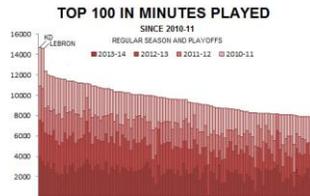


# The science of LeBron's cramping

• BY TOM HABERSTROH VIA [ESPN](#)

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With a touch more than four minutes left in the fourth quarter of Game 1 of the 2014 NBA Finals, [LeBron James](#) crossed over [Boris Diaw](#), drove hard to the rim and floated a layup. With 4:10 left to play, the ball dropped through the hoop, bringing the [Miami Heat](#) within two points of the [San Antonio Spurs](#) and setting up what was sure to be another memorable Finals finish from two teams that specialize in them.

And what happened next will indeed be forever remembered, but not for the basketball. What happened next was ... nothing. The most famous and best player in the world landed on the baseline and then stuck there, as if he had grown roots. Play continued at the other end as James eventually waved for help. He would be carried off and would not return.

## The sweat test

Last fall in Sioux Falls, the 6-foot-10 Hamilton had trouble finishing games. In crunch time, his legs would lock up. Sometimes, a hamstring would go haywire. Another time, his quad would bite. Then his calf. Game after game, with a career in the balance. Hamilton guzzled Gatorade and water before, during and after games. The nightstand by his bed was littered with empty water bottles. Cramps were caused by dehydration, right?

"All my life, I never had any cramps whatsoever, so I was wondering what was going on," Hamilton said. "I was just trying to figure it out because if you cramp, you can't play."

For a fringe player trying to land an NBA gig, this is a life-changing problem. So he went to his coaching staff, led by coach Pat Delany in Sioux Falls, and told it he needed help. And a stroke of luck: One of the nation's top sports science facilities, Sanford School of Medicine, a branch of the University of South Dakota, was down the street.

Sanford's team of doctors had Hamilton run on a treadmill for an hour and a half to get a good sweat going. This taxes even a professional athlete. Hamilton was soaked. On his arm, a gauze pad with an impermeable seal collected his perspiration, which was examined not just for quantity of sweat volume but also content. How much water was being drained from his body, and how many essential minerals had he lost? One swipe of the gauze pad and the Sanford doctors knew exactly what was going on. "I was losing salt at a rate five times faster than normal," Hamilton said.

## The power of salt

A certain amount of salt is essential to hydration despite that mineral's reputation for drying you out.

Eat a bag of chips, search maniacally for a glass of water, cycle it all through and end up parched. We've all been there. But a body short of salt, or sodium chloride, won't deliver the water efficiently to the muscles, which, in Hamilton's case, is where it was needed. The bottles of water that Hamilton drank all night? They did absolutely nothing to help his condition.

Bergeron gave him the playbook. To counteract the vast quantities of salt he was losing from his body composition, taxing back-to-backs and long minutes, Hamilton would have to increase the salt intake in his diet. Dramatically. In the morning, he would have to add a fourth of a teaspoon of salt to a 20-ounce Gatorade and drink it and then eat a normal breakfast with a dusting of salt. Before shootaround or practice, another salted Gatorade. Lunch with more salt. At the start of the game, another salted Gatorade. Halftime, another. After the game, another. And so on.

It worked. Hamilton found he had more energy than he ever did before. He finished games. He ended up earning a spot on first-team All-D-League and first-team All-Defensive. On March 23, the Heat called him up for good. All thanks to salt.

### **When LeBron begged out**

Dr. Bergeron watched Game 1 of the Finals at his home in Sioux Falls, like any normal NBA fan. Unlike most fans, when he saw James pull up limp in the second half and grimace as he pointed to his leg, Bergeron immediately felt he knew what was happening: full-blown leg cramp. When James asked out of the game in the fourth quarter, one thought ran through Bergeron's mind: It's too late. James wouldn't be able to fight through this one. It had gotten too far.

Bergeron's research and other studies have shown there are two types of cramps that rarely intertwine. One is caused by skeletal muscle overload and fatigue (the tennis racket cramp is a minor example) and the other caused by lack of electrolytes. When struck with the former, you can usually address it by massaging, icing and stretching the muscle.

But the latter is far trickier. As LeBron grimaced, Twitter was flooded with armchair experts. Drink some water, chug some Gatorade and LeBron will be fine! Bergeron had no such hope those therapies would suffice. The salt, in his view, would be the salvation. "[Drinking water] is not going to be enough. That's absolutely not going to be enough," Bergeron said. "That's really a question of James losing maybe two or three liters of liquid every hour, which he's very capable [of] when you're the size of LeBron and playing hard and continuously. His sodium loss could be three, four or five thousand milligrams an hour."

For perspective, the American Heart Association recommends the average person to consume less than 2,400 milligrams of sodium a day. But James is not an average human being. James was trying to replenish his body. James was trying to replenish his salt deficits. During timeouts in the second half, James could be seen taking a pill on the sidelines. Heat coach Erik Spoelstra said at Friday's Heat practice that James took seven "cramping pills" over the course of the game.

Cramping pills, or often called "salt tablets," are allowed under league rules, and most cramping pills on the market contain loads of salt, though probably not enough to combat the sodium deficiencies of James' body. It's uncertain how much salt was in the cramping pills, but Bergeron says these are often insufficient and contain minerals like calcium and magnesium that don't do much to alleviate cramps.

"The rationale is good," Bergeron said of James taking cramping pills. "But what amount of sodium? Those salt pills might contain 600 milligrams of sodium, but he might need a thousand or tens of thousands of milligrams. Often times, it's not enough. The salt pill is often nowhere near enough once the cramps occur."

On Thursday after the game, James said he took in 2½ bags of IV fluids and needed to hit the bathroom "six or seven times" overnight. He didn't sleep much, which is probably not good for his recovery. Sleep, obviously, is important, and the lack of sleep is a common complaint for those dealing with severe leg cramps. Of course, as Bergeron indicates, sleepless nights are preventable with proper dosages of -- you guessed it -- salt.

"Many of the athletes have told me, 'Please don't tell me to drink more because I'm getting up every 10 minutes at night,'" Bergeron said. "The approach is probably inappropriate if that's the case. Athletes can drink twice as much, but because the salt intake is more, they're urinating less."

### **So why was James the only one to cramp up?**

In the aftermath of Game 1, there was a notion that because every player played under the same circumstances they should feel the same symptoms. But every human body is different.

And James' body is unlike anything we've seen in the NBA. He's built like an NFL tight end, runs around like a wide receiver and takes hits like a running back. In Game 1, he split time guarding everyone from [Tony Parker](#) to [Tim Duncan](#). No one does what he does. Meanwhile, he's enormous. Muscle mass generates heat in three dimensions, but it can get released only through the surface area on the skin. Imagine the interior of a huge house on a winter day -- it stays warmer because it's so far from an outside wall. The inside of LeBron's muscles are far from the walls.

James' large muscle mass, combined with his exertion, put him in a higher risk category for heat-related malfunctioning. That James suffers from cramps might seem like a systemic weakness to some, but not to Dr. James Wyss, who specializes in sports medicine at Hospital for Special Surgery and is the team physician for St. John's University athletics. "I think it's the opposite," Wyss said. "He has such a higher metabolic requirement, and, because of his muscle mass and the way he's able to use his body, he utilizes fluids and energy resources at such a faster rate. Under those conditions, that's part of the reason you can't prevent it as well as a normal athlete."

"It's part of the fact that he's the most unique athlete on the planet," Wyss says. "And with that, and the way he uses his muscles beyond what other people can use it, probably makes him more prone to cramps."

### **One other solution: rest**

James' cramps should have never happened in the first place, according to Bergeron, if he had been getting sufficient fluids and salt before the game and proper rest.

Spoelstra indicated that since James suffered through cramps in the 2012 Finals, the Heat have been more diligent with preparation and management, and anyone who has been to the Heat's home court in Miami knows the air conditioning works like a charm in that place. LeBron plays half of his games in a bracing arena.

On a hot night like Thursday's, however, NBA players' gladiator-like motivation kicks in. Nobody wants to rest, least of all the team leader. And when it came to James' minutes, the Finals stage might have gotten to Spoelstra.

It's almost certainly not a coincidence that the past two times James was carried off a court due to cramps were Thursday and Game 4 of the 2012 Finals. For one, in pursuit of a championship, James is pushing his body to the limit, red-lining beyond where he would in a typical regular-season game. As a result, he's sweating more and losing electrolytes at a faster rate.

If it is strictly an electrolyte problem, Bergeron says James will likely be fine for Game 2 with proper fluid intake. But it could be that James is also suffering from another common cramp trigger: muscle fatigue.

"The electrolyte one is completely preventable," Bergeron said. "The fatigue one can't be totally avoided."

Remember, James has played an additional season over the past four compared to even the most worn-down NBA players, [as this Per Diem illustrated back in April](#). This is no small thing.

James has played 14,640 minutes since he joined Miami, including the regular season and postseason. Only [Kevin Durant](#) (14,683) has racked up more over that time, and he flamed out in the Western Conference finals. After Durant and James, the next-highest player in minutes played is [Chris Bosh](#), who has played 2,200 minutes fewer than James. The difference is about one NBA season for a typical full-time player.

That could be a cause, and, of course, the Heat can't erase all that now. It's something James will have to muddle through.

- 1) According to Dr Bergeron what is the most important thing to combat cramps? Why?
- 2) Why would LeBron be more likely to cramp more than Durant even though Durant played more minutes?
- 3) Create the perfect situation to ensure that someone would cramp? Include at least 5 details.