Section: General Medicine

Original Research Article

ELECTROLYTE IMBALANCES IN PATIENTS WITH ACUTE STROKE AND EFFECT OF SERUM SODIUM LEVELS ON OUTCOME OF CVA: A RETROSPECTIVE STUDY

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Received : 30/04/2025
Received in revised form : 17/06/2025
Accepted : 03/07/2025

Keywords:
Acute stroke and effect of serum sodium levels on outcome.

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DOI: 10.47009/jamp.2025.7.4.189

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (4); 988-991

ABSTRACT

Background: CVA is of mainly divided into two types which are ischemic stroke and hemorrhagic stroke. It is often associated with electrolyte abnormalities due to various pathologies and these have to be taken into consideration while treating patients with CVA. **Materials and Methods:** This is a retrospective study conducted at our institute over a period from December 2024 to December 2023 were considered for the study. Electrolyte values and case files of were studied. The SPSS 22 is used to analyse the data. **Result:** A total of 60 patients were studied with their serum sodium levels over a course of 1 year from December 2024 to December 2023 (Table 1). Out of them 40 (66.7%) were males and 20 (33.3%) were females. Out of which 21 (35%) patients had hypernatremia, while 20 (33.3%) where hyponatremic and rest 19 (31.6%) were at normal range of serum sodium levels. Out of the three subgroups of study, patientswith hyponatremia had the highest mortality rate with 75%. **Conclusion:** Serum Sodium levels have a correlation with the mortality of the patients with Cerebrovascular Accidents with decreased sodium levels having the highest mortality levels when compared with increased and normal sodium levels. Mortality is also higher with males as compared to females in the patients with decreased sodium levels.

INTRODUCTION

Ischemic infarction or hemorrhage in the brain leads to a state of non-convulsive focal neurological deficit of abrupt onset known as stroke or cerebrovascular accident (CVA). Out of all the neurological disorders, CVA is the most debilitating and is ranked as the third leading cause of death.[1] According to the World Health Organization (WHO), the mortality due to stroke accounts for approximately 85% in developing countries.[2] The incidence of stroke has declined in the western population during the last three decades. On the contrary, the burden of the disease in South Asian countries, such as India, Pakistan, Bangladesh, and Sri Lanka, is likely to rise.[3] The Pakistani data regarding the exact epidemiology are insufficient, yet stroke is found to be the most common reason for admission in neurology and medical wards.[4]

Electrolyte disturbances are commonly found among other metabolic problems in patients with acute ischemic stroke. It is a potential cause of patient death unless corrected promptly. The disorders of sodium (Na) and potassium (K) balance are identified as the most common electrolyte abnormalities in patients with acute stroke.[5] Patients with hemorrhagic stroke present with symptoms like headache and vomiting, which in turn is a potential cause of electrolyte imbalance. This disturbance in the electrolyte balance is due to deranged secretion of antidiuretic hormones (ADHs), rise in the levels of atrial and brain natriuretic peptides, and inappropriate fluid input and output, causing complications like seizures and death.[6] Therefore, in order to prevent morbidity and mortality in CVA patients, early diagnosis of electrolyte imbalance is important.[7]

The National Institutes of Health Stroke Scale (NIHSS) is a 15- item impairment scale used to measure stroke severity.[8] The NIHSS' strong ability to predict outcomes after stroke helps clinicians provide accurate information to patients, set realistic goals for therapy and plan for discharge.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Presently, the data available about the prevalence of electrolyte disturbance in patients with stroke are not enough especially from developing countries. The purpose of our study is to determine the frequency of occurrence of electrolyte imbalance in patients presenting with acute stroke in a tertiary care hospital and to assess the outcome of stroke in dyselectrolytemias by serial NIHSS scores.

Aims and objectives:

1. Determine the frequency of occurrence of electrolyte imbalance in patients presenting with acute stroke
2. To find out the effect of serum sodium levels on mortality, morbidity and outcome by serial NIHSS score monitoring

MATERIALS AND METHODS

This is a retrospective study that is conducted in the Department of General Medicine, Government General Hospital, Ongole. The patients' data from December 2024 to December 2023 will be considered for the study. The patients with either ischemic or hemorrhagic stroke, as seen on contrast tomography (CT) scan of the head or magnetic resonance imaging (MRI) of the brain, were included in the study.

Sampling Method: Consecutive convenient non-probability sampling

Inclusion Criteria

1. Patients with acute ischemic and hemorrhagic stroke diagnosed at the time of admission
2. Patients above 18 years of age and less than 85 years of age.
3. Both diabetics and non-diabetics will be included
4. Both hypertensives and non hypertensives will be included

Exclusion Criteria

1. Patients having co morbidities like CAD, CKD, CCF
2. Patients having recurrent CVA
3. Patients who were admitted for other co morbidities but later developed CVA
4. Patients with midline shift at the the of admission were excluded

After collecting the demographics such as age and gender, the tests performed included CT scan of the brain or MRI brain, depending on the availability of either, complete blood count, blood glucose, urea, creatinine, liver function tests, chest x-ray, and serum electrolytes, i.e. Na, K, chloride (Cl), and calcium (Ca). All the information is going to be collected from the case records

The National Institutes of Health Stroke Scale (NIHSS) is a 15- item impairment scale used to measure stroke severity. The NIHSS includes the following domains: level of consciousness, eye movements, integrity of visual fields, facial movements, arm and leg muscle strength, sensation, coordination, language, speech and neglect. Each impairment is scored on an ordinal scale ranging from 0 to 2, 0 to 3, or 0 to 4. Item scores are summed to a total score ranging from 0 to 42 (the higher the score, the more severe the stroke).

Serial electrolyte measurements and NIHSS scores will be taken 0n the day of admission, day 7 and day 14. In case of death/discharge, the NIHSS score and electrolytes of that particular day were taken into account.

Statistical Analysis

The Statistical Package for Social Sciences, version 22.0 (SPSS, IBM Corporation, Armonk, NY, USA) will be used to analyze the data. For continuous variables, the mean and standard deviation will be used, while categorical variables will be represented by percentages and frequencies. Chi-square and dependent t-test will be applied to compare the categorical and numerical data, as appropriate. A p-value of less than 0.05 will be considered statistically significant.

1a—Level of consciousness	0 = Alert; keenly responsive 1 = Not alert, but arousable by minor stimulation 2 = Not alert; requires repeated stimulation 3 = Unresponsive or responds only with reflex
1b—Level of consciousness questions: What is your age? What is the month?	0 = Answers two questions correctly 1 = Answers one question correctly 2 = Answers neither questions correctly
1c—Level of consciousness commands: Open and close your eyes Grip and release your hand	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly
2—Best gaze	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation
3—Visual	0 = No visual lost 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia
4—Facial palsy	0 = Normal symmetric movements 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis of one or both sides
5—Motor arm Left arm Right arm	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
6—Motor leg Left leg Right leg	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
7—Limb ataxia	0 = Absent 1 = Present in one limb 2 = Present in two limbs
8—Sensory	0 = Normal; no sensory loss 1 = Mild-to-moderate sensory loss 2 = Severe-to-total sensory loss
9—Best language	0 = No aphasia; normal 1 = Mild-to-moderate aphasia 2 = Severe aphasia 3 = Mute; global aphasia
10—Dysarthria	0 = Normal 1 = Mild-to-moderate dysarthria 2 = Severe dysarthria
11—Extinction and inattention	0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention 2 = Profound hemi-inattention or extinction
Score = 0–42	

RESULTS

A total of 60 patients were studied with their serum sodium levels over a course of 1 year from December 2024 to December 2023 (Table 1). Out of them 40 (66.6&) were males and 20 (33.3%) were females. A total of Twenty-One patients had elevated serum sodium levels, twenty patients had low serum sodium levels and nineteen of them had normal serum sodium levels. Patients with low serum sodium levels have seen to have highest mortality with around 7 (35%) patients when compared with the other groups (Table 2). Among the patients with low serum sodium levels, females (50%) have found to have the higher mortality when compared to males (31.25%). For the population of aged 65 years, there is no gender predilection with hyponatremia, but in overall population males have a higher mortality than females. In people with increased sodium levels mortality was found to be similar in both males and females. In people with

ISSN (O): 2687-5365; ISSN (P): 2753-6556

normal sodium levels, mortality was to be higher in males when compared to females.

Table 1

S.Na+ Levels	Male	Female	Total
Increase	16 (25%)	5 (10%)	21 (35%)
Decrease	16 (26%)	4 (6.3%)	20 (33.3%)
Normal	9 (15%)	10 (16.6%)	19 (31.6%)
Total	40 (66.6%)	20 (33.4%)	60 (100%)

Table 2

S.Na+ Levels	Male	Female	Total
Increase	16 (25%)	5 (10%)	21 (35%)
Decrease	16 (26%)	4 (6.3%)	20 (33.3%)
Normal	9 (15%)	10 (16.6%)	19 (31.6%)
Total	40 (66.6%)	20 (33.4%)	60 (100%)

Table 3

Mortality Rate			
S.Na+ Levels	**Male**	**Female**	**Total**
Increase	2 (13.3%)	2 (33.3%)	4(19.04%)
Decrease	5(31.25%)	2(50%)	7(35%)
Normal	2(22.2%)	1(10%)	3(15.7%)
Total	9(22.5%)	5(25%)	14(23.3%)

DISCUSSION

In our study, majority of the population (88%) are with serum sodium level abnormalities.

Around 35% of the patients have hyponatremia, while 33.3% are found to have hypernatremia, thr remaining 31.7% were found to be normonatremic.

Incidence of hyponatremia being the highest, this finding is consistent with observations from Hossain, et al,[9] andMahesar, et al.[10]

Hyponatremia is also associated with increased mortality when compared to patients with normal or elevated serum sodium levels.

In our study, around 70% of the patients are with ischaemic stroke while the rest 30% are with hemorrhagic stroke. When the prevalence of the hyponatremia is studied as a variation between the two types of strokes, hyponatremia is found to be more prevalent in patients with hemorrhagic stroke, and this finding is consistent with studies from Mansoor, et al.[11] Increased prevalence of hyponatremia among people with hemorrhagic stroke is attributed to profound disruptions in ICP, vascular integrity and neurohormonal regulation.

Two of the main reasons for the development of hyponatremia is either SIADH or CSWS.

A group of patients who are initially normonatremic, were found to to have increased sodium levels, after a stay if few days in the hospital.

People with hyponatremia were found to have increased mortality when compared to the people from other two groups and this observation is consistent with finding from Potasso, et al.[12]

With the consistent association with altered serum sodium levels and adverse outcomes of stroke, it reflects the importance of early detection and correction of abnormality. Routine sodium monitoring and combined targeted intervention maintaining normonatremia could potentially improve the functional outcomes and decrease the mortality in stroke patients.

CONCLUSION

Serum Sodium levels have a correlation with the mortality of the patients with Cerebrovascular Accidents with decreased sodium levels having the highest mortality levels when compared with increased and normal sodium levels. Mortality is also higher with males as compared to females in the patients with decreased sodium levels.

REFERENCES

1. Serum and urinary electrolyte levels in cerebro-vascular accident patients: a cross sectional study. Chakraborty S, Ghosh K, Hazra R, Biswas RN, Ghosh S, Bhattacharya A, Biswas S. Am J Int Med. 2013;1:36–39.
2. Preventing Chronic Diseases: A Vital Investment: WHO Global Report. [Jul; 2021];World Health Organization. (2005. https://apps.who.int/iris/handle/10665/43314 2005
3. Association of phosphodiesterase 4D gene with ischemic stroke in a Pakistani population. Saleheen D, Bukhari S, Haider SR, et al. Stroke. 2005;36:2275–2277. doi: 10.1161/01.STR.0000182242.59466.ee.
4. Clinical practice guidelines for the management of ischemic stroke in Pakistan. Shafqat S. https://pubmed.ncbi.nlm.nih.gov/14765941/ J Pak Med Assoc. 2003;53:600–603.
5. Frequency of stress hyperglycaemia and its' influence on the outcome of patients with spontaneous intracerebralhaemorrhage. Samiullah S, Qasim R, Imran S, Mukhtair J. https://pubmed.ncbi.nlm.nih.gov/20726199/ J Pak Med Assoc. 2010;60:660–663.
6. Stress hyperglycemia and electrolytes disturbance in patients with acute cerebrovascular stroke. El-Fawal BM, Badry R, Abbas WA, Ibrahim AK. Egypt J NeurolPsychiatrNeurosurg. 2019;55
7. Disturbances of fluid and electrolyte balance in patients with acute stroke] Kusuda K, Saku Y, Sadoshima S, Kozo I, Fujishima M. https://pubmed.ncbi.nlm.nih.gov/2795972/ Nihon Ronen IgakkaiZasshi. 1989;26:223–227.
8. Brott T, et al. Stroke. 1989;20:864–870
9. Hossain et al, Prevalence of Electrolyte imbalance in patients with Acute Stroke: A Systemic Review. Cereus.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

2023 Aug 8;15(8):e43149. Doi:10.7759/cereus.43149. PMID: 37692728
10. Mahesar, et al. Evaluation of Hyponatremia in Ischaemic Stroke patients in a tertiary care hospital of Karachi Pakistan. Cereus. 2019 PMID: 30937232
11. Mansoor et al, Frequency of Electrolyte imbalance in patients presenting with Acute Stroke. Cereus. 2021 PMID: 34725581
12. Potasso, et al. Impact of sodium levels on functional outcomes in patients with stroke – A Swiss Stroke Registry Analysis. J ClinEndocrinolMetab. 2022 Jan PMID: 3448057.

ISSN (O): 2687-5365; ISSN (P): 2753-6556