Serum Sodium Levels on Admission and Elderly Outcomes in Geriatric Intensive Care Unit

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ABSTRACT *Aim: to determine the relationship between sodium level on admission and hospital outcome (length of stay and hospital mortality). Methods: A cross sectional study conducted on 100 patients aged 60 years and older (47 male and 53 females) recruited from geriatrics and gerontology intensive care unit, Ain-Shams University Hospital. Participants were subjected to through medical assessment and serum sodium level measurement. Results: hyponatriemia was prevalent in 45% of our population while hypernatremia was prevalent in only 1%. The most common comorbid condition associating hyponatremia was chronic liver disease. Hponatremia was significantly related to higher mortality (p = 0.02).*

Conclusion: hyponatremia is a higher is more prevalent among chronic liver disease patients and is related to worse hospital stay outcome.

Introduction:

Disorders of serum sodium concentration are the most common electrolyte abnormalities seen in the geriatric population [1]. Severe hypo- and hypernatraemia are associated with significantly high mortality and morbidity. Moreover, inappropriate treatment may result in treatment related complications such as osmotic demyelination syndrome [2]. Furthermore, the development of serum sodium abnormalities is associated with increased morbidity and mortality in affected patients [3]. Hyponatraemia is the most commonly observed electrolyte imbalance in hospitalized patients, occurring in up to 6% [4]. Hyponatremia at admission has been associated with higher in-hospital mortality and longer length of stay. Moreover, hyponatremia has been linked to higher mortality risk in numerous medical conditions, including heart failure, liver cirrhosis, cancer, congenital heart disease, community-acquired pneumonia, pulmonary arterial hypertension and pulmonary embolism, as well as in liver transplant candidates [5,6]. Hypernatremia (defined as a serum sodium level >145 mEq/L) is a rare entity. When hypernatremia does occur, it is associated with a high mortality rate (>50% in most studies) [7]. In hospitalized patients, persistent hypernatremia and protracted hypotension have been associated with a very poor prognosis [8]. Hence the aim of this study was to determine the relationship between sodium level and hospital outcome (length of stay and hospital mortality).

Materials and Methods

A cross sectional study was conducted on 100 patients aged 60 years and older (47 male and 53 females) recruited from geriatrics and gerontology acute care unit, Ain-Shams University Hospital. Inclusion criteria were; agreement to participate in the study, being ≥ 60 years, and a length of stay ≥ 2 days. Exclusion criteria were; age less than 60 years, any patient admitted with altered mental state that hinders mental and psychological assessment, and a length of stay < 2 days.

Each subject briefly interviewed and subjected to:
- Informed written consent.
- Comprehensive geriatric assessment.
- A venous blood sample (5cc) was obtained on the day of admission centrifuged & the serum was taken and stored in the freezer at temp -70C.
- The collected samples were analyzed for serum Na (Ion selective electrode method), Kidney function tests, liver function tests, and serum electrolytes. Hyponatremia was defined as serum Na < 135 meq/L and hypernatremia as a serum Na of > 145 meq/L.
- **The outcome** was measured as regard the length of stay in the acute care and mortality of each subject.

Statistical methods:

The data was collected coded and entered to a personal computer ,The data was analyzed with the program statistical package for social science(SPSS) under windows version 7.

Qualitative data is presented in form of frequency tables(numbers and percent) while quantitative data is presented in form of mean(plus or minus standard deviation) and range.

Chi-square test was used for comparison of categorical data.

Results:

Demographic characteristics are shown in table (1). Hyponatremia was prevalent in 45% of the studied population while hypernatremia was prevalent in only 1% of the studied population.

Hyponatremia was significantly related to chronic liver disease ($p < 0.001$) (table 2). Regarding outcome, the only hypernatremic patient got a hospital stay more than one week and a mortality outcome while hponatremia was significantly related to mortality ($p = 0.022$) (table 3).

Discussion:

The current study aimed to assess sodium level and its relation to the outcome in critically ill elderly patients, it was

conducted on 100 subject admitted to the acute care of geriatrics and gerontology department in ain-shams university hospitals aged 60 years or more males and females.

The most common comorbidities were hypertension, diabetes ,ISHD, and heart failure with respiratory failure was the most common cause of admission to the acute care unit followed by cerebrovascular stroke and shock. Hyponatremia was prevalent in elderly patients on admission (45%) while hypernatremia was found in only 1%. In comparison to other studies concerning the same issue, hyponatremia on admission was highly prevalent among patients admitted to the ICU with different percentages according to different study population and definition of hyponatremia [9, 10, 11]. Regarding hypernatremia in almost agreement to our study   Gregor and colleagues [12] conducted a retrospective analysis to assess the prevalence of hypernatremia. They found that hypernatremia prevalence was (2%) on admission. Our study population showed that being hyponatremic carries a higher risk of mortality (57.7%) while the outcome of the only hypernatremic patient was mortality. Georg-Christian et al, (2010) conducted a retrospective study in 77 medical,surgical and mixed ICU in Austria and concluded that both hypo- and hypernatremia present on admission to the ICU are independent risk factors for mortality. Hyponatremia was most prevalent among chronic liver disease patients of our population, as chronic liver disease is highly prevalent among Egyptian electrolyte status specially sodium needs close monitoring and intervention for correction for better hospilat outcome.

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Table 1: Demographic characteristics:

Age	68.4±6.3
Males	47%
Females	53%
Smoking	25%
Na on admission	1.35.57 ± 5.6
Na interpretation on admission	
Hyponatremia	45%
Normonatremia	54%
Hypernatremia	1%
Comorbidities	
Cerebrovascular stroke	25%
Heart failure	25%
Chronic kidney disease	18%
Chronic liver disease	16%
Chronic obstructive pulmonary disease	14%
Atrial fibrillation	13%
Cognitive impairment	6%
Bronchial asthma	5%
Interstitial pulmonary fibrosis	5%
Intracranial hemorrhage	5%
Neoplasm	4%
Cause of acute care admission	
Respiratory failure	25%
Cerebrovascular stroke	22%
Shock	16%
Cardiac arrhythmia	7%

Hepatic encephalopathy	7%
Intracranial hemorrhage	7%
Hyponatremia	6%
Acute coronary syndrome	4%
Hyperglycemic coma	3%
Uremic encephalopathy	1%
Post cardiac arrest	1
Post ictal state	1

Table 1

gender	males	47%		
	females	53%		
Admission Na level	Na: < 135	54%		
	Na: 135-145	54%		
	Na >145	1%		
Common comorbidities	Ischemic stroke	25%		
	Congestive heart failure	25%		
	Chronic renal failure	18%		
	Liver cell failure	16%		
	Chronic obstructive lung disease	14%		
	Diabetes Mellitus	49%		
	hypertension	60%		
	Atrial fibrillation	6%		
	Preadmission cognitive impairment	6%		
	Bronchial asthma	5%		

Table 2: The association between different comorbidities and Na on admission

		Hypona-tremic	Normona-tremic	Hyperna-tremic	Total	P-value
Diabetes mellitus	Yes	22(48.9%)	26(48.2%)	1(100%)	49(49%)	0.486
	No	23(51.1%)	28(51.8%)	0(0%)	51(51%)	
Hyperten-sion	Yes	23(51.1%)	36(66.7%)	1(100%)	60(60%)	0.174
	No	22(48.9%)	18(33.3)	0(0%)	40(40%)	

Heart failure	Yes	14(31.1%)	11(20.4%)	0(0%)	25(25%)	0.354
	No	31(68.9%)	43(79.6%)	1(100%)	75(75%)	
Cerebro-vascular stroke	Yes	9(20%)	16(29.6%)	0(0%)	25(25%)	0.407
	No	36(80%)	38(70.4%)	1(100%)	75(75%)	
Atrial fibril-lation	Yes	6(13.3%)	7(13.0%)	0(0%)	13(13%)	0.868
	No	39(86.7%)	47(87.0%)	1(100%)	87(87%)	
Cognitive impair-ment	Yes	0(0%)	6(11.1%)	0(0%)	6(6%)	0.021*
	No	45(100%)	48(88.9%)	1(100%)	94(94%)	
Chronic obstructive pulmonary disease	Yes	6(13.3%)	8(24.8%)	0(0%)	14(14%)	0.84
	No	39(86.7%)	46(85.2%)	1(100%)	86(86%)	
Interstitial pulmonary fibrosis	Yes	0(0%)	5(9.3%)	0(0%)	5(5%)	0.061
	No	45(100%)	49(90.7%)	1(100%)	95(95%)	
Bronchial asthma	Yes	3(6.7%)	2(3.7%)	0(0%)	5(5%)	0.759
	No	42(93.3%)	52(96.3%)	1(100%)	95(95%)	
Chronic liver disease	Yes	15(33.3%)	1(1.9%)	0(0%)	16(16%)	0.000*
	No	30(66.7%)	53(98.2%)	1(100%)	84(84%)	
Chronic kidney disease	Yes	9(20%)	9(16%)	0(0%)	18(18%)	0.748
	No	36(80%)	45(83.3%)	1(100%)	82(82%)	

Table 3: The association between Na on admission and outcome (length of stay and discharge or death)

	Serum Na status on admission			p-value
	Hypona-tremic	Normona-tremic	Hyperna-tremic	
Length of stay				
less than one week	37(52.9%)	33(47.1%)	0(0%)	0.019
More than one week	8(26.7%)	21(70%)	1(3.3%)	
Dis-charge	18 (34%)	35 (66%)	0 (0%)	0.022
Mortality	27 (57.5%)	19 (40.4%)	1 (2.1%)	

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