Acute stroke and serum sodium level among a sample of Egyptian patients

Hussien Metwally[1], Wael Hablas[2], Emad Fawzy[1], Mahrous Seddeek and Mostafa Meshref[1]

[1]Department of Neurology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
[2]Department Clinical Pathology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
mostafameshref1988@gmail.com

Abstract: Background: Sodium level disorders are common electrolyte disorders encountered in patients of neurological disorders and acute stroke patients. Sodium imbalance (especially hyponatremia) and stroke are associated with poor outcome. However, outcome of hyponatremia in acute stroke is not well established and very few studies have been conducted in this regard and according to which the mortality ranges from 14%-44%. **Objective:** Detecting serum sodium level in acute stroke patients and its effect in the morbidity and mortality. **Patients and methods:** A prospective study was done over a period of five months that included established cases of stroke diagnosed on the basis of clinical history, examination and neuroimaging within the first twenty four hours of their symptoms, during the study period from January2016 to May 2016. Eighty-five acute stroke patients were evaluated for serum sodium levels. Also, patients were closely observed for evaluation of stroke severity and stroke outcome. **Results**: Out of eighty-five patients, twenty-six patients had hyponatremia and seven patients had hypernatremia. Sixteen patients died, who included nine patients with hyponatremia and seven patients with normonatremia. **Conclusion:** Close monitoring of serum sodium level must be done in all patients who are admitted with stroke, and efforts must be made to determine the cause of sodium level disturbance, in order to properly manage such patients thereby decreasing the mortality rate.

1. Introduction

Stroke is a major public health problem. It is globally well distributed and is ranked at the second top cause of death around the world. Stroke causes a great impact on disability rate. Stroke also has enormous contribution to economic and social burden for patients and their families. **(WHO 2005 and Donnan et al., 2008)**.

Common complications after acute stroke include neurological complications like recurrent stroke, seizures and medical complications like chest infection, UTI, bowel or bladder dysfunction, deep vein thrombosis, pulmonary embolism, upper gastrointestinal bleeding, aspiration, bedsores, falls, malnutrition **(Navarro et al., 2008)**.

In almost all neurological disorders, electrolyte disturbances were prominent. Electrolyte disturbance are commonly found in acute stroke setting. Hypernatremia, hyponatremia and hypokalemia were the commonest types of disturbance. Research with electrolyte disturbances is not only focusing on the neuro-endocrine mechanism, but also on its prevalence, risk factors and association with other medical condition **(Aiyagari et al., 2006).**

Hyponatremia is the commonest electrolyte disorder encountered in patients of neurological disorders such as stroke, subarachnoid hemorrhage, and meningitis, which is usually either due to syndrome of inappropriate secretion of antidiuretic hormone (SIADH) or cerebral salt wasting syndrome (CSWS) **(Alam et al., 2012).**

The aim of this study was to detect serum sodium level in acute stroke patients and its effect in the morbidity and mortality.

2. Patients and methods:

An observational prospective study was done over a period of five months on a sample of eighty-five Egyptian patients recruited from Neurology Departments of Al-Azhar University Hospitals, within the first 24 hours of their symptoms; Informed consents were obtained before enrollment into the study, during the study period from January 2016 to May 2016. Serum sodium level was estimated in all patients at time of admission (for base line sodium level), first, third and seventh days after admission (for follow up sodium level) by serial venous blood samples with observation of serum sodium level (normal serum sodium level lies between 135-145mmol/L., hyponatremia is defined as serum sodium level <135 mmol/L., hypernatremia is defined as serum sodium level >145 mmol/L). Association of serum sodium imbalance among acute stroke patients were identified and correlated to stroke severity and its outcome. All data were collected statistically analysed. Significant results is considered if p-value < 0.05 and

highly significant results is considered if p-value < 0.01.

3. Results

The present study included eighty-five cases with acute stroke. The number of males in the studied patients was fifty-one patients (60%), while the female number was thirty-four patients (40%) (Table 1).

Table (1): Number of males and females and their average ages:

Parameters		No.= 85
Sex	Females	34 (40.0%)
	Males	51 (60.0%)
Age (yrs)	Mean ± SD	63.91 ± 8.42
	Range	50 – 83

The number of patients who had ischemic strokes was fifty patients with percentage (58.8%) of the studied group, while the number of patients who had intracerebral hemorrhage and sub arachnoid hemorrhage were twenty-nine and six patients respectively and their percentages were (34.1%) and (7.1%) of the studied group. (Table 2)

Table (2): Numbers and percentages of different types of acute stroke among the studied group:

Groups	No.	%
Ischemic stroke	50	58.8%
Intracerebral hemorrhage	29	34.1%
Subarachnoid hemorrhage	6	7.1%
Total	85	100.0%

Sodium levels showed hyponatremia in twenty-six patients (30.6%), hypernatremia in seven patients (8.2%) and normonatremia in fifty-two patients (61.2%) (Table 3).

Table (3): Frequency of serum sodium imbalance and their percentage to the studied group.

Serum sodium level	Number of patients	Percentage
Normonatremia	52	61.2%
Hyponatremia	26	30.6%
Hypernatremia	7	8.2%

The stroke severity of the patients included in this study according to NIHSS score were eight mild patients (NIHSS score <4) with percentage (9.4%), sixty-eight moderate patients (NIHSS score 4-15) with percentage (80%) and nine severe patients (NIHSS score >15) with percentage (10.6%) (Table 4).

Table (4): Number and percentage of acute stroke severity based on NIHSS score:

Degree of NIHSS score	Number	Percentage
Mild	8	9.4%
Moderate	68	80%
Severe	9	10.6%

The stroke severity based on NIHSS score increased significantly with increased age of the studied group (Table 5).

Table (5): Stroke severity based on NIHSS score in relation to sex and age of the studied group:

NIHSS score		Mild	Moderate	Severe	Chi-square test	
		No.= 8	No.= 68	No.= 9	X^2/F*	P-value
Sex	Females	3 (37.5%)	28 (41.2%)	3 (33.3%)	0.227	0.893
	Males	5 (62.5%)	40 (58.8%)	6 (66.7%)		
Age (yrs)	Mean ± SD	52.88 ± 1.55	63.97 ± 7.14	73.22 ± 9.77	17.129*	0.001
	Range	51 – 55	50 – 79	53 – 83		

The distribution of serum sodium level in acute stroke patients and their relation to NIHSS score was shown in (Table 6).

Table (6): Serum sodium levels in relation to the NIHSS score of the studied group:

NIHSS score	Normonatremia		Hyponatremia		Hypernatremia		Chi-square test	
	No.	%	No.	%	No.	%	X^2	P-value
Mild	7	13.5%	0	0.0%	1	14.3%	13.287	0.010
Moderate	43	82.7%	19	73.1%	6	85.7%		
Severe	2	3.8%	7	26.9%	0	0.0%		

Table (7): Number and percentage of the patients who survived and who died and their percentage to the studied group

Outcome	No.	%
Survived	69	81.2%
Died	16	18.8%
Total	85	100.0%

There were sixty-nine patients who were survived with a percentage (81.2%), while sixteen patients were died with a percentage (18.8%) (Table 7).

The number of died patients increased significantly with increased age (Table 8).

Table (8): The outcomes of the studied group in relation to age and sex of the studied group:

Outcome		Survived	Died	Chi-square test	
		No.= 69	No.= 16	X^2/t*	P-value
Sex	Females	27 (39.1%)	7 (43.8%)	0.115	0.734
	Males	42 (60.9%)	9 (56.2%)		
Age (yrs)	Mean ± SD	63.00 ± 7.66	67.81 ± 10.53	-2.101*	0.039
	Range	50 – 79	52 – 83		

The number of died patients were five patients with ischemic stroke, seven patients with intra cerebral hemorrhage and four patients with subarachnoid hemorrhage (Table 9).

The number of died patients increased with occurrence of hyponatremia. In addition, the number of the outcomes of died patients increased with increased stroke severity i.e. increased NIHSS score (Table 10).

Table (9): Number and percentage of the outcomes of the studied group in relation to the type of stroke.

Groups	Outcome				Chi-square test	
	Survived		Died		X^2	P-value
	No.	%	No.	%		
Ischemic stroke	45	65.2%	5	31.12%	12.071	0.0024
Intracerebral hemorrhage	22	31.9%	7	43.8%		
Subarachnoid hemorrhage	2	2.9%	4	25.0%		

Table (10): Number and percentage of the outcomes of the studied group in relation to serum sodium level and NIHSS score

Outcome		Survived		Died		Chi-square test	
		No.	%	No.	%	X^2	P-value
Sodium level	Normonatremia	45	65.2%	7	43.8%	6.845	0.033
	Hyponatremia	17	24.6%	9	56.2%		
	Hypernatremia	7	10.1%	0	0.0%		
NIHSS score	Mild	8	11.6%	0	0.0%	43.905	0.001
	Moderate	61	88.4%	7	43.8%		
	Severe	0	0.0%	9	56.7%		

The number of the outcomes of included patients in relation to risk factor. There was no significant value between the outcomes of the studied group in relation to smoking as (P-value >0.05).

There was significant value between the outcomes of the studied group in relation to hypertension as (P-value < 0.05).

There was highly significant value between the outcomes of the studied group in relation to diabetes, dyslipidemia, ischemic heart disease and atrial fibrillation as (P-value =0.000). (Table 11)

Table (11): Number and percentages to the outcomes in relation to risk factors.

Outcome		Survived		Died		Chi-square test	
		No.	%	No.	%	X²	P-value
DM	Negative	62	89.9%	7	43.8%	18.068	0.001
	Positive	7	10.1%	9	56.3%		
HTN	Negative	17	24.6%	0	0.0%	4.928	0.026
	Positive	52	75.4%	16	100.0%		
Dyslipidemia	Negative	40	58.0%	1	6.3%	13.915	0.001
	Positive	29	42.0%	15	93.8%		
IHD	Negative	65	94.2%	7	43.8%	25.520	0.001
	Positive	4	5.8%	9	56.3%		
AF	Negative	60	87.0%	6	37.5%	18.304	0.001
	Positive	9	13.0%	10	62.5%		
Smoking	Negative	27	39.1%	7	43.8%	0.115	0.734
	Positive	42	60.9%	9	56.3%		

4. Discussion

Hyponatremia in patients with an acute central nervous system disease is the most common electrolyte disturbance encountered in neurological intensive care units. It can present with signs and symptoms mimicking a neurological disease and can worsen the existing neurological deficits **(Lath, 2005).**

The frequencies of serum sodium levels percentage in our study were hyponatremia 30.6%, hypernatremia 8.2% and normonatremia 61.2%. Another study showed different percentages, which were hyponatremia 32%, hypernatremia 4% and normonatremia was 64**% (Siddiqui, et al, 2012).**

The occurrence of hyponatremia of various types of acute stroke was 32% of acute ischemic stroke and 27% of intra cerebral hemorrhage. Another study showed that the percentages were 34% and 66% respectively **(Saleem, et al., 2014).**

The occurrence of sodium imbalance especially hyponatremia increased with increased age of patients which correlated to the results of other previous study. **(Hoyle et al., 2006).**

The occurrence of hyponatremia in our study was found to increase stroke severity (increase NIHSS score), which was inconsistent with other previous study which stated that there was no significant value **(Mieke, et al., 2014).**

The mortality rate increased among patients with hyponatremia, as it was 34.6%. Other studies showed that the percentages of mortality in hyponatremic patients were between 44.2% and 24% **(Saleem, et al., 2014 and Bhattacharjee, et al., 2015).**

The seven days mortality rate after CVS varies between studies. The results of our study revealed it up to 18.8% of the patient with stroke died within the first seven days. Other studies reported that the incidence of mortality after stroke in the first week was 5% and 6.9% **(Glader, et al., 2003 and Saposnik et al., 2008).**

Also, in our study, there was a relationship between risk factors of ischemic heart disease, DM and dyslipidemia which disagreed with another previous study **(Gustavo et al., 2008).**

In our study, AF associated with mortality in the first seven days after stroke these finding are in agreement with **(Dewan K. and Rana P., 2014).**

In the present study hypertension associated with case fatality at 7 days, these findings are in agreement with **(Robinson, 2001).**

Conclusion:

Hyponatremia is the commonest electrolyte disturbance, which affects the severity and mortality rate of acute stroke.

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