

# THE EUROPEAN CARDIOLOGIST - JOURNAL BY FAX

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## WHAT WAS HOT AT ANAHEIM?—SUDDEN DEATH IN ATHLETES

**Sudden death in young athletes, is a very rare occurrence but is a tragedy that shocks the community every time it happens. These young people are usually of high-school age, previously regarded as healthy, and have had no warning symptoms. Thus, when sudden death occurs, it is a high-profile catastrophe and this is why there is much interest in this problem.**

In the US, maybe fewer than 20 cases occur annually. In the Boston area, about two such cases occur every year. If an adolescent is having chest pain or palpitations or unexplained dizziness, then this is something that can be revealed in a careful history prior to their being passed fit for participation in organized sports. Even in retrospect, most of these unfortunate athletes had no warning symptoms, but occasionally one is found to have had them. Hopefully, we may be able to detect a few of these young athletes in advance and prevent another disaster based on a careful preparticipation history.

### Causes of sudden death in young athletes

Dr Barry J. Maron of the Minneapolis Heart Institute Foundation investigated US death certificates and hospital records and was able to show that these events did not just happen out of the blue, but that there was an underlying cardiac pathology involved.

In the US, the most common cause of sudden death in young athletes is hypertrophic cardiomyopathy (HCM), of which there are two different types. The first is the obstructive type where the muscle causes obstruction to aortic outflow and a physician can usually detect a murmur on physical examination. Patients with the obstructive variety are usually identified on routine examination, and are thus unlikely to be involved in competitive sports. As it turns out, however, athletes with HCM that die during sports usually have the nonobstructive type, which is not typically associated with abnormalities on physical examination. Thus, these athletes go ahead and take part in sporting activities, believing that they are healthy until they have an unusual event in the stress of training or competition.

While most sudden deaths in athletes are associated with underlying cardiac conditions, there are some other rare cases that seem to involve patients with otherwise normal hearts. Some athletes die from receiving a sudden blow to the chest. This is a very bizarre and rare condition called commotio cordis. It happens when there is a blow near the sternum during a very specific part of the cardiac cycle. It has to happen just at the relaxation phase of the cardiac cycle, during a very specific part of the T wave, the so-called vulnerable period. Dr Mark Link from the New England Medical Center has performed the best work on this rare condition and was able to recreate it in animal models by firing hard objects at the chest of animals. He timed it at different parts of the cardiac cycle and discovered that, if he timed it just right, he could cause the animals to have ventricular fibrillation. This is what happens

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sometimes to these athletes when they get hit with a baseball or a hockey puck or suffer a violent collision on the field. It has happened to three patients in the Boston area in the last 5 years, but this is probably a statistical anomaly. Fortunately, two of those patients were resuscitated.

There is a hierarchy of diseases in the US associated with sudden death in the athlete. As mentioned earlier, the number one cause is HCM. The second cause is abnormal origin of either the right or left coronary artery, which can be silent and fatal. The third-leading cause is "possible" HCM, where it is not clear whether the problem is a thick heart because of athletic training, or whether the subjects really do have HCM. The next commonest cause is aortic dissection related to Marfan's syndrome. In addition to these conditions, there are several rare causes, including arrhythmias, cerebral aneurysms, pulmonary emboli, heat stroke, and asthma, but these are at the low end of the hierarchy.

Dr Maron listed the causes as HCM (36%), coronary anomalies (19%), "possible" HCM (10%), ruptured aorta and Marfan's syndrome (5%), aortic stenosis (about 4%), and other causes (less than 5%). These included myocarditis, mitral valve prolapse, arrhythmogenic right ventricular (RV) dysplasia, asthma, heat stroke, and arrhythmias.

The curious thing is that a similar review of these cases in Italy would show the most common cause of sudden death in young athletes to be completely different. In Italy, the number one cause is arrhythmogenic RV dysplasia, and only a small minority have HCM. There are two reasons given to explain this difference. Italy has a very rigid preparticipation screening program and no one can participate in athletics at either the high-school or college level until they have a participation certificate. The tests that young athletes undergo include electrocardiograms (ECG), something that is not required in the US. In Italy, physicians may be able to identify patients with HCM and bar them from sporting activities. It may also have something to do with population genetics in Italy: arrhythmogenic RV dysplasia is more commonly diagnosed in Europe than in the US.

### Screening and prevention

No screening strategy is 100% effective, the main reason being that there is no ideal test for these diseases. The ECG is not perfect and a test that might be absolutely diagnostic, such as magnetic resonance imaging, may not be part of a general screening program because of the cost and manpower involved. We are therefore left

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with less than perfect tools for finding a needle in a haystack. The US strategy, which has been adopted by the AHA, the American College of Cardiology, and the North American Society for Pacing and Electrophysiology, is that athletes should be screened by personal history, family history, and careful physical examination, but not routinely with an ECG unless there are suspicious items in the history or physical examination.

Dr Maron studied approximately 500 college students and found 90 abnormal subjects based on ECG. When they reviewed these 90 patients with suspicious findings using more exact testing, they found only three cases with borderline hypertrophy, and very few with real disease. This means that 87 students were barred from sports unnecessarily. This is the competing concern: that someone might be labelled as having a cardiac problem when in fact they do not. The Italian screening model, in contrast, involves patient history, family history, physical examination, ECG, pulmonary function tests, and urinalysis. The cost of such testing is underwritten by the government.

There are problems with both approaches and we are constantly trying to come up with a compromise that would capture the greatest number of patients at risk, while acknowledging that we cannot identify them all with 100% accuracy.

## Conclusions

Given the clear limitations of any screening program, we need to adopt a philosophy of universal precautions. For example, it might be reasonable to suggest that every gym teacher, coach, and trainer, at all levels, should know cardiopulmonary resuscitation (CPR). This is not currently a widespread requirement, and while most coaches and gym teachers do know CPR, not all of them do. Even if they do not end up saving an athlete's life, they may end up saving

**Further reading:** 1. Maron BJ, et al. *JAMA* 1996;276:199-204. 2. Liberthson RR. *N Engl J Med.* 1996;334:1039-1044. 3. Link MS, et al. *N Engl J Med.* 1998;338:1805-1811. 4. Corrado D, et al. *N Engl J Med.* 1998;339:364-369.

a spectator's life. This is an idea that all communities could view as reasonable and prudent.

The second potential precaution is to expand the availability of automatic electronic defibrillators (AEDs) in all communities. It is not up to me to say how far that expansion should occur, but it should be greater than it is right now. Although it is unrealistic to expect that we will have an AED at every single weekend town soccer game on a Saturday or Sunday, it would be reasonable to adopt a philosophy that a sporting event or practice session cannot get under way unless there is a cell phone at hand so that someone can call the emergency services in the event of a disaster. This is an inexpensive and easy precaution that may save lives. Making AEDs widely available is a good idea, but it is very complicated to solve the equation regarding the full extent of their distribution.

**Finally, although sudden death in athletes is very rare, the fact that it gets into the news and that we talk about it at medical meetings means that medical professionals and lay people alike are being educated about the possibility of such unfortunate outcomes. Thus, parents may look more closely at their own family history, and, if there is a cousin or sibling who died suddenly, might be more likely to have all their children examined in some detail. If there is a positive family history of sudden death, potential athletes need a very thorough examination. Both HCM and RV dysplasia are genetic diseases and we might be able to identify some at-risk athletes before they begin participating in sports.**

**A. MARQUAND - Frejus, France**  
(Guest author)

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