Should ECG be required in young athletes?

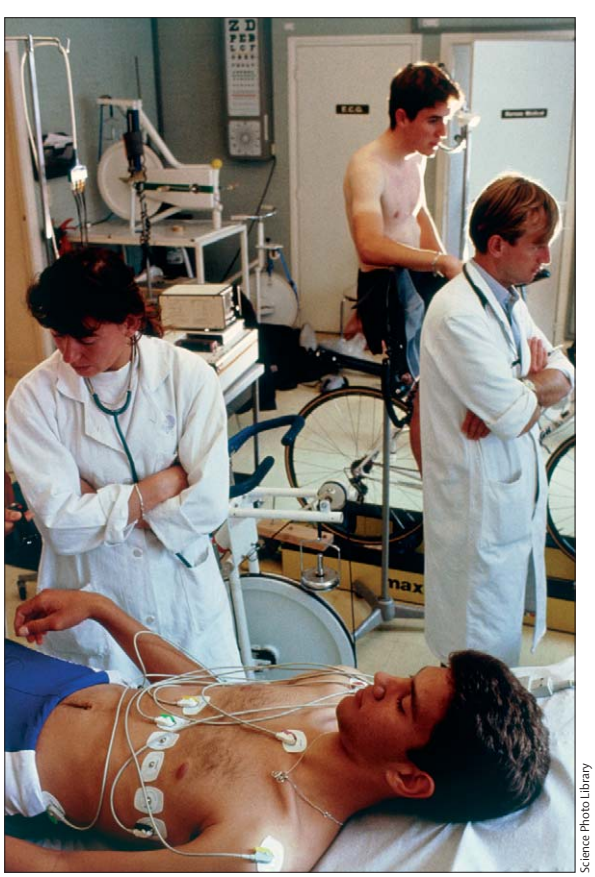
Athletes' hearts are adapted to chronic exercise training that may result in physiological increases in left-ventricular volume, left-ventricular hypertrophy, increased left-atrial volume, and right-ventricular structural changes, with preserved systolic and diastolic ventricular function and exercise ability.[1,2] The extent and variability of cardiac morphological changes in trained athletes varies with the type of exercise training, age, gender, environment, and body size. Genotype and different polymorphisms of the angiotensin-converting enzyme or angiotensinogen genes can result in different phenotypic expression in athletes' hearts.

Results of resting 12-lead electrocardiogram (ECG) reflect the autonomic and structural changes resulting from training.[3,4] Increased vagal tone usually results in sinus bradycardia, and can be associated with certain types of benign cardiac arrhythmias, ventricular hypertrophy, and repolarisation changes, such as ST segment elevation of the early repolarisation type and biphasic or inverted T waves, which occur in 2–4% of trained athletes aged 18–35 years.[3] The commonness of ECG abnormalities in apparently healthy athletes with above average exercise performance contrasts sharply with the rareness of major cardiac pathology in these individuals and extremely rare incidents of sudden cardiac death.[5]

The requirement for an ECG (and in some countries, an echocardiogram and exercise test) to detect underlying cardiac pathology in young, apparently healthy athletes is controversial. In many European countries, not only is a careful history and physical examination needed, but also a 12-lead resting ECG is required before allowing competition, a position endorsed by the Lausanne recommendations for the International Olympic Committee (IOC).[6,7] By contrast, the American Heart Association does not require or recommend routine 12-lead ECG as part of the precompetition assessment, unless the athlete fails a prescreening questionnaire and physical examination.[8] The position of the American Heart Association has recently been debated.[9,10]

The Summer Olympics will be held in Beijing, China, in August 2008. The decision to do an ECG as a precompetition requirement would have been considered by National Olympic Committees and International Federations well before the Beijing Olympics. However, how much prognostic accuracy a resting ECG adds to the detection of rare cardiac pathology and even more rare cardiac events that result in sudden cardiac death in apparently healthy athletes is unclear.

In a recent series, Antonio Pelliccia and colleagues[11] described the clinical course of 123 (1%) of 12 550 trained athletes who had inverted T waves equal to or greater than 2 mm in at least three leads, predominantly V2–V6, without apparent cardiac disease; 81 subsequently had serial clinical, ECG, and echocardiographic studies.[11] The athletes were followed up for a mean of 9 years (range 1–27 years) and were compared with 229 athletes matched for age and sex with normal ECG followed up for a similar time. Of the 81 athletes, 5 (6%) ultimately developed a cardiomyopathy, including one who died suddenly at age 24 years from arrhythmogenic right-ventricular



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dysplasia, versus none in the control group. The prevalence of congenital defects in the 12 550 athletes was 0·03% and there were sudden cardiac arrests in two patients (0·01%), one of whom was resuscitated and the other of whom died.

Basavarajaiah and co-workers assessed the prevalence of hypertrophic cardiomyopathy in 3500 elite British athletes by use of clinical history, physical examination, screening ECG, and echocardiogram.[12] 1% had deep T-wave inversion and 1·5% had echocardiographic evidence of left-ventricular hypertrophy. Physiological adaptation to training explained the findings in 50; only three (0·08%) had left-ventricular hypertrophy with non-dilated left ventricles and associated T-wave inversion, each of whom had normal cardiac MRI, normal right-ventricular and left-ventricular structure and function, and normal 48-h ambulatory ECG monitoring. One athlete who agreed to stop training had normal findings after 12 weeks.

Routine non-invasive testing with an echocardiogram is a cost-inefficient way to prospectively screen highly trained athletes, particularly those able to compete at Olympic level. The role of the resting ECG, a less expensive modality, as a prescreening requirement for different types of competitive sports in all younger athletes remains controversial,[9,10] and the use of mandatory self-funded non-invasive test screening varies among different sports associations. Additional research into methods to cost-effectively screen people involved in high-level exercise activities would be valuable.

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We declare that we have no conflict of interest.

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Expression of concern—autologous myoblasts and fibroblasts for treatment of stress urinary incontinence: a randomised controlled trial

On April 22, it was brought to our attention that the published trial registration number provided by the authors of this study is incorrect.[1] We have also been made aware of concerns about the ethical approval and conduct of this study, which are currently subject to investigations in Austria. Pending the outcome of these investigations, we issue an expression of concern about the article by Dr Hannes Strasser and colleagues.[1]

The Editors of The Lancet

1 Strasser H, Marksteiner R, Margreiter E, et al. Autologous myoblasts and fibroblasts versus collagen for treatment of stress urinary incontinence in women: a randomised controlled trial. *Lancet* 2007; **369:** 2179–86.