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CLINICAL QUIZ

Metabolic acidosis with increased anion gap, oxaluria, and acute kidney injury: Questions

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Case summary

A 17-year-old boy was admitted to a hospital with nausea and headache. His blood pressure was 140/100 mmHg, serum creatinine was 0.88 mg/dL, and white blood cell count was $11.6 \times 10^3/mm^3$. After 4 h of follow-up, he was discharged from the emergency room as his blood pressure decreased to normal range for his age.

Eight hours later, he was admitted to our pediatric emergency room with headache and somnolence. His previous medical history was unremarkable. According to his own statement, he smoked 3–4 cigarettes a day and never used drugs or alcohol.

The patient was in a moderate overall condition and appeared drowsy. Systemic physical examination was unremarkable. Vital signs were as follows: BP 180/100 mmHg (> 95th + 12 mmHg, stage 2 hypertension), HR 104 bpm, RR 20 bpm, and temperature which was 36.5 °C. His Glasgow Coma Scale score was 13/15. Neurological examination included cranial nerves and ophthalmoscopy and was unremarkable; pupils were equal and round, reactive to light.

He was the second child of three, born to consanguineous parents. The mother had type 2 diabetes mellitus and the father had hypertension. The father worked in a car repair shop 2 days a week.

Laboratory findings at the time of admission were as follows: white blood cell count was $18.7 \times 10^3/mm^3$, hemoglobin 16.9 g/dL, platelets $236 \times 10^3/mm^3$, urea 45.0 mg/dL, creatinine 1.2 mg/dL, glucose 88 mg/dL, sodium 140 mmol/L, potassium 5.4 mmol/L, chloride 102 mmol/L, calcium 9.7 mg/dL, phosphorus 3.3 mg/dL, total protein 7.8 g/dL, albumin 5 g/dL, C-reactive protein 3.8 mg/dL, ammonia 19 umol/L, and lactate 2.5 umol/L. There was metabolic acidosis (blood gas pH: 7.29, HCO_3: 17 mmol/L, PCO2: 34.6 mmHg, BE: − 10.2 mmol/L). The anion gap was 26.4 mmol/L based on the formula $[(Na^+ + K^+) - (Cl^- + HCO^{3-})]$. Calculated osmolarity was 293.5 mOsm/kg. Serum complement C3 (130.25 mg/dL) and C4 (23.8 mg/dL) were in the normal range. Serum copper level of 1.03 mcg/mL (0.75–1.45) and serum lead level 8.2 mcg/dL (< 10) were within normal limits, while serum zinc level was mildly elevated, 1.27 mcg/mL (0.70–1.20). Urinalysis revealed 1+ proteinuria and 2+ hematuria. Spot urine protein/creatinine ratio was 1.2 mg/mg. Calcium oxalate crystals were seen in urine microscopy. Blood and urine cultures were negative.

Echocardiography and cranial CT were normal. Kidney ultrasonography showed increased echogenicity, kidney parenchyma thickness, and kidney size of 12.2 cm on the right and 12.0 cm on the left.

The answers to these questions can be found at https://doi.org/10.1007/s00467-020-04758-2

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The bladder was catheterized; urine output was 0.6 mL/kg/h. During 8 h of follow-up, serum creatinine steadily increased from 1.2 to 6.7 mg/dL with an estimated GFR of 10.2 ml/min/1.73 m^2 according to the Schwartz formula.

Questions

1. What is the most likely cause of acute kidney injury?
2. Which additional tests would you perform to confirm the diagnosis?
3. How should this patient be treated?

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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