LITERATURE REVIEW

Rehabilitation Assessment and Intervention to Facilitate Return to Work in Coronary Artery Disease Patients: A Narrative Review

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ABSTRACT

Introduction: Coronary artery disease (CAD), causes significant changes in a person's life and is often accompanied by complex emotional reactions which further cause a decrease in the ability to complete work responsibilities, lower wages, and increase the risk of early dismissal. Promoting a return to work (RTW) program after CAD will improve economic burdens and the quality of life. This review aimed to explore the RTW program in CAD patients focused on the impact of CAD on the patients' ability to back to their previous work and rehabilitation management to fulfill RTW criteria.

Methods: Articles published in the last 10 years based on PubMed and Google Scholar databases were reviewed narratively. Keywords used were "coronary artery disease", "ischemic heart disease", "cardiovascular disease", "cardiac rehabilitation", "return to work", and "return to vocational activity".

Results: The impact of CAD on RTW includes a decrease in the ability to RTW and work performance as well as an increase in the risk of premature dismissal. Factors that influence the RTW ability in CAD patients are sociodemographic, psychosocial, cardiovascular risk, medical history, complications during hospitalization, and clinical characteristics. Efforts to facilitate this process involve a wide range of assessments and interventions. The RTW ability can be determined through objective assessment of cardiac function, including exercise capacity and left ventricular ejection fraction, the presence or absence of comorbidities, job satisfaction, and other assessments of general well-being. Interventions aimed at promoting RTW consist of an initial CR (phase II CR) and an extended CR program.

Conclusion: The rehabilitation assessments and interventions given to patients with CAD have shown good results for RTW rates and the quality of work.

Keywords: Anxiety, Cardiovascular Diseases, Coronary Artery Disease, Depression, Quality of Life

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INTRODUCTION

Cardiovascular disease (CVD), including coronary artery disease (CAD), is the main cause of death accounting for 31% of mortality worldwide.[1] Death caused by CAD is estimated at 16% of the total world deaths or approximately 9 million people.[2] Furthermore, the worldwide prevalence is about 1.72% or 126 million people.[3] A recent study stated that the prevalence of CAD increased with working age, specifically in men.[4]

Coronary artery disease can cause changes in a person's life and is often accompanied by complex emotional reactions including fear, anxiety, and depression that can hinder recovery of function, including the ability to work. This causes a decrease in the ability to complete work responsibilities, reduces wages, and increases the risk of early dismissal.[5-7]

Research evidence shows that the majority of CAD patients can return to their previous jobs, but there is a decline in work performance.[8, 9] The non-return of CAD patients to their original work causes an increase in economic and social burdens.[10] The percentage of CAD patients who return to work (RTW) after 2 months varies, ranging from 67% to 93% and the average time for patients to RTW is 2-3 months after CAD.[11-13] The RTW rate is mainly influenced by psychological factors, such as anxiety and depression related to worries about not being able to do the job well or anxiety about the emergence or worsening of work-related illnesses.[14]

The RTW program is given to CAD patients after a heart attack or procedure. This program is not only beneficial for patients but also for the community because the RTW program will improve the patient's economy which is a building block of the community's economy. Returning to work can also improve the quality of life, for both patients and families.[13] This review aimed to explore the RTW program in CAD patients. The sub-topics include the impact of CAD on the RTW ability and rehabilitation assessment and interventions on meeting RTW criteria.

METHODS

Articles published in the last 10 years based on PubMed and Google Scholar databases were reviewed narratively. Keywords used were "coronary artery disease", "ischemic heart disease", "cardiovascular disease", "cardiac rehabilitation", "return to work", and "return to vocational activity". Articles which were not available in English and full text were excluded.

RESULTS

Twenty-three articles from journals, books, and online databases were reviewed narratively.

DISCUSSION

Impact of CAD on RTW Ability

Several previous studies have consistently shown that CAD affects RTW rates.[15-17] Dreyer et al. found that 86% of patients returned to work within 12 months of CAD, with a slightly lower rate in females than in males. About 6% of women and 3% of men chose not to return to work, 32% of women and 33% of men were fired from their jobs, while the rest were unable to RTW.[15] Jiang et al. found that CAD patients who returned to work within 12 months after illness reached 875 people out of 1566 (55.9%). A total of 287 people (41.5%) out of 691 people decided not to return to work due to their illness, 131 people (19%) opted for early retirement, 44 people (6.4%) were fired from their jobs, and 229 people (33.1%) had no specific reasons.[16]

Factors affecting RTW ability in CAD patients include socio-demographics, annual income, history of CVD and its risk factors, as well as clinical characteristics and complications during hospitalization. Sociodemographic factors comprise age, gender, marital status, and education. Elderly patients, specifically married women tend to have lower RTW rates, with some choosing to become full housewives compared to young people. Patients with higher education levels tend to have higher RTW rates. This disparity can be attributed to diminished motivation among the elderly, specifically married women. Female and elderly workers also have lower health status, higher incidence of depression, and lower social support than men and young people. Even if female workers return to work, most will leave because they have lower job security, job control, unfavorable employment contracts, and awareness of physical and mental health than men. Old age is associated with a high risk of cardiovascular events such as CAD recurrence, CVD-related death, and stroke, making it an obstacle to return to work, specifically for jobs requiring strenuous physical activity.[15-17]

Patients with sufficient and low annual income are more likely to return to work compared to those with a good income. According to Jiang et al., among 228 patients in China who had income above 70,000 USD per year, 157 returned to work and 71 did not. Meanwhile, among 524 patients who earned less than 30,000 USD per year, 249 returned to their work and 269 did not. This discrepancy can be attributed to the long working hours and increased overtime work, which are common among young workers and men in China. These factors contributed to the reduced motivation to work in the elderly and women.[16, 17]

Complications during hospitalization and comorbid diseases also affect the RTW rate in CAD patients. The presence of multiple comorbid diseases is associated with lower rates. Several associated comorbid diseases include diabetes, heart failure, hypertension, stroke, kidney disorders, recurrent angina, depression, and anxiety. Comorbid diseases cause serious injury associated with poor clinical conditions and healing processes, a higher risk of mortality, and hospital readmission. Furthermore, depression and anxiety are frequent comorbidities and correlate with the worst prognosis. Patients

with these conditions rarely back to work even 3 months after the acute coronary syndrome (ACS) event. These disorders increase the risk of complications, side effects, and the incidence of mortality in post-ACS patients. Depression in patients who return to work worsens outcomes, as depression and anxiety after ACS are rarely detected or treated properly. Therefore, social support is needed to reduce the risk of angina development, improve physical and mental health, as well as enhance the quality of life.[15, 17]

Effects of CR on RTW Ability in CAD Patients

Return to work is one of the important targets in CAD management because physical and mental health can be improved by working.[18] Medical treatment and therapy showed good results, where most CAD patients with ACS had minimal heart damage and short hospital stays without major complications. These patients can go back to work after undergoing CR, but some had certain problems in the process.[19]

CR plays an important role in reducing long-term mortality in CVD, increasing functional capacity, and contributing to overall psychological status.[16] Patients who undergo CR tend to RTW faster, and not only perform light duties but also regular activities.[19] Despite achieving a faster RTW, data showed that a quarter of workers left their jobs 1 year after ACS. Therefore, long-term support should be considered in post-ACS patients with a focus on implementing continuous CR programs to increase not only RTW rates but also maintain sustainable work performance.[18]

Rehabilitation Assessment to Facilitate RTW

The rehabilitation assessment includes several interventions related to the factors that affect the RTW rate (Figure 1).[20]

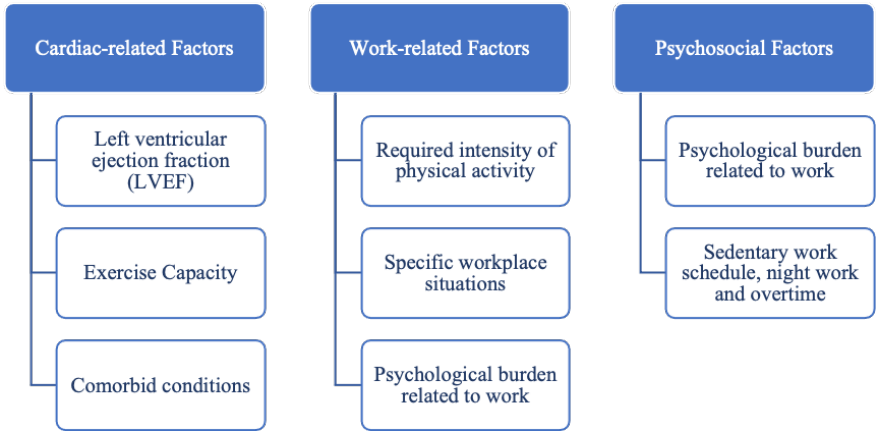

Figure 1. Factors Affecting the Return to Work Rates

Assessment of cardiac function involves various diagnostic tests such as echocardiography, electrocardiography, exercise tests, and other investigations. These tests help to identify comorbid diseases including chronic obstructive pulmonary disease, diabetes mellitus, hypertension, kidney failure, stroke, and peripheral arterial disease. The assessment of heart-related factors is essential in predicting the success of the RTW program by objectively searching for comorbidities.[18]

To determine the possible capacity for sustainable RTW performance, it is necessary to assess work-related factors. Some patients who return to work quit due to the high-intensity tasks, specifically physical work that requires energy. Pressure and psychological burden at work also contributed to discontinuation. Therefore, it is important to consider these factors during assessment.[21] The assessment of work-related factors can be conducted by evaluating the characteristics of job performance such as 1) The intensity of physical work required; 2) Chemical and physical factors at work, including toxic chemicals, fine dust, noise, electricity, hot, or cold working environment; 3) Tasks related to psychological aspects; and 4) Work with deadlines.[12, 20]

Psychosocial factors can be assessed using several tools such as the Patient Health Questionnaire-9 for depression, the 14-item Perceived Stress Scale for stress, and the ENRICHD Social Support Inventory for social support. These assessments aim to help patients evaluate their ability to carry out their previous work effectively. Psychosocial factors and lack of social support may exacerbate the illness, especially when dealing with work-related stressors.[15, 20] In addition, to achieve an optimal RTW result, a self-estimation assessment is also needed to determine any limitations that may affect the process. The results of the assessment are used to develop strategies to meet the necessary criteria.[12, 20] The flow of rehabilitation assessments and interventions to facilitate RTW in patients with CAD is depicted in Figure 2.[20]

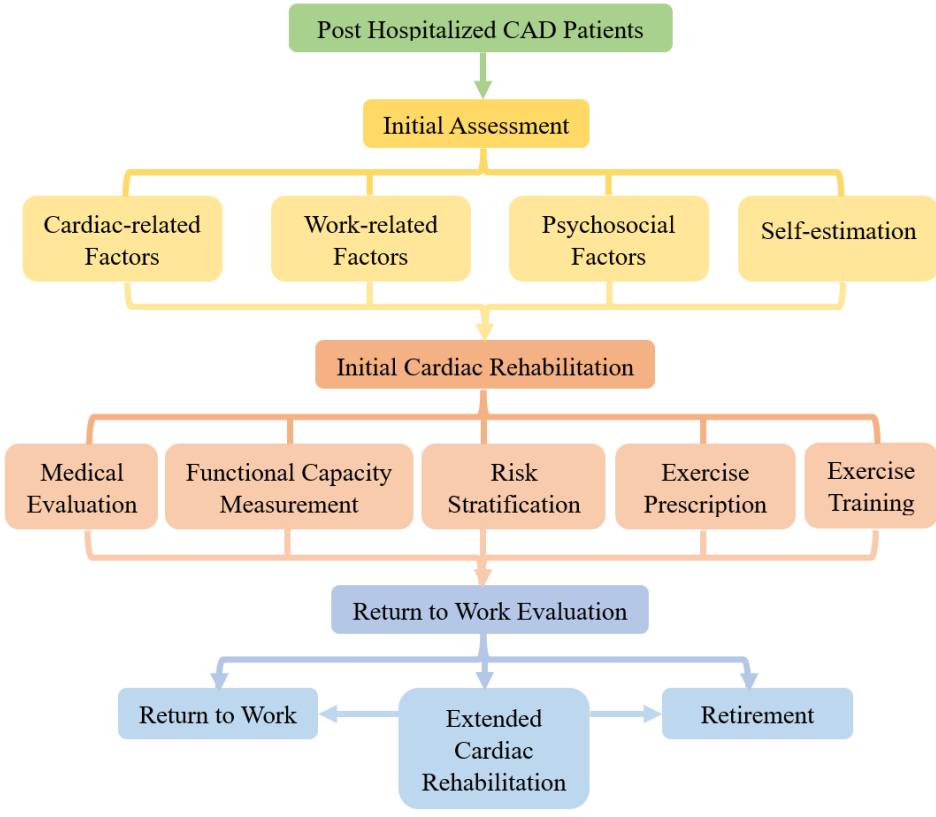

Figure 2. Rehabilitation Assessment and Intervention to Facilitate Return to Work

Rehabilitation Intervention to Facilitate RTW

1. Initial CR Program (Phase II CR)

CR is the process of engaging patients in coordinated activities necessary to address the causes of CVD and provide the best possible physical, social, and mental conditions. The goal is to enable patients to maintain or continue to function optimally within the community, promote health behaviors, as well as slow down or reverse disease progression.[22] Furthermore, CR aims to help patients regain autonomy and increase regular physical activity, control modifiable risk factors, and manage their psychosocial as well as professional problems.[23]

According to The British Association of Cardiac Prevention and Rehabilitation (BACPR), CR indications are divided into 3 major groups, namely: 1) Acute coronary syndrome, coronary revascularization, and heart failure; 2) Other patient groups known to benefit from CR including individuals with peripheral arterial disease, stable angina, post-implantation of defibrillators and resynchronization devices, post cerebrovascular events, post-heart valve replacement/repair, adult congenital heart disease, post heart transplantation, and ventricular assist devices; and 3) Asymptomatic individuals with high risk for CVD events.[22] CR is also associated with contraindications to exercise which include the presence of unstable angina, severe valvular heart disease, left ventricular outflow obstruction, advanced or decompensated heart failure, high-degree atrioventricular block (2nd or 3rd-degree block), ventricular arrhythmias, myocarditis or pericarditis, aortic dissection, acute thrombophlebitis, recent vascular embolism, psychological problems that hinder exercise, and very poor mobility.[24]

Previous studies showed that CR can improve the health and recovery of CVD patients, including those who have experienced acute myocardial infarction.[23,25,26] These benefits include 1) A significant reduction in mortality by 45-47% among patients participating in CR after the percutaneous coronary intervention; 2) A lower hospitalization rate by 31%; 3) Increased adherence to the use of preventive medicines; 4) Improved exercise performance; 5) Improved risk factors and health such as blood pressure, exercise capacity, and lipid profile; 6) Increased ability to carry out daily activities; and 7) Improved psychosocial symptoms and quality of life.[25] In acute myocardial infarction patients, other benefits of CR that have been identified include 1) Reduced incidence of recurrent myocardial infarction at 12 months; 2) A reduction in combined cardiovascular mortality from 10.4% to 7.6%; and 3) Improved effectiveness of health care resources.[23, 26]

A comprehensive CR program should include components to foster healthy behaviors, promote an active lifestyle, optimize cardiovascular risk reduction, increase adherence to healthy behaviors, and reduce disability.[27] The core components of CR and secondary prevention according to the American Heart Association, American College of Cardiology Foundation, and American Association of Cardiovascular and Pulmonary Rehabilitation are patient assessment, counseling of physical activity, exercise training, smoking cessation, nutritional counseling, weight management, aggressive management of cardiovascular risk, and psychosocial support.[23]

Furthermore, CR is a continuous intervention from hospitalization to the community.[22] This intervention is divided into 3 phases, namely

CR Phase I, II, and III (Table 1).[28] The goals of phase II CR are as follows: 1) Assisting patients in implementing an effective and safe program of physical activity and exercise; 2) Ensuring supervision to detect changes in clinical status; 3) Providing surveillance data for healthcare providers to improve medical treatment; 4) Returning the patient to recreational activities and work or modifying these activities according to the clinical status; and 5) Educating the patient, partner, or family to optimize secondary prevention through lifestyle changes.[29]

Rehabilitation interventions that should be carried out before commencing the phase II CR program include 1) Medical assessment; 2) Determination of functional capacity by exercise test; 3) Risk stratification; 4) Prescribing exercises; and 5) Exercise. Medical assessments that should be conducted before starting CR phase II are as follows 1) Diagnosis to identify cardiovascular, pulmonary, cerebrovascular disease, diabetes mellitus, anemia, peripheral arterial disease, embolism, phlebitis, pregnancy, cancer, neuromuscular and joint disease, musculoskeletal imbalance, osteoporosis, eating disorders, and emotional disorders; 2) Assessment of symptoms such as angina, discomfort including tingling, pressure, heaviness, numbness, burning, and pain in the chest, neck, arms, or jaw, as well as atypical angina, dizziness or fainting, lightheadedness, tachycardia or palpitations, shortness of breath specifically associated with eating large portions, physical activity, exposure to cold, or emotional disappointment; 3) Risk factors for the development of atherosclerotic disease; 4) Current illness, surgical procedure, or hospital treatment; 5) Dosage and schedule of drugs, or drug allergies; 6) Other habits such as use of illegal drugs or alcohol; 7) History of exercise habits; 8) Work history; and 9) Psychosocial history.[30]

Table 1. Cardiac Rehabilitation Phases

Phase I Cardiac Rehabilitation	Phase II Cardiac Rehabilitation	Phase III Cardiac Rehabilitation
Rehabilitation in hospital after cardiovascular events.	Hospital-based program as an outpatient.	Community-based program.
Time varies depending on the severity of the disease or comorbidities and the medical procedures performed. It usually lasts between 1-14 days.	Given 1-2 times a week for 6-12 weeks.	Aims to maintain the activity achieved in phase II to provide long-term benefits from exercise and minimize the risk of secondary cardiovascular events.
The program consists of education and counseling about modification of risk factors, supportive counseling, medication adherence, physical and daily activity as well as early mobilization to prevent the deleterious effects of prolonged bed rest.	The programs provided are: • Physical, psychological, and social assessments to facilitate the return of daily functions. • Education regarding risk factors for cardiovascular disease, lifestyle changes, and exercise with its long-term cardioprotective effect. • Exercise to improve cardiorespiratory fitness and functional abilities.	Exercise must be continued for life because the benefits of exercise that have been obtained during cardiac rehabilitation (such as improvements in cardiorespiratory fitness, hemodynamic function, and muscle fitness) will disappear within 3 months after stopping exercise.

The 2002 American College of Cardiology (ACC)/American Heart Association (AHA) guideline update stated that exercise tests early (2–3 weeks) or late (3–6 weeks) after discharge from the hospital are useful for prescribing activities for patients suffering from myocardial infarction with or without coronary revascularization. Exercise tests can also be performed periodically in patients participating in supervised activities and CR.[30] Absolute or relative contraindications of exercise tests are listed in Table 2.[29]

Table 2. Absolute or Relative Contraindications of the Exercise Test

Absolute Contraindications	Relative Contraindications
Unstable angina	Electrolyte disorder
A new ECG changes at rest suggesting recent myocardial infarction, significant ischemia, or other acute cardiac events	Tachy- or bradyarrhythmias
Uncontrolled cardiac arrhythmia	High-grade atrioventricular block (Grade 2 or 3)
Severe symptomatic aortic stenosis or other valvular heart diseases	Atrial fibrillation with uncontrolled ventricular rate
Advanced or decompensated heart failure	Obstructive hypertrophic cardiomyopathy (peak left ventricular flow gradient >25 mmHg)
Acute pulmonary embolism or infarction	Aortic dissection
Acute non-cardiac disorder affecting exercise performance or being induced by exercise	Severe arterial hypertension (blood pressure >200/110 mmHg)
Acute myocarditis or pericarditis	Psychological problems that interfere with the exercise
Acute thrombophlebitis	
Physical impairment that could interfere with the safety and adequacy of exercise performance	

Although exercise is considered safe for the majority of CVD patients, all patients should be examined and stratified based on the risk of cardiovascular events. Exercise and physical activity may increase the risk of musculoskeletal injuries and cardiovascular complications. Musculoskeletal injuries are the most frequent complications and are related to exercise intensity, previous physical activity, pre-existing conditions, and musculoskeletal deformities.[29] Based on the risk stratification listed in Table 3, the recommendations for the supervision intensity and risk monitoring are described in Table 4.[30]

Table 3. The American Association of Cardiovascular and Pulmonary Rehabilitation Risk Stratification

Lowest Risk	Moderate Risk	Highest Risk
Condition without exercise test: • Myocardial infarction without revascularization or complication • Resting left ventricular ejection fraction ≥50% • No heart failure • No complications of ventricular dysrhythmias at rest • No myocardial ischemia symptoms and signs • No signs of clinical depression Conditions with exercise test: • No complex ventricular dysrhythmias • No angina or other symptoms such as shortness of breath, headache, or dizziness • Normal hemodynamic response • Training capacity ≥7 METs	Condition without exercise test: Resting left ventricular ejection fraction 40-49%.	Condition without exercise test: • Cardiac arrest history • Resting left ventricular ejection fraction <40% • Presence of complex dysrhythmias at rest • Presence of heart failure • Presence of complications in revascularization or myocardial infarction • Presence of myocardial ischemia symptoms and signs • Presence of clinical depression signs
Conditions with exercise test: • No complex ventricular dysrhythmias • No angina or other symptoms such as dizziness, headache, or shortness of breath • Normal hemodynamic response • Training capacity ≥7 METs	Conditions with exercise test: • Presence of angina or other symptoms such as dizziness, headache, and shortness of breath present only at exercise with ≥7 METs • Presence of mild-moderate silent ischemia in the form of ST segment depression <2mm • Exercise capacity <5METs	Conditions with exercise test: • Presence of a complex ventricular dysrhythmia • Presence of angina or other symptoms such as dizziness, headache, and shortness of breath present only at exercise with <5 METs • Presence of silent severe ischemia in the form of ST segment depression ≥2mm • Presence of an abnormal hemodynamic response (incompetent chronotropic, systolic blood pressure remains or falls with increased intensity)

METs: metabolic equivalents

Table 4. Recommendations on Supervision Intensity Related to Risks of Exercise Participation

Risk Stratification	Recommendations on Supervision Intensity

Patients with the lowest risk for exercise-related events	• Immediate medical supervision should be provided for 6-18 practice sessions or 30 days after the procedure
	• Continuous electrocardiography (ECG) monitoring provided for 6-12 sessions
	• To remain patients at lowest risk:
	  • The hemodynamic and ECG findings must be normal during exercise
	  • No exercise intolerance or abnormal symptoms and signs
	  • Appropriate progression of exercise regimen

Patients at moderate risk for exercise-related events	• Direct supervision should be carried out for 12-24 practice sessions or 60 days after the procedure
	• Continuous ECG monitoring provided for 12-18 sessions
	• To transfer the patient to the lowest risk:
	  • The hemodynamic findings and ECG must be normal during exercise
	  • No exercise intolerance or abnormal symptoms and signs
	  • Appropriate progression of exercise regimen
	• The patient may be moved to high-risk or remain in moderate risk if there are:
	  • Abnormal hemodynamic findings or ECG during exercise, abnormal symptoms, and signs of exercise intolerance within or outside of the supervised program, may keep the patient in the moderate-risk category or even move to the high-risk category.

Patients at the highest risk for exercise-related events	• Direct supervision of exercise should be provided for 18-36 training sessions or 90 days after the procedure
	• Continuous ECG monitoring decreases to intermittent ECG monitoring.
	• To transfer the patient to the moderate risk:
	  • ECG and hemodynamic findings must be normal during exercise
	  • No exercise intolerance or abnormal symptoms and signs
	  • Appropriate progression of exercise regimen
	• The presence of abnormal ECG and hemodynamics findings, including exercise intolerance leading to exercise discontinuation. Re-assessment may be needed.

A patient-tailored program is a way to provide useful and safe physical exercise.[31] This exercise prescription aims to increase physical endurance, reduce risk factors for chronic diseases, promote health, and ensure safety.[29] It is determined by the individual response with consideration to medications, health status, behavioral traits, risk factor profile, exercise preferences, and personal goals.[29, 31]

The exercise prescription comprises four components known as the acronym FITT consisting of frequency, intensity, time, and type. Each session for patients must consist of four phases, namely warm-up, stretching, exercise/conditioning, and cool-down. The warm-up phase is a transitional phase that makes the body adapt to changes in physiological, biomechanical, and bioenergetic needs during conditioning or exercise. This phase is carried out for at least 5-10 minutes with mild to moderate intensity, and the aim is to increase body temperature as well as reduce the possibility of soreness or muscle stiffness/

cramps. The stretching phase is executed after the warm-up and cool-down phases, for at least 10 minutes. The conditioning phase consists of at least 20-60 minutes of aerobic, resistance, neuromotor, and/or sporting activity. Alternatively, patients can accumulate 10 minutes of exercise bouts, reaching a total of 20-60 minutes of daily exercise. The cool-down phase is performed with light-moderate intensity cardiorespiratory or muscle endurance activity for at least 5-10 minutes.[29]

A training plan for a patient intending to RTW should consider the muscles used and the workload required to perform the task. Exercise is carried out to increase the ability to do physical work, self-efficacy, as well as the comfort and desire to RTW after suffering from illness.[29]

The World Health Organization classifies work depending on the percentage of maximum oxygen uptake (VO2 max) being used, namely: light work (<25% VO2 max); moderate (25–50% VO2 max), and heavy or very heavy (>50% VO2 max). Furthermore, the amount of energy required for work can be classified into four groups based on metabolic equivalent (MET), namely: very light work (<3 METs), light (3–5 METs), moderate (5–7 METs), and hard (>7 METs).[20]

RTW can be recommended when an individual's functional capacity reaches at least twice the energy required for a particular work activity.[32] Jobs that involve physical activities all day such as a full-time household assistant, or hotel maid require at least 4.0 METs or the equivalent of 14 ml O2/kg/minute VO2 max. These patients must achieve at least 35 ml O2/kg/minute as the maximum value on a cardiopulmonary exercise test to RTW. For light work that involves minimal physical activity, the required METS value is 1.8 or equivalent to VO2 max of 16 ml O2/kg/minute.[20]

2. Extended CR Program

Extended CR programs including preventative care initiatives, play a crucial role in ensuring the continuity of CR services.[33] In this program, patients can undertake a total of 24 sessions consisting of an exercise program, nutrition advice, and health education up to one year after the end of the initial rehabilitation. The results showed that patients who attended an intensive post-CR program had better rates for RTW than the control.[20]

Two randomized controlled trials compared the effects of the extended and standard CR programs. The extended program consists of all standard components but has better collaboration with primary care, a longer period for CR, more focus on support from relatives, and intensive education such as direct practice to patients. The extended CR program also significantly reduced rates of hospital readmission, as well as reinfarction and death from CVD compared to the standard type. The same outcomes were also found in the results of the lipid profile, body mass index, and blood pressure where patients who followed the extended program had better values compared to standard CR.[34, 35] This extended CR program can be improved using new digital technologies (web-based, online programs), specifically for time-constrained patients. Cardiac tele-rehab as a new strategy, was reported to be effective in delivering CR services remotely.[36]

CONCLUSION

Coronary artery disease (CAD) can significantly reduce the ability to return to work, increase the risk of premature dismissal, and decrease work performance. Factors that influence the RTW ability in CAD patients are sociodemographic, psychosocial, cardiovascular risk, medical history, complications during hospitalization, and clinical characteristics. Efforts to facilitate this process involve a wide range of assessments and interventions. The RTW ability can be determined through objective assessment of cardiac function, including exercise capacity and left ventricular ejection fraction, the presence or absence of comorbidities, job satisfaction, and other assessments of general well-being. Interventions aimed at promoting RTW consist of an initial CR (phase II CR) and an extended CR program. The rehabilitation assessments and interventions given to patients with CAD have shown good results for RTW rates and the quality of work.

Conflict of Interest

The authors declared there is no conflict of interest.

Funding

This study received no funds for the conceptualization, design, data collection, analysis, decision to publish, or preparation of the manuscript.

Author Contribution

AN contributes to all concepts, design, writing preparation, editing, and review of this manuscript. GA contributes to writing preparation and editing this manuscript.

ACKNOWLEDGMENT

The author would like to thank Padjadjaran University for the opportunity to do this review and for database facilitation.

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