Section: Neurology

Original Research Article

A PROSPECTIVE STUDY OF EVALUATION AND ASSESSING THE CORRELATION BETWEEN HYPONATREMIA OR EUNATREMIA IN PATIENTS WITH ACUTE STROKE FOR SEVERITY AND OUTCOME

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Abstract

Background: Electrolyte displacement is most commonly reported in patients with stroke. Hyponatremia is often reported in stroke patients upon arrival or during their hospitalization. The study aims to evaluate the number of acute stroke patients having hyponatremia and the in hospital outcome of stroke patients having hyponatremia. **Materials and Methods:** The prospective observational study was conducted in a tertiary hospital in Trichy involving 77 patients diagnosed with acute ischemic stroke and acute hemorrhagic stroke by clinical examination, CT, or MRI. Patients with pre-existing chronic kidney disease and chronic liver disease, cardiac failure, on drugs causing hyponatremia, cancer, head injury were excluded from the study as sodium levels can be altered in such conditions. Patient demographic details and laboratories parameter was evaluated with serum sodium levels < 135 mEq/L. The NIHSS scale was used to assess stroke severity in patients with hyponatremia during admission and at discharge. **Result:** From a total of 77 patients, the median age of incidence of stroke was 56 years, with male predominance (81.0%) reported in the study. Acute ischemic stroke was prevalent in 68%, and intracerebral hemorrhage was seen in 32%. A higher incidence of infarct was reported at 40%, with a significant difference related to hyponatremia (p-value <0.0001) based on the infarct site. One patient was reported with mortality. The NIHSS scale outcome did not reveal a significant difference; however, a higher mean was reported in patients with hyponatremia. **Conclusion:** 19% of the overall study population was reported with hyponatremia with a significant difference in the infarct site. A poor NIHSS score was reported in patients with hyponatremia during admission and discharge.

INTRODUCTION

Hyponatremia is the most prevalent electrolyte problem in hospitals and the community, with up to 30% and 8%, respectively. Hyponatremia is often reported in stroke patients upon arrival or during their hospitalization. It is linked to worse stroke outcomes and higher mortality; however, the data quality is insufficient to determine if this is a direct result of hyponatremia.[1] Electrolyte displacement is common in stroke patients, with hyponatremia being a particular cause that exacerbates neurological symptoms. The most common causes of hyponatremia after stroke are cerebral salt-wasting syndrome, characterized by natriuresis with extracellular fluid depletion, and syndrome of inappropriate antidiuretic hormone secretion, characterized by free water retention caused by excessive antidiuretic hormone secretion and results in hypo-osmolar hyponatremia.[2]

Enlarged urine Na+ content, indications of a normal or slightly increased intravascular volume, and hyponatremia in the context of an incorrectly concentrated urine are the characteristics of the syndrome of inappropriate ADH secretion (SIADH).[3] Although body fluid hypotonicity and an

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increased effective circulatory volume are present in the secretion of antidiuretic hormone (SIADH), there is a continuous generation of Antidiuretic hormone (ADH), which prevents the negative feedback mechanism that typically regulates ADH from working and causes ADH to continue to be produced. The term "cerebral salt wasting syndrome" (CSW) refers to renal sodium loss brought on by an intracranial condition that causes hyponatremia and hypovolemia. Patients with brain tumors, injuries, subarachnoid hemorrhages, intracranial hemorrhages, ischemic strokes, and central nervous system infections (CNS) have all been shown to have this syndrome.[4] Patients with intracranial illness who develop severe natriuresis and consequent hyponatremia, or dehydration, are said to have cerebral salt wasting syndrome (CSWS).[5] Despite several concepts, the precise mechanism behind CSWS remains unknown. Euvolumic and hypertensive patients with SIADH are typical. Drowsiness, seizures, and coma are among the neurologic symptoms to watch for in individuals with SIADH. Fluid restriction and medications like furosemide, demeclocycline, or lithium are used to treat SIADH. Treatment of the underlying cause, volume replacement with normal or hypertonic saline, and drugs such as fludrocortisone is used to control CSWS.[5]

One of the significant reasons for the persisting impaired sensorium in stroke patients is hyponatremia. Additionally, it can cause a variety of other neurological signs and symptoms, such as seizures, which can worsen the level of awareness and prognosis.[4] The sudden start of a neurologic impairment with a clear vascular cause is referred to as a stroke, also known as a cerebrovascular accident (CVA).[4] About 6.7 million individuals die from stroke each year, making it one of the four leading causes of death worldwide. The two primary forms of stroke are ischemic and hemorrhagic. Acute ischemic stroke affects roughly 795,000 people in the United States (AIS).[6] Hyponatremia is often categorized into three volumes: low-volume hyponatremia, normal-volume hyponatremia, or high-volume hyponatremia, depending on the person's bodily fluid state. Vomiting, perspiration, diuretics, and diarrhea can all cause low-volume hyponatremia; dilute and concentrated urine instances can cause normal-volume hyponatremia.[7] Large amounts of hyponatremia are typically caused by liver, heart, and renal failure. Hyperglycemia, hyperproteinaemia in multiple myeloma, and hyperlipidemia might cause low-volume hyponatremia to be evaluated incorrectly.[8] Stroke and hyponatremia are linked with a bad prognosis. However, the prognosis of hyponatremia in acute stroke is not well established, and only a few studies have been done in this area, where the mortality varies from 14% to 44%.[9]

A physical examination, medical history, and laboratory tests are required to identify the hyponatremia condition's underlying etiology. Hyponatremia is diagnosed when a blood test shows serum sodium levels below 135 mmol/L. The underlying reason can be identified by identifying the patient's hypervolemia, euvolemia, or hypovolemia level during the physical exam and history. Examinations must be performed to determine if the hyponatremia patient is exhibiting neurological symptoms. Concentration, orientation, and alertness tests should be part of such evaluations.[1] This research was conducted in a tertiary care hospital to evaluate hyponatremia in hospitalized stroke patients.

MATERIALS AND METHODS

Two-month prospective research was conducted in a tertiary care hospital in Trichy. Seventy-seven patients with acute stroke who met the inclusion and exclusion criteria were enrolled in the research to evaluate hyponatremia. The study started after approval, and informed consent was obtained.

Inclusion criteria: Patients >18 years of age diagnosed based on clinical examination and CT or MRI as acute ischemic stroke and acute hemorrhagic stroke.

Exclusion criteria: All those patients who had a history of chronic kidney disease and chronic liver disease, cardiac failure, cancer, head injury, and on intake of drugs causing hyponatremia were excluded from the study.

A total of 77 stroke patients were included and demographic details of all the patients were recorded. Regarding volume status, all patients underwent evaluation. In addition, measurements of urinary sodium, serum osmolality, serum uric acid, and serum sodium were made. Patients with strokes whose serum sodium level was less than 135 mEq/L when hospitalized were assessed. NIHSS was used to evaluate their progress at both admission and discharge. Mortality was analyzed. Statistical significance was analyzed using the SPSS (Statistical Package for Social Science) Software

RESULTS

Among the total 77 patients in the study, 56 (81%) were males, and 21 (19%) were females. The median age was 56 years. 52 (68%) were reported with acute ischemic stroke. 15 (19%) patients with stroke had hyponatremia. 12 (81%) patients had mild, 1 (6%) had moderate, and 2 (13%) had severe hyponatremia. The site of stroke was then determined in patients with hyponatremia and eunatremia. Capsular infarct 6 (40.0%) was the most common site in patients with hyponatremia, and capsuloganglionic bleeding 15 (24.2%) was the most common in patients with eunatremia. None of the patient in the hyponatremia group had cerebellar infarct, corona radiata infarct, pontine infarct and thalamic infarct. In Infarct eunatremic patients 40 (64.5%) were more than the patients with hyponatremia 12 patients (80.0%) (P-value 0.25). In Hemorrhagic stroke hyponatremia

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was seen in 3 patients (20.0%), and eunatremia was reported in 22 (35.5%) respectively. In the present study, out of 15 hyponatremic patients, 1 (6.7%) died, and 14 (93.3%) survived. While among 62 patients with eunatremia, 4 (6.5%) died (P-value 0.976) [Table 1].

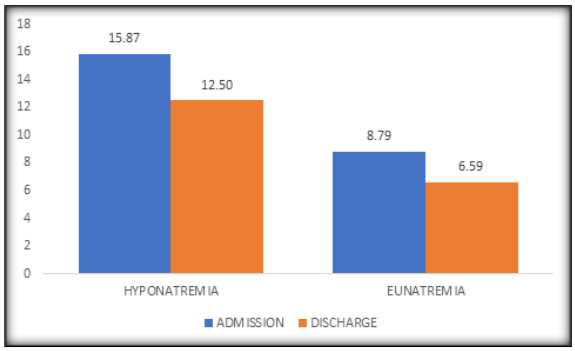

Figure 1: Incidence of hyponatremia and eunatremia

Based on the NIHSS scale, hyponatremia was presented with mean NIHSS of 15.87 ± 8.19 SD during admission and decreased to 12.50 ± 6.54 SD during discharge. Similarly, a mean NIHSS of 8.79 ± 4.85 SD was during the admission for eunatremia, whereas it decreased to mean NIHSS of 6.59 ± 2.26 SD at discharge [Table 2].

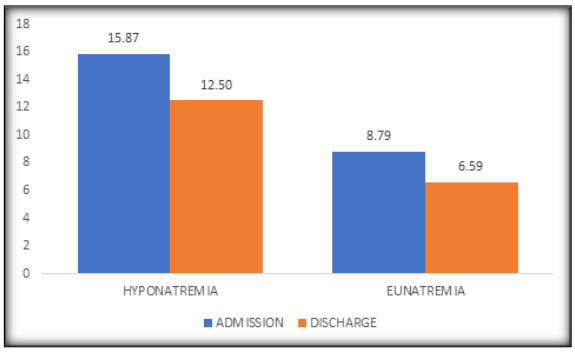

Figure 2: Comparison of hyponatremia and eunatremia based on the NIHSS scale

Table 1: Baseline characteristics of patients

		Hyponatremia	Eunatremia	P-Value
Sex	Female	2 (13.3%)	9 (30.6%)	0.177
	Male	13 (86.7%)	43 (69.4%)	
Side	Bilateral	0	3 (4.8%)	0.272
	Left	11 (73.3%)	32 (51.6%)	
	Right	4 (26.7%)	27 (43.5%)	
Size	Large	4 (26.7%)	6 (9.7%)	0.212
	Medium	5 (33.3%)	24 (38.7%)	
	Small	6 (40.0%)	32 (51.6%)	
Site	Capsular Infarct	6 (40.0%)	10 (61.1%)	<0.0001
	Capsuloganglionic Hemorrhage	2 (13.3%)	15 (24.2%)	
	Cerebellar Infarct	0	3 (4.8%)	
	Corona Radiata Infarct	0	7 (11.3%)	
	Pareital Infarct	1 (6.7%)	7 (11.3%)	
	Pareito Occipital Hemorrhge	1 (6.7%)	7 (11.3%)	
	Pareito Occipital Infarct	5 (33.3%)	6 (9.7%)	
	Pontine Infarct	0	3 (4.8%)	
	Thalamic Infarct	0	4 (6.5%)	
Type	Infarcts	12 (80.0%)	40 (64.5%)	0.25
	Hemorrhage	3 (20.0%)	22 (35.5%)	
Death	No	14 (93.3%)	58 (93.5%)	0.976
	Yes	1 (6.7%)	4 (6.5%)	

Table 2: Comparison of hyponatremia and eunatremia based on NIHSS scale

Nihss	Hyponatremia		Eunatremia		P-value
	Mean	Std Deviation	Mean	Std Deviation	
Admission	15.87	8.19	8.79	4.85	0.002
Discharge	12.50	6.54	6.59	2.26	0.001

DISCUSSION

The most frequent electrolyte abnormality seen in neurological clinical practice is hyponatremia, which most commonly affects patients with acute central nervous system (CNS) diseases.[10] In our study, the motive was to evaluate the number of acute stroke patients having hyponatremia and the outcome of stroke patients having hyponatremia.

Out of the total 77 patients admitted to the hospital, hyponatremia was seen as more prevalent in males than females. A similar study shows the predominance of males over females having hyponatremia. Male to female ratio was 1.08:1 in hemorrhagic patients and 1.27:1 in ischemic patients.[6] Out of the 77 participants in our study, 15 were reported to have hyponatremia, and 62 had eunatremia. A study showed out of the 51 participants who had hyponatremia, the majority (25%) had minor alterations in their sodium levels, and just a small number (3.8%) had substantial hyponatremia.[11] The mortality rate in our study in

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patients due to hyponatremia was observed to be less than eunatremia. Similar results were observed where the death rate was less in patients having hyponatremia than in patients without hyponatremia. 553 patients out of 647 without hyponatremia survived, whereas 94 patients passed.[4] In-hospital mortality for hemorrhagic stroke patients who were hyponatremic was almost double that of non-hyponatremic patients. The age range most often impacted in the research was between 41 and 60 years (42.55%), followed by 61 to 80 years (40.96%). (40.9%; n=27 versus 21.1%; n=75). And there was a statistically significant (p=0.001) correlation between the two.[11] According to the study, of the 353 stroke patients with hyponatremia, 197 survived, and 156 passed away (44.2%), while of the 647 patients who did not have hyponatremia, 553 lived, and 94 perished (14.5%). This time, the p-value was 0.001, which is statistically significant.[4] Another research revealed that patients with acute first-ever ischemic stroke had hyponatremia in 11.6% of instances and that this condition was a predictor of 3-year death.[7] In clinical practice, hyponatremia is crucial because it can mask signs of brain damage in individuals who already have it. Early identification of rapidly dropping sodium levels helps these individuals receive therapy.[13]

In all trials reporting on the length of hospitalization, patients with hyponatremia remained longer than those without hyponatremia.[2] In a study conducted in Iraq, hyponatremia occurred in 17% of stroke patients. Their clinical symptoms included convulsions, headaches, visual abnormalities, and altered consciousness.[6] A study of stroke patients found that hyponatremia occurred 38.6% of the time. Of them, 26% had moderate hyponatremia, 10% had severe hyponatremia, and 65% had mild hyponatremia.[11] According to the diagnosis, Sixty-four people in a sample of 100 patients had ischemic strokes.[14] Among 100 individuals who had hemorrhagic strokes, 17 were found to have hyponatremia in another investigation. According to research, 33 out of 132 individuals diagnosed with ischemic stroke with sodium levels between 130 and 134 mmol/L had hyponatremia.[10] Additionally, the study found that ischemic stroke patients did not have low blood salt levels.[14] In the hospital and after 90 days, hyponatremia was associated with a greater mortality rate in ischemia patients.[16] Another research found no association between hyponatremia and short-term fatalities, including those that occur in hospitals or within 30 or 90 days of an ischemic stroke.[6] When hospitalized, stroke patients need to have their electrolyte levels checked.[13]

In this study, Capsular infarct was the most common site in patients with hyponatremia, and capsuloganglionic bleeding was the most common in patients with eunatremia. Another study showed in the SIADH group that hemorrhages to the left putamen were more frequent than to the right putamen and right thalamus. Their investigation found that pontine hemorrhage was more prevalent.[4] The NIHSS score in our study was more in patients having hyponatremia than eunatremia. Numerous studies have shown a connection between hyponatremia and intracerebral hemorrhage and lower NIHSS scores, which increases the risk of stroke inpatient death.[16] Surprisingly, the risk of mortality is greater among younger hyponatremia patients. Due to their fragility and greater vulnerability to the negative symptoms of hyponatremia, such as disorientation, falls, and fractures, we first hypothesized that elderly persons would be most at risk.[17]

CONCLUSION

Hyponatremia was observed in 19% of Acute Stroke patients. Hyponatremia was associated with a poor NIHSS score on admission and discharge but not with the type of stroke, the size of the infarct, the side of the infarct, or death. As a result, all patients hospitalized with stroke must have their blood electrolyte levels closely monitored, and attempts must be made to discover the etiology of hyponatremia to manage such patients and reduce mortality correctly.

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