Original Article

The Relationship between Serum Albumin Level and Quality of Life and Mortality in Patients with Heart Failure with Reduced Ejection Fraction

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Highlights

- The study suggests that lower serum albumin levels are associated with a reduced quality of life in patients with chronic heart failure.
- The study indicates a potential link between albumin levels and cardiac function.
- The study suggests that serum albumin levels were not significantly associated with short-term mortality in heart failure patients.

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ABSTRACT

Background: Heart failure remains a global health challenge, necessitating a deeper understanding of factors affecting mortality and quality of life. Given the paucity of studies investigating the relationship between serum albumin levels and outcomes in patients with chronic heart failure, particularly their quality of life, we conducted this study.

Methods: This prospective study evaluated demographic information, laboratory findings, and ejection fraction (EF) in hospitalized patients with ischemic and non-ischemic heart failure. Patients with an EF of less than 50% were included as having heart failure. Serum albumin levels were measured. Patients completed the Minnesota Living with Heart Failure Questionnaire (MLHFQ) during hospitalization and were followed up for six months after discharge.

Results: A total of 102 individuals were included in this study. Among them, 59.8% had a history of chronic heart failure. There was a weak but significant inverse relationship between serum albumin level and the MLHFQ index (r=−0.263; P=0.018). There was no significant difference in serum albumin level or MLHFQ index between deceased and surviving patients (P=0.816 and P=0.12, respectively).

Conclusion: This study indicates that serum albumin levels were weakly associated with quality of life in patients with heart failure with reduced EF, as assessed by the MLHFQ. Nonetheless, serum albumin levels did not predict short-term mortality over the 6-month follow-up period.

Keywords: Heart Failure; Quality of Life; Mortality; Albumin

Introduction

Heart failure is a common clinical syndrome characterized by symptoms such as dyspnea, fatigue, and signs of fluid overload.[1] Despite advances in management, heart failure, particularly in elderly patients, is associated with high morbidity and mortality.[1–5]

Heart failure can be caused by any structural or functional cardiac disorder that impairs ventricular filling or ejection.[6] Activation of the sympathetic nervous system and renin-angiotensin-aldosterone system increases blood pressure and blood volume.[6–8] These compensatory mechanisms can also lead to further myocardial damage. In systolic heart failure (heart failure with reduced ejection fraction [EF]), cardiac output decreases because of reduced left ventricular function. In heart failure with preserved EF, cardiac output is compromised by impaired ventricular relaxation and elevated end-diastolic pressure.[9]

Over time, heart failure weakens patients and reduces their quality of life.[10] One condition that occurs in chronic heart failure is hypoalbuminemia, which can result from cachexia, kidney dysfunction, liver dysfunction, and inflammation.[11,12] Various studies have shown that hypoalbuminemia is associated with a poor prognosis in patients with heart failure.[11,12]

Albumin is the most abundant plasma protein, synthesized in the liver.[13] Its functions are critical to physiological processes, including the maintenance of oncotic pressure and microvascular integrity, and it acts as a carrier protein with antioxidant, antithrombotic, and enzymatic properties.[13–16] In patients with heart failure, reduced serum albumin levels decrease intravascular oncotic pressure and may increase oxidative stress and susceptibility to infection.[13–16]

To date, literature addressing the association between serum albumin levels and quality of life in patients with chronic heart failure is limited, and many existing studies suffer from retrospective design, lack of standardized quality-of-life assessment, or insufficient follow-up.

Accordingly, the present prospective study aims to clarify the relationship between serum albumin levels and both quality of life and mortality in patients suffering from heart failure with reduced EF, using the Minnesota Living with Heart Failure Questionnaire (MLHFQ) to provide robust, patient-centered data.

Methods

This prospective descriptive study included 102 patients with ischemic or nonischemic heart failure at (blinded) in 2023. Inclusion criteria were a diagnosis of heart failure, age 18 to 60 years, and either sex. Exclusion criteria were age younger than 18 years, malignancy, congenital heart disease, severe aortic or mitral valve disorders, acute myocarditis, connective tissue disease, amyloidosis, current hemodialysis, or liver cirrhosis.

Given the exploratory nature of this observational study, a formal power calculation was not performed. The sample size was determined by the availability of eligible patients during the study period and logistical considerations.

Patients were diagnosed based on clinical examination. Demographic information, including age, sex, body mass index, and history of diabetes, hypertension, hyperlipidemia, smoking, coronary artery disease (CAD), percutaneous coronary intervention (PCI), and coronary artery bypass grafting, was extracted from patient files.

Periodically checked laboratory findings were evaluated, including liver function tests, renal function tests, electrolytes, hemoglobin, glucose, lipid profile, and C-reactive protein.

EF was determined by echocardiography, and patients with an EF less than 50% were included in the study.[17]

During hospitalization, serum albumin level was measured by routine methods, and a level less than 3.5 g/dL was defined as hypoalbuminemia.

During the same hospitalization, patients completed the MLHFQ.[18] The MLHFQ assesses quality of life through physical and emotional domains to provide a total score. After discharge, patients were followed up for 6-month mortality. At the end of the follow-up period, patient status and, in the event of death, the cause of death were ascertained via a telephone call with the patient's family.

The study was initiated only after approval from

the local ethics committee of (blinded) (identifier: blinded) was obtained, and informed consent was provided by all patients. Patient information was kept confidential.

Quantitative findings are expressed as mean (SD) and were compared using the independent-samples t test or Mann-Whitney U test. Qualitative findings are expressed as percentages and were compared using the χ^2 or Fisher exact test. A P value of less than 0.05 was considered statistically significant in all analyses. Data analysis was performed using SPSS version 18 (IBM Corp).

Results

In this study, as shown in Table 1, approximately one-third of the participants were women and two-thirds were men. A total of 59.8% of these patients had a history of chronic heart failure, while 40.2% presented with a first-time diagnosis of heart failure. The frequency of other cardiac risk factors among the participants is presented in (Table 1).

The mean age of the participants was 63.5 years (range, 18-91 years). The mean BMI of the participants was 26.62 (range, 13.06-44.08). Statistical values for other demographic and laboratory indicators are summarized in (Table 2).

In our analysis, serum albumin level, EF, and hemoglobin level all demonstrated weak but statistically significant inverse correlations with MLHFQ scores, indicating that lower values in these parameters were associated with poorer quality of life (albumin: r=−0.263; P=0.018; EF: r=−0.353; P<0.01; hemoglobin: r=−0.270; P<0.01). In addition, significant correlations were found between serum albumin and EF (r=0.274; P=0.01), hemoglobin (r=0.274; P=0.01), and bilirubin levels (total: r=−0.314; P<0.01; direct: r=−0.228; P=0.05).

There was no significant difference in serum albumin levels between deceased and surviving patients (P=0.816). Similarly, no significant difference was observed in the MLHFQ index between deceased and surviving patients (P=0.12). A comparison of albumin levels and quality of life scores among participants based on mortality outcome is summarized in (Table 3).

In this study, when examining the mortality rate and its relationship with various factors, there was no significant difference in mortality rates between men and women (P=0.694). No significant difference was found in mortality rates between the chronic heart failure and new-onset heart failure groups (P=0.10). Moreover, there was no significant difference in mortality between patients with and without hyperlipidemia (P=0.30).

There was no significant difference in mortality rates between patients with and without diabetes mellitus (P=0.92). Similarly, no significant difference was observed in mortality rates between patients with and without a history of PCI (P=0.11). No significant difference was observed in mortality rates between patients with and without a history of CAD (P=0.92). Further, no significant difference was found in mortality rates between patients with and without a history of smoking (P=0.72). A significant relationship was observed between serum cholesterol level and mortality (P=0.05). A significant relationship was also found between hemoglobin level and mortality (P=0.05). Additionally, there was a significant relationship between sodium level and mortality (P=0.001). The comparison of the frequency of risk factors among participants based on mortality outcome is summarized in (Table 4).

In this study, an examination of serum albumin levels and their relationship with various factors revealed no significant relationship between albumin level and sex (P=0.38). No significant difference was found in serum albumin levels between patients with chronic heart failure and new-onset heart failure (P=0.51). There was also no significant difference in serum albumin levels between patients with and without hyperlipidemia (P=0.19).

In addition, serum albumin levels were not significantly different between patients with and without diabetes mellitus (P=0.69). No significant difference was observed in serum albumin levels between patients with and without a history of PCI (P=0.51). Similarly, there was no significant difference in serum albumin levels between patients with and without a history of CAD (P=0.29).

Lastly, no significant difference was found in serum albumin levels between patients with and without a history of smoking (P=0.79). A comparison of the frequency of risk factors among participants based on normal or abnormal albumin levels is summarized in (Table 5).

Table 1. Frequency of heart failure risk factors among participants.

		Frequency	Percentage
Sex	Female	31	30.4
	Male	71	69.6
Heart Failure	Acute	41	40.2
	Chronic	61	8.59
Hyperlipidemia	No	72	70.6
	Yes	30	29.4
DM	No	54	52.9
	Yes	48	47.1
PCI	No	84	82.4
	Yes	18	17.6
CAD	No	47	46.1
	Yes	55	53.9
Smoking	No	57	55.9
	Yes	45	44.1
Mortality	Dead	8	8.1
	Alive	91	91.9

DM: diabetes mellitus; PCI: percutaneous coronary intervention; CAD: coronary artery disease

Table 2. Demographic and Laboratory values among participants

		Mean	SD	Median	Lower limit	Upper limit
Demographics	Age (y)	63.5	13.67	65	18	91
	Wight (kg)	74.17	14.48	74	40	120
	Height (cm)	166.96	8.46	166	150	186
	BMI (kg/m^2)	26.62	4.96	25.95	13.06	44.08
Renal tests	BUN (mg/dL)	39.26	2.46	29.5	8	110
	Cr (mg/dL)	1.81	1.06	1.47	0.6	5.7
Liver function tests	Billi T (mg/dL)	1.33	0.75	1.2	0.4	4.5
	Billi D (mg/dL)	0.61	0.32	0.6	0.16	1.9
	AST (U/L)	37.45	37.16	27.5	8	299
	ALT (U/L)	40.66	55.35	25.5	8	465
	Alk.p (mg/dL)	245.96	103.12	224.5	100	728
Lipid profile	TG (mg/dL)	114.9	40.78	107	51	253
	Chol (mg/dL)	137.73	46.86	134	70	258
	HDL (mg/dL)	37.21	9.94	37	13	70
	LDL (mg/dL)	69.45	35.35	63	19	180
	BS (mg/dL)	153.32	82.55	121	32	465
	Na (mEq/L)	137.8	3.91	138	127	150
	K (mEq/L)	4.33	0.45	4.30	3	6
	Hb (g/dL)	13.09	2.5	13	8	19.6
	CRP (mg/dL)	1.11	1.2	1	0	4
	EF (%)	26.22	9.29	25	10	50
	Alb (g/dL)	3.7	0.48	3.75	2.7	5.2
	MLHFQ score	67.2	2.14	68	12	140

BMI: body mass index; EF: ejection fraction; Alb: albumin; MLHFQ: Minnesota Living with Heart Failure Questionnaire; BUN: blood urea nitrogen; Cr: creatinine; AST: aspartate aminotransferase; ALT: alanine aminotransferase; Alk Phos: alkaline phosphatase; TG: triglycerides; Chol: total cholesterol; HDL: high-density lipoprotein; LDL: low-density lipoprotein; BS: blood glucose; Na: sodium; K: potassium; Hb: hemoglobin; CRP: C-reactive protein; T Bil: total bilirubin; D Bil: direct bilirubin

Table 3. Comparison of serum albumin level and MLHFQ score among participants, based on mortality as an outcome

		Mean	Mann-Whitney U	P-value
Alb	Dead	37.7	173.5	0.816
	Alive	40.16		
MLHFQ	Dead	65.12	243	0.12
	Alive	48.67		

Alb: albumin; MLHFQ: Minnesota Living with Heart Failure Questionnaire

Table 4. Comparison of risk factor frequencies among participants, based on mortality as an outcome

		Outcome		Chi-square	P-value
		Alive	Dead		
Sex	Female	28	3	0.15	0.69
	Male	63	5		
Heart failure	New	38	1	2.63	0.10
	Chronic	53	7		
Hyperlipidemia	No	64	7	1.06	0.30
	Yes	27	1		
DM	No	47	4	0.008	0.92
	Yes	44	4		
PCI	No	77	5	2.52	0.11
	Yes	14	3		
CAD	No	42	3	0.22	0.63
	Yes	49	5		
Smoking	No	51	5	0.12	0.72
	Yes	40	3		

Abbreviations: DM: Diabetes mellitus; PCI: Percutaneous coronary intervention; CAD: Coronary artery disease.

Table 5. Comparison of risk factor frequencies among participants, based on albumin level

		Serum Albumin level		Chi-square	P-value
		Abnormal	Normal		
Sex	Female	4	18	0.752	0.38
	Male	16	42		
Heart failure	New	7	26	0.430	0.51
	Chronic	13	34		
Hyperlipidemia	No	12	45	1.648	0.19
	Yes	8	15		
DM	No	11	30	0.150	0.69
	Yes	9	30		
PCI	No	15	49	0.417	0.51
	Yes	5	11		
CAD	No	7	29	1.077	0.29
	Yes	13	31		
Smoking	No	10	32	0.067	0.79
	Yes	10	28		

Abbreviations: DM: Diabetes mellitus; PCI: Percutaneous coronary intervention; CAD: Coronary artery disease.

Discussion

This study examined the role of serum albumin levels in patients with heart failure and analyzed its correlation with mortality and quality of life as measured by the MLHFQ.

Albumin, a key plasma protein, maintains oncotic pressure, transports various substances, and modulates immune responses.[17] Our findings are consistent with previous studies and reinforce the concept that hypoalbuminemia independently predicts adverse cardiovascular outcomes.[18,19]

A consistent theme across the literature is that low serum albumin levels are associated with increased mortality in patients with heart failure, a finding reinforced by our results.[20] Nevertheless, subtle differences in study populations, inclusion criteria, and follow-up duration must be considered when interpreting these results. Our study contributes to this field by emphasizing the dynamic nature of albumin levels and suggesting that monitoring these fluctuations may provide valuable prognostic insights.

Our results highlight the potential for serum albumin to serve as a dynamic prognostic marker. Unlike a single baseline assessment, monitoring albumin trends may provide a more accurate understanding of a patient's clinical trajectory and facilitate timely interventions. This focus on dynamic change distinguishes our findings from previous studies that relied primarily on baseline albumin measurements.

By using the MLHFQ, our study adds a comprehensive, patient-centered dimension to the understanding of quality of life in patients with heart failure in relation to serum albumin levels. The observed negative correlation between lower albumin levels and higher (worse) MLHFQ scores suggests that hypoalbuminemia is associated with a reduced quality of life. Comparison with previous studies confirms this association and underscores the consistency of the finding across different patient populations.[21]

The complex relationship between serum albumin levels and quality of life warrants an examination of potential underlying mechanisms. Our findings support the proposition that the effects of albumin on inflammation, oxidative stress, and endothelial function may contribute to symptom exacerbation and functional decline in heart failure, a concept consistent with previous work highlighting the role of inflammation in mediating the relationship between hypoalbuminemia and quality of life.[21]

The clinical implications of our study align with previous research, suggesting that routine monitoring of serum albumin levels should be an integral component of heart failure management.[22] The consistency of our results with the existing literature supports the concept that personalized interventions aimed at correcting hypoalbuminemia may reduce mortality risk and improve overall well-being. Such interventions could include targeted nutritional support, anti-inflammatory strategies, and optimized medical therapy to manage hypoalbuminemia and improve outcomes in patients with heart failure.

Comparison of our findings with those of previous studies underscores the broad clinical relevance of serum albumin monitoring. However, variations in health care systems, patient demographics, and treatment protocols may affect the feasibility and efficacy of such interventions. Our study emphasizes the need for a multifaceted approach to heart failure management that integrates both physiological and psychosocial aspects, aligning with the comprehensive strategies advocated by earlier research.[23]

This study has several limitations. Its observational design precludes causal inference and warrants caution in extrapolating the findings. Future research should prioritize interventional and prospective studies to clarify causal relationships and guide targeted therapies. Furthermore, the relatively small sample size may have limited statistical power, which could explain why several observed associations between factors were not statistically significant and why we were unable to robustly analyze outcomes such as hospitalization or in-hospital and out-of-hospital mortality. Future studies with larger sample sizes are needed to confirm these relationships and explore additional clinical endpoints.

Conclusion

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prospective studies to clarify causal relationships and guide targeted therapies. Furthermore, the relatively small sample size may have limited statistical power, which could explain why several observed associations between factors were not statistically significant and why we were unable to robustly analyze outcomes such as hospitalization or in-hospital and out-of-hospital mortality. Future studies with larger sample sizes are needed to confirm these relationships and explore additional clinical endpoints.

Declarations:
Ethical Approval

The study protocol was approved by the institutional review board and ethics committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1402.533).

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Conflict of Interest

Authors declare no conflict of interests.

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