

REVIEW TOPIC OF THE WEEK

Sudden Cardiac Death in the Older Athlete



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ABSTRACT

The overwhelming majority of sports-related sudden deaths occur among those older than 35 years of age. Because increasing numbers of older people are participating in organized endurance and competitive sporting events, the incidence of sports-related sudden death in older adults is expected to rise. Older athletes will approach clinical cardiologists for advice regarding their fitness for participation. It is important to recognize both that strenuous exercise is associated with a transient elevation in risk of sudden cardiac death and that appropriate training substantially reduces this risk. The approach to pre-participation screening for risk of sudden death in the older athlete is a complex issue and at present is largely focused on identifying inducible ischemia due to significant coronary disease. In this brief review, we summarize the current state of knowledge in this area with respect to epidemiology, mechanisms, and approaches to risk stratification, as viewed from the perspective of the consulting clinical cardiologist. (J Am Coll Cardiol 2015;65:493-502)

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The legend of the first marathon runner, Pheidippides, embodies the popular notion that endurance athletics increase the risk of death. An Athenian messenger approximately 40 years of age, he is fabled to have run from Marathon to Athens in 490 B.C., perishing on arrival after proclaiming the Greek victory over the Persians. The beneficial, health-promoting effects of habitual physical and sports activity are undeniable. However, a “sports paradox” exists: some people, most often those not habituated to exercise, experience sports activity-related cardiac arrests, usually associated with underlying heart disease. Middle-aged and older athletes are at significantly higher risk for sudden cardiac death (SCD) compared with younger athletes and are more vulnerable to misconceptions regarding the cardiovascular effects of sports. The burden of SCD during sports needs further evaluation but probably constitutes a small proportion (5% to 6%) of sudden deaths in the general population (1,2). However, from a societal perspective, sports-related SCD can have a disproportionate impact. People who engage in athletic activity are ostensibly healthier than

most and therefore considered least likely to experience a cardiac arrest. The media attention on sports-related SCD tends to exaggerate the sports paradox and obscure the global health benefits of regular exercise. In addition to being cardiologists, both authors of this review are dedicated long-distance runners who seek to put the clinical risks and benefits of aerobic exercise in scientific balance.

A leisure athlete is “an individual, usually middle-aged or elderly (≥ 35 years), who participates in a variety of informal recreational sports, on either a regular or an inconsistent basis, which do not require systematic training or the pursuit of excellence” (3). For the purpose of this review, the term “older athlete” includes all athletes older than 35 years of age participating in sports at a competitive or masters level or as a leisure activity. Both clinical cardiologists and their patients will benefit from a balanced approach to education, risk stratification, and exercise prescription for the middle-aged and older athlete. The goal of this review is to put forth such an approach on the basis of a current and comprehensive assessment of previously published studies.

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**ABBREVIATIONS
AND ACRONYMS**

- CAC** = coronary artery calcium
- CAD** = coronary artery disease
- MET** = metabolic equivalent
- MI** = myocardial infarction
- RV** = right ventricular
- SCD** = sudden cardiac death

**CURRENT BURDEN AND
FUTURE PROJECTIONS**

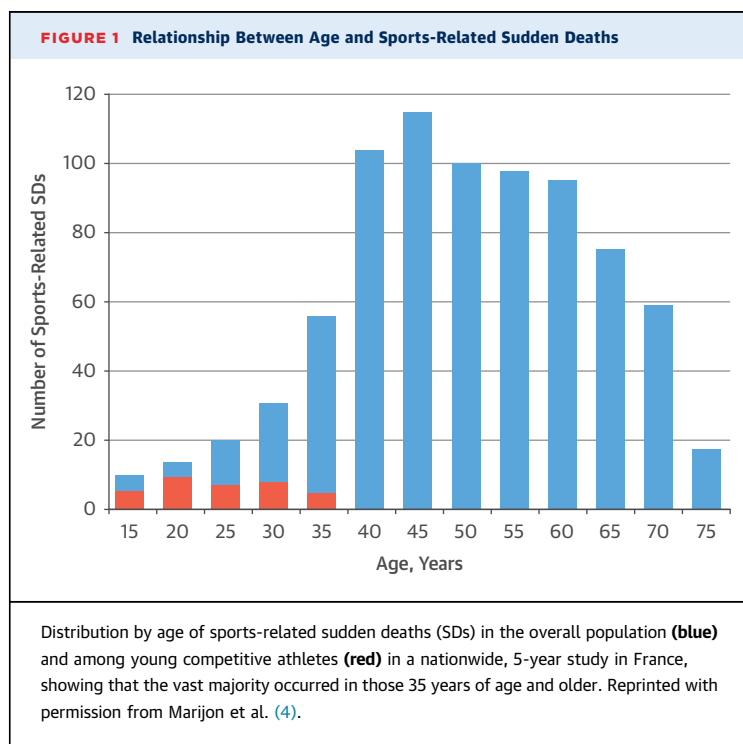
The overwhelming majority of sports-related sudden deaths occur among those 35 years of age or older (4) (Figure 1). Because many such deaths are unwitnessed, the magnitude of the problem is difficult to ascertain. Retrospective studies of athletes who participate in marathons yield estimates of 0.8 to 2 SCDs per 100,000 marathon runners (4-11). More comprehensively, a prospective 5-year study of sports-related SCD in the general population of France reported an annual incidence of 4.6 sports-related SCDs per 1 million residents of France (4). Most of these events occurred in older male athletes, with only 6% (50 of 820) of all cases of sports-related SCDs in young, competitive athletes. When placed in the context of the overall burden of SCD in the general population (600 to 900 per million), sports-related SCDs constitute a small subset. Some have reasoned that the absolute burden of sports-related SCD is small and therefore of modest clinical significance. For recreational joggers, however, the annual incidence of SCD is significantly higher: 13 SCDs per 100,000 joggers per year (8).

Several additional factors contribute to the clinical and public health importance of SCD in the older

athlete. The number of older Americans is steadily increasing and is expected to double by 2035, reaching 70 million. By 2040, 21% of the U.S. population will be older than 65 years of age (currently 13.7%) (12). As the population ages, a burgeoning subgroup of older athletes is participating in leisure and organized sports. The popularity of endurance sports, especially running, is significantly on the rise in the United States. For example, there are approximately 20,000,000 participants in foot races in the United States annually. Of these, 54% are older than 35 years of age and 57% are male. The number of participants has been growing steadily for the past 15 years (13) (Figure 2). These trends are driven by the growing awareness of the health benefits of exercise activity but are matched by increasing levels of cardiovascular risk among aspiring older athletes. According to recently published studies, the overwhelming majority of sports-related SCDs have occurred in men, with a 9:1 ratio of men to women experiencing SCD during sports (11). Potential explanations include lower participation rates for women in marathons or similar events. Because women tend to develop atherosclerosis about 10 years later than men, the participation rate of women at risk may be even lower. As the demographics of endurance athletics change along with the population, we anticipate that increasing numbers of older women will pursue endurance athletics. However, women clearly enjoy the advantage of a lower likelihood of overall SCD, and the possibility remains that they have a special advantage during physical activity.

**EVIDENCE FOR TRANSIENT ELEVATION IN
RISK WITH EXERCISE, COUNTERED BY A
PROTECTIVE EFFECT OF REGULAR EXERCISE**

Several now-classic studies showed an increased risk of SCD and myocardial infarction (MI) during strenuous exercise. Siscovick et al. (7) interviewed the spouses of 133 men with SCD without known prior heart disease and reported a significant increase in relative risk with exercise, but this effect strongly depended on the habitual exercise level. Among sedentary people, the relative risk of SCD during exercise was increased 56-fold compared with other times. This contrasted strikingly with the lower relative risk during exercise of 5 for men with the highest level of habitual activity. Despite the residual 5-fold increased risk of SCD during vigorous activity, men with the highest habitual level of physical activity had a substantially lower relative risk (0.4) of global SCD compared with sedentary controls.



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