Can Running Marathons Cause Kidney Damage?

By Jamie Wells, M.D. — March 29, 2017

Given the popularity of marathons and participation in the United States exceeding half a million annually, a Yale-led team of researchers sought to explore the relationship between strenuous exercise and kidney function. (1)

Not much has been done on the topic, so they sought to investigate adverse effects that such vigorous activity compounded by the heat stress experienced could have on the kidney. Their findings were just published in the American Journal of Kidney Diseases [2].

Appreciating that the blood flow to the kidneys can diminish as much as 25% under intense activity compared to when a person is at rest, they hypothesized that ischemic tubular damage could be a consequence. (2) When a body is under stress, the heart pumps faster and its load can increase three to five times to accommodate the demand. (3) Activating this cascade prompts the blood to flow toward the most vital organs like the lungs, brain, or skeletal muscles and away from those less essential for the task at hand.

The authors reference research showing that army recruits, mine and agricultural workers, for example, who ostensibly exercise with rigor in warmer climates have endured acute kidney injury (AKI). Though such heat stress typically causes transient kidney issues, there have been some data suggesting longer term problems can occur. As per this report, it is known that the core rectal temperatures of runners can exceed 102 and 104 degrees Fahrenheit in environmental temperatures of 50 and 95 degrees Fahrenheit, respectively. (4)

So, they opted to study marathoners to start a discussion about the activity’s influence on the kidney.

They collected urine and blood samples of marathon runners who participated in the 2015 Hartford
Marathon (Connecticut) to measure markers of kidney function and injury. They used conventional biomarkers (e.g. vital signs, serum creatinine, serum creatine kinase) and novel urinary ones that monitor for injury and repair (e.g. NGAL, IL-6, IL-8 etc.) along with urine microscopy. Specimens were assessed 24 hours pre-marathon (day 0), shortly post-marathon (day 1) and 24 hours later (day 2).

Of the 132 runners who replied to an online survey, only 22 ultimately met the inclusion criteria and consented to the study. So, yes, it was a small sample size. These were their results:

- Serum creatinine and urine albumin levels substantially increased after the marathon
- 82% of runners demonstrated at least stage 1 of AKI (one reached Stage 2)
- Serum creatine kinase activity escalated into Day 2 to levels much higher than prior days
- 73% had positive urinary microscopy findings on Day 1 or 2
- The urinary biomarkers indicating injury were highest on Day 1

**What does this mean?**

There are many influences on the kidney during such exertion. Dehydration, volume shifts, inflammation, muscle breakdown and heat-related changes, for example, can all tax the valued organ system. Though this particular group showed no evidence of chronic kidney disease, the results of their testing in this study revealed acute structural damage. Because the work was on so small a sample with minimal longer term follow-up, it is more of a proof-of-concept effort that encourages larger sampling and vigorous study to take place.

As a result, the question to answer becomes “what is the long term impact of this repetitive injury?”

As study author and Professor of Medicine (Nephrology), Dr. Chirag Parikh states [3]: “The kidney responds to the physical stress of marathon running as if it's injured, in a way that's similar to what happens in hospitalized patients when the kidney is affected by medical and surgical complications. We need to investigate this further. Research has shown there are also changes in heart function associated with marathon running. Our study adds to the story—even the kidney responds to marathon-related stress.”

**The Take Home Message...**

Extreme physical exertion—especially under profound environmental stressors—can impact multiple organ systems. This is why proper monitoring and precautions, training and hydration practices need to be employed before, during and after the event. The extent of considerations can be reviewed in *7 Marathons In 7 Days On 7 Continents (Healthy?)* [4] along with the included links.

It is always advisable to follow regularly with your doctor to assess your well-being and undergo routine checks. Your recreational and occupational history, for instance, may require special preparation and observation. Since your treating physician knows your comprehensive medical history and physical examination, he/she is best to guide you.
Just remember to keep those kidneys in mind when planning your next marathon (along with everything else!).

SOURCES:
