Cardiac Rehabilitation

MARK B. STEPHENS, CAPT, MC, USN, *Uniformed Services University of the Health Sciences, Bethesda, Maryland*

An estimated 80 million (nearly one in three) Americans have cardiovascular disease, which is the leading cause of morbidity and mortality worldwide. In the United States alone, more than 850,000 deaths are attributed annually to cardiovascular disease, and more than 8 million Americans have had a heart attack. Nearly 7 million cardiovascular procedures are performed annually in U.S. hospitals. Cardiac rehabilitation is a comprehensive program of patient evaluation, risk factor reduction (e.g., lipid control, weight management), physical activity, and longitudinal care designed to reduce the effects of cardiovascular disease, and is an effective means of mitigating disease and disability. Family physicians incorporate many of the fundamental principles of comprehensive cardiac rehabilitation into their daily practices. However, the use of dedicated cardiac rehabilitation programs serves to further reinforce the principles of nutrition, physical activity, risk factor reduction, and wellness. Cardiac rehabilitation services are underused in the United States, even though there is evidence that structured programs improve quality of life and reduce mortality for patients with coronary artery disease and other select forms of cardiovascular disease. (*Am Fam Physician*. 2009;80(9):955-959, 960.

▶ **Patient information:** A handout on cardiac rehabilitation, written by the author of this article, is provided on page 960.

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Cardiovascular disease remains the leading cause of death in the United States. More than 850,000 annual deaths in the United States are attributed to cardiovascular disease.[1] On a worldwide basis, 30 percent of deaths (an estimated 17 million deaths per year) are attributable to cardiovascular disease.[2] An estimated 80 million (nearly one in three) Americans have cardiovascular disease, and nearly 8 million have a heart attack each year.[1] Nearly 7 million cardiovascular procedures are performed annually in U.S. hospitals.[1] In 2006, the total estimated direct and indirect costs associated with treatment of cardiovascular disease exceeded $400 billion.[3] Primary prevention remains a national health priority. Cardiac rehabilitation is an important element of a comprehensive plan for secondary prevention of cardiovascular disease, which can reduce the age-adjusted cardiovascular mortality rate by nearly 50 percent.[4]

Definition

Cardiac rehabilitation was initially defined by the U.S. Public Health Service as a comprehensive long-term program "involving medical evaluation, prescribed exercise, cardiac risk factor modification, education, and counseling."[5] These programs were specifically designed to "limit the physiologic and psychological effects of cardiac illness, reduce the risk for sudden death or reinfarction, control cardiac symptoms, stabilize or reverse the atherosclerotic process, and enhance the psychosocial and vocational status of selected patients."[5] The American Association of Cardiovascular and Pulmonary Rehabilitation and the American Heart Association (AHA) have refined the definition slightly, stating that, "cardiac rehabilitation refers to coordinated, multifaceted interventions designed to optimize a cardiac patient's physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality."[6]

The overall principles of proper patient identification, enrollment in a cardiac rehabilitation program, comprehensive risk factor reduction, and longitudinal care are consistent with the principles of family medicine and with the modern concept of the medical home. The biopsychosocial model of health embedded within the core programmatic elements of structured cardiac rehabilitation lends itself well to holistic care. Family

SORT: KEY RECOMMENDATIONS FOR PRACTICE

Clinical recommendation	Evidence rating	References
Cardiac rehabilitation is recommended for patients with STEMI.	B	10, 12, 15, 17
Cardiac rehabilitation is recommended for patients with non-STEMI.	B	10, 12, 15, 18
Cardiac rehabilitation is recommended for patients with chronic stable angina pectoris.	C	19
Cardiac rehabilitation should be offered to all patients following coronary artery bypass grafting.	B	21

STEMI = ST-segment elevation myocardial infarction.

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to http://www.aafp.org/afpsort.xml.

physicians are well suited to participate in and facilitate all of these domains of care, and many routinely include elements of risk factor reduction and nutrition and physical activity counseling in their practices. The advantage of a formal cardiac rehabilitation program is that it specifically incorporates key elements of secondary prevention in a structured, graded, and codified manner.

Candidates for Cardiac Rehabilitation

Cardiac rehabilitation traditionally has been used following acute myocardial infarction (MI),[7] but many other patients benefit from structured cardiac rehabilitation programs as well *(Table 1)*.[6] The Centers for Medicare and Medicaid Services also recognizes coronary artery bypass grafting (CABG) surgery, stable angina pectoris, percutaneous coronary intervention (PCI), heart valve repair or replacement, and heart transplantation as additional indications for formal cardiac rehabilitation.[8] Evidence also supports cardiac rehabilitation for patients with heart failure.[9] Currently, Medicare covers cardiac rehabilitation programs for up to three sessions per week for three months. Medicare reimbursement applies to patients with acute MI, CABG, stable angina pectoris, PCI, valvular surgery, and heart transplantation.[8]

Table 1. Indications for Cardiac Rehabilitation

Patients with a history of:
Atherosclerotic coronary artery disease
Acute coronary syndrome
Myocardial infarction
Coronary artery bypass grafting
Percutaneous coronary intervention
Stable angina pectoris
Atherosclerotic peripheral vascular disease
Peripheral arterial disease
Heart transplantation
Stable congestive heart failure
Valvular surgery
Ventricular assist devices

Information from reference 6.

Evidence for Effectiveness

A comprehensive program of cardiac rehabilitation results in multiple positive outcomes for appropriately selected patients. Symptoms such as angina, dyspnea, and fatigue are reduced.[10] Depressive symptoms following a major cardiac event also are reduced.[11] Exercise performance and the ability to participate in activities of daily living are increased.[10] Quality of life and the ability to individually manage one's own disease are improved.[12] Rates of hospitalization and absence from work are also decreased.[12]

Multiple meta-analyses have been conducted to examine the effectiveness of cardiac rehabilitation in the setting of atherosclerotic coronary artery disease and MI.[13-15] Pooled data from these meta-analyses indicate that patients who undergo comprehensive cardiac rehabilitation following MI have a 15 to 28 percent reduction in all-cause mortality (number needed to treat [NNT] = 4 to 6) and a 26 to 31 percent reduction in cardiac mortality (NNT = 3 to 4) when compared with patients who do not participate in a structured program. It is estimated that roughly 50 percent of the reduction in cardiac mortality is attributable to lifestyle changes and improvements in cardiovascular risk profiles.[16] The American Heart Association and American College of Cardiology clinical practice guidelines recommend cardiac rehabilitation for patients following ST-elevation MI (STEMI) and non-STEMI.[17,18]

A Cochrane review of the evidence for a benefit of cardiac rehabilitation following MI was performed in 2001.[10] Investigators examined data from 32 separate trials that met eligibility requirements. Overall, there was a 27 percent reduction in all-cause mortality for exercise-only cardiac rehabilitation programs compared with control programs. Exercise-only programs were found to be similar to comprehensive programs (i.e., programs that included tobacco cessation, psychosocial counseling, and other risk factor modifications) in terms of overall

reduction in adverse clinical outcomes. Cardiac rehabilitation was shown to confer a morbidity and mortality benefit following MI, and is recommended for patients with chronic stable angina.[19]

The data supporting cardiac rehabilitation following CABG are less voluminous, but equally supportive. Patients who participated in a comprehensive cardiac rehabilitation program 10 years after having CABG had an 18 percent rate of cardiovascular events, compared with a 35 percent rate of cardiovascular events for patients who did not enter cardiac rehabilitation (NNT = 5.5).[20] The American College of Cardiology and AHA guideline on CABG recommends cardiac rehabilitation for patients following CABG.[21]

Congestive heart failure (CHF) is another indication for cardiac rehabilitation. Patients with CHF enrolled in cardiac rehabilitation exhibited a 15 to 30 percent increase in cardiorespiratory endurance as measured by maximum oxygen consumption (VO_{2max}).[22-25] Patients with CHF who participated in cardiac rehabilitation also showed a significant reduction in mortality compared with control groups.[23]

There are limited trial data examining the impact of cardiac rehabilitation in patients who have had transplant or valvular surgery. One review indicated that cardiac rehabilitation improves VO_{2max} by 50 percent in patients with a transplant.[26] Patients undergoing cardiac rehabilitation following valve replacement surgery demonstrated a 25 percent increase in VO_{2max}[27] and a 25 percent increase in functional capacity.[28] Whether cardiac rehabilitation confers a survival benefit is not clear in this population.

Components of a Comprehensive Cardiac Rehabilitation Program

Cardiac rehabilitation aims to restore patients with cardiovascular disease to a state of good health through the use of programs that incorporate regular exercise, with or without patient education or psychosocial support.[10] Therefore, it is important to know how individual programs are structured when referring patients for cardiac rehabilitation. Most formal cardiac rehabilitation programs have several core components that work interchangeably to improve a patient's exercise performance, promote lifestyle changes, and increase psychosocial well-being.

A formal patient assessment should occur on enrollment to any cardiac rehabilitation program. This initial evaluation includes the patient history and physical examination, review of pertinent testing or intervention data, and risk stratification. Patients should then have an individualized program of secondary prevention designed to target their specific risk factor profile. These elements include nutrition counseling, weight management, tobacco cessation, physical activity counseling, and a targeted prescription for physical activity. Initially, most programs use supervised exercise to ensure that patients are properly performing the recommended activities and to screen for symptoms during exercise. Established program standards[29] and performance measures[30] are available to guide the implementation of cardiac rehabilitation services.

Traditionally, cardiac rehabilitation programs have been assigned phases of progression, depending on the patient's diagnosis and referral source. Phase 1 occurs in association with hospitalization for an acute MI or other similar coronary event. During this time, the patient is exposed to supervised and structured early physical activity. Patient education, risk factor modification, and risk stratification using low-level graded exercise tolerance testing often take place during the hospitalization. Phase 2 is the early outpatient phase of cardiac rehabilitation. During this period, which occurs after discharge from the hospital, patients participate in a supervised program of physical activity, nutrition counseling, risk factor modification, and psychosocial support. Programs based in the patient's home, an outpatient clinic, or a wing of the hospital or community center can be designed to enhance patient adherence. Performance measures for cardiac rehabilitation programs are available *(Table 2)*.[29,31] The third phase (late outpatient) aims to maintain lifestyle changes established in phases 1 and 2. During phase 3, there are periodic reassessments of patient symptoms, risk factors, medication use, and psychosocial support. Phases 2 and 3 represent elements of secondary prevention and are the major focus of cardiac rehabilitation.

Final Comments

Despite the apparent benefits of cardiac rehabilitation in multiple populations of patients with cardiovascular disease, these programs remain largely underused. In the United States, Medicare data indicate that cardiac rehabilitation services are used by 14 percent of eligible patients following hospitalization for acute MI and 31 percent of eligible patients following CABG surgery.[32] Data from the United Kingdom are similar.[33]

Many factors contribute to the underuse of cardiac rehabilitation programs. The most commonly cited barriers include distance from the program facility; transportation; low patient self-esteem; and lack of physician referral, perceived benefit, and social support.[34]

Table 2. Performance Measures for Cardiac Rehabilitation Programs

Performance measure	*Target/goal*	*Intervention*
Blood pressure control	Normotension (< 140/90 mm Hg, or < 130/80 mm Hg in patients with diabetes)	Lifestyle modification; medication
Depression	Assess for presence of depression	Use of acceptable depression screening tool, with intervention as indicated
Diabetes control	A1C < 7 percent	Diabetes self-education, nutrition and weight management, and physical activity programming
Exercise capacity	Assess symptom-limited exercise tolerance	Exercise prescription tailored to each patient
Lipid control	For patients with cardiovascular disease, low-density lipoprotein level < 100 mg per dL (2.59 mmol per L)	Lifestyle modification; medication
Physical activity	30 minutes per day, five days per week	Physical activity programming tailored to individual needs and abilities
Preventive medications	Adherence to preventive medications	Age- and gender-appropriate preventive counseling and intervention
Tobacco use	Abstinence or cessation	Tobacco cessation program
Weight management	Body mass index of 18.5 to 24.9 kg per m^2 *and* waist circumference < 40 inches for men and < 35 inches for women	Multidisciplinary program of diet modification, physical activity programming, and psychosocial support

Information from references 29 and 31.

Additionally, once enrolled in a cardiac program, many patients drop out. Factors associated with nonadherence include older age, female sex, and lower premorbid levels of physical activity.[34] Recognizing that cardiac rehabilitation programs are underused, that many patients fail to complete the programs, and that other patients fail to sustain lifestyle changes after program completion, the Cochrane Database of Systematic Reviews recently reviewed the available medical literature to provide evidence-based recommendations regarding use of and adherence to such programs.[35]

Family physicians have an important role as the central coordinating figures in the medical home. This role includes promoting cardiovascular wellness through routine provision of primary and secondary preventive services; identifying patients who would benefit from a structured cardiac rehabilitation program and helping them to enroll; encouraging current participants to complete the program; and providing longitudinal follow-up for patients after program completion. Family physicians also play a key role in managing all three phases of cardiac rehabilitation by representing a critical aspect of patient continuity. By knowing which cardiac rehabilitation resources are available within the local community (http://www.aacvpr.org/Resources/SearchableCertifiedProgramDirectory/tabid/113/Default.aspx) and providing continuity of care, preventive counseling services, and a medical home for patients with cardiovascular disease, family physicians can help improve these patients' quality of life while reducing morbidity and mortality.[36]

The opinions and assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Uniformed Services University, the U.S. Department of the Navy, or the U.S. Depeartment of Defense.

The Author

MARK B. STEPHENS, CAPT, MC, USN, FAAFP, CAQAM, is an associate professor of family medicine at the Uniformed Services University of the Health Sciences in Bethesda, Md.

Address correspondence to Mark B. Stephens, CAPT, MC, USN, 4301 Jones Bridge Rd., Bethesda, MD 20814 (e-mail: mstephens@usuhs.mil). Reprints are not available from the author.

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