Original Article
Effects of advanced nursing on temporary pacemaker installation during PCI treatment for acute myocardial infarction

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Abstract: Objective: This paper aimed to study the effects of advanced nursing on temporary pacemaker installation during percutaneous coronary intervention (PCI) treatment for acute myocardial infarction (AMI). Methods: Ninety-two patients with AMI admitted to Zhucheng People's Hospital from January 2017 to August 2018 were enrolled for a retrospective analysis. They were treated with PCI during which temporary pacemakers were installed. According to nursing methods, the patients were divided into a control group (45 cases received routine nursing interventions) and an observation group (47 cases received advanced nursing interventions). They were compared with respect to their prognostic outcomes, incidence of complications, nursing satisfaction, and negative emotions and quality of life before and after nursing. Results: There was no statistically significant difference in the success rate of temporary pacemaker installation between the control and observation groups (P>0.05). The retention time of pacemakers, the number of patients undergoing permanent pacemaker implantation, the number of patients with pacemaker perception dysfunction, and the number of patients with Ron-t were significantly less in the observation group (all P<0.05). Patients in the observation group had significantly higher nursing satisfaction (all P<0.05), and significantly lower SAS and SDS scores after nursing (all P<0.05). After nursing, scores of self-care ability, physical condition, mental health and social function were significantly higher in the observation group (all P<0.001). After nursing, the incidence of complications such as infection, electrode displacement, cardiac catheter thrombosis, hypotension after reperfusion, and severe bradyarrhythmia was significantly lower in the observation group (all P<0.05). Conclusion: The application of advanced nursing to temporary pacemaker installation during the PCI treatment for AMI has higher safety, and can significantly enhance the surgical effect on the patients and improve their prognosis, quality of life, and nursing satisfaction.

Keywords: Acute myocardial infarction, temporary pacemaker, advanced nursing, complications

Introduction

Acute myocardial infarction (AMI) is a common disease in the Cardiology Department, and the effectiveness of its emergency treatment is crucial to improve patient prognosis [1]. In recent years, percutaneous coronary intervention (PCI) technologies have significantly increased the recanalization rate and have significantly reduced the mortality rate of the disease [2]. However, most AMI patients after PCI treatment suffer from various complications, of which severe bradyarrhythmia is the most

common and fatal one. Severe complications even cause the patients to die before their coronary blood flow recovers. Moreover, hypotension after reperfusion may occur and affect patient prognosis [3]. At present, temporary pacemakers are usually installed to prevent severe bradyarrhythmia after PCI, and mainly used for patients with ineffective drug prevention and protection [4].

However, in addition to various steps and complex processes, temporary pacemaker intervention also greatly increases the incidence of

complications (such as infection and cardiovascular thrombosis) while relieving severe brady-arrhythmia [5]. Therefore, active and effective nursing interventions during the installation of temporary cardiac pacemakers are particularly significant to prevent the occurrence of related complications. Besides, it is essential to select a reasonable and effective nursing mode [6]. With the characteristics of foresight and less trauma, advanced nursing is a mode that prevents possible complications through analyzing them and taking corresponding nursing measures in advance. According to previous studies, advanced nursing in the intensive care unit obviously improves the rehabilitation efficiency of patients, but there are very few studies on the application of this mode in temporary pacemaker installation during PCI treatment for AMI patients [7]. This was explored in this study to investigate the application effect of this nursing mode so as to provide guidance for clinical nursing.

Materials and methods

General information

This study was approved by the Medical Ethics Committee of Zhucheng People's Hospital. A total of ninety-two patients with AMI admitted to Zhucheng People's Hospital from January 2017 to August 2018 were enrolled for a retrospective analysis. They were treated with PCI during which temporary pacemakers were installed. According to nursing methods, the patients were divided into the control group (45 cases received routine nursing intervention) and the observation group (47 cases received advanced nursing intervention).

Inclusion criteria: 1) All patients met diagnostic criteria for AMI from the 9th edition of Internal Medicine [8]. 2) Those that had no obvious contraindications to PCI. 3) Those that had no obvious contraindications to temporary pacemaker installation. 4) The time from the onset of chest pain was ≤12 h and their chest pain duration was >30 min. 5) Patients and their families agreed with this study and signed an informed consent form.

Exclusion criteria: 1) Those with preoperative hemodynamic disorders; 2) Those with such serious atrioventricular block that drug therapy was ineffective; 3) Those complicated with blood system diseases and accompanied by coagulation disorders; 4) Those with a depression trend and/or a family history of depression; 5) Those with incomplete data.

Methods

Surgical methods

After admission, all research subjects underwent PCI with temporary pacemaker installation (Shanghai Jumu Medical Instruments Co., Ltd., China).

PCI: First of all, routine preoperative preparations including disinfection and local anesthesia were made for the patients. After the puncture site was located at the radial artery of the right hand, a small opening was made with a skin-breaking scalpel and was punctured with a puncture needle. Next, a sheath was inserted along the puncture guide wire to establish an access route, and the guide wire and the inner sheath were then pulled out, with the outer sheath left in the blood vessels. Subsequently, angiography was started. The flexible guide wire and the angiographic catheter were introduced into the vessels through the outer sheath. After that, the contrast agent (Hangzhou Huqing Yutang Medical Technology Co., Ltd., China) was pushed into the vessels through a syringe, so as to observe the vessel shape through X-ray. Finally, balloon dilatation was carried out. After the diseased vessels were determined, the angiographic guide wire and the catheter were pulled out, and introduced through the outer sheath. The balloon was pressurized by a pressure pump, and then a stent was implanted.

Temporary pacemaker installation: After the sheath was established according to the above steps, under the guidance of X-ray, the sterilized temporary pacing electrode catheter was inserted into the right ventricular apex and embedded into the trabecular muscle to contact the endocardium. Then, the optimal threshold and the electrocardiogram (ECG) were measured. After the electrode catheter was fixed and the external pacemaker was connected, the pacemaker was turned on and the pacing parameters were adjusted under the ECG oscillogram. The output voltage was approximately twice the pacing threshold, and the perception sensitivity was approximately 2.0 mV,

with the frequency being approximately 70/min. Finally, the external electrode and the pacemaker were fixed.

Nursing methods

Control group: Patients in the control group received routine nursing interventions, which consisted of routine preoperative health education, postoperative medication, reexamination guidance and the monitoring of vital signs. Specific contents included the guidance of disease knowledge, a healthy diet and reasonable exercises, the emphasis on medication content, medication methods and matters needing attention, and the monitoring of basic vital indicators such as blood pressure, pulse, and respiration [9].

Observation group: Patients in the observation group received advanced nursing interventions, which consisted of preoperative, intraoperative, and postoperative steps [10], with details as follows:

1) Preoperative advanced nursing: First, preoperative item examinations were carried out. In addition to conventional ECG monitors and defibrillators, the battery, lead wire, and intra-aortic balloon counterpulsation system of the pacemaker were additionally examined and taken as the key examination contents, so as to prevent the occurrence of complications such as the electricity shortage or the poor wire connection of the temporary pacemaker. Secondly, relevant rescue drugs were prepared. The nursing staff analyzed possible adverse conditions before and during operation and prepared the drugs needed for rescue in advance. The staff also allocated the relevant drugs and then marked their names and doses accurately and clearly, so that they could be used in time and accurately during the rescue. Thirdly, psychological nursing was conducted before operation. The nursing staff analyzed the patients' psychological problems that may occur during and after operation, carried out preoperative health education on the patients, and informed them of the inevitability of the related problems as well as the benefits of solving the problems. The power of the patients' family members could be combined. Fourthly, trauma operation nursing was carried out. The nursing staff improved the methods and optimized the care

in the trauma operation as much as possible to reduce trauma. The staff briefly explained specific operating steps before trauma operation, so as to solve the patients' doubts and relieve their uneasiness. The staff also played light music during trauma operation to distract their attention and relieve their tension and other negative emotions, so as to avoid generating postoperative adverse emotions. Finally, drug administration nursing was carried out. The nursing staff confirmed the preoperative oral medication of the patients through examining vomitus, so as to prevent drug insufficiency caused by vomiting up medication. Oral drugs were administrated again if necessary.

2) Intraoperative advanced nursing: First, the patients' situations after temporary pacemaker installation were monitored. The nursing staff monitored the patients' blood pressure, blood oxygen saturation, heart rhythm and other indicators, once every 1 min. The staff also observed whether the pacemaker was dislocated or not and whether the pacemaker signal was normal or not, once every 5 min. Secondly, advanced nursing during PCI was conducted to prevent arrhythmia and the displacement of the pacemakers during the first coronary angiography and during balloon dilatation. Before and after the above two time points, the patients' heart rates, blood pressure, intracoronary pressure, TIMI myocardial perfusion grading, and arrhythmia were monitored. If the indicators showed a decreasing trend, corresponding interventions (such as fluid replacement and raising pressure) were carried out to prevent complications.

3) Postoperative advanced nursing: First, the leading wire of the pacemaker was fixed to prevent it from falling off due to transportation, vomiting, and other factors. The nursing staff innovatively fixed the wire with both an application and an elastic bandage. Secondly, the nursing care before temporary pacemaker removal was strengthened. Based on monitoring ECG information, the electrode displacement and the power consumption of the pacemaker were additionally observed. The temporary pacemaker removal was prepared as soon as possible after the patients' heart rhythm recovered, so as to prevent the occurrence of postoperative complications.

Outcome measures and evaluation criteria

Main outcome measures: 1) Prognostic outcomes: The success rate of temporary pacemaker installation, the retention time of pacemakers, the number of patients undergoing permanent pacemaker implantation, the number of patients with pacemaker perception dysfunction, and the number of patients with Ron-t. Successful installation indicated that the pacemaker had a good ability to recognize the P or QRS waves. Pacemaker sensory dysfunction indicated that the pacemaker could not recognize the P or QRS waves, which thereby resulted in the dysfunction of pacemaker pacing on demand. Ron-t was defined as when premature ventricular contraction appeared on the T wave of the previous heartbeat.

2) Incidence of complications: The complications included infection, electrode displacement, cardiac catheter thrombosis, hypotension after reperfusion, and severe bradyarrhythmia. Electrode displacement indicated that the electrode tip was out of contact with the endocardium, and the degree of detachment showed electrode swimming or micro-displacement. Severe bradyarrhythmia indicated diseases characterized by heart rates lower than 60 beats/min, including sinus bradycardia, sinus arrest, sinoatrial block, sick sinus syndrome and atrioventricular block.

Secondary outcome measures: The following indicators were collected in person by the in-group scale evaluators and the research subjects before and after nursing. The collection was strictly carried out according to the specific indicator evaluation period, and the collection time for each case was not less than 20 min. The questionnaires were collected on site.

1) Nursing satisfaction: The in house nursing satisfaction self-rating scale was used to assess the patients' nursing satisfaction, with a full score of 100 points. The satisfaction was divided into very satisfied (90-100 points), relatively satisfied (75-90 points), generally satisfied (60-75 points) and dissatisfied (<60 points). Nursing satisfaction = (very satisfied + relatively satisfied + generally satisfied cases)/total number of cases ×100.0%.

2) Negative emotions: Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) were adopted to assess the patients' anxiety and depression [11, 12]. Each scale had 20 items, and each item was scored with 1-4 points. The total score of each item was multiplied by 1.25, and the integral part of the results was taken as the standard score. A high score indicated serious anxiety and depression.

3) Quality of life: 36-Item Short-Form Health Survey (SF-36) was used to assess the patients' quality of life, which consisted of self-care ability, physical condition, mental health and social function [13]. Each dimension had a score of 0-25 points, with a total score of 100 points. A higher total score indicated better quality of life.

Statistical methods

All statistical data in this study were analyzed and processed by SPSS 21.0. Measurement data were expressed by mean ± standard deviation ($\overline{x}$ ± sd) and analyzed by t test, while count data were expressed by the number of cases/percentage (n/%), analyzed by χ^2 test, and represented by χ^2. When P<0.05, the difference was considered statistically significant.

Results

Comparison of general information

There was no significant difference in general information between the control and observation groups (P>0.05; **Table 1**).

Comparison of prognostic outcomes

There was no statistically significant difference in the success rate of temporary pacemaker installation between the control and observation groups (P>0.05). The retention time of pacemakers, the number of patients undergoing permanent pacemaker implantation, the number of patients with pacemaker perception dysfunction, and the number of patients with Ron-t were all significantly less in the observation group (all P<0.05; **Table 2**).

Comparison of incidence of complications

The incidences of infection, electrode displacement, cardiac catheter thrombosis, hypoten-

Table 1. Comparison of general information

Group		Control group (n=45)	Observation group (n=47)	x^2/t	P
Gender (male/female)		24/21	25/22	0.038	0.845
Age (year)		61.9±6.8	62.2±6.1	0.222	0.824
BMI (kg/m^2)		11.34±7.05	11.31±7.06	0.020	0.984
Onset time (h)		9.11±2.54	9.21±2.57	0.188	0.852
Chest pain duration		35.21±4.21	36.42±4.54	1.326	0.188
Complications	Obvious sinus bradycardia	2 (4.44)	2 (4.26)	0.218	0.640
	Sinus arrest	3 (6.67)	3 (6.38)	0.135	0.713
	Atrioventricular block II	6 (13.33)	8 (17.02)	0.041	0.840
	Atrioventricular block III	14 (31.11)	15 (31.91)	0.020	0.887
	Ventricular arrest	3 (6.67)	3 (6.38)	0.135	0.713
Infarct location	Anterior wall infarction	18 (40.00)	19 (40.42)	0.029	0.864
	Anterior interwall infarction	12 (26.67)	13 (27.66)	0.016	0.899
	Inferior wall infarction	8 (17.78)	8 (17.02)	0.032	0.858
	Infarction of anterior posterior wall	7 (15.56)	8 (17.02)	0.008	0.927

Note: BMI: body mass index.

Table 2. Comparison of prognostic outcomes

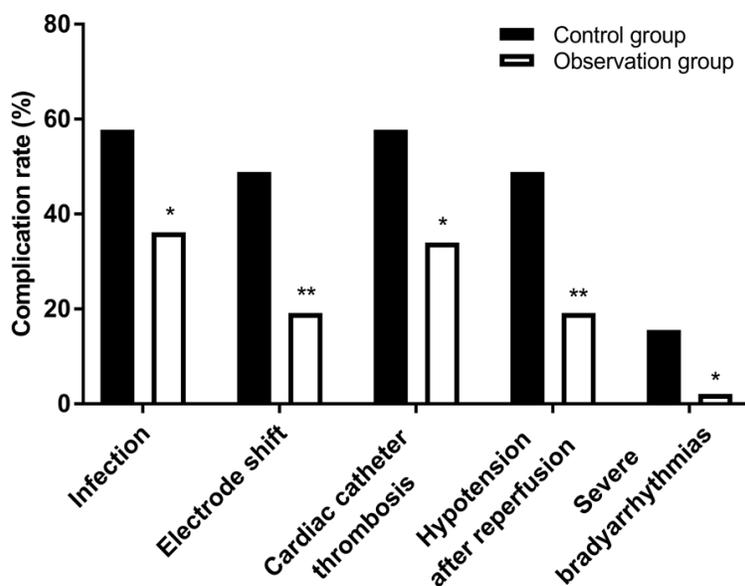| Group	Control group (n=45)	Observation group (n=47)	t/x^2	P
Successful installation of temporary pacemaker	44 (97.78)	46 (97.87)	0.468	0.494
Retention time of pacemaker	9.12±1.09	6.97±0.87	10.428	0.000
Patients with permanent pacemaker implantation	12 (26.67)	3 (6.38)	5.524	0.019
Patients with pacemaker perception dysfunction	8 (17.78)	1 (2.13)	4.730	0.030
Patients with Ron-t	6 (13.33)	0 (0.00)	4.695	0.030

Figure 1. Comparison of the incidence of complications between the two groups of patients. Compared with the control group, *P<0.05, **P<0.01.

sion after reperfusion, and severe bradyarrhythmia in the observation group (were respectively 16 cases (34.04%), 9 cases (19.15%), 16 cases (34.04%), 9 cases (19.15%), 1 case (2.13%)). Which were significantly lower than those in the control group (26 cases (57.78%), 22 cases (48.89%), 26 cases (57.78%), 22 cases (48.89%), 7 cases (15.56%), respectively) (all P<0.05; **Figure 1**).

Comparison of nursing satisfaction

After nursing, the nursing satisfaction in the observation group was 93.62%, significant-

Table 3. Comparison of nursing satisfaction

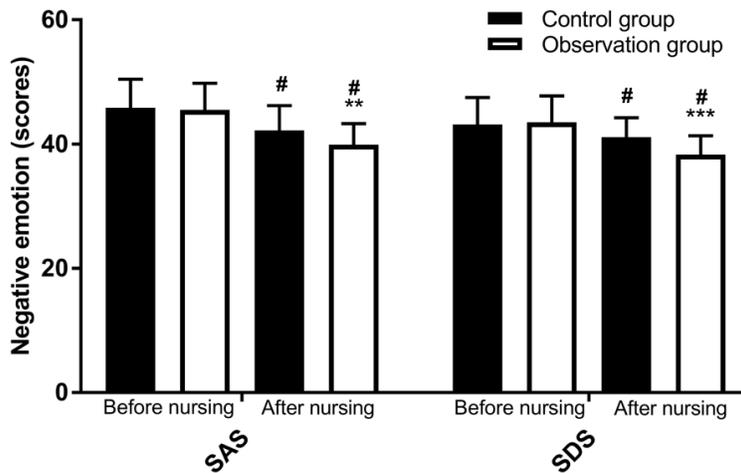| Group	Very satisfied	Relatively satisfied	Generally satisfied	Dissatisfied	Total satisfaction
Control group (n=45)	16 (35.56)	10 (22.22)	8 (17.78)	11 (24.44)	34 (75.56)
Observation group (n=47)	26 (55.32)	13 (27.66)	5 (10.64)	3 (6.38)	44 (93.62)
t/χ^2					4.497
P					0.034

Figure 2. Comparison of SAS and SDS scores between two groups of patients before and after nursing. SAS: self-rating anxiety scale; SDS: self-rating depression scale. Compared with the control group, **P<0.01, ***P<0.001. Compared with the same group before nursing, #P<0.05.

ly higher than 75.56% in the control group (P<0.05; **Table 3**).

Comparison of SAS and SDS scores before and after nursing

Before nursing, there were no significant differences in SAS ((45.83±4.62) vs. (45.52±4.29)) and SDS ((43.15±4.33) vs. (43.50±4.26)) scores between the control and observation groups (P>0.05). After nursing, the scores in the two groups were significantly lower than those before nursing (all P<0.05). The SAS (39.92±3.35) and SDS (38.32±3.01) scores in the observation group were significantly lower than those in the control group ((42.22±3.96), (41.11±3.13); all P<0.05; **Figure 2**).

Comparison of quality of life scores before and after nursing

Before nursing, there were no significant differences in quality of life (self-care ability, physical condition, mental health and social function) scores between the control and observation groups (P>0.05). After nursing, the four scores

in the two groups were significantly higher than those before nursing (all P<0.05), and the scores were significantly higher in the observation group (all P<0.001; **Table 4**).

Discussion

In this study, advanced nursing was mainly divided into preoperative, intraoperative, and postoperative stages, indicating its scientific applicability and comprehensiveness. Preoperative nursing consists of item examinations, the preparation of rescue drugs, psychological nursing, trauma operation nursing, and drug nursing. Newly added with pacemaker-related items, item examinations are better than insufficient preoperative preparations in conventional nursing, and the examinations can effectively prevent consequences of poor pacemaker use [14]. The preparation of rescue drugs refers to the enumeration of accidents that may occur during operation. Compared with routine motor handling, this link can clearly shorten rescue time and reduce unexpected rescue failure during operation through preparing related drugs in advance for accidental use [15]. Elderly AMI patients are usually accompanied by anxiety and depression, which are negative emotions easily aggravated by surgeries and pacemaker installation. Advanced psychological nursing can make the patients prepared psychologically. Compared with conventional guidance for negative emotions that have occurred, this mode can effectively reduce or avoid the emotions induced by psychological trauma in the elderly patients [16]. In addition, due to the lower tolerance of the elderly patients, trauma nursing applied to this study is of great significance to middle-aged and elderly patients, because this mode can reduce their pain and

Table 4. Comparison of quality of life scores before and after nursing ($\bar{x} \pm$ sd)

Time	Group	Scores of self-care ability	Scores of physical condition	Scores of mental health	Scores of social function
Before nursing	Control group (n=45)	15.67±3.28	16.65±3.30	15.24±3.82	18.53±3.25
	Observation group (n=47)	15.49±3.31	16.43±3.24	15.36±3.77	18.41±3.30
t		0.262	0.322	0.152	0.176
P		0.794	0.748	0.880	0.861
After nursing	Control group (n=45)	19.72±3.26[#]	20.02±2.71[#]	19.83±3.16[#]	20.45±2.73[#]
	Observation group (n=47)	23.04±1.83[#]	23.15±1.64[#]	23.41±1.45[#]	23.11±1.82[#]
t		5.988	9.667	32.283	5.474
P		0.000	0.000	0.000	0.000

Note: Compared with that before nursing, [#]$P<0.05$.

improve the surgical effects [17]. Drug nursing highlights the caution of this nursing mode. It confirms the patients' oral medication before operation, and then prevents *in-vivo* drug insufficiency caused by vomiting, thereby improving the operative preparations. Intraoperative nursing mainly includes the monitoring of temporary pacemaker installation and intraoperative PCI nursing. The former innovatively adds the monitoring of whether the pacemakers are dislocated or not and the pacemaker signals, so as to prevent the pacemakers from moving, the signals from weakening, and the prognosis quality from lowering significantly. Secondly, the conditions during the first coronary angiography and during balloon dilatation were monitored to prevent postoperative arrhythmia and other complications. In postoperative nursing, the advantages and innovations of advanced nursing lie in strengthening the fixation of the pacemaker leading wires and the nursing links before temporary pacemaker removal. The fixation is also innovative compared with traditional nursing, i.e. double fixation is adopted to effectively prevent the wires from falling off due to factors such as transportation and vomiting. Strengthening the nursing links before the actual removal, can effectively shorten the removal time of temporary pacemakers and prevent postoperative complications [18].

In our study, the retention time of pacemakers, the number of patients undergoing permanent pacemaker implantation, the number of patients with pacemaker perception dysfunction, and the number of patients with Ron-t were significantly less in the observation group. This suggests that the patients' prognosis is significantly improved after advanced nursing inter-

ventions, which is consistent with findings of previous research [19]. This may be related to the innovative addition of preoperative item examination contents and drug preparation procedures in this study, which solved a series of intraoperative accidents and enhanced the surgical effect. Additionally, the incidence of complications was lower but the quality of life was better in the observation group, which reveals that advanced nursing has higher safety and can clearly improve the patients' prognosis and quality of life, consistent with findings of previous research [20]. Laserina O'Connor, Mary Casey and others have applied advanced nursing to the postpartum nursing of premature infants, finding that this mode obviously reduced the incidence of maternal and infant complications and had a better prevention effect. This further demonstrates that advanced nursing has an obvious advantage in preventing complications [21]. Moreover, after nursing, SAS and SDS scores were significantly lower in the observation group; the nursing satisfaction was significantly higher in the observation group. This indicates that advanced nursing reduces intraoperative trauma, relieves the patients' negative emotions, and improves their nursing satisfaction. This is because this nursing mode takes measures in advance to make patients prepared psychologically, thereby reducing their negative emotions. This paper has innovatively applied advanced nursing to reduce the trauma to elderly patients, which is an advantage. In the future, we will further enlarge the sample size to obtain more comprehensive data, and combine with multi-country center treatments to make the data more applicable.

In summary, the application of advanced nursing to temporary pacemaker installation during PCI treatment for AMI is remarkably effective, and it can significantly improve the patients' prognosis and quality of life.

Disclosure of conflict of interest

None.

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