

**Study of Correlation of Serum Albumin Levels and in-Hospital Outcome in Acute Ischemic Stroke Subjects**Ameen Ahsan V<sup>1</sup>, Ramesh S S<sup>2</sup>, Lavanya B U<sup>3</sup><sup>1</sup>Postgraduate, Department of General Medicine, Mysore medical college and Research Institute<sup>2</sup>Professor, Department of General Medicine, Mysore medical college and Research Institute<sup>3</sup>Assistant Professor, Department of General Medicine, Mysore medical college and Research Institute

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Conflict of interest: Nil

**Abstract:**

**Background:** Acute ischemic stroke (AIS) is defined by the sudden loss of blood flow to an area of the brain with the resulting loss of neurologic function. Stroke is the second most common cause of death and disability-adjusted life years worldwide. Albumin is mainly synthesized in the liver and classified as a non-glycosylated plasma protein and is involved in the transport of small molecules, is used as a co-factor in different essential pathways, and contributes as a major force in limiting fluid leakage from vascular compartment into the interstitium, also offers neuroprotective effect. This study is undertaken to study the correlation between Serum Albumin Levels and In-Hospital Outcome in Acute Ischemic Stroke Subjects.

**Method:** Longitudinal observational study was done for a period of 1 year in KR Hospital, Mysore in 30 acute ischemic stroke patients who met inclusion and exclusion criteria. After taking institutional ethical clearance the nature of study was explained to patient and patient party and written informed consent taken. Clinical and demographic profile at the time of admission were recorded and laboratory investigations (CBC, LFT, RFT, S/E, RBS, Lipid profile, NCCT Head, ECG, 2D Echo) were performed within 24 hours of admission. Neurological status at the time of admission were assessed using NIHSS and were classified into 4 categories (Minor, Moderate, Moderate-severe, Severe). Functional outcome was assessed on day 7 of admission using mRS (modified Rankin scale) and were divided into 2 categories (Poor outcome, Non poor outcome). The outcomes were correlated with serum albumin level.

**Result:** In the present study, Out of the 30 subjects, 60% were males and 40% were females. Majority of the patients belonged in 41-60 years age group (53.3%). Hypertension was the most common risk factor observed in the study (70%). Most of the cases were in NIHSS Moderate-severe category (33.3%). Serum albumin levels at the time of admission were shown to have inverse correlation with severity at admission and outcome at day 7.

**Conclusion:** The findings in present study suggest that there is an inverse correlation between serum albumin and outcome in patients with acute ischemic stroke. It also shows that low admission levels of serum albumin correlates with high NIHSS scores indicating severity of stroke. Serum Albumin level can be used as cost effective marker for prognostication in acute ischemic stroke patients.

**Keywords:** Acute ischemic stroke; Serum albumin levels; Risk factors; Prognosis.

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**Introduction**

Acute ischemic stroke (AIS) is defined by the sudden loss of blood flow to an area of the brain with the resulting loss of neurologic function [1]. Stroke is the second most common cause of death and disability-adjusted life years worldwide [2]. Albumin is mainly synthesized in the liver and classified as a non-glycosylated plasma protein and is involved in the transport of small molecules, is used as a co-factor in different essential pathways, and contributes as a major force in limiting fluid leakage from vascular compartment into the interstitium, also offers neuroprotective effect [3]. This study is undertaken to study the correlation between Serum Albumin Levels and In-Hospital

Outcome in Acute Ischemic Stroke Subjects. A stroke, or cerebrovascular accident, is defined as an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause [4]. Of all strokes, ≈87% are ischemic, 10% are intracranial hemorrhage, and 3% are subarachnoid hemorrhage [5]. Stroke is the second leading cause of death worldwide, with 6.2 million dying from stroke in 2015, an increase of 830,000 since the year 2000. In 2016, the lifetime global risk of stroke from age 25 years onward was 25%, an increase of 8.9% from 1990. Stroke is likely to remain the second most common disabling condition in individuals aged 50 or older worldwide [6].

### Aims and Objectives

- To study serum albumin levels in ischemic stroke subjects
- To correlate the levels of albumin to in-hospital outcome

### Materials and Methods

**Source of Data:** IPD patients, Department of General Medicine, KR Hospital, MMCRI, Mysore

#### Collection of Data:

**Study design:** Longitudinal observational study

**Study period:** August 2022 to August 2023

**Place of study:** KR Hospital, MMCRI, Mysore

#### Statistical Methods

- Statistical analysis was done using IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp
- Descriptive statistical methods used were: mean, standard deviation, frequency and percentage
- Inferential statistics methods were t-test for independent samples, ANOVA, chi-square test

The study was conducted over a period of 1 year after obtaining clearance from institutional ethical committee. Patients of 18 years and above and meeting the selection criteria were enrolled into the study. Consent was taken from each patient willing to participate in the study. Clinical and demographic profile at the time of admission were recorded and laboratory investigations (CBC, LFT, RFT, S/E, RBS, Lipid profile, NCCT Head, ECG, 2D Echo) were performed within 24 hours of admission. Neurological status at the time of admission were assessed using NIHSS and were classified into 4 categories (Minor, Moderate,

Moderate-severe, Severe). Functional outcome was assessed on day 7 of admission using mRS (modified Rankin scale) and were divided into 2 categories (Poor outcome, Non poor outcome). The outcomes were correlated with serum albumin level.

#### Selection Criteria

##### Inclusion Criteria:

- Acute ischemic stroke patients
- Age more than 18 years

##### Exclusion Criteria:

- Hemorrhagic stroke
- Cerebral venous sinus thrombosis
- Serious medical illness leading to prolonged immobilization
- Chronic gastrointestinal disease
- Chronic liver disease
- Chronic renal disease
- Malignancy
- Autoimmune disease

#### Sample size Estimation

- Considering population prevalence of stroke 1% to 2%
- $S = Z^2PQ/D^2$
- S=sample size
- Z=std. value @ 0.05 level =1.96
- P=proportion of prevalence =2% becomes 0.02
- $Q = 1 - P = 1 - 0.02 = 0.98$
- $D^2 = \text{Margin of error or confidence interval} = 5\%$  (to be expressed in decimals) = 0.05
- $S = (1.96 \times 1.96 \times 0.02 \times .98) / 0.05 \times 0.05 = 30$
- Sampling-purposive sampling

### Results

#### Age

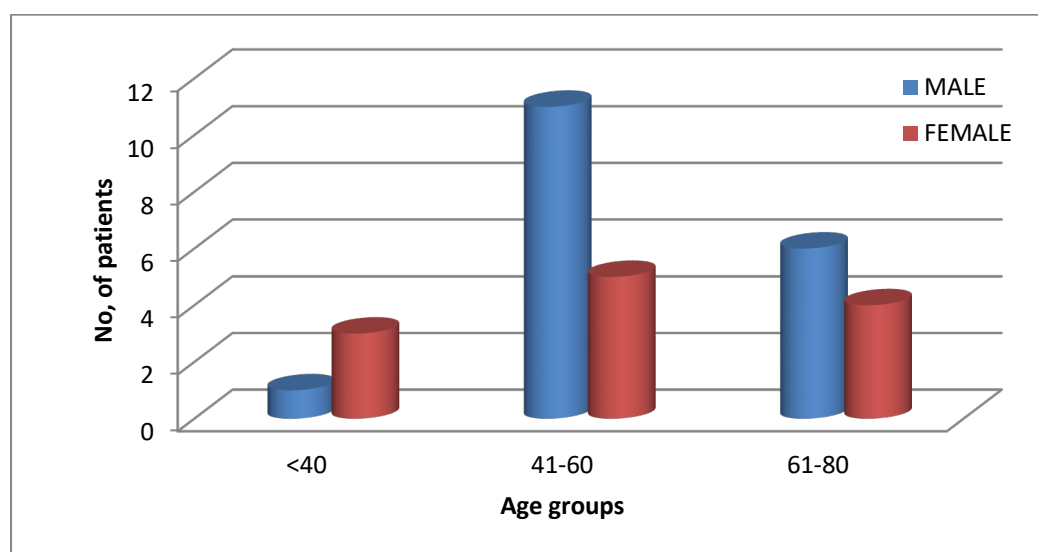
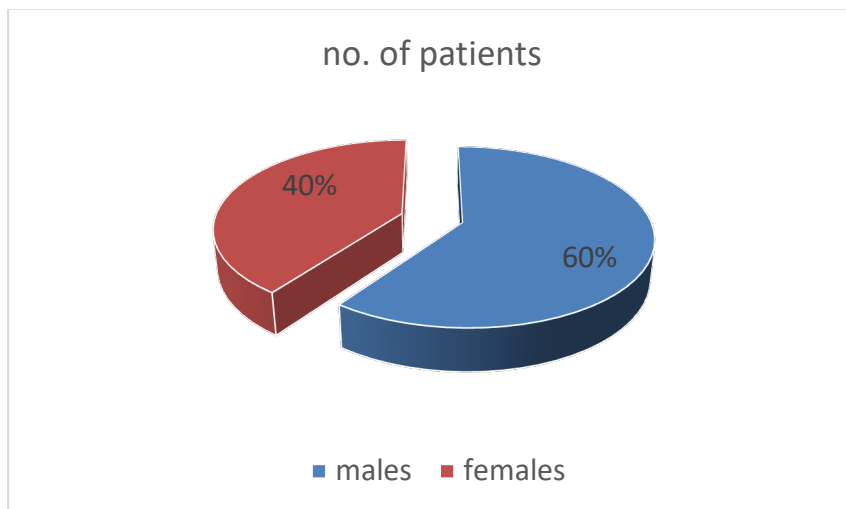


Figure 1: Distribution according to age groups

Out of 30 subjects, majority of the patients were in the 41-60 years age group(53.3%), followed by 61-80 years(33.3%), then <40 years(13.3%)

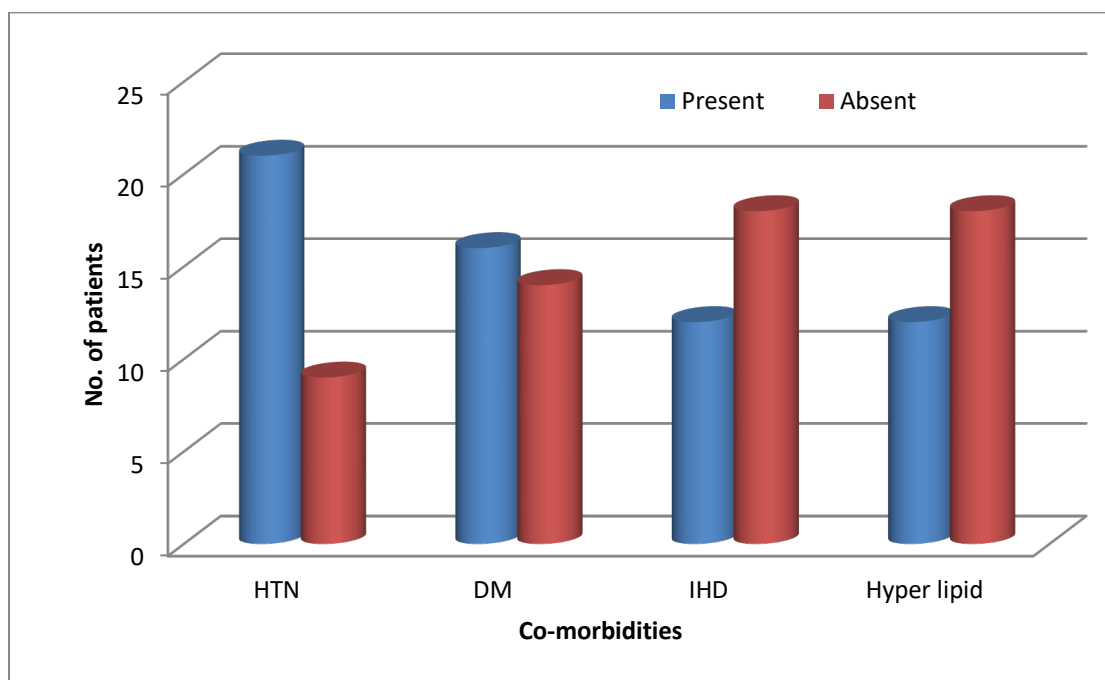
**Gender**



**Figure 2: Distribution of Study population according to gender**

In this study majority of subjects were male (60%), and female (40%)

**Distribution according to co-morbidities**



**Figure 3: Distribution of study population according to co-morbidities**

**Table 1: Distribution of study population according to co-morbidities- Hypertension**

Hypertension		
	Frequency	Percent
Yes	21	70.0
No	9	30.0
Total	30	100.0

Out of 30 subjects, 21(70%) were found to have hypertension

**Table 2: Distribution of study population according to co-morbidities-Diabetes Mellitus**

Diabetes Mellitus		
	Frequency	Percent
Yes	16	53.3
No	14	46.7
Total	30	100.0

Out of 30 subjects, 16(53.3%) were found to have diabetes mellitus

**Table 3: Distribution of study population according to co-morbidities- Ischemic heart disease**

Ischemic heart disease		
	Frequency	Percent
Yes	12	40
No	18	60
Total	30	100.0

Out of 30 subjects, 12(40.0%) were found to have Ischemic heart disease

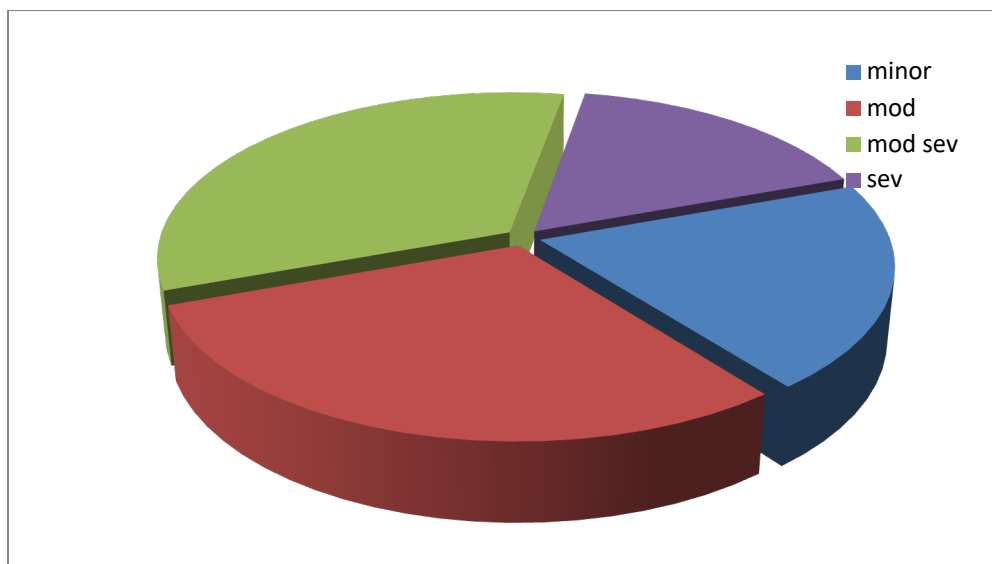
**Table 4: Distribution of study population according to co-morbidities- Dyslipidemia**

Dyslipidemia		
	Frequency	Percent
Yes	12	40
No	18	60
Total	30	100.0

Out of 30 subjects, 12(40.0%) were found to have Dyslipidemia

**Table 5: Distribution of study population according to NIHSS score at admission**

NIHSS Category	No. of patients
Minor	6(20%)
Moderate	9(30%)
Moderate-severe	10(33.3%)
Severe	5(16.6%)

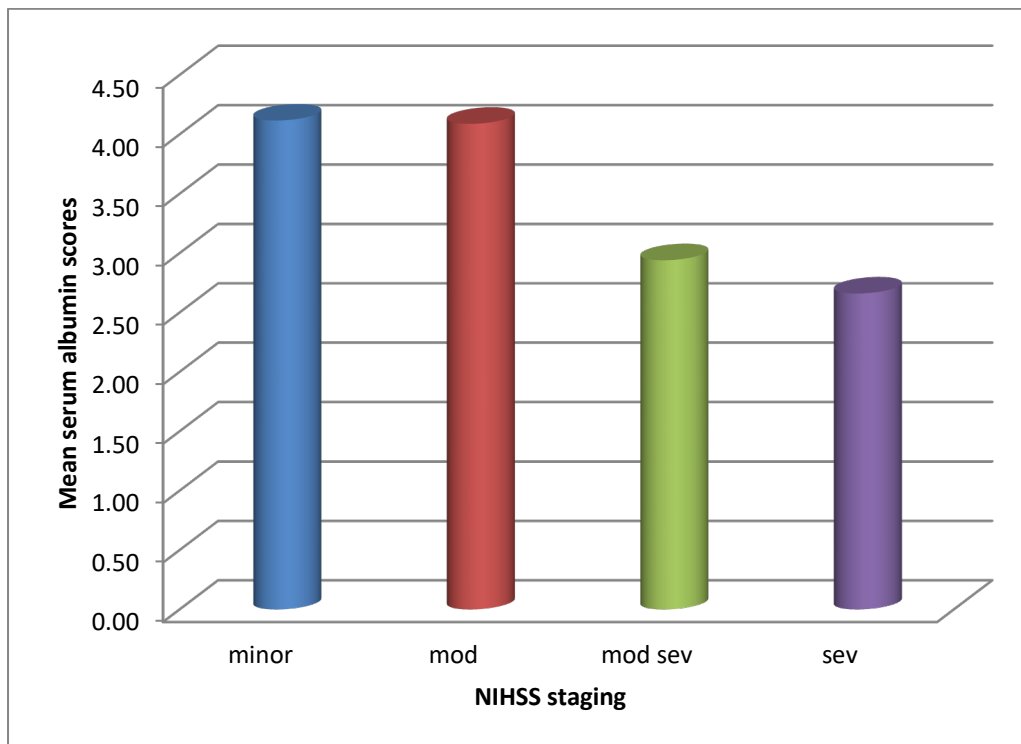


**Figure 4: Distribution of study population according to NIHSS score at admission**

The severity of ischemic stroke at the time of admission was assessed by NIHSS (0-42) and patients were categorised into mild (1-4), moderate (5-15), moderate-severe(16-20), and severe(21-42). In present study, most of the (33.3%) were in moderate-severe category, followed by moderate(30%), minor(20%), and severe(16.6%) categories.

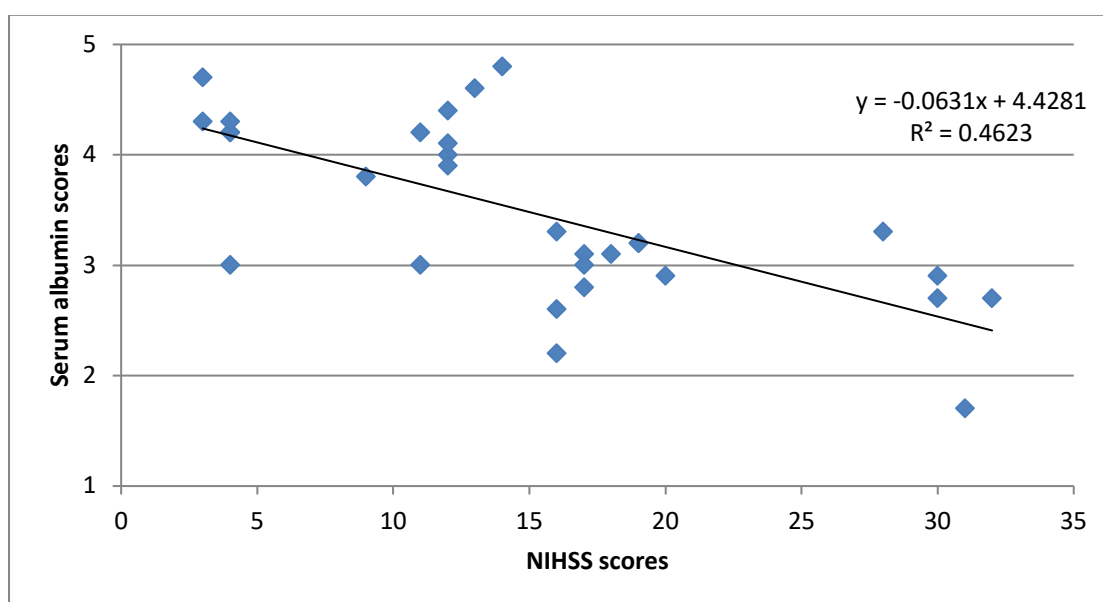
**Table 6: Mean serum albumin values in patients as per NIHSS category**

NIHSS Categories	Mean serum albumin
Minor	4.11±0.57
Moderate	4.08±0.52
Moderate-severe	2.94±0.33
Severe	2.66±0.58



**Figure 5: Mean serum albumin values in patients as per NIHSS category**

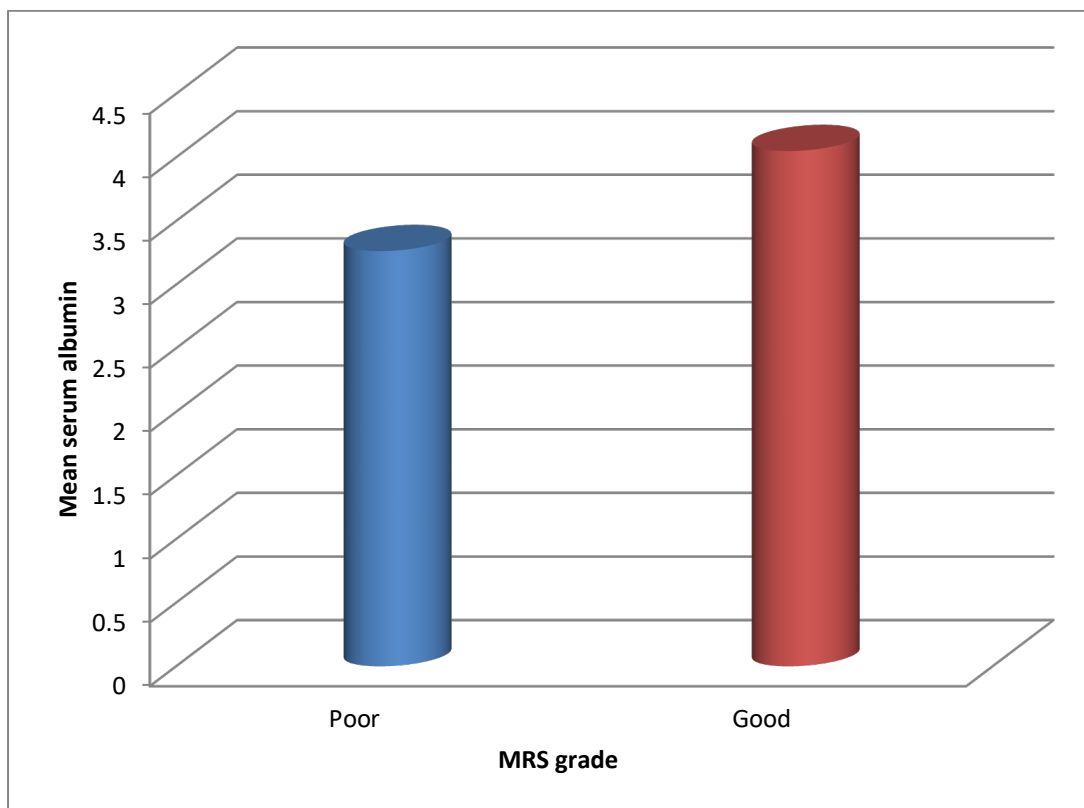
In the present study, there was significant difference in the mean value of serum albumin in the different NIHSS categories. The mean value of serum albumin in minor, moderate, moderate-severe and severe categories were 4.11±0.57, 4.08±0.52, 2.94±0.33, 2.66±0.58 respectively. Using ANOVA, the difference in the mean values of serum albumin between the categories was significant (p value<0.05).



**Figure 6: Correlation of Serum Albumin and NIHSS scores- Scatter plot**

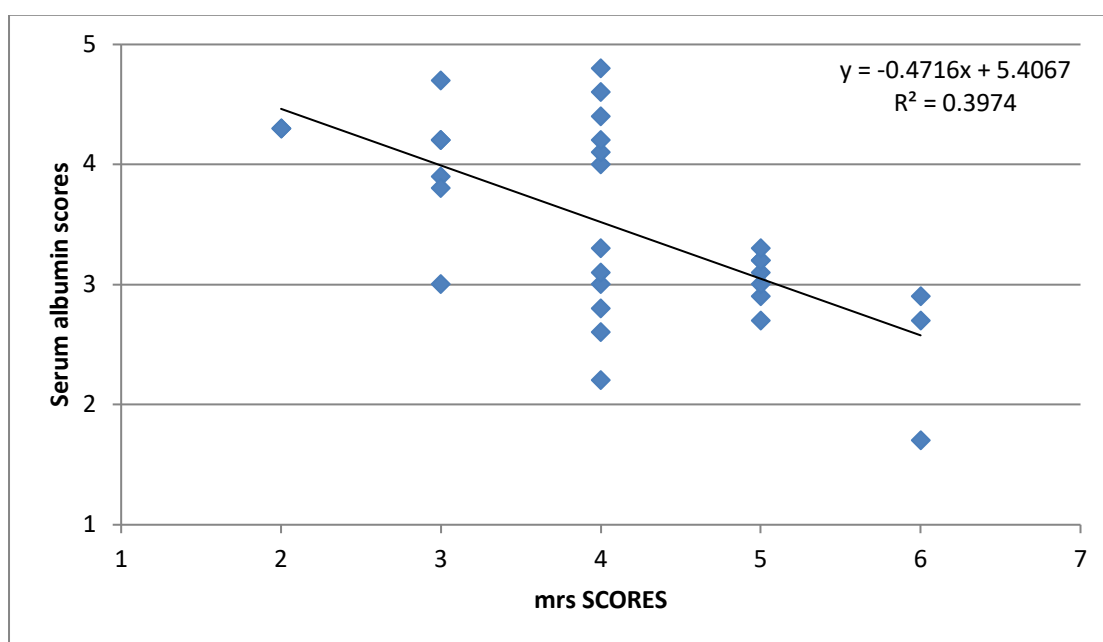
**Table 7: Mean serum albumin values in patients as per mRS score**

mRS category	Mean serum albumin
Poor	3.26±0.78
Good	4.05±0.50



**Figure 7: Mean serum albumin values in patients as per mRS score**

In the present study, there was significant difference in the mean value of serum albumin in the two classes of functional outcome. The mean value of serum albumin in poor outcome group was 3.26±0.78 and in good outcome group was 4.05±0.50. Using Independent t-test, the difference in the mean values of serum albumin between the categories was significant (p value<0.014).



**Figure 8: Correlation of Serum Albumin and mRS scores- Scatter plot**

**Table 8: Univariate analysis of association of Hypertension with NIHSS score at admission**

			NIHSS c				Total
			minor	Mod-sev	mod	sev	
HTN	YES	Count	2	5	9	5	21
		% within NIHSS c	33.3%	55.6%	90.0%	100.0%	70.0%
	NO	Count	4	4	1	0	9
		% within NIHSS c	66.7%	44.4%	10.0%	0.0%	30.0%
Total		Count	6	9	10	5	30
		% within NIHSS c	100.0%	100.0%	100.0%	100.0%	100.0%

In the present study, Hypertension was found to be an independent confounding factor for the severity of stroke ( $p=0.032$ )

**Table 9: Univariate analysis of association of Diabetes mellitus with NIHSS score at admission**

			NIHSS c				Total
			minor	mod sev	mod	sev	
DM	YES	Count	1	5	7	3	16
		% within NIHSS c	16.7%	55.6%	70.0%	60.0%	53.3%
	NO	Count	5	4	3	2	14
		% within NIHSS c	83.3%	44.4%	30.0%	40.0%	46.7%
Total		Count	6	9	10	5	30
		% within NIHSS c	100.0%	100.0%	100.0%	100.0%	100.0%

In the present study, Diabetes mellitus was not found to be an independent confounding factor for the severity of stroke ( $p=0.215$ )

**Table 10: Univariate analysis of association of Ischemic heart disease with NIHSS score at admission**

			NIHSS c				Total
			minor	mod sev	mod	sev	
IHD	YES	Count	2	3	3	4	12
		% within NIHSS c	33.3%	33.3%	30.0%	80.0%	40.0%
	NO	Count	4	6	7	1	18
		% within NIHSS c	66.7%	66.7%	70.0%	20.0%	60.0%
Total		Count	6	9	10	5	30
		% within NIHSS c	100.0%	100.0%	100.0%	100.0%	100.0%

In the present study, Ischemic heart disease was not found to be an independent confounding factor for the severity of stroke ( $p=0.258$ )

**Table 11: Univariate analysis of association of Dyslipidemia with NIHSS score at admission**

			NIHSS c				Total
			minor	mod sev	mod	sev	
Dyslipidemia	YES	Count	1	4	3	4	12
		% within NIHSS c	16.7%	44.4%	30.0%	80.0%	40.0%
	NO	Count	5	5	7	1	18
		% within NIHSS c	83.3%	55.6%	70.0%	20.0%	60.0%
Total		Count	6	9	10	5	30
		% within NIHSS c	100.0%	100.0%	100.0%	100.0%	100.0%

In the present study, Dyslipidemia was not found to be an independent confounding factor for the severity of stroke ( $p=0.159$ )

**Table 12: Univariate analysis of association of Hypertension with mRS score at day 7**

			mrs c		Total
			Poor	Good	
HTN	YES	Count	18	3	21
		% within mrs c	81.8%	37.5%	70.0%
	NO	Count	4	5	9
		% within mrs c	18.2%	62.5%	30.0%
Total		Count	22	8	30
		% within mrs c	100.0%	100.0%	100.0%

In the present study, Hypertension was found to be an independent confounding factor for the poor functional outcome in stroke (p=0.019)

**Table 13: Univariate analysis of association of Diabetes mellitus with mRS score at day 7**

			mrs c		Total
			Poor	Good	
DM	YES	Count	14	2	16
		% within mrs c	63.6%	25.0%	53.3%
	NO	Count	8	6	14
		% within mrs c	36.4%	75.0%	46.7%
Total		Count	22	8	30
		% within mrs c	100.0%	100.0%	100.0%

In the present study, Diabetes mellitus was not found to be an independent confounding factor for the poor functional outcome in stroke (p=0.061)

**Table 14: Univariate analysis of association of Ischemic heart disease with mRS score at day 7**

			mrs c		Total
			Poor	Good	
IHD	YES	Count	9	3	12
		% within mrs c	40.9%	37.5%	40.0%
	NO	Count	13	5	18
		% within mrs c	59.1%	62.5%	60.0%
Total		Count	22	8	30
		% within mrs c	100.0%	100.0%	100.0%

In the present study, Ischemic heart disease was not found to be an independent confounding factor for the poor functional outcome in stroke (p=0.866)

**Table 15: Univariate analysis of association of Dyslipidemia with mRS score at day 7**

			mrs c		Total
			Poor	Good	
Dyslipidemia	YES	Count	10	2	12
		% within mrs c	45.5%	25.0%	40.0%
	NO	Count	12	6	18
		% within mrs c	54.5%	75.0%	60.0%
Total		Count	22	8	30
		% within mrs c	100.0%	100.0%	100.0%

In the present study, Dyslipidemia was not found to be an independent confounding factor for the poor functional outcome in stroke (p=0.312)

### Discussion

Majority of patients in the study population belonged to age group 41 to 60 years (53.3%). Mean age in present study was 56.8±14.17 years, as compared to 68.3±12 years in a study by Tomasz Dziedzic et al [7]., and 49.31 ± 10.46 years

in a study by Faheem Shaikh et al. [8] and 57.68±12.4 years in a study by Sani Abubakar et al. [9]

The sex distribution of the study population was 60% males and 40% females, as compared to 71.6% males and 28.4% females in the study by Mallemoggala Sai Babu et al. [10] and 47.03% males and 52.97% females in the study by Tomasz Dziedzic et al, and 74.5% males and 25.5% females in the study by Faheem Shaikh et al, and 57.4%



males and 42.6% females in the study by Zilong Hao et al. [11]

In the study population, 70% patients had hypertension, 53.3% patients had diabetes mellitus, 40% patients had dyslipidemia and 40% had IHD as compared to 70.5%, 32.8%, 34.9%, 31.2% respectively in the study done by David Tanne et al. [12] and 81.6%, 40.3%, 29.1%, 35.7% respectively in the study by Faheem Shaikh et al, and 48.8%, 14.71%, 18.2%, 21.6% respectively in the study done by Zilong Hao et al.

In the present study, mean serum albumin (g/dl) of the poor outcome group was 3.26 and of the good outcome group was 4.05, as compared to 3.41 and 3.68 in the study by Tomasz Dziedzic et al, and 2.08 and 3.03 in the study by Zilong Hao et al.

### Conclusion

The findings in present study suggest that there is an inverse correlation between serum albumin and outcome in patients with acute ischemic stroke. It also shows that low admission levels of serum albumin correlates with high NIHSS scores indicating severity of stroke. Serum Albumin level can be used as cost effective marker for prognostication in acute ischemic stroke patients

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