions and improving self-efficacy. Accordingly, they can actively face life and cope with the disease, thereby improving their satisfaction with life and medication compliance. MBSR can encourage nursing staff to communicate with patients amicably and to give more encouragement and support to those not good at communication, so that the nurse-patient relationship and nursing satisfaction can be improved [29, 30].

Due to limited time and energy, this study had fewer samples and a short follow-up time. The effects of MBSR on the long-term quality of life and the prevention of complications were also not discussed. Therefore, we hope that the sample size will be enlarged, the follow-up time will be prolonged, and the efficacy of other aspects will be further analyzed.

In summary, MBSR applied in patients with AMI during the perioperative period of PCI is beneficial in regulating their negative emotions, improving their sleep quality, medication compliance, and satisfaction with life, and in enhancing the patient-nurse relationship.

Disclosure of conflict of interest

None.

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