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LETTER TO THE EDITORS

Acute renal failure due to obstructive uric acid stones associated with acute gastroenteritis

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Sirs,

The development of acute renal failure (ARF) in young children with acute gastroenteritis can lead to a presumptive diagnosis of pre-renal azotemia resulting from diarrheal dehydration. Recently, however, several cases of children with acute post-renal failure due to bilateral obstructive uric acid stones associated with acute gastroenteritis have been reported in Japan [1]. We have also encountered three similar cases in which the serum uric acid concentration was in the lower end of the normal range and fractional excretion of uric acid (FEUA) increased after the patients had recovered.

Case 1 was a 3-year-old boy with a 1-week history of rotavirus gastroenteritis and a 2-day history of oligouria. He was referred to our hospital for further examination of the oligouria. He had been healthy prior to the presentation of the gastroenteritis and had no familial history of urolithiasis. On admission, physical examination showed peripheral oxygen saturation (SpO_2) of between 80 and 90% for a maximum of 2 l/min supplemental O_2. Clinical and laboratory data are summarized in Table 1. Ultrasound scan of the kidney disclosed bilateral dilated pelvises containing debris. Despite adequate fluid control and diuretic therapy, his condition worsened rapidly, desaturating to SpO_2 60% for a maximum of 10 l/min supplemental O_2, so that he required mechanical ventilation. Emergent computed tomography (CT) disclosed pulmonary edema and bilateral urolithiasis located at the pelviureteric junction (PUJ). Based on these findings, he was diagnosed with severe overhydration resulting from post-renal ARF due to bilateral urolithiasis. Since the anuria continued after 15 h of emergent continuous venovenous hemodiafiltration, percutaneous nephrostomy tubes were inserted bilaterally under ultrasound guidance. Sandy stones excreted through the nephrostomy tubes together with the urine consisted mainly of ammonium acid urate (AAU) (>98%). An antegrade nephrostogram performed on postoperative day (POD) 6 showed residual stones in the left PUJ. The patient therefore underwent left-sided extracorporeal shockwave lithotripsy (ESWL). He was discharged on POD 17. Follow-up ultrasound performed 6 months postoperatively indicated bilateral mild hydronephrosis, but no evidence of stones.

Case 2 was a 16-month-old boy with a 3-day history of vomiting and diarrhea. He was initially admitted to a local hospital because of dehydration but was referred to our hospital the following day as he demonstrated prolonged oligouria despite sufficient fluid replacement therapy. He had been previously healthy and had no familial history of urolithiasis. On admission, physical examination revealed mild dehydration. Ultrasound scan of the kidney disclosed bilateral dilated pelvises containing debris, and the abdominal CT scan revealed bilateral urolithiasis at the PUJ. Percutaneous nephrostomy tubes were inserted bilaterally on his second day of hospitalization, and after 48 h of

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Table 1 Clinical and laboratory data of three children with acute renal failure

Clinical and laboratory parameters	Case 1	Case 2	Case 3
Age (years)	3	1.3	1.6
Gender	Male	Male	Male
Rotavirus antigen in the stool	Positive	Not measured	Not measured
Stone composition	AAU	AAU	AAU
Laboratory findings on admission	Day 0	Day 0	Day 0
Serum			
BUN (mg/dl)	17.6	40.2	68.9
Cr (mg/dl)	1.4	2.1	3.6
Uric acid (mg/dl)	8.7	12.1	14.0
Sodium (mmol/l)	131	132	130
Potassium (mmol/l)	3.4	3.2	4.3
Chloride (mmol/l)	103	104	97
Calcium (mg/dl)	8.0	8.6	8.7
Laboratory findings after recovery	day 17	day 10	day 16
Serum			
BUN (mg/dl)	8.3	12.5	13.1
Cr (mg/dl)	0.24	0.18	0.19
Uric acid (mg/dl)	2.8	2.2	3.4
Urine			
Calcium/Cr (mg/mg creatinine)	0.16	Not measured	0.11
Uric acid/Cr (mg/mg creatinine)	1.69	1.38	2.07
FEUA (%)	14.5	11.3	11.6

AAU, Ammonium acid urate; BUN, blood urea nitrogen; Cr, creatinine; FEUA, fractional excretion of uric acid (normal range 7– 11%)

intravenous rehydration, an antegrade nephrostogram demonstrated the presence of bilateral residual stones at the PUJ. Oral bicarbonate was therefore administered for systemic alkali therapy. An antegrade nephrostogram performed on POD 9 showed no stones remaining in the PUJ. At the 6-month follow-up, no recurrence of stones was observed.

Case 3 was a 19-month-old boy who was transferred to our hospital for further treatment of gastroenteritis and oligouria that had persisted for 9 and 2 days, respectively. He had been previously healthy and had no familial history of urolithiasis. On admission, physical examination revealed mild dehydration. Radiological examination confirmed bilateral urolithiasis at the PUJ. Percutaneous nephrostomy tubes were inserted bilaterally on his second day of hospitalization. An antegrade nephrostogram performed on POD 3 revealed no residual stones. At the 6-month follow-up, no recurrence of stones was observed.

In all patients, the serum uric acid concentration was in the lower end of the normal range and the urinary uric acid to creatinine ratio and FEUA increased after the patients had recovered.

Renal hypouricemia is a rare hereditary disorder characterized by impaired urate handling in the renal tubules [2]. Mutations in human urate transporter 1 (hURAT1) encoded by *SLC22A12* have been found to cause this disorder [3]. The lack of a functional hURAT1 transporter is known to result in lower levels of blood urate and the accumulation of urate crystals in kidney tubules, leading to urolithiasis. Ichida et al. [4] performed sequence analysis of the *SLC22A12* gene in 32 unrelated idiopathic renal hypouricemia patients and found that the serum urate levels were significantly lower and the urinary urate excretion was significantly higher in heterozygotes than in healthy subjects. These changes were even more significant in homozygotes and compound heterozygotes. We therefore performed sequence analysis of the hURAT1 gene in our three Japanese children to determine whether heterozygotic *SLC22A12* mutations are responsible for the pathogenesis of this disorder. However, no such mutation was detected in our patients.

In conclusion, we recommend that post-renal ARF due to obstructive uric acid stones in children with acute gastroenteritis should be explored when anuria is refractory to sufficient fluid replacement therapy. Investigations with a larger sample size are required to elucidate the background of the disease.

References

1. Fujinaga S, Kaneko K, Ohtomo Y, Takada M, Kobayashi K, Tada M, Yamashiro Y (2005) Acute renal failure due to obstructive uric acid stones associated with rotavirus gastroenteritis. Pediatr Nephrol 20:239–240

2. Maesaka JK, Fishbane S (1998) Regulation of renal urate excretion: A critical review. Am J Kidney Dis 32:917–933
3. Enomoto A, Kimura H, Chairoungdua A, Shigeta Y, Jutabha P, Cha SH, Hosoyamada M, Takeda M, Sekine T, Igarashi T, Matsuo H, Kikuchi Y, Oda T, Ichida K, Hosoya T, Shimokata K, Niwa T, Kanai Y, Endou H (2002) Molecular identification of a renal urate anion exchanger that regulates blood urate levels. Nature 417:447–452
4. Ichida K, Hosoyamada M, Hisatome I, Enomoto A, Hikita M, Endou H, Hosoya T (2004) Clinical and molecular analysis of patients with renal hypouricemia in Japan-influence of URAT1 gene on urinary urate excretion. J Am Soc Nephrol 15:164–173