Detection of Cardiac Abnormalities in Elite Black and White Athletes:
Still Not Black and White

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Sports are “hot”. The average cost of a 30-second advertisement at the 2014 Superbowl was $4,000,000 \(^1\) and millions of fans worldwide spent much of their February 2014 watching the Sochi Winter Olympics and its advertising. Sports cardiology is also hot. The American College of Cardiology in 2011 established a section dedicated to Sports and Exercise Cardiology and now the College has several sports cardiology sessions during its annual meeting. Additional heat in sports cardiology comes from for the controversy as to whether or not the screening of young athletes for sports participation requires an ECG. European colleagues favor ECG screening primarily because of a 2006 observational study demonstrating reduced cardiovascular deaths among screened athletes and no decrease in a non-athletic comparison population. \(^2\) At least two \(^3,4\) subsequent papers failed to corroborate a reduction in events with ECG screening.

Scientific debate is unlikely when the evidence and its interpretation are clear. As usual this controversy is among experts with different opinions on the quality of the data on how to protect athletes. Most evidence suggest that the annual risk of a sports-related cardiovascular death is 1 in 200,000 \(^5\) to 900,000 \(^6\) participants/year, but one study in an earlier edition of Circulation found a yearly death rate of 1 per 3,100 National Collegiate Athletic Association Division I male basketball players or 1 death per 800 athletes over a college career, \(^7\) a figure high enough, if true, to question the value of the sport. There is also debate as to whether or not finding asymptomatic, but potentially life threatening conditions, will actually save lives and not simply subject athletes to more tests resulting in procedures that could actually increase mortality. Then there is the issue of cost because sports cardiology is potentially big business and companies have been formed to provide athlete screening to schools. ECG screening costs more than not doing an ECG, but the real financial burden is not in the ECG, but in the evaluation required to evaluate abnormal ECG results. Most studies suggest that 9\% of ECG-
screened athletes will require additional testing to allay physician, parent, and patient concerns. Consequently, providing “free” ECG screening to local schools increases the number of subjects referred for subsequent, more expensive (and lucrative) testing. Including an ECG increases the personal and societal costs of screening. Any reduction in the false positive rate reduces the screening costs and improves the risks to benefit ratio.

A British group lead by Sheikh in this issue of Circulation with senior authors William McKenna and Satish Sharma, experts in hypertrophic cardiomyopathy (HCM) and sports cardiology, compared previous ECG guidelines for athletes with their suggested new approach. The European Society of Cardiology (ESC) was the first group to establish guidelines for ECG interpretation in athletes in 2005 with an update in 2010. Discontent with even the updated guidelines prompted a panel of experts to establish the “Seattle Criteria” in 2012. These improved specificity in endurance and non-endurance elite athletes, but a high rate of false positive results persisted, and there was little data on these criteria’s performance in different racial groups.

These various criteria for evaluating athletes’ ECGs are designed to detect the common cardiac causes of sudden cardiac death in young athletes including hypertrophic cardiomyopathy (HCM), the predominant cause in the United States, and arrhythmogenic right ventricular cardiomyopathy (ARVC), the predominant cause in Italy. Both have characteristic findings on the ECG. Up to 90% of patients with HCM have an abnormal ECG, which typically includes left axis deviation, ventricular and atrial hypertrophy, repolarization abnormalities, and abnormal septal Q waves. Only 50 to 60% of patients with ARVC have an abnormal ECG at presentation. ECG findings in ARVC include T wave inversions in leads V1-3, prolongation of the QRS in V1 compared to V6, an incomplete or complete right bundle branch block, a prolonged S wave
upstroke and a terminal, late depolarization “epsilon wave” usually seen in V1. Some of these ECG findings of ARVC, however, are normal in many healthy young athletes. 14

The study by Sheik and colleagues included in this issue, 15 compares the performance of the ESC and Seattle guidelines against the refined ECG criteria created by the authors from the previously published consensus guidelines. The analyses were performed using ECGs from 5,505 elite athletes, 4,297 white and 1,208 black, from multiple sports. The ESC recommendations labeled 21.5% of the athletes ECGs as abnormal, whereas the Seattle Criteria classified only 9.6% as abnormal. The newly refined criteria reduced the number of abnormal ECGs to 6.6% for the total cohort, with a more pronounced reduction in the number of black athletes whose ECGs were considered abnormal. Specifically, the European, Seattle and refined criteria labeled 40.4%, 18.4%, and 11.5% of the blacks’ ECGs abnormal compared with 16.2%, 7.1% and 5.3% of the whites’.

This larger absolute reduction in blacks is due in part to the higher percentage of abnormal ECGs among blacks. Consequently, any improvement in specificity would be most effective among those with the worst prior specificity. Black men have been known since the 1950’s 16,17 to present more frequently with marked precordial T wave inversions and early repolarization in V3-V6 suggestive of a myocardial infarction. 18,19 Indeed Wilt Chamberlain, the legendary American basketball player and the only one to score 100 points in a single National Basketball Association game, had an ECG that looked like a classical anterior wall myocardial infarction. 20 In the present study black athletes were 2.5-times more likely to have an abnormal ECG compared to white athletes when using the ESC criteria and 2.6-times more likely when using the Seattle criteria. ECGs in black athletes were still more likely to be abnormal with the newly refined criteria, but only 2.2 times more likely.
Sheik and colleagues should be commended for their search for more accurate criteria to interpret athletes’ ECGs. Unfortunately, even these new criteria considered 5.3% of whites’ and 11.5% of blacks’ ECGs to be abnormal and required further investigation, but only 0.45% of those with abnormal ECGs were diagnosed with cardiac disorders, and the importance of some of these abnormalities (bicuspid aortic valve, atrial septal defect, and mitral valve prolapse) to sports participation is unclear. The cost and worry to the athletes and their families and the financial and manpower costs to society would be worth it if we were sure that the risk of sport was high and the benefit of screening justified, but neither is certain. Enthusiasts for ECG screening say it is time to stop worrying about how frequently sport related deaths occur and get on with screening, improving the science as we proceed, 21 but consider the damage we do before we are certain what we are doing. The ESC, Seattle and new criteria labeled 21.5%, 9.6% and 6.6% as abnormal respectively, which is a great improvement, but also means that many athletes screened by using ESC and Seattle criteria over the last 4 and 2 years, faced undue alarm and expense. Furthermore, the present study was done in elite athletes by elite cardiologists. Will clinicians with variable training doing screening in the community be as willing to ignore the abnormal findings reported by the ECG computer?

These revised criteria will be useful and should reduce the error rate to interpret the ECGs of athletes when the athletes, their sports organization or their physicians deem ECG screening appropriate. Nevertheless, it really is time to perform a clinical trial to evaluate ECG screening before it becomes standard practice. If a trial is impossible because of sample size, we already have part of the answer. And with respect to the certainty some have for or against screening with an ECG, we would quote another Hartford resident, Mark Twain, who said “It's not what you don't know that kills you, it's what you know for sure that ain't true”. 22
**Conflict of Interest Disclosures:** Dr. Fernandez has no conflict of interest. Dr. Thompson is an author of the American Heart Association’s position paper on screening athletes. He is an unpaid member of Runners World Medical Advisory Board and owns shares of General Electric which makes electrocardiographic equipment.

**References:**


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