

Rhabdomyolysis - Exercise induced nightmare

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ABSTRACT

The term rhabdomyolysis refers to the disintegration of striated muscle which results in the release of muscular cell constituents into the extracellular fluid and circulation. Exertional rhabdomyolysis is occasionally seen after strenuous exercise. The progression to compartmental syndrome or renal failure is a rare complication that requires prompt recognition and treatment to prevent morbidity. We present the case of a 35-year-old male who came to our emergency department after a strenuous workout followed by fasting for a day. He presented with generalized weakness, decreased urine output, and one episode of dark-colored urine. He was found to have rhabdomyolysis with acute kidney injury (AKI). His condition progressed to frank renal shutdown requiring several sittings of dialysis and a very stormy course in hospital lasting about a month.

Keywords: Dialysis, exercise, rhabdomyolysis

Introduction

With an increase in the level of health awareness, the number of people participating in regular exercise programs has been continuously increasing due to its positive effect on physical and mental health. However, excessive or intense exercise beyond the extent of one's personal or physical limits may induce various types of musculoskeletal damage, including exercise-induced rhabdomyolysis (EIR), a pathophysiological condition of skeletal muscle damage.

Rhabdomyolysis (rhabdo, striated; mayo, muscle; lysis, breakdown) is a syndrome characterized by the disintegration of skeletal muscle resulting in the release of muscle cell elements such as myoglobin and creatine kinase (CK) into the blood stream and urine.^[1] EIR requiring medical attention is a rare complication of any form of exercise. The manifestations of EIR are mostly nonspecific and can delay medical attention most of the time; however, complications of EIR are serious. EIR can cause acute kidney injury (AKI), hepatic dysfunction, compartment syndrome, dysrhythmia,

heart failure, electrolyte imbalance, and in severe cases, even death.^[2] AKI is one of the most serious complications associated with EIR, and only very few prospective studies have reported the characteristics, risk factors, and prognosis of severe EIR with AKI.^[3,4] EIR is an uncommon cause of severe rhabdomyolysis and a very rare cause of AKI. A recent prospective observational study of 25 patients diagnosed with EIR was conducted in a multispecialty hospital in Dubai from 2009 to 2015. Five out of 25 patients experienced AKI necessitating temporary renal replacement therapy.^[5] Mortality data vary widely according to the study population, setting, and severity of coexisting conditions. Among patients in the intensive care unit, mortality has been reported to be 59% when accompanied with AKI and 22% in its absence.^[6] The intent of this review and case report is to provide primary care physicians the information necessary to identify the condition and its prevention.

Case Report

A 35-year-old male presented to the emergency department 3 days after a strenuous workout with symptoms of generalized weakness, haematuria, and decreased urine output, with no accompanying history of fever, chills, nausea, or

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vomiting. He denied use of alcohol, tobacco, or drugs and refused using prescription or over-the-counter medications on a regular basis.

His blood pressure was 154/98 mmHg, heart rate was 96 beats/min, and respiratory rate was 16 breaths/min with 100% saturation in room air. He seemed to be a well-nourished and well-developed male in no acute distress. Head, eyes, ears, nose, and throat examination were normal. There were no murmurs noted, and the lungs were bilaterally clear on auscultation. Abdomen was soft with no tenderness and distension on admission. It was noted that he had developed tenderness in both thighs but maintained full range of motion. Pulsations were felt in both dorsalis pedis and posterior tibial artery with intact sensation.

Investigations revealed total leukocyte count of 19400 per cu.mm, Hb = 14.4 gm/dl, platelet count = 172000 per cu mm, uric acid = 9 mg/dl, and urinary Na = 45 mEq; blood for viral serology was negative, and urine and blood culture were negative. The physical appearance of urine is shown in Figure 1. Arterial blood gas analysis showed metabolic acidosis. Treatment of rhabdomyolysis includes fluid resuscitation, correcting electrolyte imbalance, and preventing end organ failure. Accordingly our patient was treated with intravenous fluids to achieve high urinary flow, but despite adequate hydration for 24 hours, the patient remained anuric and had to be taken up for hemodialysis after establishing a femoral line. Three dialysis each lasting 4 h was performed on alternate days, with a meagre flow of 50 ml urine collecting in the urinary bag at the end of the third dialysis. A slight improvement was seen after the fourth dialysis with 170 ml of outflow. The fifth dialysis proved to be a game-changer as for the first time throughout his inpatient stay a four-digit output was recorded. Thereafter, the urine output showed considerable improvement along the rest of the parameters. Subsequently, he underwent two more sittings of hemodialysis and was discharged in a stable condition. The leukocyte count settled, and he was sent home with a creatinine level of 1.4 mg/dl. The follow-up investigation has been described in Tables 1 and 2.

Discussion

Rhabdomyolysis is the result of a muscular injury through either physical forces or nonphysical means such as exertion. The initial cellular injury leads to swelling of the cells and release of cellular contents, including electrolytes, CK, and myoglobin, which is one of the key compounds released as an 18,800-Dalton oxygen carrier.^[7]

Normally, myoglobin is loosely bound to plasma globulin and only a small amount reaches the urine, however, when massive amounts are released, the binding capacity of the plasma protein is exceeded. Myoglobin is then filtered by the glomeruli and reaches the tubules, where it may cause obstruction and renal dysfunction.^[1] Myoglobin can also promote intrarenal



Figure 1: Urine specimen of our patient [dark brown on standing]

Table 1: Rhabdomyolysis diagnostic profile

| Parameters | On Admission | 2 nd Week | On Discharge |
|-------------------|--------------|----------------------|--------------|
| CK (IU/L) | 2937.7 | 2154.2 | 250 |
| SGPT (IU/L) | 642.9 | 456.7 | 43 |
| SGOT (IU/L) | 2332.1 | 1449.3 | 47 |
| LDH (IU/L) | 678 | 470 | 200 |
| Uric acid (mg/dl) | 9 | 7.9 | 6 |
| Phosphate (mg/dl) | 5.8 | 5.4 | 4 |

Table 2: Renal parameter

| Parameters | On Admission | 2 nd Week | On Discharge |
|---------------------|--------------|----------------------|--------------|
| Creatinine (mg/dl) | 12.2 | 9.6 | 1.4 |
| Urea (mg/dl) | 148 | 109 | 50 |
| Na (mEq/l) | 122 | 138 | 137 |
| K (mEq/l) | 4.2 | 4.5 | 4.7 |
| Bicarbonate (mEq/l) | 17 | 16.5 | 20 |
| Calcium | 8.1 | 8.3 | 8.7 |

vasoconstriction by scavenging the vasodilator nitrous oxide from renal microcirculation.^[8] Other intracellular compounds such as protons, phosphate, potassium, nucleotides, and precursors of uric acid are also released from damaged muscles and play an important role in the pathophysiology of rhabdomyolysis-induced AKI.^[9,10]

Eccentric exercising without much knowledge causes a lot of muscle injury.^[1] Our patient performed strenuous workout for the first time followed by fasting which is a form of eccentric exercise resulting in severe muscle injury. He presented with typical clinical features, and investigations revealed myoglobinuria, hypocalcemia, elevated levels of serum CK, phosphate, uric acid, liver enzymes, lactate dehydrogenase, and renal parameters with metabolic acidosis, confirming EIR with AKI. The serum potassium level was normal throughout the hospital stay. He was taken up for hemodialysis, and a total of seven sittings were required. The urine color and output along with other deranged parameters almost returned to normal by the beginning of the fourth week.

Conclusion

Rhabdomyolysis is not an uncommon condition and the gravity of this syndrome has never been appreciated and not adequate attention has been given to the condition. When accompanied with various complications, rhabdomyolysis can have disastrous consequences. Therefore, it is important to know the related information about it as well as various kinds of exercise-induced risk factors associated with it. History of inciting events, elevated CK level, and myoglobinuria confirm the diagnosis of rhabdomyolysis. A swift and timely intervention can be of tremendous help in preventing complications and is crucial for a successful outcome. It must be kept in mind that every individual is unique and one must know and accept their limitations and exercising capacity. A gradual increase in the duration of exercise is much better than a sudden surge like what was described in our patient above.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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