PRE-PARTICIPATION SCREENING
THE SPORTS PHYSICAL

Michele Krenek, MSN, RN, FNP-C
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According to the AHA the definition of the pre-participation is the “systematic practice of medically evaluating large, general populations of athletes before participation in sports for the purpose of identifying (or raising suspicion of) abnormalities that could provoke disease progression or sudden death”
PRE-PARTICIPATION SCREENING GOALS

- Overreaching goal of screening is “to maximize the health of athletes and their safe participation in sports” (American Family Physicians, 2015)

- 36th Bethesda Conference Guidelines states “the ultimate objective of pre-participation screening carried out in the general population of trained athletes is the recognition of the “silent” cardiovascular abnormalities that can progress or cause sudden cardiac death

- American Academy of Pediatrics established guidelines with the goal to “uncover conditions that might require further investigation or treatment that would hinder the health and safety of the athlete”. Detection of pre-existing cardiovascular abnormalities with the potential for SD or significant morbidity associated with intense physical training and competition is the major objective in pre-participation screening of high school and college sport’s participants

- Is the purpose to prevent SCD or to identify those children with cardiovascular abnormalities that place them at increased risk of SCD?
SUDDEN CARDIAC DEATH

- Sudden cardiac death has been defined as an unexpected death from a cardiac cause that occurs within one hour of symptom onset (witnessed) or within 24 hours of last being observed in normal health (unwitnessed).
- Approximately 1 in 500 young athletes may have an underlying cardiac condition that places them at risk for SCD.
- SCD in individuals < 35 y/o during or just after exercise is almost always secondary to a structural or functional cardiac disease.
- Frequency is unknown but ranges from 1:160,000 to 1:300,000 for competitive athletes between the ages of 12-35, 1:9,000 military recruits, 1:37,000 college athletes.
- More common in males, African-Americans, and in basketball and soccer players.
- 60-80% of patients with SCD had no symptoms prior to their death.
CAUSES OF SUDDEN CARDIAC DEATH

- Congenital cardiac defects
- Myopathies (HCM most common 1/500) 33%
- Coronary artery anomalies
- Commotion cordis
- Electrical abnormalities (Long QT syndrome, CPVT, Brugada) syndrome
- Myocarditis
- Marfans syndrome
- Aortic valve disease
- Coronary artery disease (uncommon)
SCHOOL AGE VERSUS ADOLESCENT PARTICIPATION

• Guidelines established for competitive athletics due to the difference between pre-adolescent competitive training (skills and coordination, perform at comfort level) versus competitive athletics (focuses on professional coaching, organized, high skill level, high intensity)

• Students are more influenced by personal motivation and outside influences such as coaches, team members, parents, and spectators

• End result is the potential for patient to push themselves to participate beyond the level they or their providers consider safe

• Training is usually more rigorous than the event
COMPETITIVE ATHLETE

- According to the Bethesda Conference a competitive athlete is one who participates in an organized team or individual sport that requires regular competition against others as a central component, places a high premium on excellence and achievement, and requires some form of systematic (and usually intense) training. Therefore, organized competitive sports are regarded as a distinctive activity and lifestyle.
14 KEY ELEMENTS OF THE SPORT’S PHYSICAL

• Medical:
  • Chest pain during or following exertion
  • Syncope (unexplained or with/following exertion)
  • Dyspnea or excessive fatigue with exertion
  • Heart murmur
  • Elevated systemic blood pressure
  • Abnormal cardiac testing (ECG, echo) in the past
True anginal pain, characterized by substernal, deep, pressure-like pain that radiates, is associated with dyspnea, and causes the athlete to stop activity, is unusual in adolescents. The presence of any of the above symptoms that cannot be explained requires exclusion from participation in competitive sports pending cardiac evaluation, and the patient should also be counseled to avoid strenuous exercise until that evaluation is complete.
KEY ELEMENTS OF THE SPORT’S PHYSICAL

• Family History:
  • Premature death < 50 years of age from heart disease or sudden death (1st or 2nd degree relative)
  • Disability from heart disease in a close relative < 50 y/o
  • Knowledge of certain cardiac conditions in relatives (HCM, DCM, Long QT syndrome or other ion channelopathies, Marfan syndrome, or clinically significant arrhythmias such as CPVT)
  • Family history of unexplained fainting, seizures, or near drowning/single car accidents
KEY ELEMENTS OF THE SPORT’S PHYSICAL

• Physical Exam:
  • Heart murmur
  • Evaluation of femoral and pedal pulses (exclude aortic coarctation)
  • Physical characteristics of Marfan syndrome
  • Brachial artery blood pressures in both arms (recommend 4 extremity blood pressures)
TO ECG OR NOT ECG....THAT IS THE QUESTION!

- AHA and European Society of Cardiology agree pre-participation screening of young athletes is warranted but disagree over the utility of the ECG. The AHA does NOT endorse screening ECGs on all patients unless there is a positive screen.

- Benefit: Diseases may be latent or not picked up by family history or physical exam alone (HCM, coronary artery anomalies, WPW, prolonged QT interval)
BARRIERS TO SCREENING

- 10-12 million athletes would need an ECG with an increase in cost by a minimum of $500 million (assuming an ECG’s cost is $50...which it’s not)
- Of those at least 890,000 would be positive prompting an echo ($1,500 X 890,000= 1.84 billion dollars)-Most institutions charge upward of $3,000-$5,000
- Diverse and ethnic population with subsequent different normative values on the ECG
- Cost effectiveness and limited resources makes screening all athletes with ECG, echo impractical
- ABSOLUTELY IMPOSSIBLE TO ELIMINATE ALL RISKS
- Liability
CLASSIFICATION OF ABNORMALITIES ON THE ATHLETE’S ECG

• Common and training-related ECG Changes:
  • Sinus bradycardia
  • First degree AV block
  • Incomplete right bundle branch block
  • Early repolarization
  • Isolated QRS voltage criteria for LVH
CLASSIFICATION OF ABNORMALITIES ON THE ATHLETE’S ECG

• Uncommon and training-unrelated ECG changes
  • T wave inversion (precordial leads)
  • ST-segment depression
  • Pathologic Q waves
  • Left atrial enlargement
  • Left axis deviation
CLASSIFICATION OF ABNORMALITIES ON THE ATHLETE’S ECG

- Right axis deviation
- Right ventricular hypertrophy
- Ventricular pre-excitation
- Complete LBBB or RBBB
- Long or short QT interval
- Brugada pattern
CARDIOLOGY REFERRAL

• Abnormalities on the physical, family, or medical portion of the sport’s physical should prompt a referral to a cardiologist

• Cardiology evaluation may lead to additional work-up including an ECG, Holter, echocardiogram, stress test, CT, cardiac MRI, or event monitor
Recommend reviewing the AHA/ACC Scientific Statement:
Eligibility and Disqualification Recommendations for Competitive Athletes with Cardiovascular Abnormalities: Preamble, Principles, and General Considerations
EXERCISE STRESS TESTING

• The AHA and ACC recommend exercise stress testing prior to competitive sport’s participation in most patient’s with risk factors concerning for sudden death

• Bruce protocol is the most commonly used protocol

• The simple stress test includes a continuous 12 lead ECG with rhythm strips, blood pressure measurements, O2 saturations
EXERCISE TREADMILL MEASUREMENTS

• Electrocardiographic measurements:
  • ST segment depression/elevation
  • ST depression slope (downsloping, horizontal, upsloping)
  • Number of leads showing ST changes
  • Duration of ST deviation into recovery
  • ST/HR indexes
  • Time to onset of ST deviation
  • Exercise induced arrhythmias/PVC cessation with exercise
  • QT measurements
EXERCISE TREADMILL MEASUREMENTS

• Hemodynamic measurements:
  • Maximum exercise heart rate
  • Maximum exercise systolic blood pressure
  • Maximum exercise double product (HRxBP)
  • Total exercise duration
  • Exertional hypotension
  • Chronotropic competence
EXERCISE TREADMILL MEASUREMENTS

• Symptoms:
  • Exercise induced angina
  • Exercise limiting symptoms
  • Time to onset of symptoms
COMPLEX STRESS TESTING

- Adjunctive tools in assessing patients with cardiac vascular and pulmonary disease
- Includes oxygen uptake (VO2)
- Carbon dioxide output (VCO2)
- Minute ventilation
- Ventilatory/anaerobic threshold
OXYGEN UPTAKE (VO2)

• VO2 at maximum exercise is considered the best index of aerobic capacity and cardiorespiratory function

• Maximum VO2 is defined as the point at which no further increase in measured VO2 occurs despite an increase in work rate

• ACC/AHA Guidelines for Exercise Testing