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Original Research Article

Frequency of Hyponatremia in Ischemic Stroke Patients Admitted in Medical Unit, MTI DHQ Dera Ismail Khan

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Abstract: *Hyponatremia is a common electrolyte disturbance in acute stroke and may influence clinical monitoring and management. Early identification of low serum sodium is relevant in ischemic stroke patients admitted to medical units.* ***Objective:*** *To determine the frequency of hyponatremia in ischemic stroke patients admitted to the medical unit.* ***Methods:*** *This study included 121 patients aged 35 to 80 years, of either gender, presenting with ischemic stroke from 24 November 2024 to 24 March 2025 at the Department of Medicine, MTI DHQ Teaching Hospital, Dera Ismail Khan. Patients with previous stroke, hemorrhagic stroke, brain tumor, cerebral abscess, tuberculomas, those on medications including diuretics, steroids, antidepressants, antipsychotics, carbamazepine, or non-steroidal anti-inflammatory drugs, and patients with renal failure or severe hyperglycaemia > 300 mg/dl were excluded. Blood samples were collected from all patients to assess hyponatremia, defined as a serum sodium level < 135 mmol/L. Data were analyzed using SPSS 25.* ***Results:*** *The mean age of 121 patients in this study was 57.02±12.56 years. Male patients were 81 (66.9%), while female patients were 40 (33.1%). The mean duration of stroke was 33.26±4.51 hours, and the mean serum sodium level was 136.98±7.24 mmol/L. Hyponatremia was observed in 40 (33.1%) cases.* ***Conclusion:*** *It is concluded that the frequency of hyponatremia in patients presenting with ischemic stroke was 33.1%. Routine screening of serum sodium at admission is recommended for all ischemic stroke patients.*

Keywords: Hyponatremia, ischaemic stroke, serum sodium, electrolyte disturbance

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Introduction

Stroke is a neurological emergency characterized by neurological deficit. Stroke is the second leading cause of death worldwide, with an annual mortality of about 5.5 million. (1,2) There are female- specific risk factors for stroke, including hypertensive disorders of pregnancy, oral contraception, and hormonal therapy use. Some conventional risk factors, such as hypertension, smoking, and atrial fibrillation (AF), have been associated with increased risk of stroke in all patients. (3) Studies report that approximately 80%80% of all stroke cases are ischemic. (4) Ischemic stroke occurs when a blockage in blood vessels deprives a localized area of the brain of oxygen and blood supply, leading to ischemic damage or necrosis of brain cells. During ischemic injury, hypoxia and ischemia result in abnormal brain cell metabolism. This abnormal metabolism involves a series of biochemical events, including adaptive metabolic changes, cell death, and the triggering of a cascade within ischemic brain tissue. This cascade includes the overproduction of reactive oxygen species (ROS), decreased pH, inflammation, and disruption of the blood-brain barrier (BBB). The complexity of the ischemic pathological microenvironment in ischemic brain tissue is further compounded by its dynamic changes as the disease progresses, potentially limiting the efficacy of current stroke therapies. (5)

Clinically, these abnormalities are pervasively reflected as a range of multisystem complications, which commonly emerge at particular stages and complicate the clinical course of stroke. Whether these seemingly unrelated complications coincide with or are attributable to stroke is not well documented. (6) Hyponatremia is common in patients with stroke and is associated with adverse outcomes and increased mortality risk. In this setting, hyponatremia and water balance exhibit detrimental effects on the injured brain and might increase the corresponding mortality by 60%. (7) Previous studies have shown that up to 19% of patients with acute ischemic stroke present with hyponatremia. (8)

The rationale of this study is to determine the frequency of hyponatremia in ischemic stroke patients. Hyponatremia is a common electrolyte disturbance observed in patients with various neurological disorders, including ischemic stroke. The presence of hyponatremia in stroke patients is of clinical concern because it is associated with increased morbidity, mortality, and poorer neurological outcomes. Given the high incidence of ischemic stroke worldwide and the potential impact of hyponatremia on patient recovery, understanding the frequency and underlying mechanisms of this electrolyte imbalance in ischemic stroke patients is critical for optimizing management strategies. No such study has been conducted in our population previously.

Methodology

This study was conducted from 24 November 2024 to 24 March 2025 in the Department of Medicine, MTI DHQ Teaching Hospital, Dera Ismail Khan. Ethical approval was obtained from the hospital's institutional review board. The sample size for the present study was 121, calculated using the WHO calculator with a 95% confidence level, a 7% margin of error, and a 19% previous frequency of hyponatremia in ischemic stroke.8 Non-probability sampling was used.

Patients aged 35 to 80 years, of either gender, presenting with ischemic stroke were enrolled in this study. A patient was labeled as having a stroke if they present clinically with any one of the following features for the first time, persisting for more than 24 hours, Weakness of any half or limb of the body, i.e., power less than 5/5 of both upper limb and lower limb of that half, and Altered sensorium, i,e. Glasgow coma scale score of less than 13/15, plus a confirmatory CT scan showing acute cerebral ischemia (hypodense area). Patients with previous history of stroke determined on history and medical record, patients with hemorrhagic stroke determined on CT scan, patients with brain tumour, cerebral abscess or tuberculomas determined on history and CT scan, patients on therapy with diuretics,

steroids, selective serotonin reuptake inhibitors, tricyclic antidepressants, narcotics, non-steroidal anti-inflammatory drugs, antipsychotics, carbamazepine, cyclophosphamide, or clofibrate, patients with renal failure having serum creatinine level more than 2 mg/dl, and patients with severe hyperglycemia > 300 mg/dl were all excluded from the study.

Written informed consent was obtained from the patient/guardian after explaining the purpose, benefits, and risks of the study. Demographic data, including age, gender, stroke duration, profession, socioeconomic status, education level, and residence, were recorded. At the time of presentation, 5 mL of venous blood was drawn and sent to the hospital's hematology lab. Serum sodium level was noted. The frequency of hyponatremia was determined if the Serum level was less than 135mg/dL. Data was entered into a specially designed pro forma.

Data were entered and analyzed using SPSS 25. Quantitative variables such as age, stroke duration, and serum sodium level were expressed as means and standard deviations. Frequencies and percentages were calculated for qualitative variables, including gender, education level, socioeconomic status, residence, profession, and presence of hyponatremia. Data were stratified by age, gender, duration of hyponatremia, education level, socioeconomic status, residence, and profession. A post-stratification chi-square test was applied; p-values <0.05 will be considered significant.

Results

The study included 121 patients presenting with ischemic stroke. The mean age of the patients was 57.02±12.56 years. The duration of stroke symptoms at the time of presentation was 33.26±4.51 hours. The mean serum sodium level was 136.98±7.24 mmol/L.

Male patients were more common than female patients; 81 (66.9%) were male, while 40 (33.1%) were female. Regarding the area of residence, 64 patients (52.9%) resided in urban areas, while 57 patients (47.1%) resided in rural areas. Thirty patients (24.8%) were illiterate, twenty-eight patients (23.1%) had only primary schooling, forty two patients (34.7%) had completed secondary education, and 21 patients (17.4%) had education up to matriculation or above. The remaining distribution is presented in Table 1.

Among 121 patients, hyponatremia was present in 40 (33.1%), while 81 (66.9%) had normal serum sodium levels (Table 2). Table 3 presents the stratification of hyponatremia with various demographic variables and duration of stroke.

Table 1: Demographic Characteristics

Demographics		n	%
Gender	Male	81	66.9%
	Female	40	33.1%
Residence	Urban	64	52.9%
	Rural	57	47.1%
Education level	Illiterate	30	24.8%
	Primary education	28	23.1%
	Secondary education	42	34.7%
	Matric & above	21	17.4%
Profession	Job	31	25.6%
	Business	26	21.5%
	Unemployed	64	52.9%
Socioeconomic status	Low (Monthly income less than 20 thousand)	42	34.7%
	Middle (Monthly income 20-50 thousand)	54	44.6%
	High (Monthly income more than 50 thousand)	25	20.7%

Table 2: Frequency of hyponatremia

Hyponatremia	n	%
Yes	40	33.1%
No	81	66.9%

Table 3: Stratification of hyponatremia with demographics and duration of stroke

Variables		Hyponatremia				p value
		Yes		No		
		n	%	n	%	
Age groups (Years)	35 to 50	12	30.0%	31	38.3%	0.660
	51 to 65	14	35.0%	26	32.1%	
	> 65	14	35.0%	24	29.6%	
Gender	Male	29	72.5%	52	64.2%	0.361
	Female	11	27.5%	29	35.8%	
Residence	Urban	23	57.5%	41	50.6%	0.476
	Rural	17	42.5%	40	49.4%	
Education level	Illiterate	13	32.5%	17	21.0%	0.002
	Primary education	6	15.0%	22	27.2%	
	Secondary education	8	20.0%	34	42.0%	
	Matric & above	13	32.5%	8	9.9%	
Profession	Job	14	35.0%	17	21.0%	0.116
	Business	5	12.5%	21	25.9%	
	Unemployed	21	52.5%	43	53.1%	
Socioeconomic status	Low (Monthly income less than 20 thousand)	15	37.5%	27	33.3%	0.772

	Middle (Monthly income 20-50 thousand)	16	40.0%	38	46.9%	
	High (Monthly income more than 50 thousand)	9	22.5%	16	19.8%	
Stroke duration (Hours)	25 to 35	25	62.5%	51	63.0%	0.960
	> 35	15	37.5%	30	37.0%	

Discussion

Hyponatremia has been recognized as a common electrolyte disturbance in patients presenting with acute stroke. Several studies from various parts of Pakistan have examined this phenomenon. A study by Rehman et al. included both ischaemic and haemorrhagic strokes and found hyponatremia in 30.80% of the study population. The mean age in that study was 62.00±10.32 years, and male patients accounted for 84 (70.0%). Ischaemic stroke was the common type seen in 92 (76.7%) of cases. No significant association was found between hyponatremia and age, gender, or stroke type in that study. (10)

Kidwai et al. conducted a study on 110 patients with acute ischaemic stroke who had confirmed hyponatremia. The mean age of their patients was 61.45±11.8 years. Male patients accounted for 66 (60%) in their study, while females accounted for 44 (40%). The overall mortality in patients with hyponatremia was 14.5%. Moderate hyponatremia was observed in 32 (29%) of the hyponatremic patients, while severe hyponatremia was present in 12 (11%). Their study concluded that older age and moderate to severe hyponatremia were linked to higher mortality rates. (11)

Khan et al. in their study enrolled 289 patients with ischaemic stroke. The mean age was 53±8.53 years. Male patients accounted for 162 (56.1%) in their study, while females accounted for 127 (43.9%). Hyponatremia was observed in 101 (35%) of patients. (12)

A study by Zafar et al. reported hyponatremia in 30.1% of patients. The mean age in their study was 62.3±13.3 years. Male patients made up 103 (57.5%) of the total population. In-hospital death was notably higher in patients with severe stroke and among those with severe hyponatremia. The length of hospital stay was also significantly longer in patients who had severe hyponatremia (13)

Another study from Pakistan found that in patients with ischemic stroke, NIHSS score on admission, IHD, hypertension, and hyponatremia were independent risk factors for mortality (14)

The present study observed hyponatremia in 33.1% of the sample. This figure is consistent with the aforementioned studies. The mean age in the present study was 57.02±12.56 years. Regarding gender distribution, the present study found that male patients were in the majority (81, 66.9%), while females were 40 (33.1%). This pattern is also consistent with the aforementioned studies.

The mean duration of stroke symptoms at presentation in the present study was 33.26±4.51 hours. This shows that the study's inclusion criterion required symptoms to persist for more than 24 hours. When the patients were divided into two groups based on symptom duration, those with a duration of 25 to 35 hours were 25 (62.5%) in the hyponatremic group and 51 (63.0%) in the normonatremic group. Those with duration greater than 35 hours numbered 15 (37.5%) in the hyponatremic group and 30 (37.0%) in the normonatremic group. This suggests that once the patient has crossed the 24-hour threshold of ischemic stroke, the exact duration of symptoms in the range of 25 to 40 hours does not influence whether they will have hyponatremia or not.

Conclusion

From the present study, it is concluded that the frequency of hyponatremia in patients presenting with ischemic stroke was 33.1%. Serum sodium levels should be measured routinely in all patients presenting with acute ischemic stroke at the time of admission.

Declarations

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-MITDHK-923/24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Chandrabhatla AS, Kuo EA, Sokolowski JD, Kellogg RT, Park M, Mastorakos P. Artificial intelligence and machine learning in the diagnosis and management of stroke: a narrative review of United States Food and Drug Administration-approved technologies. J Clin Med. 2023;12(11):3755. https://doi.org/10.3390/jcm12113755
2. Soun JE, Chow DS, Nagamine M, Takhtawala RS, Filippi CG, Yu W, et al. Artificial intelligence and acute stroke imaging. AJNR Am J Neuroradiol. 2021;42(1):2-11. https://doi.org/10.3174/ajnr.A6883
3. Kelly DM, Engelbertz C, Rothwell PM, Anderson CD, Reinecke H, Koeppe J. Age- and sex-specific analysis of stroke hospitalization rates, risk factors, and outcomes from German nationwide data. Stroke. 2024;55(9):2284-2294. https://doi.org/10.1161/STROKEAHA.123.046118
4. Campbell BCV, De Silva DA, Macleod MR, Coutts SB, Schwamm LH, Davis SM, et al. Ischaemic stroke. Nat Rev Dis Primers. 2019;5(1):70. https://doi.org/10.1038/s41572-019-0118-8
5. Wu F, Zhang Z, Ma S, He Y, He Y, Ma L, et al. Microenvironment-responsive nanosystems for ischemic stroke therapy. Theranostics. 2024;14(14):5571-5595. https://doi.org/10.7150/thno.99822
6. Cui P, McCullough LD, Hao J. Brain to periphery in acute ischemic stroke: mechanisms and clinical significance. Front Neuroendocrinol. 2021;63:100932. https://doi.org/10.1016/j.yfrne.2021.100932
7. Xian Y, Li S, Jiang T, Beon CD, Poudel R, Thomas K, et al. Twenty years of sustained improvement in quality of care and outcomes

for patients hospitalized with stroke or transient ischemic attack: data from the Get With The Guidelines-Stroke Program. Stroke. 2024;55(11):2599-2610. https://doi.org/10.1161/STROKEAHA.124.048174

8. Liamis G, Barkas F, Megapanou E, Christopoulou E, Makri A, Makaritsis K, et al. Hyponatremia in acute stroke patients: pathophysiology, clinical significance, and management options. Eur Neurol. 2019;82(1-3):32-40. https://doi.org/10.1159/000504475

9. Shima S, Niimi Y, Moteki Y, Takahashi O, Sato S, Inoue T, et al. Prognostic significance of hyponatremia in acute stroke: a systematic review and meta-analysis. Cerebrovasc Dis. 2020;49(5):531-539. https://doi.org/10.1159/000510751

10. Jamil Ur Rahman, Ahmad T, Shakir Ullah, Hussain M, Haleem Ur Rahman, Bashar N. Frequency of hyponatremia in patients with acute stroke in Ayub Teaching Hospital Abbottabad. Indus J Biosci Res. 2025;3(4):1256-1260. https://doi.org/10.70749/ijbr.v3i4.2921

11. Kidwai AA, Ara J, Rasheed SA, Najeebullah, Paracha S. Impact of hyponatremia on outcome of acute ischemic stroke in a tertiary care hospital. Professional Med J. 2019;26(10):1789-1793. https://doi.org/10.29309/TPMJ/2019.26.10.4142

12. Khan Z, Iqbal S, Ahmed F, Ahmad A. Characterization of hyponatremia in patients with ischemic stroke. J Med Sci. 2024;32(1):82-84. https://doi.org/10.52764/jms.24.32.1.15

13. Zafar M, Jalil A, Ghaffer A, Yousaf M, Batool S. Hyponatremia in ischemic stroke patients and its relationship to clinical outcomes in such patients. J Rawalpindi Med Coll. 2024;28(4):603-608. https://doi.org/10.37939/jrmc.v28i4.2560

14. Khan A, Khan Z, Khan S, Ullah A, Ayub G, Tariq MN. Frequency of hyponatremia and its impact on prognosis in ischemic stroke. Cureus. 2023;15(6). https://doi.org/10.7759/cureus.40317