A study on electrolyte abnormalities among stroke patients

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Abstract

Background: Globally, cerebrovascular accidents (stroke) are the 2nd leading cause of death and 3rd leading cause of disability. Worldwide, 70 p.c of stroke cases and 87 p.c of both stroke-related deaths and disability-adjusted life years occur in low- and middle-income countries. In India, the incidence of stroke ranged from 105 to 152 per lakh persons per year during the past 20 years. Sodium and potassium concentration disorders are the common electrolyte abnormalities reported in cerebrovascular accident (CVA) and lead to mortality if not corrected in time. **Aim and Objectives:** To study the common electrolyte disturbances among different types of stroke patients. To study their association with outcome of stroke. **Material and Methods:** A hospital-based, analytical prospective observational study was conducted among fifty individuals who presented with stroke and got admitted in Department of General Medicine of Sapthagiri Institute of Medical Sciences and Research Center, Bangalore. The study was conducted for a period of 8 months from 1st August 2017 to 31st March 2018. A prior permission was obtained from the institutional ethics committee. The study population included patients aged 16 years or above of both genders admitted within 48 hours of onset and with a CT-Brain confirmation of stroke. Using a standardized proforma demographic data and clinical data were obtained. The subtype of stroke was determined by clinical examination and CT scan of brain. Total serum sodium and potassium levels were determined. Patients were followed-up for two weeks during their stay and before discharge from the hospital using Glasgow outcome scale. The data obtained was entered in Microsoft Excel and analyzed in SPSS version-22 trial. Chi-square test was performed. A *p*-value of less than 0.05 was considered significant. **Results** Majority 64 p.c (32) were males and 36 p.c (18) were females. Majority 52 p.c (26) had ischemic stroke followed by 46 p.c (26) had intracerebral hemorrhagic stroke and 2 p.c (1) had subarachnoid hemorrhagic stroke. Among patients with hemorrhagic stroke 66.6 p.c (16) had dyselectrolytemia and 33.4 p.c (8) had normal electrolytes and among patients with ischemic stroke 46.2 p.c (12) had dyselectrolytemia and 53.8 p.c (14) had normal electrolytes. **Conclusion:** Electrolyte imbalance commonly occurs during and after acute stroke. Hyponatremia and hypokalemia are most common electrolyte imbalances in both ischemic and hemorrhagic stroke.
Keywords: Electrolyte abnormalities, stroke.

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INTRODUCTION

Globally, cerebrovascular accidents (stroke) are the 2nd leading cause of death and 3rd leading cause of disability.[1] World Health Organization (WHO) defined stroke as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin".[2] Worldwide, 70 p.c of stroke cases and 87 p.c of both stroke-related deaths and disability-adjusted life years occur in low- and middle-income countries.[3] In India, the incidence of stroke ranged from 105 to 152 per lakh persons per year during the past

20 years.[4] According to the Indian stroke factsheet (2012), the estimated age-adjusted prevalence rate for stroke ranged from 84 to 262 per lakh in rural areas and 334 to 424 per lakh in urban areas.[4] In a door-to-door survey conducted in Kolkata, the age-standardized incidence rate of first-ever-in-a-lifetime stroke was 145 per lakh person-years.[5] Developing countries are now facing a dual burden of both non-communicable and communicable diseases. In India, Stroke is one of the leading causes of morbidity, disability and mortality. Sodium and potassium concentration disorders are the common electrolyte abnormalities reported in cerebrovascular accident (CVA) and lead to mortality if not corrected in time. [6] In a study conducted by Alam MN *et al..* it was reported that there was no significant difference in hemorrhagic and ischemic stroke, also hyponatremia, hypokalemia and hypochloridemia were more common than hypernatremia, hyperkalemia and hypochloridemia.[7] It was also reported that hypokalemia was almost equally common in both hemorrhagic and ischemic group without any significant difference.[7] Syndrome of inappropriate antidiuretic hormone (SIADH) secretion is the major leading cause of electrolyte disturbance.[8] Most of the hemorrhagic stroke patients present with headache and vomiting, which is an important cause of dyselectrolytemia.[9] After acute stroke, neurological complications include recurrent stroke and seizures, whereas medical complications include chest infection, urinary tract infection, dysfunction of bowel or bladder, deep vein thrombosis (DVT), pulmonary embolism, upper gastrointestinal bleeding, aspiration, bedsores and malnutrition.[10]

AIM and OBJECTIVES
1. To study the common electrolyte disturbances among different types of stroke patients.
2. To study their association with outcome of stroke.

MATERIAL AND METHODS
A hospital-based, analytical prospective observational study was conducted among fifty individuals who presented with stroke and got admitted in Department of General Medicine of Sapthagiri Institute of Medical Sciences and Research Center, Bangalore. The study was conducted for a period of 8 months from 1st August 2017 to 31st March 2018. A prior permission was obtained from the institutional ethics committee. The study population included patients aged 16 years or above of both genders admitted within 48 hours of onset and with a CT-Brain confirmation of stroke. Patients with a previous history of stroke, transient ischemic attack, syncope and any subdural hemorrhage / epidural hemorrhage / intracerebral hemorrhage / infarction caused by an infection / tumor or patients with preexisting severe physical or cognitive disabilities were excluded from the study. After taking an informed consent from patients or their relatives. Using a standardized proforma demographic data and clinical data were obtained. The subtype of stroke was determined by clinical examination and CT scan of brain. Total serum sodium and potassium levels were determined. Patients were followed-up for two weeks during their stay and before discharge from the hospital using Glasgow outcome scale. Data obtained was entered in Microsoft Excel-2013 and analyzed in SPSS version-22 trial. Chi-square test was performed where necessary.

RESULTS
In the present study 50 CT-confirmed cases of stroke satisfying the inclusion criteria were selected. Majority 64 p.c (32) were males and 36 p.c (18) were females. Figure-1 reports the distribution of cases based on type of stroke, majority 52 p.c (26) had ischemic stroke followed by 46 p.c (26) had intracerebral hemorrhagic stroke and 2 p.c (1) had subarachnoid hemorrhagic stroke. Figure-2 reports the distribution of cases based on on electrolyte imbalance and type of stroke, among patients with hemorrhagic stroke 66.6 p.c (16) had dyselectrolytemia and 33.4 p.c (8) had normal electrolytes and among patients with ischemic stroke 46.2 p.c (12) had dyselectrolytemia and 53.8 p.c (14) had normal electrolytes. Table-1 and figure-3 reports the association between electrolyte imbalance and outcome of stroke based on Glasgow coma scale, among dyselectrolytemic patients poor outcome was present among 53.57 p.c (15) cases and 46.43 p.c (13) cases were with good outcome, among normal electrolytic patients poor outcome was present among 18.18 p.c (4) cases and 81.82 p.c (18) cases were with good outcome, both had a statistically significant association. Table-2 reports that there exists a statistically significant association between hyponatremia, hypokalaemia and outcome of stroke.
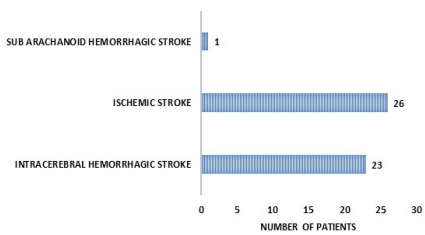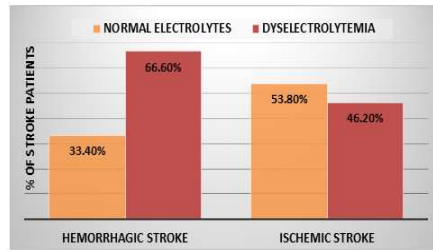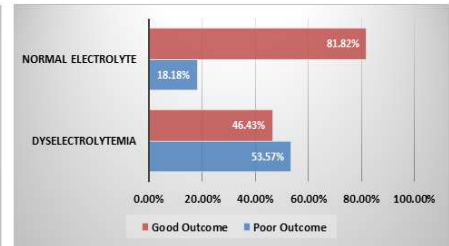
| Figure 1 | Figure 2 | Figure 3 |

Figure 1: showing the distribution of patients based on type of stroke; **Figure 2:** shows distribution of stroke patients based on electrolyte imbalance and type of stroke; **Figure 3:** showing electrolyte imbalance and outcome of stroke

Table 1: Showing the association between electrolyte imbalance and outcome of stroke

Glasgow outcome Scale (GOS)		Dyselectrolytemia present	Normal Electrolyte	Total	p-value
Poor (GOS=1+3)	Count [%]	15 (9+6) [53.57%]	4 (2+2) [18.18%]	19 [38%]	
Good (GOS=4+5)	Count [%]	13 (10+3) [46.43%]	18 (10+8) [81.82%]	31 [62%]	**0.0004**
Total	Count [%]	28 [100%]	22 [100%]	50 [100%]	

Table 2: Showing the association between hyponatremia, hypokalaemia and outcome

ELECTROLYTE		OUTCOME		SUB-TOTAL	TOTAL	p-value
		DIED	SURVIVED			
HYPONATREMIA	PRESENT	7	9	16	50	<0.05
	ABSENT	6	28	34		
HYPOKALAEMIA	PRESENT	6	9	15	50	<0.05
	ABSENT	5	30	35		

DISCUSSION

The study was done in the Department of General Medicine, Sapthagiri Institute of Medical Sciences and Research Center, Bangalore, from 1st August 2017 to 31st March 2018. A total of 50 patients of stroke were selected from patients satisfying the inclusion criteria. In this present study CT scan finding of the studied patients reported the majority 52 p.c patients had ischemic stroke, 46 p.c had intracerebral hemorrhage and only 2 p.c had subarachnoid hemorrhage, these results were similar to the studied conducted by Alam B *et al..*[11] and Indian Collaborative Acute Stroke Study (ICASS)[12, 13] conducted in Kolkata as these studies had majority of the patients with hemorrhagic stroke. About 56 p.c of acute stroke patients had dyselectrolytemia and 44 p.c had normal electrolyte. Among patients with hemorrhagic stroke 66.6 p.c (16) had dyselectrolytemia and among patients with ischemic stroke 46.2 p.c (12) had dyselectrolytemia. The result reports that dyselectrolytemia was almost equally common in both hemorrhagic and ischemic group without significant difference (p>0.05), this was similar to study conducted by Kusuda K *et al..*[14] that reported 52 p.c hemorrhagic stroke and 26 p.c ischemic stroke patients had dyselectrolytemia. In this study 32 p.c of all stroke patients had hyponatremia. Hyponatremia was most common among hemorrhagic stroke patients followed by ischemic stroke patients, but there was no statistically significant association between hyponatremia and type of stroke (p>0.05). In this study 30 p.c of all stroke patients had hypokalemia. Hypokalemia was most common among hemorrhagic stroke patients followed by ischemic stroke patients and had statistically significant association between hypokalemia and hemorrhagic stroke (p<0.05). In this study 22 p.c of all patients expired (i.e.GOS-1) and 78 p.c of all patients survived (i.e.GOS-3,4,5) which is similar to the study conducted by Malini Kulshrestha[15] in northern India. Out of 16 patients with hyponatremia with stroke, 9 survived and 7 died and out of 34 patients without hyponatremia with stroke, 28 survived and 6 died, statistically significant association exists (p=0.0003). This is similar to the study conducted by Sheikh Saleem IY *et al..*[16]. Out of 15 patients with hypokalemia with stroke, 9 survived and 6 died and out of 35 patients without hypokalemia with stroke, 30 survived and 5 died, statistically significant association exists (p=0.0043). This is similar to the study conducted by GariballaSE *et al..*[17].

CONCLUSION

Electrolyte imbalance commonly occurs during and after acute stroke. Hyponatremia and hypokalemia are most common electrolyte imbalances in both ischemic and hemorrhagic stroke. Electrolyte imbalance may adversely affect outcome of stroke. Serum electrolyte should be determined for every patient with stroke. There exists a strong association between hyponatremia or hypokalemia

and outcome of stroke. Early detection and management of stroke may improve the overall outcome of stroke patients.

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