

# Exercise training in chronic heart failure? A case report

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## Abstract

Despite remarkable progress in the therapeutic approach of patients with chronic heart failure, the high rate of hospitalization, poor adherence to prescribed therapies, and exercise intolerance remain hallmarks of the syndrome. Secondary prevention with exercise-based cardiac rehabilitation programs are now generally accepted as a valuable adjunct treatment modality and are considered the single most effective measure to prevent the progression and tackle the different aspects that determine exercise intolerance and quality of life in these patients, with both low and preserved ejection fraction. A clinical case of a difficult ischemic male patient who finally developed heart failure because of poor adherence to the prescribed therapies is here presented and the difficulties found in prevention implementation and optimization of the prescribed therapies are discussed, along with the critical role of cardiac rehabilitation ■ *Heart Metab.* 2018;77:28-31

**Keywords:** exercise testing; heart failure; prognosis

## Case presentation

**A** This is a case of AC, a 75-year-old gentleman, who used to manage a small, local agriculture factory on his own property. Around 10 years ago, he left the responsibility of the factory to his two sons, and since then, he has retired. He lives with his wife in the countryside, where he spends most of his time at home, mainly watching TV and surfing the web.

In fact, throughout his career, he was not used to doing much physical activity, as he relied on the agricultural machines to perform the heavy duties and he could remain comfortably seated most of the time. He also claimed that the main physical activity for him

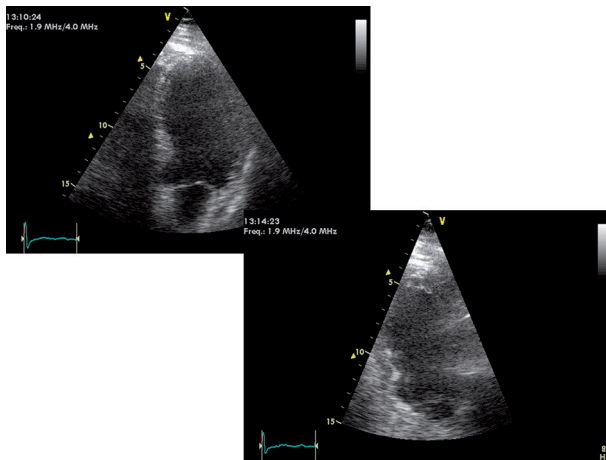
was done when he was obliged to accompany his wife on her weekly shopping trips. Moreover, he has always enjoyed his wife's cooking and he is a good cook himself, so he has always been mildly obese, and, not only did he enjoy eating, but he also drank half a bottle of wine every day and smoked at least 1 to 2 cigarettes after meals for a long time.

He admitted being lucky enough to have a life that was relatively uneventful, meaning he had no significant clinical disease and he rarely needed to visit the local hospital, since he always felt fine otherwise, until 8 years ago. However, in the rare cases when he had to visit the local surgery, mainly for administrative reasons, certificates, and very few blood tests, his general practitioner used to warn him about his blood

pressure, blood glucose, and lipid values. However, at that time, AC did not pay much attention to this warning advice, since he was still actively involved in his job.

### First acute myocardial infarction

However, in 2010, he experienced an inferior acute myocardial infarction (MI), successfully treated by primary percutaneous coronary angioplasty (PCA) on the right coronary artery, from which he experienced no complications. He was able to recover quickly, and he was discharged after only 4 days. On his last day in the hospital, a cardiac scan documented only some minor left ventricular impairment (45% to 50% left ventricular ejection fraction [LVEF], but no valve or pericardial diseases) (*Figure 1*). An appropriate



**Fig. 1** Echo scan after the first myocardial infarction.

pharmacological therapy to control some of his risk factors, such as hypertension, diabetes, and dyslipidemia (ie, amlodipine 5 mg once daily, aspirin 300 mg once daily, atorvastatin 40 mg once daily, bisoprolol 3.75 mg, clopidogrel 75 mg once daily, metformin 500 mg twice daily, and ramipril 5 once daily) was started, but no structured secondary prevention program was planned.

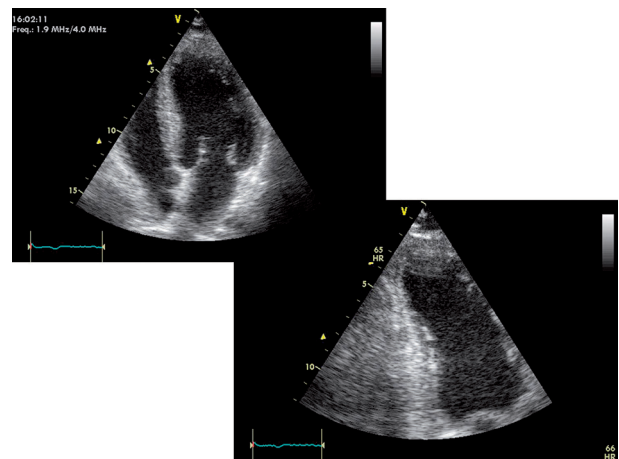
Thus, the other important risk factors, such as smoking, sedentary habits, and obesity, remained unaffected. In addition, after this acute event, he rarely checked his blood pressure or lipid levels. At 6 months, he underwent a planned follow-up visit in the outpatient department, where AC self-reported poor compliance to drug therapy (he stopped taking the  $\beta$ -blocker) and confirmed, to present, a still important uncontrolled cardiovascular risk factor. How-

ever, he complained about being very tired during the daytime, with the tendency to fall asleep in front of the TV or the computer. His wife reported that AC was presenting with poor quality sleep, accompanied by snoring during the nights, and the occurrence of phases of hyperpnea with hypopnea, and occasionally phases of no breathing at all (apnea).

The physician invited AC to restart the recommended medication and gave advice to stop smoking and maintain a healthy diet, but AC and his physician took no further action.

### Second myocardial infarction

In December 2015, 5 years later, a second, but more extensive, MI occurred, this time affecting the anterior wall of the left ventricle: at the acutely performed coronary arteriography, proximal left anterior descending coronary disease was detected and immediately treated with primary PCA. In addition, the treatment was accompanied by an uneventful recovery, but, this time, with more substantial left ventricular damage (LVEF, 40%), which was associated with mild-to-moderate mitral regurgitation (*Figure 2*).



**Fig. 2** Echo scan after the second myocardial infarction.

At discharge, most of the previously recommended therapy was confirmed, including the  $\beta$ -blocker that AC refused after the first MI (aspirin 300 mg once daily, atorvastatin 80 mg once daily, bisoprolol 5 mg, canrenone 25 mg, metformin 500 mg twice daily, prasugrel 10 mg once daily, ramipril 2.5 once daily). At this time, an outpatient rehabilitation program proposed was refused by AC, since he did not see the need because he felt fine otherwise after the acute event.

## Heart failure

A few months later, in February 2016, at a routine preplanned clinical follow-up, he presented with shortness of breath for moderate effort, and he was still smoking, overweight (169 cm tall; 88 kg; BMI 31), not performing physical activity, not eating a healthy diet, and blood tests showing poor glycemic and lipid control (Table I).<sup>1</sup> At physical examination, there were some bilateral lung rales and mild ankle swelling.

Test	Preexercise training	Postexercise training	Reference values
<b>Blood test</b>			
Glycemia (mg/dL)	153	91	<110
HbA <sub>1c</sub> (mmol/mol)	71	51	<53
LDL (mg/dL)	84	65	<70*
HDL (mg/dL)	34	44	>40*
Triglycerides (mg/dL)	183	143	<150
<b>Cardiopulmonary exercise testing: values at peak</b>			
Time (min)	6	7	NA
Heart rate (bpm)	90	90	NA
Blood pressure (mm Hg)	115/65	130/90	NA
Respiratory quotient	1.01	1.1	>1.1
Peak V <sub>O<sub>2</sub></sub> (mL/kg/min)	11.6 (38%)	14.6 (65%)	>18 (>85%)
Ve/VCO <sub>2</sub>	37	27	<34
Oscillatory breathing	Yes	No	No

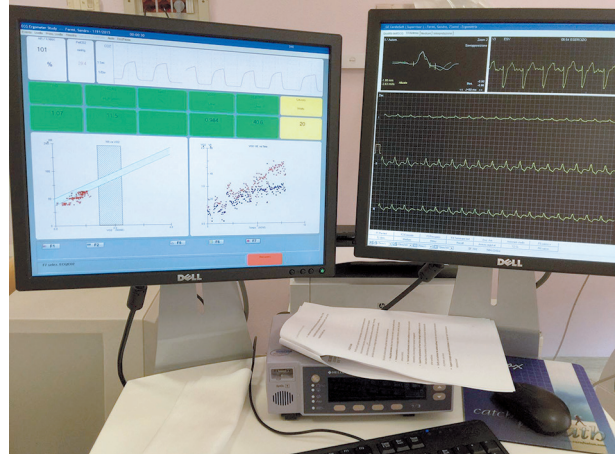
**Table I** Tests before and after an exercise training-based cardiac rehabilitation program. \*Recommended values.

Data from reference 9: Piepoli et al. Eur J Prev Cardiol. 2016;23(11): NP1-NP96.

At this time, he confirmed poor compliance to the prescribed lifestyle recommendations (“Christmas holiday with rich lunches and drinks did not help” he used to say) and to the prescribed therapies. After a short hospital admission to restore clinical compensation, he agreed to start a program of residential cardiac rehabilitation in a specialized center.

## Exercise-based cardiac rehabilitation program

At the admission center, cardiopulmonary exercise testing was performed (Figure 3). It was completed



**Fig. 3** Cardiopulmonary exercise testing.

with no adverse events, but it confirmed a severe limitation in exercise capacity (peak V<sub>O<sub>2</sub></sub>, 11.6 mL/kg/min; 38% predicted value), abnormally elevated ventilatory responses to exercise (Ve/VCO<sub>2</sub> slope, 37), and an oscillatory ventilatory pattern during exercise, all ominous signs of poor prognosis and high mortality in heart failure.<sup>2</sup>

The preventive program included a 3-week inpatient phase followed by a twice a week outpatient ambulatory cardiac rehabilitation program, which included:

1. Physical activity promotion and a supervised exercise training program (mainly aerobic endurance, both continuous and interval training, and strength exercises, at least 60 minutes a day).
2. Risk factor control program (smoking cessation program, healthy diet promotion, and psychological support, with family involvement).
3. Pharmacological optimization: aspirin 300 mg once daily, atorvastatin 40 mg once daily, ivabradine 5 mg twice daily, canrenone 25 mg, metformin 500 mg twice daily, prasugrel 10 mg once daily, ramipril 2.5 mg once daily. At the second week, a lower dosage of β-blocker (bisoprolol 1.25) was reintroduced and titrated to 2.5 mg once daily.

At the 6-month regular follow-up visit, AC felt better, was able to quit smoking, was still overweight, but with a much improved exercise tolerance (the peakV<sub>O<sub>2</sub></sub>, Ve/VCO<sub>2</sub> improved and the oscillatory ventilatory pattern disappeared), glycemic and lipid levels were controlled (Table I),<sup>2</sup> and no further hospitalization.

## Comments

Each year, more than 7 million people worldwide experience a MI,<sup>3</sup> and, although substantial reductions in mortality have been experienced in recent decades,<sup>4</sup> 1-year mortality rates are still in the range of 10%,<sup>5</sup> varying with patient characteristics. The consequences of MI are more dramatic: among patients who survive a MI, 20% suffer a second cardiovascular event in the first year and approximately 50% of major coronary events occur in those with a previous hospital discharge diagnosis of MI.<sup>6</sup> During 30 months of follow-up, cardiovascular death, hospitalization, and death from MI have been described in 33%, 26%, and 5%, respectively.<sup>7</sup>

The people behind these numbers spur a call for action. Prevention after MI is crucial to reduce risk and suffering. Evidence-based interventions include optimal medical treatment with anti-platelets and statins, achievement of blood pressure, lipid, and blood glucose targets, and appropriate lifestyle changes.<sup>8</sup>

In this clinical case, only a structured secondary prevention program was able to persuade AC to start taking care of his life, controlling his important risk factors. The physician could optimize his medical therapy by implementing guideline-recommended medication, including ivabradine, which also allowed AC to restart low-dose  $\beta$ -blockade. This regimen maintained AC with control of some of the ominous indices in heart failure, such as low exercise tolerance, abnormal ventilator response to exercise, in keeping with published evidence.<sup>9</sup>

Secondary prevention programs, defined as the level of preventive care focusing on early risk stratification, use of referral services, and initiation of treatment to stop the progress of established disease processes, are highly recommended in all post-MI patients, to restore quality of life, maintain or improve functional capacity, and prevent recurrences.<sup>2</sup> Cardiac rehabilitation, operationally defined here as a structured multidisciplinary intervention for cardiovascular risk assessment and management, advice on physical activity, psychosocial support, and the appropriate prescription and adherence to cardioprotective drugs, is the most investigated modality of secondary prevention interventions,<sup>10</sup> and its core components in post-MI patients are well identified.<sup>11</sup> Over the past decade, there was a significant increase in cardiac rehabilitation referral following an acute coronary syndrome. However, cardiac rehabilitation is still underutilized in important high-risk subsets of this population. Patients referred to cardiac rehabilita-

tion have a lower adjusted mortality risk.<sup>12</sup> Furthermore, dropout for nonmedical reasons was independently associated with a negative outcome.<sup>13</sup>

Finally, in the light of the presented clinical case, the following conclusions can be drawn:

1. Finding strategies to get patients referred and enrolled in an effective secondary and cardiac rehabilitation program is necessary.
2. Prescribing exercise and healthy lifestyle advice for patients with HF is similar to patients without HF. Using this opportunity to optimize therapy and give disease-specific education for the patient, relatives, and caregivers is important.
3. Collaborating with caregivers and health care providers helps maintain patient stability and provide close surveillance of the symptoms and early signs of decompensation. ■

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