JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
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THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC.

VOL. 66, NO. 21, 2015
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2015.09.038

AHA/ACC SCIENTIFIC STATEMENT

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 6: Hypertension

A Scientific Statement from the American Heart Association and the American College of Cardiology

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An elevation of blood pressure (BP) in the systemic circulation (hypertension) is the most common cardiovascular condition in the general population and considered to be the most ubiquitous cardiovascular risk factor in competitive athletes. Competitive athletes include those athletes involved in organized sports that typically occur in schools, communities, and professional leagues, including but not limited to intramural and league sports in which medical supervision is typically required. Although most competitive athletes are between the ages of 20 and 40 years, many younger people now participate in competitive athletics. The 2013 update from the American Heart Association using the National Health and Nutrition Examination (NHANES) data from 2007 to 2010 estimates that 9.1% of men aged 20 to 34 years and 6.7% of women of that age are hypertensive, based on having an elevated BP measurement or answering "yes" to the question, "Are you taking antihypertensive medication or were you told that you had hypertension?" (1) The prevalence in children and adolescents is estimated to be ≈3.5%, with higher percentages in older and obese children (2). The diagnosis of hypertension is based on the subject

*On behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology.

The American Heart Association and the American College of Cardiology make every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest. The Preamble and other Task Force reports for these proceedings are available online at www.onlinejacc.org (J Am Coll Cardiol 2015;66:2343-9; 2350-5; 2356-61; 2362-71; 2372-84; 2385-92; 2398-405; 2406-11; 2412-23; 2424-8; 2429-33; 2434-8; 2439-43; 2444-6; and 2447-50).

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on June 24, 2015, and the American Heart Association Executive Committee on July 22, 2015, and by the American College of Cardiology Board of Trustees and Executive Committee on June 3, 2015.

The American College of Cardiology requests that this document be cited as follows: Black HR, Sica D, Ferdinand K, White WB; on behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology. Eligibility and disqualification recommendations for competitive athletes with cardiovascular abnormalities: Task Force 6: hypertension: a scientific statement from the American Heart Association and the American College of Cardiology. J Am Coll Cardiol 2015;66:2393-7.

This article has been copublished in *Circulation*.

Copies: This document is available on the World Wide Web sites of the American Heart Association (http://my.americanheart.org) and the American College of Cardiology (www.acc.org). For copies of this document, please contact Elsevier Inc. Reprint Department via fax (212-633-3820) or e-mail (reprints@elsevier.com).

having an elevated BP at or above certain levels measured by routine sphygmomanometry under appropriate conditions on at least 2 separate occasions separated by at least 1 week (3). However, BP measurements in the competitive athlete are typically obtained by different healthcare providers, which makes it particularly necessary that the testing conditions be standardized before the diagnosis of hypertension is made. People >18 years of age with a BP >140 mm Hg systolic and/or >90 mm Hg diastolic are considered to have hypertension (3). In children and adolescents, hypertension is defined as average systolic or diastolic BP levels greater than the 95th percentile for sex, age, and height; however, earlier physical maturation of the competitive athlete leaves open to question when an adult age criterion for hypertension should be applied to the adolescent (4). In determining the level of competitive athletic activity that a hypertensive person may engage in, it is also important to determine the degree of hypertension-related target-organ damage. Although hypertension has been associated with an increased risk for complex ventricular arrhythmias and sudden death, this cardiovascular risk factor per se has not been implicated in sudden death in young competitive athletes (5). For the general population, increased levels of noncompetitive recreational physical activity are generally regarded as beneficial. With physical activity, BP typically falls, the incidence of hypertension drops (6,7), and protection against stroke is afforded (8). Those who are hypertensive derive protection from both all-cause and cardiovascular mortality by maintaining higher levels of cardiorespiratory fitness (9).

ASSESSMENT OF BP

BP should be accurately measured in all people who wish to participate in competitive athletics before they begin training. BP should be measured by standard techniques, using the guidelines listed in the **Table**. It is common in young athletes to have their BP measured with an inappropriately sized BP cuff because of their often larger (>33 cm) midarm circumference. In these people, BP measured this way is often spuriously increased and results in unnecessary referrals to clinicians for evaluation and consideration of antihypertensive therapy. Also, there are often discrepancies between in-office and out-of-office BP measurements. For example, elevations induced by anxiety related to the medical examination are seen in young people concerned about the potential negative consequences of the examination. Anxiety-related BP elevations may be marked by elevations in heart rate, which further complicates the interpretation of the physical examination findings. In such instances, it is advisable to obtain unbiased and more comprehensive information through the use of 24-hour ambulatory BP monitoring.

TABLE Guidelines for Clinic (or Office) BP Measurement

Posture
BP obtained in the seated position is recommended. The subject should sit quietly for 5 min, with the back supported in a chair, with feet on the floor and the arm supported at the level of the heart, before BP is recorded.
Circumstances
No caffeine should be ingested during the hour preceding the reading, and no smoking during the 30 min preceding the reading.
A quiet, warm setting should be available for BP measurements.
Equipment
Cuff size
The bladder should encircle and cover at least 80% of the length of the arm; if it does not, use a larger cuff. If bladder is too short, misleadingly high readings may result.
Manometer
Use a validated electronic (digital) device, a recently calibrated aneroid or mercury column sphygmomanometer.
Technique
Number of readings
On each occasion, take at least 2 readings, separated by as much time as is practical. If readings vary by >10 mm Hg, take additional readings until 2 consecutive readings are within 10 mm Hg.
If the arm pressure is elevated, take the measurement in 1 leg to rule out aortic coarctation (particularly in patients <30 y of age).
Initially, take pressures in both arms; if the blood pressures differ, use the arm with the higher pressure.
If the initial values are elevated, obtain 2 other sets of readings at least 1 wk apart.
Performance
Inflate the bladder quickly to a pressure 20 mm Hg above the systolic BP, as recognized by the disappearance of the radial pulse; deflate the bladder at 2 mm Hg/s.
Record the Korotkoff phase I (appearance) and phase V (disappearance) sounds. If the Korotkoff sounds are weak, have the patient raise the arm, then open and close the hand 5–10 times, and then reinflate the bladder quickly.

BP indicates blood pressure.

In some people, extremely high BPs may occur on a single measurement. In this type of patient, ambulatory BP monitoring would help to further stratify the athlete's risk of hypertension at present or in the future if borderline values were obtained. Ambulatory BP measurement in people with elevated exercise BP values improves the prediction of left ventricular hypertrophy (LVH) by echocardiography and development of sustained hypertension according to 1 study with an 8-year follow-up (10).

EVALUATION

All people who are diagnosed as hypertensive, whether competitive athletes or not, need a thorough but directed history and physical examination with a minimal number of laboratory tests. The history should be sure to determine whether the person has a family history of hypertension or cardiovascular disease, symptoms suggestive of a pheochromocytoma (paroxysmal hypertension, headache,

diaphoresis, and palpitations) or if he or she uses nonsteroidal anti-inflammatory agents or street drugs, especially cocaine or amphetamines. Use of nonsteroidal anti-inflammatory agents is particularly common among competitive athletes, who often have minor injuries for which these analgesic agents are beneficial and available without a prescription. Amphetamines are used to increase mental alertness and decrease fatigue (11). Participation in certain extracurricular activities, such as high-contact sports, may influence male participants to misuse prescription stimulants as performance enhancers either on or off the playing field. However, the use of these agents is not more common in competitive athletes than in the general population. Although anabolic steroid abuse is becoming increasingly uncommon in athletes in competitive sports, an analysis of existing evidence suggests that chronic anabolic steroid use does have a negative impact on lipoproteins and BP in athletes (12).

The physical examination should be used to look for clues to an identifiable cause of hypertension (so-called secondary hypertension) such as abdominal bruits, which may indicate the presence of renal artery stenosis and renovascular hypertension, or a cushingoid body habitus or abdominal striae suggesting adrenocortical hormonal excess. The laboratory tests should also be limited to assessing the presence of other cardiovascular risk factors such as dyslipidemias, glucose intolerance, and diabetes mellitus, and particularly chronic renal disease, a problem common among young black men and that is often asymptomatic until its later stages. All competitive athletes should have a lipid profile (total cholesterol, high-density lipoprotein cholesterol, and serum triglycerides) performed; fasting serum glucose, electrolytes, and hemoglobin measured; and urinary protein estimated by dipstick (3,13). Although it is usually recommended that a lipid profile and glucose determination should be obtained after at least a 9-hour fast, this may be logistically difficult. Having the blood drawn in the athletes in a fasting state may not be feasible in most circumstances, and it may be more reasonable to obtain the samples when convenient and only repeat the test in the fasting state when it is abnormal (13).

A 12-lead ECG is recommended but not mandated to ascertain the presence of LVH or conduction abnormalities, although the yield will be small. In those people with stage 2 hypertension (a systolic BP >160 mm Hg or a diastolic BP >100 mm Hg) or who have a suggestion of target-organ damage on history or physical examination, a screening echocardiogram is advisable to distinguish physiological hypertrophy attributable to physical exercise (athlete's heart) versus pathological LVH from hypertension. Athletes with normal (or physiological) hypertrophy have echocardiographic and other imaging evidence of increased posterior and septal wall thicknesses with normal cavity chamber size accompanied by normal rates of left ventricular filling during diastole (14); in contrast, hypertrophy caused by hypertension, although having similar structural findings, has both impaired rates of left ventricular filling and slow isovolumic relaxation times (15). If needed, the pathophysiology of cardiac hypertrophy attributable to physiological causes versus pathophysiological causes (hypertension) can be discriminated with echocardiography using Doppler imaging or magnetic resonance imaging as a tertiary methodology. People with larger body size and blacks may have an increase in wall thicknesses on echocardiography, which should be correlated with ECG, clinical signs and symptoms, and family history before they are advised against participation in competitive sports. It is rare for physiological increased left ventricular wall thicknesses to exceed 13 mm and indicates the advisability of a referring the patient for further evaluation for hypertrophic cardiomyopathy with ECG, clinical assessment, and family history. Of note, LVH is more prevalent in blacks and is an independent predictor of diminished cardiovascular survival (16). The ECG is widely available, inexpensive, and has high specificity but poor sensitivity for detection of LVH; however, the combination of an abnormal ECG, any signs and symptoms of heart disease, and a positive family history for premature cardiac death warrants further evaluation. Cardiac stress testing is not warranted unless there are symptoms that occur with maximal exercise. The competitive athlete need not routinely require orthostatic BP determinations unless the athlete is symptomatic in the upright position in a volume replete state.

In an adolescent or young adult (i.e., <25 years of age) with stage 2 hypertension, it may be appropriate to refer this person for further evaluation and therapy to a cardiologist or hypertension specialist. The workup for secondary forms of hypertension and proper pharmacological management is often outside the scope of general pediatricians and family practitioners who might otherwise be seeing these athletes.

EFFECTS OF EXERCISE ON BP

Both systolic and diastolic BP rise during resistance (static or isometric) exercise, and strenuous aerobic or resistance exertion may precipitate myocardial infarction and sudden death in susceptible, untrained people. In the long term, both systolic and diastolic BPs are lower with aerobic (dynamic) exercise and remain lower for up to 24 hours (17). In a person with normal BP at rest, a rise in systolic BP to >200 mm Hg during an exercise treadmill test may suggest underlying hypertension. This person may benefit from further investigation, including 24-hour ambulatory BP monitoring, to document true sustained hypertension (18). A hypertensive responsive to exercise testing may also indicate an independent risk for cardiovascular events and mortality (19).

Recommendations

1. **It is reasonable that the presence of stage 1 hypertension in the absence of target-organ damage should not limit the eligibility for any competitive sport. Once having begun a training program, the hypertensive athlete should have BP measured every 2 to 4 months (or more frequently, if indicated) to monitor the impact of exercise *(Class I; Level of Evidence B)*.**
2. **Before people begin training for competitive athletics, it is reasonable that they undergo careful assessment of BP, and those with initially high levels (>140 mm Hg systolic or >90 mm Hg diastolic) should have comprehensive out-of-office measurements to exclude errors in diagnosis. Ambulatory BP monitoring with proper cuff and bladder size would be the most precise means of measurement *(Class I; Level of Evidence B)*.**
3. **Those with prehypertension (BP of 120/80 mm Hg–139/89 mm Hg) should be encouraged to modify their lifestyles but should not be restricted from physical activity. Those with sustained hypertension should have screening echocardiography performed. Athletes with LVH beyond that seen with "athlete's heart" should limit participation until BP is normalized by appropriate antihypertensive drug therapy *(Class IIa; Level of Evidence B)*.**
4. **It is reasonable that athletes with stage 2 hypertension (a systolic BP >160 mm Hg or a diastolic BP >100 mm Hg), even without evidence of target-organ damage, should be restricted, particularly from high static sports, such as weight lifting, boxing, and wrestling, until hypertension is controlled by either lifestyle modification or drug therapy *(Class IIa; Level of Evidence B)*.**
5. **When prescribing antihypertensive drugs, particularly diuretic agents, for competitive athletes, it is reasonable for clinicians to use drugs already registered with appropriate governing bodies and if necessary obtain a therapeutic exemption *(Class IIa; Level of Evidence B)*.**
6. **When hypertension coexists with another cardiovascular disease, it is reasonable that eligibility for participation in competitive athletics is based on the type and severity of the associated condition *(Class IIa; Level of Evidence C)*.**

DISCLOSURES

Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10,000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10,000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.
*Modest.

Reviewer Disclosures

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This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10,000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10,000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.
†Significant.

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KEY WORDS ACC/AHA Scientific Statements, athletes, blood pressure measurement, cardiovascular abnormalities, hypertension