

Severe Rhabdomyolysis Associated With a Popular High-Intensity At-Home Exercise Program

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Abstract

High-intensity exercise programs have become popular methods of unsupervised home exercise. We present a case of severe rhabdomyolysis that developed in a 23-year-old athlete, who after two sessions of the extreme workout known as the “P90X” developed rhabdomyolysis. His CK level peaked at 1,286,900 IU, the second highest CK level ever reported in the medical literature. After aggressive inpatient medical care, the patient sustained no long-term sequelae.

Keywords: Rhabdomyolysis; Exercise; High intensity

Introduction

Many physicians are well aware of the potential risk of rhabdomyolysis in individuals participating in strenuous athletic endeavors, but may not consider the diagnosis in those participating in home exercise programs. Extreme physical workouts have become popular among athletes and non-athletes as a method of losing weight and gaining muscle strength. A particularly popular exercise and nutrition program, P90X (the Beachbody Company), has reported sales of almost three million copies [1]. P90X can be performed at home without supervision or prior medical evaluation.

This case highlights a healthy athlete who developed severe rhabdomyolysis shortly after initiating this exercise regimen.

Case Report

A 23-year-old African American male athlete presented to the Emergency Department (ED) of our community hospital seeking treatment for bilateral arm pain and swelling of 3 days duration. The swelling developed after the second day of using the P90X exercise program. In addition to experiencing diffuse muscular pain, which was most intense in the arms, he also reported having brown colored urine. His past medical history was significant for migraine headaches and a traumatic rupture of the tympanic membrane. There was no family history of muscle related disorders. He denied any medications, steroids, hormone replacements or dietary supplements. He did report the use of marijuana, but denied using cocaine or other stimulants. He also denied any additional athletic activities during the 2 days prior to presentation. The physical exam demonstrated tense, swollen upper extremities bilaterally, most notably in the biceps. No neurovascular compromise was noted in the upper extremities.

The initial laboratory evaluation revealed a serum creatinine kinase (CK) level of 170,300 IU/L (normal 0 - 195 IU/L). Myoglobinuria was present without hematuria or other abnormalities on microscopy. Intravenous fluids were initiated and the patient was admitted to the medical service with a diagnosis of rhabdomyolysis.

Approximately 10 hours after admission, a repeat CK value of 1,286,900 IU/L was recorded. Liver function studies revealed an AST of 1720 IU/L (Normal 10 - 41 IU/L), ALT of 364 IU/L (Normal 15 - 62 IU/L), and LDH of 5147 IU/L (Normal 60 - 190 IU/L). The compartment pressure in both posterior upper extremity compartments was 27 mmHg.

Hydration, urinary alkalinization and opiate analgesia were continued during the patient's hospitalization. The patient's pain and swelling gradually improved. His laboratory values also demonstrated gradual improvement (Table 1). The patient was discharged after 7 days of hospitalization.

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Table 1. Daily Laboratory Values

Chemistry	Day #1	Day #2	Day #3	Day #4	Day #5	Day #6	Day #7
CK (IU/L) (Note: Max daily values)	1,286,900	136,660	121,460	112,414	52,610	34,560	37,120
AST	1720	1785	1896	1529	1053	797	448
ALT	364	475	500	495	455	452	362
Alkaline phosphatase	55	51	52	50	49	51	47
BUN	16	6	8	10	9	11	17
Creatinine	1.1	1.0	0.9	1.0	1.0	0.9	0.9

Ref: Creatinine kinase (CK), Aspartate aminotransferase (AST), Alanine aminotransferase (ALT).

Discussion

Rhabdomyolysis has been attributed to illicit drug use (for example, PCP), medications (for example, statins), trauma, and excessive muscular exertion. Approximately 26,000 cases of rhabdomyolysis are reported annually in the US [2]. However, the percentage of cases associated with exercise is unknown. A historical cohort study of 157 patients diagnosed with rhabdomyolysis noted only 9 cases due to “excess activity” [3]. Since then, exercise-induced rhabdomyolysis has been reported in small series and case reports but its association with proprietary exercise programs has not been previously reported [4-12].

P90X is a 90-day program utilizing a mix of exercises that include strength training, cardiovascular, yoga, plyometrics and stretching. Included is a nutrition guide, fitness

plan, DVD series and calendar. Cost is \$119.85. The routine consists of exercising six days per week, for 13 weeks. Each workout is usually less than 1 hour in duration. Workouts consist of pushups, pull ups, yoga exercises, and aerobic exercises. A Medline search using the term “P90X” resulted no reports of rhabdomyolysis. A Google search revealed only one self-report of rhabdomyolysis associated with P90X that did not require hospitalization.

Most ED physicians would consider rhabdomyolysis in patients at risk but might think home exercise would only be associated with delayed-onset muscle soreness (DOMS) [8]. Common risk factors associated with rhabdomyolysis are listed in Table 2. Interestingly, our patient had no known underlying risk factors for developing massive rhabdomyolysis, which suggests that even physically fit individuals should remain cautious when initiating at home workout

Table 2. Common Risk Factors Associated With Rhabdomyolysis

Risk Factor Type	Examples
Drug Use	PCP, cocaine, amphetamines
Seizures	Status epilepticus
Trauma	Car accidents, crush injury, burn
Envenomation	Snake bites, bee stings, centipede bites
Infections	Influenza A, Influenza B
Medications	Statins, diuretics
Underlying Medical Condition	Chronic kidney disease, hypothyroidism
Excessive Muscular Exertion	Marathon run, military training
Hereditary Condition	McArdle syndrome, carnitine palmitoyltransferase deficiency, sickle cell disease
Inflammatory Disorders	Dermatomyositis, polymyositis

regimens.

Our patient's CK level quickly surpassed one million IU. The only other reported case of a CK level greater than one million was also in a young male starting an exercise program [13]. The degree of CK elevation correlates with the severity of muscle injury and has been associated with the development of acute renal failure (ARF) [3]. However, neither case of exercise-induced rhabdomyolysis with CK values over one million developed ARF. In 1994, Sinert reported 35 cases of exercise-induced rhabdomyolysis in which none of the patients developed ARF [14]. No cases of ARF were noted in a larger series of 89 students with elevated CK values after repetitive exercise [15]. All of these cases involved young patients that were presumably in good health. We hypothesize that other factors, such as age, co-morbidities, hydration status and volume resuscitation may play a more significant role in the development of ARF than the absolute CK value [16].

Aggressive volume administration is often recommended to prevent heme-pigment induced acute renal injury. However data is lacking regarding the proper rate of administration [16]. Urinary alkalization to prevent heme-protein precipitation is also often employed but a recent review demonstrated no clinical benefit [17]. This same review found mannitol-induced diuresis also provides no benefit.

In conclusion, medical providers should not categorically dismiss complaints of muscle pain after home exercise programs as simple muscle soreness. Attention to complaints of exquisite muscle pain, swelling and/or dark colored urine should trigger further investigation.

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Conflicts of Interest

The authors declare no conflicts of interest.

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