Abstracts

VIIth Symposium Heart and Competitive Sports Bad Oeynhausen, April 28-29, 2006

Athletes With Cardiac Diseases: Clinical Aspects, Diagnostic Options, Current Recommendations

Competitive sports in asymptomatic and symptomatic athletes with cardiovascular disorders is associated with an increased hazard of sudden cardiac death or clinical deterioration.

In cooperation with experts in the field of cardiovascular diseases, exercise physiology, sports medicine and clinical cardiology, the working group "Sports Cardiology" of the European Society of Cardiology (ESC) has established recommendations for competitive athletes on the basis of our present knowledge. These recommendations are intended to find a balance between the calculable risk and the potential hazard associated with physical exercise without excessive restrictions. In this context, nearly all fields of cardiology – from congenital to acquired heart diseases - are considered.
The working group "Sports Cardiology" of the European Society of Cardiology places particular emphasis on a Europe-wide consideration of these recommendations. Pilot studies have shown that a structured basic screening is supposed to be highly efficient and may reduce the risk of cardiovascular fatalities.

On the occasion of the VIIth Symposium „Heart and Competitive Sports", members of the working group "Sports Cardiology" of the ESC presented and discussed these recommendations.

ABSTRACT No. 1

Heart and competitive sports: screening in young children (<12 years)

Nicole M Panhuyzen-Goedkoop, (sports)cardiologist[1,2], Joep LRM Smeets, cardiologist[1]

Heart Centre Radboud University Hospital Nijmegen[1] & Centre for Sportscardiology Sint Maartenskliniek – SMC Papendal Arnhem[2], the Netherlands

Background

In 2005 the European Society of Cardiology (ESC) study group of Sports cardiology issued a consensus statement for a common "European protocol" on preparticipation cardiovascular screening (PCS) in young competitive athletes (12-35 yr). Italian data have demonstrated that personal history, family history, physical examination and resting 12-lead ECG can reduce exercise related cardiac events, such as sudden cardiac death (SCD). However, in children below 12 years of age, there is no statement concerning preparticipation cardiovascular screening.

Method

The literature was reviewed by Medline for the last 5 years using the key words sudden cardiac death, children, athlete, and syncope.

Results

SCD in children (< 12 yr) is classified in 3 groups: sudden infant death syndrome (< 1 yr), SCD with unknown cardiac disease and SCD in congenital cardiac disease. The incidence of SCD with unknown cardiac disease in girls and boys is low: 0.64 resp. 1.7/100 000; 91 % is due to cardiac arrhythmia. The incidence of SCD in children during exertion is not determined. Syncope accounts for 1/2 000 emergency pediatric visits, and is highest among girls 15-17 yr. Syncope or palpitations during exertion, and family history of SCD are "alarming" symptoms with a high risk of SCD during sports. Especially if syncope occurs during peak exertion, is recurrent, results in significant injury, is preceded by chest pain, or with a family history of SCD.
Causes of SCD < 12 yr are: anomalous coronary arteries, myocarditis, electrical diseases (Brugada syndrome, long and short QT syndrome, arrhythmogenic right ventricular cardiomyopathie, supraventricular tachycardia), (sub)valvular aortic stenosis, and blunt chest trauma. Hypertrophic cardiomyopathy, although seen in the very young, usually develops during adolescence with rapid hypertrophy during rapid growth and development, and is therefore not a common cause of SCD during sports < 12 yr. Ischaemia, electrical diseases and long/short QT syndromes all induce ventricular arrhythmia during exertion, leading to SCD.

Conclusions

There is no evidence for preparticipation cardiovascular screening in children (< 12 yr) and it should not be routinely performed. However, if there are "alarming" symptoms or family history of SCD extensive preparticipation cardiovascular evalutation is warranted. Recommendations for sports participation should follow the recommendations for 12-35 yr.

ABSTRACT No. 2

Stress ECG in patients with ischemic heart disease (HID) or with high risk factor profile for HID

Deodato Assanelli, Floriana Bandera

Cattedra di Medicina dello Sport, Università degli Studi di Brescia, Italy

Ischemic heart disease (HID) is the leading cause of death in the western world and the self-reported prevalence of HID increases with age. In addition, the prevalence of clinically asymptomatic HID (silent ischemia) is estimated to be 2-4 % in the general population and 10 % in individuals with two or more risk factors for HID. HID also accounts for most exercise-related sudden deaths: in fact, sudden cardiac death is often the initial coronary event in patients with either silent or symptomatic HID.
The risk for triggering fatal/non-fatal coronary events increases transiently during vigorous physical activity. However, the benefits of regular physical activity by far outweighs the increased relative risk for triggering a coronary event during the exercise session. Positive effects of regular physical activity is largely associated with moderate intensity activity that increase vagal tone. In contrast, potential negative effects are almost exclusively related to high intensity activity, that typically stimulates sympathetic tone, and increase adrenalin with increased risk for dysrhythmia in patients with underlying IHD. Therefore it is essential to give the patients with IHD who wants to take part in competitive sports or leisure-time sport activity, instructions on how to be physically active at safe intensity level.

Exercise testing is a cardiovascular stress using treadmill or bicycle exercise and electrocardiographic and blood pressure monitoring. Exercise testing has three important contents:

- Diagnostic content: stress ECG is able to detect a coronary artery disease and the stenosis level.
- Prognostic content: stress ECG ST- segment depression is a prognostic marker of adverse cardiac outcomes in coronary artery disease.
- Functional content: during the stress ECG it's possible to de termine the oxygen consumption and so the assessment of left ventricular function.

Exercise testing is widely available and relatively low cost. Compared with imaging procedures such as stress echocardiography, stress single-photon emission computed tomography, myocardial perfusion imaging and coronary angiography, treadmill exercise testing can be performed at a much lower cost. Stress ECG has a good sensibility and specificity for detecting coronary stenoses, even if the ECO stress is better (on condition that the test is carry out to elevated double products).

Exercise testing should be supervised by an appropriately trained physician. The electrocardiogram, heart rate, and blood pressure should be carefully monitored and recorded during each stage of exercise as well as during ST-segment abnormalities and chest pain. The patient should be continuously monitored for transient rhythm disturbances, ST- segment changes and other electrocardiographic manifestations of myocardial ischemia.

The parameters monitored in this test are:

HR – heart rate: % on theoretical HR: min target 90 %
- man: Theoretical HR = 200 – age
- woman: Theoretical HR 220 – age
BP- blood pressure: danger when systolic > 240 mmHg and/or diastolic > 115 mmHg
DP - double product = HR x systolic BP: min target 20 000

The double product is considered the global index for the cardiovascular system, depending on patient history and cardiologist DP knowledge can be used to stop the test.
Although exercise testing is commonly terminated when subjects reach an arbitrary percentage of predicted maximum heart rate, the use of rating of perceived exertion scales, such as the Borg scale, is often helpful in assessment of patient fatigue. Symptom-limited testing using the Borg scale as an aid is very important when the test is used to assess functional capacity. Interpretation of the exercise test should include exercise capacity and clinical, haemodynamic, and electrocardiographic response. The occurrence of ischemic chest pain consistent with angina is important, particularly if it forces termination of the test. Abnormalities in exercise capacity, systolic blood pressure response to exercise, and heart rate response to exercise are important findings. The most important electrocardiographic findings are ST depression and elevation. The most commonly used definition for a positive exercise test result from an electrocardiographic standpoint is greater than or equal to 1 mm of horizontal or downsloping ST- segment depression or elevation for at least 60 to 80 milliseconds after the end of the QRS complex.

Stress ECG has two limitations:
- It's able to detect the coronary disease but unable to detect the development from chronic to acute disease.
- Stress ECG may give from 20 % to 30 % of negative false results, because of its sensibility and specificity.

Patients without evidence of HID, but with one or more classical risk factors for HID
According to the SCORE - system, in asymptomatic, apparently healthy subjects, the total HID risk level can be estimated from the presence of the major risk factors namely age, sex, smoking, blood pressure, and total cholesterol - level, as well as diabetes. Patients with a high risk factor profile for future cardiovascular events (> 5 % risk in SCORE) should be further evaluated to rule out silent or symptomatic ischemia, by extensive symptom evaluation (especially ask for atypical symptoms) and by maximal physical stress ECG if competitive sports is intended. For recreational sports/leisure time activity only on an individual basis.

Stress ECG remains the most evaluated test to unmask a high ischemic-threshold, and the exercise test may be useful when combined with the SCORE-system to risk-stratify asymptomatic individuals in a screening programme. Alternatively, stress scintigraphy or stress echocardiography may be superior to stress ECG, mainly in doubtful cases, but costs are higher.

Athletes with known HID
Includes athletes with unstable angina, stable angina, post myocardial infarction, post CABG/PCI and silent ischemia.

Exercise test has a good sensitivity and specificity for CAD (coronary artery disease) screening in subjects with high pretest probability of disease because of the presence of two or more coronary risk factors. The ischemia on exercise ECG does predict the likelihood of future hard cardiovascular events. This is greatly influenced by functional capacity and the threshold at wich the ischemia develops, but far less so by the concurrent occurrence of pain during the test.

We shell define:
- Stable patients those who develop symptoms at a high threshold, whose stenoses are stable and that have cardiovascular risk factors under control
- Unstable patients those who have a high probability for exercise-induced events (Significant coronary stenosis of main coronary arteries (> 70 %) or left main stem (> 50 %), regardless of risk-factor status, exercise induced pathological dyspnoea or syncope).

ABSTRACT No. 3

Recommendations for sports in athletes with valvular heart disease

Frank van Buuren, Klaus Peter Mellwig

Department of Cardiology, Heart and Diabetes Center North Rhine-Westphalia, Ruhr University Bochum, Bad Oeynhausen, Germany

Introduction
Physical check-ups among athletes with valvular heart disease are of signicant relevance. The specific valve lesion and its degree of severity is assessed clinically and by echocardiography according to the ASE (American Society of Echocardiography) guidelines. In addition to history taking and physical examination an ECG has to be obtained. A chest x-ray may be necessary.
Exercise testing should be obtained after evaluation of the heart valves by echocardiography. In certain cases Holter-ECG may be useful. Cardiac catheterisation may occasionally be required in those patients in whom discrepancies between clinical and echocardiographic findings regarding the severity valve defects occur. There are no valid statements about the influence of physical activity on progression of valvular disease. Moreover, little is also known about the influence of isometric efforts on the progression of ventricular dysfunction. The extent of physical activity can be subdivided into "dynamic" and "static" and 3 levels of intensity (low, moderate, high). According to this classification the recommendations have been given.
The most common valve defects are described as follows. For additional information see EHJ 26 (2005) 1422-1445.

Mitral valve stenosis
Mitral valve stenosis (MVS) is usually of rheumatic origin. It accounts for 12 % of single native valve disease in the Euro Heart Survey (EHS). Patients who develop a pulmonary arterial systolic pressure of more than 60 mmHg under stress are at risk of severe adverse effects on right ventricular function.
Recommendations: Patients with sinus rhythm (SR) and mild MVS can participate in all types of competitive sports. Individuals with mild MVS and atrial fibrillation in combination are allowed to perform low/moderate dynamic and static type of sport. Athletes with moderate or severe MVS should not participate in competitive sports. Patients under anticoagulation should not participate in any types of sports associated with a high probability of injury.

Mitral valve regurgitation
Mitral valve regurgitation (MVR) is the second most common valve lesion after aortic stenosis and was present in 31 % of all valve lesions encountered in the EHS.
The most frequent cause for MVR is a prolapse of the leaflets. Assessing the impact of volume load on the left ventricle in MVR it should be taken into consideration that end-diastolic left ventricular size in well trained and healthy athletes is higher than in non-athletes. Recommendations: Patients with mild to moderate MVR, maintained SR, a normal exercise test, with normal left ventricular size and function may participate in all types of sport. Cardiac reevaluation should be performed once a year. Patients with mild to moderate MVR, SR, mild left ventricular dilatation and normal resting left ventricular function may participate in low/moderate isometric and dynamic type of sport. Athletes with moderate to severe MVR and marked left ventricular enlargement (LVEDDI > 34 mm/m^2 and LVESDI of > 23 mm/m^2) or resting left ventricular dysfunction should not participate in sport.

Aortic valve stenosis
Aortic valve stenosis (AVS) is the most common valve lesion, accounting for 42 % of all native valve lesions in the EHS. The most common etiology in adults is degenerative.
Recommendations: Asymptomatic athletes with mild AVS may take part in low/moderate static or dynamic types of sports, as long as LV function and size is normal, a normal response to exercise is present and there are no arrhythmias. Asymptomatic athletes with moderate AVS should only take part in sports with low dynamic and static stress. Patients with moderate AVS and left ventricular dysfunction or marked left ventricular hypertrophy (> 15 mm) or patients with severe AVS and/or relevant dilatation of the ascending aorta should not participate in competitive sport.

Aortic valve regurgitation
Aortic valve regurgitation (AVR) was present in 13 % of patients in the EHS on valvular heart disease. It is unclear how competitive exercise training affects prognosis.
Recommendations: Athletes with mild or moderate aortic valve regurgitation, with normal end-diastolic left ventricular size and systolic function can participate in all types of sport. In asymptomatic moderate AVR and progressive left ventricular dilatation, sports of low dynamic and low static intensitiy may be carried out. Regular clinical and echocardiographic evaluations at half yearly intervals are important. Athletes with mild or moderate aortic valve regurgitation and significant ventricular arrhythmia at rest or during exercise should not participate in competitive sports. Athletes with severe aortic regurgitation and/or marked dilatation of the ascending aorta (> 50 mm) should not participate in competitive sports, irrespective of the left ventricular function and should be evaluated for valve surgery.

Tricuspid regurgitation
Tricuspid regurgitation (TVR) is often the result of right ventricular dilatation and pulmonary hypertension, most commonly due to mitral valve disease. There is no indication that athletes with isolated primary tricuspid valve insufficiency are exposing themselves to an acute risk if they follow a physical activity.
Recommendations: Patients with isolated mild to moderate tricuspid valve regurgitation may take part in competitive sports. High intensive dynamic and/or static sports activities should be avoided.

Mitral valve prolaps
A mitral valve prolapse (MVP) is mostly associated with structural diseases of the myocardium and endocardium in the sense of a myxomatous proliferation. Ischaemic cardiomyopathy and hypertrophic obstructive cardiomyopathy might also cause MVP. Holter-ECG monitoring should also be performed, to detect significant arrhythmias. In cases of complex arrhythmia, family history of sudden cardiac death, syncopes or severe MVR no competitive sports are allowed. In absence of the above cited characteristics, all types of sports can be performed.

Endocarditis prophylaxis
All athletes with known valvular heart disease or a previous history of infective endocarditis should receive endocarditis prophylaxis before dental, oral, respiratory, intestinal and genitourinary procedures associated with bacteremia. Sport activities have to be avoided during active infection with fever.

ABSTRACT No. 4

Recommendations for Endocarditis Prophylaxis in Athletes With Cardiac Diseases

Cornelia Piper, Dieter Horstkotte

Department of Cardiology, Heart and Diabetes Center North Rhine-Westphalia, Ruhr University Bochum, Bad Oeynhausen, Germany

Infective endocarditis (IE) is an endovascular infection of cardiovascular structures or intracardiac foreign bodies (e.g. prosthetic valves, pacemaker or ICD leads, surgically created conduits) facing the blood with an appr. annual infection rate of 7 cases per 1 000 population. With a mortality rate up to 40-56 %, infective endocarditis is still a serious disease.
The prerequisite for the development of IE is colonization of the endocardium by microorganisms capable of reproduction. Exogenic bacteraemias may occur following diagnostic or therapeutic interventions or injury. Arterial and venous abscesses, indwelling catheters, respiratory treatment and infections can cause persisting endogenic bacteraemias. Although nearly all microorganisms may colonize the endocardium under appropriate conditions, gram-positive cocci constitute appr. 90 % of endocarditis pathogens. As previously undamaged endocardium is resistant to colonization by microorganisms, only athletes with some preexisting cardiac diseases carry a certain risk for the development of IE. This risk may be low or high depending on the underlying disorder.

The observation described first in 1944 about a relationship between transient bacteraemia (often due to viridans streptococci after dental extraction) and bacterial endocarditis in patients predisposed by rheumatic heart diseases forms the basis for the use of antibiotics to prevent IE in patients/athletes undergoing dental treatment or other procedures that may cause bacteraemia. Despite a lack of convincing evidence, analysis of all material presently available results in a class I recommendation (level C evidence) for antibiotic prophylaxis (ESC Guidelines 2004).

Antimicrobial prophylaxis is indicated in athletes with the following cardiac conditions:

- Prosthetic heart valves (high-risk group)
- Complex congenital cyanotic heart diseases
- Previous infective endocarditis (high-risk group)
- Surgically constructed systemic or pulmonary conduits (high-risk group)
- Acquired valvular heart diseases
- Mitral valve prolapse with valvular regurgitation or severe valve thickening
- Non-cyanotic congenital heart diseases (except for secundum type ASD)
- Hypertrophic cardiomyopathy when exposed to risk of bacteriaemia in accordance with the ESC recommendations.

Prophylaxis should be performed as follows:

Dental, oral, respiratory, and oesophageal procedures:
- Not allergic to penicillin, oral prophylaxis:
  Amoxicillin 2.0 g 1 h before procedure.
- Not allergic to penicillin, unable to take oral medication:
  Amoxicillin or ampicillin 2.0 g i.v. within 1/2 - 1 h before procedure. A second amoxicillin dose is not necessary(3).
- Allergic to penicillin, oral prophylaxis:
  Clindamycin 600 mg or azithromycin or clarithromycin 500 mg 1 h before procedure.

Genitourinary or gastrointestinal procedures:
- Not allergic to penicillin, high-risk group: Ampicillin or amoxicillin 2.0 g i.v. or i.m. plus gentamicin 1.5 mg/kg within 1/2 - 1 hr i.m. or i.v. before procedure; 6 h later, ampicillin or amoxicillin 1 g p.o.
- Not allergic to penicillin, moderate-risk group: Ampicillin or amoxicillin 2.0 g i.v. or i.m. within 1/2 - 1 h before procedure, or amoxicillin 2.0 g p.o. 1 h before procedure.
- Allergic to penicillin, high-risk group: Vancomycin 1.0 g) over 1-2 h plus gentamicin 1.5 mg/kg i.v. or i.m.
- Allergic to penicillin, moderate-risk group: Vancomycin (see above) without gentamicin.

To ensure proper prophylaxis, adequate information of the athlete is the most critical issue. Athletes with these cardiac conditions must be really aware of the potential risks and threats which might occur in particular with dental procedures. Therefore, the athlete should receive written information and a certificate. The athlete should be informed that the cause of any fever should be investigated before antibiotics are given. One of the most common misinterpretations is occurrence of fever, which is most often due to a virorespiratory infection. Unfortunately, antibiotic prophylaxis is often requested and prescribed in this situation.

As a general rule, all sports activities should be avoided when active infection with fever is present. Resumption of sports activities can be considered when the inflammatory process is completely extinguished. The rules of endocarditis prophylaxis should be strictly observed by all athletes at risk.

ABSTRACT No. 5

Recommendations for sports in patients with ventricular arrhythmias and ICD

Hein Heidbüchel

Cardiology - Electrophysiology, University Hospital Gasthuisberg

Introduction

Ventricular tachyarrhythmias form the major final common pathway to sports-related sudden death. Moreover, they may result in hemodynamic impairment with the risk of syncope or presyncope which may compromising the safety of the athlete or other participants during sports participation. Many cardiovascular conditions, like hypertension, ischemic and valvular heart disease, congenital malformations and dilated cardiomyopathy, may predispose to ventricular arrhythmias. These underlying diseases are discussed in other presentations. The question of imminent life-threatening arrhythmias is especially present when 1) some form of ventricular rhythm disorder is documented, or 2) when the patient is diagnosed to have inherited a genetic disorder (channelopathy) that may predispose to ventricular arrhythmias.

Recommendations are guidelines for individualized medical advice, not rigid standards. The physician should also discuss with the patient that systematic or progressive training cannot cure or prevent exercise-related arrhythmias, contrary to the belief of many. Extensive descriptions of recommendations summarized here can be found in the literature (1-3).

Documented arrhythmias

Documentation of ventricular extrasystoles (VPB), certainly when frequent (i.e. > 2 000/24h), should prompt for a more thorough evaluation to rule out underlying heart disease. The optimal assessment strategy is not known but routine screening should at least be supplemented with echocardiography (to rule out dilated, hypertrophic and right ventricular cardiomyopathy, pulmonary hypertension or valve disease), exercise testing (inducible arrhythmias) and 24h Holter (if possible also during training and competition). Further imaging like coronary angiography (coronary abnormalities or premature atherosclerosis) and cardiac magnetic resonance imaging (arrhythmogenic right ventricular cardiomyopathy, ARVC) needs to be considered. Imaging however may not be able to rule out unequivocally mild structural changes nor underlying inherited arrhythmogenic conditions. Therefore, careful assessment of electrophysiological data is warranted. This includes 1) evaluation of repolarisation abnormalities (ARVC, HCM, long or short QT syndrome, Brugada syndrome), 2) late depolarisation (epsilon waves, late potentials), 3) careful evaluation of the 12-lead morphology of any documented arrhythmia (which may be indicative of idiopathic right ventricular outflow tract tachycardia or LV fascicular tachycardie, or show prognostically ominous polymorphic). In some cases, an invasive electrophysiological study may be warranted to evaluate the inducibility of sustained arrhythmias, to differentiate from supraventricular tachycardia with aberrant conduction, and to assess the arrhythmia mechanism (automaticity or reentry).

Athletes with frequent VPB or nonsustained VT and underlying abnormalities should not participate in competitive sports, since even activities with low cardiovascular demand may be associated with important changes in autonomic tone which could lead to more malignant arrhythmias and sudden cardiac death. In the absence of identifiable underlying structural heart disease competitive or intensive recreational sports can be allowed when there is a) absence of any familial antecedents of sudden

death, b) a typical presentation of idiopathic RVOT ectopy or fascicular VT (or another idiopathic form of automatic and slow VT ≤ 150 bpm) with nonsustained bouts of tachycardia (≤ 8-10 beats), and c) no symptoms of hemodynamic compromise during exercise. When such patients require drug treatment for suppression, more caution should be used since the extreme conditions of competition can never fully be reproduced during non-invasive or invasive testing: repeated event-recording during real-life sports is mandatory. Also in rare cases with a manifest transient etiology (like myocarditis or electrolyte disturbances) and after complete resolution is confirmed (including absence of any inducible arrhythmias during exercise or EP study), resumption of competitive sports can be considered after a 3 to 6 month period.

In some athletes implantation of an automatic implantable defibrillator (ICD) may be warranted. The ICD is no substitute for the prohibition to perform competitive or high-intensity leisure-time sports since the safety under these circumstances is unknown and may be suboptimal. Moreover, vigorous activity increases the risk for inappropriate therapy which is a psychological burden and may even be dangerous.

Some ventricular arrhythmias (mainly idiopathic and/or focal types) are amenable to radiofrequency catheter ablation, with a reasonable ablation success. The procedures however carry a small risk, which should be discussed with the athlete. After successful ablation and absence of any recurrent symptoms during a 6 w to 3 m period, resumption of competitive or leisure-time athletic activity can be permitted in patients without underlying structural disease. Close early follow-up is warranted (every 3 m for the first year, and immediately after recurrence of symptoms), since some may have underlying slowly progressive cardiac disease which will only manifest itself over time. There are no data to indicate that resumption of athletic activity after successful ablation of reentrant ventricular arrhythmias is safe, since the underlying substrate likely is still present.

In all other patients with documented ventricular arrhythmias, only light-to-moderate leisure-time activity can be allowed, provided that there is proven arrhythmic control with installed therapy.

Inherited arrhythmogenic conditions (channelopathies)
A number of familial arrhythmogenic conditions have been characterized over the last decades. They have in common that they are associated with life-threatening arrhythmias in young adults. They are mainly due to mutations in transmembrane ion channels or proteins involved in intracellular (sarcolemmal) calcium handling. They include long- and short-QT syndromes (with a prolonged QT interval sometimes only evident after exposure to drugs or other factors), Brugada syndrome, catecholaminergic polymorphic VT (CPVT) and other forms of familial electrical disease without known underlying etiology at present.

Unequivocal diagnosis for any of these entities may be difficult. It requires specialist assessment, sometime including direct genotyping. Phenotypic and genotypic findings will define a risk profile for any individual. If considered at high risk for sudden death, a prophylactic ICD may be implanted. Generally, competitive sports are not allowed with these arrhythmogenic conditions and recreational activity should be restricted to a moderate level. When in patients with a Brugada-like ECG the risk for malignant ventricular arrhythmias and sudden death is judged to be low, all non-competitive sports activity can be allowed.

Patients should however be convinced that re-evaluation is urgently needed in case of symptoms of hemodynamic impairment (even when aspecific). In long-QT patients specific triggers, like abrupt exertion or diving, need to be avoided. In LQTS, CPVT and ARVC, even activities with low cardiovascular demand may be associated with important changes in autonomic tone which could lead to malignant ventricular arrhythmias and sudden cardiac death. Such low-intensity sports can only be allowed in proven SCN5A mutation carriers, since they are mainly at risk for malignant arrhythmias at rest. In other LQTS patients, beta-blockers remain the mainstay therapy, but are no substitute for recommendations regarding sports participation. The same holds true for CPVT. Any drug that may prolong the QT interval is prohibitid in LQTS patients or gene carriers. For the other entities, there is no known effective drug therapy.

No firm data exist concerning the exercise-related risk of silent mutation carriers, i.e. family members without overt phenotype but with a proven mutation. They become more prevalent with more widespread availability of genotyping. Given the fact that sudden death has been described in such carriers, it seems advisable to also refrain them from competitive sports, especially when there is a family history of sudden death.

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ABSTRACT No. 6

Recommendations for participation in sports in athletes with hypertension

Fagard RH, MD, PhD

Hypertension and Cardiovascular Rehabilitation Unit, Department of Cardiovascular Diseases, Faculty of Medicine, University of Leuven, Belgium

Introduction
Hypertension is defined as systolic blood pressure (BP) ≥140 mm Hg and/or diastolic BP ≥ 90 mmHg, measured by conventional techniques in the seated subject according to established guidelines (1-3). Isolated systolic hypertension corresponds to an elevated systolic BP with normal diastolic BP. Subjects with elevated BP in the clinic and normal out-of-office BP have white-coat or isolated clinic hypertension. The current threshold for an elevated 24-hour ambulatory BP is 125/80 mmHg; the threshold for daytime ambulatory BP and home BP is 135/85 mmHg (3).

Risk stratification
The severity of hypertension does not only depend on the BP level, but also on the presence of other cardiovascular (CV) risk factors, target organ damage and CV and renal complications, i.e., the overall CV risk; the current risk stratification is based on the presence of selected risk factors, target organ damage and/or of associated clinical conditions (1). The terms low, moderate, high and very high added risk, in comparison with healthy normotensive subjects without risk factors, are calibrated to indicate an approximate absolute 10-year risk of CV disease of < 15 %, 15-20 %, 20-30 % and > 30 %, respectively, according to the Framingham criteria, or an approximate absolute risk of fatal CV disease of < 4 %, 4-5 %, 5-8 % and > 8 % according to the European SCORE system (2). With regard to left ventricular (LV) hypertrophy, it should be noted that sports activity itself may induce hypertrophy; the pattern of hypertrophy and assessment of diastolic LV function may help to distinguish between hypertensive heart disease and athlete's heart (4).

Evaluation
Diagnostic procedures comprise repeated BP measurements according to established guidelines (1-3), medical history, physical examination, laboratory and instrumental investigations, of which some should be considered part of the routine approach in all subjects with high BP, and some are recommended in the hypertensive athlete. For instance, echocardiography and exercise testing (with ECG and BP monitoring), which are not always included in the evaluation of the hypertensive patient, are warranted as routine tests in the hypertensive athlete. Additional tests, such as stress echocardiography/myocardial scintigraphy and/or 24-h Holter ECG monitoring may be recommended depending on the patient's symptoms, CV risk profile, associated clinical conditions and the results of the first set of investigations.

Recommendations

General recommendations
Athletes with hypertension should be treated according to the general guidelines for the management of hypertension (1). Appropriate non-pharmacological measures should be considered in all patients. Antihypertensive drug therapy should be started promptly in patients at high or very high added risk for CV complications. In patients at moderate added risk, drug treatment is only initiated when hypertension persists after several months despite appropriate lifestyle changes. Drug treatment is not considered mandatory in patients at low added risk. The goal of antihypertensive therapy is to reduce BP to at least below 140/90 mmHg and to lower values if tolerated in all hypertensive patients, and to below 130/80 mmHg in diabetics. Current evidence indicates that patients with white-coat hypertension do not have to be treated with antihypertensive drugs, unless they are at high or very high risk, but a regular follow-up and non-pharmacological measures are recommended (1).

Choice of drugs
Several drug classes can be considered for first-line antihypertensive therapy: diuretics, beta-blockers, calcium channel blockers, angiotensin converting enzyme inhibitors and angiotensin II receptor blockers (1). However, in endurance athletes diuretics and beta-blockers are not recommended because they may impair exercise performance and capacity and/or cause electrolyte and fluid disturbances (5, 6). In addition, they are on the doping list for some sports, in which weight loss or control of tremor are of paramount importance. Calcium channel blockers and blockers of the renin-angiotensin system are the drugs of choice for the hypertensive endurance athlete (7) and may be combined in case of insufficient BP control. However, the combination of an angiotensin converting enzyme inhibitor and an angiotensin II receptor blocker is currently not advocated. If a third drug is required, a low dose thiazide-like diuretic, possibly in combination with a potassium sparing agent, is recommended. There is no unequivocal evidence that antihypertensive agents would impair performance in static sports.

Recommendations for sports participation
Recommendations for participation in competitive sports in athletes with hypertension are based on the risk stratification, and with the understanding that the general recommendations for the management of hypertension are observed, that blood pressure and risk factors are controlled and that the clinical condition is stable (8). Recommendations for the various risk categories are as follows: - low risk: all sports; - moderate risk: all sports with exclusion of high static, high dynamic sports (III C); - high risk: all sports, with exclusion of high static sports (III A-C); - very high risk: only low-moderate dynamic, low static sports allowed (I A-B). In patients with secondary hypertension, clinical and diagnostic evaluation for sports participation is postponed to after the removal of the cause of hypertension, if possible. Patients with polycystic kidney disease or with coarctation of the aorta should avoid sports with danger of bodily collision.

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ABSTRACT No. 7

Recommendations for sports in athletes with ischemic heart disease

Mats Borjesson

Multidisciplinary Pain Center, Department of Medicine, Sahlgrenska University Hospital/Ostra, Goteborg, Sweden

Introduction
Ischemic heart disease (IHD) accounts for most exercise-related sudden deaths, especially in individuals over 35 years. The risk of triggering coronary events increases transiently during vigorous physical activity, partly due to catecholamine-release, platelet activation, increased potassium levels and heat-related complications. "Social" drugs (alcohol/ cocaine) and doping may also trigger myocardial ischemia, particularly in vulnerable individuals. The Study Group of Sports Cardiology within the ESC has recently published recommendations for sports participation/eligibility for athletes with different cardiovascular abnormalities. A part of these recommendations specifically target athletes with IHD to complement existing guidelines for primary and secondary prevention as well as cardiac rehabilitation.

Methods
The target of the recommendations are competitive athletes, divided into three groups: 1. Those with known IHD (unstable/stable angina/previous myocardial infarction/previous coronary intervention); 2. No known IHD, but risk factors; 3. Other entities associated with myocardial ischemia (myocardial bridging, spasm angina, syndrome X). The categories may be evaluated by personal history, resting ECG, provocation/stress testing, echocardiography, coronary angiography (if indicated) and Holter ECG. 1. Athletes with known IHD are then risk stratified as having "lower" or "higher" probability for exercise-induced cardiac events.
2. Those athletes with risk factors only, are risk stratified according to the SCORE-system ("high"/"low" risk). Athletes with a high risk profile (> 5 % SCORE-risk) should be further risk stratified by stress test to rule out/confirm the presence ischemia. 3. For the other entities associated with myocardial ischemia, risk stratification is often difficult.

Results
According to the evaluation and subsequent risk stratification, recommendations for participation in different athletic activity for athletes with IHD (or risk factors for IHD) can be made.
- In case of definitive IHD together with a higher probability of events, no competitive sports are recommended.
- For athletes with IHD and a lower probability for events low static/low to medium dynamic sports (class I A-B) are recommended only.
- The same recommendations apply for athletes with a high risk profile and a positive stress test.
- For athletes with a high risk profile and a negative stress test most competitive sports are recommended on an individual basis, with the possible exception of competitive high static sports.
- For the low risk profile athletes, no restrictions in competitive sports apply, while recommendations for athletes with other entities associated with ischemia often have to be made on an individual basis.

The complete ESC study group-recommendations have now been published in Eur Heart J 26 (2005) 1422-1445.

Conclusions
The recommendations for athletes with IHD are an important part of the Study Group´s aim of producing common European recommendations for competitive sports participation in athletes with different cardiovascular abnormalities. A future task is the implementation of these recommendations into the sporting community for the safety of our athletes. In additon, while restrictions for participation in competitive sports may apply for athletes with IHD, leisure-time physical activity should always be encouraged and individually prescribed.

ABSTRACT No. 8

Recommendations for competitive sports in patients with congenital heart disease

Asle Hirth

Department of Heart Disease, Haukeland University Hospital, Bergen, Norway

Patients with congenital heart disease (CHD) who want to participate in competitive sports may expose their body to an upper limit of physical and mental stress. Since the available literature regarding exercise and sport participation in patients with CHD is limited, a restrictive attitude seems wise.

Due to major improvement in congenital heart surgery and peri-operative care more than 85 % of children with CHD survive into adulthood. The majority will be in NYHA Class I and many of them will have a normal or close to normal cardiac function. There is a tendency to overprotection of children with CHD during childhood. This may lead to a sedentary lifestyle with the risk of early development of illnesses associated with physical inactivity. From the age of 10-12 the children and their parents should be guided whether restrictions on competitive sport is necessary in that particular lesion. In general static exercise causes mainly pressure overload and can be difficult to control and is therefore less suitable than dynamic exercise in patients with CHD. Patients with a conduit or on anticoagulation should avoid sports with risk of bodily collision. Preparticipation screening should be extensive and include detailed knowledge of previous surgical reports.

Non-restricted participation in competitive sport is only recommended in patients with complete/anatomical repair and non-significant residual disease. This is usual the case in patients with small or repaired atrial and ventricular septal defects, persistent ductus Arteriosus and successfully repaired complete and partial anomalous pulmonary venous connection or complete and partial atrioventricular septal defects.

Patients with significant residual disease or ventricular dysfunction, pulmonary hypertension and significant arrhythmias are not eligible for competitive sports. This include patients with Eisenmenger Syndrome, patients with transposition of the great arteries (TGA) corrected with Senning, Mustard or Rastelli, congenitally corrected TGA, Ebstein Anomaly and patients with Fontan circulation/single ventricle.

Some CHD typically represent a group of intermediate risk regarding competitive sports and these need special attention. Most patients with Tetralogy of Fallot have pulmonary regurgitation to some degree, leading to right ventricular (RV) overload and the risk of ventricular dysfunction and arrhythmias. This is important to assess accurately. In patients with coarctation of the aorta (CoA) one should look out for signs of re-coarctation and hypertension (at rest or during exercise). MRI is useful in the regular follow-up and mandatory in patients with Dacron patch repair due to the increased risk of aneurysm at the operation site. Incompetence of the neo aortic valve (pulmonary valve in systemic position) and pulmonary artery stenosis have been reported in patients with TGA and arterial switch. Regular exercise testing to look for ischemia is indicated if the surgical report suggests an intramural course of the coronary arteries. Most patients with treated or mild pulmonary stenosis can participate in competitive sport with no limitations. Only those with a transvalvular gradient between 30 mmHg and 50 mmHg should have restrictions.

Aortic stenosis is associated with sudden cardiac death and a restrictive approach to competitive sport is recommended. Those with only mild or moderate stenosis can participate with appropriate restrictions. Physical activity and sport participation have positive effects on both physical and mental health and only those patients with CHD who are likely to deteriorate as a consequence of regular physical stress and/or those in whom exercise may trigger serious arrhythmias should be restricted from sport participation. It is impossible to state recommendations valid in all cases and this support the importance of tailoring the recommendations for each single patient.

ABSTRACT No. 9

Recommendations for Athletic Participation in Patients with Cardiomyopathy

William J McKenna

The Heart Hospital, University College Hospital, London, Great Britain

Individuals with cardiomyopathy are potentially at risk from disease progression and complications, most notably sudden death. The vast majority of patients with cardiomyopathy however, remain asymptomatic throughout life, and to do not experience disease related complications. Indeed, data for hypertrophic cardiomyopathy suggests that 70-80 % of individuals who fulfil stringent diagnostic criteria go undiagnosed. Current recommendations for athletic participation in cases of cardiomyopathy range from legislated prohibition (Italy), conservative restrictions (USA and ESC) to individualised recommendations (UK). Current guidelines have a limited evidence base and present recommendations that make no distinction in relation to heterogeneous disease expression, ignore the clinical ability to stratify disease severity and risk and make no attempt to determine the level of risk that is acceptable to the athlete, family or team. A revisit of our current approach incorporating the views of athletes and sporting bodies is warranted, particularly as there is an increasing impetus for screening programs which will increasingly identify asymptomatic athletes, the vast majority of whom will not have severe disease markers or be at significant risk of disease complications.