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Life-Threatening Events During Endurance Sports

Is Heat Stroke More Prevalent Than Arrhythmic Death?

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ABSTRACT

BACKGROUND Two important causes of sudden death during endurance races are arrhythmic death and heat stroke. However, "arrhythmic death" has caught practically all the attention of the medical community whereas the importance of heat stroke is less appreciated.

OBJECTIVES The study sought to determine what percentage of life-threatening events during endurance races are due to heat stroke or cardiac causes.

METHODS This retrospective study examined all the long distance popular races that took place in Tel Aviv from March 2007 to November 2013. The number of athletes at risk was known. The number of athletes developing serious sport-related events and requiring hospitalization was known. Life-threatening events were those requiring mechanical ventilation and hospitalization in intensive care units.

RESULTS Overall, 137,580 runners participated in long distance races during the study period. There were only 2 serious cardiac events (1 myocardial infarction and 1 hypotensive supraventricular tachyarrhythmia), neither of which were fatal or life threatening. In contrast, there were 21 serious cases of heat stroke, including 2 that were fatal and 12 that were life threatening. One of the heat stroke fatalities presented with cardiac arrest without previous warning.

CONCLUSIONS In our cohort of athletes participating in endurance sports, for every serious cardiac adverse event, there were 10 serious events related to heat stroke. One of the heat stroke–related fatalities presented with unheralded cardiac arrest. Our results put in a different perspective the ongoing debate about the role of pre-participation electrocardiographic screening for the prevention of sudden death in athletes. (J Am Coll Cardiol 2014;64:463–9) © 2014 by the American College of Cardiology Foundation.

There is an increasing rise in the number of recreational runners participating in long distance races of 10 km or more, generally referred to as endurance races. For instance, approximately 500,000 runners crossed the finish line of a marathon race in the United States in 2011 alone, representing a 20-fold increase from the 25,000 finishers in 1976 (1). Although regular physical activity is generally considered healthy and is recommended by all major cardiovascular societies (2), long distance running, especially full and half marathon races, involve an increased risk of sudden death (3). Although the absolute risk for the participants is low, ranging from 0.5 to 1.5 cases per 100,000 athletes (3–7), such tragedies are particularly meaningful, because they involve young subjects, perceived to be healthy, dying as a result of participating in a recreational event.

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Two important causes of sudden death during endurance races are arrhythmic death and heat

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ABBREVIATIONS AND ACRONYMS

ECG = electrocardiographic

stroke. Yet, arrhythmic death has caught the majority of attention from the medical community. For example, a PubMed search (performed in 2013) using the key words ["arrhythmias"] AND ["athletes" OR "sports"] yields >1,500 medical studies; in contrast, there are <260 medical publications on ["heat stroke"] AND ["athletes" OR "sports"].

Exertional heat stroke is defined as a core body temperature of >104°F to 105°F (40.0°C to 40.5°C) associated with multiorgan dysfunction (8). Cerebral dysfunction, a sine qua non of this entity, ranges from disorientation, confusion, loss of balance, irrational behavior, apathy, aggressiveness, and delirium to sudden collapse with loss of consciousness. Importantly, the initial symptoms of heat stroke often go unrecognized, so rapid deterioration culminating in cardiac arrest (9) and ventricular fibrillation (10) may occur. Moreover, in an athlete admitted after sudden collapse, the diagnosis of heat stroke will be missed if—as often happens—the core body temperature is not immediately measured (11). In such cases, a primary cardiac disorder may be suspected when arrhythmias predominate the clinical presentation at the time of collapse.

During a 2011 Tel Aviv endurance race, heat stroke by far outweighed cardiac conditions as the reason for admission of participant athletes to our hospital (a tertiary medical center, serving as the city hospital of Tel Aviv). In light of this, we conducted the present study to define the role of heat stroke and cardiac arrhythmias as the cause of serious sudden adverse event among athletes participating in endurance races.

METHODS

We performed a retrospective study of all the long distance races that took place in Tel Aviv between March 2007 and November 2012 and prospectively collected data for the 2013 races. The number of athletes participating in each 1 of the races was obtained from the official database of the race organizations. The number of athletes experiencing serious sudden adverse events was determined from the number of race participants requiring emergency medical care and hospitalization as a consequence of medical event occurring during the race.

RACES. Since 1997, public races have been conducted in Tel Aviv twice a year. To avoid extreme weather conditions, 1 daytime race (the Tel Aviv Race) is conducted during early spring, whereas the other (the Tel Aviv Night Run) is conducted during the summer but at night. The races offer several options for professional and amateur participants, including 10 km, half marathon (21.1 km), and full marathon (42.2 km) tracks. The 2 races are held within the perimeter of downtown Tel Aviv, and the entire path of the races is within 10 min driving distance from the Tel Aviv Medical Center, the city hospital. Therefore, athletes developing serious medical problems are transferred to our hospital.

PARTICIPANTS. In these popular races, participants range from highly trained athletes, mainly racing the marathon, to self-trained amateur athletes, mainly participating in the popular 10 km and 21.1 km races. Participants have to register in advance. The number of runners in each race was obtained from official online records, which track the athletes that cross the finish line (12).

The Israeli sports law states that pre-participation medical approval, including mandatory electrocardiographic (ECG) screening, is required for participants who are organized in teams or associations, but not for subjects attending public sporting events, such as these studied races. To participate in these races, the runners only were required to submit a personal statement confirming a state of "good health." Nevertheless, to determine the percent of participants undergoing medical and/or ECG screening prior to the races, we performed a prospective evaluation using a questioner that was distributed among participants of the 2013 race (see subsequent sections).

MEDICAL EVENTS. Medical attention at all these races included several levels: 1) the first level involves the national medical emergency service "Magen David Adom" (Israeli equivalent of the Red Cross) with ambulances, mobile intensive care units, and paramedics on motorcycles spread along the course of the race; and 2) a first-line emergency station deployed by the director of our Department of Emergency Medicine (P.H.) and fully trained emergency medicine physicians from our hospital. This first line station is located nearby the finish line that is common to all the races. This station is fully equipped with means of resuscitation, including mechanical respirators. Initial medical attention is provided on the track by either ambulance teams or scooters equipped with basic and advanced life support capability. Following initial contact with an emergency service team, patients are either discharged or transported for further evaluation and treatment. Patients in unstable condition, particularly those requiring resuscitation maneuvers in the last part of the race, nearby the finish line, are transported to the first-line emergency

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