How to prescribe exercise in cardiac patients with co-morbidities

Dominique Hansen answers key questions - on behalf of the EXPERT project group in collaboration with the EAPC Cardiac Rehabilitation Section

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Exercise-based rehabilitation effectively increases life expectancy and suppresses hospitalisation frequency in patients with cardiac disease. However, selecting the most effective exercise modalities in cardiac patients with various co-morbidities, which is often the case in clinical practice, is difficult. Even though clinical guidelines formulate how to prescribe exercise in these various co-morbidities separately, a guideline or tool that assists the physician how to select training modalities in these patients remains presently absent. However, a European team of rehabilitation specialists is working on a tool that might overcome this problem in the near future...

Topic(s): Rehabilitation

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Answers:

1. Is exercise-based rehabilitation effective in cardiac patients? An update.

According to recent data from meta-analyses (1), participation into exercise-based cardiac rehabilitation programs would lead to a significant reduction in all-cause mortality (by ±19%), cardiac mortality (by ±20%), and rehospitalisation rate in the first year (by ±31%), in patients with myocardial infarction, angina pectoris, and/or coronary heart disease, with or without revascularisation by percutaneous coronary intervention or coronary artery bypass surgery.

It thus follows that cardiac rehabilitation is a class I intervention (useful and effective) when aiming to increase life expectancy and lower hospitalisation rate in patients with cardiac disease. However, the randomised controlled trials that were included in these meta-analyses applied ‘standard’ exercise interventions for all included patients, regardless of the presence of commonly present cardiovascular co-morbidities (such as hypertension, obesity, insulin resistance or type 2 diabetes, dislipidemia, etc.).

Therefore, the currently studied exercise interventions were not modified according to co-morbidities, meaning that room for further improvement in clinical effectiveness of exercise-based cardiac rehabilitation remains present.

2. How should we modify exercise interventions in case of common co-morbidities in cardiac patients?

According to current clinical guidelines for rehabilitation of patients with cardiac disease, these subjects should in general exercise >150 min/week (spread over >2 exercise sessions/week) at a low-to-moderate endurance intensity (leading to weekly caloric expenditure of 1000-2000 kcal/week), and in combination with resistance exercises.(2)

In patients with stable chronic heart failure a more gradual increase in exercise intensity and exercise session duration is advised, and in patients who underwent coronary artery bypass surgery upper body exercises are only executed when the chest is stable.(2)

Even though these guidelines provide a significant support to healthcare professionals directly dealing with cardiac patients in rehabilitation programs, and hereby could contribute to a better selection of training modalities in current cardiac rehabilitation programs throughout Europe, it still remained to be defined in detail how training modalities for cardiac patients should be adapted in case of presence of obesity.
insulin resistance or type 2 diabetes, hypertension, dislipidemia, muscle wasting, heart failure, to mention a few commonly present co-morbidities in patients with cardiac disease. In more recent publications it has been specifically aimed to address this challenging problem in current cardiac rehabilitation programs.(3,4)

When a patient with myocardial infarction, angina pectoris, and/or coronary heart disease, with or without revascularisation by percutaneous coronary intervention or coronary artery bypass surgery presents at the cardiac rehabilitation facility, first the physical fitness should be assessed (preferentially by ergospirometry exercise testing for assessment of peak oxygen uptake with ECG monitoring) and it should be examined whether physiological anomalies are present during exercise. To properly select an exercise training intensity, which is both safe and effective, a certain fraction of the peak exercise tolerance or ventilatory anaerobic threshold (with extrapolation to heart rate and/or workload) should be selected.(5,6)

In this way, both patients with a high and low baseline exercise tolerance would follow medically safe and effective exercise sessions. Next, the healthcare professional should adapt the traditionally prescribed exercise modalities (exercise >150 min/week, >2 exercise sessions/week, low-to-moderate endurance intensity, in combination with resistance exercises) according to presence of common co-morbidities (obesity, insulin resistance or type 2 diabetes, hypertension, dislipidemia, muscle wasting, heart failure)(3,4)

From current recommendations, following adaptations are proposed:(3,4)

- **Obesity**: elevate caloric expenditure by selecting exercise modes with greater energy expenditure (walking, cross-skiing, rowing, stepping), prolonging exercise sessions (>45min/session) and program participation, and advise the patient not to compensate the increased caloric expenditure during exercise training by elevations in energy intake. The addition of resistance exercises to endurance exercises and/or execution of low-intensity exercise (to stimulate fat oxidation) does not contribute to greater adipose tissue mass loss.

- **Insulin resistance or type 2 diabetes**: in these patients it is strongly encouraged to add resistance exercises on top of endurance exercises. There is evidence to support the view that the combination of different training types contribute to a greater improvement in glycemic control, as opposed to endurance or resistance training only. From the limited amount of data that is currently gathered it seems that hypertrophic strength training
(less repetitions, greater weight) might be more effective than endurance strength training (more repetitions, less weight) to lower fasting blood glucose levels in patients with type 2 diabetes. Moreover, a regular spread of the exercise volume over the week (resulting into daily exercise training) is more beneficial as opposed to an equal volume of exercise but executed on a single day in the week.

- **Dislipidemia**: to effectively improve blood lipid profile (elevate blood HDL cholesterol level and lower blood triglyceride level) endurance exercise training volume seems important. A threshold value of 1000kcal/week has been identified as the amount of endurance exercise that is mandatory to achieve these clinical benefits in patients with dislipidemia. Adding resistance exercises to endurance exercises does not seem to contribute to greater improvements in blood lipid profile, as opposed to endurance training only. Even though it remains uncertain, some studies do suggest that high-intensity endurance exercise training might be more effective to increase blood HDL cholesterol levels, as opposed to low-to-moderate intensity endurance exercise training, at least in patients with the metabolic syndrome.

- **Hypertension**: some data seem to indicate that a greater exercise training frequency might lead to greater improvements in blood pressure. Endurance training intensity is not a determining factor for the improvement in blood pressure during long-term rehabilitation intervention. Moreover, whether resistance exercises should be added to endurance exercise to further remediate hypertension remains presently speculative.

- **Muscle wasting**: when there are indications for significant muscle wasting (significant reductions in muscle mass and muscle strength) resistance exercises should be added to endurance exercise training. Healthcare professionals could select basic strength training modalities during the first few months of intervention (8-10 repetitions/set, 3 sets, large muscle groups), followed by a shift towards hypertrophic strength training (<8 repetitions/set, 3 sets, large muscle groups) during the subsequent months of exercise intervention.

- **Heart failure**: it should be mentioned that mainly heart failure patients with lowered left ventricular ejection fraction have been examined. Exercise training recommendations for heart failure patients with preserved left ventricular ejection fraction remain speculative due to limited data. Even though some studies suggest that high-intensity interval training might be more effective to improve exercise tolerance in these patients (and could be implemented in clinical practice) current recommendations remain to prefer continuous-intensity endurance training until convincing evidence is delivered in support of high-intensity interval training. In case of severely
limited heart failure patients (NYHA class >2) a gradual increase in exercise intensity and session duration could be proposed during the progression of the exercise intervention. Inspiratory muscle training should be added to endurance exercise training to further improve the clinical benefits of exercise intervention (increase in exercise tolerance). Exercise interventions should further be adapted according to implanted devices (implantable cardiac defibrillator, cardiac resynchronisation therapy, left-ventricular assist devices). In case of heart transplantation adaptation of exercise training/intervention could be mandatory due to the often observed severely lowered exercise tolerance and cardiac denervation.

3. Are effective exercise interventions being prescribed for cardiac patients with co-morbidities throughout Europe?

Because recommendations for exercise training in patients with cardiac disease have been published, and more recent publications have aimed to further differentiate between patients with different commonly observed co-morbidities, it could be questioned whether these recommendations are being implemented in current cardiac rehabilitations schemes throughout Europe. It has been observed that there is a great heterogeneity in selection of training modalities (exercise intensity, session and program duration, exercise frequency, with or without resistance exercises) in cardiac rehabilitation programs.(7)

Moreover, according to a recent Dutch study the implementation clinical guidelines into current cardiac rehabilitation programs seems problematic.(8)

The lack of adherence to current clinical guidelines by healthcare professionals in the rehabilitation of cardiac patients could be due to attitude towards and knowledge of guidelines and/or problems in practical organisation (such as complexity and costs).

However, also the complexity of how to select training modalities in cardiac patients with different co-morbidities could lead to low adherence to clinical guidelines. Although we have provided training modality adaptations for patients with common co-morbidities above, it remains open which training modalities to select in case of different primary indications for rehabilitation (for example cardiomyopathy, assist devices, congenital heart disease, pulmonary hypertension, peripheral arterial disease, etc) and in case of presence of different less common co-morbidities (such as renal failure, type 1 diabetes, pulmonary disease, sarcopenia, etc.).
It already has been suggested that the development of a decision flowchart in cardiac rehabilitation could be of great value to assist healthcare professionals in the selection of exercise modalities and hereby overcome this problem.(9)

Therefore, a European working group is currently trying to create such tool by the launch of an initiative: the EACPR EXPERT flowchart project.

4. EAPC EXPERT flowchart project

In this project, 28 cardiopulmonary rehabilitation experts throughout Europe contribute to a flowchart that will assist healthcare professionals to properly select training modalities for cardiac patients. These experts will collect state-of-the-art evidence (mainly out of meta-analyses and clinical guidelines) for exercise prescription in certain cardiovascular disease (CVD’s: 12 primary indications), CVD risk factors (n=5), and chronic disease (n=6) that require modification of exercise prescription. Hereby a flowchart integrating all these separate programs will be generated.

This flowchart will lead clinicians, based on the primary indication, CVD and/or co-morbidities of the patient, to the most effective rehabilitation program. Such flowchart will be made available to clinicians involved in rehabilitation and prevention of CVD (risk factors).

By using such flowchart on a European scale, we hope that these improved rehabilitation schemes will lead to greater improvement in patients' CVD risk factors, physical fitness, quality of life and life expectancy, together with greater reductions in healthcare-related costs.

Read more on the EXPERT flowchart project.

5. References

- Vanhees L, Geladas N, Hansen D, et al. Importance of characteristics and modalities of physical activity and exercise in the management of cardiovascular health in individuals with

