

Early Cardiac Rehabilitation Nutrition Management Mode for Patients After Cardiac Surgery

Shengping He

Department of Cardiovascular Surgery, Nanfang Hospital, Southern Medical University, Guangzhou, 510515, China

Abstract

Objective: To explore the early cardiac rehabilitation nutrition management mode for patients after cardiac surgery and observe its application effect, so as to provide evidence for clinical application. **Methods:** A total of 148 patients who received cardiac surgery in our hospital from January 2022 to January 2023 were selected as research subjects and randomly divided into a conventional group and an intervention group, 74 cases in each one. Routine management was adopted for patients in the routine group, while early cardiac rehabilitation nutrition management mode was added for patients in the intervention group on the basis of routine management. Time indicators, cardiac function indicators and nutrition assessment were observed. **Results:** ICU stay time and total hospitalization time of patients in the intervention group were significantly decreased. The LVEDV and LVESV of the intervention group were significantly lower than those of the conventional group, and the LVEF and CI were significantly higher than those of the conventional group. At the same time, the nutritional status of the intervention group was significantly better than that of the conventional group. All the above differences had statistical differences ($P < 0.05$). **Conclusion** Early cardiac rehabilitation nutrition management mode for patients after cardiac surgery can help patients recover as soon as possible and improve their cardiac function and nutritional status.

Keywords

Cardiac surgery; Early cardiac rehabilitation; Nutrition management model.

1. INTRODUCTION

There are about 330 million people suffering from cardiovascular diseases in China, including about 11 million people suffering from coronary heart disease, and the number of people suffering from such diseases and deaths is still increasing year by year [1], Cardiac surgery is a common method for the treatment of coronary heart disease, cardiac valvular disease, and the like [2]. However, patients in cardiac surgery often suffer from pre-operative cardiac insufficiency, surgical trauma stress, post-operative insufficient food intake, various treatment adverse reactions [3], Postoperative patients suffer from different degrees of malnutrition, Bistrin reports that the incidence of malnutrition in some hospitalized patients is as high as 70%, while more than 80% of patients with rheumatic valvular disease and 25% of patients with ischemic heart disease in cardiac surgery suffer from different degrees of malnutrition [4]. Some scholars evaluated 196 patients with rheumatic heart disease. The data showed that the patients were undernourished 9.2%, overweight 18.4%, and obese 5.6%. The patients who were screened out of nutritional risk accounted for 37.8% of the total investigated cases. Finally, for patients at nutritional risk, parenteral/enteral nutrition was used for 32.4% [5]. Some scholars found that among the 485 cases with thoracotomy, 13.2% were at risk of nutrition before operation through preoperative nutrition assessment, among which the incidence of

large vessel disease, coronary heart disease and valvular disease was higher [6]. Studies in China and abroad have shown that the incidence of malnutrition in children with pre-operative congenital heart disease is 25.3%–28.6% [7-8]. and most of them suffer from nutritional metabolism disorder after surgery, which seriously affects the rehabilitation effect of early cardiac rehabilitation [9]. Early cardiac rehabilitation is a comprehensive intervention, including medication, exercise, nutrition, life guidance and other aspects, to promote patients to construct a healthy behavior style, improve the prognosis outcome, and thus return to social life as soon as possible [10]. Many studies point out that early cardiac rehabilitation intervention can help patients recover quickly after cardiac surgery, prevent complications and has a positive effect on mental health of patients [11]. In addition, studies have shown that the decline of nutritional status will increase cardiac metabolic disorders and delay the recovery of the heart and the original affected organs, and perioperative nutritional support can reduce the incidence of postoperative complications and has a positive effect on surgical traumatic stress [12]. Nutritional management attaches importance to postoperative nutritional support and actively improves malnutrition, which plays a vital role in postoperative rehabilitation and improvement of quality of life. Some patients had nutritional problems such as excessive nutrition, nutritional imbalance and bad dietary habits before surgery [13]. Therefore, the nutritional management of early cardiac rehabilitation is special, so this study explores the nutritional management model of early cardiac rehabilitation for patients after cardiac surgery and observes it, hoping to provide theoretical support for clinical practical application.

2. DATA AND METHODS

2.1. General information

According to the inclusion and exclusion criteria, 148 patients who received cardiac surgery in our hospital from January 2022 to January 2023 were selected as research subjects and randomly divided into the conventional group and the intervention group, with 74 cases in each group. There were 41 males and 33 females in the control group, and they were aged between 25 and 63 years old, with the average age of (53.73 ± 3.64) years old. There were 43 males and 31 females in the intervention group, and they were aged between 23 and 68 years old, with the average age of (54.18 ± 3.02) years old. There was no significant difference in age and gender between the routine group and the intervention group ($P > 0.05$). The consent of the Ethics Committee had been obtained in this study, and all patients participating in this study had informed consent to the content of this experiment.

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) patients over 18 years of age; (2) Patients undergoing cardiac surgery for the first time; (3) Pre-surgery limb function is normal, with normal cognitive function; (4) Patients who were willing and able to cooperate with this study.

Exclusion criteria: (1) patients with incomplete clinical data; (2) Patients who were unwilling or unable to cooperate with this study; (3) Patients with malignant tumor; (4) Patients complicated with severe dysfunction of other organs and systems; (5) Patients with consciousness disorder or mental disease that cannot communicate; (6) patients who are too young.

2.3. Methods

Patients in the routine group received routine management, while those in the intervention group received early cardiac rehabilitation nutrition management mode on the basis of routine management. The specific measures were as follows:

The specific routine management measures included postoperative escort of the patients to the anesthesia recovery room, close observation of heart rate and respiration, postoperative analgesia with drugs such as tramadol and Obi, extubation of patients who met the indications for extubation, good pipeline care to prevent infection, close observation of postoperative recovery, and timely symptomatic treatment in case of complications.

Specific measures of nutrition management mode for early cardiac rehabilitation included: (1) Nutrition screening and evaluation: The patients completed nutrition screening within 24 hours after admission and nutrition evaluation within 48 hours, formulated nutrition support plan, and recorded daily food intake of the patients in detail. Oral diet mainly included staple foods, meat, eggs, vegetables and fruits, and oral nutritional supplements. Establish patients' nutrition archives before discharge, regular follow-up. (2) establish regular nutrition succession, ward round system. Dieticians attend ward morning shift, for new admission, 1 week after admission and nutrition plan special adjustment of patients need to nutrition shift, according to the patient's nutrition situation to evaluate nutrition support plan, regularly every week to participate in director and attending doctor rounds, timely understand the basic condition of the patient and the treatment. (3) Health education: Health education related to nutrition was provided during hospitalization, for patients and their families. Individualized health education was conducted in a one-on-one manner regarding the disease, cognition, lifestyle, nutritional status and dietary structure of patients, and lectures were given twice a month to explain the precautions in diet after operation according to the disease pathology, physiology and nutritional status of patients.

2.4. Observation indicators

(1) Time index: The rehabilitation status of patients was reflected by time index, including ICU time and total hospital stay.

(2) Cardiac function indicators: Changes in left ventricular end diastolic/systolic volume (LVEDV /LVESV), left ventricular ejection Fraction (LVEF), and cardiac index (CI) of the patients in the two groups were measured before and two weeks after surgery.

(3) Nutrition assessment: Total subjective nutritional assessment (SGA) was a nutrition assessment tool proposed by Detsky et al. [14] in 1987. SGA score was composed of six parameters including body weight change history, changes in dietary intake, activity ability, gastrointestinal symptoms, as well as muscle and fat consumption and edema, and ascites. According to the nutritional status of patients, SGA score was divided into Grade A: good nutrition, Grade B: mild and moderate malnutrition, and Grade C: severe malnutrition.

2.5. Statistical analysis

All the collected data were entered into SPSS software for statistical analysis. The enumeration data were recorded in the ways of example and percentage, and analyzed by χ^2 test. The measurement data were recorded in the ways of mean and standard deviation, and analyzed by t-test and chi-square test. When $P < 0.05$, the data were considered to be statistically different.

3. RESULTS

3.1. Comparison of general data between the two groups

It could be seen that there was no statistically significant difference in gender and age between the two groups ($P > 0.05$).

Table 1. Comparison of general data between the two groups ($\bar{x}\pm s, \%$)

	gender		age
	man	woman	
Conventional group(n=74)	41(55.41)	33(44.59)	53.73±3.64
Intervention group(n=74)	43(58.11)	31(41.89)	54.18±3.02
t/X ² value		0.110	0.818
P value		0.740	0.414

3.2. Comparison of time indexes between the two groups

It could be seen that the ICU stay time and total hospitalization time of patients in the conventional group were (21.36±3.25) h and (8.89±1.49) d, respectively, while those in the intervention group were (18.29±3.09) h and (7.28±1.13) d, respectively. The ICU stay time and total hospitalization time of patients in the intervention group were significantly decreased ($P < 0.05$).

Table 2. Comparison of time indexes between the two groups(Number,%)

	ICU time(h)	Total hospitalization time(d)
Conventional group(n=74)	21.36±3.25	8.89±1.49
Intervention group(n=74)	18.29±3.09	7.28±1.13
X ² value	5.889	7.406
P value	0.000	0.000

3.3. Comparison of cardiac function indexes between the two groups

It could be seen that before the management intervention, there was no statistical difference in LVEDV, LVESV, LVEF and CI between the routine group and the intervention group ($P > 0.05$). However, after the management intervention, there was a statistical difference in LVEDV, LVESV, LVEF and CI between the two groups ($P < 0.05$). The LVEDV and LVESV in the intervention group were significantly lower than those in the routine group, while the LVEF and CI in the intervention group were significantly higher than those in the routine group.

Table 3. Comparison of cardiac function indexes between the two groups($\bar{x}\pm s$)

Time	Group	LVEDV (mL)	LVESV (mL)	LVEF (%)	CI (L·min-1·m-2)
Before intervention	Conventional group(n=74)	101.68±9.43	67.28±6.89	35.09±2.79	2.14±0.24
	Intervention group(n=74)	103.41±8.07	65.35±5.91	35.81±3.01	2.18±0.21
	t value	0.199	1.829	1.509	1.079
	P value	0.232	0.069	0.133	0.282
After intervention	Conventional group(n=74)	99.14±7.48	58.28±7.03	48.28±5.72	3.21±0.63
	Intervention group(n=74)	93.23±8.27	51.21±7.38	52.71±5.39	3.87±0.68
	t value	4.559	5.967	4.849	6.125
	P value	0.000	0.000	0.000	0.000

3.4. Comparison of nutritional status between the two groups

After management, 58 patients (78.38%) in the routine group were in Grade A, 11 patients (14.86%) in Grade B, and 5 patients (6.76%) in Grade C. After management, 69 patients (93.24%) in the routine group were in Grade A, 39 patients (4.05%) in Grade B, and 2 patients (2.70%) in Grade C. There was a significant difference in the nutritional status between the two groups ($P < 0.05$). The nutritional status of the intervention group was significantly better than that of the routine group, as shown in Table 4

Table 4. Comparison of nutritional status between the two groups

	Good nutrition		malnutrition	
	Level A	Level B	Level C	
Conventional group(n=74)	58(78.38)	11(14.86)	5(6.76)	
Intervention group(n=74)	69(93.24)	39(4.05)	2(2.70)	
X ² value		5.549		
P value		0.018		

4. DISCUSSION

Patients in cardiac surgery have severe and complicated illnesses. In addition to the large trauma and high risk in cardiac surgery, postoperative rehabilitation for patients in cardiac surgery has become a clinical focus. Patients in cardiac surgery will have decreased digestive and absorption functions due to cardiac insufficiency, and postoperative recovery will be difficult and complications will correspondingly increase due to dysfunction of circulatory system, respiratory system and other organs [15]. The concept of accelerated rehabilitation surgery was first proposed by the Danish scholar Kehlet H in 1997. [16] In the theory of accelerated rehabilitation surgery, the application of evidence-based medicine has confirmed a series of effective measures, the main purpose of which is to optimize the perioperative treatment and care, accelerate the recovery of patients, shorten the hospitalization time, reduce stress response and complications. Postoperative recovery time, hospitalization time and hospitalization expenses were closely related to malnutrition. Nutritional status is of great significance in promoting rapid rehabilitation [17-18]. To evaluate patients before cardiac surgery and actively provide additional nutritional support for those at nutritional risk, with adequate energy and required nutrients, can restore the normal physiological function of various organs and provide a good basis for patient rehabilitation. Some literature pointed out that scientific and reasonable nutrition supplement could improve the success rate of severe surgery, shorten the monitoring time and hospital stay, reduce complications and costs, and reduce the mortality rate [19].

In this study, nutritional assessment was performed on patients before operation, and targeted nutrition support scheme was given according to the body state characteristics of different patients to obtain the optimal nutrition intake. The results showed that the ICU stay time and total hospitalization time of patients in the intervention group were significantly decreased, indicating that early cardiac rehabilitation nutrition management model could help patients recover as soon as possible. Early postoperative nutritional intervention is not only to provide nutritional substrates, but also has more important significance in reducing the body's hypercatabolism and insulin resistance, reducing the release of inflammatory factors, promoting anabolism and body recovery, maintaining intestinal mucosal barrier and immune function, preventing intestinal bacteria shift, and helping to promote incision healing, reduce

complications and shorten hospital stay [20]. This is consistent with the results of previous studies [21]. A meta-analysis of the impact of perioperative enteral nutrition support on nutritional evaluation indexes of patients showed that postoperative nutrition support could shorten the average hospital stay of patients by 2d, promote their early postoperative recovery and reduce hospital costs.

In addition, in this study, we also found that the LVEDV and LVESV of the intervention group were significantly lower than those of the conventional group, and the LVEF and CI of the intervention group were significantly higher than those of the conventional group. LVEDV and LVESV are both effective indicators reflecting ventricular contraction and relaxation dysfunction. LVEF is the percentage of stroke volume to LVEDV and is related to myocardial contraction ability. CI is an index reflecting the work ability of the heart, and also indirectly reflects the myocardial contractility. The results show that the nutritional management mode of early cardiac rehabilitation can improve the cardiac function of patients, This study also found that the nutritional status of the intervention group was significantly better than that of the conventional group, indicating that the early cardiac rehabilitation nutrition management model developed in this study could significantly improve the nutritional status of patients. The analysis reason was that preoperative nutritional support and related nutritional intervention for patients with nutritional risk could improve the energy protein malnutrition.

In summary, the implementation of early cardiac rehabilitation nutrition management model for patients after cardiac surgery can help patients recover as soon as possible, and improve their cardiac function and nutritional status.

REFERENCES

- [1] Wu Liuyang, Yan Qiqi, Mai Haohui, et al. Does the Geriatric Nutritional Risk Index Play a Predictive Role in Postoperative Atrial Fibrillation and Outcomes in Cardiac Surgery?[[J]]. *Journal of Cardiothoracic and Vascular Anesthesia*,2023,37(1).
- [2] Brief Floriane, Guimber Dominique, Baudalet Jean-Benoit,et al. Prevalence and associated factors of long-term growth failure in infants with congenital heart disease who underwent cardiac surgery before the age of one[[J]]. *Archives of Cardiovascular Diseases Supplements*,2021,13(4).
- [3] Donahue Brian S.. Commentary: Preoperative Nutritional Status And Mortality from Cardiac Surgery: Do We Have Your Attention Yet?[[J]]. *The Journal of Thoracic and Cardiovascular Surgery*, 2021, (prepublish).
- [4] Jared P. Beller, Daniel Phadke, Elizabeth D. Krebs,et al. Percutaneous Endoscopic Gastrostomy After Cardiac Surgery: A Temporary Measure in a High-Risk Cohort[[J]]. *The Annals of Thoracic Surgery*, 2019, 108(4).
- [5] Stoppe Christian, Ney Julia,Lomivorotov Vladimir V,et al. Prediction of Prolonged ICU Stay in Cardiac Surgery Patients as a Useful Method to Identify Nutrition Risk in Cardiac Surgery Patients: A Post Hoc Analysis of a Prospective Observational Study. [[J]]. *JPEN. Journal of parenteral and enteral nutrition*, 2019, 43(6).
- [6] Edward Litton, Emma J. Ridley, Anthony Delaney. Cardiac Surgery and the Low Hanging Fruit of Perioperative Nutritional Interventions[[J]]. *Journal of Cardiothoracic and Vascular Anesthesia*, 2018, 32(3).
- [7] Anna Vittoria Mattioli, Francesca Coppi, Sonia Pennella, et al. Combined Rehabilitation and Nutritional Coaching After Cardiac Surgery: Gender Differences[[J]]. *The Annals of Thoracic Surgery*, 2018, 106(4).

- [8] Gao Jian, Tu Guo-Wei, Wang Chun-Sheng, et al. A quality improvement program with nutrition therapy: restriction of lipid emulsions in cardiac surgical patients. [J]. Journal of thoracic disease, 2018, 10(2).
- [9] Rahman Adam, Agarwala Ravi, Martin Claudio, et al.. Nutrition Therapy in Critically Ill Patients Following Cardiac Surgery: Defining and Improving Practice[J]. Journal of Parenteral and Enteral Nutrition, 2017,41(7).
- [10] Stoppe Christian, Goetzenich Andreas, Whitman Glenn, et al. Role of nutrition support in adult cardiac surgery: a consensus statement from an International Multidisciplinary Expert Group on Nutrition in Cardiac Surgery.[J]. Critical care (London, England), 2017, 21(1).
- [11] Adam S. Evans, Leila Hosseinian, Tricia Mahabir, et al. Erratum to 'Nutrition and the Cardiac Surgery Intensive Care Unit Patient—An Update' [Journal of Cardiothoracic and Vascular Anesthesia 29 (2015) 1044–1050][J]. Journal of Cardiothoracic and Vascular Anesthesia,2017,31(3).
- [12] Gonçalves Luciana de Brito, de Jesus Natanael Moura Teixeira, Gonçalves Maiara de Brito, et al. Preoperative Nutritional Status and Clinical Complications in the Postoperative Period of Cardiac Surgeries.[J]. Brazilian journal of cardiovascular surgery, 2016,31(5).
- [13] J.M. Sánchez-Migallón Montull, M. Cachero Triadu, M. Martin Giol, et al. MON-PP158: Prevalence of Malnutrition in Patients Admitted to the Care of Cardiology and Cardiac Surgery Departments[J]. Clinical Nutrition,2015,34(S1).
- [14] Detsky A S, McLaughlin J R, Baker J P, et al. What is subjective global assessment of nutritional status?[J]. JPEN J Parenter Enteral Nutr, 1987, 11(1):8- 13.
- [15] Adam S. Evans, Leila Hosseinian, Tricia Mohabir, et al. Nutrition and the Cardiac Surgery Intensive Care Unit Patient—An Update[J]. Journal of Cardiothoracic and Vascular Anesthesia,2015,29(4).
- [16] Kristi L. Fogg, Sinai C. Zybiewski. Nutrition and Growth in Neonates Undergoing Cardiac Surgery[J]. NeoReviews,2015,16(3).
- [17] Irit Chermesh, Jonathan Hajos, Tatiana Mashiach, et al. Malnutrition in cardiac surgery: food for thought[J]. European Journal of Preventive Cardiology,2014,21(4).
- [18] R. Ettema, L. Peelen, A. Koops-Oosterhuis, et al. Malnutrition screening in older patients undergoing cardiac surgery: Both in preoperative patients not having an increased weight and in postoperative overfilled patients[J]. European Geriatric Medicine,2012,3.
- [19] Y. Tanishima, T. Fujita, Y. Suzuki, N. et al. LB027 EFFECTS OF HALF-SOLID NUTRIENTS ON GASTROESOPHAGEAL REFLUX IN BEAGLE DOGS WITH OR WITHOUT CARDIOPLASTY AND INTRATHORACIC CARDIOPEXY[J]. Clinical Nutrition Supplements, 2008,3(S1).
- [20] Z. Z. Nadiradze, Yu. A. Bakhareva, O. V. Nadiradze, et al. Nutritional Support in Children after Cardiosurgical Operations[J]. Obšaa Reanimatologîa, 2010,6(4).
- [21] STRATTON R J, HEBUTERNE X, ELIA M. A Systematic review and meta-analysis of the impact of oral nutritional supplements on hospital readmissions[J]. Ageing Res Rev, 2013, 12(4):884-897.