

# Current trends in cardiac rehabilitation

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## Abstract

CARDIAC REHABILITATION can reduce mortality and morbidity for patients with many types of cardiac disease cost-effectively, yet is generally underutilized. Rehabilitation is helpful not only for patients who have had a myocardial infarction but also for those with stable angina or congestive heart failure or those who have undergone myocardial revascularization procedures, a heart transplant or heart valve surgery. The beneficial effects of rehabilitation include a reduction in the rate of death from cardiovascular disease, improved exercise tolerance, fewer cardiac symptoms, improved lipid levels, decreased cigarette smoking, improvement in psychosocial well-being and increased likelihood of return to work. Rehabilitation involves a multidisciplinary team that focuses on education, individually tailored exercise, risk-factor modification and the optimization of functional status and mental health. Current research trends in this area include the evaluation of new secondary-prevention modalities and alternative program options, such as home-based rehabilitation.

## Résumé

LA RÉADAPTATION CARDIAQUE peut réduire de façon rentable la mortalité et la morbidité chez les sujets victimes de nombreux types de cardiopathie, mais elle est en général sous-utilisée. La réadaptation est utile non seulement pour les patients qui ont subi un infarctus du myocarde, mais aussi pour les personnes atteintes d'angor stable ou d'insuffisance cardiaque globale, ou pour celles qui ont subi une intervention de revascularisation du myocarde, une transplantation cardiaque ou une intervention chirurgicale aux valvules cardiaques. Les effets bénéfiques de la réadaptation comprennent les suivants : réduction du taux de mortalité causé par les maladies cardiovasculaires, amélioration de la tolérance à l'effort, réduction des symptômes cardiaques, amélioration des taux de lipides, réduction du tabagisme, amélioration du mieux-être psychologique et probabilité accrue de retour au travail. La réadaptation est dirigée par une équipe multidisciplinaire qui met l'accent sur l'éducation, l'exercice personnalisé, la modification des facteurs de risque et l'optimisation de l'état fonctionnel et de la santé mentale. Les tendances des recherches en cours dans le domaine comprennent l'évaluation de nouvelles méthodes de prévention secondaire et d'autres programmes possibles, comme la réadaptation à domicile.

**D**espite significant advances in its treatment over the last 20 years, cardiovascular disease remains the leading cause of death in Canada.<sup>1</sup> Thus, it is essential that a comprehensive cardiovascular treatment program be provided to manage and reduce the burden of this disease. Health Canada's *Guidelines for Establishing Standards for Cardiovascular Services*<sup>2</sup> and the Canadian Cardiovascular Society<sup>3</sup> recommend that cardiac rehabilitation be an integral part of such comprehensive cardiovascular services.

As a treatment modality, cardiac rehabilitation has a cost-effectiveness similar to that of coronary artery bypass grafting for left main coronary artery disease (approximately US\$9200 per quality-adjusted life year)<sup>4</sup> and can reduce mortality by up to 25%.<sup>5</sup> This form of cardiac care is often underutilized despite its efficacy and cost-effectiveness. As a result, only 10%<sup>6,7</sup> to 40%<sup>8</sup> of patients in Canada and the United States are referred for rehabilitation. The reasons for this low referral rate have to do with the limited access and funding for available programs,<sup>7</sup> the provision of risk-factor modification by the treating physician (making formal rehabilitation appear unnecessary) and professional scepticism about the efficacy of

## Education

## Éducation

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cardiac rehabilitation or lifestyle changes for cardiac patients (Dr. George Fodor, Ottawa Heart Institute, Ottawa: unpublished data, 1996).

The goal of this article is to provide clinicians with an update on cardiac rehabilitation, by highlighting some of the changes in care that have occurred over the last few years. These changes involve both the type of patient who can benefit from rehabilitation and the breadth of treatment programs. In addition, we identify current and future research and program initiatives.

### What is cardiac rehabilitation?

In 1964 the World Health Organization defined cardiac rehabilitation as “the sum of activity required to ensure cardiac patients the best possible physical, mental, and social conditions so that they may, by their own efforts, regain as normal as possible a place in the community and lead an active life.”<sup>9</sup> This expansive definition suggests that all patients with heart disease receive some form of rehabilitation, whether it be through their family physician, by dint of their own efforts or through attendance at a formal program. A more recent definition by the US Public Health Service stated that cardiac rehabilitation services are comprehensive, long-term programs involving medical evaluation, prescribed exercise, cardiac risk-factor modification, education and counselling.<sup>10</sup>

The most definitive assessment of cardiac rehabilitation was recently conducted by the Agency for Health Care Policy and Research and the National Heart, Lung, and Blood Institute in the United States.<sup>11</sup> A multidisciplinary panel completed a thorough and critical review of the scientific literature and concluded that cardiac rehabilitation services are an essential component of the contemporary management of patients with multiple presentations of coronary artery disease and heart failure.

The beneficial effects of rehabilitation include an improvement in exercise tolerance (without significant complications), fewer symptoms, improved lipid levels, reduction in cigarette smoking, improvement in psychosocial well-being and reduction in rates of death from cardiovascular disease.<sup>11</sup> Additional benefits include improved quality of life, enhanced return to work and reduced costs for subsequent hospital treatment.<sup>12-14</sup>

### Who benefits from cardiac rehabilitation?

Cardiac rehabilitation has expanded well beyond the initial mandate of treating middle-aged men after a myocardial infarction (Table 1). According to recent evidence-based guidelines, it is beneficial as soon as coronary artery disease is established or as late as after multiple infarctions complicated by congestive heart failure.<sup>11</sup> Cardiac rehabili-

tation has now been shown to be a beneficial adjunct to drug therapy for congestive heart failure from any cause<sup>15,16</sup> and is widely prescribed after heart transplants. As awareness of the prevalence of heart disease in women grows, women are increasingly referred to rehabilitation, and these services are offered more often to elderly people as well. It has been our clinical experience that patients with diagnoses other than those in Table 1 (e.g., those with arrhythmias or congenital heart disease or those who have implantable defibrillators) can also benefit from cardiac rehabilitation services.

Criteria to evaluate the best candidates for rehabilitation programs are still being developed. In the interim, clinicians should consider referring any patient with heart disease who could benefit from exercise training, risk-factor modification, education or psychosocial intervention for coping with heart disease. Appropriate candidates should be motivated and medically stable.

### What occurs during cardiac rehabilitation?

The aims of rehabilitation are to limit the physiologic and psychologic effects of cardiac illness, reduce the risk of sudden death or reinfarction, control cardiac symptoms, stabilize or reverse the atherosclerotic process and enhance the psychosocial and, when appropriate, the vocational status of patients with heart disease.<sup>11</sup> These aims are achieved by a multidisciplinary team that offers patients a comprehensive educational program and exercise prescriptions as well as additional services tailored to patient needs, including weight-loss strategies, lipid management, smoking-cessation techniques, measures to decrease stress and improve psychosocial well-being and vocational counselling.

#### Patient education

Education and counselling are integral components of cardiac rehabilitation programs. With the trend toward early discharge, patients and their families need further explanations about how best to live with heart disease and how to develop lifestyle-change strategies. To implement

**Table 1: Types of patients who can benefit from cardiac rehabilitation**

**Medical**

- Patients with
  - stable angina
  - myocardial infarction
  - congestive heart failure

**Postsurgical**

- Patients who have undergone
  - coronary artery bypass grafting
  - percutaneous transluminal coronary angioplasty
  - heart transplantation
  - heart-valve surgery



such changes, information about the various risk factors and practical techniques to alter behaviours are provided. Such education can occur in formal sessions with group support or informally, on a one-to-one basis.

It is unrealistic to impart all of the educational information in a few discrete sessions. The educational needs of each patient and family are unique and depend on a number of factors, including age, sex, level of education and the readiness for change for each risk factor. A considerable amount of unfiltered information about heart disease is available through the media, the Internet, well-meaning friends and family members. The cardiac rehabilitation personnel can help patients distinguish the proverbial "wheat from the chaff" and become informed health care consumers.

### Exercise

Exercise training formed the basis of cardiac rehabilitation in the 1950s for patients who had had myocardial infarctions. Today, exercise remains a cornerstone of cardiac rehabilitation programs. To devise a realistic exercise program, rehabilitation staff conduct a detailed assessment that includes documentation of pre-event and post-event exercise habits and the patient's aerobic capacity, as determined by exercise testing. Patients with heart disease are naturally concerned about the appropriate intensity of exercise as well as "safe" vocational and avocational activities. Most patients are not satisfied with vague recommendations to "listen to your body" or "just try out any activity"; they appreciate specific guidelines. It is, of course, impossible to give an exact intensity of exercise that will be appropriate in all conditions, since the disease process is dynamic, the status of the coronary arteries varies with circadian rhythms and the workload for tasks is affected by various environmental factors.<sup>17</sup>

Patients with uncomplicated disease can be encouraged to reach a heart rate 70% to 85% of their peak heart rate achieved during exercise testing or, in the presence of ischemia, a heart rate below the ischemic threshold.<sup>18</sup> For patients who are deconditioned, or those with limiting medical conditions, exercise training intensities in the range of 50% to 70% of the maximal heart rate are suggested.<sup>11,18</sup> This more moderate training level has been shown to induce a training response and improve functional capacity and is likely to improve long-term adherence. The success of using exercise as a therapeutic modality requires a thorough knowledge of the effects of exercise on various medical conditions (e.g., diabetes mellitus or obesity). The exercise therapist requires considerable skill to prescribe and adjust the exercise prescription according to the individual psychological and medical needs of each patient.

How much exercise is required for a beneficial effect? Exercise is similar to most biologic variables in that there

appears to be a continuous gradient in its cardioprotective effect.<sup>19</sup> Thus, sedentary patients should be encouraged to increase their activity to mild to moderate levels (e.g., to expend 4186 to 6278 kJ [1000 to 1500 kcal] per week), which can be accomplished by daily walks (up to 17 km per week) and improved activity habits (such as using the stairs). Optimal benefits accrue from increasing the activity levels to expend more than 6278 to 8371 kJ (1500 to 2000 kcal) per week, which is usually achieved by exercising 4 or 5 times a week, with each session being 45 to 60 minutes. The exercise program is generally designed to expend 837 to 1256 kJ (200 to 300 kcal) per session. The threshold for a beneficial effect from exercise varies for other risk factors (e.g., improved high-density lipoprotein [HDL] levels or adiposity), but, if the goal of expending 6278 to 8371 kJ (1500 to 2000 kcal) per week can be realized, then all of the end points should improve.

A major change to programs in the last decade has been the inclusion of strength training for appropriately screened patients. Weight training according to specified guidelines has been shown to be safe, to improve aerobic tolerance and activities of daily living and to help with the physical demands of jobs.<sup>11,18</sup>

Previous concerns regarding deleterious effects due to an increased afterload have not been borne out. Indeed, there appears to be less myocardial ischemia during resistance training than during a standard exercise test. This should not lessen the proscription of excessive isometric or isotonic work demands (e.g., pushing a car) that can precipitate significant cardiac events.

Table 2 identifies how physicians can obtain information about local resources for patients with cardiac disease. A comprehensive manual that offers the theory behind and practical aspects of exercise prescription is also available.<sup>18</sup>

### Lipid management

It is well recognized that optimal management of lipid levels can mitigate symptoms as well as favourably slow the progression of heart disease. Traditionally, cardiac rehabili-

**Table 2: Resources available in cardiac rehabilitation**

#### "Heart to heart" support groups

- Organized by local chapters of the Heart and Stroke Foundation; to find out about the one nearest you, call your provincial Heart and Stroke Foundation

#### Referral information

- To find the nearest cardiac-rehabilitation program, call the Canadian Association of Cardiac Rehabilitation at 204 488-8023

#### Cardiac Rehabilitation Resource Kit

- To obtain an annotated bibliography of resources for professionals and for patients with heart disease, call the Canadian Association of Cardiac Rehabilitation at 204 488-8023



tation programs have involved education about the role of diet and cholesterol, dietary changes to reduce the intake of saturated fats, exercise and weight loss, to induce a more favourable lipid profile. According to recent guidelines,<sup>20</sup> target lipid levels for patients with known cardiac disease include a low-density lipoprotein (LDL) cholesterol level of less than 2.5 mmol/L, an HDL cholesterol level of more than 1.0 mmol/L and a triglyceride level of less than 1.8 mmol/L.

Lipid levels may drop temporarily after myocardial infarction or bypass grafting. Thus, an assessment of the patient's fasting lipid levels should be performed 8 weeks after the cardiac event as a component of a comprehensive risk-factor evaluation. If the lipid levels are higher than those noted above, then both lifestyle modification (low-fat diet and exercise) and treatment with lipid-lowering drugs are indicated.<sup>21</sup> Which lipid-lowering drugs to use are also noted in these recent guidelines.<sup>20</sup>

Educating patients about lipid-lowering diets can be difficult because of the differences between dietary and serum cholesterol as well as between saturated and unsaturated fats, and the difficulty in learning how to determine the percentage of fat in the diet. Dietary changes require patients to understand food labels, prepare new and different foods and convince family members to embark on new dietary directions. Most rehabilitation programs have a dietitian as a member of the multidisciplinary team; he or she can provide group or individual educational sessions in order to help patients achieve a more favourable lipid profile or lose weight.

Aggressive lifestyle changes, such as those involved in the very-low-fat diets recommended by Ornish and associates<sup>22</sup> or Schuler and collaborators,<sup>23</sup> can induce regression of atherosclerotic plaques (by angiography) comparable to that induced by lipid-lowering agents. Some rehabilitation programs offer support groups for patients who are attempting such dietary interventions. However, because many people cannot sustain these very-low-fat diets, lipid-lowering agents may be necessary as well. An encouraging trend in rehabilitation is the formal linkage of rehabilitation programs with lipid clinics for a combined medical and lifestyle treatment approach.

### **Smoking cessation**

Smoking cessation after a myocardial infarction reduces the expected risk of death by 40% to 60%,<sup>24</sup> as well as lowering the risk of vein graft failure<sup>25</sup> and decreasing the incidence of angina.<sup>26</sup> A combined educational and behavioural intervention program can result in smoking cessation among 17% to 26% of patients who smoke.<sup>27,28</sup> Most traditional cardiac rehabilitation programs offer education and other interventions (e.g., stress management) that may help with smok-

ing cessation and relapse prevention. It has been our experience that patients who are still smoking upon entry to rehabilitation programs are often the strongly addicted, recalcitrant smokers. By the time they reach rehabilitation, they have been admonished to stop smoking by a phalanx of health care workers, family members and coworkers. It is still worth while to have a thorough discussion with such patients, as they may not know the impact of smoking cessation on other factors such as low HDL cholesterol levels, dyspnea levels and frequency of anginal episodes. Such patients often need to achieve success in another area of risk-factor modification, such as weight loss, before embarking on smoking cessation. Adjunctive aids such as nicotine gum or the patch are usually necessary. Patients who use the nicotine patch should remove it before exercise to avoid an increased absorption of nicotine through the vasodilated skin overlying exercising muscle.

### **Blood pressure control**

Cardiac rehabilitation programs can provide frequent measurements of blood pressure and promote appropriate lifestyle changes that may lessen resting and exercise blood pressure levels. Such lifestyle changes, consistent with the National High Blood Pressure Education Programs report issued in 1993,<sup>29</sup> include weight reduction, increased physical activity, reduced dietary sodium levels and moderate alcohol consumption. The exercise program may need to be modified so that aerobic exercise and resistance training are in the lower intensity range.<sup>18</sup> If drug treatment is required, then further information should be provided concerning the purpose of recommended drugs, their potential side effects and strategies to improve adherence.

### **Optimization of weight**

Obesity, commonly defined as a body mass index over 27, is relatively common in adults<sup>30</sup> and is well known to be associated with hypertension, non-insulin-dependent diabetes mellitus and coronary artery disease. A multifactorial intervention program is usually required to induce significant weight loss.<sup>11</sup> Dietary recommendations involve lower dietary fat, moderate intake of concentrated sugars and portion control. Patients who can do this in combination with their exercise program are usually successful in losing weight. Often, however, obese patients have a long history of inactivity and dislike formal exercise programs. Thus, the rehabilitation staff members need to encourage the gradual resumption of activities and look for creative alternatives to traditional exercise classes that are attractive to obese patients. The exercise intensity should be in the low-to-moderate-intensity range in order to produce an energy expenditure of 1256 kJ (300 kcal) or more per session and involve minimal risk of orthopedic problems.<sup>18</sup>



Food consumption has a number of determinants, including cultural influences, eating patterns and coping strategies. Since weight loss is one of the more difficult goals to accomplish, patients may prefer to seek extra help from a commercial weight-loss program. Fenfluramine has been used as an appetite suppressant but its safety and long-term efficacy in patients with heart disease have not been determined.<sup>31</sup>

### **Management of diabetes mellitus**

Patients with diabetes mellitus are at 2 to 5 times greater risk of coronary artery disease than those who are normoglycemic,<sup>32</sup> and those with heart disease should be given a high priority for cardiac rehabilitation programs. The complications of diabetes mellitus — neuropathy, retinopathy and nephropathy — all affect the exercise prescription. The altered dietary and exercise habits in cardiac rehabilitation influence glycemic control. Blood glucose levels should be monitored before and after exercise sessions at the outset of the program and, if levels are stable, as indicated thereafter. Close communication is required between the treating physician and the rehabilitation program to optimize medical management.<sup>18</sup> Graded exercise testing is recommended if any exercise more strenuous than walking is undertaken. This recommendation is especially important for patients with diabetes mellitus because of their higher incidence of silent ischemia.

### **Maximizing psychosocial well-being**

Depression and social isolation after a myocardial infarction are significant risk factors for subsequent death.<sup>11,33</sup> Rehabilitation programs help health care professionals to identify patients who are significantly depressed and to initiate appropriate treatment that acts in synergy with other components of the rehabilitation program, such as exercise.<sup>34</sup> Friendship and altruism often develop among participants in cardiac rehabilitation programs; these qualities help to foster a new social-support network.

The popular perception that the “Type A” personality is associated with a risk of further cardiac events holds true only for those with the so-called “toxic type A” elements: anger and hostility.<sup>35-37</sup> Intervention to alter these elements is difficult; routine stress-management programs may need to be supplemented with individual counselling or group therapy specifically designed for hostility reduction.<sup>38</sup>

Since the family, as individual members and as a unit, is affected by a cardiovascular event, rehabilitation programs include the spouse and interested family members in various educational sessions. Literature that addresses the spouse's concerns is readily available,<sup>39</sup> and support groups help spouses cope with role adjustments.

It is a common perception among patients with heart

disease that stress is a major contributory factor to their disease. The provision of stress-management programs helps participants acquire skills that may lessen the need for maladaptive supports, whether these be nicotine, alcohol, overwork or food. The stress of a cardiac event usually aggravates any pre-existing stressors, be they marital, financial or family-related. Coping with these stressors may require individual, couple or family counselling by the patient's physician, an appropriate therapist to whom he or she is referred or one of the trained cardiac rehabilitation professionals.

For most patients, return to work is an important objective. The economic realities of the patient's life and the life of his or her family usually depend on gainful employment. The cardiac rehabilitation program can help ease the transition of work return by providing objective assessments of functional capabilities, improving the patient's fitness capacity (from both an aerobic and strength perspective) and imparting needed skills for better functioning in the work environment, such as stress management. Some programs have staff who can provide more formal assessments of job requirements.

Comprehensive rehabilitation includes exploring with patients what their heart disease means to them. As Kleinman<sup>40</sup> writes, “illness has meaning: and to understand how it obtains meaning is to understand something fundamental about illness, about care, and perhaps about life generally.” For some, the diagnosis of heart disease may have a minimal effect. But many describe the diagnosis as a “wake-up call” that provokes an examination of all aspects of their life. It is often a time of change and new direction. Various books of interest for those going through this type of re-evaluation and reorientation are available.<sup>41-43</sup>

### **Conclusions and future challenges**

Cardiac rehabilitation is a rapidly expanding field, in the areas of both research and program development. As an intervention, it is efficacious, cost-effective and accepted as an integral component of cardiovascular care. The current thrust for researchers is to assess the effectiveness of rehabilitation for women, elderly people, high-risk patients who have not yet had a cardiac event and patients with rhythm disturbances and valvular heart disease. Vocational counselling and stress management need more specific evaluations. Exercise training is undergoing further study to determine its mechanism of action, such as its physiologic effect on vascular endothelium.

Cardiac rehabilitation services can provide an integrating structure for secondary prevention efforts. There are a number of new treatment modalities for secondary prevention of heart disease that require further research. Present questions of intense interest include the need for hormone-replacement therapy for postmenopausal



women with heart disease, the efficacy of vitamin supplementation and the effect of active treatment of depression.

The different ways in which cardiac rehabilitation is offered need to be assessed and compared. One of the recent trends in cardiac rehabilitation is the development of home rehabilitation programs. These are designed to target "hard-to-reach" and highly motivated patients. They allow rehabilitation programs to go beyond their usual geographic catchment areas and address the problem of access.

Finally, the timing and length of rehabilitation need to be determined. The optimal timing for risk-factor change needs to be more precisely identified (i.e., when are patients with cardiac disease the most highly motivated?). The optimal duration of rehabilitation and form of follow-up are still unknown. The drop-out rate from hospital programs can vary from less than 20%<sup>44</sup> to greater than 80%<sup>45</sup> over 5 years. Strategies are being tested to improve adherence rates.

Future program innovations will likely include a more individual approach to each patient, the establishment of a maintenance phase and the use of technologies and treatment strategies to cost-effectively improve long-term adherence. These efforts will refine the facility with which the rehabilitation team can help patients with heart disease face their life with hope, knowledge, skills and confidence.

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