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EDITORIAL COMMENT

ECG Screening Is Not Warranted for the Recreational Athlete*

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Sudden cardiac death (SCD) in a young athlete is a devastating event. There has thus been strong interest in screening athletes for disorders associated with a high risk of SCD before athletic participation. The attraction of adding a resting 12-lead electrocardiogram (ECG) to the screening process lies in the noninvasive nature of this modality to detect conditions associated with exercise-induced cardiac arrhythmias and SCD.

See page 2028

Both the American Heart Association (AHA) (1) and the European Society of Cardiology (ESC) (2) have proposed guidelines for pre-participation screening for young athletes planning to begin competitive sports. The obvious difference between these two proposals is that the AHA guidelines recommend a pre-participation history and physical examination for general screening but not routine use of ECGs. The rationale for the AHA objection to universal ECG screening involves the risk of false-positive results, leading to anxious moments for the athletes and their families and the need for further testing. In addition, such a national screening program would have a substantial impact on the feasibility and the cost-effectiveness of screening a large U.S. population of young athletes. The ESC guidelines, on the other hand, include a standard 12-lead ECG, based on a national screening program that has been in effect in Italy since 1982.

Although the value of ECG screening in competitive athletes continues to be debated, the reality is that most individuals are sedentary or at most recreational athletes. In this issue of the *Journal*, Chandra et al. (3) investigated the prevalence of potentially abnormal ECG patterns in young individuals. ECGs were performed in 7,764 non-athletes ages 14 to 35 years and 4,081 athletes. A non-athlete was defined as an individual not involved in regular competitive team or individual sports, including sedentary individuals and those exercising recreationally. The subjects in the study were self-selected and were not required to have any concerns in their medical history or worrisome symptoms to participate. An athlete was defined as an individual competing at the regional, national, or international level.

ECGs were analyzed for group 1 (training-related) and group 2 (potentially pathological) patterns as described in the 2010 ESC paper (2). Group 1 ECG changes included sinus bradycardia, first-degree atrioventricular block, incomplete right bundle-branch block, early repolarization, and isolated QRS voltage criteria for left ventricular hypertrophy. Group 2 ECG changes included T-wave inversion, ST-segment depression, pathological Q waves, left or right atrial enlargement, left- or right-axis deviation, right ventricular hypertrophy, ventricular pre-excitation, right bundle-branch block, left bundle-branch block, long QTc, short QTc, and Brugada-like pattern.

Group 1 ECG patterns, not surprisingly, were highly prevalent among athletes and quite common as well in the non-athlete group (87.4% vs. 49.1%). This finding might be explained by the fairly active nature of the non-athlete group (60.1% active for <4 h/week, and 39.1% active for >4 h/week), rendering it a mixture of recreational athletes and more sedentary individuals rather than a purely non-athlete group. Many of the non-athletes had group 1 changes, and, because these are not thought to require further investigation, this finding is not critical to the debate on ECG screening. On the other hand, group 2 ECG patterns were commonly present in both cohorts, although they were more common in athletes (33.0% vs. 21.8% in non-athletes). More than half of the group 2 abnormalities detected in non-athletes were QTc extremes, both short and long. The rest of the abnormalities were almost evenly split among atrial enlargement, axis deviation, right ventricular hypertrophy, and T-wave inversion.

Echocardiographic evaluation of all 784 non-athletes with group 2 ECG patterns suggestive of a cardiomyopathy or structural cardiac abnormality identified a normal heart in the majority (84%) of individuals. Only 2% (n = 16) of non-athletes with group 2 ECG patterns had echocardiographic findings that could be consistent with a mild cardiomyopathy, and the rest had incidental findings that would not affect sports participation.

As mentioned above, the most common group 2 ECG patterns found in non-athletes were a combination of long- and short-QTc intervals. This finding is in contrast with reports by Corrado et al. (2) and Pelliccia et al. (4) demonstrating a low prevalence of QTc prolongation (0.69% and 0.003%, respectively). The cut-off values of 440 ms (men) and 460 ms (women) proposed in the ESC criteria appear to result in a high frequency of false-positives, and higher cut-off values of 470 ms (men) and 480 ms (women) have been adopted in the 36th Bethesda Conference guidelines.

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In the current study, such higher cutoff values would have reduced the prevalence of QTc prolongation to 1.2% in non-athletes and 0.18% in athletes. These are more tolerable percentages, yet still greater than the reported prevalence of long-QT syndrome in the general population. More germane to the point of mass screening, few individuals would be identified with QTc intervals >500 ms, which is the group at highest risk of SCD.

The definition of short-QT syndrome (SQTS) is also controversial. Several authors consider QTc intervals shorter than 360 and 370 ms, when supported by symptoms or family history, and QTc shorter than 330 ms and 340 ms (men and women, respectively), in the absence of symptoms or family history, to be diagnostic of SQTS (5). When the cut-off value for SQTS was reduced from <380 ms to <360–370 ms, the prevalence of SQTS in the Chandra study declined from 6.9% to 1.2% in non-athletes and from 13% to 4.5% in athletes. However, these percentages are still higher than the true prevalence of SQTS.

The Italian national screening program, which included a 12-lead ECG, reduced the annual incidence of SCD in young athletes from 3.6 of 100,000 person-years in 1979 to 1980 to 0.4 of 100,000 person-years in 2003 to 2004 (89% reduction) (6). An important limitation of this study is that it compared data from the 2 years preceding implementation of the screening program with data from the subsequent 2 decades with no controlled comparison of screening versus non-screening in athletes.

In the United States, Maron et al. (7) reported that the SCD rate among high school athletes over a 23-year period in Minnesota was lower than that reported in Italy (1/100,000 person-years). ECGs were not part of the screening strategy used in the United States during that period. Other estimates of event rates in the United States are as low as 0.44 of 100,000. With these low event rates, a large-scale ECG screening program before participation in sports would clearly not be cost-effective. The annual cost of a mass screening program that includes a prescreening ECG was estimated at $2 billion per year in the 2007 AHA report. Given that 21.8% of the entire population of recreational athletes and sedentary individuals is a much larger number of people than 33.0% of elite athletes, all these figures would be substantially higher if we were to institute mass ECG screening in young individuals.

With respect to screening in specific populations within the non-athlete group, a key point to remember is that women have a much lower incidence of exercise-related death, estimated at 1 of 769,000 in one study (8). Thus, mass ECG screening of women would be even more difficult to justify. On the other hand, hypertrophic cardiomyopathy is more often found in African-American athletes than in other demographic groups. It is less certain when ECG screening might be considered to be of value in these individuals.

Despite the tragedy of losing even one young individual to SCD, mass ECG screening programs before sports participation, especially in recreational athletes, are neither cost-effective nor sustainable. The most common finding by far is a false positive test result leading to additional testing before most individuals are found to be normal and cleared to exercise. The best way to avoid that scenario is not to screen with the use of ECGs in the first place.

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