Acute Kidney Injury and Rhabdomyolysis as an Initial Presentation of Hashimoto's Thyroiditis

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Abstract

The myopathy associated with hypothyroidism is usually mild and causes myalgia, stiffness, fatigability, and muscle weakness. Severe forms of myopathy, such as rhabdomyolysis with acute kidney injury (AKI), have rarely been reported in hypothyroid patients. We describe a young patient who presented with generalized body aches, cramps, and abdominal pain with vomiting after physical exercise. His laboratory studies demonstrated that he had rhabdomyolysis and AKI secondary to hypothyroidism; both resolved with thyroid hormone replacement. Hypothyroidism should be considered in the differential diagnosis of rhabdomyolysis when common causes are excluded.

Key words: hypothyroidism, Hashimoto's thyroiditis, acute kidney injury, rhabdomyolysis

Introduction

Mild forms of myopathy occur frequently in patients with hypothyroidism and cause muscle pain, stiffness, cramps, fatigability, and weakness.[1] Severe myopathy with rhabdomyolysis and associated complications has rarely been reported in patients with hypothyroidism.[2-8] We describe a patient with rhabdomyolysis and acute kidney injury (AKI) as the initial presentation of hypothyroidism.

Case Presenttion

A twenty-one year old man presented to the emergency room with a five hour history of intense, intermittent, and non-radiating hypogastric pain that was aggravated by movement. He also had nausea and non-bilious and non-bloody vomiting. The patient had a history of constipation and generalized body aches and cramps for one month. He participated in outdoor activity for eight hours during the day with ambient temperatures greater than 90°F before the admission. His occupation involved manual labor and clerical work. He had a history of asthma and of depression treated with citalopram for six months.

Vital signs included a blood pressure of 116/56 mmHg and a pulse rate of 66 bpm. The only significant physical finding was sluggish deep tendon reflexes. He did not have thyroid enlargement or nodules. His serum creatine was 1.9 mg/dL (0.5-1.2mg/dL), and his creatine kinase (CK) was 5369 IU/ml, consistent with AKI secondary to rhabdomyolysis. He also had an elevated LDH of 511U/liter and a uric acid level of 5.5 mg/dl,consistent with muscle cell breakdown. Urine analysis was normal except for trace ketones. The fractional excretion of Na^+ was 2.35%, consistent with acute tubular necrosis. Renal ultrasound revealed normal kidney size and no evidence of renal stones or hydronephrosis. His serum electro-

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lytes were normal except for phosphorus of 5.4mg/dL (2.5-4.5 mg/dL).The TSH was 69.22 µIU /ml (0.27-4.20 µIU /ml), the T4 was 0.42 mcg/dL (5.1-14.1mcg/dL), and anti-thyroid peroxidase antibody (292 IU/ml; normal <34 IU/ml) and anti-thyroglobulin antibody (167 IU/ml; normal <115 IU/ml) levels were elevated. The patient's serum cortisol level at 4:00 pm was 41.5 mcg/dl (6.2 - 19.4mcg/dL); his anti-mitochondrial antibody, rheumatoid factor, and double stranded DNA assays were negative. Thus inflammatory myopathy was ruled out as an etiology. The patient was started on intravenous fluids and levothyroxine 50 microgram per day orally. After forty-eight hours of treatment the serum CK level decreased to 2866 IU/L, and his kidney function improved (Table1). He was discharged home on oral levothyroxine, and two weeks later the patient had a dramatic improvement in his fatigue and myalgia.

Discussion

Nearly 40% of patients with hypothyroidism have mild forms of myopathy.[1] However, hypothyroidism presenting with rhabdomyolysis and AKI has rarely been reported.[2-8] Our literature review using the PubMed database identified seven adults and two children with hypothyroidism and rhabdomyolysis [2-8] Most of the patients presented with acute renal failure secondary to rhabdomyolysis.Our patient was a young, healthy man who presented with mild symptoms of myopathy for a month prior to diagnosis. Intense exercise just before admission probably triggered his rhabdomyolysis. Since his myopathy improved with thyroid hormone replacement and no additional episodes of rhabdomyolysis occurred during follow-up for more than one year, hypothyroidism was the most likely cause of his rhabdomyolysis.

Table 1. Laboratory values

	Admission	Day 2	Follow up 2 months	Follow up 3 months	Follow up 6 months
Free T4 (0.93-1.70) ng/dL	0.42	–	0.57	1.18	1.44
TSH (0.27-4.20) µIU /ml	69.2	–	52.1	34.0	4.7
CK (26-308) IU/ml	5,369	2,866	216	–	–
LDH (135-225) U/L	511	400	–	–	–
AST (5-37) U/L	60	64	–	–	–
ALT (5-41) U/L	90	79	–	–	–
Creatinine (0.5-1.2) mg/dL	1.9	1.5	–	–	–

Thyroid hormones regulate the metabolism and contractile phenotype of skeletal muscle.[9] These hormones promote the conversion of oxidative slow type I fibers to a combination of oxidative and glycolytic type IIC or IIA fibers and increase mitochondrial content and oxidative and contractile capacity of skeletal muscle.[9] Slow type I fibers predominate in hypothyroid muscles. The mitochondria in type I fibers have high oxidative capacity, but studies using nuclear magnetic resonance spectroscopy have shown that after exercise the skeletal muscle of hypothyroid subjects has a decreased ratio of phosphocreatine/inorganic phosphate (PCr/Pi) and increased Pi levels.[10] In addition, the recovery of PCr levels is decreased in hypothyroidism post exercise.[11] Since PCr used for type I fiber contraction is produced mainly from mitochondrial ATP,[10] these finding suggest that hypothyroidism is associated with impaired oxidative metabolism. The observation that thyroid hormone replacement increases the PCr/Pi ratios in hypothyroid subjects also indicates that the energy impairment in skeletal muscle is hormone dependent.[11] PCr promotes membrane stabilization, and a decrease in the intracellular PCr pool might destabilize muscle cell membranes.[12]

Rhabdomyolysis can develop in the presence of defects in high energy phosphate metabolism by mitochondria.[10] ATP depletion causes Na^+K^+ATPase and Ca^{++} ATPase pump dysfunction leading to increased cellular permeability to sodium ions and an increase in intracellular calcium concentration.[3] This excess calcium then increases the activity of intracellular proteolytic enzymes that degrade the muscle cell.[3] As the myocyte degenerates, large quantities of potassium, aldolase, phosphate, myoglobin, CK, lactate dehydrogenase, aspartate transaminase, and urate leak into the circulation and can cause electrolyte abnormalities and AKI.[13]

Conclusion

In conclusion, hypothyroidism should be considered in the differential diagnosis of rhabdomyolysis after ruling out more common causes. These patients respond well to thyroid replacement, and renal function usually recovers.

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