



Physical examinations for young athletes

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TO THE EDITOR: I read with interest the article by Drs. Mick and Dimeff¹ ("What kind of physical examination does a young athlete need before participating in sports?") in the July 2004 issue of the *Cleveland Clinic Journal of Medicine*. They state that a primary goal of the preparticipation examination is to detect potentially life-threatening cardiovascular conditions. They refer to a recent consensus document² from the American Heart Association, which recommends a detailed preparticipation cardiovascular history and physical examination, but does not recommend preparticipation noninvasive testing such as electrocardiography (ECG). Appropriately, the authors further ask: "Does screening prevent death?" They evaluate the advantages and disadvantages of the recommended cardiovascular preparticipation history and physical vs screening ECG in preventing cardiac death in young athletes, and they conclude that neither screening approach is very effective and, in particular, that ECG is impractical and costly.

From our own prospective evaluation of nearly 6,000 high school athletes³ who underwent a screening cardiovascular history and physical examination, as recommended by the American Heart Association, and also 12-lead ECG, we derived additional data from which to draw helpful conclusions.

A reasonable estimate of the risk of sudden cardiac death during a 3-year high school career is 1 in 72,500.⁴ Further, for every high school athlete who experiences cardiac death, about 10 have a condition putting them at risk for sudden cardiac death.⁵ Therefore, the challenge of cardiovascular screening is to identify the 1 athlete out of 7,250 athletes screened who actually has a previously undetected cardiovascular abnormality that predisposes to sudden cardiovascular death.

The most common cause of sudden cardiac death in high school athletes is hypertrophic cardiomyopathy, which is responsible for about one half of cases.⁶ Therefore, the estimated prevalence of hypertrophic cardiomyopathy capable of causing sudden cardiac death in high school athletes is approximately 1 in 15,000.

The sensitivity of the cardiac history and

physical examination for hypertrophic cardiomyopathy in high school athletes is not known, but as Drs. Mick and Dimeff point out, it is probably 20% at best. Alternatively, the sensitivity of ECG for hypertrophic cardiomyopathy capable of causing sudden cardiac death in a young athlete is 95%.⁷

Therefore, approximately 100 of 1.5 million high school athletes screened have hypertrophic cardiomyopathy capable of causing sudden cardiac death, but the cardiac history and physical would detect it in only 20 (20%) of them. The specificity of the cardiac history and physical is 97.8%³; therefore, for every 1.5 million high school athletes screened, 33,000 would be referred for echocardiography and would be found not to have hypertrophic cardiomyopathy. Overall, 1,650 would have to undergo echocardiography to identify 1 athlete with hypertrophic cardiomyopathy capable of causing sudden cardiac death.

Screening ECG would detect virtually all 100 "at-risk" athletes in the screened population of 1.5 million. The specificity of 12-lead ECG is 84.3%.³ Therefore, out of 1.5 million athletes screened, 235,500 would have an abnormal screening ECG and subsequently a normal echocardiogram. Overall, 2,350 would require echocardiography for each one found to have hypertrophic cardiomyopathy capable of causing sudden cardiac death.

The cost per case of hypertrophic cardiomyopathy detected, in terms of echocardiographic tests performed, is similar with either screening method, but screening with ECG is much more effective in detecting the condition in high school athletes. It appears that the lower specificity of screening ECG is more than offset by its much greater sensitivity.

An additional advantage of screening ECG is its ability to detect many of the other causes of sudden cardiac death in young athletes, such as arrhythmogenic right ventricular dysplasia, myocarditis, dilated cardiomyopathy, Q-T segment prolongation, and primary conduction abnormalities.

Importantly, screening ECG as the sole cardiac preparticipation tool is reliable, standardized, and reproducible, whereas the cardiac history and physical are not.

If you were a parent, which preparticipation screening test would you want for your child?

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■ REFERENCES

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IN REPLY: I appreciate the valuable comments of Dr. Fuller. Cardiac screening certainly remains controversial. A number of authors have advocated the use of screening electrocardiography and echocardiography to identify people at risk for sudden cardiac death. However, their arguments are based on epidemiologic studies, and no outcome-based studies have determined that these tests can consistently identify the high-risk athlete or reduce the instances of sudden cardiac death.

As Dr. Fuller states, cardiac tests in asymptomatic patients often generate a false-positive result that

requires a complete follow-up evaluation and more expensive testing for cardiovascular disease. In the soon-to-be-published third edition of *Pre-participation Physical Evaluation*, a collaborative effort of the American Academy of Family Physicians, the American Academy of Pediatrics, the American Academy of Sports Medicine, the American Medical Society for Sports Medicine, the American Orthopaedics Society for Sports Medicine, and the American Osteopathic Academy for Sports Medicine, it was concluded that a test that identifies the 1 athlete out of 100,000 who is at risk for sudden cardiac death would have to demonstrate high sensitivity and specificity to merit the cost of implementation into the nationwide preparticipation evaluation process. We must also recognize that many students do not participate in high school sports and so would not have electrocardiographic screening, and yet this population also has the risk of sudden death due to undetected cardiac disease. Because these deaths do not occur on the playing field, they do not receive the media attention that occurs when an athlete experiences an untoward cardiac event.

Finally, while the cost of a preparticipation evaluation may be \$25 to \$35, the cost of a 12-lead electrocardiogram is more than \$50, more than doubling the cost of the evaluation.

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