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ORIGINAL RESEARCH

A Hospital Based Prospective Study to Assess the Serum Albumin Level as a Prognostic Indicator of Acute Ischemic Stroke Using Modified Rankin Scale (MRS) at 3 Months Follow Up of Patients Admitted in General Medicine Ward at Tertiary Care Center

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ABSTRACT

Background: Serum albumin acts as an independent predictor of mortality in various clinical settings. Serum albumin level at admission was found to be an independent prognostic factor for ischemic stroke outcome in studies done in western population. Some of the studies have shown that albumin transfusion is capable of minimizing volume of infarction and cerebral edema. Hence through this study, the goal is to understand the association between serum albumin on admission and the functional status at 3 months. It also aims to find the other indicators that influence the outcome after ischemic stroke.

Materials & Methods: A hospital based prospective study done on 50 patients who got admitted in medical wards of our hospital with first instance of ischemic stroke within the first 72 hours of onset of symptoms. Patients were followed up, and after 90 days following the onset of stroke, were evaluated either in person or over the phone using the Modified Ranking scale to assess their functional status. Statistical analysis was carried out to establish whether a statistically significant association exists between serum albumin level on admission and the stroke severity, as well as the functional outcome at the end of 90 days.

Results: Majority of patients were in the 50-60 years age group with a mean age of 56.8±10.24 years. Among the study population, 30 were males and 20 were females. Hypertension (60%) was found to be the most frequently associated comorbid condition. Patients with low serum albumin level at admission time were directly proportional to severity of stroke at presentation and poor clinical outcome. The patients with poor outcome had significantly more severe neurological deficit on admission measured on Scandinavian Stroke Scale.

Conclusion: We concluded that serum albumin level was inversely associated with severity of stroke at onset and thereafter in outcome on follow up, studies involving large number of patients will throw more light in future in this regard.

Keywords: IHS, Serum albumin, mRS scale, Scandinavian Stroke Scale.

INTRODUCTION

Stroke is one of the major causes of mortality and morbidity worldwide. After coronary artery disease and cancers of all types, stroke is the third commonest cause of death worldwide. Globally about 15 million new stroke events occur every year, two-third of which occur in people living in low income and middle-income countries. Demographic transition resulting from adaptation of westernized lifestyle is also likely to increase the burden of stroke in developing economies.[1] In India, age adjusted prevalence rate of ischemic stroke is 250-350/1,00,000 and stroke contributes 1.2% of total death in India. As late as 2000, India was ranked among countries lacking sufficient data on stroke.[2]

Early mortality due to stroke is directly related to stroke. Complications affect the mortality only later in the course. Previous studies have elucidated the various risk factors of stroke as well as the factors which influence mortality, which serve as predictors of mortality. Stroke severity, type of stroke, increased age, level of consciousness and hyperglycaemia are a few of them. These are non-modifiable, hence of limited interest in clinical practise. Identification of predictors of mortality which are modifiable are vital so that prompt therapeutic measures can be started to improve outcome.[3]

Albumin is a multi-factorial protein which has been proven to have neuroprotective effect in animal studies. Albumin also is an indicator of nutritional status. Serum albumin acts as an independent predictor of mortality in various clinical settings. Serum levels of albumin may also serve as a marker of subclinical disease in elderly patients. Studies in hospitalized patients have revealed that low serum concentration of albumin is associated with prolonged hospital stay, more complications and higher mortality. It also correlates with the prolongation of stay in intensive care unit, increased ventilator requirements and escalating rate of infections. The daily trend of serum albumin may be used as a guide to predict the weaning capability of patients on mechanical ventilation.[4] Serum albumin values at 24-48hours of ICU admission were found to be as good as APACHE II score in predicting mortality. APACHE III system takes serum albumin value into consideration and has better predictive value for mortality in critical illness.[5] Serum albumin, though considered a measure of nutrition, is not a reliable marker of the nutritional status in those who are critically ill.

Studies on prognostic factors of ischemic stroke in our population are limited. Serum albumin level at admission was found to be an independent prognostic factor for ischemic stroke outcome in studies done in western population. Some of the studies have shown that albumin transfusion is capable of minimizing volume of infarction and cerebral edema. Albumin reduces the hematocrit as well as the erythrocyte sedimentation rate by its affect on erythrocyte aggregation. Effect of albumin is primarily in the early reperfusion phase of acute ischemic stroke where it has an inhibitory effect on thrombosis, stagnation and adhesion of leucocytes in microcirculation. Hence through this study, the goal is to understand the association between serum albumin on admission and the functional status at 3 months. It also aims to find the other indicators that influence the outcome after ischemic stroke.

MATERIALS & METHODS

A hospital based prospective study done on 50 patients who got admitted in medical wards of our hospital with first instance of ischemic stroke within the first 72 hours of onset of symptoms. These patients were included in the study after getting informed consent either from the patient or from the legal guardian.

EXCLUSION CRITERIA

- Acute haemorrhagic stroke, ischemic stroke with hemorrhagic transformation or stroke related to intracranial space occupying lesion (ICSOL).

- Past history of stroke.
- Patients presenting more than 72 hr after the onset of stroke.
- Patients with diagnosed malignancy.
- Patients with history of chronic liver disease, chronic heart failure, chronic kidney disease or dementia.
- Patients with fever or infections.

METHODS

Cases were defined as per WHO definition of stroke. Hypertension was documented if there were records proving it or when at least 2 readings of blood pressure - systolic blood pressure was ≥140 mm Hg and diastolic blood pressure was ≥90 mmHg after the acute phase of stroke. Coronary artery disease was diagnosed with either ECG changes or previous records. Patient was considered a smoker if he had a history of smoking in the past 5 years.

A detailed history was elicited from the attenders, followed by general examination, an elaborate CNS examination and relevant examination of other systems. Vitals were stabilized, and patients underwent a CT scan of the brain in order to rule out hemorrhagic stroke or any mass lesion. Severity of stroke was graded using the Scandinavian Stroke Scale (SSS). Basic investigations like complete hemogram-including ESR, blood sugar, renal function test, liver function test and serum proteins-albumin and globulin, lipid profile and urine routine examination. ECG was taken to establish any coronary artery disease.

SERUM ALBUMIN WAS MEASURED USING BROMOCRESOL GREEN

Patients were followed up, and after 90 days following the onset of stroke, were evaluated either in person or over the phone using the Modified Ranking scale to assess their functional status.

STATISTICAL ANALYSIS

The significance of association was tested using Anova and Kruskal wallis test. Statistical analysis was carried out to establish whether a statistically significant association exist between serum albumin level on admission and the stroke severity, as well as the functional outcome at the end of 90 days. The secondary outcomes that were aimed to be tested included the association with risk factors and the viability of the stroke scales.

RESULTS

In this study, about 50 patients with AIS were included. The majority of patients were in the 50-60 years age group with mean age of 56.8±10.24 years. Among the study population, 30 were males and 20 were females.

Hypertension (60%) was found to be the most frequently associated comorbid condition followed by diabetes mellitus (26%). Only 24% were addictive habits in this study (table 1).

As per the scores for disability on the MRS range the patients were divided into mild moderate and severe disability. There were 12 patients with mild score, 12 with moderate disability and severe disability were present in 26 patients.

Our study showed that MCA infarct was present in 26 patients followed by lacunar infarct was present in 12 patients, multi-infarct was present in 10 patients and posterior CIRC stroke was present in 2 patients. The correlation of type of lesions with MRS score was statistical non-significant ($P>0.05$) (table 2).

The association between GCS and albumin was found to be significant (p value<0.05) using the ANOVA test. The mean albumin in those with GCS>13was 4.19 mg/dl while those for GCS< 9 was 3.18 mg/dl (table 3).

The mean albumin level in subjects with mild disability was 4.20 mg/dl, as opposed to 3.26 mg/dl in patients with severe disability, the higher the serum albumin levels, the lower the MRS score, hence better the outcome at 90 days. The mean albumin in patients with mild impairment was 4.18 mg/dl, while in those with severe impairment was 3.31 mg/dl. The patients with poor outcome had significantly more severe neurological deficit on admission measured on Scandinavian Stroke Scale (table 4).

Table 1: Demographic profile of patients with disability based MRS score

Demographic profile	Disability (MRS score)			Total	P-value
	Mild (N=12)	Moderate (N=12)	Severe (N=26)		
Age (yrs) Mean±SD	60.23±11.86	54.58±12.24	59.6±13.43	56.8±10.24	>0.05
Sex					
Male	7	9	14	30	>0.05
Female	5	3	12	20	
Systemic hypertension					
Yes	6	8	16	30	>0.05
No	5	4	10	20	
Type-II Diabetes mellitus					
Yes	3	4	6	13	>0.05
No	9	8	20	37	
Addictive habits					
Yes	4	3	5	12	>0.05
No	8	9	21	38	

Table 2: Type of lesions with disability based MRS score

Type of lesions	Disability (MRS score)			P-value
	Mild (N=12)	Moderate (N=12)	Severe (N=26)	
MCA infarct (N=26)	8	6	12	>0.05
Multi infarct (N=10)	1	3	6	
Posterior CIRC stroke (N=2)	0	1	1	
Lacunar infarct (N=12)	3	2	7	

Table 3: GlassGow Coma Scale v/s disability based MRS score

GlassGow Coma Scale	Disability (MRS score)			P-value
	Mild (N=12)	Moderate (N=12)	Severe (N=26)	
Mild (N=6)	4	2	0	<0.05*
Moderate (N=23)	8	6	9	
Severe (N=21)	0	4	17	

Table 4: Serum albumin level v/s disability based MRS score

Serum albumin level (mg/dl)	Disability (MRS score)			P-value
	Mild (N=12)	Moderate (N=12)	Severe (N=26)	
Mean±SD	4.20±0.28	4.08±0.46	3.26±0.74	<0.001**
	SCANDINAVIAN STROKE SCALE			
	Mild (N=3)	Moderate (N=18)	Severe (N=29)	
Mean±SD	4.18±0.46	3.87±0.63	3.31±0.66	0.001**

DISCUSSION

Albumin is a molecule with multifaceted action on various systems in the body. Neuroprotective effects of albumin have been well documented in animal studies. Studies have been conducted in the western population regarding the usefulness of serum albumin as an indicator of prognosis in
ischemic stroke.[6] There are few Indian studies in this regard. Previous studies concluded that serum albumin is an independent predictor of functional outcome in ischemic stroke. The study by Gariballa et al, has observed that low serum albumin level is a prognostic indicator of poor functional outcome in stroke. In this study, among the various nutritional markers used, only serum albumin level had significant and independent association with stroke outcome.[7] Babu et al also observed an association between low admission time serum albumin and poor functional outcome after 3 months of follow up.[8] Also observed that recurrence of stroke is high in patients with low serum albumin level at presentation. Ramesh et al also identified serum albumin level as an independent predictor of survival in neurosurgical ICU patients.[9]

Serum albumin acts as an independent predictor of mortality in various clinical settings. Serum levels of albumin may also serve as a marker of subclinical disease in elderly patients. Studies in hospitalised patients have revealed that low serum concentration of albumin is associated with prolonged hospital stay, more complications and higher mortality.[10] It also correlates with the prolongation of stay in intensive care unit, increased ventilator requirements and escalating rate of infections. Albumin slows the onset and enhances the vasodilatory response to nitric oxide. Nitric oxide by binding to the sulfhydryl groups of albumin, forms the S-nitrosothiol group which is not rapidly degraded. Thus albumin plays a role in the regulation of vasodilatory tone of vessels.[11]

Our study showed that the majority of patients were in the 51-60 year age group. In the present study, higher male predominance among the AIS patients was observed which may be attributed to a sociocultural bias in India and also males are more exposed to tobacco chewing/ smoking and alcohol. This study was comparable to other Indian studies on stroke patients where greater preponderance was seen among males. Age is one of the non-modifiable risk factors of ischemic stroke.[12]

HTN and diabetes mellitus were the most common risk factors observed in this study which is supported by other studies like Reeta et al, and Gaurav et al, study.[13,14]

Our study showed that MCA infarct was present in 26 patients followed by lacunar infarct was present in 12 patients, multi-infarct was present in 10 patients and posterior CIRC stroke was present in 2 patients. The correlation of type of lesions with MRS score was statistical non-significant ($P>0.05$). Dr. Durga hari prasad D et al[15] found right side weakness was presenting complaint in 52 patients followed by left side weakness was presenting complaint in 48, Out of 100 patients 52 have LEFT MCA infarct ,48 have RIGHT MCA infarct.

The association between GCS and albumin was found to be significant (p value<0.05) using the ANOVA test. The mean albumin in those with GCS$>13$was 4.19 mg/dl while those for GCS$<$ 9 was 3.18 mg/dl.

Using ANOVA test, the association between MRS and serum albumin had a p value<0.05 which was significant. Hence there was a negative correlation between serum albumin at admission with the MRS score at 90 days. The mean albumin level in subjects with mild disability was 4.20 mg/dl, as opposed to 3.26 mg/dl in patients with severe disability, the higher the serum albumin levels, the lower the MRS score, hence better the outcome at 90 days. Dash PK et al[16] found serum albumin level was compared with mRS score at the end of first week revealing spearman's rank correlation coefficient of r= -0.410 and p value less than 0.001 which is significant. Similarly, serum albumin level was compared with mRS score at 3 months of post admission revealing spearman's rank correlation coefficient of r= -0.633 and

p value of less than 0.01 revealing significant negative correlation. A lower mRS score indicates a milder disability and better outcome. Hence the higher the serum albumin level, the lower the mRS score and better the outcome.

The association between SSS and albumin had a significant association with a p value<0.05. Hence proving that there was a positive correlation between the SSS score at admission and the serum albumin. The mean albumin in patients with mild impairment was 4.18 mg/dl, while in those with severe impairment was 3.31 mg/dl. The patients with poor outcome had significantly more severe neurological deficit on admission measured on Scandinavian Stroke Scale. Dash PK et al[16] at 3-month follow-up period, 36% had poor outcome, with 12.9% deaths. Poor outcome patients had mean serum albumin level of 3.4 g/dl Vs 3.6 g/dl in good outcome group. Dr Sachin Thacker et al[17] found that there was a strong negative correlation between the SSS score at admission and the MRS score at 90 days. This entails that higher the SSS score, lower the MRS score hence more the disability at 90 days.

Malnutrition, liver disease, renal disease etc reduce serum albumin level. Catabolic state and neuroendocrine response that follow stroke alter serum albumin level. Malnutrition also down regulate protein synthesis. Nutrition is thought to be the single most important factor regulating albumin synthesis.

CONCLUSION

We concluded that serum albumin level was inversely associated with severity of stroke at onset and thereafter in outcome on follow up, studies involving large number of patients will throw more light in future in this regard.

REFERENCES

1. Lamberti E. Ross L, Taub E, editors. Thieme atlas of anatomy: head and neuroanatomy.1st ed. New York: Thieme; 2007.p.176.
2. Chozakade A: A Study of Serum Albumin Level as a Prognostic Indicator of Acute Ischemic Stroke. Coimbatore Medical College, Coimbatore, 2019.
3. Donkor ES: Stroke in the century: a snapshot of the burden, epidemiology, and quality of life. Stroke research and treatment 2018, 2018.
4. Sapijasko MJA, Brant R, Sandham D, Berthiame Y. Nonrespiratory predictors of mechanical ventilation dependency in ICU patients. Crit care Med 1996;24:601-607
5. Knaus W A, Wagner DP, Draper EA, Zimmerman JE, Bergner M, Bastos PG et al. The APACHE III prognostic system risk prediction of hospital mortality for critically ill hospitalised adults. Chest 1991;100:1619-36.
6. Ezra A, Rabinovich-Nikitin I, Rabinovich-Toidman P, Solomon B: Multifunctional effect of human serum albumin reduces Alzheimer's disease related pathologies in the 3xTg mouse model. Journal of Alzheimer's Disease 2016, 50:175-88.
7. Gariballa. Influence of nutritional status on clinical outcome after acute stroke. Am J Clin Nutr. 1998;68:275-81.
8. Babu MS, Kaul S, Dadheech S, Rajeshwar K, Jyothy A, Munshi A. Serum albumin levels in ischemic stroke and its subtypes: correlation with clinical outcome. Nutrition. 2013;29(6):872-5.
9. Ramesh VG. Bedside computed tomography in traumatic brain injury. Neurol India 2016. 2019; 64:12-3.
10. Henry OF, Blacher J, Verdavaine J, Duviquet M, Safar ME: Alpha 1-acid glycoprotein is an independent predictor of in-hospital death in the elderly. Age and Ageing 2003, 32:37-42.

11. McConeghy KW, Hatton J, Hughes L, Cook AM: A review of neuroprotection pharmacology and therapies in patients with acute traumatic brain injury. CNS drugs 2012, 26:613-36.
12. Dash PK, Behera S, Sahoo NC, Rattan R, Tripathy SK. Serum albumin level as prognostic indicator of acute ischemic stroke in tertiary care hospital admitted patients. Int J Adv Med 2020;7:948-53.
13. James R, Antony J, Sreedhar S, Mathew R, Surendran A. study of serum albumin as a predictor of short-term functional outcome in acute ischaemic stroke J. Evolution Med Dent Sci. 2278-4802.
14. Kasundra G, Sood I. Prognostic Significance of Serum Albumin Levels In Acute Ischemic Stroke. Natl J Integr Res Med. 2014;5:1-4
15. Dr. Durga hari prasad D, Dr. E. Arunraj, Dr. K. Vignesh. Serum Albumin Level as Prognostic Indicator of Acute Ischemic Stroke in Tertiary Care Centre. International Journal Dental and Medical Sciences Research,2022;4(4):01-05.
16. Dash PK, Behera S, Sahoo NC, Rattan R, Tripathy SK. Serum albumin level as prognostic indicator of acute ischemic stroke in tertiary care hospital admitted patients. Int J Adv Med 2020;7:948-53.
17. Dr Sachin Thacker, Dr. Shrijikumar C. Thakkar, Dr Purvi J Tanna, Dr. Ruchi Baghel. Serum Albumin Level as a Prognostic Indicator of Acute Ischemic Stroke. Journal of Cardiovascular Disease Research,2022;13(05):1820-24.