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ORIGINAL ARTICLE

Prevalence of Hyponatremia in Acute Stroke Patients in a Federal Teaching Hospital, Abakaliki, Nigeria

Prévalence de L'hyponatrémie chez les Patients Victimes d'un Accident Vasculaire Cérébral Aigu Dans Un Hôpital Universitaire Fédéral, Abakaliki, Nigeria

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ABSTRACT

BACKGROUND: Hyponatremia is a common electrolyte imbalance which is readily observed in patients with neurological disorders such as stroke. It is associated with increased morbidity and mortality during and after hospitalization. There has not been any study to demonstrate the frequency of admission hyponatremia in acute stroke patients in Nigeria. It is against this backdrop that we embarked on this study to determine the frequency and pattern of admission hyponatremia in acute stroke patients in a Federal Teaching Hospital, Abakaliki, Nigeria.

METHODS: This was a cross-sectional observational hospital-based study undertaken at the Emergency unit of the Alex Ekwueme Federal University Teaching Hospital Abakaliki, Nigeria from November 2021 to April 2022.

RESULTS: Amongst the 177 acute stroke patients enrolled in the study, 58 (32.8%) had hyponatremia. Advanced age, alteration in consciousness, and haemorrhagic (intracerebral and subarachnoid haemorrhage) stroke were significantly associated with presence of hyponatremia.

CONCLUSION: Admission hyponatremia is prevalent amongst acute stroke patients in Abakaliki, Nigeria and commonly associated with advanced age, alteration in consciousness and haemorrhagic stroke. **WAJM 2022; 39(11): 1188–1192.**

Keywords: Acute stroke, Hyponatremia, Medical emergency, Abakaliki, Nigeria.

RÉSUMÉ

CONTEXTE: L'hyponatrémie est un déséquilibre électrolytique commun qui est facilement observé chez les patients atteints de troubles neurologiques tels que l'AVC. Elle est associée à une morbidité et une mortalité accrues pendant et après l'hospitalisation. Aucune étude n'a été menée pour démontrer la fréquence de l'hyponatrémie à l'admission chez les patients victimes d'un AVC aigu au Nigeria. C'est dans ce contexte que nous avons entrepris cette étude pour déterminer la fréquence et les caractéristiques de l'hyponatrémie à l'admission chez les patients victimes d'un AVC aigu dans un hôpital universitaire fédéral à Abakaliki, au Nigeria.

MÉTHODES: Il s'agissait d'une étude transversale d'observation en milieu hospitalier entreprise au service des urgences de l'Alex Ekwueme Federal University Teaching Hospital d'Abakaliki, au Nigeria, de novembre 2021 à avril 2022.

RÉSULTATS: Parmi les 177 patients victimes d'un AVC aigu inscrits à l'étude, 58 (32,8 %) présentaient une hyponatrémie. L'âge avancé, l'altération de la conscience et l'AVC hémorragique (hémorragie intracérébrale et subarachnoïde) étaient significativement associés à la présence d'une hyponatrémie.

CONCLUSION: L'hyponatrémie à l'admission est prévalente chez les patients victimes d'un accident vasculaire cérébral aigu à Abakaliki, au Nigeria, et est souvent associée à un âge avancé, à une altération de la conscience et à un accident vasculaire cérébral hémorragique. **WAJM 2022; 39(11): 1188–1192.**

Mots clés: Accident vasculaire cérébral aigu, hyponatrémie, urgence médicale, Abakaliki, Nigeria.

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INTRODUCTION

Stroke is characterized as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) due to a vascular cause, and include cerebral infarction (CI), intracerebral haemorrhage (ICH), and subarachnoid haemorrhage (SAH).[1] Hyponatremia is a common electrolyte imbalance which is readily observed in patients with neurological disorders such as stroke.[2] It is commonly defined as serum sodium levels < 135 mmol/L.[3] The frequency of hyponatremia in acute stroke patients on admission varies widely by 3.9–45.3% depending on the case definition.[4–10]

The etiology of hyponatremia is usually either due to Syndrome of inappropriate Antidiuretic hormone (SIADH) secretion or cerebral salt wasting syndrome (CSWS).[11] It may also be due to dietary restriction of sodium as part of a measure to control hypertension, use of anti-hypertensive drugs such as diuretics, and secondary infections.[2]

Presentations of hyponatraemia can vary from mild and non-specific to severe and life-threatening symptoms and are usually dependent on the level and rapidity of changes of serum sodium levels.[3] Usual symptoms include headache, fatigue, nausea, dizziness, gait disturbances, muscle cramps, falls, confusion, seizures and coma.[3] Hyponatremia is associated with an increased risk of death both during hospitalization as well as after hospital discharge.[12]

Considering the prevalent nature of stroke in Nigeria and the overall implication of dyselectrolytemia on its outcome determination, there is a need to specifically determine the frequency and pattern of hyponatremia in those who have suffered acute stroke. Findings from this study will highlight the burden of this condition in a single hospital setting as well as provide data for further exploratory studies.

METHODOLOGY

This was a cross-sectional observational hospital-based study conducted at the Medical Emergency Unit of Alex Ekwueme Federal University Teaching Hospital Abakaliki, a tertiary hospital in Abakaliki, Nigeria from November 2021 to April 2022 (a 6-months period). The hospital is a referral hub for Ebonyi and other surrounding states. Acute stroke (1–7 days post-stroke) patients usually present to the medical emergency unit from where they are admitted to either the intensive care unit or the medical wards depending on severity. All consecutively presenting adult stroke patients aged 18 years and above were recruited for this study. Case notes of the patients were used to retrieve relevant information on the biodata, clinical characteristics, stroke types, and location based on neuroimaging. Serum sodium level results were also retrieved and documented. Stroke was classified as ischemic or hemorrhagic (both intracerebral and subarachnoid haemorrhage) based on imaging finding.[13]

Blood sample was collected at presentation for serum electrolytes assay before commencement of stroke treatment. This helped to reduce the possibility of hyponatremia resulting from initial emergency treatments. Venous blood samples collected in the tubes were spun in a centrifuge at 2500 r/min for 10 minutes and resultant sera were stored in Eppendorf tubes at "20°C before analyses. Serum electrolytes levels, including sodium, were determined using an ion-selective electrode (SFR, 4000), while urea and creatinine were determined using autoanalyzer Cobas C-111. Hyponatremia was defined as serum sodium concentration <135 mmol/L and then further classified as mild (130-134mmol/L), moderate (125- 129mmol/L) and severe (< 125mmol/L).[14]

Altered consciousness was defined as Glasgow coma score (GCS) of < 15/15. Renal dysfunction was defined as estimated Glomerular filtration rate (eGFR) of < 60ml/min/1.72m^2 using Modification of Diet in Renal Disease Study (MDRD) calculator.[15] MDRD takes into consideration serum creatinine, age, sex and race in calculation of eGFR.[15] Hyperglycemia was defined as Random blood glucose (RBG) level of ≥ 140mg/dl.[16] Hypertension was defined as Systolic blood pressure (SBP) of ≥140mmHg and/or Diastolic blood pressure (BDP) of ≥ 90mmHg.[17] The study population were grouped into elderly (≥ 65 years) and working population (18–64 years) age groups.[18] The data were analyzed with Statistical Package for the Social Sciences (SPSS) version 25. Categorical variables were presented as proportions and percentages while numerical variables were presented as means and standard deviations. Chi-square with Yates correction and t-test were used for test of statistical significance in categorical and numerical variables, respectively, with p-value of < 0.05 as significant.

RESULTS

Out of the 191 acute stroke patients who presented within the study period, 177 {male – 96 (54%), female – 81(46%)} fulfilled the study criteria and were included in the study. The mean age of the study population was 60.1 ± 14.2 years with female-to-male ratio of approximately 1: 1.2. Fifty-eight (male- 33, female – 25) of the patients had hyponatremia which constituted 32.8% of the study population with mean age of 62.3 ± 12.7 years. Of the 58 cases with hyponatremia, thirty-three (57%) had mild hyponatremia while 14 (24%) and 11 (19%) had moderate and severe hyponatremia, respectively. Advanced age (≥ 65 years), alteration in consciousness, hemorrhagic stroke and normoglycemia (normal serum glucose level) were statistically associated with hyponatremia. The details are shown in Tables 1, 2, 3 and Figure 1 below.

DISCUSSION

Hyponatremia is a common electrolyte imbalance which is observed in patients with neurological disorders such as stroke and it is commonly defined as serum sodium levels < 135 mmol/L.[2,3] It is associated with varying degrees of symptoms depending on the severity.

The total number of stroke patients (191) that presented in acute phase during the study period was high. This underscores the reported high hospital and community prevalence of stroke especially in developing countries.[19–21] Stroke burden is high in the developing countries probably due to high prevalence of the stroke risks and due to increased longevity occasioned by

Table 1: Distribution of Clinical Parameters

Variables	Hyponatremia n (%)	Normonatremia n (%)	Total N (%)	Chi²	P-value
Age Range (years)					
(<65)	25 (14.1)	79 (44.6)	104 (58.7)	7.7888	0.00526*
≥ 65	33 (18.6)	40 (22.6)	73 (41.2)		
Gender					
Male	33 (18.6)	63 (35.6)	96 (54.2)	0.1123	0.73758
Female	25 (14.1)	56 (31.6)	81 (45.7)		
Stroke Types					
Ischemic	35 (19.8)	104 (58.7)	139 (78.5)	15.357	0.00009*
Hemorrhagic	23 (13.0)	15 (8.5)	38 (21.5)		
Conscious Level					
Normal	27 (15.2)	95 (53.7)	122 (68.9)	18.6411	0.00001*
Altered	31 (17.5)	24 (13.6)	55 (31.1)		
Renal Status					
Normal	39 (22.0)	88 (49.7)	127 (71.7)	0.5664	0.45169
Impaired	19 (10.7)	31 (17.5)	50 (28.2)		
RBG					
Normal	47 (26.6)	79 (44.6)	126 (71.2)	3.3962	0.06535
Raised	11 (6.2)	40 (22.6)	51 (28.8)		
BP					
Normal	12 (6.8)	39 (22.0)	51 (28.8)	2.218	0.13641
Hypertension	46 (26.0)	80 (45.2)	126 (71.2)		

RBG, Random Blood Glucose; BP, Blood Pressure.

Table 2: Age and Sex Distribution of the Study Population

Age Range (Years)	Male (%)	Female (%)	Total (%)
18 – 29	0 (0)	3 (1.7)	3 (1.7)
30 – 39	7 (3.9)	5 (2.8)	12 (6.8)
40 – 49	17 (9.6)	11 (6.2)	28 (15.8)
50 – 59	18 (10.2)	28 (15.8)	46 (26.0)
60 – 69	21 (11.9)	18 (10.2)	39 (22.0)
70 – 79	20 (11.3)	14 (7.9)	34 (19.2)
≥ 80	13 (7.3)	2 (1.1)	15 (8.4)
Total	**96 (54.2)**	**81 (45.8)**	**177 (100)**

Table 3: Distribution of Numerical Variables – Mean Values

Variable	Hyponatremia	Normonatremia	P- value
Age (years)	62.3	59.1	0.0977
MABP (mmHg)	113.3	111.3	0.9399
RBG (mg/dl)	127.4	164.5	0.0001*
GCS	11.9	13.8	0.0001*
eGFR (ml/1.73m2/minute)	81.2	78.5	0.0936

MABP, Mean Arterial Blood Pressure; RBG, Random Blood Glucose; GCS, Glasgow Coma Scale; eGFR, Estimated Glomerular Filtration Rate.

improving health care delivery in the developing countries.[22,23]

Hyponatremia was noted in about one-third of the study population. This finding is of concern because 1 in every 3 acute stroke patients is affected. The finding is similar to other hospital-based studies which reported frequency of 3.9–45.3% depending on the case definition.[2,4–10,24] This high frequency of hyponatremia is a source of concern because it is a predictor of poor outcome following stroke through cerebral oedema, encephalopathy and irreversible brain death.[5,25] The pathogenesis of hyponatremia following stroke is multifactorial and includes the Syndrome of inappropriate Antidiuretic hormone (SIADH) secretion, Cerebral salt wasting syndrome (CSWS), dietary restriction of sodium as a measure to control hypertension, use of anti-hypertensive medicine such as diuretics, and secondary infections.[2,11]

The severity of hyponatremia ranged from mild (59%), moderate (24%) and severe (17%) in decreasing order of magnitude. It is worthy of note that majority had mild hyponatremia, though they could still be symptomatic.

Hyponatremia was more prevalent in elderly patients. This association is statistically significant and it is in keeping with other studies.[2] The above could result from the presence of factors contributing to increased antidiuretic hormone secretion, frequent prescription of drugs associated with hyponatremia, as well as other mechanisms such as malnutrition in seniors due to their lack of desire or inability to prepare and/or eat proper meals, relying instead on simple fare such as tea and toast ("tea and toast" syndrome).[26] The high prevalence of hyponatremia in elderly stroke patients portends great risk as the symptoms of both acute and chronic hyponatremia are more frequent and severe in elderly patients.[27,28] In addition, elderly patients commonly have multiple co-morbidities which may worsen the morbidity and mortality of hyponatremia.[29]

Hyponatremia was also more prevalent in patients that had altered consciousness. This is not unexpected as alteration in consciousness is one of the symptoms of hyponatremia,[28,30] as well as a marker of severe brain injury. Brain injury, including stroke, is a major risk factor for Syndrome of inappropriate Antidiuretic hormone (SIADH) secretion and cerebral salt wasting syndrome (CSWS).[31] SIADH is characterized by hyponatremia with an inappropriately concentrated urine, increased urine sodium concentration, and evidence of

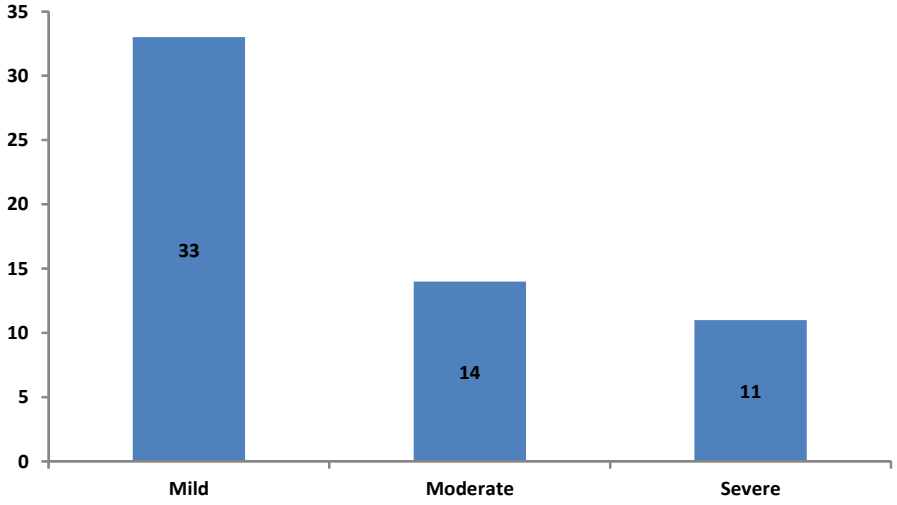

Fig. 1: Severity of Hyponatremia.

normal or slightly increased intravascular volume while CSWS is characterized by hyponatremia with contracted extracellular fluid (ECF) volume due to excessive renal sodium excretion.

Hyponatremia was, furthermore, noted to be significantly associated with hemorrhagic stroke. This is similar to other hospital-based studies.[11,32] This stems from the effect of raised intracranial pressure in hemorrhagic stroke which induces SIADH.[33,34]

Hyponatremia was also associated with lower serum glucose and inversely associated with hyperglycemia. This association could stem from the dilutional effect of SIADH which is a common risk factor of post-stroke hyponatremia.[11] Conversely, severe dehydration that characterizes hyperglycemia could induce hypernatremia through hypotonic renal fluid loss especially if the water loss is not replaced sufficiently.[35] This invariably explains the association between hyponatremia and lower serum glucose level.

There was no sex predilection for occurrence of hyponatremia. This is not unexpected as sex hormones are not involved in the etiopathogenesis of post-stroke hyponatremia.

Conclusion and Recommendations

The hospital prevalence of post stroke hyponatremia was high in our study and appeared to have association with advanced age, altered consciousness and hemorrhagic stroke.

There is need to pay attention to the blood sodium level in patients admitted for acute stroke as hyponatremia is an easily treatable condition with deleterious consequences if undetected.

Study Limitations

Our findings may not be generalizable due to the absence of information on the pre-stroke serum sodium status of the study population.

Again, the relationship between hyponatremia and age, alteration in consciousness and stroke types, as noted in this study, is unlikely to be a simple one. So, multivariate model would have helped to determine true predictors of hyponatremia in the study population.

Disclosures

None.

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