Should Preparticipation Cardiovascular Screening of Athletes Include ECG?

Yes: Screening ECG Is Cost-Effective

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This is one in a series of pro/con editorials discussing controversial issues in family medicine.

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Deaths among several high-profile athletes have caused increased public awareness and anxiety about the risk of sudden cardiac death (SCD) in sports.[1] The prevalence of a potentially fatal cardiac abnormality in a young person is as high as one in 300.[2] The American Heart Association and the European Society of Cardiology endorse preparticipation screening to detect athletes at risk of exercise-related SCD. The U.S. approach, which relies on a health questionnaire and physical examination, is inexpensive and pragmatic. However, it has poor sensitivity for detecting disease because 80% of young athletes are asymptomatic before SCD.[3,4] In addition, most conditions implicated in SCD do not have associated physical signs and are therefore unlikely to be detected without cardiac evaluation.

The European approach advocates the inclusion of 12-lead electrocardiography (ECG), which is effective for the detection of electrical abnormalities. There is increasing evidence that the heart is morphologically normal in 25% to 30% of all perons who experience SCD.[4,5] Such deaths are often caused by ion channelopathies and congenital accessory pathways that are best detected with 12-lead ECG. Indeed, the ECG has a pivotal role in risk stratification of ion-channel diseases. A QTc interval greater than 500 milliseconds and a spontaneous type 1 Brugada ECG pattern are associated with a high risk of adverse events. ECG results are abnormal in more than 90% of patients with hypertrophic cardiomyopathy and in nearly 80% of patients with arrhythmogenic right ventricular cardiomyopathy; these conditions account for more than 40% of all SCDs in athletes.[6,7] Because most conditions that cause SCD in young athletes are genetic, the detection of disease in one person may result in cascade screening and identification of other at-risk family members.

A large, prospective, nationally sponsored study of young Italian competitive athletes found a 90% reduction in the incidence of SCD after mandatory ECG screening was implemented (3.6 cases per 100,000 to 0.4 cases per 100,000).[8] Although some argue that ECG screening has an unacceptably high false-positive rate, there has been a plethora of evidence-based data over the past 10 years about the role of various ECG patterns in detecting serious disease.[9,10] Most recently, allowances for electrical patterns related to ethnicity and nonspecific ECG anomalies that are rarely indicative of cardiac disease in isolation (specifically, axis deviation, voltage criteria, atrial enlargement, or right ventricular hypertrophy) have reduced the false-positive rate to about 5% in white athletes without compromising specificity.[9]

Scarce resources are often highlighted in the debate over mandatory preparticipation ECG screening, but this must be considered in the context of multiple decades of life lost. Based on 100 SCDs per year in U.S. athletes, we estimate that these athletes lose a total of 5,000 life-years. The estimated cost of ECG screening is $42,000 per life-year,[11] which is within the acceptable range of $50,000 to $100,000 spent per quality-adjusted life-year.[12]

ECG screening is not perfect and will not detect coronary artery anomalies or premature coronary artery disease, but this is a limitation of any low-cost preparticipation screening program that attempts to detect a diverse spectrum of cardiovascular diseases. In contrast with the success of the nationally sponsored Italian ECG program in reducing the incidence of SCD, U.S. studies have shown that screening based on the history and physical examination alone is extremely poor at identifying athletes who subsequently experience SCD.[3] Training of medical personnel using online ECG tools is effective and should allow for an infrastructure to implement national ECG screening in young athletes.[13] As a result, we feel that cardiovascular screening with ECG is a valid, cost-effective, and worthwhile endeavor in the preparticipation sports evaluation. ▶

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