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## The Truth About Rhabdo

Rhabdomyolysis is only occasionally seen in athletes. Dr. Mike Ray explains why, how the condition is treated and how smart trainers minimize the risk for their athletes.

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By Dr. Michael Ray CrossFit Flagstaff

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Susannah Dy/CrossFit Journal

*When marathons, hiking and long-distance running became popular, Dr. Ray saw an increase in cases of rhabdo. Still, it is far more common in patients who have experienced crushing injuries or electrocution.*

Rhabdomyolysis is a medical condition that may arise when muscle tissue breaks down and the contents of muscle cells are released into the bloodstream. One molecule in particular, myoglobin, is toxic to the kidneys and can cause kidney failure and, in the most severe cases, death.

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1 of 4

Rhabdo has been seen after high-intensity exercise. It is well known to emergency department physicians who see it in victims of crushing injuries and electrocutions. It can also occur in those with severe bee-sting allergies and massive infections, and occasionally it is seen in athletes, particularly those who have become dehydrated after prolonged exertion in high heat. I work in northern Arizona and see it most commonly in people who have been hiking in the Grand Canyon.

### Symptoms and Treatments

Symptoms of rhabdo include severe generalized muscle pain, nausea and vomiting, abdominal cramping, and, in significant cases, dark red “Coca-Cola” urine. The color of the urine is from the myoglobin, which is the same molecule that gives red meat its color.

Rhabdo is diagnosed when a patient with an appropriate history has an elevated level of another molecule, creatine kinase, also known as CK or CPK. CPK is easier to measure in the blood than myoglobin and is generally used as a marker for rhabdo, even though it's the myoglobin that does the damage.

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**In real terms, the risk of serious rhabdo is genuine, but it is low.**

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Treatment consists of generous amounts of intravenous fluids to dilute and flush the myoglobin through the kidneys. In the worst cases, patients may need dialysis while the kidneys recover. Death, though rare, can result when the kidney failure causes imbalances in the usual electrolytes, which may cause cardiac arrhythmias. Most patients make a complete recovery after being rehydrated with IV fluids over anywhere from several hours to a week or so, depending on the severity.

Compartment syndrome is occasionally seen in combination with rhabdo. Compartment syndrome results when an area of soft tissue that is encased in non-expandible connective tissue experiences so much swelling that the



Susannah Dy/CrossFit Journal

***Dr. Ray recommends drinking water after a workout to flush myoglobin out of the kidneys. It's important to consume food as well to prevent hyponatremia, which can occur when you wash all the sodium out of your system.***



*CrossFitting doctor Ahmik Jones wrote that most clients will never get rhabdo even if you do everything wrong. Still, it can happen to any athlete in any sport, but the benefits of high-intensity workouts far outweigh the risks, which can be minimized with careful training.*

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**There is no way to separate the effectiveness of the training from all risk. A completely safe training program is doomed to produce only couch potatoes. The safety of strength and conditioning programs across the board, including CrossFit, is very good . . . .**

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pressures exceed the pressure of blood circulating in the small capillaries within the compartment. The resulting ischemia kills the involved soft tissue. When this soft tissue is muscle, myoglobin may again be released into the blood.

Compartment syndrome most commonly occurs in muscle compartments of the extremities and may result from intense exercise, though is more frequently associated with crush injuries or long-bone fractures.

With CrossFit, we perform whole-body functional movements because those are the movements we need in sport, in life, in battle. We execute those movements at high intensity because that intensity produces all the positive adaptations found with CrossFit and maximizes our work capacity across broad time and modal domains. It seems reasonable that exercising a large muscle mass at high intensity might cause some breakdown of muscle cells, releasing myoglobin and CPK.

This seems to happen at dangerous levels only rarely, though in the emergency department when I see patients who have just exercised (running, working out on machines at the Globo Gym, hiking, CrossFit, etc.) I routinely see mildly elevated levels of CPK (when I have reason to check it). Only rarely do they have dangerously high levels or do they experience any ill effect. Generally, these patients are in the emergency department for completely unrelated reasons. We think there may be an adaptive effect to regular high-intensity exercise that allows the body to somehow protect itself from rhabdo in a manner similar to how a person will become acclimated to altitude upon regular exposure.

### **Reducing the Risk**

Strategies to reduce the risk of rhabdo include a gradual introduction to intensity. The athletes at highest risk seem to be those with a reasonable baseline level of fitness they have obtained through some non-CrossFit training, or those who are returning to CrossFit after a layoff. These athletes have sufficient muscle mass and conditioning to go hard enough to hurt themselves but do not have the protection that develops with regular exposure to real intensity.

The severely deconditioned don't seem to have enough muscle mass or the capacity to break down enough muscle to do damage. Established CrossFitters seem to be protected, though the mechanism remains unclear.

Certain practices seem more associated with the risk of rhabdo. We are particularly cautious about “negatives,” where the athlete intentionally prolongs the eccentric phase of a movement. We are also cautious about reducing the weight on a “new” or deconditioned athlete in order to maintain intensity. In general, it is better to allow them to stop and take the rest needed to complete the workout. We encourage athletes to eat and drink plenty of water after a workout. The water is to flush myoglobin through the kidneys; the food is to prevent hyponatremia, which results from flushing all the sodium out of one’s system by drinking too much water without any salt.

The irony of rhabdo is that after marathons and hiking became so popular, we started to see people come in to the ER with rhabdo. We told them to drink lots of water to prevent rhabdo. Now I see more patients from the Grand Canyon with hyponatremia than I do with rhabdo, and the only deaths I have seen were from hyponatremia.

Ahmik Jones, another CrossFitting doctor, wrote some great advice for rhabdo prevention on the CrossFit Message Board in a thread titled [Top 10 Ways to Avoid Giving a Client Rhabdo](#).

In real terms, the risk of serious rhabdo is genuine, but it is low. As Ahmik mentions in his post, even if you do everything wrong, most of your clients will never get rhabdo. Conversely, even if you do everything right, there is still a risk of rhabdo, however small.

There is no way to separate the effectiveness of the training from all risk. A completely safe training program is doomed to produce only couch potatoes. The safety of strength and conditioning programs across the board, including CrossFit, is very good, especially when compared to sports like basketball, football and soccer.

Every case of an injured athlete is unfortunate. But we believe it’s no more unfortunate than the people who hurt their backs because they never learned how to pick up something heavy or the patient who dies because the firefighters carrying her out of the woods don’t have the heart and lungs to make it in one hour instead of two.



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### About the Author

*Dr. Mike Ray is the co-owner of CrossFit Flagstaff. He enjoys everything from adventure racing to rock climbing, martial arts, trail running and beyond. He is married to Lisa Ray, who finished 44th in the 2009 CrossFit Games and is a member of CrossFit HQ’s traveling certification staff.*