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Pre-participation Physical Exams: Are We Doing Enough?

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Abstract

- Inclusion of screening electrocardiograms (EKGs) during pre-participation physical examination has been a topic of debate for some time. There is unquestioned usefulness in the ability of a well-trained health care provider in using EKG to identify cardiac abnormalities.
- Further, there have been several contemporary EKG criteria that published increase specificity and sensitivity of detection of disease. However, these criteria do not account for athletes less than 14 years of age, and that demographic represents a large portion of patients seeking pre-participation screenings in the United States.
- The lack of research into pediatric cardiac remodeling secondary to activity, coupled with the significant overlap in normal pediatric EKG findings with adult pathological EKG findings create a difficult position for any health care provider.
- A literature review was performed to determine if screening EKGs are effective both medically and economically in athletes less than 14 years of age.
- Based on the review, the limitations of contemporary EKG criteria, the inability to prove cost effectiveness in the US healthcare model, and the lack of research into activity modulated pediatric cardiac remodeling should reinforce that the ACC/AHA checklist is an appropriate foundation for conducting pre-participation physical examination.

Introduction

- Pre-participation physical examinations are routinely conducted in the United States in an effort to protect young athletes.
- There are estimates regarding the incidence of sudden cardiac death (SCD) in athletes, ranging from one in 40,000 to one in 80,000, and though SCD is a rare occurrence the multifactorial effects on the surrounding community cannot be denied.
- The majority of recommendations surrounding these physical examinations gather a personal and family history in the ability of a well-trained healthcare provider in using EKG to identify cardiac abnormalities.

Statement of the Problem

- Many of the underlying pathologies that lead to SCD produce subtle findings on exam and are difficult for even an experienced Primary Care Provider to detect (Finocchiaro et al., 2016).
- Between 2013 and 2023, 170 million high school and college athletes will require pre-participation physical examination. No estimate is available for primary school children.

Research Question

In patients requiring pre-participation physical examination, would EKG be an effective screening tool, both medically and economically, to identify conditions that may cause SCD in athletes younger than 14 years old?

Literature Review

Contemporary EKG interpretation criteria

- The European Society of Cardiology (ESC) released recommendations intended to improve specificity secondary to increasing number of unacceptably high levels of false positive EKGs.
- The ESC recommendations were followed by the Seattle and refined criteria, which further improved sensitivity and reduced the abnormal rate of EKG to 9.6% and 6.6% (p=0.001) respectively.

Economic Impact

- Corrado et al. (2006) reported a marked decline in SCD among athletes after the implementation of Italian law mandating EKG screening.
- Halkin et al. (2012) recognized that the Corrado study failed to address economic impact. They executed a cost-progression model that estimated the cost of screening EKG would reach $69 billion in the US by 2023.
- European studies provide more favorable economic outcomes, reducing cost to approximately $87 dollars per athlete (Dhutia et al., 2016), but the data lacks portability to the US secondary to dissimilar health care models and degree of subsidization.

Current recommendations

- The American Heart Association and the American College of Cardiology recommend a 14 item checklist when executing a pre-participation screening:

  1. **QRS duration**: duration of QRS complex in lead V1, V2 (≥120ms in lead V1)
  2. **Right ventricular hypertrophy**: S wave in V1 or V2
  3. **Abnormal Q wave**: Q wave in lead V1, S wave in lead II, III, or aVF
  4. **Prolongation of P wave duration**: P wave duration in lead II or aVR (≥120ms in lead II)
  5. **RBBB or LBBB**: QRS duration > 120 ms in lead V1, V2, V3, and aVF
  6. **Pathological Q wave**: QRS duration > 50 ms in lead V1, V2, V3, and aVF
  7. **Significant axis deviation**: QRS axis deviation ≤ 90 degrees
  8. **ST segment deviation**: ST segment deviation 0.2 mV or without delta wave
  9. **P wave notching**: P wave notching 0.1 mV or without delta wave

Applicability to Clinical Practice

- Concerns for the provider when interpreting an athlete’s EKG include both missing a dangerous cardiac condition and making false positive interpretations that cause needless further investigations, increased economic cost, and potentially unnecessary activity restriction for the athlete (Drezner et al., 2013).
- The ACC/AHA check sheet provides an appropriate framework for screening. If false negative findings present themselves, specialist referral prior to participation is appropriate.
- Provider-directed risk stratification of proposed activity levels is also appropriate.

References


Discussion

- None of the contemporary criteria included children less than 14 years of age in their studies, nor were they intended for use by primary care clinicians alone.
- Leger et al. (2016) point out that there is a significant overlap in normal pediatric EKG findings with adult pathological EKG findings, and that no current data exists on the physiologic cardiac modifications related to exercise in children thus making EKG less effective as a screening tool in children than adults.