

Original Research Article

A comparative study of serum electrolytes and lipid levels in ischaemic and haemorrhagic stroke

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ABSTRACT

Background: Stroke or cerebrovascular accident is a major cause of disability worldwide and the second most common cause of death after ischaemic heart disease. There has been a steady increase in incidence of stroke; recent data shows that stroke incidence decreased by 42% in high-income countries and by 100% in low to middle income countries. Aim of the study was to know the association of serum electrolytes and lipid levels in stroke.

Methods: This was a retrospective study conducted in June 2014 at tertiary care hospital in South India. Data was obtained from the medical records departments from June 2011 to August 2012. An adult Treatment Panel III criterion was used to classify plasma lipid levels. The serum urea, serum creatinine, serum electrolytes and urinary electrolyte levels were measured by flame photometry. Descriptive statistics has been carried out in the present study. Student 't' test used to test the significance, between the groups and P value of <0.05 were considered as moderately significant, P values of <0.01 was considered highly significant.

Results: There was no statistically significant difference in electrolyte levels between ischaemic and haemorrhagic stroke patients. Most common electrolyte imbalance in ischaemic stroke was hyponatremia and most common electrolyte imbalance in Haemorrhagic stroke was hypokalemia. Statistically significant alteration were seen in total cholesterol, LDL and VLDL levels between haemorrhagic and ischaemic stroke.

Conclusions: In the present study total cholesterol and HDL levels were higher in haemorrhagic stroke whereas triglycerides, LDL and VLDL were high in ischaemic stroke. Regular monitoring of lipid levels in patients with high risk factors for stroke patients will help in decreasing the mortality and morbidity. Future studies should be prospective, multi-centric and include a large sample size which will help in determining the association between electrolytes and lipid levels in stroke patients.

Keywords: Electrolytes, Haemorrhagic stroke, Ischaemic stroke, Lipid parameters

INTRODUCTION

Stroke or cerebrovascular accident is a major cause of disability worldwide and the second most common cause of death after ischaemic heart disease.^{1,2} There has been a steady increase in incidence of stroke; recent data shows that stroke incidence decreased by 42% in high-income countries and by 100% in low to middle income countries.³ Nearly one third of stroke patient die within 3

weeks and 48% die within one year. The cause for high mortality is multifactorial like cerebral edema infection, deep vein thrombosis, pulmonary embolism, electrolyte imbalance, associated heart disease and metabolic disorder.⁴

Disorders of serum electrolytes i.e. sodium and potassium are the commonest electrolyte abnormalities found in stroke patients.⁵ Electrolyte disturbances such as

hyponatraemia, hypernatraemia resulting, increase in brain natriuretic peptide and atrial natriuretic peptide are common in acute phase of stroke.⁶ Early diagnosis of electrolyte disturbances is essential to prevent morbidity and mortality in stroke patients.⁷

The relationships of serum lipids with stroke have been studied and clinical trials show an association between high serum lipid level and ischaemic stroke.^{8,9} Regarding lipid levels it has been found that approximately 1% of all patients with ischemic stroke and in up to 4% of young adults with stroke, the major precipitant of brain ischemia is mainly by blockage of artery with free radicals and lipid molecules.¹⁰⁻¹²

It is important to evaluate the difference in serum lipid levels in subtypes of strokes to guide lipid-lowering therapy which can reduce incidence of stroke and related mortality by adapting primary and secondary preventive measures. There are very few studies conducted on serum electrolytes and lipid levels in ischaemic and haemorrhagic stroke patients in this region, hence the present study.

METHODS

This was a retrospective study conducted in June 2014 at tertiary care hospital in South India. Data was obtained from the medical records departments from June 2011 to August 2012.

A stroke case was diagnosed clinically and my CT scan or MRI scans. The data collected included demographic data, type of stroke (ischemic or hemorrhagic), previous history of stroke, hypertension, diabetes mellitus, dyslipidemia, cardiac disease, smoking and alcohol addiction. Serum lipid levels, serum electrolyte and urinary electrolytes measured on first day of admission were included in the study.

An adult treatment panel III criterion was used to classify plasma lipid levels.¹³ Serum total cholesterol (TC) and triglycerides (TG) were measured by enzymatic method. Serum high density lipoprotein (HDL) was measured by phosphotungstate precipitation, followed by enzymatic method. Serum low density lipoprotein (LDL) and very low density lipoprotein (VLDL) was measured using Friedewald's formula.¹⁴

The serum urea, serum creatinine, serum electrolytes and urinary electrolyte levels were measured by flame photometry. The urine electrolytes were done from a pooled 24-hour specimen.

Statistics analysis

Descriptive statistics has been carried out in the present study. Data is expressed as Mean±S.D. Statistical analysis was performed using the SPSS software (version 16). Student 't' test used to test the significance, between

the groups and P value of <0.05 were considered as moderately significant, P values of <0.01 was considered highly significant.

RESULTS

Out of 114 cases of stroke, 79 were Ischaemic stroke and 35 were Haemorrhagic stroke. The demographic data of the stroke patients is shown in Table 1.

Table 1: Demographic data of the subjects.

Variable	Ischaemic (79)	Haemorrhagic (35)
Age	54.7±8.56	57.2±7.87
Male:Female	48:31	22:13
SBP	149.23±9.35	154.91±9.97
DBP	91.54±5.45	92.34±5.95
Risk factors		
Hypertension	43	5
Diabetes Mellitus	34	14
Heart disease	11	8
Alcohol	15	11
Smoking	29	9
Family history		
Stroke	9	6
Hypertension	13	10
Heart disease	5	2
Diabetes mellitus	8	3

SBP = Systolic blood pressure, DBP = Diastolic blood pressure.

No statistically significant difference was seen between the ischaemic stroke and haemorrhagic stroke patients.

Table 2: Serum urea, creatinine and electrolyte levels in the patients with stroke.

Parameter	Ischaemic (79)	Haemorrhagic (35)
Urea	51.78±5.34	46.65±7.96
Creatinine	1.76±0.34	1.39±0.56
Serum Na	144.7±3.45	146.9±3.92
Serum K	4.32±1.24	3.47±0.78
Urinary Na	213.45±17.5	235.47±18.3
Urinary K	82.9±15.8	74.2±13.3

There is an increased serum level of urea, creatinine, sodium, potassium in ischaemic stroke patients when compared to haemorrhagic stroke patients but there is no statistically significant difference in electrolyte levels between ischaemic and haemorrhagic stroke patients.

Normal serum urea (15-45mg/dl); normal serum creatinine (0.7-1.5mg/dl); normal serum sodium (135-145mmol/l); normal serum potassium (3.5-5mmol/l); Urinary Na and K = meq/day. The frequency of serum sodium and potassium imbalance in stroke patients is shown in Table 3.

Table 3: Lipid profiles of the stroke patients.

Parameter	Ischaemic (79)	Haemorrhagic (35)
Sodium		
Normal Sodium	39 (49.3%)	12 (34.2%)
Hyponatraemia	26 (32.9%)	9 (25.7%)
Hypernatraemia	14 (17.7%)	14 (40%)
Potassium		
Normal Potassium	32 (40.5%)	14 (40%)
Hypokalaemia	22 (27.8%)	16 (45.7%)
Hyperkalaemia	25 (31.6%)	5 (14.2%)

Normal serum sodium (135-145mmol/l), hyponatraemia (<135mmol/l), hypernatraemia (>145mmol/l); normal serum potassium (3.5-5mmol/l), hypokalaemia (<3.5mmol/l), hyperkalaemia (>5mmol/L).

Most common electrolyte imbalance in ischaemic stroke was hyponatremia and most common electrolyte imbalance in haemorrhagic stroke was hypokalemia which is statistically significant. The Lipid profiles in the patients with stroke are shown in Table 4.

Table 4: Lipid profiles of the stroke patients.

Parameter	Ischaemic (79)	Haemorrhagic (35)
TC	169.24±12.76	184.63±17.87*
TGL	94.12±9.67	86.23±11.56
HDL	44.23±2.92	47.67±3.47
LDL	86.46±9.47	77.39±8.78*
VLDL	25.78±9.32	20.13±4.86*

*P≤0.01 = Highly significant; TC = Total Cholesterol, TGL = Triglycerides, HDL = High density Lipoprotein, LDL = Low density Lipoprotein, VLDL = Very low density Lipoprotein cholesterol

Serum Total cholesterol, serum LDL, Serum VLDL was significantly increased in ischaemic stroke patients when compared to haemorrhagic stroke patients.

DISCUSSION

In India there are very few studies describing these electrolyte disturbances in stroke patients. The most common age group affected was 45-60 years. Majority of the patients were males. This finding is similar to other studies.^{15,16}

The majority of the stroke cases were ischaemic (69.2%). Other studies have also reported ischaemic stroke as the most common type.^{16,17} In the present study, 64% of stroke patients had some electrolyte imbalance (Table 2). Other studies have reported electrolyte imbalance in 50% to 55% of stroke patients.^{16,18}

There was no statistically significant difference in Urea, Creatinine and electrolyte levels (urinary and serum) between ischaemic and haemorrhagic stroke patients (Table 2). Serum sodium levels were higher in

haemorrhagic stroke patients, and serum potassium was higher in ischaemic stroke patients. 50% of ischaemic stroke patients had sodium dyseleolytaemia but it was only 34% in haemorrhagic stroke patients. Potassium dyseleolytaemia was 60% in both types of stroke. Other studies have reported dyseleolytaemia ranging from 52% to 70%.^{5,16,19} These differences might be due to different demographic profile of the patients and the method used for collection of data.

Urinary sodium levels were higher in haemorrhagic stroke and urinary potassium levels were higher in ischaemic stroke. A study conducted by Sisir Chakraborty et al reported sodium and potassium levels higher in both haemorrhagic and ischaemic stroke.²⁰ In another study, urinary sodium and potassium excretion was highest on day 1 of stroke and decreased progressively on day 10.²¹ We were able to record levels of sodium and potassium only on day one. Evidence derived from studies indicates the association of a reduction in sodium intake with reduced events of CVA, suggesting a protective role of limiting dietary sodium intake.²² Experimental studies on animals (hypertensive animal models) suggest a protective role of potassium intake on vascular events.^{23,24}

Regarding lipid levels, statistically significant alteration were seen in total cholesterol, LDL and VLDL levels between haemorrhagic and ischaemic stroke (Table 4). Ischemic stroke is the commonest type of stroke worldwide, occurring in over 80% of the stroke cases.²⁵ There are conflicting results about the correlation between the cholesterol levels and the risk of stroke. Some studies have found positive correlation while other studies have reported negative findings.²⁶⁻²⁹ Similar results were found with triglycerides levels and risk of stroke. Some studies reported positive correlation while other were less conclusive.³⁰⁻³³ In the present study total cholesterol and HDL levels were higher in haemorrhagic stroke whereas triglycerides, LDL and VLDL were high in ischaemic stroke (Table 4). In the present study there was an inverse association between HDL-cholesterol and stroke but was not statistically significant.

However, recently it has been shown that serum HDL levels decrease significantly at the time of acute ischemic stroke and it may be used as an indicator of acute phase reactant or nascent biomarker of acute stroke.³⁴ In a recent study conducted on risk factors for ischaemic stroke, failed to demonstrate any relationship between high triglycerides and cholesterol, low HDL with stroke events.³⁵

Limitations of the study

The present study was a retrospective study and the sample size was small. Future studies should be prospective, multi-centric and include a large sample size.

CONCLUSION

Most common electrolyte imbalance in ischaemic stroke was hyponatremia and most common electrolyte imbalance in Haemorrhagic stroke was hypokalemia. 50% of ischaemic stroke patients and 34% in haemorrhagic stroke patients had sodium dyselectrolytaemia. In the present study total cholesterol and HDL levels were higher in haemorrhagic stroke whereas triglycerides, LDL and VLDL were high in ischaemic stroke. There was statistically significant difference between total cholesterol LDL and VLDL levels between haemorrhagic and ischaemic stroke. Regular monitoring of lipid levels in patients with high risk factors for stroke patients will help in decreasing the mortality and morbidity.

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