Received: 4 February 2016 | Accepted: 9 August 2016

DOI: 10.1002/jgf2.44

LETTER TO THE EDITOR

Journal of General and Family Medicine Open Access WILEY

The prevalence and relevant factors of hyponatremia under long-term total enteral nutrition: A cross-sectional study

Enteral nutrients contain the amounts of sodium (Na) above the estimated requirements (600 mg/d in Japan); however, some patients receiving enteral nutrition suffer from hyponatremia (HN) [serum Na level <135 mEq/L]. HN is the most common electrolyte disorder,[1] and is associated with an increased risk of death in both an ambulatory setting and hospitalization even though the severity is mild.[2,3]

My retrospective study included 175 patients who had received a periodic replacement of gastrostomy catheters between April 1, 2012, and April 30, 2015, and who had been receiving total enteral nutrition for more than 5 months. There were no instances of fever, hypoxemia, vomiting, diarrhea, nephrotic syndrome, liver cirrhosis, or hemorrhagic diseases. The prevalence of HN was investigated and divided into three categories: mild [131—134 mEq/L], moderate [126—130 mEq/L], and severe [≤125 mEq/L]. Furthermore, I analyzed 128 patients, for whom no data were missing, to distinguish a difference between non-HN (n=68) and HN (n=60) groups in a number of well-known associated factors: age, the period after gastrostomy, past history of cerebrovascular diseases (cerebral infarction, cerebral hemorrhage, subarachnoidal hemorrhage, or subdural hemorrhage), daily dosage of Na<600 mg/d, causative medications such as loop diuretics, thiazide diuretics, aldosterone antagonists, angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, nonsteroidal anti-inflammatory drugs, or anticonvulsants (valproic acids, carbamazepine, or phenobarbital), serum total protein level, plasma glucose level, serum creatinine level, blood brain natriuretic peptide level, serum potassium level, and malignancies. I also used logistic regression modeling to examine the association between HN and potentially relevant factors,[4] and sequentially introduced six variables including serum uric acid (UA) level, hemoglobin level, gender, serum albumin level, serum C-reactive protein level, and medications for hyperuricemia into the model.

All statistical analyses were conducted using EZR (Easy R) version 1.27, and a *P* value of <.01 was considered to be statistically significant. I used the two-sided Mann-Whitney U test for the difference between two groups, and the Fisher's exact test for the two-by-two frequency table. This study was approved by the Institutional Ethics Committee, and informed consent was obtained from the patients or their families.

Seventy-three patients (42%) had HN, but only five patients (3%) had severe HN (Table 1). There were no differences between two groups in the above-mentioned associated factors. The adjusted odds ratio of the serum UA level was 0.59 per 1 mg/dL increment (99% confidence interval, 0.43—0.81).

TABLE 1 The patients' backgrounds (n=175)

Age (y)	81.4 ± 11.9[a]
Male, n (%)	60 (34)
Period after PEG (mo)	31.7 ± 24.7[a]
Indications for PEG	
CVD, n (%)	93 (53)
Dementia, n (%)	77 (44)
Parkinson's disease or syndrome, n (%)	3 (2)
Cervical esophageal cancer, n (%)	1 (0.5)
Huge esophageal diverticulum, n (%)	1 (0.5)
Serum Na level (mEq/L)	135.9 ± 5.9[a]
Hyponatremia[b], n (%)	73 (42)
Mild, n (%)	42 (24)
Moderate, n (%)	26 (15)
Severe n, (%)	5 (3)
Serum uric acid level (mg/dL)	
Nonhyponatremia group	4.16 ± 1.36[a]
Hyponatremia group[c]	3.53 ± 1.49[a]

PEG: percutaneous endoscopic gastrostomy, CVD: cerebrovascular diseases (cerebral infarction, cerebral hemorrhage, subarachnoidal hemorrhage, or subdural hemorrhage), Na: sodium.

[a]Mean±standard deviation.

[b]Hyponatremia [serum Na level <135 mEq/L] was divided into three categories: mild [131—134 mEq/L], moderate [126—130 mEq/L], and severe [≤125 mEq/L].

[c]Three patients with unknown data were excluded.

My study clearly demonstrates that HN is a common comorbidity under long-term total enteral nutrition and suggests the importance of monitoring serum Na level, although most cases of HN are mild or moderate. Additionally, it was revealed that serum UA level was significantly lower in the HN group.

This study has two limitations. First, because the study design was a cross-sectional, the causation of HN was unclear. Second, urine and endocrinological tests were not examined. Further studies are needed to investigate the relationship of a low serum UA level on the syndrome of inappropriate secretion of antidiuretic hormone.[5]

CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

Yusaku Kajihara MD, FACP
Department of Gastroenterology, Fuyoukai Murakami Hospital, Aomori, Japan

REFERENCES

1. Upadhyay A, Jaber BL, Madias NE. Epidemiology of hyponatremia. Semin Nephrol 2009;29:227–38.
2. Gankam-Kengne F, Ayers C, Khera A, de Lemos J, Maalouf NM. Mild hyponatremia is associated with an increased risk of death in an ambulatory setting. Kidney Int 2013;83:700–6.
3. Waikar SS, Mount DB, Curhan GC. Mortality after hospitalization with mild, moderate, and severe hyponatremia. Am J Med 2009;122:857–65.
4. Tseng CK, Lin CH, Hsu HS, et al. In addition to malnutrition and renal function impairment, anemia is associated with hyponatremia in the elderly. Arch Gerontol Geriatr 2012;55:77–81.
5. Decaux G, Musch W. Clinical laboratory evaluation of the syndrome of inappropriate secretion of antidiuretic hormone. Clin J Am Soc Nephrol 2008;3:1175–84.