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Cardiac screening: time to move forward!

Mats Borjesson,¹ Jonathan Drezner²

Cardiac screening of athletes has been passionately discussed for over two decades. Increased attention and controversy emerged after the publication of the 2005 European Society of Cardiology (ESC) guidelines endorsing a screening protocol inclusive of a resting 12-lead ECG.¹ The American Heart Association (AHA) also strongly advocates for cardiovascular screening in athletes, but recommends a programme based only on a personal and family history and physical examination.² After years of fervent debate, it is time to put *passion* aside and instead focus on the expanding body of *knowledge* which now exists. With careful analysis and thoughtful perspective, the discussion on cardiac screening can move forward—beyond the usual rhetoric—to benefit athletes and prevent sudden death.

In this issue professors Levine and Thompson (USA) and professors Whyte and Wilson (Great Britain) debate 'Challenges in Sports Cardiology: US versus European Approaches' (*see page i9*). The paper addresses several difficult questions on cardiac screening of athletes which are posed to both 'sides'. While the expertise of the professionals involved in this debate is unquestionable, we add these comments for readers to consider regarding our current challenges to cardiac screening.

IS 'MANDATORY' THE RIGHT QUESTION?

If we could remove 'mandatory' from the discussion both sides might be a lot closer to agreeing on a screening protocol. We should consider that the focus on 'mandatory' or 'national' screening programmes has distracted this discussion from addressing key issues that affect the sports physician when faced with conducting a preparticipation evaluation. The merits of ECG screening are often examined and debated regarding the initiation of a nationalised, mandatory screening programme as existing in Italy.³ However, the questions that a sports physician (or consultant cardiologist) considers when seeing an

athlete for a preparticipation evaluation may be very different. Sports physicians may ask: How should I be screening this athlete? What is 'best practice'? What allows me to meet the stated objectives of cardiovascular screening—namely, early detection of those at risk?

The sports medicine community must first define what is recommended—what is best practice—and then define what steps are needed to successfully achieve that goal. This two-step process is especially important if the traditional screening model is believed to be ineffective.

BENEFIT VERSUS HARM OF SCREENING

The potential harms of increased disease identification in athletes and false-positive results need to be defined; Levine and Thompson appropriately emphasise this point. Potential harms also need to be defined for the history and physical examination. However, outcome studies based on newspaper clippings are simply insufficient to draw reliable conclusions or evaluate the outcomes of screening.⁴

There is universal agreement that exercise is a trigger for sudden cardiac arrest in individuals with underlying pathological cardiac disorders. In addition, early detection of at risk disorders and the principle of mitigating risk through activity restrictions and medical interventions is the very premise of preparticipation screening. While the long-term consequences of increased disease detection need to be determined, if one does not believe that early detection reduces risk, then the

¹Department of Cardiology, Karolinska University Hospital, Stockholm, Sweden

²Department of Family Medicine, University of Washington, Seattle, Washington, USA

Correspondence to Professor Jonathan Drezner, Department of Family Medicine, American Medical Society for Sports Medicine, University of Washington, PO Box 354410, Seattle, WA 98195, USA; jdrezner@uw.edu

argument is for no screening of any kind (regardless of ECG inclusion). If 'first do no harm' is the dominant principle to base our policy as asserted by Levine and Thompson, we should also consider that screening based only on history and physical examination requires significant cost to society but with a low yield of disease detection and a high false-negative rate (false-reassurance).

The screening debate may be even more complex in real life than outlined in this instructive paper. For example, many US cardiologists and sports physicians favour ECG screening in competitive athletes, a position not reflected by the official view of the AHA. In fact, ECG screening of professional and many college athletes is performed in the USA today. Thus, the term 'US approach' is not an accurate generalisation. Along the same line, experts in Europe are not of one opinion either. For instance, some European countries (ie, Norway) are debating whether to recommend cardiac screening of athletes *at all*, but very few (if any) European experts advocate for cardiac screening that does not include ECG.

'BEST PRACTICE'?

As Whyte and Wilson indicate, both the AHA and ESC agree 'that compelling justification exists for cardiovascular preparticipation screening on medical, ethical and legal grounds'. The next step must be to decide which screening components to include. Available methods include personal history, physical examination, resting ECG, echocardiography, stress tests, Holter monitoring as well as novel imaging methods such as cardiac MR and CT angiography. The logical way to approach this would be to add one component at a time to the proposed screening procedure, and carefully and critically analyse available data regarding the sensitivity, specificity and cost-effectiveness of each approach.

Cardiac screening with only personal history and physical examination has very low sensitivity.⁵⁻⁸ This is acknowledged by both sides in the debate, who 'readily acknowledge that screening with ECG will find more underlying pathology'. What has attracted very little discussion in this US-Europe debate is the *low specificity* of using history and physical examination alone. The nature of cardiovascular symptoms are very diffuse, possibly vague (ie, palpitations, lightheadedness and fatigue) and, most importantly, common in adolescents and young adults in everyday life. These symptoms require careful evaluation, typically by adding an ECG or other cardiac investigation, to assess for underlying

disease. In addition, symptoms are sometimes evaluated by clinicians with little knowledge of cardiovascular-related symptoms or the disorders causing sudden cardiac death in young athletes, further complicating the usefulness of this approach.

The sensitivity of cardiac screening is improved with the addition of ECG as a majority of athletes with underlying relevant cardiac abnormalities will have an abnormal ECG. A challenge regarding the use of ECG has been the potential low-specificity and high-false-positive rate. This is a very valid point and one that has to be addressed for ECG screening to be considered as best practice. Recent initiatives and consensus papers regarding ECG interpretation in athletes have provided modern interpretation guidelines to improve the specificity of ECG screening while maintaining a high sensitivity.^{9,10} Future studies are needed to improve ECG interpretation accuracy in different athlete populations, especially the influence of ethnicity on normal athletic ECG variants.

The use of echocardiography as a regular part of cardiac screening as proposed by FIFA and UEFA will increase sensitivity by another small fraction but at a very high cost (economically and logistically), and should be reserved for elite athletic settings with high economic resources. Newer methods like CT angiography offer non-invasive information on coronary anatomy and atherosclerosis but has not been studied as a method to detect underlying pathology in younger athletes. CT angiography may be a promising tool for evaluating older competitive athletes (>35 years old), where coronary artery disease becomes the most common cause of sudden cardiac death.

COST AND INFRASTRUCTURE

The economic analysis and justification of any cardiac screening programme is critical and must be addressed by more studies. Most existing cost-effectiveness studies conclude that cardiac screening by history and physical examination alone is the least cost-effective of all options, and that screening by ECG *is* economically justified and approximates the same costs per quality-adjusted-life-year saved (QALY) as other accepted treatments in healthcare (ie, dialysis in chronic renal disease).^{11,12} It is clear that the traditional screening model in the USA is not cost-effective and occurs at substantial total cost, an important consideration that is often overlooked. While a history and physical evaluation may provide other benefits to the athlete (ie, non-cardiac issues or non-catastrophic

injury prevention), this benefit remains unmeasured and unproven.

If the only way to reasonably identify athletes at risk for sudden death is by using a protocol that includes ECG, then sports physicians should be asking 'how do I do it?' This raises issues about physician training and education in ECG interpretation, and cardiology training in the evaluation of athletes with an abnormal ECG. Just as many sports physicians have adopted neuropsychological testing and musculoskeletal ultrasound into their practices, the acquisition of any new skill requires new curricula and educational modules. For example, revised consensus guidelines for ECG interpretation will be published later this year in *BJSM*, the result of a joint US-European-World initiative to develop a freely accessible online training module to assist physicians around the globe distinguish physiological adaptations in athletes from ECG findings suggestive of underlying pathology (<http://blogs.bmj.com/bjism/2012/03/09/ekg-summit-in-seattle-successes-and-next-steps/>).

Unfortunately, the details and challenges of improving our infrastructure to effectively utilise ECG in the screening process are seldom addressed, and the focus has remained on the *de novo* creation of a universal and 'mandatory' programme which is inherently not feasible in countries with no physician infrastructure for accurate ECG interpretation or skilled cardiology referral. As acknowledged by Whyte and Wilson, 'Unless there is a significant emphasis placed on training and education, effective pre-participation screening is doomed to failure before it has begun'.

MOVING FORWARD ...

The continued emphasis on 'mandatory' screening of athletes should be replaced by focusing on what screening protocol should be medically recommended and is scientifically justified. This programme must consider medical, ethical, economical and logistical considerations, and may in the end be different for different levels of athletes or defined higher risk groups. We believe that the way forward for cardiac screening is to frame this issue on available data from the perspective of 'best practice' instead of remaining fixed in the rhetoric and long-standing debate of mandatory screening.

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