HOSPITAL CHRONICLES 2008, SUPPLEMENT: 151–155

Exercise Prescription in Patients With Arrhythmias

Franco Giada, MD[1], Pietro Delise, MD[2], Alessandro Biffi, MD[3], Silvia Priori, MD[4], Massimo Santini, MD[e], Antonio Raviele, MD[5]

[1]Cardiovascular Department, Umberto I Hospital, Mestre-Venice; [2]Cardiovascular Department, Civic Hospital, Conegliano, Treviso; [3]Istitute of Science and Sports Medicine, CONI, Rome; [4]Division of Molecular Cardiology, S. Maugeri Foundation, University of Pavia, Pavia; [5]Cardiovascular Department, San Filippo Neri Hospital, Rome, Italy

Epidemiological, clinical and laboratory studies have yielded definitive evidence that physical activity is able to reduce the morbidity and mortality of cardiovascular diseases and to improve physical fitness and quality of life. Moreover, physical activity seems to be capable of significantly reducing the risk of developing other chronic diseases, such as obesity, osteoporosis, diabetes, some neoplasms and depression. For these reasons, physical exercise has been proposed as an efficacious, low-cost, physiological means of disease prevention and therapy. However, although enormous amounts of scientific data have demonstrated the benefits of a physically active lifestyle, only a minority of people in Europe take regular physical exercise. One of the prime objectives of healthcare institutions is therefore to promote physical activity in the general population, as well as in patients with cardiovascular diseases.

In the present review, we analyze the following points: some clinical aspects of arrhythmias and their relationships with physical exercise; the specific recommendations for exercise prescription in the various arrhythmias and in arhythmogenic heart diseases; the interactions between physical activity and antiarrhythmic therapies.

CLINICAL ASPECTS OF ARRHYTHMIAS

DIAGNOSTIC AND PROGNOSTIC MANAGEMENT OF PATIENTS WITH ARRHYTHMIAS

Many cardiac arrhythmias are clinically well tolerated; others depress pump function to varying degrees, and some can lead to sudden death. Sudden death is normally linked to an acquired or congenital heart disease. In the arrhythmic subject therefore, the presence and type of any underlying heart disease should first of all be evaluated[1-4].

During clinical history, it is important to check for the presence of a family history of sudden death or genetic heart disease, arrhythmia-related symptoms (especially syncope) and possible triggering factors (e.g. hyperthyroidism). With regard to instrumental investigations, 12-lead ECG is crucial; indeed, in addition to yielding diagnostic information on single arrhythmias, in many cases it enables most potentially arrhythmic heart diseases to be discovered, or at least suspected. Further investigations may be prescribed when an organic heart disease is suspected (echocardiography), when the circadian pattern and the response of individual arrhythmias to effort need to be assessed (Holter monitoring, exercise testing), or when the mechanism of the arrhythmia itself is to be analysed (electrophysiological study).

Address for correspondence:
Franco Giada, MD
Dipartimento Cardiovascolare,
Ospedale Umberto I,
Via Circonvallazione 50, 30170,
Venice-Mestre, Italy
tel. +39 041 2607201;
fax +39 041 2607235;
e-mail: francogiada@hotmail.com

RELATIONSHIPS BETWEEN ARRHYTHMIAS AND PHYSICAL EXERCISE

Generally, physical exercise does not induce direct favourable effects on arrhythmic burden of patients with arrhythmias. Indeed, by increasing sympathetic activity, physical effort tends to favour the onset of both ventricular and supraventricular tachycardias. Moreover, increased sympathetic tone reduces the threshold of ventricular fibrillation. Finally, in pathological conditions, effort can induce arrhythmias indirectly through mechanisms such as ischemia, left ventricular outflow obstruction, etc. However, because of the above mentioned capacity to reduce total and cardiovascular morbidity and mortality, and to improve physical fitness and quality of life, judicious physical activity must be precribed also in patients with arrhythmias.

In the absence of heart disease, most arrhythmias are well tolerated from the haemodynamic point of view, even during effort. In the presence of heart disease, however, and obviously in relation to the type and degree of the disease, many arrhythmias can compromise pump function and even cause cardiac arrest.

Some heart diseases are particularly vulnerable to the development of malignant ventricular arrhythmias during effort: hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy, coronary heart disease (including congenital coronary anomalies) and myocarditis. Some ion channel disorders (long-QT syndrome, catecholaminergic polymorphic ventricular tachycardia) can be added to these. Some physical activities may arouse a strong emotional response (e.g. downhill skiing, climbing, etc); these are therefore to be avoided in all those arrhythmogenic conditions that are favoured by a sudden increase in catecholamines (e.g. long-QT syndrome). Finally, in sinus bradycardias and nodal atrio-ventricular blocks, regular high-intensity aerobic activity may have a worsening effect.

In those arrhythmias and potentially arrhythmogenic syndromes that are associated with a risk of syncope, any physical activity in which loss of consciousness may lead to death by injury or drowning ("intrinsic risk" activities), such as climbing, motorcycle sports, swimming, sub-water diving, etc., must be avoided.

RECOMMENDATIONS IN THE VARIOUS ARRHYTHMIAS AND IN ARRHYTHMOGENIC DISEASES

The specific recommendations in the various arrhythmias and in potentially arrhythmogenic genetic heart diseases are summarized in table 1 and 2.

INTERRACTIONS BETWEEN EXERCISE AND ANTIARRHYTHMIC THERAPIES

ANTIARRHYTHMIC PHARMACOLOGICAL THERAPY

Many subjects with arrhythmias take anti-arrhythmic drugs, most of which can have both cardiac and extra-cardiac side-effects. In prescribing physical activity, it should be born in mind that some drugs tend to depress myocardial contractility to varying degrees (e.g. class IC); while their effect is not significant in non-cardiopathic subjects, it may be considerable in patients with depressed left ventricular pump function. Moreover, other drugs reduce cardiac output, thereby reducing the chronotropic response to effort (e.g. beta-blockers), and others are banned by the International Olympic Committee as doping agents (e.g. beta-blockers, diuretics).

TRANSCATHETER ABLATION

Transcatheter alation is widely used in clinical practice to treat tachyarrhythmias. This procedure creates one or more coagulative lesions in the myocardium which tend to heal within a few days. There is no evidence to suggest that ablation has major arrhythmogenic effects. The treated arrhythmia may recur if the lesion is insufficient and its efficacy only transitory, though in general this will come to light within a few hours or a few days. After an efficacious ablation procedure, patients can undertake physical activity compatible with their state of health within a fairly short time (one month), as long as they suffer no symptomatic or electrocardiographic (e.g. reappearance of the delta wave in WPW] recurrence. In asymptomatic subjects, follow-up electrophysiological study is not normally necessary, with the exception of particular cases.

Patients who undergo ablation for atrial fibrillation (pulmonary vein isolation, etc] or for atrial flutter, often suffer early recurrences, which may be asymptomatic. Moreover, many of these patients have to remain on anticoagulant therapy for long periods. An adequate observation period is therefore necessary before any type of physical exercise can be prescribed.

PACEMAKERS (PM]

Patients who have a PM may or may not be affected by structural heart diseases and by various arrhythmias. The type of physical activity that can be undertaken will depend on these differing circumstances[1-4]. The following recommendations apply to these patients:

a. In the first 6 months after implantation, the patient should avoid vigorous exercise and extreme movements of the ipsilateral limb, in order to avoid lead dislodgement;
b. Activities involving physical contact or high intrinsic risk, and those performed in high-pressure environments e.g. sub-water diving], are to be avoided, as these may damage the stimulator and/or the pacing leads. These precautions

TABLE 1. Recommendations for exercise prescription in individual arrhythmias

Arrhythmia	Evaluations Recommended	Clinical Situations	Recommendations
Severe sinus bradycardia (<40 bpm) and/or pause >3 sec.	ET, Holter, consider Echo	a) asymptomatic, non-cardiopathic b) asymptomatic after de-training c) symptomatic	a) any activity b) low-intensity activity without intrinsic risk c) pacemaker implantation
Second-degree AVB, type 2, and third-degree AVB	ET, Echo, Holter, consider EPS	a) asymptomatic, non-cardiopathic, sporadic nodal AVB b) symptomatic, cardiopathic, persistent subnodal AVB	a) any activity b) pacemaker
Frequent supraventricular premature beats	Holter, Echo, consider ET	a) asymptomatic, non-cardiopathic b) cardiopathic	a) any activity b) individual decision
Ventricular premature beats	Holter, Echo, ET	a) asymptomatic, non-cardiopathic b) cardiopathic, frequent/repetitive forms	a) any activity, if repetitive forms, individual decision b) low-moderate intensity activity
Persistent or paroxysmal atrial fibrillation and flutter	Holter, Echo, ET	a)asymptomatic, non-cardiopathic, heart rate not elevated on effort b) symptomatic, cardiopathic c) subjects on anticoagulant therapy	a) any activity b) low-moderate intensity activities without intrinsic risk c) avoid activities at risk of injury
Permanent atrial fibrillation and flutter	Holter, Echo, ET	a)asymptomatic, non-cardiopathic, heart rate not elevated on effort b) symptomatic and cardiopathic c) subjects on anticoagulant therapy	a) low-moderate intensity activities b) low intensity activities without intrinsic risk c) avoid activities at risk of injury; consider ablation, particularly in cases of flutter
Supraventricular tachycardias without pre-excitation	Echo, Holter, ET (consider EPS)	a) sporadic forms, of brief duration, not related to effort, without syncope or heart disease b) all other cases	a) any activity, excluding those with intrinsic risk; consider ablation b) mild intensity activities; consider ablation
WPW syndrome	Echo, ET, Holter (consider EPS)	a)asymptomatic, non-cardiopathic b) symptomatic for reciprocating tachycardias c) symptomatic for atrial fibrillation	a) mild intensity activities; for moderate-high intensity activities EPS b) EPS: if at risk, no activity or ablation c) no activity; suggest ablation
Non-sustained ventricular tachycardia	Echo, Holter, ET; consider coronary angiography	a) no family history of sudden death, asymptomatic, non-cardiopathic, typical outflow tract or fascicular forms b) symptomatic, cardiopathic	a) mild-moderate intensity activities; consider ablation b) mild intensity activities
Sustained ventricular tachycardias	Echo, Holter, ET; consider coronary angiography	a) no family history of sudden death, asymptomatic, non-cardiopathic, typical outflow tract or fascicular forms b) symptomatic, cardiopathic	a) mild-moderate intensity activities; consider ablation b) mild intensity activities; consider ablation

AVB= atrio-ventricular block; Echo = echocardiography; ET = exercise test; EPS = electophysiological study

TABLE 2. Recommendations for exercise prescription in arrhythmogenic genetic diseases

Syndrome	Evaluations Recommended	Clinical Situations	Recommendations
Long-QT syndrome (QTc >450 ms in males and >470 ms in females)	Holter, Echo, ET	a) asymptomatic, carrier of the genetic defect with negative phenotype b) symptomatic	a) mild intensity activities; avoid sudden effort and activities with intrinsic risk. Consider ICD for high-risk subjects (QTc >600 ms, etc) b) mild intensity activities
Short-QT syndrome (QTc <320 ms)	Holter, Echo, ET	a) asymptomatic, no family history of sudden death b) family history of sudden death, symptomatic	a) mild intensity activities. Consider ICD for carriers of the genetic defect and in the positive phenotype b) No activity; consider ICD
Brugada's syndrome	Holter, Echo, ET; consider EPS	a) asymptomatic, low-risk b) asymptomatic, high-risk c) symptomatic	a) mild intensity activities b) mild intensity activities; consider ICD c) Consider ICD
Arrhythmogenic right ventricle cardiomyopathy	Holter, Echo, ET	a) asymptomatic without arrhythmias b) asymptomatic with non-repetitive arrhythmias c) symptomatic	a) mild-moderate intensity activities b) mild intensity activities; avoid aerobic activities c) Consider ICD
Catecholaminergic ventricular tachycardia	Holter, Echo, ET	In all cases	Mild intensity activities Consider ICD
Hypertrophic cardiomyopathy	Holter, Echo, ET	a) asymptomatic, low-risk b) symptomatic and/or high-risk	a) mild intensity activities b) mild intensity activities; consider ICD

are particularly important if the patient is PM-dependent;

c. Correct adjustment of the heart rate during effort should be assessed (by means of exercise testing and/or Holter monitoring). In this regard, it should be pointed out that, in sinus node disease, heart rate adjustment during effort is enabled by the AAI-R and DDD-R stimulation modes; in complete AVB, by the DDD and VDD modes; and in chronic atrial fibrillation, by the VVI-R mode. Given the different features of the sensors utilized in rate-responsive PM, evaluation must be made on a case-by-case basis;
d. Since right ventricular stimulation can, in time, worsen left ventricular pump function and/or accentuate mitral regurgitation, these parameters should be checked periodically.

IMPLANTABLE DEFIBRILLATOR (ICD)

A patient with an ICD may have a structurally normal heart or be affected by organic diseases that do not significantly compromise left ventricular pump function. Many patients, especially if young, should not be precluded from an active life, or even from sport, simply because they have an ICD. Moreover, even patients with structural heart disease can benefit from physical exercise[1-4].

In ICD patients, in addition to the recommendations applicable to PM patients, the following considerations should be made:

a. patients who have already suffered from ventricular tachycardias or ventricular fibrillation should not undertake demanding physical activity for at least six months after the last appropriate ICD intervention;
b. it should be borne in mind that sinus tachycardia may cause inappropriate shocks, as the ICD may interpret the sinus tachycardia as a ventricular tachycardia if it exceeds the programmed cut-off rate. To obviate this risk, the ICD should be a dual-chamber model (which discriminates better between the two situations); the discrimination algorithms should be active; the programmed cut-off rate should be high (if possible, above the patient's maximum heart rate); and the use of beta-blockers should be considered. In addition, patients should be made aware of the problem so that they can check their own heart rate during effort. Given the wide variability among individual patients, evaluation (by means of exercise testing and/or

Holter monitoring) should be made on a case-by-case basis;

c. in spite of the protection provided by the ICD, activities that can trigger malignant arrhythmias are to be avoided.

REFERENCES

1. Delise P, Guiducci U, Zeppilli P, et al. Cardiological guidelines for competitive sports eligibility. *Ital Heart J* 2005; 6(8):661-702.
2. Maron BJ, Zipes D. 36th Bethesda Conference: eligibility recommendations for competitive athletes with cardiovascular abnormalities. *J Am Coll Cardiol* 2005; 45: 1312-75.
3. Pelliccia A, Fagard R, Bjornstad HH, et al. Recommendations for competitive sports participation in athletes with cardiovascular disease. *Eur Heart J* 2005; 26:1422-45.
4. Biffi A, Pelliccia A, Verdile L, et al. Long-term clinical significance of frequent and complex ventricular tachyarrhythmias in trained athletes. *J Am Coll Cardiol* 2002; 40:446-452.
5. Maron BJ, Chaitman BR, Ackerman MJ, et al. Recommendations for physical activity and recreational sports participation for young patients with genetic cardiovascular diseases. *Circulation* 2004; 109:2807-16.