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The Association of Diastolic Dysfunction in Patients with Hypoalbuminemia

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Abstract: ***Serum albumin is the most abundant serum protein that is responsible for maintaining the colloid osmotic pressure that counteracts the hydrostatic pressure in the body. As an acute phase reactant, serum albumin levels are decreased in acute and chronic illness. Low serum albumin level was associated with myocardial stiffening and fibrosis that can lead to diastolic dysfunction.***

Keywords: Serum Albumin, Diastolic dysfunction

1. Introduction

Serum albumin as we know forms the important protein component in the serum. Albumin being a negative acute phase reactant is found to decrease with inflammation. Robust inflammatory process is more frequently associated with myocardial injury and myocardial dysfunction. Decreased albumin is also a pathophysiological factor leading to the development of carotid atherosclerosis. Hypoalbuminemia is also associated with endothelial dysfunction which may impair coronary perfusion and subsequent myocardial dysfunction

Objective
To Estimate the association of diastolic dysfunction in patients with hypoalbuminemia.

2. Methodology

An observational cross-sectional study of patients having diastolic dysfunction and its correlation with the serum albumin levels. Patients were selected from the cardiology OPD in MMC & RGGGH who visit for routine cardiac evaluation. Serum protein values were noted from the case records and ECHO parameters of diastolic dysfunction are obtained for all the cases. Serum albumin levels of less than 3.5 are taken as cut off for hypoalbuminemia and single ECHO parameter of E/E' > 13 taken as marker of diastolic dysfunction. Other parameters like LDH, ESR, Hemoglobin, Blood group, Age were noted from case records

Sample Size:
100 participants:
Among 100 participants, 50 patients had hypoalbuminemia and the remaining 50 were age-matched individuals.

Inclusion Criteria:
1) Nephrotic syndrome
2) Chronic liver disease
3) Hypothyroidism
4) Protein losing enteropathy
5) Malnutrition
6) Sepsis
7) Idiopathic

Exclusion Criteria:
1) Diabetes
2) Hypertension
3) Valvular heart disease
4) Heart disease with Systolic dysfunction (LVEF < 50%)
5) Pregnancy
6) Age > 60 years

Statistical Analysis
The variables collected were made into master chart using Microsoft excel 2019 and the chart was then loaded onto SPSS version 26 for statistical analysis. The quantitative variables were expressed using mean and standard deviation. The qualitative variables using frequency and percentages. To compare the mean values between hypoalbuminemia and normal group, independent samples T test was used and to compare the distribution of qualitative variables between the groups, chi square test was used. A P value of less than 0.05 was considered to be statistically significant.

3. Results

The mean age among the participants with hypoalbuminemia was 30.60±11.99 years and for those with normal albumin levels was 29.40±10.96 years. The mean age was found to be similar between hypoalbumin group and normal group with P value of more than 0.05. Among those with hypoalbuminemia, 44% were B positive followed by 12% with A positive and O positive blood groups, respectively. Among those with normal albumin levels, 28% were B positive and O positive, respectively. The pattern of distribution of blood groups were similar between the groups with P value of more than 0.05. The mean albumin among those with hypoalbuminemia was 2.4 ± 0.24 mg/dl and that of normal albumin group was 4.5 ± 0.62 mg/dl. (Table 1).

The mean E/E' among those with hypoalbuminemia was 14.75±3.27 and among those with normal albumin the mean was 11.28 ± 1.99. The mean E/E' were significantly more in the hypoalbuminemia group than the normal with P value of less than 0.05 (Fig 1). Among the participants with diastolic dysfunction, 72% had hypoalbuminemia and the proportion was 28% among participants without diastolic dysfunction. Hypoalbuminemia and diastolic dysfunction were found to be associated with each other with P value of less than 0.05. Those with hypoalbuminemia were at 6 times increased risk of getting diastolic dysfunction (Table 2).

The mean haemoglobin values among those with hypoalbuminemia group was 11.40 ± 2.19 gm% while among the normal albumin group was 11.92 ± 2.38 gm%. The mean platelet count among the hypoalbuminemia group was 2.55 ± 0.79 lakhs per cu.mm and that of the normal albumin group was 2.49 ± 1.01 lakhs per cu.mm. The mean ESR was 22.44 ± 12.94 mm for hypoalbuminemia group and 15.44 ± 6.27 for normal albumin group. The mean LDH level was 188.28±57.95 IU/L among hypoalbuminemia group and 187.76 ± 40.92 IU/L among normal albumin group. The mean sodium level was 134.44 ± 5.33 mmol/L among hypoalbuminemia group and 134.08±6.14 mmol/L among normal albumin group. The mean potassium levels were 4.45±0.70 mmol/L and 4.52±0.62 mmol/L for hypoalbuminemia group and normal albumin group, respectively. The mean values for all the parameters above were similar between hypoalbuminemia group and normal albumin group (P value >0.05) except for ESR where the mean was more among the hypoalbuminemia group than the normal albumin group with P value of less than 0.05(Table 3).

Table 1: Comparison of baseline characteristics between hypoalbuminemia and normal group

Variable		Hypoalbuminemia	Normal	P value
Age (in years)		30.60±11.99	29.40±10.96	0.603
Blood groups	A-	4	2	0.418
	A+	6	6	
	B-	4	4	
	B+	22	14	
	AB-	4	4	
	AB+	4	6	
	O+	6	14	
Albumin (mg/dl)		2.40±0.24	4.50±0.62	0.001

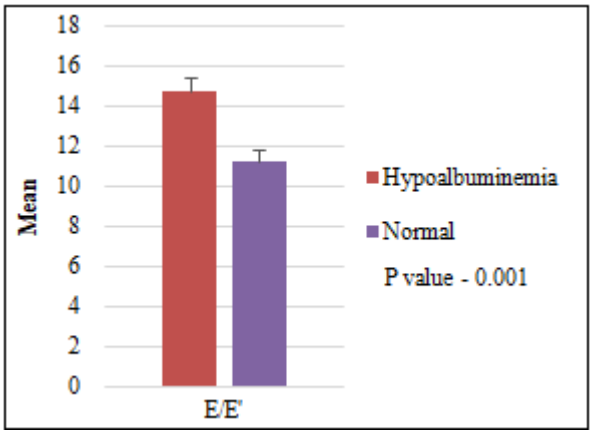

Figure 1: Comparison of mean E/E' values between hypoalbuminemia and normal group

Table 2: Association between diastolic dysfunction and hypoalbuminemia among the study participants

Hypoalbuminemia	Diastolic dysfunction				X^2	P value
	Present		Absent			
	N	%	N	%		
Present	36	72	14	28	19.39	0.001
Absent	14	28	36	72		

Odds ratio – 6.61 (2.76 – 15.83).

Table 3: Comparison of other parameters between hypoalbuminemia and normal groups

Variables	Cases (n=50)	Controls (n=50)	P value
Hb (gm%)	11.40±2.19	11.92±2.38	0.260
Platelet counts (lakhs per cu.mm)	2.55±0.79	2.49±1.01	0.743
ESR (mm)	22.44±12.94	15.44±6.27	0.001
LDH (IU/L)	188.28±57.95	187.76±40.92	0.959
Sodium (mmol/L)	134.44±5.33	134.08±6.14	0.755
Potassium (mmol/L)	4.45±0.71	4.52±0.71	0.613

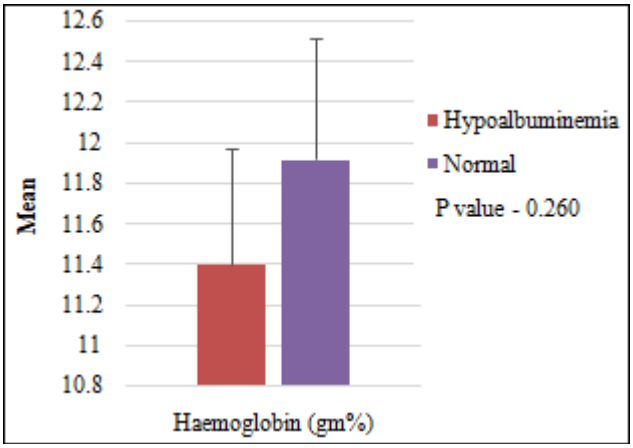

Figure 2: Comparison of hemoglobin level in normal and hypoalbuminemia

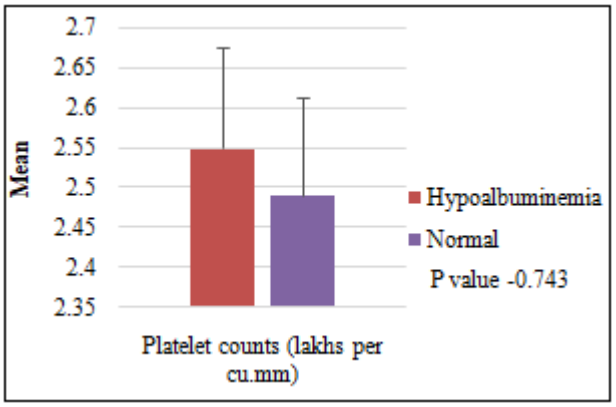

Figure 3: Comparison of platelets among hypoalbuminemia and normal

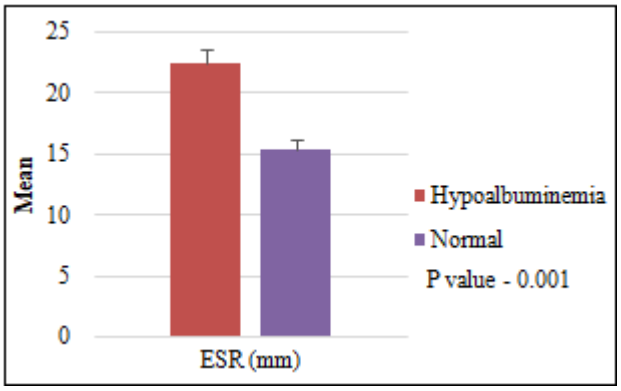

Figure 4: Comparison of ESR

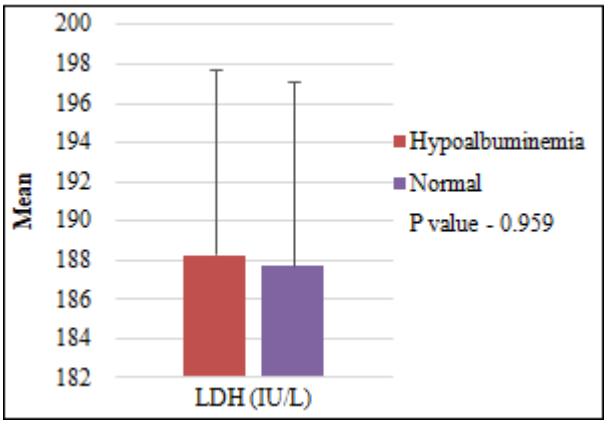

Figure 5: Comparison of LDH

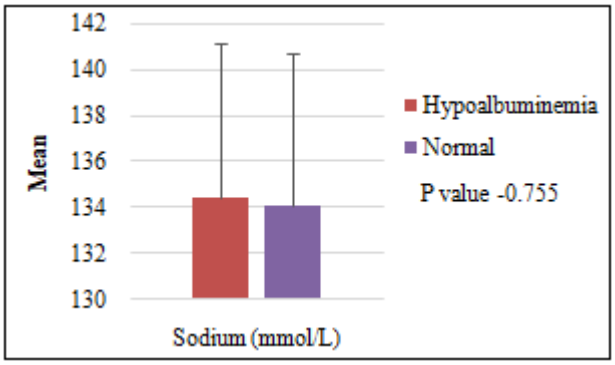

Figure 6: Comparison of sodium among two groups

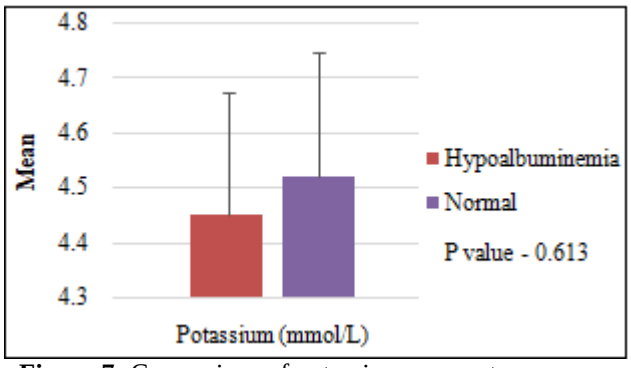

Figure 7: Comparison of potassium among two groups

4. Discussion

In this study, we examined the association of diastolic dysfunction in patients with hypoalbuminemia. We demonstrated that E/E' which is a parameter of diastolic dysfunction is higher in patients with hypoalbuminemia and hence diastolic dysfunction is strongly associated with hypoalbuminemia. Several explanations has been offered to justify the effect of albumin level on diastolic dysfunction. The first explanation is the possibility of albumin in scavenging free oxygen radicals and decreasing inflammation. Hypoalbuminemia will decrease the anti-inflammatory activity and enhances the inflammatory pathway. Dirajalal – Fargo and colleagues reported that hypoalbuminemia can be a pathogenic factor in the inflammatory process leading to the development of atherosclerosis. Serum albumin helps to maintain the integrity of microvasculature of the myocardium through its oncotic properties and its interaction with the endothelial glycocalyx. Hypoalbuminemia can cause endothelial dysfunction. Such endothelial dysfunction can impair coronary perfusion leading to subsequent ventricular dysfunction. Severe hypoalbuminemia aggravates the myocardial edema, which is considered one of the causes for myocardial dysfunction and electrophysiological instability in many heart diseases. It can exacerbate oxidative stress and inflammation that are involved in the overall heart failure process, and contributes to fluid overload by activating baroreceptors and resistance to diuretics. A low serum albumin was associated with myocardial extracellular volume expansion leading to decrease in compliance.

5. Conclusion

The diastolic dysfunction correlates strongly with reduced albumin levels when compared with age and phenotype matched patients with normal albumin level. Albumin acts as free radical scavenger and can have anti-inflammatory activity. So patients with hypoalbuminemia are adversely affected by the emergence of diastolic dysfunction.

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