Case Report

RHABDOMYOLYSIS-RELATED ACUTE RENAL FAILURE AND BI-PHASIC CALCIUM METABOLISM

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ABSTRACT

Rhabdomyolysis is one of the causes of acute renal failure (ARF) and it can be life-threatening in some cases. Hypocalcemia is prominent during the oliguric phase of renal failure and if the patient reaches the diuretic phase, hypercalcemia can develop. We report a 20-year-old male patient with rhabdomyolysis-induced ARF with bi-phasic calcium metabolism observed during the course of ARF.

KEY WORDS: Rhabdomyolysis, Acute renal failure, Hypocalcemia, Hypercalcemia, bi-phasic calcium metabolism.

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INTRODUCTION

Rhabdomyolysis is one of the causes that can lead to acute renal failure (ARF). Bi-phasic calcium metabolism can accompany deteriorated renal function in the case of rhabdomyolysis-related ARF (RM-ARF). Hypocalcemia is prominent during the oliguric phase of renal failure and if the patient reaches the diuretic phase, hypercalcemia can develop. Absolute calcium metabolism is not yet understood. Some theories have been put forth to explain the association of bi-phasic calcium metabolism in RM-ARF.

We present herein a patient with rhabdomyolysis-induced ARF with bi-phasic calcium metabolism observed during the course of ARF.

Case: A 20-year-old male patient with no known renal or muscle disease presented to our out-patient clinic with complaints of oliguria, nausea, vomiting and generalized myalgia. His initial physical examination revealed severe dehydration and neck stiffness. He was immediately hospitalized and initial laboratory tests revealed rhabdomyolysis. Despite acquisition of a detailed medical history, complete physical examination and laboratory evaluation including lumbar puncture, no cause of rhabdomyolysis could be determined. Initial laboratory tests revealed the following: creatine kinase (CK): 120 x 10^3U/ml, creatine kinase MB isoenzyme (CK-MB): 2460U/ML, lactate dehydrogenase (LDH): 2245U/L, parathyroid hormone (PTH): 170pg/ml, calcium (Ca): 7.9mg/dl, phosphorus (P): 6.3mg/dl, and crea-

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tinine: 1.9mg/dl. Immediately after establishment of intravenous line, both oral and parenteral rehydration was maintained. Despite rehydration, serum levels of CK, CK-MB, LDH and creatinine remained consistently elevated, up to 133 x 10^3U/ml, 2960U/ML, 3174U/L and 6.2mg/dl, respectively.

As the patient was oliguric, after a temporary dialysis catheter insertion, he underwent hemodialysis five times. His serum Ca level decreased to as low as 5.5mg/dl during this oliguric phase. After diuretic phase was initiated, serum levels of all the above-mentioned parameters decreased to normal except Ca and PTH: serum Ca levels increased during diuretic phase up to 14.6mg/dl, while PTH level decreased below normal levels to as low as 5.6pg/ml. During hypercalcemic phase, hydration with diuretics and a PTH antagonist, salcatonin (100U/day dosage for 6 days), were administered. Renal function of the patient was closely monitored during the 36–day follow-up, and the patient was discharged with complete recovery.

DISCUSSION

Rhabdomyolysis is one of the causes of ARF, and it can be life-threatening in some cases. It is reported that RM-ARF accounts for up to 9% of all cases of ARF.[1] Rhabdomyolysis generally occurs after a trauma, but it can also be caused by genetic conditions, metabolic disorders, exercise, toxins, infections, and drugs, etc.[2,3] RM-ARF can have accompanying serum Ca level disturbances, and this can be in the form of hypercalcemia, hypocalcemia, or both.[4-7]

Rhabdomyolysis can be diagnosed based on its characteristic clinical and laboratory features, including muscle tenderness, pigmenturia with urine that is orthotoluidine (Hematest) positive, greatly elevated CK levels, and often, renal failure. Muscle biopsy can also be applied but is not always helpful in diagnosis,[2] as in our case, since biopsy of our patient showed no sign of rhabdomyolysis.

Rhabdomyolysis does not always result in ARF. Thus, there are likely some other contributing factors that play a role in determining the outcome in rhabdomyolysis. Dehydration, as observed in our case, has been cited as one of the predisposing factors in the onset of rhabdomyolysis and ARF.[1,2]

Hypocalcemia together with hyperphosphatemia may be encountered especially during the initial oliguric phase of RM-ARF. This can be explained by the influx of calcium to necrotic muscle tissue, the negative effects of hyperphosphatemia, and decreased renal production of 1,25(OH)2D.[2,5,6] In one study, deposition of calcium in tissue was documented via technetium-99 scan in hypocalcemic patients with RM-ARF.[8] Elevated serum PTH levels, as seen in our patient, are seen in this initial hypocalcemic and oliguric phase of ARF, probably as a physiologic response of the body to hypocalcemia; hyperphosphatemia is also prominent in this phase. Replacement calcium therapy in these patients via calcium salts and/or with vitamin D derivatives during the hypocalcemic phase is dangerous and should be avoided.[9] Replacement may cause severe complications especially during the hypercalcemic phase which follows, with calcium depositions in soft tissues and hypercalcemia that give ineffective response to usual treatment modalities. In another study, hyperkalemia, hyperphosphatemia, and hypocalcemia were more common in the oliguric than in the non-oliguric RM-ARF patients.[1] The causes for such a difference require further evaluation.

In the recovery phase, hypercalcemia was present associated with suppression of PTH secretion, low 1,25(OH)2D3 levels, decreased bone resorption and mobilization of the muscle calcium deposits.[4,6] Decreased renal production of 1,25(OH)2D3 resulted from low levels of PTH as a response to hypercalcemia.[5]

Hypercalcemia in the diuretic phase requires close monitoring due to its life-threatening effects. Conventional regimens (rehydration plus diuretics and chelators) against hypercalcemia can be ineffective in the case of RM-ARF. In serious or urgent cases, hypocalcemic hemodialysis may be required, with the simultaneous

administration of calcitonin and diphosphonates.[9] Addition of mithramycin, diphosphonates, calcitonin, and salcatonin to medical treatment can be considered.

CONCLUSIONS

RM-ARF is a serious and rapidly advancing condition, which can increase mortality. It should be diagnosed, followed and treated very promptly. Patients are susceptible to electrolyte and volume imbalances. During the initial oliguric phase, predisposing factors (infection, dehydration, etc.) should be investigated and ameliorated. Hemodialysis should be kept in mind both for initial oliguric phase (in case of hypocalcemia, uremia) and for diuretic phase (in case of severe hypercalcemia). Calcium replacement should be avoided in the oliguric phase; addition of new generation long-acting anti-hypercalcemic agents may be considered. RM-ARF has a good prognosis with appropriate medical management.

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