Pre-participation Screening for the Prevention of sudden Cardiac Death in Young Athletes

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Cardiovascular disorders are the leading cause of sudden death in young athletes accounting for approximately 75% of all sudden deaths in athletes.
## Incidence of Nontraumatic Sudden Death in Athletes

<table>
<thead>
<tr>
<th>Population group</th>
<th>Incidence</th>
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<tbody>
<tr>
<td>High school/college athletes</td>
<td>7.47 : 1,000,000 per year (male)</td>
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<tr>
<td></td>
<td>1.33 : 1,000,000 per year (female)</td>
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<tr>
<td>U.S. Air Force recruits 17 to 28 years of age</td>
<td>1 : 735,000 per year</td>
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</tbody>
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Adapted from O’Connor et al
CAUSE of SUDDEN CARDIAC DEATH

• Due to a heterogeneous group of structural cardiovascular abnormalities and primary electrical diseases.

• These typically go undetected in otherwise healthy-appearing athletes.
Distribution of cardiovascular causes of sudden death in 1435 young competitive athletes.

- HCM (36%)
- Indeterminate LVH - possible HCM (8%)
- Coronary artery anomalies (17%)
- Myocarditis (6%)
- ARVC (4%)
- MVP (4%)
- Tunneled LAD (3%)
- CAD (3%)
- AS (3%)
- Dilated C-M (2%)
- Sarcoidosis (1%)
- Aortic rupture (2%)
- Ion channelopathies (3%)
- Other congenital HD (2%)
- Other (3%)
- Normal heart (3%)


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Hypertrophic Cardiomyopathy
HCM

• Only 21% of athletes who died of HCM had any signs or symptoms in previous 36 months
• Only 25% have a murmur

• Characteristic morphology
  – Asymmetric left ventricular hypertrophy (usually involving the ventricular septum)
  – Left ventricular wall thickness of 16mm Non-dilated left ventricle with impaired diastolic function
HCM

• Hank Gathers
Coronary Artery Anomalies

- 2nd leading cause of SCD (17%)
- Less than half have prodromal symptoms

“Pistol” Pete Maravich
Stigmata of Marfan Syndrome

- Kyphoscoliosis
- High arched palate
- Pectus carniatum of excavatum
- Arachnodacty
- Arm span greater than height (ratio >1.05)
- Mitral valve prolapse
- Aortic insufficiency murmur
- Myopia
- General hyperlaxity
- Ectopia lentis
- Aortic root dilation or dissection
Marfan Syndrome

- Flo Hyman
Myocarditis

• 6% of SCD in U.S. athletes
• Viral etiology most common
Arrhythmogenic Right Ventricular Cardiomyopathy

- 4% of SCD in U.S. but 22% in Veneto region of Italy
- Genetic abnormality
- Caused by progressive fibro-fatty replacement of the right ventricular myocardium.
Hypertension

• Most common cardiovascular disease encountered in the athletic population (6.4%)
• Must also check lower extremity blood pressure if pre-hypertensive (120-139/80-89) or hypertensive stages I and 2 to R/O coarctation of aorta
• All children must have evaluation for secondary causes
Preparticipation Cardiovascular Screening

“The systematic practice of evaluating athletes before participation in sports for the purpose of identifying or raising suspicion of abnormalities that could provoke disease progression or sudden death”.
Preparticipation Physical Evaluation (PPE) Monograph
4th Edition
Preparticipation Physical Evaluation (PPE) Monograph
4th Edition

• Derived from both evidence-based studies and expert opinion principles and practice

• A screening tool designed to identify diseases or processes that may affect the athlete:
  – athletes at risk of sudden death
  – pre existing medical and/or musculoskeletal conditions that may require further evaluation before participation
  – at-risk behaviors
Cardiovascular Screening History

Does the athlete have a history of:

– Exertional chest pain or discomfort, or shortness of breath?
– Exertional syncope or near-syncope, or unexpected fatigue?
– History a of cardiac murmur or systemic hypertension?
– Known family history of hypertrophic cardiomyopathy, other cardiomyopathies, long QT syndrome, Marfan syndrome, significant dysrhythmias?
– Family history of premature death or known disabling cardiovascular disease in a first- or second-order relative younger than 50 years? (More concern if younger than 40 years.)

• From Am Fam Physician. 2000 May 1;61(9):2683-2690.
Critical History Form Questions (1)

- Have you ever passed out or nearly passed out DURING or AFTER exercise?
- Have you ever had discomfort, pain, tightness, or pressure in your chest during exercise?
- Does your heart ever race or skip beats (irregular beats) during exercise?
- Has a doctor ever told you that you have any heart problems?
Critical History Form Questions (2)

- Has a doctor ever ordered a test for your heart (for example, ECG/EKG or echocardiogram)?
- Do you get lightheaded or feel more short of breath than expected during exercise?
- Have you ever had an unexplained seizure?
- Do you get more tired or short of breath more quickly than your friends during exercise?
Critical History Form Questions (3)

• Has any family member or relative died of heart problems or had any unexplained or unexpected death before age 50?
• Does anyone in your family have a heart problem, pacemaker, or implanted defibrillator?
• Has anyone in your family had unexplained fainting, unexplained seizures, or near drowning?
Physical Examination

Cardiovascular Exam

Auscultate with athlete supine, standing and with Valsalva – murmur?

Palpate femoral pulses bilaterally and also radial vs. femoral pulse

Brachial artery blood pressure sitting

Screen for Marfan Syndrome
Auscultation of the Heart

- Auscultate with athlete supine, standing and with Valsalva maneuver.
- Look for murmurs of LV outflow obstruction.
- Timing of murmurs relative to $S_1$ and $S_2$.
- Extra heart sounds and clicks.
Femoral Artery Pulses

• Simultaneous palpation of femoral and radial arterial pulses
Noninvasive cardiovascular Screening in Athletes

• ECG
  – United States position
  – European position

• Echocardiogram