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The association between serum sodium levels at time of admission and mortality and morbidity in acutely admitted elderly patients: a prospective cohort study

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To the Editor: Throughout life, serum sodium level is maintained within narrow limits despite continuous variations in water and salt intake. Renal sodium transporters and osmoreceptors in the hypothalamus that control secretion of antidiuretic hormone (ADH) and regulate thirst are the main governors of sodium and water homeostasis. Disturbances in water and sodium homeostasis are frequently observed in elderly patients and, when severe, may lead to loss of consciousness, coma, or even death.[1] Deviations in serum sodium have been associated with mortality and functional decline, but the association with functional decline has, to the knowledge of the authors, never been prospectively examined. The present study assessed the association between deviations in serum sodium levels at time of admission and 3-month mortality and functional decline in acutely admitted elderly patients.

METHODS

Nine hundred forty-five eligible patients aged 65 and older who were acutely admitted to the Department of Internal Medicine of the Academic Medical Centre, Amsterdam, the Netherlands between November 2002 and July 2007 were enrolled. The primary endpoints of the study were mortality in the hospital and by 3 months after admission. Secondary endpoint was decline in functional status, defined as a loss in one or more activity of daily living (ADL) functions of the Katz ADL index.2 Telephone interviews with patients or their relatives were conducted 3 months after hospital admission. Laboratory analyses were performed within 24 hours of admission. Based on the reference values used in our hospital, 307 patients (34.3%) had hyponatremia (sodium o135 mmol/L) and 22 (2.5%) had hypernatremia (sodium 4145 mmol/L). Because of the leftward shift, the distribution of serum sodium in the population of interest was used to stratify participants according to _ 1 standard deviation around the mean serum sodium level. Comorbidity was defined as possible confounders selected using univariate analysis for mortality, such as history of

malignancy, renal failure, heart failure, or liver failure. Logistic regression analysis was performed to determine the risk for 3-month mortality and functional decline.

[FIGURE 1]

RESULTS

Eight hundred ninety-five eligible patients with a mean age of 78 ± 8.7 were enrolled in the study; 53.4% were female. Fifty patients (5.3%) were excluded because of unknown serum sodium levels (n=31) or drug-induced hypo- or hypernatremia (n=19). The mean serum sodium level of the cohort was 136 ± 5.6 mmol/L. Three-month mortality was higher in the low-sodium group (107–130 mmol/L) than the reference group (130– 142 mmol/L) (odds ratio (OR)=1.5, 95% confidence interval (CI) =1.0–2.2, P=.05; Figure 1). After adjustment for comorbidity, 3-month mortality in the low-sodium group was comparable with that of the reference group (OR=1.2, 95% CI=0.8–1.9, P =0.6). Katz ADL index before admission was higher in the low- (6.7 ± 4.5) and high- (7.4 ± 5.3) sodium groups than the reference group (4.7 ± 4.2, Po.01). In all groups, the Katz ADL index increased equally after 3 months in all sodium groups but remained different for the low- and high-sodium groups and the reference group.

DISCUSSION

This study showed that hyponatremia is frequently observed in acutely admitted elderly patients. A higher prevalence of hypo- and hypernatremia was found than in other reports that examined disturbances in serum sodium levels in acutely hospitalized patients.3,4 Age-related physiological changes may increase susceptibility to disturbances in water and salt balance.5,6 The fact that the average age of participating patients was higher than in previous studies may therefore explain the high prevalence of hyponatremia in the current study.7,8 Low serum sodium levels at presentation were associated with a 50% greater risk of mortality, although the association between serum sodium levels and mortality disappeared after adjusting for comorbidity, suggesting that the effect of deviations in serum sodium levels on mortality is associated more with a person's underlying disease state than deviations in serum sodium level per se. Similar results were found after we performed post-hoc analysis in three groups according to reference value used in our hospital (normal sodium 135–145 mmol/L). Finally, an increase in the Katz ADL index before admission was observed in the low- and high-sodium groups, suggesting lower functional status in patients who presented with a deviation in serum sodium. At 3 months, the change in the Katz ADL index was still different across sodium groups, but the change in functional status was equal in all groups, suggesting that poorer functional status is associated with greater risk of hypo- and hypernatremia, but there was no evidence of functional decline in association with deviations in serum sodium. In conclusion, hyponatremia is common in acutely admitted elderly patients and is associated with greater risk of mortality and longer length of hospital stay, although it was not possible to demonstrate that disturbed serum sodium levels had an independent effect on mortality risk or functional status.

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Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this paper. Author Contributions: WJF: conception and design, acquisition of subjects and data, analysis and interpretation of data, preparation of the manuscript. BJvdB: conception and design, interpretation of data, preparation of the manuscript, critical revision of the manuscript for important intellectual content. SEdR: conception and design, interpretation of data, critical revision of the manuscript for

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RELIABILITY AND VALIDITY OF THE VISUAL ANALOGUE SCALE FOR FEAR OF FALLING IN OLDER PERSONS

To the Editor: Fear of falling (FOF) is a serious problem in older adults living in the community.[1–4] The main risk factor for developing FOF is experiencing at least one fall.[1,4] FOF is associated with recurrent falling, less physical activity, less confidence in performing activities of daily living, restriction of activities, and overall lower quality of life (QoL).[1–4] Different definitions for FOF have resulted in the development of many different instruments to measure FOF.[5] A new and brief method to measure FOF is a visual analogue scale (VAS). A VAS is useful for measuring a variety of subjective phenomena and provides a convenient, easy, and rapidly administered measurement strategy.[6] The VAS for FOF (VAS-FOF) uses a numeric scale (1–10) to measure perceived FOF after a fall, with 1 representing no FOF and 10 representing extreme FOF. Twenty-three fall prevention clinics in the Netherlands currently use the VAS-FOF in clinical practice. This study aimed to assess the reliability and validity of the VAS-FOF as a method of assessing FOF in older persons who have experienced a fall.

FIGURES

Figure 1

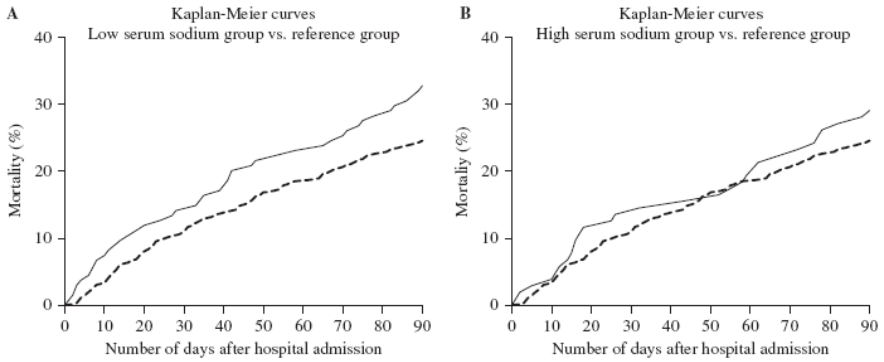

Figure 1. Mortality 90 days after admission in acutely admitted elderly patients: Kaplan-Meier curves. (A) Straight line, low–serum sodium group (107–130 mmol/L); dotted line, reference group (130–142 mmol/L) (32.8% vs 24.6%; $P = .05$) (B) Straight line, high–serum sodium group (142–162 mmol/L); dotted line, reference group (130–142 mmol/L) (26.2% vs.24.6%; $P = .30$).