Pre-Participation Cardiac Screening

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Goal and Objectives

• Goal: Review the current state of cardiac screening for sports participation

• Objectives
  – Review cardiac evaluation on the PPE (Pre-participation exam)
    • Discuss rationale for doing these exams
    • Review current process in Texas
    • Review American Heart Association (AHA) and American Academy of Pediatrics (AAP) Recommendations
  – ECG interpretation in athletes
  – Discuss the debate over universal ECGs for sports participation
Rationale for Cardiac Screening

• Identify conditions that prevent athlete from participation
  – Detect conditions that put athlete at risk for serious injury or death
  – Sudden cardiac death is the most common cause of death during sports / exercise

• Identify conditions that may be worsened by participation

• Legal Requirement / Participation Requirement
  – Recent Study: 98% of states require, 53% outdated (Caswell et al. 2015)
Preventing Sudden Cardiac Death

- Extremely rare event
  - Prevalence of SCD (debated)
    - ~1 in 80K high school and 1 in 50K college athletes
  - NOT all athletes are created equal
    - Higher in males, African Americans, basketball, and football
    - Male College Basketball 1:9000*
    - Much lower than other causes

- BUT greatly effects community
    - Project Adam – Focuses on CPR & AED, saved > 100 lives

- History is better than Exam

- Optimal screening is controversial

*Drezner et al. CJSM 2016*
Texas PPE – Cardiac Screen

History

3. Have you ever had prior testing for the heart ordered by a physician?
   • Yes
   • No

   Have you ever passed out during or after exercise?
   • Yes
   • No

   Have you ever had chest pain during or after exercise?
   • Yes
   • No

   Do you get tired more quickly than your friends do during exercise?
   • Yes
   • No

   Have you ever had racing of your heart or skipped heartbeats?
   • Yes
   • No

   Have you had high blood pressure or high cholesterol?
   • Yes
   • No

   Have you ever been told you have a heart murmur?
   • Yes
   • No

   Has any family member or relative died of heart problems or of sudden unexpected death before age 50?
   • Yes
   • No

   Has any family member been diagnosed with enlarged heart, (dilated cardiomyopathy), hypertrophic cardiomyopathy, long QT syndrome or other ion channelopathy (Brugada syndrome, etc), Marfan's syndrome, or abnormal heart rhythm?
   • Yes
   • No

   Have you had a severe viral infection (for example, myocarditis or mononucleosis) within the last month?
   • Yes
   • No

   Has a physician ever denied or restricted your participation in sports for any heart problems?
   • Yes
   • No

Exam

Tips

• Pause, get their attention
• Get and document any additional details
• Low threshold to call parent to clarify
# AHA Recommendations – 14 Points

## 10 Point History

### Personal History
1. Chest pain/discomfort/tightness/pressure related to exertion
2. Unexplained syncope/near-syncope
3. Excessive and unexplained dyspnea/fatigue or palpitations, associated with exercise
4. Prior recognition of a heart murmur
5. Elevated systemic blood pressure
6. Prior restriction from participation in sports
7. Prior testing for the heart, ordered by a physician

### Family History
8. Premature death (sudden and unexpected, or otherwise) before 50 y of age attributable to heart disease in a relative
9. *Disability from heart disease in close relative <50 y of age*
10. Hypertrophic or dilated cardiomyopathy, long-QT syndrome, or other ion channelopathies, Marfan syndrome, or clinically significant arrhythmias; specific knowledge of genetic cardiac conditions in family members

## 4 Point Exam

### Physical Examination
11. Heart murmur
12. Femoral pulses to exclude aortic coarctation
13. Physical stigmata of Marfan syndrome
14. Brachial artery blood pressure (sitting position)
AAP PPE – 4 Recommendations

• 12 Point history
  – 8 Personal history
  – 4 Family history

• 4 Point Exam (same as AHA)

• No studies have validated this or the AHA Criteria*

*Fudge et al. BJSM. 2014
Assessing Chest Pain

Pain – vs SOB, tightness, Point (location)?

Quality – sharp, burning, dull aching?

R – Radiate, Relieved by rest, inhaler, water?

S – Severity, worsened by (deep breathing), other symptoms (pre-syncope, palpitations, nausea, vision, recent cough, fever)?

T – Timing (when did it start, how long, how many times/how often, at rest, after eating), Trauma?

HARD STOP = SYNCOPE during EXERCISE
Essentials of the Screening Cardiovascular Exam

- Auscultation, supine & standing
- Splitting of S2
- Palpation – thrill, LVI, RVI, simultaneous palp. of femoral & brachial arteries, peripheral pulses
- Murmur – location, intensity, timing, supine to sitting, squatting to standing, Valsalva
Sudden Death in Young Athletes in U.S. – Causes*

*Maron, BJ. Am J Cardiol. 2015
Evolution of ECG Interpretation in Athletes

• Criteria have evolved
  – 2005 – Study Group of Sport Cardiology
  – 2010 – Updated: “Modern” ECG interpretation standards
  – 2012 – Seattle Criteria
  – March 2017 – International Criteria

• Maintained sensitivity, decreased false positive rates
  – Identifies 98.1% of athletes with HCM

• To Use:
  – Older than 12 years old
  – Must be an athlete
International ECG Criteria

- **Key Pediatric Consideration:** Juvenile T wave inversion variant (red box)
- **Includes recommendations on next steps**
The ECG Debate

• Some conditions are detectable on resting ECGs

• Europe Endorses Screening
  – Italian study showed drastic decrease in SCD after implementation: 89% (3.6 to 0.4/100K)*
  – Funded mandate
  – Higher prevalence of ARVC
  – Data Questioned

* Corrado et al. JAMA. 2006.
ECG Debate continued

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<tr>
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<th>SN</th>
<th>SP</th>
<th>False Positive Rate</th>
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<tbody>
<tr>
<td>History</td>
<td>20%</td>
<td>94%</td>
<td>8%</td>
</tr>
<tr>
<td>Exam</td>
<td>9%</td>
<td>97%</td>
<td>10%</td>
</tr>
<tr>
<td>ECG</td>
<td>94%</td>
<td>93%</td>
<td>6%*</td>
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*NCAA does not mandate ECG
- Many D1 programs choose to do it

*Must interpret correctly
- International Criteria

*False positives lead to unnecessary further testing and athletic restriction


*Drezner et al. BJSM
# Pre-Participation ECG’s

<table>
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<th>Pros</th>
<th>Cons</th>
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| • Readily available  
• Can identify problems that may be missed on PE  
  – LVH  
  – Prolonged QT  
  – Rhythm disturbances  
• High negative PV (95%)  
• Can be done inexpensively* | • Low Positive Predictive Value (many false positives) leading to unnecessary workup  
  – Depends on interpretation  
• False negatives  
• Resources, manpower not available  
• Too expensive  
• Unnecessary restriction in setting of obesity epidemic |

* may depend on setting
The ECG Debate – Current State

- AMSSM recommendation: Not enough data to support universal ECG screening – Consider targeted screening
- American College of Cardiology & NIH do not support universal ECG screening – Use as a tool/aid
- Very important to consider implications of requiring ECG – Especially in current health care environment – Especially if unfunded
PPE Cardiac Screen: How Good Is It?

• Not:
  – Studies have not shown it to prevent morbidity or mortality
  – Specifically, PPE has shown limited ability to identify children at risk for sudden cardiac death
  – Recent “Myth Buster” session at AMSSM: Plausible

• Why isn’t it?
  – Sudden death is often 1st symptom (50-80%)*
  – Lack of Uniformity
    – 43% of states had all 12 CV points**
  – 74% of states, including Texas, allow non-physicians to perform**
  – Honesty

• Should we stop?

**Caswell et al, Pediatrics, 2015
Interested in Learning More?

- Project Adam: http://www.chw.org/childrens-and-the-community/resources-for-schools/cardiac-arrest-project-adam/

- Free Modules on ECG interpretation in athletes available through BJSM: http://learning.bmj.com/learning/course-intro/.html?courseld=10042239


- 36th Bethesda Guidelines – rules for clearance
Take Home Points

• Sudden cardiac death in athletes is a rare but devastating condition

• Currently the cardiac screening process in Texas consists of history and physical exam during pre-participation physical based on AHA/AAP recommendations

• ECG interpretation in athletes should be completed using the International Criteria
  – Remember: over 12 years old AND athlete

• Universal ECG screening is currently not recommended by major medical organizations
Acknowledgements

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References

- UIL Texas PPE form PDF: https://www.uiltexas.org/files/athletics/forms/PrePhysForm15.pdf
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