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Short Communication

Marathon Running: Blowing the Whistle on Race-Related Cardiac Arrest

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- Sudden cardiac death in marathon runners is not a new problem.
- At increased risk are middle-aged men who are unaware of the risk of sub-clinical coronary atherosclerosis.
- For over a decade, Dr Arthur J Siegel at Harvard Medical School, USA has researched and published extensively on this topic in a bid to raise awareness of the risks of race-related cardiac arrest.
- He calls on healthcare providers to consider coronary artery calcium scoring to assess the anticipated benefit of pre-race aspirin for enhanced primary prevention.

Humans have been partaking in long-distance running for thousands of years. In fact, the word 'marathon' has its roots in Greek history, where following a battle in 430 BC in a town known for its marathon – the Greek word for fennel – a messenger named Pheidippides ran 260 kilometers to inform the authorities of their victory. After relaying the message, he collapsed and died of what is suspected to be a cardiac arrest

After running across the Plain of Marathon, Phidippides delivered his message and died.

Some marathon runners continue to succumb to this same tragic fate, in the sport derived from this event, even in the modern era. While the incidence of marathon-related cardiac arrest is considerably low – 0.8 deaths per 100,000 participants – it could certainly be lower. Such cases significantly increased in the United States road races since 2000, mainly in middle-aged men with coronary atherosclerosis. Why is this happening, and what can be done to mitigate this ongoing premature cardiac morbidity and mortality in recreational male runners? Dr Arthur J Siegel, MD, associate professor of medicine at Harvard Medical School, USA has uncovered the root cause of race related cardiac arrest in observational studies in Boston marathon physician-runners conducted over several decades.

The exercise conundrum

It is a paradox that regular vigorous exercise reduces lifetime cardiovascular risk but at the same time can induce sudden death. Ever since the first race in 1897, there have been numerous studies of Boston

marathon runners. Even at that very first race, the danger of prolonged exercise to the heart had been acknowledged. In the 1970s, blood samples from healthy asymptomatic individuals taken before and after running the Boston marathon gave real insight into what was happening in the body. Siegel authored several publications revealing these findings.

The elevated inflammatory markers, white blood cells, and clotting agents in their blood post-race not only indicated muscle breakdown, but also signaled increased risk of sudden cardiac death related to plaque rupture and blood clot formation.

One study of marathon runners identified atherosclerotic heart disease-calcium plaque build-up in the arteries of the heart – in three quarters of those who suffered cardiac events. Their average age was just 46 years old. In fact, elevated levels of calcium in heart arteries are more common in regular marathon runners compared to novices, with the levels building up over time as they age.

Studies by Siegel support the notion that calcium plaques in the arteries break, and along with a blood clot, block blood supply to the heart, resulting in cardiac death. This process can be triggered by acute inflammation resulting from rhabdomyolysis – extreme exercise that causes muscle breakdown and protein release into the blood. Consequently, levels of calcium build-up in the arteries as well as post-race blood C-reactive protein – a marker of inflammation – can help us to estimate the risk of sudden cardiac death.

Prevention is better than cure

Siegel proposes guidelines based on these factors for assessing risk of cardiac death. Almost half of the marathon finishers in the US are over 40 years old, putting them in the higher-risk category for sudden cardiac death. The question of the hour is – what pre-emptive measures can be taken to prevent these sudden deaths?

Pre-race low-dose aspirin is currently recommended to mitigate this problem, based on two randomized, controlled clinical trials showing that it significantly reduces major acute cardiac events, including cardiac arrest. This strategy rests on the demonstration that inflammation following exertional rhabdomyolysis (‘hitting the wall’) activates atherothrombosis during the race, resulting in procoagulant effects including in vivo platelet activation. This measure is a specific clinical application of the hypothesis that inflammation is the root cause of coronary atherosclerosis. Based on evidence that coronary artery calcification (CAC) scores predict major acute cardiac events, Siegel also advises CT scanning for middle-aged male runners to stratify the benefit of pre-race aspirin for enhanced primary prevention of the transiently increased risk of cardiac arrest during races.

Siegel – a longstanding advocate for the prevention of marathon race-related cardiac events – encourages middle-aged male marathon runners to discuss the risks and benefits of pre-race low-dose aspirin with healthcare providers. He advises runners with incrementally positive scores above zero to minimize their risk for cardiac arrest by such use. This advice is concordant with recommendations from the American Heart Association, which advise pre-hospital administration of aspirin for suspected cases of acute coronary syndromes.

In this way, assessing runners' risks pre-race and giving aspirin as indicated enhances primary prevention for elevated atherosclerotic risk and importantly, could prevent exertional sudden deaths in recreational athletes.

Personal Response

What inspired you to conduct this research?

The outcome of my studies with colleagues and collaborators has reduced fatalities in marathon runners during races (exercise–associated hyponatremia and sudden cardiac death). The process has been one of transposing evidence-based practices in internal medicine into the sports medicine arena. The clinical goal is to save one life at a time.

What advice can you give to someone who is a keen and regular long-distance runner to help stay healthy?

Consistency and moderation are the tickets to maximizing benefits while reducing risks.

How do you take this work forward to be implemented at national and international levels?

By participating in dialogues with colleagues in the medical community to make endurance sports safer for recreational athletes.

Conflict of Interest

The author declares no competing interests.

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