Editorials

Is It Safer and More Beneficial to Work Heart Failure Patients Harder? An Editorial Commentary

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Introduction

Exercise training is undoubtedly beneficial to heart failure patients in terms of improved physical fitness and quality of life,[1,2] although a clear survival benefit has yet to be demonstrated.[3] The results of some previously published exercise training trials may have been affected by several factors. First, exercise adherence is often below desired targets, which may lead to much smaller improvements than expected. Second, studies may have been affected by crossover to the exercise intervention in up to one-third of sedentary controls, which was the case in the largest trial to date, HF-ACTION (Heart Failure: A Controlled Trial Investigating Outcomes of Exercise Training).[3] Finally, moderate-intensity continuous exercise has historically been the cornerstone of exercise programming, although a small volume of recent work has shown high-intensity interval exercise training to be superior for eliciting improvements in peak VO_2 and systolic heart function.[4,5]

Exercise training guidelines have emerged in the last 20 years, for both subclinical and clinical populations. The American Heart Association (AHA) recently published physical activity guidelines for people with type II diabetes,[6] which is especially interesting as it was perhaps the first to adjust weekly exercise time according to various activity intensities. Guidelines have been developed on the relatively large volume of data from clinical exercise training trials of moderate-intensity continuous exercise (MICE).

There seem to be 3 pillars, or established reasons, why there exists an historical preference for MICE therapy in people considered to be medium to high risk for cardiovascular events. First, the stimulus from MICE is considered sufficient to stimulate health benefits. Second, the risk of serious medical events from MICE is considered acceptable, whereas intuitively high-intensity exercise is considered by many to carry a higher risk of serious illness. Third, MICE is well tolerated by most people and is not suspected to detract from exercise adherence.

Recently, there have been a number of high-intensity intermittent exercise (HIIE) studies and study protocols published in the scientific literature. A notable study of HIIE for clinical populations was Wisloff et al's work in heart failure patients,[5] which produced unsurpassed clinical improvements. These improvements included 46% improvements in peak VO_2, which is regarded as the best predictor of prognosis in these patients. Wisloff et al's study was conducted in a small sample size of 3 groups of 9 patients, and therefore in light of this, many clinicians remain unconvinced of the potential benefits of HIIE or that these programs are safe and well tolerated. Wisloff et al's work was published in the number 1 ranking cardiology journal *Circulation* (citation impact 16) despite the small sample size. The underlying success of Wisloff et al's[5] and other HIIE work is that interval exercise allows for rest periods that make it possible for patients with heart failure to perform the total work of exercise at high intensity; exercise at high intensity is the major determinant of adaptation. In Wisloff et al's work, the comparison (continuous exercise) group completed exactly the same amount of work, thus removing ambiguity over dose responses.

Interest in clinical HIIE programs is growing, and the SMARTEX group (Controlled Study of Myocardial Recovery After Exercise Training in Heart Failure) has grant funding for a larger HIIE program for heart failure patients.[7] In Australia, our group has recently registered an HIIE trial protocol (presented as Supporting Information in the online version of this article), which will also involve collaborative centers in Italy.[8] Moreover, the recent AHA scientific sessions held in 2012 devoted almost an entire session to 3 HIIE studies presented as conference papers.[9–11] The data from these abstracts and other published works suggest that HIIE is at least as effective as MICE. Despite the intuitive opinion that HIIE programs are unsafe and poorly tolerated by patients, a recent study has suggested that high-intensity interval exercise is even more enjoyable than continuous exercise at lower intensity, which has clear implications for exercise adherence.[12] Moreover, the exercise session time required to complete the same volume of energy expenditure is often less for HIIE than in MICE sessions.[5] As such, the required weekly exercise session frequency is also likely to be lower, as the stimulus is greater with HIIE compared to MICE. The resultant shorter time commitment required from patients is likely to equate to better exercise adherence.

One recent editorial has called for high-intensity aerobic interval training to become the clinical standard in exercise therapy for heart failure patients.[13] This may be premature but likely in the future, as clinical improvements, safety, and adherence with HIIE all seem to be comparable or superior to those observed with MICE. To our knowledge, in approximately 110 randomized, controlled trials of exercise training in heart failure (including high-intensity exercise) that have been published to date, not 1 person has died directly due to exercise training, which equates to well over 100 000

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patient-hours of exercise training without a death due to exercise.

The next logical step will be to examine in a large trial if HIIE provides better exercise adherence for the heart failure population. For this reason and those stated above, we present here a study design with larger patient numbers and follow-up periods that have been trialed previously using HIIE. Our hypothesis is to show that time-efficient HIIE produces better adherence than MICE, which is more time demanding. We also believe we will show mortality, serious event, and hospitalization benefits as the larger sample size and extended follow-up periods are likely to provide sufficient numbers of events to detect differences between allocation groups. Such data may have important clinical implications including improving clinical outcomes and quality of life in this growing clinical population. The results from high-intensity interval training or moderate continuous training are likely to provide an objective framework for designing a more efficacious exercise training program for heart failure patients.

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