



“A STUDY OF SERUM ALBUMIN, SERUM CALCIUM AND SERUM URIC ACID IN THE PREDICTION OF NEUROLOGICAL SEVERITY IN ACUTE ISCHEMIC STROKE.”

General Medicine

**Dr Roshan
Yogendra**

Medicine Resident Department Of General Medicine, Mrmc, Kalaburgi, Karnataka

Dr Shoukath A R

Professor Department Of General Medicine, Mrmc, Kalaburgi, Karnataka

**Dr Chethan
Kumar B P**

Medicine Resident Department Of General Medicine, Mrmc, Kalaburgi, Karnataka

ABSTRACT

Background: A stroke is rapidly developing clinical signs of focal disturbance of cerebral function with symptoms lasting 24 hours or longer or leading to death with no apparent cause other than of vascular origin. Serum albumin increases the collateral perfusion in the ischemic areas has been suggested as one of neuroprotective mechanism. Calcium ions play a physiological role in the multiple pathomechanisms of cerebral ischemia. Elevated serum levels of uric acid act as an indicator for tissue infarction. However, serum calcium, albumin and uric acid are rarely tested in acute ischemic stroke for severity and short-term prognosis. **Materials And Methods:** prospective observational study was done over a period of 18 months. The study included 200 individuals who experienced an acute ischemic stroke within 24 hours of onset. Patients with hemorrhagic stroke, chronic liver, and renal disease were excluded. At admission, serum calcium, albumin, and uric acid were measured along with the National Institute of Health Stroke Scale (NIHSS) to predict the severity. **Results:** In our 200 person study, stroke was common among the individuals aged more than 60. Participants included 127 (63.5%) males and 73 (36.5%) females. Male preponderance of the ratio 1.74:1 was observed. A total of 113 (56.5%) individuals had hypertension, 52 (26%) had diabetes. Hypertension and diabetes did not show a significant correlation. low serum calcium and albumin and high serum uric acid was found to be significantly correlated with NIHSS severity **Conclusion:** blood uric acid, albumin and calcium measurement can be an important additional parameter for predicting poor prognosis and recovery in ischemic stroke patients. From all these, We can conclude that, Ischemic stroke patients with low blood albumin low blood calcium and high blood uric acid levels had bad prognosis.

KEYWORDS

INTRODUCTION:

A stroke is defined by the World Health Organization (WHO) as a syndrome of “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.”⁽¹⁾ WHO estimates show the brain stroke is second most leading cause of mortality next to the ischemic heart disease in the developed Countries, whereas in poor countries it ranks sixth leading cause. Some of the recent studies have elucidated the stroke pattern to considerable extent in our country with a prevalence rate of 471.58/1,00,000 population.⁽²⁾

In a recent study conducted in India, Latin America and China, chronic diseases as a whole (stroke, heart disease, diabetes, chronic respiratory disease, and malignancy) accounted for the majority of death among the elderly⁽³⁾. Stroke also entails a high socioeconomic burden due to increased morbidity and mortality. Ischemic strokes account for > 80% of total stroke events⁽⁴⁾. Early identification of individuals at risk could be of help in primary prevention strategies⁽⁵⁾.

Albumin is a simple monomeric protein synthesized by hepatocytes. It functions as carrier protein and exerts plasma oncotic pressure (plasma colloid osmotic pressure). Experimental studies have suggested the albumin exerts neuroprotective effects by reducing brain edema or by reducing oxidative stress and apoptosis. It is proved that sufficient serum albumin level improve the plasma viscosity, microcirculation and oxygen transport capacity. Immune functions are positively influenced by the serum albumin. Serum albumin increases the collateral perfusion in the ischemic areas has been suggested as one of neuroprotective mechanism. . Serum albumin acts as a unique multifunctional protein and it has many neuroprotective effects.⁽⁶⁾ There are many growing evidence as of its prognostic significance in acute ischemic stroke⁽⁷⁾

Calcium (Ca²⁺) ions play a physiological role in the multiple pathomechanisms of cerebral ischemia. Cell calcium metabolism during and immediately after a transient period of ischemia influences the cascade of events that leads to subsequent neuronal injury. For instance, ischemia/hypoxia triggers rapid translocation of Ca²⁺ from extracellular to intracellular spaces of cerebral tissues. Awareness of the participation of Ca²⁺ in the ischemic cascade has led to the development of several potential neuroprotective agents designed to

modify the role of this ion in acute focal brain injury. Ca²⁺ has also been studied with regard to its relationship with stroke risk factors and stroke incidence. High calcium levels were associated with good outcome in AIS.

Uric acid is the final product of purine metabolism. Evidence from epidemiological studies suggests that elevated serum uric acid (SUA) levels may predict an increased risk for cardiovascular events, including stroke. Moreover, therapeutic modalities with a SUA lowering potential have been shown to reduce Cardiovascular disease morbidity and mortality. Elevated serum levels of uric acid were shown to increase the risk of stroke and recurrent infarction in patients suffering from myocardial infarction. The fact that thrombotic stroke and myocardial infarction are similar in many risk factors and pathophysiology, have resulted in considerable attention paid recently to the role of uric acid in patients with stroke.

In this study I analyzed the effect of serum albumin, uric acid and calcium levels on short term outcome and as a prognostic indicator and this could help in providing information regarding their significance.

Objectives: To study serum albumin, uric acid and calcium as a predictor of neurological severity in ischemic stroke.

MATERIALS AND METHODS:

A cross sectional study was conducted at Mahadevappa Rampure Medical college, Kalaburgi during the period of August 2022-January 2024 on 200 patients admitted to inpatient department of general medicine with Acute ischemic stroke and evaluated for the same. Data was analysed using appropriate inferential statistics.

Study Design: Prospective observational Study.

Source Of Data: The source of the data was collected from the individuals attending IPD services at Basaveshwar Teaching & General Hospital, attached to Mahadevappa Rampure Medical College, Kalaburgi during the time period of August 2022-January 2024 were evaluated.

Sample Size Estimation: 300 cases based on the hospital inpatient admissions and appropriate age in accordance to our hospital statistics was selected.

Inclusion Criteria:

1. Patients aged ≥ 40 years.
2. Diagnosed as having acute ischaemic cerebrovascular stroke within previous 72 hours by clinical examination and confirmed by either a CT scan or by a MRI scan .

Exclusion Criteria:

1. Presenting with haemorrhagic stroke / subarachnoid haemorrhage / cerebral venous sinus thrombosis.
2. Patients with previous history of Transient Ischaemic Attack (TIA)/Cerebrovascular Accident (CVA).
3. Patients who are on thiazide diuretics/known cases of gout or show clinical evidences of gout/Chronic Kidney Disease (CKD).
4. Patients who were of known cardiac diseases, which could be sources of emboli or whose echocardiogram shown sources of emboli.
5. Patients with haematological abnormalities (leukaemia, other myeloproliferative disorders).

Statistical Analysis:

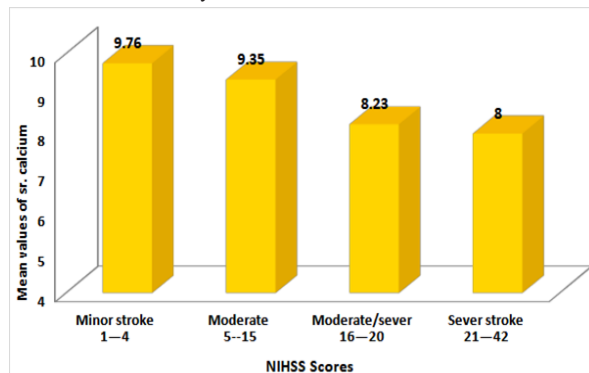
Statistical data was analyzed by IBMSPSS25.0 version software. Collected data were spread on excel sheet and prepared master chart. Through the master chart tables and graphs were constructed. For quantitative data analysis mean and standard deviations were calculated, t-test was applied for statistical significant. For qualitative data analysis chi-square test and Fisher exact probability tests were applied for statistical significance. If P-value was less than 0.05 considered as significant.

RESULTS:

Table No.8: Correlation of NIHSS score with serum calcium

NIHSS score	Categories	No	Sr. calcium Mean $\pm$ SD
1—4	Minor stroke	37	9.76 $\pm$ 0.64
5--15	Moderate	100	9.35 $\pm$ 0.56
16—20	Moderate/sever	29	8.23 $\pm$ 0.44
21—42	Sever stroke	34	8.00 $\pm$ 0.30
Total	—	200	9.03 $\pm$ 0.83
ANOVA test, P-value	—	—	F = 101.05, P = 0.000, HS
Correlation coefficient	—	—	r = -0.812 P = 0.001, HS

Study reveals that; there was statistically highly significant negative correlation between NIHSS scores with serum calcium ($P < 0.001$). As NIHSS score of severity increases serum calcium level decreases

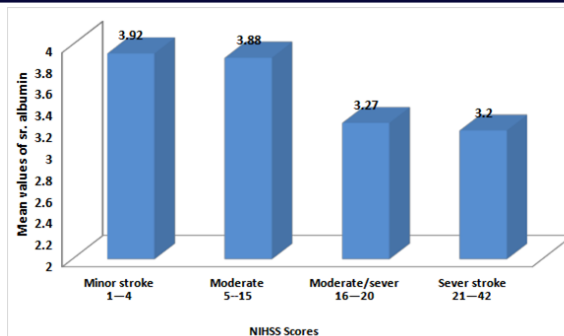


Bar diagram presents correlation of NIHSS score with calcium

Table No.9: Correlation of NIHSS score with serum albumin

NIHSS score	Categories	No of patients	Sr. uric acid Mean $\pm$ SD
1—4	Minor stroke	37	3.74 $\pm$ 0.85
5--15	Moderate	100	4.58 $\pm$ 1.10
16—20	Moderate/sever	29	6.40 $\pm$ 0.86
21—42	Sever stroke	34	7.04 $\pm$ 0.42
Total	—	200	5.11 $\pm$ 1.49
ANOVA test, P-value	—	—	F = 102.12, P = 0.000, HS
Correlation coefficient	—	—	r = +0.772, P = 0.001, HS

Study reveals that; there was statistically highly significant negative correlation between NIHSS scores with serum albumin ($P < 0.001$). As NIHSS score of severity increases serum albumin level decreases

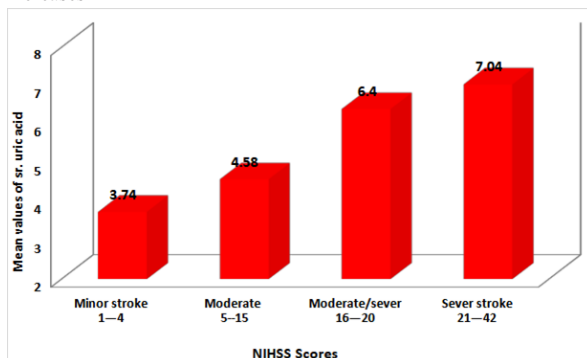


Bar diagram presents correlation of NIHSS score with serum albumin

Table No.10: Correlation of NIHSS score with serum Uric Acid

NIHSS score	Categories	No	Sr. albumin Mean $\pm$ SD
1—4	Minor stroke	37	3.92 $\pm$ 0.26
5--15	Moderate	100	3.88 $\pm$ 0.37
16—20	Moderate/sever	29	3.27 $\pm$ 0.39
21—42	Sever stroke	34	3.20 $\pm$ 0.57
Total	—	200	3.68 $\pm$ 0.51
ANOVA test, P-value	—	—	F = 39.78, P = 0.000, HS
Correlation coefficient	—	—	r = -0.621 P = 0.01, HS

Study reveals that; there was statistically significant positive correlation between NIHSS scores with serum Uric Acid ($P < 0.001$). As NIHSS score of severity increases serum uric acid level also increases



Bar diagram presents correlation of NIHSS score with serum Uric Acid

DISCUSSION

Study observed that, 99 (49.5%) of patients were seen with hypocalcaemia, 43 (21.5%) of patients were seen hypoalbuminemia and 62 (31.0%) of patients were seen with hyperuricemia. Each group has been compared with the demographic factors such as age and gender along with diabetic and hypertensive status. Study observed that; Out of 200 sample of ischemic stroke patients, 52 (26.0%) of patients were seen type 2 diabetes mellitus and 113 (56.5%) of patients were seen hypertension. In our study of 200 Acute ischemic stroke patients, we found a significant positive correlation between SUA and NIHSS score. Chiquete E1, Ruiz-Sandoval JL, et al.⁽⁶⁾ studied 463 patients (52% men, mean age 68 years) with AIS pertaining to the multicenter registry PREMIER and found SUA ≤ 4.5 mg/dl was positively associated with short-term outcome and concluded that low SUA concentration is modestly associated with a very good short-term outcome.

In our study, the mean serum albumin level in the study population was 3.6 ± 0.7 g%. The mean NIHSS score was 12.12. The serum albumin values had a highly significant correlation with the neurological severity by NIHSS scores (p value < 0.001). Sharma et al.⁽⁹⁾ (Delhi) studied the correlation of serum albumin with initial neurologic severity and short-term outcome in patients with AIS. The neurologic severity was measured at admission using NIHSS score. The mean serum albumin level in the study population was 3.73g%. The serum albumin values had a highly significant negative correlation with the

NIHSS scores (p value < 0.001).

In the present study, it was found that serum calcium levels had a negative correlation with NIHSS in patients with ischemic stroke, and this correlation was statistically significant. A study conducted by Pavan Kumar Bharamaraddi Chinnammanavar, Vijayakumar G Somannavar, Prashanth B Mohan et al⁽¹⁰⁾ found that Low serum calcium exacerbates NIHSS. However, they found that NIHSS was unrelated to albumin, uric acid, or demography.

CONCLUSION

We conclude that blood uric acid, albumin, and calcium measurement can be an important additional parameter for predicting poor prognosis and recovery in ischemic stroke patients. From all these, we can conclude that ischemic stroke patients with low blood albumin, low blood calcium, and high blood uric acid levels had a bad prognosis.

REFERENCES

1. Sacco RL, Kasner SE, Broderick JP, Louis R, Caplan J, J, Buddy Connors, Antonio Culebras et al. An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2013;44(7):2064-2089.
2. Das SK, Banerjee TK, Biswas A, Trishit Roy, Deepak K Raut, Chandra S Mukherjee et al. A prospective community-based study of stroke in Kolkata, India. *Stroke* 2007;38(3):906-910.
3. Ferri CP, Acosta D, Guerra M, Huang Y, Llibre-Rodriguez JJ, Salas A, et al. Socioeconomic factors and all cause and cause-specific mortality among older people in Latin America, India, and China: a population-based cohort study. *PLoS Med.* 2012; 9(2):e1001179.
4. Bonita R. Epidemiology of stroke. *The Lancet.* 1992;339(8789):342-4.
5. Buckley BM. Healthy ageing: ageing safely. *European Heart Journal Supplements.* 2001; 3(N):N6-10.
6. Dziedzic T, Slowik A, Szezdlik A. Serum albumin level as a predictor of ischaemic stroke outcome. *Stroke.* 2004;35(1):156-158.
7. Idicula TT, Waje-Andreassen U, Brogger J, Naess H, Thomassen L. Serum albumin in ischemic stroke patients: the higher the better. *The Bergen Stroke Study. Cerebrovasc Dis.* 2009; 28(1): 13-7.
8. Chiquete E, Ruiz-Sandoval JL, Murillo-Bonilla LM, Arauz A, Orozco-Valera DR, Ochoa-Guzman A, et al. Serum uric acid and outcome after acute ischemic stroke: PREMIER study. *Cerebrovascular Diseases.* 2013; 35(2):168-74.
9. Giri S, Agarwal MP, Sharma V. Correlation of serum calcium levels with neurologic severity and short-term outcome in acute ischemic stroke. *J Assoc Physicians India.* 2009; 74:112.
10. Bharamaraddi Chinnammanavar PK, Somannavar VG, Mohan PB. Role of Serum Calcium, Serum Albumin, and Serum Uric Acid as Markers of Initial Neurological Severity and Short-term Outcome Indicators in Acute Ischemic Stroke. *J Assoc Physicians India* 2024;72(5):41-44.