The Preparticipation Physical Exam

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Overview

- Identify the goals of the Preparticipation exam (PPE)
- Understand the content of the PPE
- Understand the use of the PPE as a tool to prevent sudden cardiac death
Introduction

- 30 million adolescents participate in organized sports
- A preparticipation physical exam (PPE) is the standard of care
- 49 states require an exam
Primary objectives of the PPE

● To detect potentially life-threatening or disabling medical or musculoskeletal conditions
● To screen for medical or musculoskeletal conditions that may predispose an athlete to injury or illness during training or competition.

Secondary objectives of the PPE

● To determine general health
● To serve as an entry point into the health care system for adolescents
● To provide an opportunity to initiate discussion on health-related topics

Goal of the PPE

- Maximize SAFE participation
  - Identify medical problems with risks to the athlete or another participant during participation
  - Identify conditions requiring treatment before participation
  - Remove unnecessary restrictions on participation
  - NOT to disqualify, but to INTERVENE

The PPE should not serve as a substitute for comprehensive health maintenance.
“Current research fails to demonstrate that the PPE has had any effect on the morbidity or mortality of athletes overall. Data to support its effectiveness as a screening tool is also lacking.”

Physical Activity is Important

- Fewer than 1 in 4 children get 20 minutes of vigorous activity per day
- Every exam a PPE
  - Pediatric
  - Geriatric
  - OB
Primary care provider??

- This may be the only contact with a physician an adolescent experiences.
- Only contact with healthcare personnel for 50-90% of athletes
- Some states authorize chiropractors, athletic trainers, or other healthcare providers to perform PPE
Settings for the PPE

- **Office**
  - Continuity
  - Familiarity
  - Privacy
  - Access to the medical record
  - Communication?

- **Station based**
  - Convenience
  - Cost
  - Communication with school and coaches
  - Potential for expertise
  - Lack of privacy
Timing for PPE

- 6 weeks prior to the start of season/training
- At every new level of school with interval exams annually
PPE form

- Standardized questionnaire
- Signed by parent
- Easily reviewed
- Designed by experts
- Be familiar with the form and questions asked

http://www.niaa.com/forms/forms-new
HISTORY

- Physicians should confirm key responses
  - Passed out (syncope)?
  - Chest pain?
  - Shortness of breath (dyspnea)?
  - Family history of sudden death?

- “The personal and family history of the athlete reveals 64-78% of conditions that could prohibit or alter sports participation making it a more sensitive tool than the physical exam.” Kurowski K, Chandran S.

EXAM

- Should focus on the musculoskeletal and cardiac exams
- Height, weight, HR, BP, vision, pupils
- 2 minute musculoskeletal exam
General appearance

- Evaluate for the stigmata of Marfan’s syndrome
Vision

- Acuity and pupil size
  - 20/40 in at least one eye provides “good vision”
    - If best corrected in one eye is <20/40 the athlete is functionally one-eyed
    - Sports in which one cannot effectively protect the eye contraindicated for one-eyed athletes
  - If one eyed, avoid high risk activities – baseball/softball, ice/field hockey, lacrosse
Cardiac exam

- Blood pressure
- Pulses (radial, femoral)
- Heart (rate, rhythm, murmurs)
- “a complete and careful personal and family history and physical examination designed to identify, or raise suspicion of, those cardiovascular lesions known to cause sudden death is the best available and most practical approach to screening populations of sports participants, regardless of age.”

Any athlete with symptoms of exertional syncope, near syncope, chest pain, palpitations, or excessive exertional dyspnea will require a thorough cardiovascular evaluation to exclude underlying heart disease. They should be restricted from any athletic participation until this workup is completed.
Hypertension in pediatric population

<table>
<thead>
<tr>
<th>Blood pressure classification</th>
<th>BP measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;90&lt;sup&gt;th&lt;/sup&gt; percentile</td>
</tr>
<tr>
<td>High normal</td>
<td>90&lt;sup&gt;th&lt;/sup&gt;-95&lt;sup&gt;th&lt;/sup&gt; percentile</td>
</tr>
<tr>
<td>Hypertension</td>
<td>&gt;95&lt;sup&gt;th&lt;/sup&gt;-99&lt;sup&gt;th&lt;/sup&gt; percentile</td>
</tr>
<tr>
<td>Severe hypertension</td>
<td>&gt;99&lt;sup&gt;th&lt;/sup&gt; percentile</td>
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</tbody>
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Hypertension cont.

- Common
- May be cleared unless
  - >99th percentile in children
  - >160 systolic, >100 diastolic in adults
  - Secondary cause is suspected
- Ensure proper cuff size
- Ask about supplements, caffeine, and drugs
Murmurs

- Listen supine and sitting/standing
- Benign functional murmurs
  - Common
- Further evaluation needed if:
  - Murmur is grade 3 in severity or greater
  - Diastolic murmur
  - Increases with Valsalva
Genitalia

- Single or undescended testes
- Hernia
- Testicular mass
  - Testicular cancer is the leading cause of cancer deaths in men 15-35 yrs of age.
  - Tanner staging no longer recommended
Musculoskeletal system

- 2 minute musculoskeletal exam
- scoliosis
- Ask about previous injuries
- “joint-specific examinations are more time-consuming ... and have a low yield in an asymptomatic athlete”
  - PPE, 3th
General musculoskeletal examination

The general musculoskeletal exam can reveal clues to potential abnormalities, injuries, and areas of weakness that might predispose the athlete to injury.

Step 1
Observe the standing athlete from the front for symmetry of trunk, shoulders, and extremities.

Step 2
Observe neck flexion, extension, lateral flexion on each side, and rotation to evaluate range of motion and the cervical spine.

Step 3
Have the athlete shrug the shoulders a gentle resistance from the examiner to evaluate trapezius strength.

Step 4
Have the athlete perform shoulder abduction against resistance from the examiner to assess deltoiod strength.

Step 5
Have the athlete clencht the fist, then spread the fingers to assess range of motion in the hand and fingers.

Step 6
Observe extension and flexion of the elbow to assess range of motion.

Step 7
Observe internal and external rotation of the shoulder to evaluate range of motion of the glenohumeral joint, and observe pronation and supination of the forearm to evaluate elbow and wrist range of motion.

Step 8
Observe the standing athlete from the rear for symmetry of trunk, shoulders, and extremities.

Step 9
Have the athlete stand with the knees straight and bend backward from the waist. Discomfort with extension of the lumbar spine may be associated with spondylolisthesis and spondylosis.

Step 10
Have the athlete stand with the knees straight and flex forward at the waist, first away from the examiner, then toward the examiner, to assess for scoliosis, spine range of motion, and hamstring flexibility.

Step 11
Have the athlete stand facing the examiner with quadriceps flexed to observe symmetry of leg musculature.

Step 12
Have the athlete duck walk 4 steps to assess hip, knee, and ankle range of motion, strength, and balance.

Step 13
Have the athlete stand on the toes, then the heels, to evaluate calf strength, symmetry, and balance.
Diagnostic testing

- None required currently
- EKG currently under study
  - “The current cardiovascular screening recommendations in the United States call for a detailed personal and family history and focused physical examination, but do not recommend the routine use of ECG.”

34% of 1718 EKGs in healthy soldiers were “abnormal,” only 7 EKGs changed management, and only 2 patients were found to have potentially serious cardiovascular disease. 


“In a normal well-conditioned young athlete, the heart may develop ECG changes that falsely suggest ventricular hypertrophy; the specificity of the test is poor in this population.”

Kurowski K, Chandran S.

Evaluation with PPE and EKG

89% decrease in the incidence rate of sudden cardiac death among young competitive athletes in Italy

Figure 6. Annual incidence rates of sudden cardiovascular death (SCD) per 100,000 person, among screened competitive athletes and unscreened non-athletes 12–35 years of age in the Veneto region of Italy, 1979–2004. During the study period (the nationwide preparticipation screening programme was launched in 1982), the annual incidence of SCD declined by 89% in screened athletes (p for trend <0.001). In contrast, the incidence rate of SCD did not demonstrate consistent changes over time in unscreened non-athletes. Adapted from Corrado et al.18
Why not EKG and echo?

- “Obstacles in the US to implementing obligatory government-sponsored national screening including ECGs or echocardiograms are the particularly large population of athletes to screen, major cost-benefit considerations, and the recognition that it is impossible to absolutely eliminate the risks associated with competitive sports.”

- “Adaptations to training include a variety of abnormal 12-lead ECG patterns in about 40% of elite athletes, which not infrequently mimic those of cardiac disease.”

Conditions limiting participation

- Cardiac conditions
  - Hypertrophic cardiomyopathy
  - Commotio cordis
  - Coronary artery anomalies
  - Myocarditis
  - Aortic rupture (Marfan syndrome)
  - Arrhythmogenic right ventricular hypertrophy
Cardiac conditions

- Dependent on diagnosis
- Expert guidelines available
- Consider cardiology input/consultation
- Bethesda guidelines:
  - Google “Bethesda guidelines”
  - http://www.csmfoundation.org/36th_Bethesda_Conference_-_Eligibility_Recommendations_for_Athletes_with_Cardiac_Abnormalities.pdf
Marfan’s syndrome

- Autosomal dominant with high penetrance
- Musculoskeletal
  - Tall stature
  - Thin, gangly body habitus
  - Arachnodactyly
  - High arched palate
  - Hyperextensible joints
  - Kyphoscoliosis
  - Joint laxity
- Cardiovascular
  - Aortic root dilatation
  - Mitral valve abnormalities
- Ocular
  - Subluxation of lens

Go to: marfan.org
The “Older” Patient

“Identifying cardiovascular disease risk factors remains an important objective of overall disease prevention and management, but risk factor profiling is no longer included in the exercise preparticipation health screening process.”
Sudden death

- Overwhelmingly cardiac
- 1:100,000 to 1:300,000
Causes of sudden death

Hypertrophic cardiomyopathy

- Hypertrophic cardiomyopathy
  - Murmur increases in intensity with valsalva (decreased venous return)
  - Disproportionate hypertrophy of the LV septum
  - Autosomal dominant with >50% penetrance
  - Evidence of disease is found in 25% of first degree relatives
EKG of hypertrophic cardiomyopathy

33 yo man with HCM. Voltage criteria for LVH. ST segment elevation in the lateral leads and biphasic T waves V1 – V3.
Hypertrophic cardiomyopathy

- Hank Gathers
  - Exercise related syncope
  - Extensive work-up
  - Exercise-related complex ventricular tachyarrhythmias
  - Signed waiver
  - Noncompliant with recommendations
  - Gathers’ heirs filed a $32 million lawsuit

Lead the NCAA in scoring and rebounding 1990
Coronary anomalies

- Abnormal origin
- Abnormal course

“Pistol” Pete Maravich

NCAA Records:

Highest PAG (season) 44.5 1969-1970
Highest PAG (career) 44.2 1968-1970
Marfan’s syndrome

Flo Hyman - 3-time All-America spiker at Houston and captain of 1984 U.S. Women's Olympic team
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