Am J Transl Res 2021;13(7):8323-8329
www.ajtr.org /ISSN:1943-8141/AJTR0130837

Original Article

The application of whole-course nursing in patients undergoing emergency PCI and its impact on cardiac function

Caixia Lin[1], Haijin Liu[2], Xiarong Liu[2], Yumei Zhang[3], Fenfen Wu[1]

Departments of [1]Nursing, [2]Emergency, [3]Cardiology, Quanzhou First Hospital Affiliated to Fujian Medical University, Quanzhou, Fujian Province, China

Received January 26, 2021; Accepted February 23, 2021; Epub July 15, 2021; Published July 30, 2021

Abstract: Objective: To implement whole-course care in patients undergoing emergency percutaneous coronary intervention and investigate its impact on cardiac function. Methods: This study included 88 acute myocardial infarction patients undergoing percutaneous coronary intervention. These patients were randomly divided into the control group (n=44, which underwent routine care) and the experimental group (n=44, which underwent whole-course care). The cardiac function, physiological states, quality of life, complications, and the patient satisfaction with the care were compared between the two groups. Results: Compared with before the surgery, the left ventricular ejection fractions and the cardiac output in both groups at discharge were increased, while the left ventricular end-systolic diameters and left ventricular end-diastolic diameters were decreased (all P<0.05). In addition, the changes in the experimental group were greater than they were in the control group (all P<0.05). The HAMA and HAMD scores in the two groups at discharge were decreased compared with before the surgeries, but the GQOLI-74 scores in all aspects were increased (all P<0.05). Similarly, the changes in the experimental group were greater than those in the control group (all P<0.05). The incidence of postoperative complications in the experimental group was lower than it was in the control group, and the satisfaction with care was higher than it was in the control group (both P<0.05). Conclusions: The whole-course care of AMI patients undergoing PCI can significantly relieve their negative emotions, improve their cardiac function, increase their quality of life, and reduce their incidences of complications.

Keywords: Whole-course care, percutaneous coronary intervention, cardiac function

Introduction

Acute myocardial infarction (AMI) refers to acute necrosis induced by long-term severe myocardial ischemia. It is most commonly observed in middle-aged and elderly people. The characteristics of AMI are rapid onset and rapid progression. If it is not treated in time, it develops into a fatal disease such as cardiogenic shock or acute heart failure [1, 2]. Percutaneous coronary intervention (PCI) can quickly restore coronary blood flow, and it causes little trauma. As a result, it has become a common and effective treatment for AMI [3-5]. However, perioperative care has a direct impact on PCI patients' recoveries.

Whole-course care is a nursing model that includes the preoperative, intraoperative, and postoperative care. Adequate preoperative preparation contributes to the success of the surgery. Effective intraoperative and postoperative care is essential for the patients' post-surgical accelerated recovery [6]. At present, there are many studies on the application of whole-course care in the nursing of PCI patients in the perioperative period. In addition, most of these studies focus on the reduction of postoperative complications. For example, Li et al. reported that whole-course care can significantly reduce the risk of complications such as arrhythmia and cardiogenic shock in PCI patients [7]. However, there are currently very few studies available on the impact of whole-course care on cardiac function in PCI patients. In this study, we mainly investigate the impact of whole-course care on the cardiac function of patients after PCI.

Materials and methods

General information

This prospective study was conducted in 88 AMI patients admitted to the emergency department of our hospital for PCI between January 2019 and February 2020. These patients were randomly divided into the control group (n=44, which underwent routine care) and the experimental group (n=44, which underwent whole-course care). This study was approved by the ethics committee of our hospital.

Inclusion criteria: Patients who were diagnosed with AMI through an electrocardiogram (ECG) examination, patients who had clear indications for PCI, and patients who voluntarily agreed to participate in the study and who signed the informed consent.

Exclusion criteria: Patients who had no indication for PCI or could not tolerate PCI, patients who suffered from a communication or cognitive impairment, patients who had a mental illness or malignant tumors, patients with a history of PCI, and patients were pregnant or breastfeeding.

Methods

The patients in the control group underwent routine care, which includes instructing the patients to rest in bed, oxygen therapy, orally taking antithrombotic drugs as prescribed by the doctors after diagnosis, monitoring the patients' vital signs 24 hours a day, cooperating closely with the surgeons during their operations, providing nutritional advice after the operations, distributing medicine to the patients based on their prescriptions, supervising the taking of these medicines, and handing these responsibilities over during the nurse to nurse shift changes.

The patients in the experimental group underwent whole-course care, which has three aspects [8, 9]. (1) Preoperative care: medical guides or volunteers are arranged to instruct the patients to seek medical advice after their admission. Their examinations were closely followed up, and the patients diagnosed with AMI were referred to the doctors immediately. According to medical advice, patients took 300 mg of aspirin enteric-coated tablets (Bayer Vital GmbH, Germany), 180 mg of ticagrelor tablets (AstraZeneca AB, Sweden) and 20 mg of rosuvastatin (AstraZeneca Pharmaceutical (China) Co. Ltd., China) to prevent thrombosis. The patients' blood routines, infectious diseases, coagulation function, blood types, and so on were urgently examined. The nursing staff contacted the blood bank in advance to ensure that the stored blood was sufficient. In order to be prepared for the intraoperative blood transfusion and rehydration, two venous channels were established. A defibrillator was set up in advance to treat the patients with arrhythmia as soon as possible. (2) Intraoperative care: after entering the emergency room, the ECG monitoring system was instantly connected to monitor the patients' vital signs closely. During the operation, the nursing staff closely cooperated with the doctors to perform the PCI operations quickly and accurately. (3) Postoperative care: defibrillators and endotracheal intubation-related equipment were provided in the ward. The 24 hour periods after the operations were crucial periods. Therefore, the patients' vital signs were continuously monitored for 24 hours with the ECG monitoring system. The patients were immediately attended to in case of ECG abnormalities. After the operations, special attention was paid to patients' situations such as bleeding gums, oozing wounds, and hematomas. Their vital signs were recorded every half hour. By doing so, the occurrence of postoperative complications could be promptly found at an early stage. In addition, the corresponding treatment measures could be carried out. Tirofiban hydrochloride (Shenyang Xinma Pharmaceutical Co., Ltd., H20153204, specification: 5 mg in the chemical formula of tirofiban) was continuously pumped for 48 hours after the operation to prevent platelet aggregation and thrombosis. During this process, close attention was paid to the patients' bleeding, and their chest-pain symptoms were checked every 30 minutes. The patients might suffer from different levels of negative emotions due to multiple factors, such as postoperative pain, concern about their prognoses, and long-term postoperative bed rest. Therefore, the nursing staff was supposed to communicate with the patients promptly to determine the main causes of their postoperative psychological changes. In this way, targeted psychological counseling could be offered to

Table 1. Baseline data ($\bar{x}$ ± sd)

Group	Experimental group (n=44)	Control group (n=44)	χ^2/t	P
Gender (n)			0.409	0.522
Male	24	21		
Female	20	23		
Age (years)	48.8±5.7	49.5±7.3	0.501	0.617
Location or type of infarction (n)			1.164	0.762
Anterior wall	12	10		
Inferior or posterior wall	9	11		
Extensive anterior wall	10	13		
Non-ST segment elevation	13	10		

eliminate the patients' negative emotions. Furthermore, they were comforted and encouraged to increase their confidence in the treatment.

Outcome measures

Main outcome measures: (1) Color Doppler ultrasound (Voluson E8 Expert, General Electric Company, USA) was used to monitor the changes in the cardiac function indexes, such as cardiac output (CO), left ventricular end-systolic diameter (LVESD), and left ventricular end-diastolic diameter (LVEDD) before and two weeks after the surgeries. The left ventricular ejection fraction (LVEF) was calculated based on the equation: LVEF = (EDV-ESV) × 100%/EDV. Here, EDV was end diastolic volume, while ESV was end systolic volume.

(2) The Hamilton anxiety scale (HAMA) and the Hamilton depression scale (HAMD, items) were used to evaluate the patients' physiological states before the surgery and at discharge [10, 11]. When the HAMA score is more than 7 points, it indicates that the patients might be suffering from anxiety. When the HAMA score is less than 7 points, it indicates that the patients are not experiencing anxiety. When the HAMD score was 7-17 points, it indicates that the patients might be suffering from depression. When HAMD score is below 7 points, it indicates that patients had no depression. The higher the HAMA score, the more severe the anxiety. Similarly, the higher the HAMD score, the more severe the depression.

Secondary outcome measures: (1) The generic quality of life inventory-74 (GQOLI-74) was used to assess the quality of life before the surgery and at discharge [12]. The GQOLI-74 social, physical, and psychological function scores ranged from 20-100 points, and 16-80 points for material life. The higher the score, the better the quality of life was.

(2) Any complications that occurred during the hospitalization, such as nausea and vomiting, local bleeding, urine retention, arrhythmia, and infection, were recorded. The total incidence of complications = the amount of complications/the total number of patients * 100%.

(3) A self-made questionnaire was implemented to evaluate the satisfaction with the care, and the results in the two groups were recorded. Satisfaction in care = (satisfied + basically satisfied)/the total number of patients * 100%.

Statistical methods

All the data were analyzed using SPSS statistical software version 20.0. The enumeration data were expressed as number/percentage (n/%), and the comparisons were conducted with chi-square tests. The normally distributed measurement data were calculated as the mean ± standard deviation ($\bar{x}$ ± sd), and independent sample t tests were used for the inter-group comparison, while paired t-tests were applied for the before-after comparisons within the same group. A difference was statistically significant when the *P* value was less than 0.05.

Results

Baseline data

There were no significant differences in the baseline data between the two groups (all P>0.05, **Table 1**).

Cardiac function

As shown in **Table 2**, there were no significant differences concerning the cardiac function indexes, including LVEF, CO, LVESD, and LVE-

Table 2. Cardiac function ($\bar{x}$ ± sd)

Group	LVEF (%)	CO (L/min)	LVESD (mm)	LVEDD (mm)
Experimental group (n=44)				
Before surgery	46.50±4.42	3.77±0.92	46.55±4.54	56.50±3.39
2 weeks after surgery	55.43±4.53*,#	4.89±1.10*,#	42.20±3.79*,#	49.96±3.59*,#
Control group (n=44)				
Before surgery	46.11±4.93	3.70±0.83	47.03±4.38	55.85±3.54
2 weeks after surgery	51.18±4.38*	4.24±1.27*	45.50±4.115*	52.20±4.03*

Note: LVEF: left ventricular ejection fraction; CO: cardiac output; LVESD: left ventricular end-systolic diameter; LVEDD: left ventricular end-diastolic diameter. Compared with before surgery, *P<0.05; compared with control group, #P<0.05.

Table 3. The HAMA and HAMD scores ($\bar{x}$ ± sd)

Group	HAMA score	HAMD score
Experimental group (n=44)		
Before surgery	6.97±1.33	7.30±1.42
At discharge	5.22±1.28*,#	6.14±1.37*,#
Control group (n=44)		
Before surgery	7.10±1.54	7.96±1.40
At discharge	6.45±1.20*	7.04±1.20*

Note: HAMA: Hamilton anxiety scale; HAMD: Hamilton depression scale. Compared with before the surgery, *P<0.05; compared with the control group, #P<0.05.

DD before the surgeries in the two groups (all P>0.05). Compared with before the surgery, the LVEF and CO in both groups at discharge were increased, but the LVESD and LVEDD were decreased (all P<0.05). Additionally, the changes in the experimental group were greater than the changes in the control group (all P<0.05).

Physiological state

As shown in **Table 3**, there were no significant differences in the HAMA and HAMD scores before the surgeries in the two groups (both P>0.05). The HAMA and HAMD scores in the two groups at discharge were lower than they were before the operations (all P<0.05). In addition, the HAMA and HAMD scores in the experimental group were lower than they were in the control group (both P<0.05).

The quality of life

As shown in **Table 4**, there were no significant differences in the GQOLI-74 scores in all aspects before the surgeries in the two groups (all P>0.05). The GQOLI-74 scores in all aspects in the two groups at discharge were higher when compared with the GQOLI-74 scores before the surgeries (all P<0.05). Additionally, the GQOLI-74 scores in all aspects in the experimental group were higher than the GQOLI-74 scores in the control group (all P<0.05).

Complications

The total incidence of postoperative complications in the experimental group was lower than it was in the control group (P<0.05, **Table 5**).

Satisfaction with the care

The satisfaction with the care in the experimental group, which was composed of 26 satisfied cases and 15 basically satisfied cases was significantly higher than it was in the control group (93.18% vs. 75.00%, P<0.05, **Figure 1**), which consisted of 20 satisfied cases and 13 basically satisfied cases.

Discussion

AMI is an acute and critical illness, with a sudden onset and a high mortality. PCI, an effective treatment for AMI, can rescue the dying myocardium and reduce mortality to a great extent [13, 14]. AMI has a rapid progression. In other words, when the patients come to hospital with AMI symptoms, their conditions are generally pretty critical. Specifically, their circulatory system is obstructed. Additionally, their blood flow is extremely unstable. Therefore, any slight carelessness during the operation or after the operation may cause a fatal complication [15]. Effective perioperative care can reduce the occurrence of postoperative complications. This means that perioperative care

Table 4. GQOLI-74 scores ($\bar{x}$ ± sd)

Group	Material life	Social function	Physical function	Psychological function
Experimental group (n=44)				
Before surgery	54.40±5.39	67.60±6.44	70.05±5.81	72.20±5.50
At discharge	61.04±5.66*,#	75.55±6.25*,#	78.89±6.46*,#	79.56±5.86*,#
Control group (n=44)				
Before surgery	53.88±5.03	67.32±6.32	69.80±5.04	71.84±6.11
At discharge	57.78±5.40*	71.10±6.13*	73.33±5.33*	75.50±5.57*

Note: GQOLI-74: generic quality of life inventory-74. Compared with before the surgery, *P<0.05; compared with the control group, #P<0.05.

Table 5. Complications (n, %)

Group	Experimental group (n=44)	Control group (n=44)
Nausea and vomiting	2 (4.55)	3 (6.82)
Local bleeding	1 (2.27)	3 (6.82)
Urine retention	0 (0.00)	1 (2.27)
Arrhythmia	0 (0.00)	1 (2.27)
Infection	0 (0.00)	2 (4.55)
The total incidence of complications	3 (6.82)#	10 (22.73)

Note: Compared with the control group, #P<0.05.

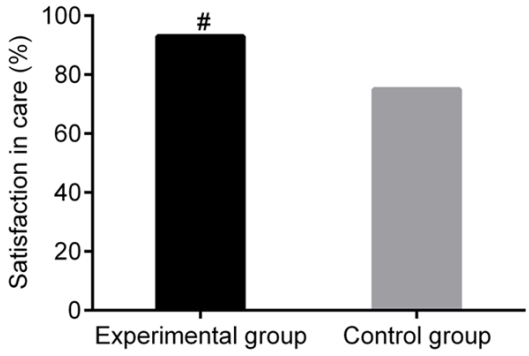

Figure 1. Comparison of the satisfaction with the care between the two groups. Compared with the control group, #P<0.05.

plays an extremely important role in improving patient prognosis [16].

Whole-course care is a comprehensive care model that covers the periods before, during, and after surgery. Preoperative care mainly includes preoperative preparation. Adequate preparation before surgery is conducive to the success of the surgery. The improvement in the patients' cardiac function is thus relatively clear [17]. Kähkönen et al. found that different perioperative care had a dissimilar effect on the improvement of cardiac function in patients with myocardial infarction; in addition, the improvement of the cardiac function in patients undergoing high-quality perioperative care was more significant [18]. Haddad et al. also reported that the effect of whole-course care on cardiac function in AMI patients was better than routine care [19]. In our study, the patients in both groups underwent PCI, but they underwent different perioperative care. Our results showed that the LVEF and CO in the experimental group at discharge were higher than they were in the control group, but the LVESD and LVEDD were lower than they were in the control group. These results indicate that the effect of whole-course care on the improvement of heart function in AMI patients undergoing PCI is more significant.

AMI has a rapid onset. The patients' ignorance of their own condition and their concern about the surgical risk can usually result in different levels of psychological disorders, and even depression in severe cases [20]. Abed et al. pointed out that whole-course care in the perioperative period helps to relieve patients' negative emotions, and its effect on patients with depression was much more significant. The whole-course care of PCI patients in the perioperative period requires meticulous and adequate preparation before surgery. In this way, the patients' trust in the medical staff is enhanced and their moods are relaxed. The relaxation is also helpful for the success of the surgery. The postoperative care of the patients' complications and psychological states not only decreases the occurrence of complications, but it also eliminates the patients' nega-

tive emotions to a certain extent [21, 22]. In our study, the HAMA and HAMD scores in the experimental group at discharge were decreased when compared with the control group. The result suggests that whole-course care in the perioperative period has a more significant effect on the improvement of the adverse physiological states in AMI patients undergoing PCI, effectively alleviating the patients' anxiety, depression, and other negative emotions.

In our study, GQOLI-74 was employed to assess the quality of life before and after surgery from four aspects, including social function, physical function, psychological function, and material life. Our results showed that the GQOLI-74 scores in all aspects in the experimental group at discharge were higher than they were in the control group, indicating that the whole-course care of AMI patients undergoing PCI can more significantly improve the postoperative quality of life. Wilgenhof et al. also reported a similar study and found that the different perioperative care of PCI patients had dissimilar effect on the quality of life after surgery. What's more, they pointed out that high-quality whole-course care has a clearer effect on the improvement of postoperative quality of life [23]. In our study, we also found that the total incidence of postoperative complications in the experimental group during the hospitalization was decreased when compared with the control group, but the satisfaction with the care was higher. These results suggest that the application of whole-course care in the perioperative period of PCI patients can more significantly reduce their postoperative complications and improve the quality of the care.

However, there are some shortcomings. First, this study was a single-centered and controlled clinical study. Second, the sample size was small. Finally, we only observed changes in the cardiac function before the surgeries and at discharge. The effect of whole-course care on the patients' long-term cardiac function after surgery still needs to be confirmed by more in-depth studies.

In summary, whole-course care of AMI patients undergoing PCI can significantly relieve their negative emotions, improve their cardiac function, raise their quality of life, and reduce the incidence of complications. It is worthy of clinical promotion.

Disclosure of conflict of interest

None.

Address correspondence to: Fenfen Wu, Department of Nursing, Quanzhou First Hospital Affiliated to Fujian Medical University, No. 250 East Street, Quanzhou 362000, Fujian Province, China. Tel: +86-0595-28121525; E-mail: wufenfen7j9b@163.com

References

[1] Anderson JL and Morrow DA. Acute myocardial infarction. N Engl J Med 2017; 376: 2053-2064.

[2] Tibaut M, Mekis D and Petrovic D. Pathophysiology of myocardial infarction and acute management strategies. Cardiovasc Hematol Agents Med Chem 2017; 14: 150-159.

[3] Kalra S, Bhatt H and Kirtane AJ. Stenting in primary percutaneous coronary intervention for acute ST-segment elevation myocardial infarction. Methodist Debakey Cardiovasc J 2018; 14: 14-22.

[4] Saito Y and Kobayashi Y. Percutaneous coronary intervention strategies in patients with acute myocardial infarction and multivessel disease: completeness, timing, lesion assessment, and patient status. J Cardiol 2019; 74: 95-101.

[5] Cowper PA, Knight JD, Davidson-Ray L, Peterson ED, Wang TY and Mark DB. Acute and 1-year hospitalization costs for acute myocardial infarction treated with percutaneous coronary intervention: results from the TRANSLATE-ACS registry. J Am Heart Assoc 2019; 8: e011322.

[6] Pang L, Wang Y, Xing Y and Zhao C. Application effects of whole course high-quality nursing on patients with liver cancer during radiotherapy. Iran J Public Health 2019; 48: 1777-1785.

[7] Li M and Liu H. Implementation of a clinical nursing pathway for percutaneous coronary intervention: a prospective study. Geriatr Nurs 2018; 39: 593-596.

[8] Guo L, Mu C, Yang T and Yin D. Effect of whole-course seamless link nursing model intervention on the treatment of acute coronary syndrome. Minerva Med 2020; 10: 237-246.

[9] Harolds JA. Quality and safety in health care, part XL: stents and unusual indications for a PCI. Clin Nucl Med 2018; 43: 739-741.

[10] Zimmerman M, Martin J, Clark H, McGonigal P, Harris L and Holst CG. Measuring anxiety in depressed patients: a comparison of the Hamil-

ton anxiety rating scale and the DSM-5 Anxious Distress Specifier Interview. J Psychiatr Res 2017; 93: 59-63.
[11] Raimo S, Trojano L, Spitaleri D, Petretta V, Grossi D and Santangelo G. Psychometric properties of the Hamilton depression rating scale in multiple sclerosis. Qual Life Res 2015; 24: 1973-1980.
[12] Zhou Y, Zhou R, Li W, Lin Y, Yao J, Chen J and Shen T. Controlled trial of the effectiveness of community rehabilitation for patients with schizophrenia in Shanghai, China. Shanghai Arch Psychiatry 2015; 27: 167-174.
[13] Gao Y, Zhang F, Li C, Dai Y, Yang J, Qu Y, Qian J and Ge J. Optimal strategy of primary percutaneous coronary intervention for acute myocardial infarction due to unprotected left main coronary artery occlusion (OPTIMAL): study protocol for a randomised controlled trial. Trials 2019; 20: 162.
[14] Okumura H, Hayashi H, Harada M and Mikuri M. Retrograde percutaneous coronary intervention for acute myocardial infarction following blunt chest trauma. Catheter Cardiovasc Interv 2018; 92: E461-E464.
[15] Wang TJ, Chiang MH, Huang SS, Wu CH, Sung SH, Chan WL, Lin SJ, Lee WL and Lu TM. Clinical outcomes of percutaneous coronary intervention with rotablation in patients with acute or recent myocardial infarction. J Chin Med Assoc 2017; 80: 532-538.
[16] Jeong JS, Kong SY, Shin SD, Ro YS, Song KJ, Hong KJ, Park JH and Kim TH. Gender disparities in percutaneous coronary intervention in out-of-hospital cardiac arrest. Am J Emerg Med 2019; 37: 632-638.
[17] Shu Q, Wu L, Zhang R, Zhang Q, Huang J and Meng Y. Age-dependent changes in cardiac performance, motor function, QoL, and mental status in metoprolol-treated chronic heart failure patients. Sci Rep 2019; 9: 453.
[18] Kähkönen O, Saaranen T, Kankkunen P, Lamidi ML, Kyngäs H and Miettinen H. Predictors of adherence to treatment by patients with coronary heart disease after percutaneous coronary intervention. J Clin Nurs 2018; 27: 989-1003.
[19] Haddad NE, Saleh MN and Eshah NF. Effectiveness of nurse-led video interventions on anxiety in patients having percutaneous coronary intervention. Int J Nurs Pract 2018; 24: e12645.
[20] Uchmanowicz I. Myocardial infarction, periodontitis and depression. Eur J Cardiovasc Nurs 2017; 16: 466-467.
[21] Abed MA, Ali RM, Abu Ras MM, Hamdallah FO, Khalil AA and Moser DK. Symptoms of acute myocardial infarction: a correlational study of the discrepancy between patients' expectations and experiences. Int J Nurs Stud 2015; 52: 1591-1599.
[22] Benson S, Hagen S, Hoffmann O, Pasler A, Bingel U, Schedlowski M, Peters J, Elsenbruch S and Frey UH. Can a brief psychological expectancy intervention improve postoperative pain? A randomized, controlled trial in patients with breast cancer. Pain 2019; 160: 1562-1571.
[23] Wilgenhof A, Droogmans S, Sonck J, Lochy S, Kayaert P and Schoors D. How to measure quality of care in patients presenting with STEMI? A single-centre experience. Acta Cardiol 2015; 70: 1-11.