



## Abnormal ECG Patterns in Athletes: An Initial Expression of Underlying Cardiomyopathy?

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**Michael O'Riordan**

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– An abnormal

electrocardiogram (ECG) in a

young, highly trained athlete might be the first expression of underlying cardiomyopathy, a new study suggests, and might not simply be the benign expression of cardiac remodeling associated with athletic conditioning [1]. As the underlying cardiomyopathy might not show itself until many years later and may be associated with adverse outcomes, athletes with abnormal ECGs merit continued clinical surveillance, say investigators.

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"Contrary to previous reports describing such ECG patterns as innocent manifestations of 'athlete's heart,' without adverse clinical consequences, the present study shows that these abnormal ECGs may represent the initial expression of genetic cardiac disease, preceding by many years phenotypic expression and adverse clinical outcomes," according to lead investigator **Dr Antonio Pelliccia** (Institute of Sports Medicine and Science, Rome, Italy) and colleagues.

Publishing their report in the January 10, 2008 issue of the *New England Journal of Medicine*, the Italian authors, along with **Dr Barry Maron** (Minneapolis Heart Institute Foundation, MN), note that 12-lead ECGs often show a range of alterations in young, trained athletes, most commonly of the type suggesting left ventricular hypertrophy. These repolarization abnormalities are usually thought to be the result of exercise training, but the group writes that a small subgroup of athletes without evidence of structural heart disease might have "diffusely and deeply inverted T waves, suggestive of an underlying cardiac disorder."

### Screening for all athletes in Italy

Italy is one of the few countries to legally require those participating in competitive sports to undergo preparticipation ECG screening to rule out cardiovascular disease. Because of this, Pelliccia and colleagues were able to evaluate the clinical outcomes associated with abnormal ECGs, characterized by these distinctive repolarization patterns, in trained athletes. From the database of more than 12 000 athletes, the group identified 81 athletes with repolarization abnormalities--inverted T waves  $\geq 2$  mm in at least three leads--but who had no apparent cardiac disease.

Of the 81 athletes with abnormal ECGs, five later proved to have cardiomyopathies, including one who died at age 24 from undetected arrhythmogenic right ventricular cardiomyopathy. The clinical and phenotypic features of hypertrophic cardiomyopathy developed in three subjects after approximately 12 years, and one of these subjects had an aborted cardiac arrest. The fifth athlete had dilated cardiomyopathy after nine years of follow-up. Comparisons between 229 matched control athletes with normal ECGs from the same database revealed that none of those

athletes had a cardiac event or were diagnosed with cardiomyopathy more than nine years after their initial evaluation.

"These observations underscore the importance of greater diagnostic scrutiny and continued clinical surveillance of trained athletes who present with such distinctly abnormal ECGs," write the authors.

Commenting on the findings for *heartwire*, **Dr Benjamin Levine** (University of Texas Southwestern Medical Center, Dallas) noted that the most feared of the cardiomyopathies of the left and right ventricles are associated with sudden death in competitive athletics. Regarding the Italian cohort, he pointed out that nearly one-third of the athletes were part of a select population, referred to the authors because of bizarre ECG screening, rather than detected on routine screening.

"Therefore, the authors carefully and appropriately avoid raising any implications of their findings for the 'hot' issue of ECG screening of competitive athletes," noted Levine. "In my opinion, these data provide no further evidence that can inform this debate--mass screening of any population, regardless of the method, is likely to identify a fraction of 1%, probably 0.2% to 0.5%, of individuals who may have an underlying inherited cardiomyopathy that is at some point in its clinical expression."

The frequency of previously undiagnosed cardiomyopathies was a small but important fraction of the total of athletes with abnormal ECG patterns. He noted that if 24 athletes with documented cardiomyopathy, picked up at the initial ECG screening but excluded from subsequent analysis, were added to the five subjects in whom cardiomyopathy was later detected, the overall prevalence of clinically meaningful cardiomyopathy in the population was 0.23%, "remarkably similar to the prevalence of hypertrophic cardiomyopathy that has been reported in the general population."

In addition, Levine noted that the study highlights the finding that a normal ECG is strongly predictive of a benign short-term, approximately 10 years, clinical course.

1. Pelliccia A, Di Paolo FM, Quattrini FM, et al. Outcomes in athletes with marked ECG repolarization abnormalities. *N Engl J Med* 2008; 358:152-61