



Overlap Between Nutritional Indices in Patients with Acute Coronary Syndrome: A Focus on Albumin

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Albumin, a key protein synthesized in the liver, plays a crucial role beyond its traditional function of maintaining oncotic pressure and fluid balance. Recently, its use as a prognostic marker for cardiovascular diseases (CVDs) has garnered attention. Serum albumin levels below normal have been repeatedly linked to higher rates of morbidity and mortality in individuals with heart diseases, particularly those with acute coronary syndrome (ACS).¹ This association highlights albumin's potential utility as a biomarker for risk stratification and mortality prediction in CVD. Understanding the mechanisms linking albumin deficiency to adverse cardiovascular outcomes may offer insights into novel therapeutic approaches and personalized management strategies. This editorial explores the current evidence on the predictive value of albumin in CVD and discusses its implications for clinical practice and future research directions.

The role of albumin as a prognostic indicator in patients with ACS has gained acceptance following the demonstration of its predictive value for both in-hospital and long-term mortality outcomes in multiple studies.² Therefore, numerous indices incorporating the albumin level have been established. Furthermore, several additional parameters have been added to the albumin level to better reach the endpoints. The prognostic nutritional index, which was first established for patients with cancer, was initially applied in cardiology in patients with ACS.^{3,4} Subsequently, the geriatric nutritional index and controlling nutritional (CONUT) score have been found to influence significant outcomes in both acute and chronic CVDs. Similar to studies on the prognostic nutritional index, the most frequently studied disease using these indices is ACS.^{5,6} The total cholesterol level, lymphocyte count, and weight of the patients were added to these indices to increase their acuity in predicting both in-hospital and long-term outcomes. In the prognostic nutritional index, lymphocyte count was integrated with the albumin level. Similarly, the CONUT score incorporates both the lymphocyte count and total cholesterol level. In the geriatric nutritional index, patient weight

has been included with the albumin level (Figure 1). These scores represent significant examples illustrating the value of albumin in patients with ACS. From this perspective, the crucial consideration arises: why does albumin impact prognostication and consistently demonstrate a significant relevance across multiple studies?

Several important physiological and clinical systems must be considered to determine the possible causes of albumin's predictive role. First, the albumin level reflects a patient's systemic inflammation and general nutritional state. Low albumin levels are frequently associated with chronic inflammation, malnourishment, and compromised cellular repair mechanisms. These factors play a crucial role in the development of adverse events and the course of coronary artery disease.⁷ The pathophysiology of coronary artery disease is dependent on endothelial dysfunction, plaque instability,

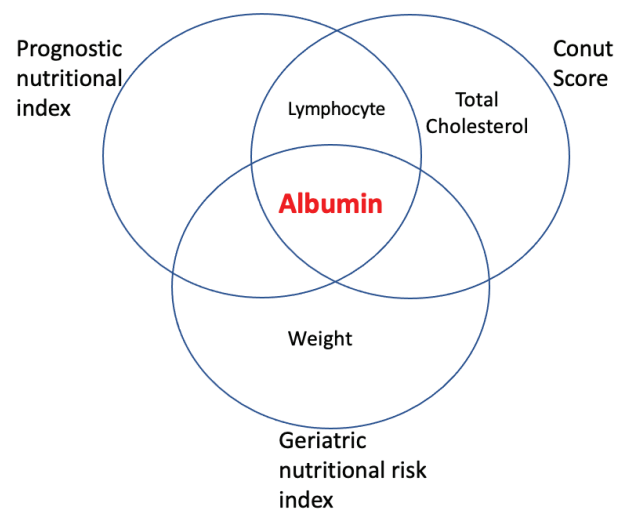


FIG. 1. The inclusion of the patient's weight into the albumin level in the geriatric nutritional index.



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and increased susceptibility to thrombosis, which are exacerbated by malnutrition and inflammation. Furthermore, albumin acts as a store for bioactive compounds such as antioxidants and binding proteins, which include medications and hormones. Its antioxidant properties help protect against oxidative stress, a major contributor to endothelial dysfunction and atherosclerosis progression. Low albumin levels can cause a reduction in antioxidant capacity, which aggravates the oxidative damage to the arterial wall and encourages the development of atherogenesis.⁸ Albumin also regulates endothelial function and vascular tone. It modulates nitric oxide synthesis, a key vasodilator that maintains vascular homeostasis. Low albumin levels can impair nitric oxide bioavailability, leading to vasoconstriction, increased vascular resistance, and compromised coronary perfusion, which predispose patients to ischemic events.⁹ Beyond its direct physiological roles, albumin serves as a surrogate marker for systemic comorbidities and severity of coronary artery disease. Low albumin levels are associated with a higher burden of cardiovascular risk factors such as hypertension, diabetes mellitus, and chronic kidney disease, all of which independently contribute to adverse cardiovascular outcomes.¹⁰ Furthermore, albumin levels may reflect the presence of acute stressors and acute-phase reactions, which are common in patients experiencing adverse cardiac events. Albumin's predictive value in coronary artery disease extends to its association with clinical outcomes such as myocardial infarction, stroke, and cardiovascular mortality. Studies have consistently demonstrated that low serum albumin levels independently predict the incidence of adverse cardiac events and are associated with a poor prognosis in patients with coronary artery disease who are undergoing coronary interventions or medical therapy.¹¹ This prognostic utility highlights albumin's role as a valuable biomarker for risk stratification and clinical management in coronary artery disease. The multifaceted role of albumin in predicting adverse cardiac events in patients with coronary artery disease can be attributed to its reflection of nutritional status, inflammatory burden, antioxidant capacity, vascular function, and overall disease severity.¹² Furthermore, its predictive power highlights the complex interplay between systemic inflammation, oxidative stress, endothelial dysfunction, and atherosclerosis progression, which contributes to the pathophysiology of coronary artery disease. However, further studies are required to elucidate the precise mechanisms linking albumin level to adverse cardiovascular outcomes and explore albumin's potential as a therapeutic target in mitigating cardiovascular risk in patients with coronary artery disease.

In conclusion, the potential for including albumin levels in prediction models for both in-hospital and long-term mortality associated with CVD, particularly ACS, is significant. In the realm of personalized medicine, machine learning models and artificial

intelligence systems are poised to play central roles in future advancements in coronary artery disease.¹³ Furthermore, albumin has been integral in constructing predictive nomograms for both cardiovascular and non-CVD.^{14,15}

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