

# Acute Rhabdomyolysis : Importance of MRI and Bone Scintigraphy

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## = Abstract =

Rhabdomyolysis is a potentially life-threatening disease which may result from a variety of causes. We describe the features of magnetic resonance imaging(MRI) and bone scintigraphy, and their importance for diagnosis and treatment of a patient with rhabdomyolysis. (**J Korean Soc Pediatr Nephrol 2009;13:91-95**)

**Key Words :** Rhabdomyolysis, MRI, Bone scintigraphy

## Introduction

The etiology of rhabdomyolysis is roughly classified into two categories: physical causes (trauma, occlusion or hypoperfusion of the muscular vessels, strenuous muscular exercise, electrical current, and hyperthermia) and non-physical causes (metabolic myopathies, drugs and toxins, infections, electrolyte abnormalities, endocrine disorders, and polymyositis/dermatomyositis) [1, 2]. If undiagnosed, rhabdomyolysis may be fatal; the major complications are hyperkalemia and acute renal failure [3, 4]. Rhabdomyolysis results in a release of massive amounts of potassium and myoglobin, both of which are constituents of muscle cells. Here, we report a case of exercise-induced rhabdomyolysis in

which magnetic resonance imaging (MRI) and bone scintigraphy were very valuable for demonstrating its site and extent.

## Case report

A 13-year-old boy presented with dark urine and myalgia on both thighs one day after a strenuous muscular exertion (repetitive motions of sitting down and getting up as punishment : > 250 for 10 minutes). Laboratory findings showed a positive serum and urinary myoglobin and very high levels of creatine kinase (CK, 19,000 U/L, reference range : <176 U/L) and lactate dehydrogenase (LDH, 15,624 U/L reference range : <460 U/L). Renal function was normal. A blood chemistry panel showed alanine transaminase 2,750 U/L, aspartate transaminase 790 U/L, urea nitrogen 20 mg/dL, creatinine 0.8 mg/dL, sodium 142 mmol/L, potassium 4.2 mmol/L, chloride 103 mmol/L, glucose 134 mg/dL, uric acid 3.6 mg/dL, albumin 4.3 g/dL, total bilirubin 2.0 mg/dL, direct

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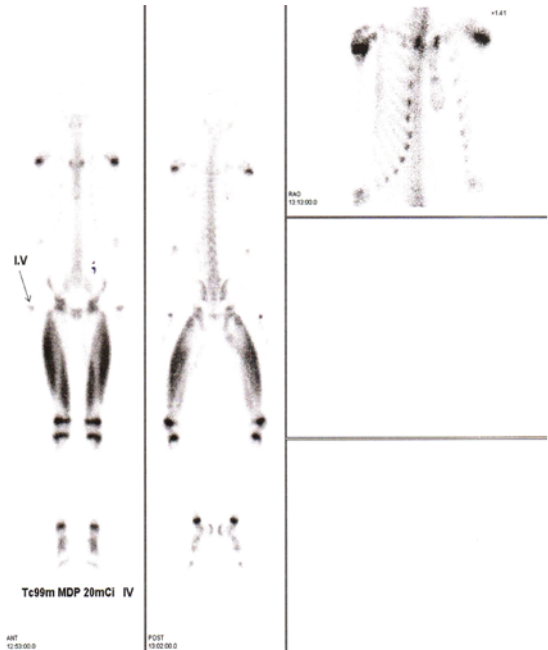
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**Fig. 1.** A magnetic resonance imaging(MRI) showed diffuse, increased signal intensity at both quadriceps and adductor magnus muscles and a thickening of fasciae on T2 weighted images.

bilirubin 0.3 mg/dL, C-reactive protein 0.08 mg/dL. After admission, he complained of severe pain at both thighs, and both buttock areas, and so we decided to perform a MRI of lower extremities. The MRI showed a diffuse, increased signal intensity at both quadriceps and adductor magnus muscles and a thickening of fasciae on T2 weighted images (Fig. 1). These MRI findings were exactly consistent with painful area of this patient. A Tc-99m MDP bone scintigraphy also showed abnormal uptakes in both thighs (Fig. 2). On the day of admission, the urine output was less than 0.5 mL/kg/hour, we continued the vigorous saline treatment and added sodium bicarbonate intravenously to achieve urine alkalization. He was given a vigorous isotonic saline hydration preserving the urine output at the rate of 2 mL/kg/hour in the acute stage and complete bed rest was also performed. Two weeks later, follow up bone scintigraphy showed no abnormal uptake and his laboratory findings were also normalized.



**Fig. 2.** A whole-body bone scintigraphy also showed abnormal uptakes in both thighs.

### Discussion

Rhabdomyolysis is a clinical syndrome caused by injury to skeletal muscle that results in release

of cellular contents into the extracellular fluid and the circulation. The diagnosis rests on measurement of these released substances in either plasma or urine. The injury can be reversible or irreversible, potentially leading to disability, renal failure, or death. Diagnosis of rhabdomyolysis is based on elevated serum creatine kinase (CK) levels of more than 1000 U/L [5, 6]. Lower levels may more appropriately be defined as myositis. Other series have used elevated serum and urine myoglobin levels ( $>300$  ng/mL and  $>10$  ng/mL, respectively) as the diagnostic criteria. In our patient, he was otherwise healthy, and he had also severe exercise history, so we could diagnose the exercise-induced rhabdomyolysis easily. In addition, there was no history of drug or alcohol. We did not perform the enzyme test for such disease as McArdle disease because there was no evidence of metabolic acidosis. The most important complication of this disorder is acute renal failure. Once acute renal failure has developed, the patient requires renal replacement therapy. The incidence of acute renal failure range from 17% to 35 % in adults and from 5% to 50% in children [3, 7]. Among patients with a CK level  $>5000$  U/L, more than 50% develop acute renal failure[8]. In our patient, although the CK level is 19,000 U/L, and there was oliguria in the early stage, but owing to vigorous hydration, he did not develop acute renal failure. The serum CK level is commonly used as biochemical marker of muscle damage and a prognosticator of the risk of acute renal failure, it show a wide range of individuals. Although the measurement of plasma or urine myoglobin can also be used as a confirmatory test, it has not been widely used in clinical practice. MRI is more sensitive than ultrasonography

or computed tomography in evaluation of muscle injuries. These measurements enable determination of the actual site and extent of damaged muscles, especially when fasciotomy is considered for treatment [9]. Fasciotomy may be considered if compartment syndrome has developed, it means compartment pressure is higher than 35 mmHg, respectively, and clinical symptoms of compartment syndrome includes pain of the affected sites, swelling, and loss of peripheral pulses [10]. Tc-99m MDP scintigraphy is also clearly valuable for visualizing the site and extent of damaged muscles. The exact mechanism by which these agents accumulate within the damaged muscle is unclear, however, several investigators have suggested that these agent may accumulate irreversibly injured muscle cells by means of cell membrane disruption and subsequent mitochondrial chelation [9, 11]. Although scintigraphy is inferior to MRI with regard to spatial resolution, it is a valuable tool for screening actual muscle damage within the whole body. In addition, bone scintigraphy is also a good method for systemic survey and follows up. In our patient, we performed the MRI and bone scintigraphy in the acute stage, and bone scintigraphy 2 weeks later as a follow-up. In summary, both MRI and Tc-99m MDP scintigraphy greatly supported an estimate of the severity and significance of acute rhabdomyolysis in this case. In particular MRI was useful for a regional evaluation of the affected sites, especially fasciotomy is considered for treatment, whereas scintigraphy was useful for a systemic survey and follow-up tools.

요 약

**급성 횡문근융해증 : 자기공명영상과  
골주사의 중요성**

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횡문근융해증은 다양한 원인에 의해서 발생하며, 생명이 위독할 수도 있는 질환이다. 저자들은 횡문근융해증이 있는 환자에서 진단과 치료에 있어 MRI와 골주사의 중요성을 경험하였기에, 이에 그 특징을 보고하는 바이다.

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