Plasma-Ionized Magnesium Concentration in a Child with Magnesium-Losing Tubulopathy

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Dear Sir,

Circulating magnesium [1], like calcium [2], exists in the ionized state and in the undissociated form, either bound to proteins, primarily albumin, or complexed to anions like bicarbonate, citrate, and phosphate. Technology for detecting circulating ionized magnesium, the most interesting form with respect to physiological and biological properties, is now available via the new magnesium-selective electrodes [3]. It has been suggested that the circulating ionized magnesium approximates 55-65% of the total magnesium [1]. However, it is tempting to assume that the total and free concentrations of magnesium often do not go hand in hand [1]. For this reason we recently assessed total and free concentration of magnesium in a patient with hereditary magnesium-losing tubulopathy [4, 5].

On September 21, 1994, a 3-year-old girl was referred to us with a 2-day history of abdominal pain and vomiting. She had had a febrile convulsion at the age of 9 months. The girl appeared moderately dehydrated.

The blood chemistry revealed severe hypo-kalemia (1.9 mmol/l), hypochloremia (79.0 mmol/l), and metabolic alkalosis (venous blood pH 7.454, plasma bicarbonate 33.1 mmol/l). Blood urea (3.70 mmol/l), creatinine (41 µmol/l) and albumin (39 g/l) were within normal ranges. The laboratory findings failed to normalize in spite of parenteral rehydration with normal saline and supplementation with potassium chloride 5 mmol/kg daily. Subsequently, abnormal urinary chloride (molar chloride to creatinine ratio 27.5) and magnesium (molar magnesium to creatinine ratio 1.28) excretion were demonstrated in the girl, despite a pathologically reduced plasma chloride (89 mmol/l) and total magnesium concentrations (0.43 mmol/l). The molar urinary calcium to creatinine ratio was 0.081, thus clearly less than 0.200 [5]. These laboratory findings were therefore considered characteristic for Gitelman syndrome, the hypocalciuric variant of Bartter syndrome [4, 5]. Total plasma magnesium (by the xylide blue I photometric method) Table 1. Plasma total and ionized magnesium concentrations in a girl with Gitelman syndrome and in 74 healthy subjects (38 males and 36 females, aged from 20 to 38 years)

and ionized magnesium (by the neutral carrier ETH 7025 using the AVL 988-4/Mg Analyzer) concentration were assessed [3] in triplicate in the patient and in 74 healthy humans (38 males and 36 females, aged from 20 to 38 years). Circulating total and ionized magnesium were found

to be strongly reduced in the patient (table 1). In the patient, the free magnesium fraction was only 49% of the total magnesium. The concomitant occurrence of a low free magnesium fraction and hyperbicarbonatemia confirms the ability of this anion to complex with magnesium [1].

In conclusion, the present observation demonstrates ionized hypomagnesemia and a reduced free magnesium fraction in the clinical setting of hereditary magnesium-losing tubulopathy [4, 5].

References

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