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Cardiac Rehabilitation in the Elderly

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ABSTRACT

Coronary heart disease (CHD) is the leading cause of death worldwide. Advanced age is associated with a higher prevalence of CHD as well as increased morbidity and mortality. One key vulnerability relates to the fact that older individuals are generally among the least fit, least active cohort and at increased risk of complications after an acute cardiac event and/or major surgery. There is ample evidence to demonstrate the beneficial effects of exercised-based cardiac rehabilitation (CR) programs on improving functional capacity and other indices of cardiovascular (CV) health. Although the predominant number of studies is in middle-aged patients, there is an escalating amount of new information that establishes the cardioprotective role of CR and, in particular, structured exercise therapy (ET) among the elderly. The present review summarizes the current data available regarding CR and ET and its salutary impact on today's growing population of older adults with CHD.

Over the past century we have witnessed an exponential increase in the elderly population in the United States (US). Average life expectancy has dramatically increased from 50 years of age in the early 1900s to almost 80 years in 2008.[1,2] Nevertheless, coronary heart disease (CHD) remains the leading cause of death worldwide. In fact, 86% of all CHD related deaths in the US were among individuals aged 65 and older.[3]

Prior to an initial cardiovascular (CV) event, elderly patients are generally more deconditioned and less fit compared to their younger counterparts, with accelerated deconditioning once CHD is established.[4] Similarly, elderly patients are typically at a higher risk of complications from myocardial infarction (MI) and coronary revascularization procedures compared to their younger counterparts, leading to prolonged hospital stays and greater vulnerability to subsequent clinical sequelae and deconditioning.[5] Due to the many demonstrated benefits of formal cardiac rehabilitation (CR) and exercise training (ET) or CRET programs on morbidity and mortality, elderly patients would almost certainly benefit from these interventions. Numerous studies have established the bene-

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Abbreviations and Acronyms

BMI = body mass index

CABG = coronary artery bypass graft

CHD = coronary heart disease

CR = cardiac rehabilitation

CRET = cardiac rehabilitation exercise training

CRF = cardiorespiratory fitness

CRP = C-reactive protein

CV = cardiovascular

CVD = cardiovascular disease

ET = exercise training

HF = heart failure

HR = hazard ratio

MET = metabolic equivalent

MI = myocardial infarction

PS = psychological stress

OR = odds ratio

PA = physical activity

RT = resistance training

US = United States

VO_2 = oxygen consumption

ficial role of CR, regular ET, lifestyle physical activity (PA), and the maintenance or enhancement of cardiorespiratory fitness (CRF) on both the primary and secondary prevention of CHD among the general population,[6] including elderly patients. Consequently, the use and safety of CRET among older patients has gained increasing acceptance over the last decade.[7]

There are multiple studies substantiating the benefits of CRET on a number of physiologic parameters and clinical factors including exercise capacity or CRF, inflammation, pre-diabetic or diabetic glucose control, autonomic function, behavioral characteristics, quality of life (QoL), hospitalization costs, and CHD morbidity and mortality after a major CV event (Fig 1).[8] Most older patients with CHD also have varied comorbid conditions, making CR particularly useful as an opportunity to address the interplay of relevant clinical indices and medications. However, despite escalating evidence substantiating the benefits of CRET, this form of treatment remains underutilized among all CHD patients, including older adults.[9]

This review summarizes selected studies involving CRET, with specific reference to older adults. The information was obtained by reviewing randomized clinical trials, many large observational studies, as well as appropriate review articles and editorials. Finally, we will discuss some of the current barriers to CRET referral and participation by the elderly.

Aerobic capacity

Aerobic capacity or CRF is the highest volume of somatic oxygen consumed per minute at peak or maximum physical exertion,[10] synergistically utilizing the CV, pulmonary, and skeletal muscle systems. One of the most significant benefits of formal CRET, irrespective of age, sex, or body composition, is the increase in aerobic capacity, which is strongly associated with improved survival and prognosis.[11] Especially noteworthy is the fact that elderly patients demonstrate greater relative improvements in aerobic capacity as compared with their younger counterparts following CRET.[12]

One of the initial studies on ET in an elderly cohort with CHD was published in 1985.[13] The goal was to evaluate the potential benefits of early exercise programs on young, middle-aged, and elderly CHD patients after an acute MI or coronary artery bypass grafting (CABG). The study population included 361 patients who were categorized into one of four groups based on age. Group I included 60 patients aged ≤44 years; group II included 114 patients aged 45 to 54 years of age; group III included 111 patients aged 55 to 64 years; and group IV included 76 patients aged ≥65 years. All patients participated in a 12-week ET program within 6 weeks of acute MI or CABG. The patients aged ≥65 years demonstrated significant increases in maximal heart rate (126 to 138 beats/min) and peak metabolic equivalents (METs; 5.3 to 8.1 METs), a surrogate measure of aerobic capacity, as well as other physiologic and clinical improvements. Compared to the other groups, these patients also demonstrated similar improvements in body weight, percent body fat, resting heart rate, maximal heart rate, submaximal double product, and submaximal average rating of perceived exertion. However, the elderly had significantly lower absolute work capacity after training when equated to groups I–III.

Ades et al.[14] evaluated the impact of resistance training (RT) in disabled older women (≥65 years of age) with CHD. Control patients performed light yoga and breathing exercises whereas study participants engaged in a 6-month RT program. The RT group demonstrated statistically significant improvements in physical work capacity over a wide range of household PA that extended beyond strength-related activities such as endurance, balance, coordination, and flexibility. In a similar patient population, RT led to improved measures for upper and lower body strength, endurance, balance and coordination, and 6-min walk performance.[15]

Among elderly persons with and without CHD, RT appears to promote beneficial effects on muscular strength and endurance, which should enhance the ability to perform activities of daily living. This was observed in a study that evaluated the effect of RT on walking endurance among healthy, community-dwelling elderly individuals (≥65 years of age). Although there was a noticeable increase in leg strength, participants in the RT group also demonstrated a 38% increase in submaximal walking endurance ($P = .001$), whereas the control group remained unchanged.[16]

Lavie et al.[17] highlighted the therapeutic importance of referring all eligible patients to CR programs, irrespective of age. The study population included 92 patients aged >65 years and 182 patients ages <65 years who were enrolled in phase II CRET after a major CHD event. Elderly patients had lower baseline estimated peak METs (5.6 ± 1.6 vs. 7.7 ± 3.0, $P < .0001$) when compared with their younger counterparts. However, after CRET, older patients showed significant increases in peak METs (5.6 ± 1.6 vs. 7.5 ± 2.3, $P < .0001$). Moreover, both older and younger individuals demonstrated statistically similar improvements in functional capacity, percent body fat, body mass index (BMI), and lipid profiles.

In another age-related study, 125 younger patients (<55 years) and 57 elderly CHD patients (>70 years) were