

STUDY OF ELECTROLYTE IMBALANCE IN PATIENTS WITH ACUTE STROKE AND EFFECT OF SERUM SODIUM LEVELS ON THE OUTCOME OF CEREBRO VASCULAR ACCIDENT (CVA)

Purnima Kerketta¹, Neelkanth Modi², Preeti Priya³

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Corresponding Author:

Dr. Neelkanth Modi,
Email: drnkmodi15@gmail.com

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¹Associate Professor, Department of General Medicine, Shaheed Nirmal Mahto Medical College and Hospital (SNMMCH), Dhanbad, Jharkhand, India

²Associate Professor, Department of General Medicine, MGM Medical College, Jamshedpur, Jharkhand, India

³Post Graduate, Department of General Medicine, Shaheed Nirmal Mahto Medical College and Hospital (SNMMCH), Dhanbad, Jharkhand, India

ABSTRACT

Background: Electrolyte abnormalities are common in acute stroke patients and have a substantial impact on the course and prognosis of the disease. Electrolyte imbalances such as hyponatremia, hypokalemia, hypocalcemia, and phosphate abnormalities are frequently observed. **Materials and Methods:** 150 (one hundred and fifty) patients having strokes (ischemic/hemorrhagic) were studied. Biochemical tests included fasting blood glucose and lipid profiles; serum electrolytes were studied in both ischemic and hemorrhagic strokes and compared with normal (control) groups, and significant results were noted. **Result:** Ischemic strokes were highest in the 46-55 age group, followed by the 35-45 age group, and lowest in the 76-80 age group. Hemorrhagic strokes were highest in 24 (31.5%) in the 46-55 age group. **Conclusion:** A late approach to medical aid, preexisting malnutrition, and dehydration often exacerbate electrolyte imbalances. Elevated serum sodium is observed in acute stroke patients. It will help the physician to treat such patients efficiently and reduce morbidity and mortality.

INTRODUCTION

Patients who had an acute stroke frequently have electrolyte imbalances, which can greatly affect the course of the stroke. A common electrolyte imbalance observed in individuals with acute stroke is hyponatremia, which was 15% of the patients within the 24 hours of stroke start, as per the latest studies.^[1] Hypokalemia was found in 18.7% of the patients with acute ischemic stroke. It has a greater risk of infarction and mortality.^[2] Hypocalcemia was 11.8% and influenced or linked with hemorrhagic transformation 10% to 20%. Hypomagnesemia was linked to severe stroke or mortality.^[3] Electrolyte imbalances can have serious effects on acute stroke patients since they are essential for sustaining cellular function.^[4] Hence, it is mandatory to study the prevalence and cause of electrolyte imbalance and treat the stroke patients efficiently. Therefore, this study aims to evaluate the electrolyte imbalances and their impact on cerebrovascular accidents.

MATERIALS AND METHODS

150 (one hundred and fifty) adult patients admitted to Shaheed Nirmal Mahto Medical College and Hospital (SNMMCH), Dhanbad-826005, Jharkhand, India, having the signs and symptoms of strokes were studied.

Inclusion Criteria

Patients with clinically diagnosed and CT/MRI-proven acute stroke patients (ischemic/hemorrhagic). The patients who gave their consent in writing for the study were selected. The stroke patients were compared with a 75 (seventy-five) normal (control) group to confirm and record the findings.

Exclusion Criteria

Pregnant female patients; patients receiving dialysis for chronic renal disease or failure (CRF), uncontrolled diabetes, or hyperlipidemia; patients on anti-hypertension medications; patients with cirrhosis of the liver; and immune-compromised patients were excluded from the study.

Method: Detailed previous history, family history of hypertension, diabetes, dietary pattern, addiction, and medication, and biochemical parameters including fasting blood glucose (FBG) and lipid profile (total cholesterol, triglyceride, HDL). Estimation was done

with the help of a semi-automated biochemical analyzer (ACCLAB-AT-112+) using marked kits. (Accurex Diagnostics). Serum electrolytes were estimated by the direct Ion Selective Electrode (ISE) method using the Enlite Series Electrolyte Analyzer (Acurex Biomedical Pvt. Ltd.). The duration of the study was from January 2026 to July 2026.

Statistical Analysis: Various parameters in different age groups were classified with percentages. Serum electrolyte levels were compared in both stroke patients and the normal (control) group with the t-test. The statistical analysis was carried out using SPSS software. The ratio of male and female neonates was 2:1.

RESULTS

[Table 1] Distribution of patients based on the age group and diagnosis

- The age group 35-45 had 19 (33.9%) ischemic strokes and 20 (35.7%) hemorrhagic strokes.
- The 46-55 age group had 25 (32.8%) with ischemic and 24 (31.5%) with hemorrhagic stroke.
- The 56-65 age group had 17 (35.4%) with ischemic and 16 (33.3%) with hemorrhagic stroke.
- The 66-75 age group had 11 (30.5%) with ischemic and 12 (33.3%) with hemorrhagic stroke.
- The 76-80 age group had 3 (33.3%) with ischemic and 3 (33.3%) with hemorrhagic strokes.

[Table 2] Distribution of stroke patients based on sodium, potassium, and chloride levels

- Sodium (m Eq/L): 142.80 ($\pm$ 4.70) mean value of ischemic stroke, 149.90 ($\pm$ 5.24) hemorrhagic stroke, t test was 4.51 and $p < 0.001$ (p value is highly significant).
- Chloride: 98.75 ($\pm$ 1.82) in the ischemic group, 96.52 ($\pm$ 1.42) in the hemorrhagic group, t-test 8.3 and $p < 0.001$
- But potassium had an insignificant ($p > 0.82$) p-value.

[Table 3] Comparative study of stroke patients with a normal (controlled) group, based on sodium, potassium, and chloride

- Sodium level: mean value of 143.03 ($\pm$ 5.25) in the normal group and 138.45 ($\pm$ 2.13) in the normal group; the t-test was 7.00 and $p < 0.001$ (p-value is highly significant).
- 3.82 ($\pm$ 0.25) in potassium level stroke patients, 4.32 ($\pm$ 0.32) in the normal group, the t-test was 10.4, and $p < 0.001$ (the p-value is highly significant).
- Chloride level was more or less the same in both groups; hence, the p-value was insignificant ($p > 0.35$).

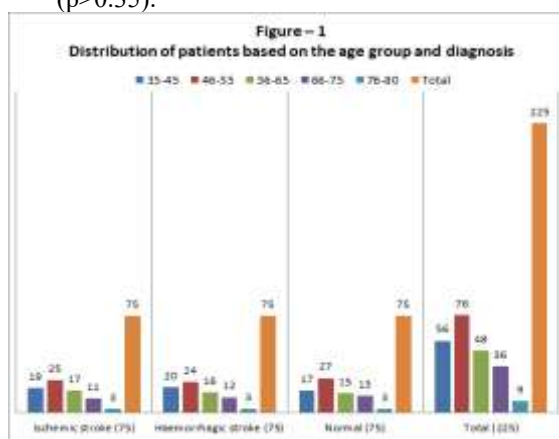


Table 1: Distribution of patients based on the age group and diagnosis

Age group	No's & %	Ischemic stroke (75)	Haemorrhagic stroke (75)	Normal (75)	Total (225)
35-45	N	19	20	17	56
	%	33.9%	35.7%	30.3%	100%
46-55	N	25	24	27	76
	%	32.8%	31.5%	35.5%	100%
56-65	N	17	16	15	48
	%	35.4%	33.3%	31.2%	100%
66-75	N	11	12	13	36
	%	30.5%	33.3%	36.1%	100%
76-80	N	3	3	3	9
	%	33.3%	33.3%	33.3%	100%
Total	N	75	75	75	225
	%	33.3%	33.3%	33.3%	100%

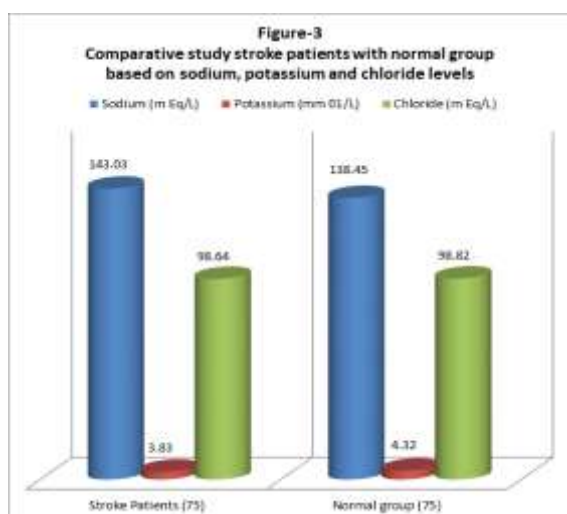
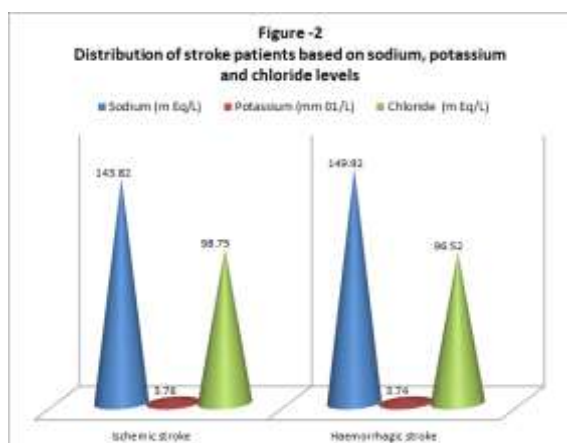
Table 2: Distribution of stroke patients based on sodium, potassium and chloride levels

Electrolytes	Ischemic stroke	Haemorrhagic stroke	t test	p value
Sodium (m Eq/L)	143.82 ($\pm$ 4.72)	149.92 ($\pm$ 5.22)	7.50	$P < 0.001$
Potassium (mm Ol/L)	3.76 ($\pm$ 0.25)	3.74 ($\pm$ 0.33)	0.41	$p > 0.82$
Chloride (m Eq/L)	98.75 ($\pm$ 1.82)	96.52 ($\pm$ 1.43)	8.34	$P < 0.001$

Table 3: Comparative study stroke patients with normal group based on sodium, potassium and chloride levels

Electrolytes	Stroke Patients (75)	Normal group (75)	t test	p value
Sodium (m Eq/L)	143.03 ($\pm$ 5.25)	138.45 ($\pm$ 2.13)	7.00	$P < 0.001$
Potassium (mm Ol/L)	3.83 ($\pm$ 0.25)	4.32 ($\pm$ 0.32)	10.4	$P < 0.001$

Chloride (m Eq/L)	98.64 ($\pm$ 1.55)	98.82 ($\pm$ 1.43)	0.41	P>0.35
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DISCUSSION

Present study of electrolyte imbalance in patients with acute stroke and the effect of serum sodium levels on the outcome of CVA in the Jharkhand population. Ischemic stroke was highest in the 46-55 age group, 25 (32.8%), followed by the 35-45 age group, 19 (33.9%), and least in the 76-80 age group, 3 (33.3%). The highest number of hemorrhagic strokes, 24 (31.5%), was in the 46-55 age group [Table 1]. In the comparison of ischemic stroke and hemorrhagic stroke, the p-value was significant in sodium and chloride level [Table 2]. In the comparison of stroke electrolytic level and the normal group (controlled group), the p-value was significant in the sodium and potassium study [Table 3]. These findings are more or less in agreement with previous studies.^[5-7]

Serum sodium levels are physiologically maintained within a narrow range, despite wide variations in water and salt intake. Serum osmoregularity is tightly regulated by the interaction between. The secretion and action of the antidiuretic hormone vasopressin (AVP), which is synthesized in the hypothalamus, and the sensation of thirst to promote water intake from the thirst center of the hypothalamus.^[8]

Hyponatremia (defined as serum sodium level <135 mmol/L) is frequent in patients who had acute stroke and is associated with longer hospitalization, higher short-term mortality, and poorer outcomes. The cause of this disorder is usually due to the syndrome of inappropriate antidiuretic hormone (SIADH) and, less frequently, cerebral salt wasting syndrome (CSWS) and inappropriate fluid intake and loss.^[9]

Clinically low potassium levels can result in muscle cramps, flaccid paralysis, and dangerous cardiac arrhythmias, complicating the course of recovery. On the other hand, hyperkalemia, although less common, may arise due to renal dysfunction, acidosis, hemolysis, or excessive potassium supplementation. It is a medical emergency, as it may cause life-threatening arrhythmias, such as ventricular fibrillation. In both cases, prompt diagnosis through ECG monitoring and regular serum potassium estimation is vital; corrective measures, including oral or IV potassium supplements or insulin dextrose infusion with calcium gluconate for hypokalemia, must be undertaken based on severity. Inclusion of routine potassium monitoring in stroke management protocols is therefore essential to prevent cardiac and neuromuscular complications.^[10]

In hemorrhagic strokes, symptoms like headache and vomiting are frequent, which contribute further to dyselektrolytemia. Apart from neurological complications such as recurrent strokes and seizures, stroke patients are also vulnerable to several medical complications, including chest infections, urinary tract infections, bowel and bladder dysfunction, deep vein thrombosis, pulmonary embolism, gastrointestinal bleeding, aspiration pneumonia, pressure ulcers, and malnutrition.^[11]

As compared to males, females are less affected, which may be because of the positive effects of estrogen on cerebral circulation. The incidence of stroke rises with age, maybe because of an unhealthy diet and lack of exercise. Multiple studies have affirmed that patients with electrolyte imbalances, particularly hyponatremia and hypernatremia, have significantly worse outcomes.^[12]

Rural patients face delays in reaching stroke-ready hospitals, further worsening the prognosis. Poor nutrition, dehydration due to a hot climate, and underlying comorbidities such as diabetes or hypertension complicate electrolyte profiles.^[13]

CONCLUSION

Electrolyte imbalances are often exacerbated by a late approach to medical aid, pre-existing malnutrition, dehydration, and lack of awareness. Routine electrolyte screening, early identification of the syndrome of inappropriate antidiuretic hormone secretion (SIADH) or cerebral salt wasting syndrome (CSWS), and timely correction are essential to improve outcomes. The present study demands that

such a study must be conducted in a large number of patients, where the latest technological facilities are available to treat emergency conditions, to confirm the present findings and results.

Limitation of study: Owing to the remote location of the research center, small number of patients, and lack of the latest techniques, we have limited findings and results.

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