Single Dose of Rasburicase for Treatment of Hyperuricemia in Acute Kidney Injury: a Report of 3 Cases

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Severe hyperuricemia accompanied by the other comorbidities such as anuria, fluid overload, calcium-phosphate imbalance, and/or tumor lysis syndrome is one of the indications for dialysis in the setting of acute kidney injury. Rasburicase is used in different clinical conditions such as tumor lysis syndrome and uric acid nephropathy. Among referred patients to our center from 2008 to 2010, there were 3 patients who had an indication for dialysis because of hyperuricemia. Contributing factors to the acute kidney injury were multi-organ dysfunction, rapidly progressive glomerulonephritis, and spontaneous tumor lysis syndrome. None of the patients showed any response to treatment with bicarbonate and hydration. After rasburicase administration, serum uric acid level declined, and urine output increased. Treatment with a single low dose of rasburicase would be effective to decrease the serum uric acid level and reverse kidney injury secondary to uric acid nephropathy.

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Case Report

INTRODUCTION

Rasburicase, recombinant of urate oxidase enzyme, metabolizes uric acid to the more soluble form, allantoin. First, it was used to prevent and treat the tumor lysis syndrome in the setting of malignancies.[1,2] Recently, there are a few reports about its benefits in treating patients with tophaceous gout,[3] obstructive urolithiasis,[4] and hyperuricemia accompanying renal failure.[5,6] We report 3 children with hyperuricemia and acute kidney injury (AKI) who were referred to our center and successfully treated by rasburicase.

CASE REPORT

Case 1

A 23-month-old boy with a history of 5 days of vomiting, profound watery diarrhea, and high fever, who had been treated with ibuprofen as an antipyretic, was brought to the emergency department because of severe dehydration, loss of consciousness, and septic shock. Antibiotic therapy, including ceftriaxone and vancomycin had been started. Despite sufficient hydration therapy with crystalloid fluids and furosemide, he remained anuric, and serum creatinine level increased progressively. Laboratory tests are shown in the Table. Because of hyperuricemia in the setting of AKI, rasburicase was given in a dosage of 0.1 mg/kg, intravenously. Next day, serum uric acid (SUA) level decreased from 20.5 mg/dL to 5.1 mg/dL. On day 12, he was discharged while serum creatinine level was 0.8 mg/dL and SUA level remained stable between 5 mg/dL to 6.8 mg/dL.

Case 2

A 5.5-year-old boy with a history of sterile pyuria, pancytopenia, and AKI for 2 weeks was treated by hemodialysis in 2 subsequent days in a local hospital and kidney function became normal. After 1 months and a half, he was admitted because of fever and acute renal insufficiency. On physical examination, he had mild hepatosplenomegaly. In

Clinical and Laboratory Data of Patients, Before and After 12 Hours of Rasburicase Prescription

Laboratory Parameter	Case 1		Case 2		Case 3	
	Before	After	Before	After	Before	After
Urine output, mL/kg/h	0.7	1.0	0	3.3	1.18	1.25
Blood urea nitrogen, mg/dL	39	46	72	60	134	110
Serum creatinine, mg/dL	3.0	3.4	2.8	2.3	1.3	2.1
Serum calcium, mg/dL	8.1	8.9	8.3	10.9	9.4	9.1
Serum phosphorus, mg/dL	5.8	5.8	3.8	2.8	6.3	6.7
Serum uric acid, mg/dL	20.8	5.1	44.0*	1.0	18.0	2.0
Serum bicarbonate, mEq/L	13.0	11.9	33.0	32.8	18	16.6
Leukocyte count, $\times 10^9$/L	6.0	6.9	38.7	27	18.1	13.4
Hemoglobin, g/dL	11.4	11.9	11.1	9.1	14	13

*It was 66 hours after initiation of dialysis.

both admissions, SUA was significantly elevated along with AKI (Table). A diagnosis of acute T-cell lymphocytic leukemia was established by conducting bone marrow aspiration and biopsy. Hyperuricemia was treated by rasburicase in a dose of 0.1 mg/kg intravenously, and SUA decreased to 1 mg/dL during 24 hours. After that, induction chemotherapy was initiated.

Case 3

A 9-year-old boy was referred to our center because of rapidly progressive glomerulonephritis from 4 months ago. The diagnosis of systemic lupus erythematosus was established by positive serologic and clinical findings, including malar rash, immune hemolytic anemia, serositis, and nephritis. Immunosuppressive drugs were administered. Because of high SUA level, rasburicase in a dosage of 0.05 mg/kg was intravenously administered. Clinical courses and laboratory tests of all presented patients are shown in the Table.

Serum creatinine was normalized after 12, 10, and 30 days of rasburicase administration in cases 1 to 3, respectively. After discharge, all the three patients were followed up for an average of 24 months. kidney function and SUA levels remained stable during the follow-up period.

DISCUSSION

Hyperuricemia, accompanied with the other comorbidities such as hyperphosphatemia, anuria, fluid overload, or tumor lysis syndrome, is one of the indications of dialysis in AKI.[7,8] Allopurinol blocks the conversion of hypoxanthine and xanthine to uric acid. Therefore, they accumulate in the body, and as they are less soluble than uric acid, they may lead to AKI by promoting urinary tubular obstruction, local granulomatous inflammation, and renal vasoconstriction.[9] We have previously reported the higher risk of mortality in pediatric intensive care unit patients with SUA more than 8 mg/dL accompanying sepsis.[10] First patient, developed acute kidney failure and hyperuricemia secondary to severe dehydration, use of non steroidal anti inflammatory drugs, and nephrotoxic antibiotics. The etiology of hyperuricemia in the third patient was multifactorial, including autoimmune hemolytic anemia, antituberculosis medication (concomitant tuberculosis), diuretic therapy, and lupus nephritis. The first and second patients did not need renal replacement therapy because of the high level of SUA. Spontaneous tumor lysis syndrome due to acute lymphocytic leukemia was the etiologic factor of high SUA.[11] A single low dose of rasburicase decreased dramatically the high SUA and serum creatinine levels.

Hobbs and colleagues reported acute kidney failure in neonates and infants secondary to the sepsis and /or hypoxic ischemic encephalopathy. They had a significant increase in SUA. They were efficiently treated with rasburicase 0.17 mg/kg.[6] Effectiveness of treatment with rasburicase in the setting of the tumor lysis syndrome in children has been proven.[1,2] In addition, disabling tophaceous gout has been shown to be resolved by a prolonged course of rasburicase therapy in a patient on hemodialysis. The proposed protocol was every two-week injection for six months followed by monthly injection for three years.[3] Segura Torres and coworkers presented patients with post obstructive AKI secondary to bilateral uric acid stones that disappeared by two-day administrations of rasburicase.[4] They postulated that, rasburicase can filtrate from the glomeruli

and reach to the urinary tract and dissolve uric acid crystals.

In conclusion, rasburicase can be an effective choice to reduce SUA and ameliorate renal insufficiency secondary to the uric acid nephropathy.

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CONFLICT OF INTEREST

None declared.

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