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 Super Bowl was $4000000,1 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 there are several sports cardiology sessions during its annual meeting. Additional heat in sports cardiology comes from the controversy regarding whether 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 nonathletic comparison population.2 At least 2 subsequent articles3,4 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 2000000 to 9000000 participants per year, but 1 study in an earlier edition of Circulation found a yearly death rate of 1 per 3100 National Collegiate Athletic Association Division I male basketball players or 1 death per 800 athletes over a college career, a figure high enough, if true, to question the value of the sport. There is also debate as to whether 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 risk:benefit ratio.

A British group led by Sheikh9 in this issue of Circulation with senior authors William McKenna and Sanjay Sharma, experts in hypertrophic cardiomyopathy 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 200510 with an update in 2010.11 Discontent with even the updated guidelines prompted a panel of experts to establish the Seattle Criteria in 2012.12 These improved specificity in endurance and nonendurance elite athletes,13 but a high rate of false-positive results persisted, and there were little data on the performance of these criteria in different racial groups.

These various criteria for evaluating athlete ECGs are designed to detect the common cardiac causes of sudden cardiac death in young athletes, including hypertrophic cardiomyopathy, the predominant cause in the United States, and arrhythmogenic right ventricular cardiomyopathy, the predominant cause in Italy. Both have characteristic findings on the ECG. Up to 90% of patients with hypertrophic cardiomyopathy have an abnormal ECG,14 which typically includes left axis deviation, ventricular and atrial hypertrophy, repolarization abnormalities, and abnormal septal Q waves. Only 50% to 60% of patients with arrhythmogenic right ventricular cardiomyopathy have an abnormal ECG at presentation.15 ECG findings in arrhythmogenic right ventricular cardiomyopathy include T-wave inversions in leads V1 through V3, prolongation of the QRS in V1 compared with V6, an incomplete or complete right bundle-branch block, a prolonged S-wave upstroke, and a terminal, late depolarization ε wave, usually seen in V1. Some of these ECG findings of arrhythmogenic right ventricular cardiomyopathy, however, are normal in many healthy young athletes.15

The study by Sheikh and colleagues included in this issue9 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 5505 elite athletes, 4297 white and 1208 black, from multiple sports. The ESC recommendations labeled 21.5% of the athlete 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 ECGs from black athletes as abnormal compared with 16.2%, 7.1%, and 5.3% of those from white athletes.

This larger absolute reduction in blacks is attributed in part to the higher percentage in abnormal ECGs in blacks. Consequently, any improvement in specificity would be most effective among those with the worst previous specificity. Black men have been known since the 1950s16,17 to present myocardial ischemia.18,19 Indeed Wilt Chamberlain, the legendary American basketball player and the only one to present early repolarization in V3 through V6, suggestive of a myocardial ischemia.20 In the present study, black athletes were still more likely to be abnormal with the newly refined criteria, but only 2.2 times more likely.

Sheikh and colleagues9 should be commended for their search for more accurate criteria to interpret athlete ECGs. Unfortunately, even these new criteria considered 5.3% of ECGs from whites and 11.5% of ECGs from blacks 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 sepal 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 that 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 organizations, 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

Disclosures
Dr Thompson is an author of the American Heart Association 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. Dr Thompson reports no conflicts.

References

**Key Words:** Editorials • arrhythmogenic right ventricular dysplasia • athletes • cardiomyopathy, hypertrophic • electrocardiography • exercise
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In the article by Fernandez and Thompson, “Detection of Cardiac Abnormalities in Elite Black and White Athletes: Still Not Black and White,” which was published in the April 22, 2014 issue of the journal (Circulation, 2014;129:1626–1628), several corrections are needed.

On page 1626, second column, first full paragraph, the senior author should be Sanjay Sharma and not Satish Sharma. The sentence should read: “A British group led by Sheikh9 in this issue of Circulation with senior authors William McKenna and Sanjay Sharma, experts in hypertrophic cardiomyopathy and sports cardiology…”

On page 1626, last paragraph, line 1 and page 1627, second full paragraph, line 1, the first author’s surname should be Sheikh and not Sheik.

The authors apologize for the errors. The corrections have been made to the current online version of the article.