Two Cases of CrossFit®-Induced Rhabdomyolysis: A Rising Concern

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Abstract
Background: The author reports the cases of two adult males who presented with severe rhabdomyolysis following identical CrossFit® workouts performed on the same day, at the same time and at the same location. Results: For both cases, symptoms of rhabdomyolysis disappeared upon discontinuation of the regime and within three days of aggressive hydration and rest. Patients made a complete recovery upon discharge. Conclusion: The rhabdomyolysis was attributed to the same excruciating workout both men underwent. Exertional rhabdomyolysis exemplified by the cases presented highlights a rising concern over the health consequences of the popular training program. CrossFit®-induced rhabdomyolysis is underrecognized and should be considered in patients presenting with signs and symptoms of rhabdomyolysis.

Keywords: Exercise, Rhabdomyolysis, Supplements, Dehydration, Sport (Source: MeSH, NLM).

Introduction
Extensive information has been published about rhabdomyolysis caused by high-intensity CrossFit® training regimes, and yet the diagnosis of CrossFit®-induced rhabdomyolysis remains underrecognized in the emergency department.1 In rhabdomyolysis, contents of injured muscle cells leak into the circulation, resulting in electrolyte abnormalities, hypervolemia, acidosis and acute renal failure.1 An increase in free intracellular calcium triggers activation of proteases, increased skeletal muscle cell contractility, mitochondrial dysfunction, and the production of reactive oxygen species, resulting in skeletal muscle death. The association between rhabdomyolysis and triggering events such as the intense CrossFit® workout regimes (the equivalent to a high intensity military workout) was first explored by Greg Glassman in 2005 in a case series out of Santa Cruz, California.1 Since then, this prevalent condition has surfaced across the United States with a plethora of etiologies.

The Cases
A 33-year-old male presented to the Dekalb Medical Center Emergency Department in Atlanta, Georgia for complaints of muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes.Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes. Patient also had some muscle pain, soreness and stiffness in his biceps and across his chest ongoing after a CrossFit® workout that he had three days prior involving 100 plus push-ups, pull-ups, squats and sit-ups all in the span of thirty minutes.

For both cases, symptoms of rhabdomyolysis disappeared upon discontinuation of the regime and within three days of aggressive hydration and rest. Patients made a complete recovery upon discharge. Conclusion: The rhabdomyolysis was attributed to the same excruciating workout both men underwent. Exertional rhabdomyolysis exemplified by the cases presented highlights a rising concern over the health consequences of the popular training program. CrossFit®-induced rhabdomyolysis is underrecognized and should be considered in patients presenting with signs and symptoms of rhabdomyolysis.

Key Points:
• Although the causal link between rhabdomyolysis and intense workout regimens has been well documented, exercise-induced (exertional) rhabdomyolysis generally go unreported as very few cases are fatal and most resolve with adequate treatment.
• The use of supplements among those undergoing CrossFit® training may increase their vulnerability to skeletal muscle breakdown and obscure the diagnosis of rhabdomyolysis.

Results:
For both cases, symptoms of rhabdomyolysis disappeared upon discontinuation of the regime and within three days of aggressive hydration and rest. Patients made a complete recovery upon discharge. Conclusion: The rhabdomyolysis was attributed to the same excruciating workout both men underwent. Exertional rhabdomyolysis exemplified by the cases presented highlights a rising concern over the health consequences of the popular training program. CrossFit®-induced rhabdomyolysis is underrecognized and should be considered in patients presenting with signs and symptoms of rhabdomyolysis.
with IV fluids (Ringer’s lactate). All forms of exercise as well as supplements were terminated until they were discharged.

**Discussion**

There are two proposed potential reasons that may contribute towards emergency medicine physicians being reluctant to conclude CrossFit® as the precise etiology of a patient’s rhabdomyolysis.

- **Firstly, it is an underreported diagnosis:** Avid proponents of the CrossFit® workout regimen maintain that musculoskeletal deterioration occurs when athletes over-exert themselves, not just when performing an inordinate amount of repetitions at oftentimes unaccustomed weight levels for above-normal periods of time – the standard protocols for CrossFit®. The demanding nature of the workout has led to its adoption by Canadian Forces, U.S. Army Commands and U.S. Marine Corps. Published records have shown exertional rhabdomyolysis in military training rising in epidemic proportions at 166% per year. However, statistics suggesting a correlation between workouts at CrossFit® locations and cases of rhabdomyolysis have yet to be published. Furthermore, case fatality rates are less than 5% from exertional rhabdomyolysis and most otherwise healthy individuals recover rather quickly with aggressive hydration and management. Hence, metabolic, renal and systemic complications are avoided and a significant number of cases might go unidentified.

- **Secondly, it is a confounding diagnosis:** Skeletal muscle breakdown as a side effect of the administration of statins, such as atorvastatin, is an issue of intense interest that has been well-documented. In fact, in a 2010 study by Guis et al, elevation of creatine kinase occurs in 3-5% of medication-induced cases, while significant rhabdomyolysis surfaces in 0.04-0.20% of them. As a result of the sheer intensity of the workouts, a number of nutritional supplements are popular among CrossFit® athletes to facilitate the training and recuperation phases of the exercise routine and have been heavily publicized in gymnasiums across the nation. Certain products, such as Creatine®, have well-known side effects of muscle cramping, straining and dehydration, all of which can contribute to the rupturing of skeletal muscles. Colonix® utilizes a laxative tea and requires at least 64 oz. of liquid with use. It is contraindicated in patients with dysphagia. Additionally, vomiting, diarrhea and excessive dehydration are all potential adverse effects. Furthermore, its active ingredient, psyllium, functions as a non-systemic cholesterol-lowering agent, just like statins. Dehydration and choking are frequent unfavorable side effects if psyllium is taken without adequate water as it thickens secretions in the throat. Toxinout®, a complex of herbs, amino acids, vitamins and antioxidants, is contraindicated in renal disease – what skeletal muscle rupture could lead to if not treated immediately. Both aforementioned supplements are hence capable of exacerbating rhabdomyolysis and its lethal complications.

**Conclusion**

CrossFit® began as an exercise regimen in 2005 with just 10 locations in the United States. Currently, there are over 15,000 locations that offer CrossFit® training across North America, and the number is growing. The workout regime itself, the publicity surrounding its advocates, and the widespread use of products marketed at the CrossFit® locales make it increasingly crucial that emergency room physicians consider CrossFit®-induced rhabdomyolysis in their differential diagnoses when they encounter a case with typical signs and symptoms in the context of a patient who undergoes CrossFit® training.
Case Report

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References


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