

Original Article

Effects of a structured team nursing model on the efficacy and quality of cardiopulmonary resuscitation in myocardial infarction patients undergoing PCI

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Abstract: Objective: This study aimed to evaluate the effects of a structured team nursing model on the efficacy and quality of cardiopulmonary resuscitation (CPR) in acute myocardial infarction patients undergoing percutaneous coronary intervention (PCI). Methods: With the random number table, 130 myocardial infarction patients undergoing PCI were divided into two groups, including the control group (n=65) receiving routine emergency resuscitation and nursing care, and the study group (n=65) receiving a structured team care model. The efficacy of CPR, cardiac function, exercise tolerance, ability of daily living activities, quality of life, complication rate and nursing satisfaction were compared between the two groups. Results: The door-to-balloon time, length of stay at the emergency department, duration of balloon dilation, bedtime and hospital stay in the study group were shorter than those in the control group ($P<0.05$). The study group showed lower LVEDD and LVESD and higher LVEF than the control group after nursing ($P<0.05$). The extend of physical limitation, angina stability, level of disease awareness, number of angina attacks, and treatment satisfaction scores in the 6-MWT, MBI, and SAQ scales in the study group after nursing were higher than those in the control group ($P<0.05$). The complication rate in the study group (7.69%) was lower than that in the control group (20.00%) ($P<0.05$). The study group had higher satisfaction with operational skills, teamwork, clinical practice, rescue awareness, orderliness, and timeliness than the control group ($P<0.05$). Conclusion: Structured team nursing model is helpful to improve the timeliness and quality of CRP, shorten the treatment time, improve patients' cardiac function and exercise tolerance, improve self-care ability and quality of life, reduce the occurrence of complications, and enhance the patient-nurse relationship.

Keywords: Myocardial infarction, percutaneous coronary intervention, structured team nursing model, effectiveness of resuscitation, quality of resuscitation

Introduction

Acute myocardial infarction is one of the common cardiovascular diseases in the emergency department, which is caused by myocardial ischemia and necrosis due to coronary atherosclerosis, and is characterized by high incidence of sudden cardiac death, rapid development and rapid onset [1, 2]. Percutaneous coronary intervention (PCI) is the first-line treatment for acute myocardial infarction, which can reduce the infarct size, preserve cardiac function, reduce the severity of myocardial injury, and enhance ischemic myocardial reperfusion in the early stage, but has a significant time-dependence [3]. The American Heart Association has proposed that definitive treat-

ment of acute myocardial infarction should be performed within 1 h of the onset of the disease [4]. However, during the resuscitation, there are many phenomena such as long ED waiting time, unclear distribution of tasks among resuscitation staff, complicated or confusing procedures, lack of order and coordination, and incomplete organizational structure, which delay and reduce the quality of resuscitation [5]. The "time window" is the key to PCI treatment of acute myocardial infarction, and reasonable resuscitation procedures and nursing management are helpful to shorten the "time window" [6].

In structured team nursing model, several nursing professional groups were established

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according to their main responsibilities. The members of each group collaborate and cooperate closely with each other to ensure a more systematic, comprehensive and standardized nursing service for patients, so as to improve the effect of resuscitation and reduce the mortality rate [7, 8]. Liu [9] reported that the introduction of the structured team nursing model in the emergency department can help shorten the establishment time of intravenous access, consumption of medication, and total resuscitation time, reduce the incidence of adverse events, and improve the success rate of resuscitation. In order to further improve the efficiency and quality of resuscitation for patients undergoing PCI, this study analyzed the application of the structured team care model.

Materials and methods

General information

A total of 130 myocardial infarction patients receiving PCI who were admitted to our hospital from January 2019 to May 2020 were enrolled, including 93 males and 37 females, with the age of 32-80 years, and the duration of hospital admission to hospital admission of 21-86 min. The patients were divided into the control group (n=65) and the study group (n=65) according to the random number table method. Informed consent was obtained from patients and their families. This study has been approved by the Ethics Committee of The Central Hospital of Wuhan, Tongji Medical College, Huazhong University of Science and Technology.

Enrollment criteria

(1) Inclusion criteria included patients meeting the diagnostic criteria for myocardial infarction in the Guidelines for the Diagnosis and Treatment of Acute Myocardial Infarction [10], and diagnosed as myocardial infarction by electrocardiogram, etc.; first-time onset, meeting the indications for PCI; time from onset to hospital admission <12 h, and successful implementation of PCI; good communication skills; cardiac function class II-IV on NYHA; patients who voluntarily signed the informed consent. (2) Exclusion criteria included patients with systemic immune dysfunction, coagulation dysfunction, neurological and communication dysfunction; severe dysfunction of major organs

(lungs, kidneys, etc.); hemodynamic instability within 12 h postoperatively or LVEF <35% 2 d postoperatively; malignant tumor, severe respiratory failure, history of stroke, constrictive pericarditis, pericardial effusion, or restrictive cardiomyopathy.

Methods

The control group was given routine resuscitation and nursing care, *i.e.*, physical examinations, triage operations, establishment of intravenous access and monitoring of vital signs after the patients were admitted to the hospital, and the emergency nurses carried out tasks according to the doctor's order, and performed symptomatic treatments such as thrombolysis, vasodilation and oxygenation.

The study group received a structured team care model, including: (1) Establishing a structured nursing team. According to the working experience, education level, nursing skill level and age, nursing staff in the emergency department were divided into four groups. Each group had 5 nurses, including 1 team leader (responsible for guiding and assigning tasks, with experience in emergency nursing ≥ 10 years), 1 deputy team leader (responsible for patient education, with experience in emergency nursing >5 year), 2 young nurses (responsible for nursing guidance, with experience in emergency nursing for 3-5 years, were proficient in dressing and puncture skills), and 1 nurse in rotating shift. Four teams alternated on duty. (2) Defining goals and staff training. The objective of the nursing program was "to improve the efficiency and quality of resuscitation for myocardial infarction patients undergoing PCI". The team leader expressed the objectives and requirements clearly to the team members and formulated the nursing objectives. The training was conducted in established groups, including resuscitation procedures, first aid training, simulation-based first aid training, sharing of skills and experience during resuscitation, etc. The training was conducted by means of theoretical lectures and simulation exercises to define the specific workflow and responsibilities of each member of the team, and the members were regularly assessed after training. (3) Program implementation. A doctor cooperated with 5 team members during the resuscitation. The doctor stood

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on the right side of the patient and was responsible for directing the overall resuscitation procedures, giving medical orders, and collaborating rescue. The team leader was located on the rear of the patient, organizing and supervising the entire resuscitation work. The deputy team leader was located on the head side of the patient, managing respiratory resuscitation. One nurse was located on the left side of the patient managing drug resuscitation and intravenous access and the other was located on the right side of the patient, managing cardiac resuscitation and connecting electrocardiogram (ECG) monitoring. One rotating nurse was located at the end of the patient's bed, responsible for observing and recording the specific process of resuscitation. (4) Prevention of postoperative complications. (I) Venous thrombosis. At 12 h after surgery, nurses massaged the patient's lower limbs, and instructed the patient to perform traumatic foot and ankle exercises under the cooperation of family members; Anticoagulant drugs were administered according to the doctor's order, and the patient's activated partial thromboplastin time (aPTT) was recorded every 6 h. (II) Bleeding. After puncture, the compression time was appropriately prolonged. Femoral artery puncture: After 12 h of sandbag application and 24 h of bracing of right lower extremity, nurses recorded whether there was bleeding at the compression site. Radial artery puncture: pressurizer compression for 6 h, relaxation every 2 h, right radial artery brake for 24 h. (iii) Vagus reflexes. The health handbook compiled by emergency department was distributed to patients and their families while health education and psychological care were performed. (iv) Cardiac arrhythmias. The patients were continuously monitored by ECG, and the 18-lead ECG changes were observed for patients with frequent episodes of chest pain. (v) Post-discharge follow-up. The follow-up visit started at 1 week after discharge from the hospital, and the follow-up was mainly performed with outpatient and telephone visits for 2 months.

Outcome measurement

(1) Timeliness of emergency resuscitation. The door-to-balloon time, length of stay in the emergency department, duration of balloon dilation, bedtime and hospital stay were recorded in both groups.

(2) Cardiac function. Left ventricular ejection fraction (LVEF), left ventricular end-diastolic diameter (LVEDD), and left ventricular end-systolic diameter (LVESD) were recorded by EPIQ7 color Doppler ultrasonography before nursing (the day of admission) and after nursing (at 2 months after hospital discharge).

(3) Quality of life. Patients' functional status and quality of life were assessed by the Seattle Angina Questionnaire (SAQ) [11] before and after nursing in terms of physical limitation, angina stability, disease awareness, angina attacks, and treatment satisfaction over 19 items, with a score of 0-100 points for each dimension. High scores indicate good functional status and quality of life.

(4) Exercise tolerance and ability to perform daily activities. Patients were instructed to walk back and forth in a 30-m long straight corridor before and after nursing, and the maximum distance was measured by 6-minute walk test (MWT). Meanwhile, the patients' activities of daily living (ADLs) were assessed using the modified Barthel Index (MBI) scale. It covers 10 domains of functioning (activities): bowel control, bladder control, as well as help with grooming, toilet use, feeding, transfers, walking, dressing, climbing stairs, and bathing. Total scores may range from 0 to 100, with higher scores indicating greater independence.

(5) Complications. Discomfort symptoms such as venous thrombosis, vagal reflexes, hypotension, and arrhythmias were recorded in both groups.

(6) Patient satisfaction. When patients were discharged from the hospital, their satisfaction with nursing was evaluated using a questionnaire developed by the hospital in terms of operational skills, teamwork, clinical practice, resuscitation awareness, orderliness, and timeliness, which were divided into dissatisfaction and satisfaction.

Statistical analysis

With SPSS23.0 software for statistical analysis, measurement data were expressed as mean \pm standard deviation ($\bar{X} \pm Sd$), and between-group and before-and-after comparisons were performed with independent samples *t* and paired samples *t* tests. Count data

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were expressed as percentages and compared using χ^2 test. $P < 0.05$ indicated significant differences.

Results

General information

There was no significant difference in the proportion of sex, age, time from onset to admission, body mass index, site of myocardial infarction, cardiac function class, smoking history and comorbidities between the two groups ($P > 0.05$), which were comparable (**Table 1**).

Indicators of resuscitation effectiveness

The study group showed shorter door-to-balloon time, length of stay at the emergency department, duration of balloon dilation, bed-time and hospitalization time than the control group ($P < 0.05$), indicating that the structured team nursing model could improve the efficiency, shorten the resuscitation time and hospitalization time, and enhance the efficiency (**Table 2**).

Cardiac function

There was no significant difference in LVEDD, LVESD and LVEF between the two groups before nursing ($P > 0.05$). LVEDD and LVESD after nursing in the study group were lower than those in the control group, and LVEF in the study group was higher than that in the control group ($P < 0.05$), suggesting that the structured team nursing model could improve cardiac function in myocardial infarction patients undergoing PCI (**Figure 1**).

Exercise tolerance and activities of daily living

The 6-MWT and MBI scores exhibited no significant difference between the two groups before nursing ($P > 0.05$). The 6-MWT and MBI scores after nursing in the study group were higher than those in the control group ($P < 0.05$), indicating that the structured team nursing model could improve ADL and enhance exercise tolerance in patients undergoing PCI (**Figure 2**).

Quality of life

SAQ scores showed no significant difference between the two groups before nursing ($P > 0.05$), and they were all higher in the study

group than in the control group ($P < 0.05$), suggesting that the structured team nursing model could improve patients' quality of life (**Figure 3**).

Incidence of complications

The complication rate in the study group (7.69%) was lower than that in the control group (20.00%) ($P < 0.05$), suggesting that structured team nursing model could reduce the complication rate and facilitate recovery (**Table 3**).

Satisfaction

Patients in the study group were more satisfied with entire treatment process than those in the control group ($P < 0.05$), indicating that the structured team nursing model could improve the care satisfaction of patients with myocardial infarction and enhance the patient-nurse relationship (**Table 4**).

Discussion

The success of rescue of acute myocardial infarction depends largely on whether the treatment is timely, while complications, infarct size, nursing and treatment options also directly affect the prognosis of patients. Emergency PCI is the preferred choice for the treatment of acute myocardial infarction. The occluded blood vessel can be opened mechanically in a short time to promote the recovery of coronary blood flow. The high-quality nursing model guarantees the best time window and improves the outcome of the disease [12, 13]. In this study, a structured nursing team was first established to improve the team members' mastery of the resuscitation procedures and skills, and to jointly formulate nursing objectives and clarify the tasks of each group, so as to improve the nursing staff's theoretical knowledge and clinical practical skills and give full play to the advantages of the team.

The structured team nursing model groups nurses according to years of work, education level, nursing skills, age, etc. The experienced team leader conducts training and assessment of nurses with medium and low experience, and participates in resuscitation, which helps young nurses quickly accumulate experience and improve overall service quality [14, 15]. During the nursing process, the responsibility is assigned to the individual, which is con-

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Table 1. Comparison of baseline data between the two groups (n/ $\bar{X} \pm S$)

Groups	M/F	Age (years)	Time from onset to admission (min)	Body mass index (kg/m ²)	Site of myocardial infarction	NYHA class	History of Smoking	Combined hypertension	Combined diabetes	Combined hyperlipidemia
					Front wall/lower wall	Class II/III/IV				
Control group (n=65)	48/17	55.49±8.12	57.26±4.76	24.67±3.01	30/35	29/20/16	28	37	19	35
Study group (n=65)	45/20	57.98±9.11	58.81±5.11	23.98±2.94	27/38	25/22/19	26	40	21	31
χ^2/t	0.340	1.645	1.789	1.322	0.281	1.032	0.127	0.287	0.144	0.492
<i>P</i>	0.560	0.102	0.076	0.189	0.596	0.099	0.722	0.592	0.704	0.483

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Table 2. Comparison of resuscitation efficacy indices between the two groups ($\bar{X} \pm Sd$)

Groups	Time to catheterization lab (min)	Length of emergency stay (min)	Duration of balloon dilation (min)	Bedtime (h)	Length of hospital stay (d)
Control group (n=65)	35.64±5.11	45.18±7.13	91.03±10.19	64.13±8.85	12.06±3.37
Study group (n=65)	30.08±4.37	34.29±8.24	79.28±9.34	60.76±7.21	9.02±2.16
t	6.667	8.057	6.853	2.380	6.123
P	<0.001	<0.001	<0.001	0.019	<0.001

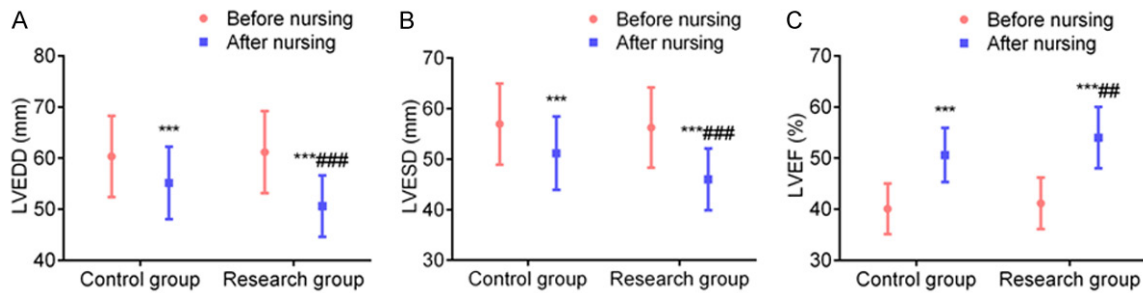


Figure 1. Comparison of cardiac function parameters between the two groups. Note: A: LVEDD level; B: LVESD level; C: LVEF level. Compared with before nursing within the same group, $***P < 0.001$; compared with the control group, $##P < 0.01$, $###P < 0.001$.

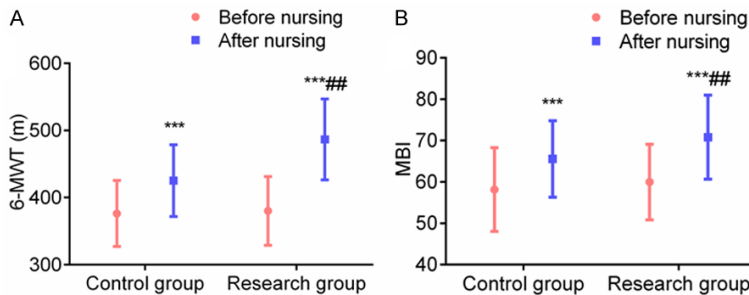


Figure 2. Comparison of 6-MWT and MBI scores between the two groups. Note: A: 6-MWT score; B: MBI score. Compared with before nursing within the same group, $***P < 0.001$; compared with the control group, $##P < 0.01$, $###P < 0.001$.

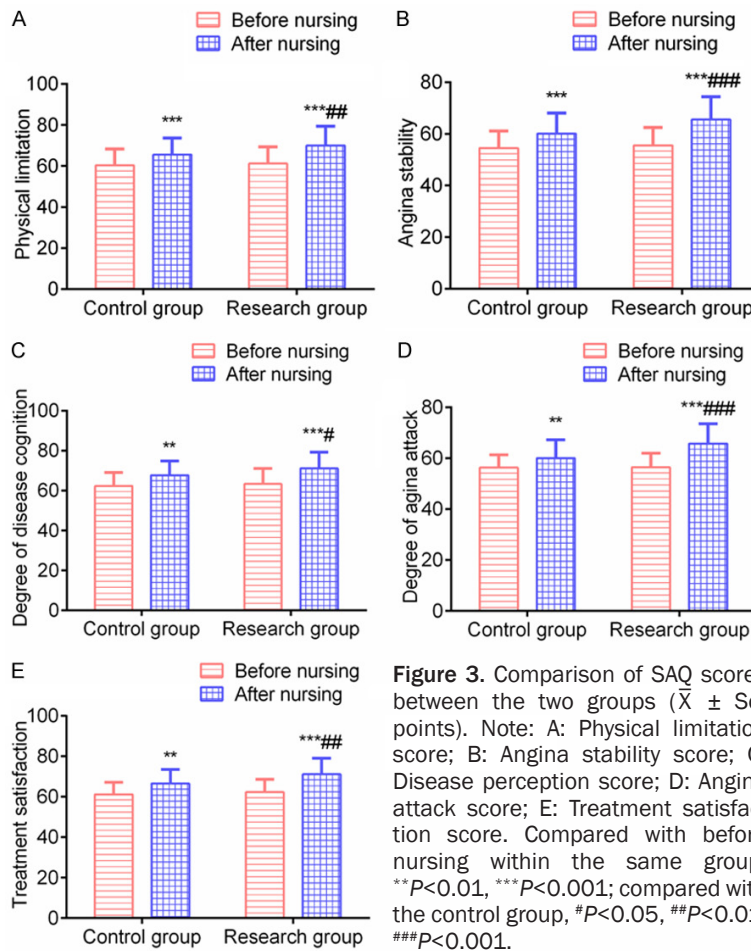
ducive to the planned work and predictive care of the nursing staff, avoiding passively performing first aid and blindly waiting for the doctor's order, thereby improving the overall level and quality of nursing, and forming an efficient, flexible and orderly nursing team [16, 17]. In this study, the cardiac function index of the study group was better than that of the control group after nursing, with higher 6-MWT, MBI and SAQ scale scores, higher nursing satisfaction, and lower complication rate in the study group than the control group, indicating that the structured team nursing model could improve cardiac function, exercise tolerance, self-care ability and quality of life, improve nurs-

ing satisfaction, reduce complications, and improve the outcomes of patients with myocardial infarction. The reason is that the team members receive systematic training and assessment, which not only gradually enhances their awareness of first aid, cooperation and collaboration ability as well as their first aid skills and professional knowledge, but also clarifies their nursing goals and ensures the continuity and integrity of

nursing care. Post-PCI massage of lower limbs, injection of anticoagulant drugs according to doctors' orders, prolonging the post-puncture compression time and continuous ECG monitoring can prevent arrhythmias and venous thrombosis. After discharge, the patients were followed up for evaluation, and educational programs and medication guidance were adjusted to make the treatment more reasonable and improve patients' quality of life [18], thereby improving patient acceptance of this care model [19].

In the process of resuscitation of critically ill patients, the starting point and destination of

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resuscitation should be placed on timeliness, and strive to race against time. In this study, the time to catheterization lab, dwell time in emergency room, duration of balloon dilatation, bedtime and hospitalization time in the study group were shorter than those in the control group, indicating that structured team nursing model could shorten the resuscitation time and hospitalization time, and improve the resuscitation efficiency. A study by Ji et al. [20] reported that the structured team nursing model used in emergency procedures could reduce the time to administer medication, the time to establish intravenous access, and the total time to resuscitate patients. Chen et al. found that after the implementation of structured team nursing mode, the establishment time of intravenous access, total rescue time and drug application time of emergency patients were shorter than those before the implementation [21], which suggested that the implementation of this mode ensured the qual-

ity and efficiency of emergency nursing management and improved the timeliness of first aid. These were basically consistent with the present study. The reason may be that this model implements a team rotation system and arranges working hours and shifts reasonably, which can give full play to the potential of nursing staffs, improve their work enthusiasm and subjective initiative. In addition, this nursing model assigns corresponding responsibilities according to the nurse's experience and level, determines the workflow, responsibilities and position of each member. For example, the team leader stands at the end of the bed and can give full command to ensure that the order is followed [22]. Low-qualified nurses are located on both sides of the patient, responsible for rapid medication administration and the opening of the venous channel, which can ensure the continuity and reduce the chaos during the

resuscitation [23]. In addition to the cooperation between nurses, good cooperation with doctors is crucial to improve the effectiveness of resuscitation. When the resuscitation doctor changes the instructions, the nursing staff can respond accordingly, which is helpful to prevent nursing errors caused by changes in the condition, reduce panic, and improve the ability of emergency response and overall collaboration [24, 25].

The continuous improvement of the nursing team can achieve standardization, homogenization, and seamless nursing care so as to gain the best "time window" for patients, thus achieving the goal of optimizing the resuscitation procedures and shortening the resuscitation time. However, there are still some shortcomings in this study, such as small sample size, short follow-up time, and no comparison between the in-hospital mortality rates of the two groups, etc. Therefore, we still need to expand the sample size, extend the follow-up

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Table 3. Comparison of complication rates between the two groups [n (%)]

Groups	Venous thrombosis	Vagus reflex	Hypotension	Cardiac arrhythmia	Totals
Control group (n=65)	5 (7.69)	2 (3.08)	3 (4.62)	3 (4.62)	13 (20.00)
Study group (n=65)	2 (3.08)	1 (1.54)	1 (1.54)	1 (1.54)	5 (7.69)
χ^2	1.359	0.341	1.032	1.032	6.095
P	0.244	0.559	0.310	0.310	0.014

Table 4. Comparison of patient satisfaction between the two groups [n (%)]

Groups	Operating skill	Teamwork skills	Clinical Practice	Resuscitation awareness	Orderliness	Timeliness
Control group (n=65)	52 (80.00)	49 (75.38)	54 (83.08)	48 (73.85)	55 (84.62)	53 (81.54)
Study group (n=65)	61 (93.85)	60 (92.31)	63 (96.92)	60 (92.31)	64 (98.46)	62 (95.38)
χ^2	1.359	6.872	6.923	7.879	8.044	6.104
P	0.244	0.009	0.009	0.005	0.005	0.013

time, and increase the observation indices for further research.

In summary, the structured team nursing model is helpful to improve the efficiency and quality of resuscitation, shorten the treatment time, improve patients' cardiac function and exercise tolerance, improve self-care ability and quality of life, reduce the occurrence of complications, and enhance the patient-nurse relationship.

Disclosure of conflict of interest

None.

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