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Severe hyponatremia in older patients at admission in an internal medicine department

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ABSTRACT

Hyponatremia is common in older people, most often of multifactorial origin, and can be associated with poor clinical outcomes. The aim was to analyze the frequency of severe hyponatremia (sodium concentration below 125 mmol/L), risk factors and mortality association in hospitalized older patients. A retrospective study was performed in older patients (over 65 years) with hyponatremia, diagnosed at admission in an Internal Medicine Department during one year. A control group of 127 older patients without hyponatremia was considered. Statistical analysis of the data gathered was made with SPSS Statistics 20. The main results were: a group of 1060 patients with age superior to 65 years was identified (representing 72.26% of total admissions); incidence of hyponatremia in those patients was 27.55% and severe hyponatremia was 5.94%; diagnosis of hyponatremia was mentioned in the discharge note in 66.67% of cases; mortality was 27.0%, against 16.0% in the control group ($p = 0.057$, Odds Ratio (OR) = 1.940); drugs were a significant risk factor ($p < 0.001$), specially thiazide diuretics ($p = 0.029$, OR = 2.774), angiotensin receptor blockers (ARB) ($p = 0.001$, OR = 4.097), proton-pump inhibitors (PPI) ($p = 0.007$, OR = 2.561) and spironolactone ($p = 0.011$, OR = 4.473); other relevant risk factors were: increased water intake ($p = 0.004$), tube feeding ($p < 0.001$), vomiting ($p = 0.032$, OR = 2.492), cirrhosis ($p = 0.008$, OR = 10.862) and hyperhidrosis ($p = 0.017$, OR = 2.542). We conclude that, although this group of patients had a high mortality, hyponatremia is often not investigated and not always mentioned as a diagnosis. Clinicians should have a clear appreciation of the roles that iatrogenic interventions and lapses in nutrition frequently play in upsetting the homeostatic balance in older patients.

1. Introduction

Hyponatremia is defined as a serum sodium concentration below 135 mmol/L and may be associated with low, normal (275–290 mosmol/kg) or high osmolality (Adrogué & Madias, 2000; Singer, Brenner, & Robertson, 2012).

Clinical severity is dependent both on the magnitude of the hyponatremia and the rate at which the serum sodium level has declined. When the decrease in serum sodium is marked (≤125 mmol/l) or acute (occurring over <48 h), serious neurological complications can ensue as a result of cerebral edema. Headache, nausea, vomiting, muscle cramps, lethargy, restlessness, disorientation, and depressed reflexes can be observed. Complications of severe and rapidly evolving hyponatremia include seizures, coma, permanent brain damage, respiratory arrest, brain-stem herniation, and death (Adrogué & Madias, 2000; Kugler & Hustead, 2000; Singer et al., 2012; Sterns, 2012a; UpTodate, 2012).

Diagnosis is based on a detailed clinical history and physical examination, serum and urinary sodium and plasma osmolality (Sterns, 2012b).

Hyponatremia with normal serum osmolality is a laboratory phenomenon, usually caused by extreme hyperlipidemia or hyperproteinemia (Kugler & Hustead, 2000; Singer et al., 2012; Sterns, 2012a). Hyperosmolar hyponatremia is caused by the accumulation of osmotically active non-electrolyte solutes, with hyperglycemia being the most common cause (Adrogué & Madias, 2000; Kugler & Hustead, 2000; Sterns, 2012a). The two most common causes of hyponatremia with a low serum osmolality are effective arterial blood volume depletion and the Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH), but it is most often multifactorial (Adrogué & Madias, 2000). Other causes of hyponatremia described in the literature are central nervous

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system disorders (stroke, hemorrhage or tumor), malignancy with ectopic ADH production (bladder, prostate or rectal carcinoma), pneumonia, hypothyroidism, drugs (thiazide diuretics, furosemide, spironolactone, indapamide, chlortalidone, metolazone, PPI, tricyclic antidepressants, selective serotonin reuptake inhibitor (SSRI) antidepressants, antipsychotics, carbamazepine anticonvulsant, angiotensin-converting enzyme inhibitors (ACEI), ARB, amiodarone, nonsteroidal anti-inflammatory agents, ciprofloxacin), increased water intake, tube feeding, advanced renal failure, vomiting, diarrhea, age superior to 80 years, heart failure, cirrhosis, hipersudoresis (Adrogué & Madias, 2000; Burton, 2012; Kugler & Hustead, 2000; Miller, 2009; Ogundipe, 2009; Sterns, 2012c; Taylor et al., 2012; Yawar, Jabbar, & Haque, 2008) etc.

Hyponatremia is a common clinical problem in older people (Adrogué & Madias, 2000; Kugler & Hustead, 2000). The aging process is usually accompanied by various maladaptations to stress in different organs and physiologic functions. The mechanisms associated with water metabolism are vulnerable to age-related maladaptations and to the various disease processes and medical interventions that frequently occur in older people (Kugler & Hustead, 2000). The physiologic changes in water regulatory systems that occur as part of normal aging, including the decreased sensation of thirst, decreased total body water, decreased renal sodium-conserving ability (altered renal tubular function, increased atrial natriuretic hormone secretion, decreased renin–angiotensin–aldosterone secretion), decreased renal water excretion ability (decreased renal blood flow and glomerular filtration rate, decreased distal renal tubular diluting capacity, increased renal passive reabsorption of water and increased ADH secretion), and the reduced distal solute delivery due to poor nutrition limiting free water excretion, make older person more susceptible to the development of hyponatremia (Kugler & Hustead, 2000; Miller, 2009).

Therefore, it is absolutely essential for clinicians to be aware of the pathophysiology of hyponatremia in this group of patients (Kugler & Hustead, 2000). The authors made a retrospective study of the hyponatremia cases in older patients, diagnosed at admission in an Internal Medicine Department in a one year period. The objectives of this study were to determine the frequency of severe hyponatremia in these patients and to identify the associated risk factors and mortality.

2. Materials and methods

A retrospective analysis of all clinical files from patients admitted in two Internal Medicine wards in the University Hospitals of Coimbra from the 1st December 2007 to the 30th November 2008 was conducted. From that data, a selection of older people (age equal or superior to 65 years old), and older people with hyponatremia (sodium plasma concentration lower than 135 mmol/L) in the first analytic control at the admission was made. From this group, those with severe hyponatremia (sodium plasma concentration lower or equal to 125 mmol/L) were identified. Data was presented by age bands 65–74, 75–84 and superior to 85 years old. The group of older patients with severe hypoosmolar hyponatremia (normal plasma osmolality was defined between 275 and 290 mosmol/kg) was analyzed and compared with a control group of 127 patients with the same age and sex distribution, but without hyponatremia in the first analysis at admission to hospital (Table 1). The following parameters were assessed: incidence of hyponatremia, sodium plasma concentration, plasma osmolality, risk factors for hyponatremia (mentioned above), symptoms, etiologic evaluation performed, reference to hyponatremia in the discharge letter and mortality. The risk factors were all mentioned in the discharge note. The analysis of the data gathered was made with SPSS Statistics 20 and Mann–Whitney *U*-test and χ^2 test were applied to determine *p*-value (significant if <0.05).

Table 1
Characteristics of the study group and control group.

Characteristics	Study group	Control	
Number of patients	63	127	
65–74 years old	12 (19.0%)	24 (18.9%)	
75–84 years old	27 (42.9%)	56 (44.1%)	
≥85 years old	24 (38.1%)	47 (37.0%)	
Age (mean ± SD)	81.57 ± 7.04	81.56 ± 7.15	$p = 0.980$
Female (number of cases, %)	38 (60.32%)	75 (59.05%)	$p = 0.497$
Female age (mean ± SD)	82.58 ± 7.10	82.39 ± 6.96	$p = 0.876$
Male (number of cases, %)	25 (39.68%)	52 (40.94%)	$p = 0.497$
Male age (mean ± SD)	80.04 ± 6.94	80.37 ± 7.43	$p = 0.855$

SD = standard deviation.

3. Results

Among the 1467 patients (798 men and 669 women) admitted between December 1st 2007 and November 30th 2008, a group of 1060 older patients was identified (72.26%), composed by 546 men (51.5%) and 514 women (48.5%); age ranged between 65 and 98 years old, with a mean age of 78 in men and 82 in women. Considering basal laboratory results on admission, hyponatremia was diagnosed in 292 older patients (27.55%), 152 men (27.84%) and 140 women (27.24%). Mean age of men and women was 78 and 88 years, respectively, being equal in patients with or without hyponatremia.

As far as plasma osmolality is concerned, 62% (55% on male, 64% on female), had osmolality lower than 275 mosmol/kg, 29% (33% on male, 29% on female) had a normal value and 9% (12% on male, 7% on female) had osmolality higher than 290 mosmol/kg.

Sodium values ranged between 103 mmol/L and 134 mmol/L (Fig. 1), with severe hypoosmolar hyponatremia in 63 cases, which means a global incidence of 5.94%, 7.39% in females ($n = 38$), and

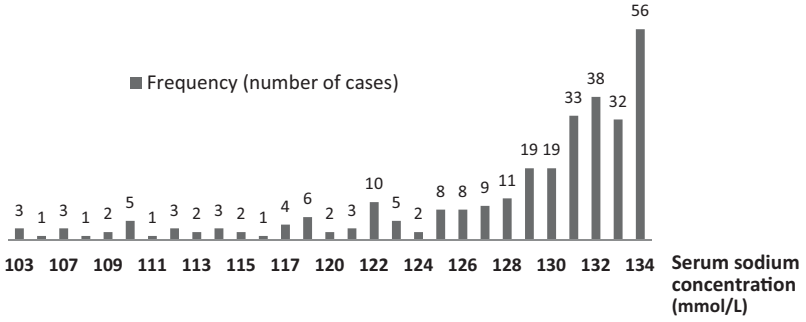

Fig. 1. Distributions oh hyponatremia cases by serum sodium concentration.