

Article

Exploration on the Value of Circulation Quality Control Intervention Mode in Percutaneous Coronary Intervention in Patients with Coronary Heart Disease and Chronic Heart Failure

Xuemian Yang¹, Songna Ren¹, Yiqing Liu¹, Xia Wu¹, Xiaohui Hao¹, Xiaowei Bai², Runze Li^{3,*}

¹Department of Cardiovascular Medicine, Xingtai Third Hospital, 054000 Xingtai, Hebei, China

²Department of Gynaecology, Xingtai Third Hospital, 054000 Xingtai, Hebei, China

³Department of Rehabilitation, Xingtai Third Hospital, 054000 Xingtai, Hebei, China

*Correspondence: 13303193253@163.com (Runze Li)

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Abstract

Background: Patients with coronary heart disease (CHD) often have other diseases due to organ dysfunction, among which chronic heart failure (CHF) is the most common. Percutaneous coronary intervention (PCI) is the mainstream method for the treatment of such diseases. Because most of the patients are the elderly and the functions of various organs are declining, it is necessary to implement scientific and efficient management methods. **Objective:** To explore the application value of circulation quality control intervention (CQCI) mode in PCI of patients with CHD and CHF. **Time:** From June 2021 to June 2023. **Methods:** The clinical data of 197 CHD patients with CHF were retrospectively analyzed, and 14 patients who did not meet the inclusion criteria were excluded. According to different perioperative management methods, the remaining cases were divided into the reference group (RG, receiving routine clinical management) and observation group (OG, receiving routine clinical management and CQCI). The cardiac function indexes and emotional state before and after management were compared between the two groups, and the quality of life in two groups was compared. **Results:** In this study, 100 patients were included in the RG and 83 patients were included in the OG finally. Compared with the RG, the OG had lower levels of left ventricular end systolic diameter and left ventricular end-diastolic diameter after management ($p < 0.05$), while the OG had significantly higher left ventricular ejection fraction level ($p < 0.001$). The OG had overtly higher clinical satisfaction than the RG ($p < 0.05$). After management, the Hospital Anxiety and Depression Scale score in the OG were distinctly lower than those in the RG ($p < 0.001$). After management, the OG had significantly higher scores of physiological field, psychological field, social relationship and environmental field than the RG ($p < 0.001$). **Conclusion:** The application of CQCI mode in the perioperative period of PCI has certain benefits for improving the cardiac function of patients. At the same time, this program can also improve the

quality of life of patients to a certain extent, which is helpful to accelerate postoperative rehabilitation.

Keywords

circulation quality control; coronary heart disease with chronic heart failure; percutaneous coronary intervention; clinical value

Introduction

Coronary heart disease (CHD) is a cardiovascular disease that affects the coronary artery, while the coronary artery provides oxygenated blood for the heart. CHD is the leading cause of death worldwide [1]. The incidence of CHD continues to rise, and the number of CHD patients with chronic heart failure (CHF) is also rising rapidly. The application of percutaneous coronary intervention (PCI) in patients with CHD and CHF has increased significantly [2]. PCI has been widely used in clinical practice because of its small trauma and remarkable curative effect. Patients with CHD and CHF are mostly elderly, and most of patients are frail in the body with severe vascular lesions, so they face a higher risk after surgery [3]. Moreover, patients are prone to various complications during the perioperative period, which affect their rehabilitation, so high-quality nursing work is particularly important in the treatment of CHD with CHF [4].

The intraoperative management is a management process to improve the quality of surgery and work efficiency. Managers must pay attention to exploration and innovation, and master advanced management theories and methods. Circulation quality control intervention (CQCI) is one of the common modes in quality management system, including plan, do, check and action stages [5] (Fig. 1). The circulation quality control was first applied to enterprise management, and has achieved good results, which is recognized as one of the effective management methods by the

management community. In recent years, more and more foreign medical workers have applied the theory of circulation quality control to hospital quality management, and this theory has achieved good results [6–8]. In China, the theory of circulation quality control is also widely used in the medical field. Li *et al.* [9] have investigated the medication safety of cancer patients by using the circulation quality control management to formulate countermeasures for intervention. The investigation shows that the incidence of medication insecurity incidents in the post-implementation group is 3.36%, which is overtly lower than 11.38% in the pre-implementation group ($p < 0.05$). This research topic keeps pace with the times, and applies the circulation quality control theory to the intraoperative management of PCI, aiming to reduce the intraoperative risk of PCI and ensure the smooth surgery.



Fig. 1. Management system of circulation quality control theory.

Materials and Methods

Research Objects

The research objects were 197 patients with CHD and CHF who underwent PCI in our hospital from June 2021 to June 2023. Fourteen patients who did not meet the inclusion criteria were excluded, and the remaining cases were included in this study.

Research Design

According to the different perioperative intervention schemes, the patients were divided into the observation

group (OG, 83 patients receiving CQCI mode and perioperative routine management) and reference group (RG, 100 patients receiving perioperative routine management).

Inclusion and Exclusion Criteria

Inclusion criteria. (1) Patients had complete medical records. (2) Patients had normal cognitive function and language expression ability, and could cooperate to fill in the research scale. (3) Patients underwent PCI at the first time. (4) Patients had severe complications after surgery, which were life-threatening.

Exclusion criteria. (1) Patients had missing medical records, so it was unable to extract relevant information or data. (2) Patients had disturbance of consciousness and severe cognitive impairment. (3) Patients had malignant tumors.

Methods

The RG received routine management, including basic management, medication management, dietary guidance, preoperative preparation for intervention, preoperative psychological guidance and health education, postoperative vital signs observation, and symptomatic nursing according to doctor's advice.

Based on the above routine management, the OG received the intervention of circulation quality control theory, as shown in Fig. 2, Table 1.

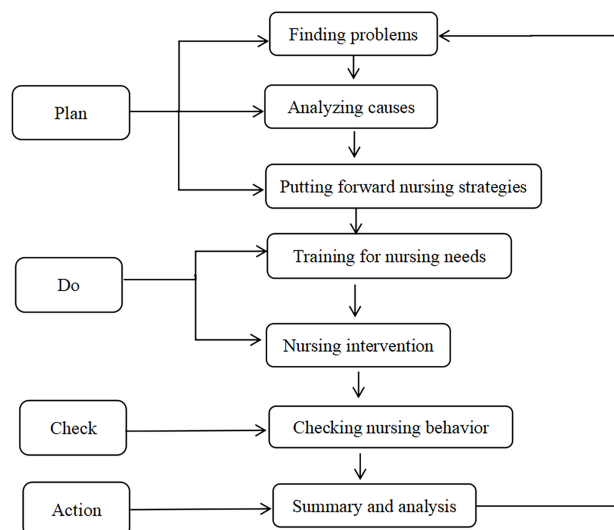


Fig. 2. Intervention process of circulation quality control management.

Table 1. Specific process of CQCI mode.

Steps	Specific process
Plan (P)	(1) Nursing plan. A group of CQCI was established, and this group consisted of 1 head nurse and 7 nurses. All members in the group have received professional training in PCI for patients with CHD with CHF to ensure that each member was proficient in the relevant nursing operations. (2) Risk identification and assessment. According to the content of nursing records and the daily reaction of patients, the risk factors for postoperative complications were evaluated.
Do (D)	(1) In view of the potential safety hazard, the nursing group needed to strengthen the service consciousness and nursing skills, and focused on the targeted and individualized nursing intervention. (2) Nursing staff established intravenous infusion pathway to assist anesthesia treatment, closely monitored the changes of vital signs in patients, and took timely and targeted treatment for emergencies. The nursing staff paid attention to patients' physical changes during the surgery, keenly observed their heart rate, blood pressure and pulse indexes, and reported it to the attending doctor in time. When accidents occurred during surgery, nursing staff performed emergency operations quickly and safely based on the doctor's instructions to avoid further escalation of risks. (3) Individualized nursing intervention. (a) The vital signs of patients were detected by the multi-parameter monitor. (b) Antiarrhythmic care. According to the doctor's advice, the nursing staff established the venous access of indwelling needle in the left upper limb of patients. Patients were treated with antiarrhythmic drugs and nutritional myocardial drugs. Nursing staff strictly controlled the speed of infusion, and observed whether the patients' arrhythmia was corrected in time after medication. (c) Temperature management. The patients' body temperature was measured every 4 h, and the ice bag was used for cold compress under temperature of $\leq 38^{\circ}$. If this physical cooling method could not relieve patients' body temperature, and the body temperature continued to rise, patients could take ibuprofen sustained-release capsules, acetaminophen tablets and other drugs under the guidance of doctor. (d) Posture management. Patients were assisted in taking a semirecumbent position to facilitate their diet and reduce the risk of aspiration. (e) Nursing of nausea and vomiting. (f) Skin care. Specially made protective sleeve of blood pressure measurement. According to the length and width of cuff, a cylindrical protective sleeve was sewn along the cuff to buffer the pressure caused by blood pressure measurement and reduce skin damage. The cuff was released every 2 h. (g) Mental nursing. Nursing staff helped patients to adapt to the hospital environment, cared for their body, persuaded them patiently, and gave them encouragement and support, so that patients could actively cooperate with various nursing measures. A good nurse-patient relationship should be established to help patients maintain a good attitude and accelerate the recovery of disease.
Check (C)	Nursing staff regularly assessed patients' condition to accurately grasp the effect of the program. Nursing managers were responsible for urging other nursing staff to consciously abide by rules, regulations and operating standards, while strengthening inspections and patrols.
Action (A)	Nursing managers made a summary according to the examination results. Monthly seminars were held regularly to formulate reasonable solutions to the problems existing in the inspection results. Then the next cycle was pushed for continuous improvement.

CQCI, circulation quality control intervention; CHD, coronary heart disease; CHF, chronic heart failure.

Observation Indexes

Baseline Data

The general data such as age, gender, record, complications and average operation time were compared between the two groups.

Cardiac Function Indexes

The levels of left ventricular ejection fraction (LVEF), left ventricular end systolic diameter (LVESD) and left ventricular end-diastolic diameter (LVEDD) before and after

management in the two groups were measured by echocardiography.

Psychological State

The Hospital Anxiety and Depression Scale (HADS) [10] was used to evaluate the psychological status of patients. The scale had 14 items totally, including 7 items for anxiety (A) and 7 items for depression (D), with a total of 6 reverse scoring items. The scale adopted 4-level scoring method from 0 point to 3 points, with the score range of 0–21 points in anxiety subscale, and 0–21 points in depression subscale. The higher score indicated that patients had more

severe anxiety and depression.

Living Conditions

The Methods World Health Organization on Quality of Life Brief Scale (WHOQOL-BREF) [11] was adopted to evaluate the quality of life of patients. This scale contained 4 scoring items, namely, physiological field, psychological field, social relations field and environmental field. The full score of each item was 100 points, and the higher score indicated that subjects had better quality of life.

Clinical Satisfaction

After the end of management, the self-made satisfaction questionnaire by our department was adopted to evaluate the satisfaction in patients. The scale divided the satisfaction into very satisfied, relatively satisfied, satisfied, generally satisfied, dissatisfied and extremely dissatisfied. Satisfaction degree = [(very satisfied cases) + (relatively satisfied cases) + (satisfied cases)] / total cases \times 100%.

Statistical Analysis

SPSS 25.0 software (International Business Machines Corporation, Armonk, NY, USA) was used to analyze and process the data in this study. Firstly, the Shapiro-Wilk method was adopted to test the normal distribution of continuous variables. The data that did not conform to the normal distribution were expressed by $M (P_{25}, P_{75})$, and detected by non-parametric test, while the data conforming to normal distribution and homogeneity of variance were indicated by (mean \pm SD), detected by t test. The categorical variables were indicated by $[n (\%)]$, detected by χ^2 test. $p < 0.05$ indicated that the difference was statistically significant. Fig. 1 and Fig. 2 were drawn by the Microsoft Office Word 2020 (manufacturer: Microsoft Corporation; origin: Redmond, WA, USA).

Results

General Data

By comparison, the study found that there was no significant difference in age, gender and complications between the two groups ($p > 0.05$), as shown in Table 2.

Cardiac Function Indexes

The study found that there was no overt difference in levels of LVESD, LVEDD and LVEF between the two groups before management ($p > 0.05$). After management, the OG had lower levels of LVESD and LVEDD than the RG ($p < 0.05$), while the OG had significantly higher LVEF level ($p < 0.001$). See details in Table 3.

Clinical Satisfaction

The research results showed that the total clinical satisfaction in the OG was distinctly higher compared with the RG ($p < 0.05$), as shown in Table 4.

HADS Scores

Before management, there was no distinct difference in HADS-D scores and HADS-A scores between the two groups ($p > 0.05$). After management, the OG had significantly lower HADS-D score and HADS-A score than the RG ($p < 0.001$), as detailed in Table 5.

WHOQOL-BREF Scores

The study showed that the scores of physiological field, psychological field, social relationship and environmental field in the OG after management were overtly higher than those in the RG ($p < 0.001$), as shown in Table 6.

Discussion

This research results showed that the OG had lower levels of LVESD and LVEDD than the RG after management ($p < 0.05$), and had significantly higher LVEF level than the RG ($p < 0.001$). The above results show that the implementation of CQCI mode can improve the cardiac function in patients. The reason is as follows. The theory of circulation quality control management is a scientific procedure that should be followed in quality management [12]. This mode is one of the standardized, systematic, scientific and effective management modes in line with nursing management under the new situation. In the application to patients with CHD and CHF undergoing PCI, this mode formulates a targeted clinical management plan through identifying the potential risks during the perioperative period, which is more comprehensive and targeted compared with conventional nursing management. This may be beneficial to promote the improvement of perioperative cardiac function.

CHD, a common clinical cardiovascular disease in the elderly, is the leading cause of high morbidity and mortality worldwide [13]. The decline of myocardial endothelial cell function and abnormal energy metabolism are important links to aggravate heart failure [14]. The changes in condition of CHD with CHF is complicated, and PCI as a traumatic operation greatly increases the risk during perioperative period [15]. In this study, the CQCI mode focuses on the patients' situation in PCI surgery, and advocates to take measures in advance for the patients' possible unexpected situations. Under this mode, medical staff control the infusion speed of patients and observe whether the arrhythmia in patients is timely corrected. These subtle in-

Table 2. Comparison of general data in two groups.

Category		OG (n = 83)	RG (n = 100)	z/χ^2	p
Age [years old, M (P ₂₅ ,P ₇₅)]		69.00 (65.00, 75.00)	68.00 (65.00, 74.75)	-0.204	0.839
Gender	Male	49 (59.04)	58 (58.00)	0.020	0.887
	Female	34 (40.96)	42 (42.00)		
Complications	Hypertension	9 (10.84)	9 (9.00)	0.230	0.973
	Diabetes	5 (6.02)	7 (7.00)		
	Hyperlipidemia	8 (9.64)	10 (10.00)		
Left main coronary artery lesion	Yes	4 (4.82)	5 (5.00)	0.003	0.955
	No	79 (95.18)	95 (95.00)		
Vascular access	Radial artery	76 (91.57)	90 (90.00)	0.132	0.719
	Femoral artery	7 (8.43)	10 (10.00)		
History of respiratory diseases	Yes	9 (10.84)	12 (12.00)	0.060	0.807
	No	74 (89.16)	88 (88.00)		
Multi-branches lesions	Yes	72 (86.75)	87 (87.00)	0.003	0.960
	No	11 (13.25)	13 (13.00)		
Number of scaffold	1	7 (8.43)	9 (9.00)	0.018	0.893
	≥2	76 (91.57)	91 (91.00)		
Anticoagulant medication	Aspirin	37 (44.58)	42 (42.00)	0.630	0.730
	Clopidogrel	19 (22.89)	20 (20.00)		
	Aspirin + Clopidogrel	27 (32.53)	38 (38.00)		

OG, observation group; RG, reference group.

Table 3. Comparison of cardiac function indexes in both groups before and after management [M (P₂₅, P₇₅)].

Time point	Indexes	OG (n = 83)	RG (n = 100)	z	p
Before management	LVESD (mm)	71.00 (67.00, 73.00)	70.00 (67.00, 73.75)	0.243	0.808
	LVEDD (mm)	42.00 (40.00, 44.00)	42.00 (40.00, 44.00)	0.139	0.890
	LVEF (%)	36.00 (33.00, 39.00)	36.00 (33.00, 39.00)	0.286	0.775
After management	LVESD (mm)	67.00 (62.00, 70.00)	68.00 (65.00, 72.00)	-2.930	0.003
	LVEDD (mm)	37.00 (35.00, 39.00)	39.00 (36.00, 41.00)	-2.310	0.021
	LVEF (%)	40.00 (37.00, 43.00)	38.00 (34.25, 41.00)	3.709	<0.001

LVESD, left ventricular end systolic diameter; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction.

Table 4. Comparison of clinical satisfaction in both groups [n (%)].

Groups	n	Very satisfied	Relatively satisfied	Satisfied	Generally satisfied	Dissatisfied	Extremely dissatisfied	Satisfaction degree
OG	83	36 (43.37)	22 (26.51)	21 (25.30)	3 (3.61)	1 (1.20)	0	95.18% (79/83)
RG	100	20 (20.00)	42 (42.00)	24 (24.00)	7 (7.00)	5 (5.00)	2 (2.00)	86.00% (86/100)
χ^2								4.310
p								0.038

Table 5. Comparison of HADS scores in both groups before and after management [M (P₂₅, P₇₅), points].

Time point	Projects	OG (n = 83)	RG (n = 100)	z	p
Before management	HADS-D scores	12.00 (10.00, 14.00)	13.00 (11.00, 15.00)	-0.988	0.323
	HADS-A scores	13.00 (11.00, 15.00)	14.00 (12.00, 15.00)	-1.255	0.209
After management	HADS-D scores	10.00 (9.00, 11.00)	11.50 (10.00, 13.00)	-4.543	<0.001
	HADS-A scores	10.00 (8.00, 11.00)	11.00 (9.00, 13.00)	-3.771	<0.001

HADS, Hospital Anxiety and Depression Scale.

interventions have left a good impression on patients. The results of this study showed that patients in the OG had

significantly higher clinical satisfaction than the RG ($p < 0.05$), suggesting that CQCI mode can improve the clini-

Table 6. Comparison of WHOQOL-BREF scores in both groups after management [M (P₂₅, P₇₅), points].

Groups	n	Physiological field	Psychological field	Social relationship	Environmental field
OG	83	78.00 (75.00, 82.00)	77.00 (74.00, 80.00)	80.00 (76.00, 84.00)	81.00 (80.00, 83.00)
RG	100	75.00 (72.00, 79.00)	73.50 (71.00, 76.00)	74.00 (70.00, 77.00)	74.00 (71.00, 77.00)
<i>z</i>		4.803	6.094	7.631	11.020
<i>p</i>		<0.001	<0.001	<0.001	<0.001

WHOQOL-BREF, The Methods World Health Organization on Quality of Life Brief Scale.

cal satisfaction of patients to a certain extent. This point is beneficial to improve patients' compliance.

The research data showed that there was no significant difference in HADS-D and HADS-A scores between two groups before management ($p > 0.05$), and the HADS-D score and HADS-A score of the OG were significantly lower than those of the RG after management ($p < 0.001$). After management, the WHOQOL-BREF scores in physiological, psychological, social and environmental fields in the OG were significantly higher than those in the RG ($p < 0.001$). The above results suggest that the application of CQCI mode in the intraoperative management of PCI for patients with CHD and CHF can effectively improve the psychological state and promote their quality of life. The CQCI mode is divided into plan, do, check and action stages, which is more procedural and normative [16]. This mode can deploy and solve previous problems in advance, and timely identify weak links in nursing management work, proposing targeted solutions. At the same time, patients' needs are actively met under this mode, which greatly improves their confidence in treatment, eliminates the doubts and anxieties of patients about clinical treatment to the greatest extent, and adjusts their psychological state. The advantage of the CQCI mode is to focus on the strength of departments and systematically analyze the hidden problems of nursing management [17], which is helpful to reduce errors in the implementation of nursing, improve nursing quality, improve medical services, and enhance patients' quality of life.

This study has some limitations, for example, due to limitations in research time, funding and other conditions, the study includes limited samples. Moreover, few observation indicators may lead to bias in research results. Thus, multi-center and large-sample clinical trials should be carried out in the future to further explore the clinical value of CQCI mode in PCI for patients with CHD and CHF.

Conclusion

The implementation of CQCI mode in the perioperative period of PCI is beneficial to improve the cardiac function and quality of life in patients. This intervention mode can provide reference for the selection and formulation of subsequent clinical management programs.

Availability of Data and Materials

Data to support the findings of this study are available on reasonable request from the corresponding author.

Author Contributions

XY, SR, YL and RL contributed to the concept and designed the research study. XY, SR and XB performed the research. YL, XW, XH and RL provided help and advice on the experiments. XW, XH and XB contributed to the analysis and interpretation of the data. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study conforming to the principles of Declaration of Helsinki (2013) has been approved by the ethical committee of Xingtai Third Hospital (approval No.: 20220402). Since this study is a retrospective analysis, it is not necessary to obtain informed consent of patients.

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Conflict of Interest

The authors declare no conflict of interest.

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