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Brief Report

The prevalence of dysnatremia in the elderly patients without CKD

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ABSTRACT

Introduction: Dysnatremia is one of the most commonly encountered electrolyte disorders in the emergency department (ED). Few studies have reported the prevalence of dysnatremia in elderly patients without chronic kidney disease (CKD). We investigated the prevalence of dysnatremia in elderly patients without CKD in an emergency department in Japan.

Methods: We reviewed 10,558 patients presenting to the ED between July 2015 and December 2017. The adult group consisted of 4562 patients aged between 18 and 64 years old, and the elderly group consisted of 5996 patients aged over 65 years. Information collected included age, gender, serum sodium and serum creatinine. Hyponatremia was defined as serum sodium level < 135 mEq/L, and severe hyponatremia was defined as a serum sodium level < 125 mEq/L. Hypernatremia was defined as a serum sodium level > 145 mEq/L, and moderate to severe hypernatremia was defined as a serum sodium level ≧ 150 mEq/L.

Results: In the adult group, the prevalence of hyponatremia was 2.8% in patients without CKD and 10.3% in patients with CKD ($P < 0.001$). On the other hand, in the elderly group, the prevalence of hyponatremia was 14.8% in patients without CKD and 12.9% in patients with CKD ($P = 0.034$). In the adult group, the prevalence of hypernatremia was 0.7% in patients without CKD and 2.0% in patients with CKD ($P = 0.003$). Similarly, in the elderly group, the prevalence of hypernatremia was 1.5% in patients without CKD and 3.5% in patients with CKD ($P < 0.001$).

Conclusion: In elderly patients, the prevalence of hyponatremia was higher in patients without CKD than in patients with CKD. Special attention should be paid to elderly patients without CKD in order to prevent severe hyponatremia.

1. Introduction

Dysnatremia is a commonly encountered electrolyte disorder in the emergency department [1,2]. Age is a strong independent risk factor for dysnatremia, and dysnatremia is known for its high morbidity and mortality [2-7]. Few studies have reported the prevalence of dysnatremia in elderly patients without CKD [8]. Considering the aging population in Japan, the increased susceptibility of the elderly to develop dysnatremia is particularly important. We investigated the prevalence of dysnatremia in elderly patients without CKD in the emergency department in Japan.

2. Materials and methods

All adult patients (18 years old or older) who had their serum sodium levels measured in the emergency department between January 2016 and December 2017 were included. Hyponatremia was defined as a serum sodium level < 135 mEq/L, and severe hyponatremia was defined as a serum sodium level < 125 mEq/L. Hypernatremia was defined as a serum sodium level > 145 mEq/L, and moderate to severe hypernatremia was defined as a serum sodium level ≧ 150 mEq/L. Information collected included age, gender, serum sodium and serum creatinine. The eGFR of each participant was calculated using the following formula: $eGFR\ (mL/min/1.73\ m^2) = 194 \times \text{serum creatinine}^{-1.094} \times Age^{-0.287} \times 0.739$ (if female) [9]. Chronic kidney disease was defined as GFR < 60 mL/min/1.73 m^2. The study was approved by the Institutional Review Boards at our institution.

3. Statistical analyses

Data analysis was performed using SPSS, version 21.0 (IBM Corp, Armonk, NY). Comparisons between the groups were performed using Student's unpaired *t*-test or the Mann-Whitney *U* test for continuous data and chi-squared test for categorical data. A P-value of <0.05 was considered statistically significant.

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Table 1
Patient characteristics.

	All	Adult	Elderly	P
N	10,558	4562	5996	
Male (%)	49.5%	51.0%	48.3%	0.006
Age (years)	63.6 ± 22.4	41.3 ± 13.7	80.6 ± 8.4	<0.001
Serum creatinine (mg/dL)	1.0 ± 1.0	0.9 ± 0.9	1.1 ± 1.1	<0.001
eGFR (mL/min/1.73 m^2)	67.7 ± 27.0	81.8 ± 24.1	57.0 ± 24.1	<0.001

4. Results

4.1. Patient characteristics

From July 2015 to December 2017 a total of 10,558 adult patients had their serum sodium measured in the emergency department. The key characteristics of the patients are summarized (Table 1). The mean age was 63.6 ± 22.4 years, and 49.5% of the patients were male. Patients were divided into the adult group aged from 18 to 64 years and the elderly group aged 65 years and over. The adult group included 4562 patients with a mean age of 41.3 ± 13.7 years, and 51.0% of the patients were male. In the adult group, there were 3958 patients without CKD and 604 patients with CKD. The elderly group included 4855 patients with a mean age of 80.6 ± 8.4 years, and 48.3% of the patients were male. In the elderly group, there were 2621 patients without CKD and 3375 patients with CKD (Table 2).

4.2. Prevalence of hyponatremia in the adult group with and without CKD

The prevalence of hyponatremia was 2.8% in the adult patients without CKD and 10.3% in the adult patients with CKD (P < 0.001). Similarly, the prevalence of severe hyponatremia was 0.2% in adult patients without CKD and 1.3% in adult patients with CKD (P = 0.001) (Table 3).

4.3. Prevalence of hyponatremia in the elderly group with and without CKD

The prevalence of hyponatremia was 14.8% in elderly patients without CKD and 12.9% in elderly patients with CKD (P = 0.034). Similarly, the prevalence of severe hyponatremia was 2.5% in patients without CKD and 1.2% in patients with CKD (P < 0.001) (Table 3).

4.4. Prevalence of hypernatremia in the adult group with and without CKD

The prevalence of hypernatremia was 0.7% in adult patients without CKD and 2.0% in adult patients with CKD (P = 0.003). Similarly, the prevalence of moderate to severe hyponatremia was 0.1% in adult patients without CKD and 0.3% in adult patients with CKD (P = 0.183) (Table 4).

4.5. Prevalence of hypernatremia in the elderly group with and without CKD

The prevalence of hypernatremia was 1.5% in elderly patients without CKD and 3.5% in elderly patients with CKD (P < 0.001). Similarly, the prevalence of moderate to severe hypernatremia was 0.5% in patients without CKD and 1.4% in patients with CKD (P < 0.001) (Table 4).

Table 3
Prevalence of hyponatremia in the adult group and the elderly group.

	Adult group			Elderly group		
CKD		−	+		−	+
N	4562	3958	604	5996	2621	3375
Hyponatremia (N)	173	111	62	823	388	435
Prevalence of hyponatremia (%)	3.8%	2.8%	10.3%*	13.7%	14.8%	12.9%***
Severe hyponatremia (N)	17	9	8	106	65	41
Prevalence of severe hyponatremia (%)	0.4%	0.2%	1.3%**	1.8%	2.5%	1.2%****

* P < 0.001 compared with prevalence of hyponatremia in adult patients without CKD.
** P < 0.001 compared with prevalence of severe hyponatremia in adult patients without CKD.
*** P = 0.034 compared with prevalence of hyponatremia in elderly patients without CKD.
**** P < 0.001 compared with prevalence of severe hyponatremia in elderly patients without CKD.

5. Discussion

In elderly patients, the prevalence of hyponatremia including severe hyponatremia was significantly higher in patients without CKD than in patients with CKD. This was in contrast to the adult group, in whom the prevalence of hyponatremia including severe hyponatremia was significantly higher in patients with CKD than in patients without CKD.

Few reports have reported the prevalence of hyponatremia in patients with various stages of CKD, and the prevalence of hyponatremia was reported to be higher in patients with CKD stages 1 and 2 than in those with CKD stages 3 or above [8]. In that study, the mean age was 73.9 ± 9.8 years, suggesting that most of the patients were elderly. In our study, the prevalence of hyponatremia including severe hyponatremia in elderly patients was also significantly higher in patients without CKD than in patients with CKD. In addition to confirming the results of previous reports in Japanese elderly patients, we also showed that the prevalence of hyponatremia including severe hyponatremia was not higher in patients without CKD than in patients with CKD in adult patients.

With advanced CKD, renal diluting ability is affected [10]. Therefore, one might expect that, as seen in the adult patients, the prevalence of hyponatremia and severe hyponatremia would be higher in elderly patients with CKD than in elderly patients without CKD; however, this is not the case in elderly patients. Not a lower but a higher eGFR was associated with hyponatremia in elderly patients [8,11]. In elderly patients, hyponatremia might be more affected by concomitant comorbidities, water ingestion and salt intake than by CKD itself [12].

On the other hand, the prevalence of hypernatremia including moderate to severe hypernatremia was significantly higher in both adult and elderly patients with CKD than in patients without CKD. A previous report also showed that the prevalence of hypernatremia increased significantly with advanced stages of CKD [8]. This supports the observation that renal concentrating ability is affected to a greater extent by advancing CKD than is its diluting ability [13].

Table 2
Patient characteristics of the adult group and the elderly group with and without CKD.

	Adult group			Elderly group		
CKD	−	+	P	−	+	P
N	3958	604		2621	3375	
Male (%)	48.2%	69.2%	<0.001	48.3%	48.3%	NS
Age (years)	39.5 ± 13.3	53.2 ± 9.2	<0.001	78.7 ± 8.3	82.1 ± 8.1	<0.001
Serum creatinine (mg/dL)	0.7 ± 0.2	1.9 ± 2.2	<0.001	0.7 ± 0.1	1.5 ± 1.3	<0.001
eGFR (mL/min/1.73 m^2)	87.5 ± 19.4	44.2 ± 16.6	<0.001	77.5 ± 17.8	41.1 ± 14.4	<0.001

Table 4
Prevalence of hypernatremia in the adult group and the elderly group.

	Adult group			Elderly group		
CKD		−	+		−	+
N	4562	3958	604	5996	2621	3375
Hypernatremia (N)	38	26	12	158	40	118
Prevalence of hypernatremia (%)	0.8%	0.7%	2.0%*	2.6%	1.5%	3.5%***
Moderate to severe hyponatremia (N)	6	4	2	58	12	46
Prevalence of moderate to severe hypernatremia (%)	0.1%	0.1%	0.3%**	1.0%	0.5%	1.4%****

* $P = 0.003$ compared with prevalence of hypernatremia in adult patients without CKD.
** $P = 0.183$ compared with prevalence of moderate to severe hypernatremia in adult patients without CKD.
*** $P < 0.001$ compared with prevalence of hypernatremia in elderly patients without CKD.
**** $P < 0.001$ compared with prevalence of moderate to severe hypernatremia in elderly patients without CKD.

The prevalence of dysnatremia observed in emergency departments varies between studies. In our study, the prevalence of hyponatremia was 3.8% in the adult group and 13.7% in the elderly group. This was close to the value of a previous report [8]. The prevalence of hypernatremia was reported to be about an order of magnitude lower overall than the prevalence of hyponatremia [8]. In our study, the prevalence of hypernatremia was 0.8% in the adult group and 2.6% in the elderly group. This was also close to the value in a previous report [14].

This study is not without limitations. First, this was a single center study, and there is a possibility of selection bias in the patients enrolled. Second, serum sodium was not corrected for plasma glucose levels, when elevated. Thus, patients with pseudohyponatremia could not be completely ruled out. Third, several potential confounders were not considered, including the reason for the visit, medications that could induce dysnatremia, history of dysnatremia and past medical history.

In conclusion, we observed that elderly patients without CKD had a significantly higher prevalence of hyponatremia and severe hyponatremia than did elderly patients with CKD. Strategies to prevent hyponatremia and severe hyponatremia should be taken, especially in elderly patients without CKD.

Conflict of interests

None.

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