What duration of the QTc interval should disqualify athletes from competitive sports?

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Online publish-ahead-of-print 29 October 2007

This editorial refers to ‘Prevalence and significance of an isolated long QT interval in elite athletes’ by S. Basavarajaiah et al., on page 2944

Vigorous athletic activities are encouraged in junior school, competitive sports are part of the school curriculum during adolescence and early adulthood, and a high national emphasis is placed on elite athletes and their teams to win international championships. Endurance sports are associated with a small yet definite risk of sudden cardiac death among participants, estimated at a rate of 1–2 sudden deaths per 100 000 athletes per year in Europe, with an absolute number of ~300 cardiac-related athletic deaths annually in the USA. During the past 25 years, cardiology societies in Europe and the USA have recognized the need for pre-participation cardiac screening in order to identify competitive athletes who are at high risk for exercise-related sudden cardiac death so that athletic-related fatalities can be minimized. In 1982, the Italian Ministry of Health established rules concerning the medical protection of athletic activity. In the USA the 16th Bethesda Conference was held in 1984 with a focus on cardiovascular abnormalities in the athlete and recommendations regarding eligibility for competition.

The 2005 Study Group of Sport Cardiology of the European Society of Cardiology recommend that a 12-lead ECG (in addition to a history and physical examination) should be part of the pre-participation screening of young competitive athletes for prevention of sudden death. With this approach, disorders such as hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy/dysplasia, dilated cardiomyopathy, long QT syndrome, Brugada syndrome, pre-excitation syndrome (WPW), and some manifestations of congenital or premature atherosclerotic coronary disease can be detected, and it was recommended that athletes with these conditions be excluded from competitive athletic activities. That document included criteria for a positive 12-lead ECG and specified values of the heart rate-corrected QT interval (QTc >440 ms in males and >460 ms in females by Bazett criteria) that were of concern, with recommendation that athletes with these prolonged QT intervals should be referred for further testing. The 36th Bethesda Conference published in 2005 involved updated eligibility recommendations for competitive athletes, and the task force recommended that individuals with slightly longer QTc intervals (QTc ≥470 ms in males, ≥480 ms in females) should be restricted to low physical intensity (Class IA) sports.

The aforementioned QTc prolongation criteria were based on the distribution of QTc intervals drawn from normal population studies in which QTc values >2 SD above the mean for adult men and women were considered prolonged. Measurement of the QT interval is not an exact science due to vagaries in identifying the true end of the T wave of the QRS-T complex. Furthermore, the QT interval should be corrected for heart rate, but there is no agreement on the optimal correction formula at heart rates below 60 b.p.m. QTc screening of trained athletes is aimed at identifying subjects with prolonged ventricular repolarization due to genetic long QT syndrome (LQTS) or acquired disorders, mostly related to drugs, since it is assumed that disordered ventricular repolarization could contribute to athletic-related ventricular tachyarrhythmias and arrhythmogenic sudden cardiac death. In our LQTS research studies, we have consistently demonstrated a significant increased risk for life-threatening cardiac events in LQTS subjects with QTc prolongation >500 ms and in those with a history of prior syncope, with the risk being considerably greater in adult women than men.

Elite, highly trained, endurance athletes are a unique group of individuals with increased left ventricular mass and resting heart rates generally less than 60 b.p.m. Electrocardiographic normal standards, especially those for the QTc interval, do not exist for these individuals. It is in this context that the observational study of Basavarajaiah et al. adds relevant new information. The authors evaluated 2000 elite athletes age 14–35 years for QTc prolongation during a 10-year period between 1996 and 2006. They report their findings in seven asymptomatic, medication-free athletes with QTc (Bazett) ≥450 ms (0.35% of the athletes) comprising one female and six males who underwent detailed clinical testing. Three with QTc ≥500 ms had clinical findings suggestive or indicative of LQTS, whereas four with QTc <500 ms did not. The ECGs...
on the three subjects with QTc $\geq 500$ ms were indeed impressive for the length of the QT interval as well as for abnormal configuration of the T wave. Genetic testing was performed in five of the seven athletes, and an LQTS gene mutation was identified in the female with QTc = 515 ms. Of note, the authors allowed the four male athletes with QTc values between 460 and 492 ms to continue to participate in competitive sports, and these athletes remained well after a mean follow-up of almost 3 years.

It is clear that normal ventricular repolarization standards involving QT, heart rate, and QTc need to be developed in highly trained athletes, with final genetic testing for outcome. The report by Basavarajaiah et al. is a step in the right direction. Genetic testing for LQTS is still in its infancy, and a negative genetic test does rule out LQTS. QTc is only a surrogate marker for ventricular repolarization, and borderline QTc interval prolongation ($460 \leq QTc < 500$ ms) in trained athletes does not warrant disqualification from competitive sports in the absence of findings indicative of LQTS or structural heart disease. For athletes with QTc $\geq 500$ ms, it is reasonable and prudent to recommend that they do not participate in competitive sports.

Conflict of interest: none declared.

References


