Some Boston Marathon runners had evidence of cardiac injury post-race

Patients should be properly screened for coronary risks before running a marathon.

by Judith Rusk
TODAY IN CARDIOLOGY MANAGING EDITOR

According to the Boston Athletic Association Web site, more than 20,000 runners are expected to run the 2007 Boston Marathon on April 16.

New research, published in *Circulation,* suggests they may have to train properly to avoid one more thing, in addition to hyponatremia and leg cramps – cardiac injury.

Recent results from a study of 60 Boston Marathon participants show biochemical and echocardiographic evidence of cardiac dysfunction and injury, especially in runners who trained less than 35 miles a week.

Each year, more and more recreational runners attempt to complete a marathon; for some, it is their first racing effort. Last year, 397,000 people finished marathons, up 3.7% from 383,000 in 2005; 39.9% of the 2006 finishers were women, according to the Web site marathonguide.com.

"Anyone with a history of high blood pressure, diabetes, positive family history of coronary artery disease or personal history of coronary artery disease, smokers, or people with high cholesterol should seek an evaluation from a physician before running a marathon or starting an intensive program," researcher **Malissa J. Wood, MD,** of the department of medicine, cardiology division at Massachusetts General Hospital and Harvard Medical School, told TODAY IN CARDIOLOGY. "We did show evidence that hearts are exposed to increased stress."

The runners

The researchers screened 60 amateur Boston Marathon runners before and after the race in 2004 and 2005. The participants did not have a history of CVD and were recruited for the study by e-mails sent to local running clubs. The runners were mostly men (n=41), and trained a mean 42±9 miles per week.

The participants recorded their marathon training for four months prior to the event and completed a questionnaire about their marathon and personal history. The researchers assessed the runner's BP, heart rate, serum biomarkers N-terminal pro-brain natriuretic peptide (NT-proBNP) and cardiac troponin (cTnT), serum sodium and ischemia-modified albumin, and conducted an echocardiographic evaluation less than a week prior to the race and about 20 minutes after completing the race.

All runners finished the race and none required medical attention. Troponin was not measurable at baseline.

Study results

The 60 runners lost weight ($P<.001$), had increased heart rate ($P<.001$) and decreased systolic BP (114±12 mm Hg vs. 101±15 mm Hg; $P<.001$) post-race.

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The researchers reported more than 60% of the runners had increased cTnT >99th percentile of normal (>0.01 ng/mL) after the race; the remaining runners had a level at or above the acute myocardial necrosis decision limit (≥0.03 ng/mL), according to the study abstract. NT-proBNP concentrations post race rose from 63 pg/mL (interquartile range [IQR] 21 to 81) to 131 pg/mL (IQR 82 to 193) ($P<.001$).

"The increase in biomarkers correlated with post-race diastolic dysfunction, increased pulmonary pressures, and right ventricular dysfunction (right ventricular mid strain; $P<.001$) and inversely with training mileage ($P<.001$)," according to the abstract.

Also, athletes who trained less than 35 miles a week had increased pulmonary pressures, right ventricular dysfunction, myocyte injury, and stress when the researchers compared them with runners who trained more than 45 miles a week ($P<.001$).

Joseph Alpert, MD, professor of the department of medicine at University Medical Center, Tucson, Ariz., who was involved in a previous study by the same investigators as a participant, said this research is the latest in years of studying running's effects on the heart.

"A number of people experience small injuries to the myocardium after extensive and long exercise," Alpert, a member of the Coronary Heart Disease section of the TODAY IN CARDIOLOGY Editorial Board, said. "We don't think these are heart attacks."

Previous research, such as Siegel et al in 2001, showed runners after five Boston Marathons had abnormally high levels of inflammatory and clotting factors. None of the 80 participants – physicians running the race as members of the American Medical Athletic Association – had an acute cardiac event. **Arthur J. Siegel, MD,** director of internal medicine at McLean Hospital in Belmont, Mass., said at the time that a second event, such as a disrupted atherosclerotic plaque or an arrhythmia, is needed to trigger an MI.

"My advice to middle-aged men with likely underlying if silent CAD is to do the training, as a clear cardiovascular benefit, but skip the marathon race as an overdose of a good thing," Siegel told TODAY IN CARDIOLOGY. "The systemic inflammatory response to skeletal muscle injury may have procoagulant effects that account for the transient increase in acute cardiac events as a different issue from the transitory changes in [echocardiography and biomarkers], which may be benign."

Alpert said some of the people in the most recent study with reduced heart function 20 minutes after the race did have improved heart function a couple days later.

"Most people eventually recover," he said. "The deaths are very rare."

Information about running and training

Much information is available on the Internet for your patients about running and training for races of various lengths. Here are a few:

- **Prediction calculators, training advice and bulletin boards can be found at www.marathonguide.com.**
- **Hal Higdon has training programs, interactive message boards and a weblog at www.halhigdon.com.**
- **A Couch-to-5K plan is on www.coolrunning.com.**
- **Runner's World magazine has an area devoted to a variety of training plans at www.runnersworld.com.**
- **Jeff Galloway has programs for runners who include walking breaks at www.jeffgalloway.com.**

Interpreting the data

In a corresponding editorial, **Paul D. Thompson, MD,** and colleagues urged caution in interpreting the results.

"These results should provoke concern, but it may be too early to conclude that clinically important myocardial damage occurs with prolonged endurance exercise," they wrote.

The researchers said their study has several limitations, including that despite the lesser sensitivity of pulsed-Doppler and tissue-Doppler, these methods are not load insensitive.

"Our study does suggest that, to protect against elevations in cardiac biomarkers and echocardiographic evidence of cardiac dysfunction associated with endurance exercise, appropriate preparation is important," the researchers wrote.

Proper training important

Alpert and Wood said that proper training – running more than 35 miles a week in the months leading up to the event – and screening are keys to running safe.

Alpert added that running is great exercise. "Before you run a marathon, you ought to be checked out by your doctor to be safe," he said, "particularly if you are middle-aged."

Hal Higdon, a training consultant for The LaSalle Bank Chicago Marathon and author of numerous training programs and running books, urges marathon hopefuls to seek a doctor's or cardiologist's advice if they have risk factors. He said the positive effects of marathon running are well documented and preparation is key.

"It makes sense that if you don't want to get killed in an automobile accident, you fasten your seat belts. If you don't want to land in the [emergency department] after running a marathon, you train properly," he said.

Also, he said, "The cardiologist needs to be aware of where the good training programs are and be able to point their patients to those programs. There's just a lot of help out there." **TC**

For more information:

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