Running: Why Do Marathon Runners Die?

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With the death of a runner in the Little Rock Marathon two weeks ago, as well as deaths in the 2007 Chicago Marathon and the 2007 US Men's Olympic Trials, a number of people have recently asked the question, "why do runners die during marathons?"

After doing some research and drawing on my own anecdotal experience, I can offer some general conclusions about what causes marathon runners to die during races – and hopefully we can use this information to help avoid any of the situations that might be highlighted here.

Keep in mind that we're speaking in generalities about a sport in which hundreds of thousands on unique individuals participate each year. We all need to be mindful that marathon running is a difficult physical endeavor, but it is not necessarily an inherently dangerous activity. A study on London Marathon runners over a 20 year period, in fact, found that with a rate of death of 1 in 67,414 (representing 1 in 2,000,000 miles run) marathon running was no more dangerous than many other daily activities.

The four major circumstances that lead to marathon runner deaths appear to be: heart disease in runners over 35 years; genetic heart defects in runners under 35; hyponatremia or low blood sodium levels; and heat related illnesses, such as heat stroke.

Heart Disease or Coronary Artery Death

One of the most common causes of death in runners during marathons is heart attack caused by underlying coronary artery diseases. These heart attacks are brought on by the combination of the intense physical stress of running for an extended duration and the pre-existing disease in the runner's heart or a lack of cardiac fitness to handle the race.

This type of death typically occurs in runners that are over the age of 35 and can occur even in races as short as half-marathons. Coronary Artery Deaths are most common if the race is conducted under hot and humid conditions, which places additional stress on the heart as it struggles cool the body.

During a long running event, the heart comes under more and more stress as the body begins to fall into exhaustion. If dehydration starts to set in, the heart will work even harder to push a diminishing volume of blood through the body. This combination is extraordinarily hard on the heart and if the heart already suffers from heart disease, the combination can be fatal. The US Registry of Sudden Death in Athletes found that about 14% of all sudden athlete deaths could be attributed to coronary artery deaths.

Medical experts, such as Dr. Lewis Maraham, point out that it is especially important for people that have been sedentary (out of shape) and decide to undertake a tough endurance event should "undergo a treadmill stress test with an echocardiogram to record the heart's performance."

Heart Defects or Sudden Cardiac Death

Another factor that can cause deaths in younger runners is the presence of a genetic defect in the heart itself that hasn't previously been detected or treated. A number of heart conditions can lead to a sudden failure of the heart, including hypertrophic cardiomyopathy or HCM. According to an article in MedicExchange, this condition is characterized as:

"a relatively uncommon disorder in which the heart muscle becomes enlarged, interfering with normal cardiac function. Thickening in muscle fibers is usually greatest in the walls of the left ventricle, the heart's main pumping chamber. This thickening reduces the size of the pumping chamber itself, which in turn hinders blood flow. HCM has been implicated in the sudden deaths of some young, fit individuals."

A study detailed in the article notes that the condition is exceedingly rare in elite athletes, occurring at a rate of no more than 0.06%. The rate in the general population is about 0.2%. As a cause of sudden deaths in athletes, according to the US Registry again, the rate was about 26% of athlete deaths – but keep in mind that this includes deaths in all sports, not just running.

There has been speculation that elite marathon runner Ryan Shay may have died of an enlarged heart that caused a sudden heart attack in the US Olympic Trials last November. As of this writing, the autopsy report had not yet been released to give us the exact cause of death – a delay that has caused some frustration in the running community.

Hyponatremia and hyponatremic encephalopathy

Hydration issues have long been a concern for marathon runners. But in the last few years there has been an increase in the number of deaths from a condition called hyponatramia or "water intoxication" as it is more commonly known. The condition is a health-threatening sodium deficiency that can in a rare cases be fatal.

The body sweats to cool itself while running and sodium is lost in this fluid. Runners that have been trained to drink plenty on the race course at times drink large enough amounts of plain water, which contains no sodium., leading to a dilution of the sodium level in their blood. As blood sodium levels drop, this can lead to a condition called hyponatremic encephalopathy.

The process involved is actually quite complex. As explained in an article on the death of a runner at the Boston Marathon in 2003,

"[athletes] in extreme sporting competitions often deplete the fuel that powers the body's cells. When this happens, a hormone called arginine vasopressin gets released. Part of its

function is to tell the kidneys to hold on to fluids. That, in turn, precipitates an imbalance in sodium levels in the blood. But as salt drops in the blood, it does not do so in cells. The body, in its constant pursuit of equilibrium, attempts to force salt out of cells by flooding them. That causes swelling. Muscles can endure such swelling because they can bulge outward. The brain, though, cannot."

The swelling in the brain is what is fatal in these cases.

Avoiding hyponatremia is a matter of replenishing both fluids and electrolytes, including sodium, while running. Runners need to ensure that they learn to drink the proper amount of fluid for their sweat level and then how to adjust this for extreme temperatures.

Heat related illnesses
Another group of potentially life-threatening conditions come in the form of heat related illnesses, mostly caused by extreme dehydration. As the body becomes dehydrated, it loses the ability to regulate its temperature and as its temperature rises, the result can be heat exhaustion, heat stroke, heat induced coma and then death. For an excellent discussion of the process through which the body goes through in a marathon in heat, see this 2005 article written after four runners died in the Great North Run in England.

All runners should learn how to keep themselves cool when running in hot weather. Running in extreme heat is essentially always life-threatening, but so long as you hydrate, slow your pace, and take actions to keep yourself cool, it can be managed. You can read additional articles on this site about racing and training in hot weather and hydration basics to learn more about this important subject.

While there are dangers in marathon running, as I said at the outset, marathon running itself is not inherently more dangerous than other activities. Before undertaking a marathon training program, get a thorough physical exam from your doctor. From there, make sure that once race day comes that you are fit enough for the challenge and always remember to take actions to avoid dehydration, sodium loss and the impact of heat on your body.

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