

# Study of Electrolyte Status Inpatients with Acute Stroke and their Outcome

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**Abstract:** Background: Stroke is one of the main causes of chronic disability and mortality among the adults. Electrolyte imbalances are an important cause of morbidity and mortality in patients with acute stroke. Objectives: To find out the incidence of electrolyte abnormalities in acute stroke patients and their association with severity of acute stroke. Materials and methods: We studied the serum sodium and potassium in 80 patients with acute stroke based on clinical and radiological study. This study was an observational study conducted at biochemistry and neurosurgery department, RIMS, Ranchi, Jharkhand between June 2018 to May 2019. Data was obtained from medical records. Results: We studied the 80 patients of acute stroke out of which 66.25% were male and 33.75% were female. 40% patients were in between age group 61-70 years followed by 35% were in age group 51-60 years. 57.50% patients had ischemic stroke, 40.00% had hemorrhagic stroke and 2.50% had subarachnoid hemorrhage. 56.25% of acute stroke patients had electrolyte disturbances. 65.62% of hemorrhagic stroke patients, 52.17% of ischemic stroke patients had electrolyte disturbances. Conclusion: In haemorrhagic stroke, the incidence of electrolytes imbalance was more than ischaemic and which were mostly hyponatraemia and hypokalaemia. Electrolyte imbalance may adversely affect outcome of stroke.

**Keywords:** Stroke, Ischemic, Hemorrhagic, Dyselectrolytemia

## 1. Introduction

Stroke is a common public health problem. It is the second most common cause of death worldwide and is associated with high mortality and morbidity<sup>1</sup>.

Stroke has enormous contribution to economic and social burden for patients and their family<sup>2</sup>. Different factors like chest infection, UTI, deep vein thrombosis, pulmonary embolism, aspiration, bedsores and malnutrition are the common complication after acute stroke<sup>3</sup>. Electrolyte disturbances are also commonly found in CVA and may contribute to mortality of these patients unless corrected urgently<sup>4</sup>. Disorders of sodium and potassium concentration are the common electrolyte abnormalities found in the acute stroke patients. Electrolyte disturbances such as hypernatraemia or hyponatraemia resulting from syndrome of inappropriate antidiuretic hormone (SIADH), increase in brain natriuretic peptide (BNP), inappropriate fluid intake and loss<sup>5</sup>.

Even though there are some data about large number of electrolyte disturbances in acute stroke patients, study on the association between electrolyte disturbances and severity of acute stroke are still limited. Timely diagnosis and treatment of electrolyte imbalances can improve the prognosis of the patients.

## 2. Aims and Objectives

- 1) To study the different serum electrolyte level in CVA patients.
- 2) To find any relation of the electrolyte changes with mortality.

## 3. Material and Methods

This was a observational, hospital based , prospective study . The study was carried out at RIMS, Ranchi, Jharkhand between June 2018 to May 2019 among patients with acute stroke. To determine the subtype of acute stroke history, general physical examination and radiological study was done. At the time of admission a data sheet was used to record different demographic and clinical data. Serum electrolytes level was done in Ekolyte machine by ion selective electrode method in all patients at the time of admission. All data were collected in individual case record form. Statistical analysis was carried out by using SPSS v16.0 windows statistical software. Informed and written consent obtained from the attendant of the patients. The study was approved by the institutional ethical committee of RIMS, Ranchi. The patients were followed up during stay in hospital and before discharge from the hospital using GOS scale.

## 4. Results

A total of 80 patients of acute stroke patients confirmed by CT scan were studied. Out of 80 patients 66.25% were male and 33.75% were female patients. 40% patients were in between 61-70 years age group. Out of 80 patients 57.50% had ischemic stroke, 40% had hemorrhagic stroke and 2.50% had subarachnoid hemorrhage.

**Table 1:** Demographic characteristics of the patients

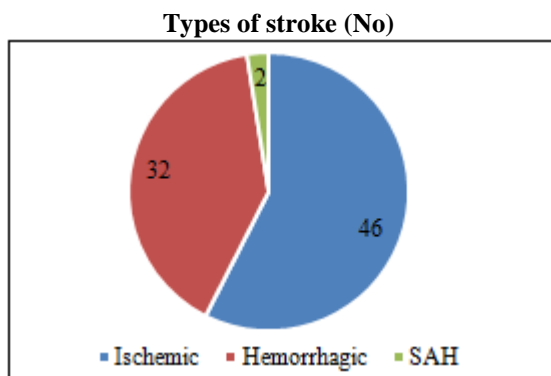
Age group(years)	Male	Female	Total
51– 60	21	11	32
61– 70	24	4	28
71– 80	6	10	16
>80	2	2	4
Total	53	27	80

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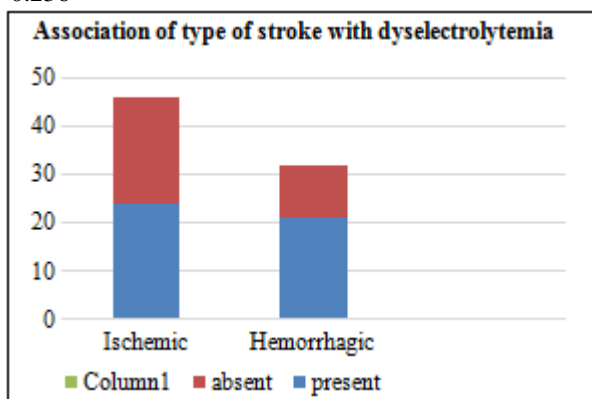
Out of 80 patients with acute stroke 57.5 % of patients had electrolyte abnormalities of which 63% of hemorrhagic stroke, 44% of ischemic stroke patients had electrolyte disturbances.



**Table 2:** Association of type of stroke with dyselectrolytemia

Dyselectrolytemia	Ischemic (n=46)		Hemorrhagic (n=32)	
	N	%	N	%
Present	24	52.17	21	65.62
Absent	22	47.82	11	34.37

P=0.236



**Table 3:** Serum sodium level in hemorrhagic and ischemic stroke

Types of stroke	Normal	Hyponatremia	Hypernatremia	Total
Hemorrhagic	13 (40.62%)	17 (53.12%)	2 (6.25%)	32 (40.00%)
Ischemic	30 (65.21%)	12 (26.08%)	4 (8.69%)	46 (57.50%)

P= 0.05

**Table 4:** Serum potassium level in hemorrhagic and ischemic stroke

Types of stroke	Normal	Hypokalemia	Hyperkalemia	Total
Hemorrhagic	18 (56.25%)	14 (43.75%)	0 (0.00%)	32 (40.00%)
Ischemic	34 (73.91%)	10 (21.73%)	2 (4.34%)	46 (57.50%)

P=0.14

**Table 5:** Dyselectrolytemia and Glasgow coma scale (GCS).

Serum electrolytes	Minor (13-15)		Moderate (9-12)		Severe (3-5)	
	No	%	No	%	No	%
Dyselectrolytemia present (n=45)	26	57.77	13	28.88	6	13.33
Normal electrolytes(n=33)	25	75.75	6	18.18	2	6.06

P=0.24

**Table 7:** Dyselectrolytemia and Glasgow Outcome Scale (GOS).

Serum electrolytes	Good GOS(4-5) No. (%)	Poor GOS(2-3) No. (%)	GOS(1) Death No. (%)
Dyselectrolytemia	22(48.89)	15(33.33)	8(17.77)
Normal electrolytes	28(84.84)	5(15.15)	2(6.06)

P=0.01

## 5. Discussion

Stroke is dominantly occurred at the middle age group or above. Maximum patients were from 51-60 years age groups (40.0%) followed by 61-70 years age group (35.0%). In the study conducted by Hasaan H. Musa et al<sup>6</sup>, the common affected age group was between 41 and 60 years (42.55%), followed by age group 61 and 80 (40.96%).

In our study 53 were males and 27 were females. M Kalyan et al<sup>7</sup> indicated that stroke is more prevalent among men than women with ratios varying from 1.3:1 to 2:1.

In this present study radiological finding of the studied patients show the majority 57.50% patients had ischemic stroke, 40.25% had ischemic stroke and only 2.25% had subarachnoid haemorrhage. MR Siddiqui et al<sup>8</sup> reported 53% ischemic stroke and 45% ICH in their series.

In our study of 80 stroke patients, 45 (56.25%) had dyselectrolytaemia. The study conducted by Hasan MK et al<sup>6</sup>, 70% of all patients with acute stroke had electrolyte disturbances. In our study, 21 (65.62%) haemorrhagic stroke patients had dyselectrolytaemia in comparison to 24 (56.25%) ischaemic stroke patient. The association between type of stroke and dyselectrolytaemia was statistically insignificant (p= 0.236). The study conducted by Mahmudur Rahman Siddiqui et al<sup>8</sup> 53% of total acute stroke patients had dyselectrolytaemia. 62.22% of acute haemorrhagic stroke & 43.39% of acute ischaemic stroke patients had dyselectrolytaemia. Of our 80 stroke patients, 29 (36.25%) patients had hyponatraemia and 6 (7.50%) had hypernatraemia and 45 (56.25%) had normal serum sodium levels. Also in present study, 12 (26.08%) ischaemic stroke patients had hyponatremia in comparison to 17 (53.12%) haemorrhagic stroke patients. 13 (40.62%) haemorrhagic stroke patients had normal serum sodium level in comparison to 30 (65.21%) ischaemic stroke patient. The association between type of stroke and serum sodium level was statistically significant (p=0.048). This was similar to the study conducted by Hasaan H. Musa et al<sup>7</sup> Sisir Chakraborty et al<sup>10</sup> and by Hasan MK et al<sup>6</sup>, which had prevalence of hyponatraemia in ischemic strokes.

In our study, we found that the hyponatremia and hypokalemia are more common in hemorrhagic stroke, followed by ischemic stroke, then SAH. Low sodium level was mainly detected among patients with hemorrhagic stroke followed by ischemic stroke patients, and there is a statistically not significant association between hyponatremia and type of stroke. A study by Alam et al<sup>11</sup> revealed that hyponatremia is the main electrolyte disturbances in CVA, both in ischemic and hemorrhagic stroke. Another study by Kusuda et al<sup>12</sup> also showed

hyponatremia, hypernatremia, hypokalemia, and hyperkalemia in CVA. The study also stated that hypernatremia is more common in hemorrhagic stroke. Watanabe O et al<sup>13</sup>, Guo Z et al<sup>14</sup> and Bremer AM et al<sup>15</sup> also showed the disturbances of electrolyte levels in cerebrovascular accidents.

The level of consciousness assessment for patients included in the present study was performed according to the GCS. Our study shows insignificant difference in the distribution of patients according to GCS levels (as mild, moderate, and severe disturbances of consciousness) ( $p=0.24$ ). We detect that patients presenting with hemorrhagic stroke had a low conscious level in comparative with ischemic and SAH.

We propose that if the patients of cerebrovascular accidents are assessed for electrolyte disturbance as early as possible, it can help the clinician for better prognosis and avoid complications. In dyselectrolytic patients, GCS was minor (13-15) in 26(57.77%), moderate (9-12) in 13(28.88%) and severe (3-8) in 6 (13.13%) cases. Electrolytes were normal in 33 of stroke patients with minor Glasgow scale in 25(75.75%), moderate in 6 (18.18%) and severe in 2(6.06%) patients.

62.5% of all patients had good outcome and 25% of all patients had poor outcome. Patients who had normal electrolytes, 84.84% had good outcome. Patients who had dyselectrolytemia, 33.33% had poor outcome. Association between electrolyte imbalance & outcome of stroke is statistically significant ( $p=0.02$ ).

In patients with dyselectrolytemia 22 (48.88%) had good GOS (4-5), 15 (33.33%) had poor GOS (2-3) and 8 (17.17%) had deaths (GOS 1). Where as in patients with normal electrolytes 28 (84.84%) had good GOS, 5(15.15%) had poor GOS and 2 (6.06%) had GOS 1 (deaths) (Table 7). Thus, in 33.33% patients with dyselectrolytemia had poor GOS versus 15.15% had poor GOS with normal electrolyte status. GOS 1 (deaths) was 17.77% in patients with dyselectrolytemia versus 6.06% with normal electrolyte status. ( $P 0.02$ ), indicating that patients with dyselectrolytemia had more deaths than in patients with normal electrolytes with similar GOS.

Bandopadhyay et al showed that 48% of their acute stroke patients with dyselectrolytemia had good outcome with GOS (4-5) in comparison to 82% of patients with normal electrolytes and 52% had poor outcome GOS (13) versus 18% with normal electrolytes.<sup>12</sup> A death rate with dyselectrolytemia was 23% is comparable to our study.

## 6. Conclusion

Our study reveals that electrolyte imbalances are the usual problem in acute stroke patients. Hyponatremia and hypokalemia are the main electrolyte disturbances in both ischemic and hemorrhagic stroke. Patients with normal electrolyte balance had best outcome and it was statistically significant; thus, early detection and correction of electrolyte disturbances may prevent further morbidity and mortality in acute stages of strokes.

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**Conflict of interest:** None declared

Ethical approval: Institutional Research & Ethics Committee

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