clinical contributions

What To Do with Hypertension and a Murmur Found During a Preparticipation Physical Evaluation?

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Case Example

An 18-year-old male is seen in the clinic for a preparticipation physical evaluation (PPE). Physical examination shows blood pressure of 145/90 mmHg and a grade 3/6 systolic murmur. Records show that one year ago during his PPE, the patient had high normal blood pressure and a grade 2/6 systolic murmur but was cleared to exercise and was told to limit his salt intake. He is asymptomatic.

Introduction

The ultimate objective of preparticipation screening for athletes is the recognition of "silent" cardiovascular abnormalities that can progress to—or manifest as—sudden cardiac death. Customary screening for high school and collegiate athletes in the United States consists of obtaining the medical history and conducting a physical examination.[1] When cardiovascular abnormality is suspected on the basis of findings such as exertional chest pain or dyspnea, family history of either sudden death or heart disease at an early age, or results of physical examination, further studies should be done to identify any conditions that can cause sudden death in young athletes.[2]

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The Cardiovascular Component of the Preparticipation Examination

To ensure accurate measurement, blood pressure should be measured by routine sphygmomanometry with an appropriately sized blood pressure cuff. If elevated, blood pressure should be remeasured after the patient has been seated quietly for five minutes. The representative blood pressure should then be documented and categorized according to the criteria set forth by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7).[3] Categories include normal, prehypertension, stage I, and stage II hypertension[3] (Table 1).[4]

The heart should be auscultated while the patient is supine and then when the patient is in an upright position, either seated or standing. If a murmur is heard, maneuvers which alter venous return (preload) can be used to further characterize the murmur. Activities that increase preload include inspiration, forceful handgrip, lying supine, passive leg elevation, and squatting. Activities that decrease preload include Valsalva maneuver, expiration, and standing. Decrease in preload usually diminishes innocent murmurs, which may become intensified when venous return is increased.[4] These murmurs are benign and functional and should not preclude participation in sports; athletes with these murmurs may be cleared to play. Diastolic murmurs, systolic murmurs greater than grade 3/6 in severity, and any murmur that becomes intensified when preload is decreased should be further evaluated before the athlete is cleared to play.[4]

Hypertension in Athletes

Elevated blood pressure is among the most common abnormal medical conditions found during the PPE,[4] and systemic hypertension is the most common cardiovascular condition diagnosed in competitive athletes.[5] According to JNC 7,[3] patients aged 18 years or older are prehypertensive if their blood pressure is 120-139/80-89 mmHg. Stage I hypertension is defined as blood pressure persistently greater than 140/90 mmHg.[3] Hypertension in children and adolescents is defined as systolic or diastolic blood pressure greater than or equal to the 95th percentile for gender, age, and height.[6]

Blood pressure measurement should be done outside the medical office to exclude isolated "white coat"


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Table 1. Classification of hypertension across age ranges[4]

Classification	Adults	Children and Adolescents
Normal	<120 mmHg systolic and <80 mmHg diastolic	Systolic and diastolic: <90th percentile for age, sex, height
Prehypertension	120-139 mmHg systolic or 80-89 mmHg	n/a
High normal	n/a	Systolic and diastolic: 90-95th percentile for age, sex, height
Stage I hypertension	140-159 mmHg systolic or 90-99 mmHg diastolic	n/a
Hypertension	n/a	Systolic and diastolic: >95-99th percentile for age, sex, height
Stage II hypertension	≥160 mmHg systolic or ≥100 mmHg diastolic	n/a
Severe hypertension	n/a	>99th percentile for age, sex, height

n/a = not applicable.

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hypertension (ie, hypertension due to anxiety provoked by medical visits). Elevated blood pressure may be diagnosed when two or more documented readings taken in the medical office are above normal. Examiners should obtain a thorough medical history, including questions about use of tobacco, caffeine, and drugs. Laboratory testing should be done to identify secondary causes as well as damage to target organs. Laboratory testing for stage 1 hypertension should measure levels of electrolytes, creatinine or GFR, and serum glucose; evaluate lipid profile and hematocrit; and include urinalysis and electrocardiography (ECG). An echocardiogram should be obtained if initial test results are abnormal, if the patient has stage 2 hypertension, or if a secondary cause is suspected.[5]

A formal medical management plan can be prescribed on the basis of overall evaluation and should include healthy lifestyle choices regarding diet, target body weight, and exercise. In addition, athletes should be educated about the hypertensive effects of such substances as nonsteroidal antiinflammatory drugs, anabolic steroid drugs, tobacco, caffeine, and various dietary supplements. A regimen of antihypertensive medication should be initiated if appropriate. Athletes with prehypertension or stage 1 hypertension without evidence of target organ damage may compete in all sports while having blood pressure monitored every two to three months.[5] Athletes with stage 2 hypertension (or >99th percentile in children) or end organ damage should not participate in competitive sports until the blood pressure is further evaluated and treated.[5]

Hypertrophic Cardiomyopathy

Hypertrophic cardiomyopathy is the most common cause of sudden death in young athletes in the United States.[7] This disorder makes the myocardium prone to arrhythmias and may lead to left ventricular hypertrophy with preferential hypertrophy of the interventricular septum. This disease is more commonly found in men, specifically in black men.[8] Its prevalence in the general US population is 0.2%.[9] In the United States, mortality rates for people with hypertrophic cardiomyopathy are 6% per year in children and adolescents and 1% to 3% per year in adults.[10] In the population affected by hypertrophic cardiomyopathy, sudden death results most often from ventricular tachyarrhythmia. Signs and symptoms may be absent or may include syncope, orthopnea, dyspnea, chest pain, lightheadedness, palpitations, and fatigue. Hypertrophic cardiomyopathy may present as a murmur detected during the PPE: Auscultation reveals a harsh crescendo-decrescendo systolic murmur heard most clearly at the left lower sternal border and apex. A fourth heart sound may be heard. The murmur of hypertrophic cardiomyopathy classically increases with maneuvers that decrease venous return (eg, Valsalva maneuver). Similarly, the murmur diminishes when preload is increased.

For murmurs suspected to indicate hypertrophic cardiomyopathy, diagnostic evaluation begins by obtaining a chest radiograph and electrocardiogram. If the suspicion remains, echocardiography should be done. Hypertrophic cardiomyopathy is shown echocardiographically by asymmetrical septal hypertrophy, left ventricular hypertrophy of at least 15 mm, or both; mitral regurgitation; premature midsystolic closure of the aortic valve; and systolic anterior motion of the mitral valve. Left ventricular hypertrophy develops unpredictably but most commonly between ages 5 and 15 years; therefore, normal results of echocardiography

do not exclude hypertrophic cardiomyopathy. Electrocardiography yields abnormal results in 75% to 95% of patients with hypertrophic cardiomyopathy.[1] Findings may include left ventricular hypertrophy and abnormal ST or T waves. An automatic implantable cardioverter-defibrillator may be placed if the patient is considered to be at high risk for ventricular or atrial tachyarrhythmia, but implantation of this device does not necessarily warrant clearance for return to high-intensity sports participation.[11]

Because physical exertion increases the risk of sudden death, "[all a]thletes with a probable or unequivocal clinical diagnosis of HCM [Hypertrophic Cardio Myopathy] should be excluded from most competitive sports, with the possible exception of those with low intensity (class 1A). This recommendation is independent of age, gender, and phenotypic appearance, and does not differ for those athletes with or without symptoms, LV [Left Ventricular] outflow obstruction, or prior treatment with drugs or major interventions with surgery, alcohol septal ablation, pacemaker, or implantable defibrillator."[11:p1341] Echocardiographic screening should be offered to all family members of a patient with hypertrophic cardiomyopathy, and serial echocardiograms should be obtained for these family members throughout their adolescence.

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Summary

The patient described here had a repeat blood pressure measurement of 142/88 mmHg and a grade 3/6 systolic murmur which diminished during Valsalva maneuver and standing. Results of laboratory screening tests, electrocardiography, and chest radiography were normal. An echocardiogram—obtained because the murmur was considered loud—showed no evidence of hypertrophic cardiomyopathy. The athlete was cleared to play, and plans were made for periodic blood pressure measurement and cardiovascular examination during the competitive sports season. ❖

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