

## ELECTROLYTE DISTURBANCES (SODIUM AND POTASSIUM) AMONG ACUTE STROKE PATIENTS AT A TERTIARY CARE HOSPITAL IN WESTERN MAHARASHTRA

Swati Aundhakar<sup>1</sup>, Piyush Prajapati<sup>2</sup>, Bhavik Shah<sup>3</sup>, Aken Desai<sup>4</sup>, Aditya Aundhakar<sup>5</sup>, Arjun Mandade<sup>6</sup>, Abhijit Patil<sup>7</sup>, Nirav Sutariya<sup>8</sup>

<sup>1</sup>Professor and HOD, Department of Internal Medicine, KIMS, Karad.

<sup>2</sup>Third Year Junior Resident, Department of Internal Medicine, KIMS, Karad.

<sup>3</sup>Third Year Junior Resident, Department of Internal Medicine, KIMS, Karad.

<sup>4</sup>Third Year Junior Resident, Department of Internal Medicine, KIMS, Karad.

<sup>5</sup>Second Year Junior Resident, Department of Internal Medicine, KIMS, Karad.

<sup>6</sup>Second Year Junior Resident, Department of Internal Medicine, KIMS, Karad.

<sup>7</sup>Second Year Junior Resident, Department of Internal Medicine, KIMS, Karad.

<sup>8</sup>Second Year Junior Resident, Department of Internal Medicine, KIMS, Karad.

### ABSTRACT

#### BACKGROUND

In our country, there are many studies on stroke, its associated conditions and their effect on stroke patient's outcome, but a few studies on electrolytes status in stroke patients have been done in our country, even outside.

#### AIMS AND OBJECTIVES

Find out the incidence of electrolyte imbalance in acute stroke setting and their association with severity of acute stroke.

#### METHODS

A total number of 150 randomly selected, clinically and CT proven acute stroke patients were studied at medicine units of Krishna Institutes of Medical Sciences, Karad. Electrolytes status in different type of acute stroke patients.

#### RESULTS

Out of 150 patients, 34% were in between 61-70 years age group and 60.66% were male and 39.33% were female patients. Majority 66.66% patients had Ischaemic Stroke, 30% Intracerebral Haemorrhage (ICH) and only 3.33% had Subarachnoid Haemorrhage (SAH). 67.97% of total acute stroke patient had Electrolyte imbalance. Total 38.66% of all stroke patients had serum sodium imbalance and 29.32% had serum potassium imbalance. In haemorrhagic stroke and ischaemic stroke patients, hyponatraemia (9.33% and 19.33%), hypernatraemia (2.66% and 6%), hypokalaemia (6% and 18.66%), hyperkalaemia (0% and 2.66%), respectively.

#### CONCLUSION

Hyponatraemia and hypokalaemia are most common abnormalities in both ischaemic and haemorrhagic stroke patients. Electrolyte abnormalities result from inappropriate secretion of Antidiuretic Hormone (ADH), increased B-type Natriuretic Peptide (BNP) and Atrial Natriuretic Peptide (ANP) secretion; as well as inappropriate and/or inadequate fluid administration and loss of fluid due to vomiting. Electrolyte abnormalities may adversely affect outcome of the acute stroke patients. So, serum electrolytes level should be determined in every patient with acute stroke. Thus, fluid intake and electrolyte levels should be closely monitored in patients with acute stroke.

#### KEYWORDS

Electrolyte Imbalance, Sodium, Potassium, Severity, Stroke.

**HOW TO CITE THIS ARTICLE:** Aundhakar S, Prajapati P, Shah B, et al. Electrolyte disturbances (sodium and potassium) among acute stroke patients at a tertiary care hospital in western Maharashtra. J. Evolution Med. Dent. Sci. 2016;5(70):5127-5130, DOI: 10.14260/jemds/2016/1163

#### INTRODUCTION

Stroke is a major public health problem. It is globally well-distributed and is ranked at the second top cause of death around the world. Stroke causes a great impact on disability rate. Stroke also has enormous contribution to economic and social burden for patients and their family.<sup>[1]</sup>

*Financial or Other, Competing Interest: None.*

*Submission 25-07-2016, Peer Review 18-08-2016,*

*Acceptance 24-08-2016, Published 01-09-2016.*

*Corresponding Author:*

*Dr. Piyush Prajapati,*

*Room No.-107, IHR Hostel,*

*Krishna Institute of Medical Sciences,*

*Malkapur,*

*Karad-415539.*

*E-mail: prajapatipiyush786@gmail.com*

*DOI: 10.14260/jemds/2016/1163*

A stroke or Cerebrovascular Accident (CVA) is defined as abrupt onset of a neurologic deficit that is attributable to a focal vascular cause.<sup>[2]</sup> There are two main types of cerebrovascular accidents. An ischaemic stroke or infarct caused by a blockage and haemorrhagic stroke (intracranial bleed) caused by a breakage in a blood vessel.<sup>[3]</sup> In these types, the release of osmotically active substances like arachidonic acid, electrolytes, lactic acid from the brain tissue causes cerebral oedema followed by vascular injury and electrolyte imbalance.<sup>[4]</sup> This electrolyte imbalance maybe accompanied by the shift of extracellular fluid into intracellular fluid ultimately causing brain oedema.<sup>[5]</sup>

In almost all neurological disorders, electrolyte disturbances were prominent. Electrolyte disturbance are commonly found in acute stroke setting.<sup>[6]</sup>

Hypernatraemia, hyponatraemia and hypokalaemia was the commonest type of disturbance.<sup>[7]</sup> Recently, research with electrolyte disturbances is not only focusing on the neuroendocrine mechanism, but also on its prevalence, risk factors and association with other medical condition.<sup>[7]</sup>

Even though there are some data about large number of electrolyte disturbances in acute stroke setting, reports on the association between electrolyte imbalance and severity of acute stroke are still in limited number. There is a lack of data about this association especially from developing countries. The objectives of this study were to find out the incidence of electrolyte disturbances in acute stroke setting and their association with severity of acute stroke.

**MATERIALS AND METHODS**

**Source of Data:** A detailed history and physical examination details were collected from patient records in the hospital medical record department. Laboratory investigations (sodium, potassium) were also obtained from the records.

**Method of Collection of Data:** A total of one hundred and fifty patient records were accessed from the medical records department in Krishna Medical College, Karad.

**Design of The Study:** Retrospective cross-sectional descriptive study.

**Duration of the Study:** The study was carried out on patients presenting with stroke during an 18-month period from 1<sup>st</sup> July 2014 to 31<sup>st</sup> December 2015.

Diagnosis of stroke was based on history, physical examination and the disease was confirmed by neuroimaging study. Electrolytes analysed in this study were sodium and potassium. Sodium level in a range of 133-146 Meq./L was defined as normal. Potassium level in a range of 3.5-5.5 Meq./L was defined as normal. Other values were categorised as electrolyte disturbances. Hyponatraemia was defined when the level below 133 Meq./L. Hypernatraemia was the level of Sodium above 146 Meq./L. Hypokalaemia was the level of Potassium below 3.5 Meq./L, while Hyperkalaemia was when the level of Potassium above 5.5 Meq./L. All the patients who met the inclusion criteria were recruited as samples.

**Inclusion Criteria**

Were: 1. Patients who were not receiving diuretic therapy. 2. Patient was not in resuscitation phase. 3. There was no history of kidney or endocrine diseases.

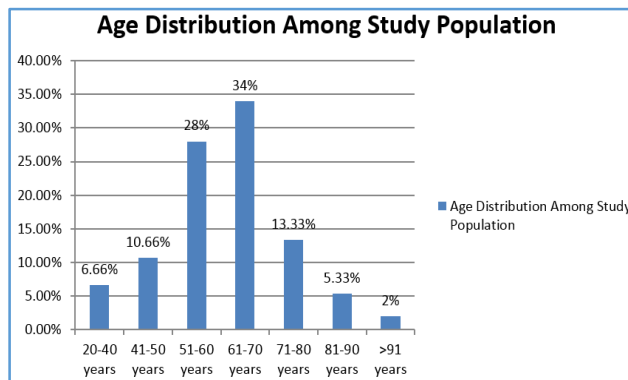
**Exclusion Criteria**

We excluded all patients with a complication that might affect electrolyte status during their stroke management.

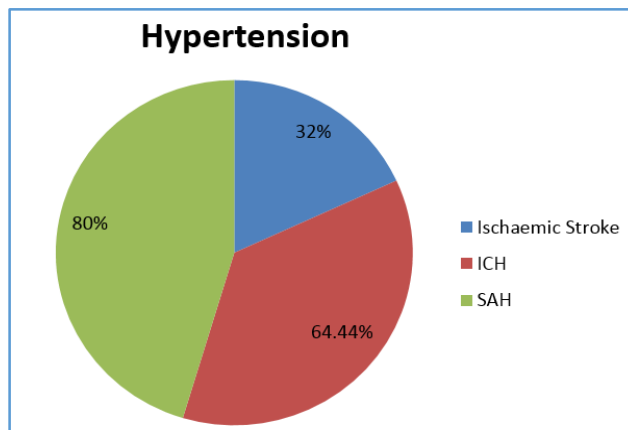
**RESULTS**

Out of total 150 patients, 34% of patients were in between 61-70 years age group, 28% between 51-60 years age group, 13.33% of patients were in between 71-80 years age group, 5.33% of patients were in between 81-90 years age group, 2% above 90 years of age, 10.66% of patients were in between 41-50 years age group, 6.66% 18 patients were between 20-40 years age group. 58% were male and 42% were female

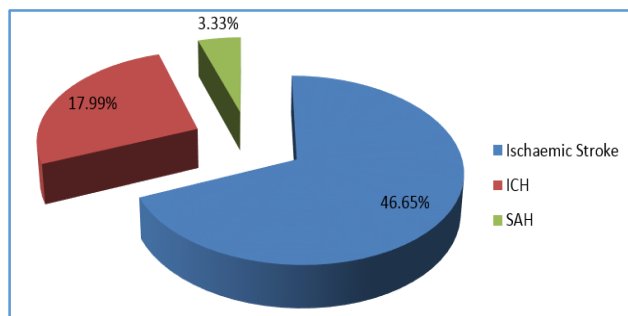
patients. CT scan findings reveal majority 66.66% patients had ischaemic stroke, 30% had intracerebral haemorrhage (ICH) and only 3.33% had subarachnoid haemorrhage (SAH). 64.44% of haemorrhagic stroke, 32% of ischaemic stroke patients and 80% SAH were hypertensive. 67.97% of all patients with acute stroke had electrolyte disturbances. Of which 46.65% of ischaemic stroke, 17.99% of haemorrhagic stroke and 3.33 of SAH patients had electrolyte abnormalities. Serum Sodium Imbalance chi-square was 0.6890 and P - Value was 0.9527, which was no statistically significant. Serum Potassium Imbalance chi-square was 6.221 and P - Value was 0.1833, which was no statistically significant.



**Fig. 1: Age Distribution Among Study Population**



**Fig. 2: Hypertension Among Acute Stroke**



**Fig. 3: Electrolyte Imbalance Among Acute Stroke**

Types of Stroke	Normal S. Sodium (%)	Hyponatraemia (%)	Hypernatraemia (%)	Total (%)	Chi-Square	Degree of Freedom	P value
Ischaemic stroke	62 (41.33%)	29 (19.33%)	9 (6%)	100 (66.66%)	0.6890	4	NS
ICH	27 (18%)	14 (9.33%)	4 (2.66%)	45 (30.00%)			
SAH	3 (2%)	2 (1.33%)	0 (0%)	5 (3.33%)			
<b>Total</b>	<b>92 (61.33%)</b>	<b>45 (30%)</b>	<b>13 (8.66%)</b>	<b>150 (100%)</b>			

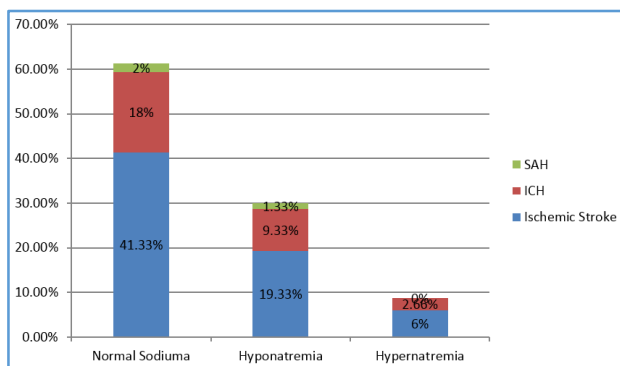
**Table 1: Frequency of Serum Sodium Imbalance in Acute Stroke Patients**

S: serum, normal serum sodium: (133-146 meq/L), hyponatraemia: (<133 meq/L), hypernatraemia: (>146 meq/L) NS: Not Significant.

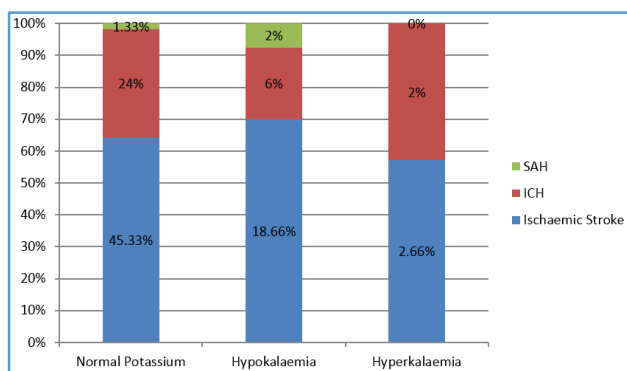
Types of Stroke	Normal S. Potassium (%)	Hypokalaemia (%)	Hyperkalaemia (%)	Total (%)	Chi-Square	Degree of Freedom	P value
Ischaemic stroke	68 (45.33%)	28 (18.66%)	4 (2.66%)	100 (66.66%)	6.221	4	NS
ICH	36 (24%)	9 (6%)	0 (0%)	45 (30.00%)			
SAH	2 (1.33%)	3 (2%)	0 (0%)	5 (3.33%)			
<b>Total</b>	<b>103 (70.66%)</b>	<b>40 (26.66%)</b>	<b>4 (2.66%)</b>	<b>150 (100%)</b>			

**Table 2: Association of Serum Potassium Imbalance in Acute Stroke Patients**

S: serum, normal serum potassium: (3.5-5.5 meq/L), hypokalaemia: (<3.5 meq/L), hyperkalaemia: (>5.5 meq/L), NS: Not Significant



**Fig. 4: Frequency of Serum Sodium Imbalance in Acute Stroke Patients**



**Fig. 5: Association of Serum Potassium Imbalance in Acute Stroke Patients**

Table I shows that 30% of all acute stroke patients had hyponatraemia. Hyponatraemia was most common among ischaemic stroke patients (19.33%) followed by ICH patients (9.33%) and SAH patients (1.33%). Only 8.66% patients had hypernatraemia of which 6% ischaemic stroke and 2.66% were ICH patients, respectively. Total 38.66% of all stroke patients had serum sodium abnormality during acute stroke.

Table II shows that 26.66% of all acute stroke patients had hypokalaemia. Hypokalaemia was most commonly found among ischaemic stroke patients (18.66%) followed by haemorrhagic stroke patients (6%) and subarachnoid haemorrhage patients (2%). Only 2.66% of all stroke patients had hyperkalaemia, which was one patient with ischaemic stroke. Total 26.66% of all acute stroke patients had serum potassium imbalance.

**DISCUSSION**

The incidence of stroke increases with increasing age. In our present study, 34% of patients were in between 61-70 years age group, 28% between 51-60 years age group, 13.33% of patients were in between 71-80 years age group, 5.33% of patients were in between 81-90 years age group 2% above 90 years of age, 10.66% of patients were in between 41-50 years age group, 6.66% of patients were between 20-40 years age group. 58% of patients were males and 42% patients were females, i.e., male incidence was 21.33% higher than female, which is almost similar to the study of Siddique MR et al in DMCH in 2010. Majority of the patients (46.65%) had ischaemic stroke, 17.99% patients had intracerebral haemorrhage and only 3.33% patients had subarachnoid haemorrhage. Our study differs markedly from most of the western studies where cerebral infarction and ICH comprise 80% and 20% of acute stroke patients, respectively.

But, our study well correlates with the studies done by Badiuzzaman M et al and Siddique MR et al in DMCH in 2007<sup>[8]</sup> and in 2010, respectively. Higher rates of haemorrhagic stroke in our country maybe due to inadequate treatment or no treatment of hypertension by many of our patients due to poverty and lack of health awareness and poor drug compliance leading to sudden rise of blood pressure causing intracerebral haemorrhage.

In this study, 67.97% of all acute stroke patients had electrolyte abnormalities. Among 100 patients with ischaemic stroke, 46.65% among 45 patients with haemorrhagic stroke 17.99% and among 5 patients with subarachnoid haemorrhage 3.33% had electrolyte abnormalities.

Our study differs from the study of Siddique MR et al. They found 53% patients with acute stroke had electrolyte imbalance of which 62.22% of haemorrhagic stroke patients, 43.39% of ischaemic stroke patients and 100% of patients with SAH had electrolyte imbalance, respectively. This may be due to these small scale hospital-based studies, which may not be representative of the problem in whole country. Moreover, data on electrolyte disturbances in patients with acute stroke are relatively scanty in our country as well as in other parts of the world so difficult to compare.

In our study, 30% of all stroke patients had hyponatraemia (Table I), which is similar to the study of Siddique MR et al.<sup>[9]</sup> Hyponatraemia was most common among ischaemic stroke patients (19.33%) followed by haemorrhagic stroke patients (9.33%) and subarachnoid haemorrhage (1.33%). This finding differs from the study of Siddique MR et al, but they found no statistically significant association of hyponatraemia and types of stroke. Only 8.66% patients had hypernatraemia of which 6% were ischaemic stroke patients and 2.66% of haemorrhagic stroke patients. Total 38.66% of all stroke patients had serum sodium imbalance during acute stroke, which is similar to the findings of Siddique MR et al,<sup>[9]</sup> 26.66% of all stroke patients had hypokalaemia (Table II). Hypokalaemia was most common among ischaemic stroke patients (18.66%) followed by haemorrhagic stroke patients (6%) and patients with SAH (2%). Only 2.66% patients with ischaemic stroke and none with ICH or SAH had hyperkalaemia. Total 29.32% patients had serum potassium abnormality during acute stroke.

In a study, Kusuda K et al<sup>10</sup> found that 34% of acute stroke patients presented with serum sodium imbalance and 44% with serum potassium imbalance; these results correlate well with our study. However, both hyponatraemia and hypokalaemia were more common in ischaemic stroke patients in our study, which differs from the study of Kusuda K et al and Siddique MR et al who found these to be more common with haemorrhagic stroke.

## CONCLUSION

This study reveals that electrolyte disturbances are quite common problem after acute stroke. Hyponatraemia and hypokalaemia are most common abnormalities in both ischaemic and haemorrhagic stroke patients. Electrolyte abnormalities result from inappropriate secretion of ADH,

increased BNP and ANP secretion as well as inappropriate and/or inadequate fluid administration and loss of fluid due to vomiting. Electrolyte abnormalities may adversely affect outcome of the acute stroke patients. So, serum electrolytes level should be determined in every patient with acute stroke. Thus, fluid intake and electrolyte levels should be closely monitored in patients with acute stroke.

## REFERENCES

1. WHO. The WHO STEPwise approach to stroke surveillance. Noncommunicable Diseases and Mental Health. WHO press Geneva 2005.
2. Smith WS, English JD, Johnston SC. Cerebrovascular diseases. Harrison's Principles of Internal Medicine. 17<sup>th</sup> ed. McGraw Hill Medical Publishers 2008:2513-36.
3. Ellis ME. Cerebrovascular accident review in health line - Brain health on www.healthline.com 2013:1-4.
4. Schuier FJ, Hossmann KA. Experimental brain infarcts in cats. II. Ischemic brain edema. Stroke 1980;11(6):593-601.
5. Siddiqui MR, Islam QT, Haque MA, et al. Electrolytes status in different type of acute stroke patients and their correlation with some common clinical presentation. J Medicine 2012;13(2):133-7.
6. Lath R. Hyponatremia in neurological diseases in ICU. Indian J Critical Care Med 2005;9(1):47-51.
7. Aiyagari V, Deibert E, Diringer MN. Hyponatremia in the neurologic intensive care unit: how high is too high? J of Crit Care. 2006;21(2):163-72.
8. Badiuzzaman M, Mohammed FR, Chowdhury FR, et al. Prevalence of modifiable risk factors among stroke patients in a tertiary care hospital in Dhaka.
9. Siddique MR, Islam QT, Haque MA, et al. Dyselectrolytaemia in acute stroke patients, an observational study. Bangladesh J Medicine 2011;22(2):30-4.
10. Kusuda K, Saku Y, Sadoshima S, et al. Disturbances of fluid and electrolyte balance in patients with acute stroke. Nihon Ronen Igakkai Zasshi 1989;26(3):223-7.