measurement such as the 99th percentile, there is greater imprecision for troponin assays than at higher ranges. Furthermore, at the lower level of measurement of troponin, a large percentage change (three standard deviations of the variability) is required for to be sure that the values are analytically different. If one also appreciates that values usually are reported to 100ths and thus the need for rounding, it becomes clear that it is necessary to show a very substantial increment of change for the analytical difference. For some assays as for the troponin T assay, that is a value fully three-fold higher than the 99th percentile range. For other assays, it may not be quite that high.

It is a different scenario when considering CABG-related MI. Obligatory myocardial necrosis always occurs during CABG. Some of this injury may be mechanical, some is due to hypothermia, and some may be the result of ischaemia. There is no way of distinguishing the impact of these various causes. Accordingly, we set criteria on the basis of prognostic data that could accommodate all the types of surgery and suggested the need for additional criteria to ascertain that the myocardial injury was ischaemic.

Patients who suffer sudden cardiac death with ECG changes suggestive of ischaemia often have acute coronary events at autopsy. This can be hard to detect because necrosis of myocardial cells requires at least 2–4 h or longer. Some of these individuals may die before blood samples for biomarkers can be obtained, or before cardiac biomarkers have risen to detectable levels. As a consequence of the scientific debate about this matter after the 2000 document, the Task Force discussed this issue in-depth and agreed that a classification of MI type 3 could be made being without biochemical evidence of myocardial necrosis if new ECG changes or evidence of fresh thrombus by angiography and/or autopsy is present.

We agree that the distinction between MIs type 1 and type 2 is sometimes difficult. That is stated as ‘on occasion, patients may manifest more than one type of MI simultaneously or sequentially’. However, we consider this classification useful given the potential differences in management. There are circumstances such as peri-operative MI where most are MI type 2.

We believe that these considerations move all the criteria of the 2007 redefinition into reasonable alignment, and that the resultant document is scientifically accurate, and clinically useful. Use of the universal definition of MI will have a major impact on the accuracy and use of clinical data from patients with MI.

References

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Prevalence and significance of an isolated long QT interval in elite athletes

Concerning the prevalence and significance of an isolated long QT syndrome in elite athletes, Basavarajaiah et al. concluded that a QTc value of ≥500 ms is diagnostic of long QT syndrome (LQTS), considering these athletes with QTc ≥500 ms (three of seven patients) having a high probability of LQTS.

We have some remarks regarding their definition of LQTS, the accuracy of Schwartz score, used in this work and the place of ethnic differences on definition of QTc interval. LQTS is a genuine channelopathy and mutations in potassium-channel genes KCNQ1 (LQT1 locus) and KCNH2 (LQT2 locus) and the sodium-channel gene SCN5A (LQT3 locus) are the most common causes, occurring in 60–75% of all cases.

Among their three patients with QTc ≥500 ms and high probability of LQTS by Schwartz score, Z (66%) had negative genetic testing and the only positive (athlete no. 3) had QTc shorter than two others (respectively, QTc interval 515 vs. 550 and 570 ms). This fact suggests that the correlation between the length of QTc interval and the gene mutation should be taken with precaution, furthermore in the literature the so-called ‘normal’ QTc LQTS has been reported in ~5% of LQTS gene carriers with QTc values <440 ms.

Athlete no. 3, positive for LQT1 had negative exercise treadmill test (ETT) despite affected first-degree family members, whereas the two others with QTc >500 ms but without LQTS (as genetic test was negative) had positive ETT and one of them had not affected first-degree family members (athlete no. 2).

Two out of four athletes, with QTc <500 ms, declined genetic testing. This lack of information (50%) does not allow us to use this cut off value of QTc interval for genetic screening of potential high-risk
population for sudden death, as elite athletes with an isolated long QT as recommended by the authors.

What is the age distribution and duration of physical activity of all seven athletes? Knowing that they were asymptomatic although two had positive ETT.

The current cut off value of a prolonged QTc interval (>440 ms in males and >460 ms in females) does not take into account the possible race specificity of phenotype-genotype correlation. This fact would be an explanation of missed diagnoses of black Africans, who represent a large cohort of elite athletes worldwide.

All these conflicting data show the difficulties in finding a high diagnostic yield and an accuracy of phenotype feature of LQTS, keeping in mind that the gold standard for diagnosis is genetic testing. Moreover, the authors studied a small number of patients to have consistent data.

In our point of view, the significance of an isolated long QT interval remains unknown, and we need to study the long-term outcome of this phenotype in elite athletes.

References


Prevalence and significance of an isolated long QT interval in elite athletes: reply

We thank Dr Aime Bonny and colleagues for raising queries regarding our definition of a long QTc in athletes, the utility of the Schwarz score for the diagnosis of congenital long QT syndrome (LQTS), and the impact of ethnicity on the QTc interval.

Screening highly trained athletes in the UK identified a long QTc (based on a value of >440 ms in males and >460 ms in females) in 0.4% athletes. The prevalence was surprisingly greater than that of hypertrophic cardiomyopathy (0.2%) and arrhythmogenic right ventricular cardiomyopathy (0.1%), which collectively accounts for almost 50% of all young exercise-related sudden cardiac deaths.

Given that a potential ion-channel disorder is implicated in <2% of all sudden cardiac deaths in young athletes, it is improbable that a long QTc identified in all 0.4% of our athletes reflected inheritance of a mutant ion-channel disorder within cardiac myocytes. Possible explanations for a higher QTc in athletes include inaccuracies in the Bazzet correction at heart rates ≤40 b.p.m. and increased left ventricular mass.

Investigation of all athletes with a long QTc revealed that only athletes with a QTc value of >500 ms exhibited other features to indicate LQTS.

We agree with Bonny and colleagues that the diagnosis of LQTS, based on non-genetic investigation, is difficult. Therefore, we provided a pragmatic diagnostic outline for cardiologists when faced with an asymptomatic athlete with a prolonged QTc. A QTc of >500 ms is diagnostic of LQTS whereas there is less convincing evidence on clinical grounds that an asymptomatic athlete with a prolonged QTc of <500 ms and normal exercise test and 24 h ECG is affected.

Bonny and colleagues correctly state that genetic testing is the gold standard test and we concede that we could not assess the impact of genetic testing in the diagnosis of LQTS. However, genetic testing for LQTS is in its infancy; results are not available in a timely fashion in an athlete striving for regular team selection. More importantly, a negative gene test does not exclude LQTS in up to 40% of individuals with the disorder and a positive gene diagnosis does not necessarily confer a worse prognosis.

We agree that one should not rely solely on the length of the QTc interval to diagnose LQTS; individuals with a shorter QTc than 500 ms may be affected and we recommend thorough evaluation of all athletes with a long QTc. We agree that one to two of our athletes with a normal QTc may be gene-carriers for LQTS, but there is no evidence that they are at high risk of sudden death; we have not observed any deaths in >8000 athletes screened over a 14 year period who have a normal QTc.

Finally, the impact of ethnicity on QTc was not evaluated in this study since 98% of athletes were Caucasian. Our experience of screening over 400 elite black athletes has not identified any differences in QTc between black and Caucasian athletes.

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