The role of exercise in cardiac disorders

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Abstract

Physical activity (PA) has been demonstrated to have a powerful role in reducing cardiovascular risk and is therefore universally recommended by international guidelines. Although there is a dose-dependent risk reduction with increasing levels of PA, there is some concern that extreme levels of PA can result in adverse cardiovascular outcomes. It is important to adapt PA advice to each individual, and in particular to note that there are conditions that are not compatible with competitive sport because of increased cardiovascular risk. Exercise also has an key role in the assessment of patients presenting with symptoms that could potentially result from cardiovascular disease, both as a measure of the impact of the disease and as a diagnostic tool.

Keywords Cardiac rehabilitation; cardiovascular risk; diagnosis; exercise; MRCP; physical activity; primary prevention; secondary prevention

Key points

- Regular exercise reduces cardiovascular risk, but there is currently uncertainty about the impact of extreme levels of exercise
- Certain conditions preclude participation in competitive sports because of increased cardiovascular risk
- Exercise capacity is a useful marker of disease state; it can also be used in conjunction with imaging techniques to provide a robust assessment of whether a patient has significant underlying coronary artery disease
- Cardiac rehabilitation programmes, of which supervised exercise forms a key part, reduce future cardiovascular events and improve quality of life

Introduction

Physical activity (PA) forms a large part of the lives of some individuals, but for most it is often not a routine part of daily living. It is therefore important to consider the impact that PA can have on cardiovascular risk, and to consider the risk associated with PA in patients with cardiovascular disease. Exercise can also form an important part of tests to diagnose ischaemic heart disease (IHD), as well as having a key role in rehabilitation after a cardiac event.

Exercise in cardiovascular risk reduction

Population studies have consistently shown that PA not only has a beneficial impact on cardiovascular risk factors, but also reduces both all-cause and cardiovascular mortality.[1–3] Aerobic PA, which involves movements of large muscle groups in a repetitive fashion, has been the most closely studied form of PA in relation to cardiovascular risk.[1–3]

It is important to assess not only the duration of PA, but also the intensity. The intensity of PA is often measured in metabolic equivalents (METs), where 1 MET is defined as the amount of oxygen consumed while sitting at rest. Table 1 demonstrates some examples of PA and the relative intensity of these. Although this mechanism of assessing the intensity of PA is helpful, it is also important to consider the relative intensity: less fit patients use more energy to perform the same PA. An assessment of relative intensity can be easily gained by either comparing the peak heart rate to the age-predicted maximum (220 beats per minute minus age) or using the 'talk test' (an assessment of the frequency of breathing; Table 1).[3] Importantly, moderate-intensity PA produces less improvement in cardiorespiratory fitness than strenuous PA.[1]

It is difficult to define the exact amount of exercise required for optimum health; specifically, there does not seem to be an upper limit of moderate-intensity PA-related health benefit.[1,3] There is, however, no evidence that high levels of very strenuous exercise provide any increased benefit.[1] International guidelines advise that individuals should aim to achieve at least 30 minutes per day of a moderate-intensity activity for 5 days per week or 15 minutes per day of a strenuous activity for 5 days per week, or a combination of these.[3]

When considering prescribing PA, it is important to review both the patient's current levels of PA and their co-morbid status because in certain circumstances it is appropriate to initially encourage very low levels of PA with a gradual increase.[3] When considering how to promote sustained improvement in PA, it is often effective to set goals and encourage adaptations to daily routine to include PA, such as using active rather than passive modes of travel.[3]

Although the evidence relating to muscle-strengthening activities is less extensive, there is a clear consensus among guidelines that adults should also perform these activities twice a week.[3] These should focus on the major muscle groups, and movements should include the full range of motion of any joint.[3] This has been well established to stimulate bone formation, and, particularly in combination with aerobic PA, there is some evidence that it reduces both blood pressure and lipid concentrations.[3]

Exercise as a source of cardiovascular risk

The general population should be reassured and encouraged to undertake more PA, given the very low associated levels of

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Intensity of PA

Intensity	METs	Examples	Percentage of max heart rate	Impact on talking
Light	1.1–2.9	Light housework Slow walking Croquet	50–63	No impact
Moderate	3–5.9	Brisk walking Vacuuming Doubles tennis Ballroom dancing	64–76	Increased respiratory rate but able to talk in full sentences
Strenuous	>6	Jogging Heavy gardening Swimming Cycling > 15 km/hour	77–93	Unable to talk in sentences owing to work of breathing

METs, metabolic equivalents.
Source: Adapted from Piepoli et al.[3]

Table 1

adverse cardiovascular events (5–17 sudden deaths per million per year).[3] However, some groups of patients with pre-existing cardiovascular conditions should adjust their PA. When considering the risk of an activity, it is important to classify PA in terms of the relative intensity of both the static and dynamic elements (Table 2). There are also rare individuals with a genetic predisposition to developing cardiac disease in whom exercise is not beneficial. Interestingly, this has been demonstrated in arrhythmogenic right ventricular cardiomyopathy, where presentation occurs earlier with increased PA.[1] It is, however, uncertain whether this feature is seen in other conditions.[1]

Intensity of dynamic and static elements by sport

	Low dynamic	Moderate dynamic	High dynamic
Low static	Bowling Cricket Golf	Fencing Table tennis Doubles tennis Baseball	Badminton Race walking Running (marathon) Cross-country skiing Squash
Moderate static	Driving and racing Equestrian sports Sailing Archery Gymnastics		Rugby Football Tennis (single)
High static	Field events Rock-climbing Windsurfing Weight-lifting	Bodybuilding Downhill skiing Wrestling Snowboarding	Boxing Cycling Canoeing Rowing Triathlon

Adapted from Pelliccia et al. (see Further reading).

Table 2

Competitive sport in athletes is associated with a small but important risk of sudden cardiac arrest (0.76 cases per 100,000 athlete–years) and therefore requires special consideration (see Further reading). Certain cardiomyopathies, IHD, arrhythmogenic conditions, valvular heart disease and other conditions preclude participation in many competitive sports except sometimes those in category 1A (Table 2)[4]

Although data demonstrating the benefits of PA are clear, there is uncertainty regarding the impact of excessive exercise, which particularly relates to endurance athletes including marathon runners, triathletes, cross-country skiers and cyclists.[1] Exercise-induced troponin release, myocardial fibrosis, cardiac dysfunction after exercise, arrhythmias, accelerated coronary artery calcification and increased cardiovascular mortality compared with recommended levels of PA have all been demonstrated in this group.[1] Despite this and studies suggesting a U-shaped relationship between amount of PA and mortality, there are some weaknesses with these data; therefore overall it has been recommended that, even in endurance athletes, the benefits of exercise outweigh the risks.[1]

The role of exercise in diagnosis

Clinicians can rapidly gain subjective insight into the severity, progress and response to treatment of cardiovascular disease by asking individuals about their exercise capacity. The 6-minute walk test can provide a useful, objective measure of exercise capacity as well as evidence for the effectiveness of treatment, and can be used as a guide to prognosis (see Further reading). The 6-minute walk test is performed according to a self-paced standardized protocol; this not only measures the distance walked, but also symptoms, oxygen saturations and heart rate (see Further reading).

Cardiopulmonary exercise testing is a more formal assessment of exercise capacity that measures oxygen uptake, carbon dioxide production and ventilation during a progressive exercise test (see Further reading). Cardiopulmonary exercise testing can provide useful prognostic data in a variety of cardiovascular conditions, as well as a detailed evaluation of functional status before major surgery (see Further reading).

Exercise can also be used as a part of diagnostic testing in cardiovascular disease, particularly to diagnose IHD. Historically, exercise tolerance testing was frequently used to assess the likelihood of IHD; in this, the individual exercised according to a certain protocol, most commonly on a treadmill using a Bruce protocol. Although this is a simple test, the sensitivity and specificity are poor so it is no longer recommended for diagnosing IHD disease. It does, however, still have a role in assessing the need for surgery in patients with asymptomatic severe aortic stenosis, as well as the assessment of possible exercise-related arrhythmias. Exercise, in combination with either echocardiography or nuclear imaging, still has an important place in the non-invasive diagnosis of IHD.

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