Journal on Surgery

www.journalonsurgery.org

Research Article

Open Access, Volume 2

Effect of Individualized Cardiac Rehabilitation on Functional Capacity, Quality of Life, Hope and Blood Lipid among Patients after CABG

Hua-qin Guan[1]; Cheng Hang[1]; Ming Zhang[2]; Li-Yan Yuan[2]; RN Yan-Jun Ding[2]*

[1]Nursing Department, The Affiliated Changzhou NO.2 People's Hospital of Nanjing Medical University, Changzhou, Jiangsu Province, China.

[2]Division of Cardiothoracic Surgery, The Affiliated Changzhou NO.2 People's Hospital of Nanjing Medical University, Changzhou, Jiangsu Province, China.

Abstract

Purpose: To investigate the effect of individualized cardiac rehabilitation (CR) on functional capacity, quality of life (QoL), hope and blood lipid in post-CABG patients.

Methods: Two different CR strategy: Basic rehabilitation and Individualized rehabilitation was designed. The patients were screened and randomized into the two groups: Basic rehabilitation group (BRG) and Individualized rehabilitation group (IRG). Then, the data, such as clinical characteristics, LVEF, 6WMD, Miller Hope Scale (MHS) score, MLwHFQ score and blood lipid were collected, recorded and compared.

Results: There's no difference between IRG and BRG patients in the clinical characteristics. The 6MWD and LVEF on post-op were significantly higher in IRG than in BRG. The MHS score was significantly higher in IRG than in BRG on post-op day 10, while not on day 60. In post-op day 10 and 60, the MLwHFQ score of IRG was significantly lower than BRG. The TC, TG, HDL and LDL levels in IRG were significant different from BRG on post-op day 60 while not on day 10.

Conclusion: Individualized CR can improve the functional capacity, hope and QoL of patients after CABG surgery. Individualized CR can reduce TC, TG and LDL levels and increase HDL level of patients after CABG surgery in late stage of post-op.

Manuscript Information: *Received: Jul 23, 2022; Accepted: Aug 12, 2022; Published: Aug 19, 2022*

Correspondance: *RN Yan-jun Ding, Division of Cardiothoracic Surgery, The Affiliated Changzhou NO.2 People's Hospital of Nanjing Medical University, 29 Xinglong Lane, Changzhou 213003, Jiangsu Province, China. Email: czeydyj@outlook.com*

Citation: *Hua-qin G, Hang C, Zhang M, Li-Yan Y, Yan-Jun DJ. Effect of Individualized Cardiac Rehabilitation on Functional Capacity, Quality of Life, Hope and Blood Lipid Among Patients after CABG. J Surgery. 2022; 2(2): 1043.*

Introduction

CHD (Coronary atherosclerotic heart disease) is a kind of heart disease caused by coronary artery functional pathological changes or organic pathologic changes, which leads to myocardial ischemia, hypoxia or necrosis [1]. It is reported that the morbidity and mortality of CHD in China has continued to rise [2]. The ESC guidelines shown that the high morbidity and mortality of CHD brings serious burden to the society [3]. CABG (coronary artery bypass grafting) is a surgical revascularization operation that uses blood vessels (arteries or veins) taken from another part of the patient's body to bypass narrow or obstructed coronary arteries. CABG which can improve myocardial ischemia and hypoxia, is an important treatment method for patients with CHD [4]. After CABG, many patients were noted to have complications, such as pain, atelectasis, delirium, anxiety and depression, which may cause physical and psychological trauma, affect postoperative rehabilitation and cause an economic burden to the family and society [5,6]. Therefore, cardiac rehabilitation (CR) received more and more attention.

CR is a comprehensive method that involves multiple therapies, including exercise training, psychological support, risk factor education and reduction, and behavior changes [7]. CR aims to improve health and outcomes after CABG. Exercise training is the core part of CR [8,9]. CR based on systematic evaluation is a safe intervention [7]. Despite CR is recommended and Beneficial, it has not been widely accepted and applied [10]. In recent years, some studies on CR after CABG have been reported, but there are still some deficiencies in these studies, such as single exercise form, lack of individualized exercise program, ect [11,12]. In present study, we aimed to investigate the effect of individualized CR on functional capacity, quality of life (QoL), hope and blood lipid in post-CABG patients.

Methods

Patients

The patients participate in the study were diagnosed with CHD and scheduled for CABG in The affiliated Changzhou NO.2 People's Hospital of Nanjing Medical University between January 2018 and June 2021. All patients were screened based on established criteria. **The inclusion criteria:** 1. 18-70 years old; 2. Cardiac function classification (NYHA): I-III; 3. No myocardial infarction occurred within 1 week; 4. No serious dysfunction of important organs such as lung, liver and kidney; 5. Sound limb function; 6. Voluntary participation. **The exclusion criteria:** 1. Also has other cardiac disease which need to operation, such as valve lesions, macroangiopathy, ventricular aneurysm, etc; 2. Emergency CABG or re-operation; 3. Unstable angina pectoris; 4. The patient is unable or unwilling to cooperate.

A total of 80 patients were included in the study and randomly divided into two groups: Basic rehabilitation group (BRG) and Individualized rehabilitation group (IRG). The patients in different groups were placed in different wards. This study was reviewed and approved by the Research Ethics Committee of The affiliated Changzhou No.2 People's Hospital of Nanjing Medical University. Written informed consents were obtained before the patients were enrolled in the study.

CR strategy

Patients in BRG: 1. Routine health education, such as admission education, diet guidance, preoperative education, postoperative education, discharge education. 2. Routine rehabilitation guidance: In preoperative stage, the patients were instructed with breathing exercise using abdominal respiration and half-closed lip respiration; In postoperative stage, the patients were instructed with limb flexion and extension exercise, ankle pump exercise and out-of-bed activity (after ECG monitoring was stopped).

Patients in IRG: In addition to CR strategy in BRG, patients in IRG received an individualized CR strategy which based on aerobic exercise and resistance exercise. In postoperative stage, the individualized CR strategy was divided into two parts, the intensive care unit (ICU) part and general ward part (Table 1). Before and during exercise, the specialist nurse will dynamically evaluate the patients and determine the CR plan of the patients according to the evaluation results (Table 1). Rating of Perceived Exertion (RPE) was used to assess the patient's level of exertion [13].

Table 1: The cardiac rehabilitation strategy of patients in individualized rehabilitation group.

		Evaluation before exercise (Start exercising only when meet all the following conditions)	**Exercise methods and frequency**	**Evaluation during exercise** (Exercising is inappropriate if any of the following conditions are not meet)	**Adjust exercise** (Methods and frequency)
Pre-extubation of the endotracheal tube	**Awake period**	☐Patient cooperation ☐Dry wound dressing ☐The tube is well fixed ☐MAP 65-110 mmHg ☐HR 50-130 bpm ☐RR 12-30 bpm ☐SpO_2 >90% ☐BG <18 mmol/L ☐Pain score <4 points ☐Limb muscle strength ≥3grade ☐No ventilator resistance ☐No Malignant arrhythmia	**Aerobic exercise:** Static flexion and extension of elbows and wrists; Ankle dorsiflexion 40°-50°, hold >3s; Ankle plantar flexion 20°-30°, hold >3s; Ankle inversion and eversion. Per time: 15-20 sets*1rep; Per day: 2-3times. **Resistance exercise:** Straight Leg Raise, at least 30cm above the bed, hold >3s. Per time: 15-20 sets*1rep; Per day: 2-3 times.	☐SBP <180 mmHg, DBP <110 mmHg ☐Increased HR ≤20 bpm ☐RR 12-40 bpm ☐SpO_2 >88% ☐RPE ≤13 points ☐Pain score <6 points ☐No ventilator resistance ☐No adverse event ☐Patient cooperation	☐**Inappropriate:** Decrease 5-10 sets next time. ☐**Appropriate:** Increase 5 sets next time.

Post-extubation of the endotracheal tube	Day 1	☐Patient cooperation ☐Dry wound dressing ☐The tube is well fixed ☐MAP 65-110mmHg ☐HR 50-130bpm ☐RR 12-30npm ☐SpO_2 >90% ☐BG <18 mmol/L ☐Pain score <4 points ☐Limb muscle strength ≥3grade ☐No Malignant arrhythmia	**Self-care activity:** Take food; wipe face, wash hands and use bedpan in bed. **Breath training:** Exercise with a breath trainer. Per time: 5-10 min; Per day: 2 times. **Aerobic exercise:** Sit beside the bed with the help of the nurse. Per time: 5-10 min; Per day: 2 times. **Resistance exercise:** Passive and active treadmill exercise in bed. Per time: 5-10 min; Per day: 2 times.	☐SBP <180mmHg, DBP <110mmHg ☐Increased HR ≤20bpm ☐RR 12-40bpm ☐SpO_2 >88% ☐RPE ≤13points ☐Pain score <6points ☐No adverse event ☐Patient cooperation	☐**Inappropriate:** Decrease 5 min next time; Decrease 5 min per time or 1 time next day. ☐**Appropriate:** Increase 5 min next time; Increase 5 min per time or 1 times next day.
	Day 2	☐Patient cooperation ☐Dry wound dressing ☐The tube is well fixed ☐MAP 65-110 mmHg ☐HR 50-130 bpm ☐RR 12-30 npm ☐SpO_2 >90% ☐BG <18 mmol/L ☐Pain score <4 points ☐Limb muscle strength ≥4grade ☐ No Malignant arrhythmia	**Self-care activity:** Take food; scrub body and clean up in bed. **Breath training:** Exercise with a breath trainer. Per time: 10-15 min; Per day: 2 times. **Aerobic exercise:** Sit up on your own; stand, mark time and try to walk beside the bed with the help of nurse. Per time: 10-15 min; Per day: 2 times. **Resistance exercise:** passive and active treadmill exercise in bed. Per time: 10-15 min; Per day: 2 times.		☐**Inappropriate:** Decrease 5-10 min next time; Decrease 5-10 min per time or 1 time next day. ☐**Appropriate:** Increase 5-10 min next time; Increase 5-10 min per time or 1-2 times next day.
	Day 3		**Self-care activity:** take food; Sit up; get out of bed and wash. **Breath training:** Exercise with a breath trainer. Per time: 10-15min; Per day: 2-3 times. **Aerobic exercise:** Warm-up; walk in ward with the help of nurse; relaxation exercise. Per time: 15-20 min; Per day: 2 times. **Resistance exercise:** Active treadmill exercise in bed. Per time: 15-20 min; Per day: 2 times.		
	Day 4	☐Patient cooperation ☐Dry wound dressing ☐The tube is well fixed ☐MAP 65-110mmHg ☐HR 50-130bpm ☐RR 12-30npm ☐SpO_2 >90% ☐BG <18mmol/L ☐Pain score <4 points ☐Limb muscle strength ≥5grade ☐No Malignant arrhythmia	**Self-care activity:** **T**ake food; get out of bed and wash; go to the toilet. **Breath training:** Exercise with a breath trainer. Per time: 10-15 min; Per day: 2-3 times. **Aerobic exercise:** Warm-up; walk in ward; relaxation exercise. Per time: 20-30 min; Per day: 2-3 times. **Resistance exercise:** Active treadmill exercise in bed. Per time: 15-30 min; Per day: 2-3 times.		
	Day 5		**Self-care activity:** Daily self-care activities. **Breath training:** Exercise with a breath trainer. Per time: 10-15 min; Per day: 3 times. **Aerobic exercise:** Warm-up; walk in ward; up and down stairs once (1/2 floor); relaxation exercise. Per time: 30-40 min; Per day: 2-3 times. **Resistance exercise:** Active treadmill exercise in bed. Per time: 20-30 min; Per day: 2-3 times.		
	Day 6		**Self-care activity:** Daily self-care activities. **Aerobic exercise:** Warm-up; walk in ward; up and down stairs once (1 floor); relaxation exercise. Per time: 30-40 min; Per day: 3-4 times.		

MAP: Mean Arterial Pressure; HR: Hart Rate; RR: Respiratory Rate; BG: Blood Glucose; SBP: Systolic Pressure; DBP: Diastolic Pressure; RPE: Rating Of Perceived Exertion.

Data collection

The data were collected and recorded in pre-operation (pre-op) and post-operation (10th and 60th day) (post-op). The data include the following contents: 1. The clinical characteristics of the patients, such as sex, age, NYHA classification, diabetes, hypertension, smoking and so on. 2. Left ventricular ejection fraction (LVEF), total cholesterol (TC) levels, triglyceride (TG) levels, high density lipoprotein (HDL) levels and low density lipoprotein (LDL) levels. 3. The MLwHFQ (Minnesota Living with Heart Failure Questionnaire) was used to evaluate the QoL. 4. The 6-min walk test (6MWT) was used to evaluate the patients' ability to carry out activities of daily living [14]. The test was carried out as recommended in the American Thoracic Society guidelines [15] and the 6-min walk distance (6WMD) was recorded. 5. The Miller Hope Scale (MHS) was used to measure hope in adults. The MHS score ranging from 48-240, and higher scores indicate a higher level of hope [16].

Data analysis

Dates were presented as means ± standard deviation. Chi square test and Student's t-test were used to compare the data. SPSS 23.0 software (IBM, NY, USA) was used to process the data and GraphPad Prism 6.02 (GraphPad Software, CA, USA) was used to draw the graphs. $P < 0.05$ was considered statistically significant.

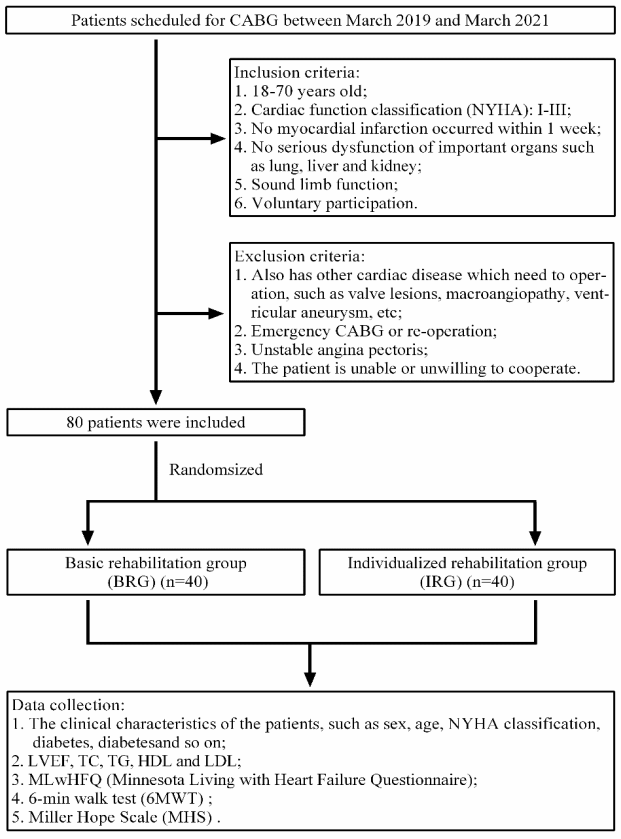

Figure 1: The study flow.

Results

The patients' clinical characteristics

The clinical characteristics of the patients were listed in (Table 2). The overwhelming majority of the patients are male. Almost one half of patients suffering from diabetes, while 78.8% suffering from hypertension. Patients who underwent off-pump CABG account for 90%. There's no difference between IRG and BRG patients in the following clinical characteristics: Sex, Age, NYHA classification, BMI, diabetes, hypertension, smoking, on-pump or off-pump CABG, number of bypass grafts (all P>0.05).

Table 2: Clinical characteristics of the patients in IRG and BRG.

Clinical characteristics	IRG	BRG	P value
Age	60.53±9.88	63.35±8.33	0.171
Sex			0.576
Male	31	33	
Female	9	7	
NYHA classification	2.25 ± 0.44	2.30 ± 0.46	0.622
BMI	25.70 ± 2.76	24.65 ± 2.72	0.092
Diabetes			0.502
With	18	21	
Without	22	19	
Hypertension			0.412
With	33	30	
Without	7	10	
Smoking			0.820
Yes	16	17	
No	24	23	
CABG			0.456
On-pump	3	5	
Off-pump	37	35	
Number of bypass grafts	3.08±0.99	2.90±0.78	0.384

6MWD and LVEF

The 6MWD of IRG was similar with BRG in pre-op (P>0.05) (Figure 2a). The 6MWD on post-op day 10 was significantly higher in IRG, remaining higher on post-op day 60, when comparing with BRG (all P<0.05) (Figure 2a). Comparing with pre-op, the 6WMD was significantly higher in IRG on post-op day 10 and 60, while BRG only on post-op day 60 (all P<0.05) (Figure 2a).

In pre-op, the LVEF was almost the same in the two group (P>0.05) (Figure 2b). The LVEF of IRG was significantly higher than BRG in post-op (P<0.05) (Figure 2b). Similarly, comparing with pre-op, LVEF of IRG in post-op was significantly improved (P<0.05), while BRG was not (P>0.05) (Figure 2b).

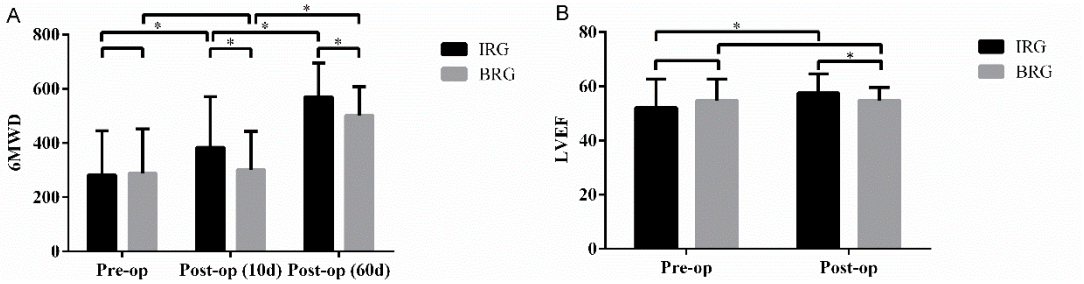

Figure 2: The 6WMD and LVEF of the patients.
a) The 6MWD on post-op day 10 was significantly higher in IRG, remaining higher on post-op day 60.
b) The LVEF of IRG was significantly higher than BRG in post-op.

MHS and MLwHFQ

The MHS score was significantly higher in IRG than in BRG on post-op day 10 (P<0.05), while no significant difference in pre-op or on post-op day 60 (all P>0.05) (Figure 3a). Comparing with pre-op, the MHS score of IRG was significantly improved both on post-op day 10 and 60, while BRG was only on post day 60 (all P<0.05) (Figure 3a). There was no significant difference in MLwHFQ score between IRG and BRG in pre-op (P>0.05) (Figure 3b). In post-op day 10 and 60, the MLwHFQ score of IRG was significantly lower than BRG (all P<0.05) (Figure 3b). The MLwHFQ scores of IRG on post-op day 10 and 60 were significantly lower than pre-op as well as BRG (all P<0.05) (Figure 3b).

Blood lipid

As shown in (Figure 4), the TC, TG, HDL and LDL levels were similar in IRG and BRG in pre-op (all P>0.05). The TC, TG, HDL and LDL levels in IRG were significant different from BRG on post-op day 60 (all P<0.05) while not on day 10 (all P>0.05) (Figure 4). Comparing with pre-op, the TC, TG and LDL levels of both IRG and BRG were significantly lower while HDL levels were significant higher in post-op day 60 (all P<0.05), but not in post-op day 10 (all P>0.05) (Figure 4).

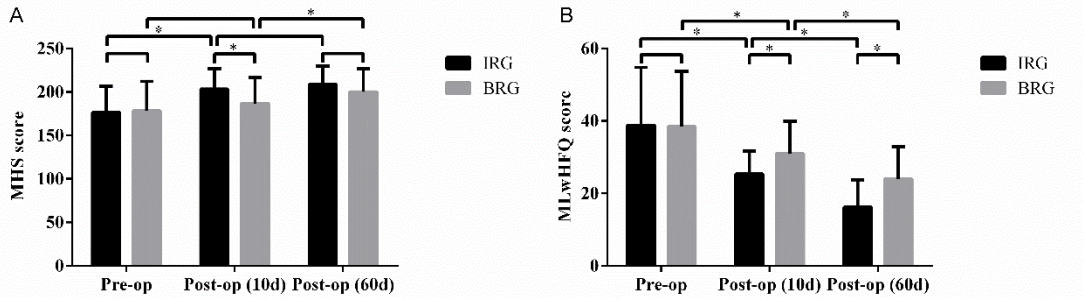

Figure 3: The MHS and MLwHFQ score of the patients.
a) The MHS score was significantly higher in IRG than in BRG on post-op day 10, but not on day 60.
b) In post-op day 10 and 60, the MLwHFQ score of IRG was significantly lower than BRG.

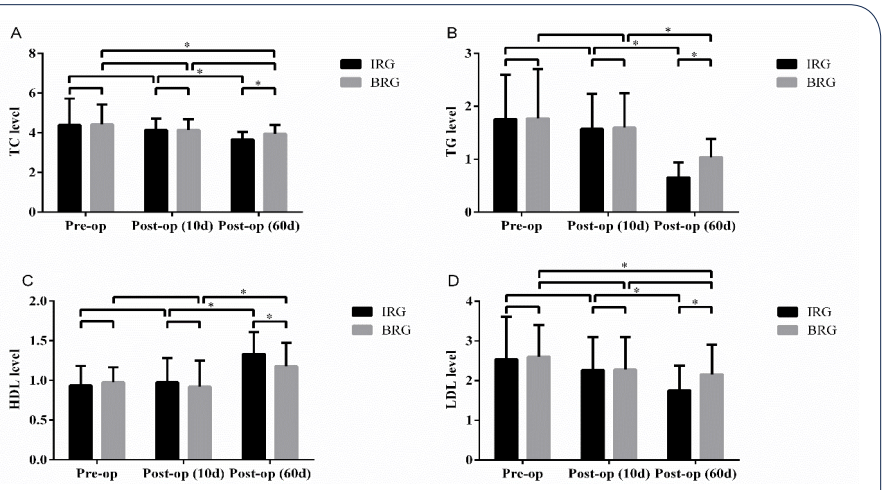

Figure 4: The blood lipid of the patients.
The TC (a), TG (b), HDL (c) and LDL (d) levels in IRG were significant different from BRG on post-op day 60 while not on day 10.

Discussion

CHD seriously endangers human health and quality of life. CABG is the only way for a lot of patients with CHD. In China, the annual number of CABG operations in China was almost 40000 [17,18]. CR is safe and recommended for patients undergoing CABG [7]. In present study, detailed exercise and evaluation rules were formulated, then the patients in IRG were evaluated and assigned different intensity exercise.

It is reported that respiratory exercises can improve patients' functional capacity which is measured by 6MWD at discharge but not at 30d post-discharge [19]. In our study, both on post-op day 10 and 60, the 6WMD of IRG is significantly higher than BRG. This is similar with the result Zanini et al. reported [20]. In our and Zanini et al. studies, the groups were homogeneous in terms of clinical characteristics, such as type of surgery, BMI and so on, which were reported be determinants of 6MWD at hospital discharge [21]. Also, we found that the difference of 6WMD on post-op day 60 was smaller than day 10. Therefore, we think that CR can improve patients' functional capacity, but mainly in the early post-op. This conclusion was further verified by comparing the LVEF of the two groups.

Sharif er al. stated that CR can decrease the depression and was associated with the patients' hope level [22]. Rakhshan et al. proposed that the hope of the patients after CABG surgery was increased in CR group, but did not in control group [23]. In our study, we found that compared with pre-op, the MHS score of IRG was significantly increased in both post-op day 10 and 60, while the score of BRG was only in post-op day 60, and the score of IRG was significantly higher than BRG in post-op day 10. This is different from Rakhshan et al. research results, we think that it's due to the routine rehabilitation guidance which was given to patients in BRG. Regarding QoL, the MLwHFQ scores of both IRG and BRG decreased significantly on post-op, and the decrease in IRG was more significant. This showed that CR could improve the QoL of the patients undergoing CABG. The viewpoint was supported by Adamopoulos et al. and Hermes et al. [24,25].

It is reported that CR is correlated with an insignificant increase in HDL serum level and a significant decrease in LDL, TC, and TG serum levels in patients with cardiovascular disease [26]. In present study, we found the similar results. It showed that the TC, TG and LDL levels were significantly decreased and HDL level was significantly increased on post-op day 60 in both IRG and BRG, especially in IRG. On post-op day 10, the TC, TG, LDL and HDL levels showed no difference between the two group. This study indicated that CR significantly reduced TC, TG and LDL levels and increased HDL level in patients undergoing CABG but not in a short time.

Conclusion

In conclusion, individualized CR can improve the functional capacity, hope and QoL of patients after CABG surgery. And, individualized CR can reduce TC, TG and LDL levels and increase HDL level of patients after CABG surgery in late stage of post-op. We hope that this study can provide some references for the formulation of individualized CR strategy and promote the wide application of CR.

Declarations

Conflicting interests: The authors declare no conflicts of interest.

Acknowledgements: This research was supported by Science and Technology Projects for Young Scientists of Changzhou Health Commission (QN201934).

Financial support: Science and Technology Projects for Young Scientists of Changzhou Health Commission (QN201934).

References

1. Maruo S, Mori K, Motoyama K, et al. Correlation analysis of monocyte subsets and insulin resistance considering fetuin-A involvement in patients with type 2 diabetes. Clin Transl Med. 2018; 7: 9.
2. China T W C O T R O C H a D I. Key points of Report on Cardiovascular Health and Diseases in China 2020. Chinese Journal of Cardiovascular Research, 2021; 19: 582-90.
3. Task Force M, Montalescot G, Sechtem U, et al. 2013 ESC guidelines on the management of stable coronary artery disease: the Task Force on the management of stable coronary artery disease of the European Society of Cardiology. Eur Heart J, 2013; 34: 2949-3003.
4. Abu Daya H, Hage F G. Guidelines in review: ACC/AATS/AHA/ASE/ASNC/SCAI/SCCT/STS 2017 appropriate use criteria for coronary revascularization in patients with stable ischemic heart disease. J Nucl Cardiol. 2017; 24: 1793-9.
5. Huang Y, Zhang R, Culler S D, et al. Costs and effectiveness of cardiac rehabilitation for dialysis patients following coronary bypass. Kidney Int, 2008; 74: 1079-84.
6. Simon M, Korn K, Cho L, et al. Cardiac rehabilitation: A class 1 recommendation. Cleve Clin J Med, 2018; 85: 551-8.
7. Dibben G, Faulkner J, Oldridge N, et al. Exercise-based cardiac rehabilitation for coronary heart disease. Cochrane Database Syst Rev. 2021; 11(CD001800).
8. Rauch B, Davos C H, Doherty P, et al. The prognostic effect of cardiac rehabilitation in the era of acute revascularisation and statin therapy: A systematic review and meta-analysis of randomized and non-randomized studies - The Cardiac Rehabilitation Outcome Study (CROS). Eur J Prev Cardiol, 2016; 23: 1914-39.
9. Stefanakis M, Batalik L, Papathanasiou J, et al. Exercise-based cardiac rehabilitation programs in the era of COVID-19: a critical review. Rev Cardiovasc Med, 2021; 22: 1143-55.
10. Kotseva K, Wood D, De Bacquer D, et al. Determinants of participation and risk factor control according to attendance in cardiac rehabilitation programmes in coronary patients in Europe: EUROASPIRE IV survey. Eur J Prev Cardiol, 2018; 25: 1242-51.
11. Rengo J L, Savage P D, Hirashima F, et al. Improvement in Physical Function After Coronary Artery Bypass Graft Surgery Using a Novel Rehabilitation Intervention: A RANDOMIZED CONTROLLED TRIAL. J Cardiopulm Rehabil Prev, 2021; 41: 413-8.
12. Reer M, Rauschenberg S, Hottenrott K, et al. Comparison between bicycle ergometric interval and continuous training in patients early after coronary artery bypass grafting: A prospective, randomized study. SAGE Open Med. 2021; 9(20503121211038202).
13. Borg G. Ratings of perceived exertion and heart rates during short-

term cycle exercise and their use in a new cycling strength test. Int J Sports Med, 1982; 3: 153-8.

14. Fiorina C, Vizzardi E, Lorusso R, et al. The 6-min walking test early after cardiac surgery. Reference values and the effects of rehabilitation programme. Eur J Cardiothorac Surg, 2007; 32(5): 724-9.

15. Argyropoulos G, Harper M E. Uncoupling proteins and thermoregulation. J Appl Physiol (1985), 2002; 92: 2187-98.

16. Miller J F, Powers M J. Development of an instrument to measure hope. Nurs Res, 1988; 37(1): 6-10.

17. Circulation C S O E. White book of Chinese cardiovascular surgery and extracorporeal circulation in 2020. Chinese Journal of Extracorporeal Circulation, 2021; 19: 257-60.

18. Improvement N C F C Q. 2021 Medical Quality Report of Cardiovascular Diseases in China: an Executive Summary. Chinese Circulation Journal, 2021; 36: 1041-64.

19. Hirschhorn A D, Richards D, Mungovan S F, et al. Supervised moderate intensity exercise improves distance walked at hospital discharge following coronary artery bypass graft surgery--a randomised controlled trial. Heart Lung Circ, 2008; 17: 129-38.

20. Zanini M, Nery R M, De Lima J B, et al. Effects of Different Rehabilitation Protocols in Inpatient Cardiac Rehabilitation After Coronary Artery Bypass Graft Surgery: A RANDOMIZED CLINICAL TRIAL. J Cardiopulm Rehabil Prev, 2019; 39: E19-E25.

21. Oliveira G U, Oliveira Carvalho V, De Assis Cacau L P, et al. Determinants of distance walked during the six-minute walk test in patients undergoing cardiac surgery at hospital discharge. J Cardiothorac Surg, 2014; 9.

22. Sharif F, Shoul A, Janati M, et al. The effect of cardiac rehabilitation on anxiety and depression in patients undergoing cardiac bypass graft surgery in Iran. BMC Cardiovasc Disord. 2012; 12.

23. Rakhshan M, Toufigh A, Dehghani-Firouzabadi A, et al. Effect of Cardiac Rehabilitation on Hope Among Cardiac Patients After Coronary Artery Bypass Graft Surgery. Risk Manag Healthc Policy. 2020; 13(1319-26.

24. Adamopoulos S, Schmid J P, Dendale P, et al. Combined aerobic/inspiratory muscle training vs. aerobic training in patients with chronic heart failure: The Vent-HeFT trial: a European prospective multicentre randomized trial. Eur J Heart Fail. 2014; 16: 574-82.

25. Hermes B M, Cardoso D M, Gomes T J, et al. Short-term inspiratory muscle training potentiates the benefits of aerobic and resistance training in patients undergoing CABG in phase II cardiac rehabilitation program. Rev Bras Cir Cardiovasc. 2015; 30: 474-81.

26. Javaherian M, Dabbaghipour N, Mohammadpour Z, et al. The role of the characteristics of exercise-based cardiac rehabilitation program in the improvement of lipid profile level: A systematic review and meta-analysis. ARYA Atheroscler. 2020; 16: 192-207.