Am J Transl Res 2023;15(3):2055-2064
www.ajtr.org /ISSN:1943-8141/AJTR0148316

Original Article

Outcome-oriented integrated zero-defect nursing combined with respiratory functional exercise in the perioperative period of patients with heart bypass

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Received December 8, 2022; Accepted February 11, 2023; Epub March 15, 2023; Published March 30, 2023

Abstract: Objective: This study aimed to explore the perioperative application of outcome-oriented integrated zero-defect nursing combined with respirational function exercise in patients undergoing cardiac bypass grafting. Methods: In this retrospective study, the clinical data of 90 patients with bypass surgery in the General Ward of Cardiac Surgery, Beijing Anzhen Hospital Capital Medical University were collected. The patients were assigned into groups A (n=30), B (n=30), and C (n=30) according to different nursing methods. Group A received outcome-oriented integrated zero-defect nursing in combination with respiratory functional exercise administration, group B received outcome-oriented integrated zero-defect nursing, and group C received routine nursing. The postoperative recovery was detected. Left ventricular ejection fraction (LVEF), left ventricular end-diastolic diameter (LVDD), left ventricular end-systolic diameter (LVSD), and interventricular septal thickness (IVST) were assessed among the three groups pre- and post-intervention. The forced expiratory volume in one second (FEV1), forced vital capacity (FVC), arterial partial pressure of oxygen (PaO_2), and arterial partial pressure of carbon dioxide ($PaCO_2$), and blood gas indices were measured before operation and three days after extubation. The occurrence of complications was compared. The quality of life among groups pre- and post-administration was evaluated by the Generic Quality of Life Inventory (GQOLI-74). Results: The length of hospital stay, first exhaust time, first excretion interval, and intestine sound improvement time in groups A and B were markedly decreased compared with those in group C, and these markers in group A were markedly decreased compared with those in group B (all $P<0.05$). After the intervention, the levels of LVEF, LVDD, LVSD, IVST and FVC in group A were more improved compared with those in groups B and C, and the levels of FEV1, PaO_2 and $PaCO_2$ were more improved compared to those in group C (all $P<0.05$). The incidences of hypotension, subcutaneous hyperemia, pericardial tamponade, short-burst ventricular tachycardia, subacute stent thrombosis and pulmonary complications in group A and group B (13.33%, 23.33%) were significantly lower than those in group C (50.00%) (all $P<0.05$). After the intervention, the results of social function, physical, psychological function, and material lifecycle status in group A and B were significantly enhanced compared with those in group C, and the indicators in group A were appreciably better compared with those in group B (all $P<0.05$). Conclusion: Outcome-oriented zero-defect integrated nursing in combination with respirational function exercise can efficiently promote the postoperative revival of patients undergoing heart bypass operation, improve their cardiopulmonary function, diminish the occurrence of complications, and improve their life quality.

Keywords: Nursing outcome-oriented, integrated zero-defect nursing, respirational function exercise, heart bypass surgery

Introduction

Heart bypass is one of the main treatment options for coronary heart disease. It is a surgical option to improve the symptoms of distal myocardial ischemia through vascular bridge transplantation. The main operation is establishing a channel at the proximal and distal ends of the coronary artery. Blood can bypass the stenosis site and reach the distal end of the vessel through this pathway, which can effectively improve the myocardial blood supply and treat illnesses such as coronary heart disease (CHD). The advantage of cardiac bypass surgery is that it can quickly relieve angina and improve heart function. However, the operation is complex and requires a long recovery time, so it is imperative to do an excellent job in

postoperative care [1-3]. Clinical routine nursing is mainly for the physiological aspects of the patient during the operation; the content is single, and it is challenging to carry out targeted physiological and psychological nursing according to the progress of the patient's disorder and possible risks. Outcome-oriented nursing can determine the nursing goals based on the clinical data of patients and meet the nursing needs of patients. In addition to strengthening the physical and psychological nursing of patients, it can also improve the clinical outcomes of patients through the joint intervention of family nursing and rehabilitation therapy. Compared with traditional nursing, it eliminates the unified and blind traditional nursing model, and the "doctor-nurse-patient" trinity nursing model can also refine the nursing duties of nurses and optimize the nursing process. The zero-defect nursing model highlights the general nursing of patients to evade unfavorable postoperative happenings and improve the prognosis of patients [4]. Heart bypass surgery belongs to thoracotomy surgery, which is traumatic. During the operation, the lung lobe can be squeezed, and the hilar and bronchus can be stimulated, leading to postoperative lung injury, thus affecting respiratory function. Without practical respiratory functional training, complications such as atelectasis, respiratory tract infection, and acute respiratory failure can occur, seriously affecting patients' prognosis [5, 6]. Outcome-oriented nursing has been widely used in cancer disease nursing, and the effect is remarkable [7]. Zero-defect nursing has been applied to many kinds of postoperative nursing [8, 9]. Respiratory function training is often used for the postoperative recovery of patients undergoing cardiac surgery. Currently, there is no report that outcome-oriented integrated zero-defect nursing combined with respiratory function training is applied in the postoperative care of cardiac surgery patients. This study aimed to investigate the appliance of outcome-oriented integrated zero-defect nursing in combination with respirational function exercise in patients suffering heart bypass surgery.

Methods

General data

In this retrospective study, the clinical data of 90 patients with bypass surgery in the General Ward of Cardiac Surgery, Beijing Anzhen Hospital Capital Medical University from May 2020 to June 2022 were collected. The patients were divided into group A (n=30), group B (n=30), and group C (n=30) according to different nursing methods. The general information among the three groups was comparable (all P>0.05). This study was approved by the Ethics Committee of Beijing Anzhen Hospital, Capital Medical University.

Inclusion criteria

(1) All patients corresponded to the relevant diagnosis criteria in the Clinical guidelines for diagnosing and treating coronary heart disease [10]; (2) All patients underwent heart bypass surgery; (3) All patients were aged 18-80 years; (4) All patients followed the criteria in the Risk Stratification of Cardiac Rehabilitation for Patients with Coronary Heart Disease (Draft) [11].

Exclusion criteria

(1) Patients with immune system syndromes and infectious diseases; (2) Patients with malignant tumor disorders; (3) Patients with mental illness or terrible cognitive dysfunction; (4) Patients with other organ dysfunction.

Methods

Group A received outcome-oriented integrated zero-defect nursing in combination with respirational function exercise administration; group B received outcome-oriented integrated zero-defect nursing alone; group C received routine nursing alone. The primary observation indicators of this study were postoperative recovery, cardiac function, lung function, and complication rate of the three groups. In comparison, the secondary observation indicator was quality of life.

Group C: First, the methods, indications, and therapeutic purposes of heart bypass surgery were explained to the patients, and the perioperative matters needing attention were told to patients in order to enhance their subjective initiative. Then, patients in group C were given routine nursing during the perioperative period. Patients' vital signs were observed, and effective measures were given to patients with abnormalities. After the operation, functional rehabilitation guidance was given to patients.

Group B: Outcome-oriented integrated zero-defect nursing outcomes include physical, psychosocial, society, family, operative, and noticed health, and healthiness understanding and performance. Finally, these nursing outcomes were summarized into three areas: reduction in the length of hospital stay, improvement of cardiac function, and the life quality of the patients, and these three areas were regarded as the framework of nursing goals in perioperative nursing of patients. (1) Preoperative nursing. After patients were admitted to the hospital, the nurse popularized the knowledge of heart bypass surgery and related surgery knowledge to patients by employing one-on-one teaching and public lectures. The learning focused on explaining successful surgery cases, reassuring patients' concerns, and relieving patients' negative emotions. During communication with patients, nurses were patient in answering patients' questions and evaluating patients' psychological states. Nurses explained the configuration of the operating room and related instruments and equipment to the patients in detail in order to relieve the patients' destructive emotions, they also encouraged and cared for the patients and told the patients about relevant precautions before surgery, and encouraged the patients to take preoperative psychological preparation. (2) Intraoperative nursing. a) Temperature care. The temperature was adjusted to 22-25°C, the humidity to 50%-60%, and the patients were covered with a thermal insulation blanket. Micropump was used to control the amount of liquid input. The liquid and plasma used during the operation were preheated first, and the wound was washed with warm water. b) Body position nursing care. The patient was positioned in the supine frog position with a cotton pillow for the head, and cloth rolls on the shoulder and back, 2 cotton pads under the buttocks, and 2 cotton pads on the heels. c) Drug preparation and cooperation with surgery. Nitroglycerin, atropine, norepinephrine, and lidocaine were prepared in advance, and the nurses cooperated with the doctors during the operation. (3) Postoperative care. a) Drainage management. Nurses mastered the indication of extubation, and extubation was carried out immediately in accordance with the indications. Generally, endotracheal intubation was removed after the operation, and the urinary and thoracic drainage tubes were removed 12-24 h after the operation. b) Diet management. If the patient had no nausea or vomiting 2 h after the operation, 300 ml of carbohydrate drink could be given orally, and fluids could be given 4 h after the operation. c) Early function exercise. Passive limb function training was performed during anesthesia recovery, and active limb function exercise was performed after anesthesia awakening. Foot dorsiflexion, flexion, and circular extension rotation: foot dorsiflexion 400-500, dorsiflexion 200-300, circular ankle rotation; Leg lifting exercise: lifting the leg 30 cm from the bed surface, 15-20 min/time, 4-5 times/day; Off-bed activity: 24 h after operation, nurses helped the patients get out of bed for early ambulation, 20 min/time, 6 times/day.

Group A: Group A accepted respiratory function training according to the nursing of Group B. Patients underwent respiratory function training immediately after tracheal intubation removal, as described below. (1) Deep breathing exercise. The abdomen was raised with inhalation through the nose, and the lips were sealed with slow exhalation after holding the breath. Generally, the inhalation was 2 s, and the exhalation was 4-6 s. The inhaling was held for about 5 s before slowly exhaling. Abdominal breathing deepened gradually as the patient felt comfortable, for a total of 3 rounds. A yawning action was performed 5-10 times per min. (2) Cough training. The patient was bent forward slightly and sitting cross-legged. Lateral decubitus cough: The patient was placed in lateral decubitus position with knees bent. Sitting cough position: The patient sat in a chair or on the edge of the bed with the shoulders bent forward and the head slightly down. A small pillow was placed over the stomach and clamped between the hands. When coughing, inhaling was done first and then the breath was held for 1-3 s, followed by opening the glottis and coughing continuously for 2-3 sounds with abdominal contraction. Irritative cough: The patient took a sitting position or oblique decubitus position. The thumb or index finger was used to exert internal pressure on the trachea at the end of inhaling and slid horizontally to stimulate the trachea and trigger the cough reflex. If the cough was weak, the nurse helped the patient cough by patting the patient's back. (3) Contracted lip breathing. When inhaling, the abdomen and lower chest

Table 1. Comparison of three groups of general data [($\bar{x}$ ± s), cases (%)]

Group	Gender (male/female)	Age (years)	Course of disease (years)
Group A (n=30)	19/11	61.07±6.70	3.67±0.88
Group B (n=30)	22/8	61.53±5.46	3.23±0.90
Group C (n=30)	16/14	58.67±4.80	3.58±0.94
F/χ^2-value	2.584	2.177	3.468
P-value	0.275	0.119	0.036

were relaxed, the lips were closed, and the nose was used to breathe. When inhaling, the abdomen was raised so the diaphragm was lowered to its maximum extent. When exhaling, the lips were drawn back in a whistling "O" shape. The air was exhaled slowly through the constricted mouth, with the abdomen drawn in and heating up, 15 min/time, twice/day. (4) Resistance breathing training. A balloon with a capacity of 800-1000 ml was used. After taking a normal deep breath, the balloon was blown up to exhaust the gas in the lungs, 3-4 times/d. The expiratory resistance was increased to ensure bronchial pressure and prevent bronchi and slight bronchi compression.

Observation targets

(1) Comparison of postoperative recovery among the three groups. (2) Cardiac function. Echocardiography was used to examine the cardiac function of the three groups before and after the intervention. LVEF, LVDD, LVSD and IVST were measured. (3) Lung function. The pulmonary function indicators and blood gas indicators including FEV1, FVC, PaO_2, and $PaCO_2$ were assessed pre-operation and 3 days after extubation. (4) Complication rate. (5) GQOLI-74 [12] was employed to evaluate the life quality pre- and post-intervention. The measurements comprised social function, physical function, mental function, and life status. The more advanced the grade, the better improved life quality.

Statistical methods

SPSS 20.0 was applied for data analysis. Descriptive data were represented as $\bar{x}$ ± s. One-way analysis of variance was performed for contrast among multiple groups, and the SNK-q test was employed for further pairwise comparison, and paired t-test was employed for contrast pre- and post-administration within a group. Enumeration statistics were represented as frequency and proportion and subject to the χ^2 test. P<0.05 denoted statistical significance.

Results

Comparison of general data among three groups

A comparison of general data among the three groups showed no significant differences (all *P*>0.05, **Table 1**).

Comparison of postoperative recovery

The length of hospital stay, first exhaust time, first defecation time, and bowel sound recovery time in groups A and B were reduced compared with those in group C. These indicators in group A were considerably shorter compared with those in group B (all P<0.05, **Table 2**).

Comparison of cardiac function among three groups

No significant differences were seen in the levels of LVEF, LVDD, LVSD, and IVST among the three groups before intervention (all P>0.05). The levels of LVEF in all three groups were elevated post-intervention, and the levels of LVDD, LVSD, and IVST were reduced. The improvement degree of LVEF, LVDD, LVSD, and IVST in group A was more significant than in group B and group C (all P<0.05, **Table 3**).

Comparison of lung function and blood gas analysis indicators among three groups

There were no significant differences in FVC, FEV1, PaO_2 and $PaCO_2$ levels among the three groups before intervention (all P>0.05). The levels of FVC, FEV1, PaO_2 and $PaCO_2$ in the three groups decreased post-intervention. The enhancement level of FVC level in group A

Table 2. Comparison of postoperative recovery of the three groups ($\bar{x} \pm s$)

Group	Length of stay (d)	First exhaust time (h)	First defecation time (h)	Bowel sound recovery time (h)
Group A (n=30)	8.93±1.23[b,c]	38.93±4.83[b,c]	47.67±4.37[b,c]	16.03±2.19[b,c]
Group B (n=30)	11.63±1.85[c]	30.67±3.12[c]	42.90±4.26[c]	18.53±1.63[c]
Group C (n=30)	15.07±2.23	24.07±4.23	37.43±5.51	20.87±2.45
F-value	86.022	97.956	34.904	39.110
P-value	<0.001	<0.001	<0.001	<0.001

Note: Compared with group B, [b]*P*<0.05; Compared with group C, [c]*P*<0.05.

was more significant than that in group B and group C, and the enhancement level of FEV1, PaO_2, and $PaCO_2$ were more significant compared with that in group C (all P<0.05, **Table 4**).

Comparison of complication rates among three groups

The total incidence of hypotension, subcutaneous congestion, cardiac tamponade, short burst ventricular tachycardia, subacute stent thrombosis, and pulmonary complications in group A and group B (13.33%, 23.33%) were lower than that in group C (50.00%) (all P< 0.05, **Table 5**).

Comparison of quality of life among three groups

There was no significant difference in the grades of social function, physical function, psychological function and material life status among the three groups before intervention (all P>0.05). After the intervention, the scores of social function, physical function, psychological function, and material life state of the three groups were all improved. The scores of group A and group B were higher than that of group C, and the score of group A was better than that of group B (all P<0.05, **Table 6**).

Discussion

Nursing outcome-oriented zero-defect integrated nursing summarizes the evaluation indexes of the seven major fields of patients into three categories: shortening the hospital stay, improving the cardiac function of patients, and improving the quality of life of patients, which can effectively prevent blind nursing; moreover, by formulating the zero-defect nursing model in the whole nursing process, the perioperative nursing risk of patients with heart bypass surgery can be effectively avoided, which is conducive to reducing the poor prognosis of patients undergoing heart bypass surgery [13-15]. Nursing outcome theory model has also been applied in various nursing research [16, 17]. This study combined the clinical nursing approaches and nursing outcome theory to construct the perioperative nursing model of patients from admission to discharge. Nursing outcomes guided patients at each stage for the whole process of follow-up nursing. The nursing process was divided into preoperative, intraoperative, and postoperative periods. Clinical nursing was purposefully strengthened and perfected to promote the postoperative recovery of patients undergoing heart bypass surgery. The preoperative respiratory function training was carried out to exercise the respiratory muscles and promote the patient's autonomous control of the respiratory muscles. Deep breathing training and lip contraction breathing can promote alveolar exchange and pulmonary blood circulation, reduce lower lung blood stasis, and cough can promote lung swelling, improve lung oxygen ventilation and facilitate early discharge of respiratory secretions after operation [18-20]. Respiratory failure is a common complication after heart bypass surgery, which may be related to injuries in the sternum, pleura, and other body parts or postoperative drainage tube placement, resulting in weakened respiratory function [21, 22]. Our results revealed that the first exhaust and defecation time, length of hospital stay, and bowel sounds recovery time in group A and group B were significantly shorter than those in group C after the intervention. These indicators in group A were also markedly reduced compared with those in group B, showing that outcome-oriented integrated zero-defect nursing could efficiently promote the postoperative rehabilitation of patients. The reason is that outcome-oriented integrated zero-defect nursing helps patients correctly

Table 3. Comparison of cardiac function among the three groups ($\bar{x} \pm s$)

Group	left ventricular ejection fraction (%)		left ventricular end-diastolic diameter (mm)		left ventricular end systolic diameter (mm)		interventricular septal thickness (mm)	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Group A (n=30)	43.41±2.98	59.69±5.28[a,b,c]	53.21±4.32	44.27±3.42[a,b,c]	38.65±4.28	30.50±3.19[a,b,c]	14.00±1.81	7.36±1.09[a,b,c]
Group B (n=30)	43.33±3.51	54.77±5.07[a,c]	55.33±3.84	48.01±4.60[a]	39.60±4.16	32.82±3.03[a,c]	14.57±2.09	9.54±1.16[a,c]
Group C (n=30)	43.54±5.41	50.95±5.17[a]	54.32±3.65	49.64±3.21[a]	39.64±4.20	35.38±3.21[a]	14.69±1.68	11.72±1.00[a]
F-value	0.020	21.536	2.171	15.815	0.523	18.049	1.165	121.097
P-value	0.981	<0.001	0.120	<0.001	<0.001	<0.001	0.317	<0.001

Note: Compared with before intervention, [a]$P<0.05$; Compared with group B, [b]$P<0.05$; Compared with group C, [c]$P<0.05$.

Table 4. Comparison of lung function and blood gas analysis indicators among the three groups ($\bar{x} \pm s$)

Group	forced vital capacity (%)		forced expiratory volume in one second (L)		arterial partial pressure of oxygen (mmHg)		arterial partial pressure of carbon dioxide (mmHg)	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Group A (n=30)	82.81±6.21	75.59±5.92[a,b,c]	2.16±0.48	1.55±0.37[a,c]	85.47±5.62	78.37±5.28[a,c]	40.02±3.37	39.16±3.62[a,c]
Group B (n=30)	79.81±8.35	70.85±7.03[a]	2.08±0.53	1.45±0.31[a]	82.73±6.08	74.80±5.55[a]	39.44±4.46	41.23±3.92[a]
Group C (n=30)	80.83±6.27	69.94±6.53[a]	2.30±0.60	1.30±0.35[a]	85.44±6.99	73.98±7.38[a]	39.54±3.29	41.97±3.42[a]
F-value	1.419	6.529	1.321	4.153	1.898	4.330	0.204	4.760
P-value	0.247	0.002	0.272	0.019	0.156	0.016	0.816	0.011

Note: Compared with before intervention, [a]$P<0.05$; Compared with group B, [b]$P<0.05$; Compared with group C, [c]$P<0.05$.

Table 5. Comparison of complication rate among the three groups [cases, (%)]

Group	Hypotension	Subcutaneous congestion	Cardiac tamponade	Short burst ventricular tachycardia	Subacute stent thrombosis	pulmonary complication	Total incidence rate
Group A (n=30)	1 (3.33)	1 (3.33)	0 (0.00)	1 (3.33)	0 (0.00)	1 (3.33)	4 (13.33)[c]
Group B (n=30)	1 (3.33)	2 (6.67)	1 (3.33)	0 (0.00)	1 (3.33)	2 (6.67)	7 (23.33)[c]
Group C (n=30)	3 (10.00)	3 (10.00)	1 (3.33)	3 (10.00)	1 (3.33)	4 (13.33)	15 (50.00)
χ^2-value							9.485
P-value							0.009

Note: Compared with group C, [c]*P*<0.05.

Table 6. Comparison of quality of life among the three group ($\overline{x} \pm s$, scores)

Group	Social function		Physical function		Psychological function		Material life state	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Group A (n=30)	46.70±4.73	68.33±4.88[a,b,c]	45.70±6.06	69.77±6.85[a,c]	45.37±5.79	70.93±6.45[a,b,c]	48.33±4.82	71.17±5.43[a,b,c]
Group B (n=30)	46.27±4.51	61.90±4.74[a,c]	46.73±4.73	65.70±7.15[a,c]	45.83±4.97	63.43±6.33[a,c]	47.83±4.86	65.73±6.33[a,c]
Group C (n=30)	46.87±4.65	56.47±4.89[a]	46.77±4.58	60.93±5.66[a]	46.97±5.26	59.23±4.67[a]	47.57±4.60	59.23±8.02[a]
F-value	0.134	45.262	0.413	13.535	0.710	30.577	0.200	23.991
P-value	0.875	<0.001	0.663	<0.001	0.494	<0.001	0.819	<0.001

Note: Compared with before intervention, [a]*P*<0.05; Compared with group B, [b]*P*<0.05; Compared with group C, [c]*P*<0.05.

understand the disease, encourages patients, and alleviates patients' destructive emotions through preoperative nursing for patients. In addition, postoperative diet guidance and early rehabilitation training promote the recovery of patients while consolidating the effect of surgery; thermal insulation nursing reduced the risk of surgery; postoperative diet and early rehabilitation exercise enhanced patients' resistance and promoted their rehabilitation. Respiratory function training in group A also promoted the postoperative recovery of patients.

In the current study, the levels of LVEF in all three groups were augmented after intervention, and LVDD, LVSD and IVST were reduced. The enhancement level of LVEF, LVDD, LVSD, and IVST in group A was superior to that in group B and group C. FVC, FEV1, PaO_2, and $PaCO_2$ levels in the three groups were decreased. The enhancement level of FVC in group A was better than that in group B and group C, and the enhancement levels of FEV1, PaO_2 and $PaCO_2$ in group A were more significant than those in group C. These results suggested that the outcome-oriented integrated zero-defect nursing combined with respirational function exercise might successfully increase patients' heart function and lung function. The nursing outcome-oriented integrated zero-defect nursing used "improving patients' heart function" nursing outcome as the nursing goal, provided preoperative, intraoperative, and postoperative nursing, and helped patients become more psychologically prepared before surgery. Intraoperative temperature management, body position management, drug preparation, and operation cooperation ensured the best surgical effect of patients and avoided nursing defects in the operation process. Postoperative diet and early functional exercise further promoted the improvement of cardiac function. In addition to improving lung function, respiratory function training promoted the improvement of cardiac function. That is why the degree of improvement of heart and lung function in group A was better than that in group B and group C. Gao Liang et al. [23] applied nursing result-oriented integrated zero-defect nursing to emergency care of acute myocardial infarction, which effectively diminished the occurrence of poor prognosis and improved the prognosis of patients. In this study, the progress of cardiac and lung function in group A was enhanced compared with that in group C, and the prognosis was better, with similar results. The total occurrence of complications, including hypotension, subcutaneous congestion, cardiac tamponade, short burst ventricular tachycardia, subacute stent thrombosis, and pulmonary complications were reduced in group A and group B (13.33%, 23.33%) compared with those in group C (50.00%). Both group A and group B received outcome-oriented integrated zero-defect nursing, and the postoperative drainage management, diet management and early functional exercise effectively reduced the occurrence of complications. The contrast of life quality among the three groups showed that, after interference, the results of social function, physical function, psychological function, and material life status were all amplified in the three groups, and those indicators in group A and group B were superior compared with those in group C. Those in groups B were also superior to group C, showing that the nursing outcome-oriented integrated zero-defect nursing combined with respirational function exercise could more efficiently improve patients' life quality. Xu Shaona et al. [24] showed that the outcome oriented integrated zero defect nursing combined with respiratory function training increased the life quality of long-term bedridden patients with stroke. Boswell-Ruys CL et al. [25] demonstrated that respiratory muscle training developed the respiratory function and life quality of patients with tetraplegia. Nursing outcome-oriented nursing and respiratory function training can improve patient's life quality. The results of this study are similar, the reason may be that the postoperative recovery and improvement of heart and lung function in group A were enhanced compared with those in group B and group C, and these indicators in group B were better compared with those in group C as well. The incidence of complications in group A and group B was lower than that in group C, indicating that the improvement of quality of life in group A and group B was higher than that in group C.

The major shortcoming of this study is that it is a retrospective study, also the quantity of included cases could be more considerable, and there might be bias in the selection. A further large-scale, multi-center prospective study

is still needed. The application of results-oriented comprehensive zero-defect nursing combined with respiratory functional exercise in patients undergoing cardiac bypass surgery can effectively promote postoperative rehabilitation, improve cardiopulmonary function, reduce the occurrence of complications, and improve the quality of life of patients. Therefore it has clinical application value.

Disclosure of conflict of interest

None.

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