e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(9); 81-87

Original Research Article

Comparative Study of Electrolyte Imbalance between Hemorrhagic and Non-Hemorrhagic Stroke Patients at a Tertiary Care Teaching Hospital

Renu Khamesra[1], Vinod Kumar Mehta[1], Rajat Talesra[2]

[1]Associate Professor, Department of Neurology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan

[2]MBBS Intern, RNT Medical College and Hospital, Udaipur, Rajasthan

Received: 26-06-2022 / Revised: 26-07-2022 / Accepted: 01-09-2022

Corresponding author: Dr Renu Khamesra

Conflict of interest: Nil

Abstract

Background: There are mainly two types of stroke patients viz; non-hemorrhagic stroke and hemorrhagic stroke. The electrolyte imbalances of sodium and potassium are the most common electrolyte abnormalities in patients with acute stroke.

Objectives: To compare electrolyte imbalance between acute hemorrhagic and non - hemorrhagic stroke patients.

Materials and Methods: This cross sectional observational study was conducted in department of Neurology and General Medicine of Geetanjali Medical College and Hospital, Udaipur, Rajasthan for a period of two years. Acute stroke was diagnosed by magnetic resonance imaging (MRI) or computer tomography (CT) of the brain. Patient's demographics, investigations and clinical profile data were entered in the performa sheet. All acute stroke patients were divided in two groups hemorrhagic (S-H) and non-hemorrhagic (S-NH) for analysis and comparison.

Results: Hyponatraemia was observed in 12 (26.08%) of S-H group and 46 (25%) in S-NH group ($p>0.05$). Hypernatremia was seen in 4 (8.69%) of S-H group and 9 (4.89%) in S-NH group ($p>0.05$). Hypokalemia was observed in 3(6.52%) of S-H group and 11(5.97%) in S-NH group ($p>0.05$). Hyperkalemia was seen in 3(6.52%) of S-H group and 18 (9.78%) of S-NH group ($p>0.05$).

Conclusion: This study concluded that electrolyte imbalance in the form of hyper or hypokalemia and hyper or hyponatremia are common in hemorrhagic and non- hemorrhagic acute stroke and they should be screened immediately irrespective of stroke type.

Keywords: Electrolyte Imbalance, Hemorrhagic Stroke (S-H), Non-Hemorrhagic Stroke (S-NH)

Introduction

Stroke is a major global public health problem. According to the latest estimate from the Global Burden of Disease, Injuries and Risk Factors Study (GBD-2015) there is a further shift from communicable diseases toward non-communicable diseases like stroke. This effect is likely caused by an increase in population and aging of the world's population as well as by decreased death rates globally in recent decades [1]. The most important cause of death is vascular

in nature and stroke is currently the second leading cause of death worldwide. Ischemic heart disease and stroke together accounted for 15.2 million deaths in 2015 [2]. While ischemic strokes comprise the highest number of stroke, much of the global burden of stroke measured in proportion to mortality and disability-adjusted life-years (DALYs) is allocated to hemorrhagic stroke (S-H) [3]. Stroke is one of the leading causes of long-term disability.

In India, stroke in younger people is high (18-32%) of all stroke cases compared to developed countries. Men are more likely to have a stroke than women and the male/female ratio for India is 7:1. This may be due to differences in risk factors such as smoking and drinking which are more prevalent among men in India compared with women [4-6]. Stroke is preventable to a large extent due to modifiable risk factors [7]. Targeting risk factors such as high blood pressure, smoking, obesity, diabetes mellitus, atrial fibrillation, dyslipidemia, and lack of physical activity may have already contributed to the observed improvement of stroke incidence.

The electrolyte imbalances of sodium and potassium are the most common electrolyte abnormalities in patients with acute stroke and cause of death unless corrected promptly [8]. There are mainly two types of stroke viz; ischemic or non-hemorrhagic stroke (S-NH) and hemorrhagic stroke (S-H). Various studies had compared the risk factors associated with these types of stroke [9,10], but data regarding electrolyte imbalances is meagre. Data from developing countries like India is very scarce. Hence, this study was planned to compare electrolyte imbalance between patients of S-H and S-NH at a tertiary care hospital.

Materials and Methods

This cross sectional, observational, duration based study was conducted in department of Neurology and General Medicine of Geetanjali Medical College and Hospital, Udaipur, Rajasthan. Consecutive convenient sampling was done. All the patients were enrolled during the study period of two years.

Inclusion criteria: Stroke arterial / venous, hemorrhagic / non-hemorrhagic, thrombotic / non thrombotic, cardio-embolic diagnosed clinically and confirmed on neuro-imaging were included in the study.

Exclusion criteria: Uncooperative, refusal for the consent, transient ischemic attacks (TIA), Stroke mimics e.g. Todd's paresis, encephalopathies (metabolic / toxic / infective), negative on neuro-imaging were excluded from the study.

Procedure: Patient fulfilling the inclusion and exclusion criteria coming to the emergency, outpatient department (OPD) or as in-patient (IPD) in the department of Neurology and General Medicine at Geetanjali Medical College and Hospital, Udaipur were enrolled in the study only after taking approval from the Institutional Ethics Committee. Informed consent was taken from all the patients. Stroke was clinically diagnosed by neurologist and confirmed on MRI (brain) or CT (Brain). After collecting the demographic details and past history, patients were asked for routine investigations like complete blood count, serum glucose, urea, creatinine, electrolytes, liver function tests, chest x-ray, 12-lead ECG.

Patient's demographics, investigations and clinical profile data were entered in the performa sheet. All enrolled subject's data were analysed and compared in two groups S-H and S-NH.

Statistical analysis: Data was entered and analyzed by using Microsoft excel version 2010 and statistical package for social science ver.16 (SPSS 16). Appropriate test of significance was applied i.e. chi-square test for qualitative data and student 't' test was applied for quantitative data. P value

less than 0.05 was considered statistically significant.

Results

Total 230 patients were enrolled during two year study. Of these 184(80%) had S-NH and 46(20%) had S-H. Gender distribution among S-H group, 28 (60.87%) were males and 18(39.13%) were females and of S-NH group, 118 (64.13%) were males and 66 (35.87%) were females. Age distribution of patients above 40 years was 39(84.78%) in S-H group and 162(88.04%) in S-NH group. Hindus were 45(97.83%) in S-H group and 166 (90.22%) in S-NH group. Patients from rural background were 28(60.87%) in S-H group and 109 (59.24%) in S-NH group. 30 (65.22%) patients were unskilled in S-H group and 119(64.67%) patients were unskilled / unemployed in S-NH group. (Table 1)

Clinical presentation in S-H group was motor disability in 31(67.39%), speech disturbances in 15 (32.61%) and impaired consciousness in 25 (54.35%) whereas in S-NH group motor disability were in 145 (78.80%), speech disturbances in 96 (52.17%), impaired consciousness in 24 (13.04%) with vomiting at onset in 13(28.6%). Impaired consciousness in patients were significantly higher in S-H group as compared to S-NH group ($p<0.05$) but speech disturbances in 96 (52.17%) patients were significantly higher in S-NH group ($p<0.05$). (Table 1)

Table 1: Demographic details of both the groups

	S-H (n=46) N (%)	S-NH (n=184) N (%)	p value
Mean age (Years)	61.28±17.31	61.19±15.22	>0.05
Gender			
Male	28(60.87%)	118(64.13%)	0.811
Female	18(39.13%)	66(35.87%)	
Age			
≤40 years	7(15.22%)	22(11.96%)	0.728
>40 years	39(84.78%)	162(88.04%)	
Religion			
Hindu	45(97.83%)	166(90.22%)	0.168
Muslim	1(2.17%)	18(9.78%)	
Residence			
Urban	18(39.13%)	75(40.76%)	0.973
Rural	28(60.87%)	109 (59.24%)	
Occupation			
Skilled	16(34.78%)	65(35.33%)	0.918
Unskilled/ unemployed	30(65.22%)	119(64.67%)	
Symptoms			
Headache	8(17.39%)	17(9.24%)	0.185
Vomiting	13(28.26%)	16(8.70%)	<0.05*
Impaired consciousness	25(54.35%)	24(13.04%)	<0.05*
Speech disturbances	15(32.61%)	96(52.17%)	<0.05*
Motor disturbances	31(67.39%)	145(78.80%)	0.150
Sensory disturbances	1(2.17%)	25(13.59%)	0.054

***significant**

Hyponatraemia was observed in 12(26.08%) patients of S-H group and in 46(25%) of S-NH group with no significant statistical difference (p>0.05). Hypernatremia was observed in 4(8.69%) of S-H group and 9(4.89%) of S-NH group with no significant statistical difference (p>0.05). Hypokalemia was reported in 3(6.52%) of S-H group patients and 11(5.97%) in S-NH group with no significant statistical difference (p>0.05), hyperkalemia was reported in 3 (6.52%) of S-H and 18(9.78%) of S-NH with no significant statistical difference (p>0.05). (Table 2)

Table 2: Comparison of electrolyte imbalance between both the groups

Serum Electrolyte	S-H (n=46) N (%)	S-NH (n=184) N (%)	P value
Sodium			
Hyponatremia	12 (26.08%)	46 (25%)	0.749
Hypernatremia	4 (8.69%)	9 (4.89%)	0.521
P value	0.043*	0.000*	
Potassium			
Hypokalemia	3 (6.52%)	11 (5.97%)	0.836
Hyperkalemia	3 (6.52%)	18 (9.78%)	0.689
P value	0.673	0.246	

***significant**

Discussion

Stroke is a devastating and disabling cerebrovascular disease with significant amount of residual deficit leading on to economic loss. It has been defined as a rapidly developing sign of focal (or global) disturbance of cerebral function with symptoms lasting for ≥24 hours, or leading to death with no apparent cause other than vascular origin [11]. It is a collection of clinical syndromes resulting from cerebral ischemia to intracranial hemorrhage. Electrolyte abnormalities are common in clinical practice during emergency situations. Previous studies have shown that these electrolyte problems also closely relate to the prognosis of intracerebral hemorrhage [12]. Few studies have reported the prognostic role of these electrolyte imbalances in stroke. This study was planned to compare electrolyte abnormalities in patients of S-H and S-NH groups.

In present study incidence of S-NH (80%) was more than the S-H (20%). Many epidemiological studies have concluded that S-NH is more common than S-H [9,10]. The reasons could be due to multiple risk factors like old age, hypertension, diabetes mellitus, smoking, dyslipidemia, atrial fibrillation, hyperhomocysteinemia, alcohol consumption etc are associated with S-NH as compared to S-H; which is due to bursting of blood vessels in brain and that may due high rise in blood pressure in vessels or abnormal blood vessels.

The mean age of patients in present study was above 60 years in both the groups. Many studies have also reported incidences of stroke are common above 60 years of age [13,14]. This shows that older age groups are at more risk for stroke as compared to younger. In present study both the groups had more male patients as compared to female. Many other epidemiological studies had also reported similar higher incidence rate of stroke in men than women, ranging from 1.4:1 to 2:1 [15,16]. This shows that men are more associated with above mentioned risk factors than women.

In present study more patients in both the groups were from Hindu religion, unskilled as well as from rural background. Other studies have also reported that stroke incidence is more

common in Hindu and also more in rural community [17,18]. This can be explained on the basis of Indian census in which more population belongs to Hindu religion and rural population is more unskilled / uneducated than urban and they are less aware about the risk factors associated with stroke.

In present study, in both types of stroke motor symptoms were more common followed by speech disturbances and impaired consciousness. These symptoms were correlated with other studies which had reported that hemiplegia or hemiparesis are common in stroke patients and also the dysarthia which lead to speech disturbances [18,19]. Vomiting and impaired consciousness were found to be significantly higher in hemorrhagic patients. Similar results were also reported by other studies [20,21]. It may be due to the accumulation of blood around the areas which lead to these symptoms. In present study speech disturbances were significantly higher in non-hemorrhagic patients. Similar results were also shown by other coworkers [22]. Speech disturbances in stroke patients range from dysarthria to dysphasia and it may be more in non-hemorrhagic stroke patients due to damage of these areas from ischemia.

In present study hyponatremia was significantly more in both groups of patients as compared to hypernatremia. Similar incidences of more hyponatremia as compared to hypernatremia were also reported by other studies [23,24]. In present study incidence of hyponatremia was also similar in both the groups. The most common reason for hyponatremia in both groups could be due to the excessive release of anti-diuretic hormone (ADH) after stroke which leads to water retention and hyponatremia [8]. One study reported 75.6% and 61.5% patients were having SIADH in non-hemorrhagic stroke with hyponatremia and hemorrhagic stroke with hyponatremia respectively [24]. This was also supported by Saleem *et al* study [25].

In present study incidence of hypokalemia and hyperkalemia was similar in both groups. There was no significant difference between the two groups. Other studies have also showed similar incidence of hypokalemia in both the groups [23,26]. It has been proved that hypokalemia is common in both hemorrhagic stroke as well as non-hemorrhagic stroke; as both strokes are emergency situations and it can be due to excessive secretion of catecholamine during emergency [21]. Nicholas *et al* study had also shown that there was no association of hyperkalemia to any type of stroke [26]. There was also no significant difference between incidence of hypokalemia and hyperkalemia in hemorrhagic stroke as well as in non-hemorrhagic stroke in present study.

Conclusion

This study concluded that electrolyte imbalance in the form of hyper or hypokalemia and hyper or hyponatremia are common in both hemorrhagic and non-hemorrhagic stroke and they should be screened immediately irrespective of types of stroke. These imbalances should be treated promptly to avoid complications and for better patients outcome.

References

1. GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388(10053):1459-544.
2. GBD 2015 Neurological Disorders Collaborator Group. Global, regional, and national burden of neurological disorders during 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Neurol. 2017;16(11):877-97.
3. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. CircRes.

2017;120(03):439-48.
4. Dalal PM, Malik S, Bhattacharjee M, Trivedi ND, Vairale J, Bhat P, *et al*. Population- bases stroke survey in Mumbai, India: incidence and 28-day case fatality. Neuroepidemiology. 2008; 31:254-61.
5. Sethi P. Stroke-incidence in India and management of ischemic stroke. Neurosciences.2002;4(3):139-41.
6. Das S, Banerjee T. Stroke Indian scenario. Circulation. 2008; 118:2719-24.
7. O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P et al. INTERSTROKE investigators. Risk factors for ischemic and intracerebral hemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. Lancet. 2010;376(9735):112-23.
8. Mansoor F, Kumar J, Kaur N, Sultan S, Tahir H, Dilip A, et al. Frequency of Electrolyte Imbalance in Patients Presenting With Acute Stroke. Cureus.2021;13(9): e18307.
9. Cabral NL, Gonçalves AR, Longo AL, Moro CH, Costa G, Amaral CH, et al. Incidence of stroke subtypes, prognosis and prevalence of risk factors in Joinville, Brazil: A 2-year community based study. J Neurol Neurosurg Psychiatry 2009; 80:755-61.
10. Delbari A, Salman Roghani R, Tabatabaei SS, Rahgozar M, Lokk J. Stroke epidemiology and one-month fatality among an urban population in Iran. Int J Stroke 2011; 6:195-200.
11. Hartona S. Experiences from a multicenter stroke register: a preliminary report. Bull WHO. 1976;54(5):541-53.
12. Dalal P, Bhattacharjee M, Vairale J, Bhat P. UN millennium development goals: Can we halt the stroke epidemic in India. Ann Indian Acad Neurol. 2007; 10:1306.
13. Siddique AN, Nur Z, Mahbub S, Alam B, Miah T. Clinical presentation and epidemiology of stroke-a study of 100 cases. J Medicine. 2009; 10:86-9.
14. Pinhero L, Damodar S, Roy AK. Risk factors in stroke: a prospective study. J Assoc Physicians India. 2000 Jan; 48:72-6.
15. Eapen RP, Parikh JH, Patel NT. A study of clinical profile and risk factors of cerebrovascular stroke. Guj Med J. 2009;64(2):47-54.
16. Sridharan SE, Unnikrishnan JP, Sukumaran S, Sylaja PN, Nayak SD, Sharma PS, et al. Incidence, types, risk factors, and outcome of stroke in a developing country: The Trivandrum Stroke Registry. Stroke. 2009; 40:1212-18.
17. Baidya OP, Chaudhuri S, Gomti Devi K. Clinico-epidemiological study of acute ischemic stroke in a tertiary hospital of northeastern state of India. IJBAR. 2013;4(9):661.
18. Shigematsu K, Shimamura O, Nakano H, Watanabe Y, Sekimoto T, Shimizu K, Nishizawa A, Makino M. Vomiting should be a prompt predictor of stroke outcome. Emerg Med J. 2013;30(9):728-31.
19. Fukaguchi K, Yamagami H, Soeno S, Hara K, Shirakawa T, Sonoo T, et al. association of initial potassium levels with the type of stroke in the emergency department. Journal of Stroke and Cerebrovascular Diseases. 2021;30(8):105875.
20. Maskey A, Parajuli M, Kohli SC. A study of risk factors of stroke in patients admitted in manipal teaching hospital, Pokhara. Kathmandu Univ Med J (KUMJ). 2011;9(36):244-7.
21. Awad SM, Al-Jumaily HF, Al-Dulaimi KM, Abdulghafoor RH. Assessment of major risk factors among stroke patients. Saudi Med J. 2010; 31(9): 1028-31.
22. Shigematsu K, Nakano H, Watanabe Y, Sekimoto T, Shimizu K, Nishizawa A, Okumura A, Makino M. Speech disturbance at stroke onset is correlated with stroke early mortality. BMC Neurol. 2013; 13:87.
23. Alam MN, Uddin MJ, Rahman KM,

Ahmed S, Akhter M, Nahar N, et al. Electrolyte changes in stroke. Mymensingh Med J. 2012;21(4):594-9.
24. Ehtesham M, Mohmand M, Raj K, Hussain T, Kavita F, Kumar B. Clinical Spectrum of Hyponatremia in Patients with Stroke. Cureus. 2019; 11(8):e5310.
25. Saleem S, Yousuf I, Gul A, Gupta S, Verma S. Hyponatremia in stroke. Ann Indian Acad Neurol. 2014;17(1):55-7.
26. Smith NL, Lemaitre RN, Heckbert SR, Kaplan RC, Tirschwell DL, Longstreth WT, et al. Serum potassium and stroke risk among treated hypertensive adults, American Journal of Hypertension 2003;16(10):806-13.