Přehledový článek | Review article

Controlling Nutritional Status Score is Linked to Cardiovascular Diseases

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ARTICLE INFO

Article history:
Submitted: 27. 12. 2024
Revised: 17. 2. 2025
Accepted: 20. 2. 2025
Available online: 15. 9. 2025

Klíčová slova:
Kardiovaskulární onemocnění
Skóre CONUT
Srdeční selhání

SOUHRN

Zvýšená hodnota skóre CONUT (Controlling Nutritional Status) byla již dříve dána do souvislosti s vyšším rizikem rozvoje kardiovaskulárních onemocnění (KVO), jako jsou ischemická choroba srdeční, cévní mozková příhoda a srdeční selhání. Nedostatečná výživa může vyvolat zánět a oxidační stres, jež mohou vést k rozvoji KVO. Nicméně vztah mezi skóre CONUT a rizikem rozvoje KVO lze pouze obtížně stanovit, protože jej ovlivňuje věk, pohlaví a komorbidity. Proto je třeba využívat skóre CONUT jako součást důkladného vyšetření pacientova nutričního stavu a stanovení kardiovaskulárního rizika, ne v diagnostice nebo při léčbě daného onemocnění.

Keywords:
Cardiovascular disease
CONUT score
Heart failure

ABSTRACT

Higher Controlling Nutritional Status (CONUT) scores have been linked to cardiovascular diseases (CVDs) such as coronary artery disease, stroke, and heart failure. Poor nutrition may cause inflammation and oxidative stress, which can lead to CVDs. However, the CONUT score and CVDs are complicated and impacted by age, sex, and comorbidities. Thus, the CONUT score should be used as part of a thorough evaluation of a patient's nutritional status and CV risk, not for diagnosis or therapy.

Introduction

Cardiovascular diseases (CVDs) continue to be a predominant cause of illness and death globally. Notwithstanding progress in evidence-based treatments, patients with CVD remain at elevated risk for mortality, recurrent cardiovascular incidents, and hospital readmissions. Identifying high-risk patients is essential for enhancing their prognosis. New research shows that nutritional status is important for predicting outcomes in a wide range of groups, including adults who live alone, cancer patients, and people with heart failure, where being malnourished is linked to lower survival rates.[1–8]

The Controlling Nutritional Status (CONUT) score is an efficient and pragmatic screening instrument for evaluating nutritional status based on blood albumin, total cholesterol, and lymphocyte counts. Patients are categorised according to their scores as follows: normal (0–1), slightly malnourished (2–4), substantially malnourished (5–8), or severely malnourished (9–12). Research reveals that 39.5% of patients with acute coronary syndrome (ACS) are malnourished based on the CONUT score. Elevated CONUT scores have been associated with poorer outcomes in CVD patients; however, the data are inconsistent, and the score is still underused by cardiologists.[9,10] This review seeks to highlight the clinical significance of the CONUT score in the management of CVDs (**Table 1**).

Coronary artery disease (CAD)

Aside from major adverse cardiovascular events (MACEs) and all-cause mortality, moderate and severe CONUT-defined malnutrition was linked to 2.51-fold and 3.79-fold higher cardiovascular mortality in CAD patients after percutaneous coronary intervention (PCI). Even after controlling for other factors, the CONUT score showed a link between malnutrition and acute kidney damage caused by contrast in CAD patients undergoing PCI.[11–13] The nutritional status is measured

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DOI: 10.33678/cor.2025.029

Please cite this article as: Askin L, Urkmez Y, Tanriverdi O. Controlling Nutritional Status Score is Linked to Cardiovascular Diseases. Cor Vasa 2025;67:505–509.

Table 1 – Calculation of the CONUT score

Parameter	Normal range	Score 1	Score 2	Score 3	Score 4
Serum albumin (≥g/dL)	≥3.5	3.0–3.49	2.5–2.99	2.0–2.49	<2.0
Total cholesterol (≥mg/dL)	≥160	140–159	120–139	100–119	<100
Lymphocyte count (≥×10³/μL)	≥1.6	1.2–1.59	0.8–1.19	0.5–0.79	<0.5

by the Geriatric Nutritional Risk Index (GNRI), the CONUT score, the Nutritional Risk Index (NRI), and the Prognostic Nutritional Index (PNI).[14] CAD patients' optimal predictive score method is unknown. Raposeiras Roubin et al.[8] found that the CONUT score predicted MACEs and all-cause death in ACS patients better than the NRI and PNI scores.

The CONUT score predicted all-cause death and MACEs in people with acute myocardial infarction (AMI) who were getting PCI. These results revealed that the CONUT score might predict worse outcomes in CAD patients. CAD patients' dietary assessment and adverse outcome prediction tools need more study.[15,16] The mechanisms connecting CONUT score-defined malnutrition to poorer CAD outcomes are unclear. Serum albumin, lymphocyte count, and cholesterol determine the CONUT score. Low lymphocyte and haemoglobin levels increased vascular results and mortality. Total cholesterol was independently related to worse outcomes. Serum albumin, lymphocyte count, and total cholesterol may improve the prognosis together. Protein, inflammation, and lipid metabolism affect the CONUT score. Malnutrition-induced inflammation and atherosclerosis syndrome may explain the CONUT score prognosis.[17–21]

Malnutrition, as measured by the CONUT score ≥2 ranged from 38.7% to 74%.[9,16] Huang et al.'s meta-analysis recommends the CONUT score for CAD patients' nutritional status. Poor nutrition (high CONUT score) independently predicts MACEs and all-cause death in CAD patients. This score may help classify CAD risk.[22] Due to a nonlinear connection between total cholesterol and worse outcomes, CAD patients with higher CONUT scores should carefully use aggressive statin therapy. Malnutrition is common and has a poor prognosis in CAD patients with high CONUT scores. Nutritional intervention in malnourished people is unproven. Malnourished CAD patients require a better designed research to see whether such treatment improves outcomes.[20] The nutritional prognostic index (NPI) and CONUT scoring systems have performed similarly to the global registry of acute coronary events (GRACE), which is used to predict non-ST elevated myocardial infarction (NSTEMI) prognosis.[23] Malnutrition was highly related to poor STEMI outcomes after primary percutaneous coronary intervention (pPCI).[24]

The CONUT score's value over clinical judgement is an important topic. Malnutrition contributes to frailty. Frailty was associated with CONUT nutrition characteristics. Frailty raises the probability of unfavourable health consequences. Thus, a failure to control for frailty and other residual confounders may have overestimated the CONUT score's predictive value.[25]

Heart failure

Li et al.[5] reported that malnourished HF patients had a greater risk of follow-up mortality (RR 2.01; 95% CI 1.58–2.57). MACE risk, including re-hospitalisation, was not examined in Li's study. To complete our meta-analysis, we included 18 studies with 12,532 participants and found that HF patients with higher CONUT scores had a higher MACE risk. Malnourished HF patients had a poorer outcome (all-cause death and MACEs). Thus, moderate to severe malnutrition patients need additional nutritional therapy (e.g., protein and energy intake) and regular follow-up to improve their prognosis.[26] HF patients with malnutrition have a dismal prognosis. Gastric congestion and edoema might decrease appetite and absorption.[27] HF inflammation induces metabolic anomalies, sympathetic nervous system activation, and anabolic-catabolic imbalance.[28] Third, cytokine, adipokine, and metabolite abnormalities may affect HF clinical outcomes and malnutrition.[29]

HF patients have more basic nutritional indicators than the CONUT score.[30] In acute and chronic HF patients, the Prognostic Nutritional Index (PNI) was associated with poor prognosis. Trials' malnutrition cut-points differed, limiting the PNI's clinical usefulnes.[31,32] Since statins reduce overall cholesterol, the CONUT score included them. This may increase malnutrition in HF patients. The same group had 54% CONUT-defined malnutrition and 8% PNI-defined.[14] Total cholesterol may be more complete for nutritional status assessment without statins or other lipid-lowering medicines since it addresses lipid metabolism.[33]

Acute ischemic stroke (AIS)

The CONUT score is easy to figure out from biochemical markers to estimate the risk of malnutrition because it gives a thorough assessment of nutritional status. This research indicated that over half of AIS patients are malnourished.[34] This finding resembles that of Naito et al.[35] Thus, acute stroke patients may have dietary issues. Malnutrition may exacerbate clinical outcomes in AIS patients; thus, nutritional status must be assessed.[36] Exploring nutritional risk factors helps avoid malnutrition. This study found worse nutritional control with age. The malnutrition risk increases with age.[37] Acute strokes may impair appetite, protein demands, and sensory function. In stroke patients, older age was the biggest risk factor for malnutrition and recovery.[38] Malnutrition increases in older AIS patients, worsening their prognosis. Age increases malnutrition risk.

NIHSS evaluates neurodeficits. NIHSS was found regardless of the CONUT score. Neurological impairment dictates AIS diets. Critical neurological issues in AIS patients include diminished awareness, dysphagia, face or arm weakness, restricted mobility, cognitive deficits, and poor oral hygiene. Dysphagia malnourishes 30–50% of acute stroke patients. Delayed stroke feeding might cause malnutrition. Depression, cognitive impairments, and linguistic difficulties might disrupt meal choices and satiety transmission, producing malnutrition, especially protein deficiency. Dextromanuality paralysis and weakness prevent feeding, forcing early termination. AIS neuropathies induce a CONUT score.[39]

Acute pulmonary embolism (APE)

The correlation between hunger and APE is still ambiguous. Based on the Malnutrition Universal Screening Tool, Maia and her colleagues did a retrospective study of 683 patients in a pulmonology unit and found that 34.8% of the population was undernourished. Patients with malnutrition had an increased risk of in-hospital mortality. This study comprised only 9 APE patients, all of whom presented with comorbidities including COPD, lung cancer, or pneumonia. A different retrospective study of 1,032 APE patients showed that 15.5% had hypoalbuminemia, which shows how common it is. Hypoalbuminemia may not be enough to diagnose malnutrition on its own, which shows that APE patients need more thorough nutritional evaluations.[40–42]

Comorbidities in APE and their effects

Comorbidities, including COPD, lung cancer, heart failure, and Parkinson's disease, frequently occur in APE patients and aggravate nutritional deficiencies. A meta-analysis revealed an increased risk of malnutrition among older Europeans, and malnutrition, in conjunction with advanced age and heart failure, was linked to elevated APE mortality rates. Although age alone could not forecast mortality, factors such as heart failure and hunger were substantial influences.[27]

Table 2 – The main topic points of recent studies

Reference no.	Authors	Subjects	Main theme
[3]	Zhang et al.	Cancer	Cancer patients with malnutrition had worse survival rates.
[14]	Sze et al.	Chronic heart failure	The nutritional status is measured by the geriatric nutritional risk index (GNRI), the CONUT score, the Nutritional Risk Index (NRI), and the Prognostic Nutritional Index (PNI).
[28]	Yıldırım et al.	Acute pulmonary embolism	Comorbidities and malnutrition are predicted in elderly APE patients. Age did not predict APE mortality, but a high CONUT score and heart failure did.
[30]	Kuzuya et al.	Elderly patients	The CONUT score – albumin, lymphocyte, and total cholesterol levels – indicates nutritional status, immunologic status, and calorie depletion. In APE patients, higher CONUT scores were associated with increased in-hospital mortality. Hypoalbuminemia may underdiagnose malnutrition.
[45]	Zhang et al.	Hematological malignancies	CONUT score predicts haematological malignancy prognosis.
[46]	Aruğaslan et al.	Patients undergoing pericardiocentesis	CONUT score independently predicts death in pericardial effusion patients.
[47]	Fan et al.	General population	All-cause and cardiovascular mortality increase with population nutrition. PNI may be a better nutritional score predictor.
[48]	Büber et al.	Patients with mitral annular calcification	Comparable CONUT ratings in mitral annular calcification (MAC) patients without chronic illnesses. The CONUT score correlated with LA diameter in MAC patients. For MAC patients with a high LA diameter, CONUT is a nutritional and inflammatory indication.
[49]	Shi et al.	Patients with diabetic foot ulcers	The CONUT score predicts diabetic foot ulcers and amputations. Early dietary improvements may lower the amputation risk.
[50]	Boyraz et al.	Non-ST elevated myocardial infarction patients	The Nutritional Prognostic Index (NPI) and CONUT scoring systems have performed similarly to the Global Registry of Acute Coronary Events (GRACE), which is used to predict non-ST elevated myocardial infarction (NSTEMI) prognosis.
[51]	Zengin et al.	ST elevated myocardial infarction patients	Malnutrition was highly related to poor STEMI outcomes after primary percutaneous coronary intervention (pPCI).
[52]	Kurmus et al.	Patients with arrhythmia	Poor PNI and CONUT scores are associated with arrhythmic events on 24-h ECG Holter recordings in people without arrhythmia.
[53]	Furui et al.	Patients with atrial fibrillation	Nutritional grading methods showed that undernourished patients had a greater atrial fibrillation recurrence risk following catheter ablation.

Predictors of outcomes in APE

Tools like the Pulmonary Embolism Severity Index (PESI) and nutritional indices like the Predictive Nutritional Index (PNI) and the CONUT score have been used to predict death in people who have had an APE. **PESI Score**: Assesses the probability of 30-day death in APE patients, providing independent outcome predictions. **PNI**: Employs total peripheral lymphocyte and serum albumin concentrations. A study indicated that diminished PNI scores upon admission forecasted increased in-hospital mortality among APE patients. The CONUT score includes serum albumin concentration, lymphocyte counts and total cholesterol to assess a person's nutritional, immune, and caloric status. APE patients with high CONUT scores had a higher risk of hospital death.[44–46]

Distinguishing APE from comorbidities

APE often coexists with COPD, lung cancer, and other illnesses, but they should be considered distinct entities – pathophysiological pathways, prognostic indicators, and consequences. Comorbidities exacerbate the probability of negative outcomes in APE, but they do not characterise the disease itself. APE-specific markers, like the PESI and CONUT scores, give us important information about death risk, even when other conditions are present. Malnutrition may result from systemic illness or age-related variables, although its impact on APE-specific outcomes requires further examination.

Recent studies

Arugaslan et al. found that the CONUT score independently predicts death in pericardial effusion patients.[47] All-cause and cardiovascular mortality increases with population nutrition. PNI may be a better nutritional score predictor.[48] Buber et al. discovered comparable CONUT ratings in mitral annular calcification (MAC) patients without chronic illnesses. The CONUT score correlated with LA diameter in MAC patients. For MAC patients with a high LA diameter, CONUT is a nutritional and inflammatory indication.[49]

The CONUT score predicts diabetic foot ulcers and amputations. Early dietary improvements may lower the amputation risk.[50] Poor PNI and CONUT scores are associated with arrhythmic events on 24-h ECG Holter recordings in people without arrhythmia.[51] Nutritional grading methods showed that undernourished patients had a greater atrial fibrillation recurrence risk following catheter ablation.[52] The main topic points of recent studies are shown in **Table 2**.

Conclusion

Studies have suggested that a higher CONUT score is associated with an increased risk of cardiovascular diseases (CVDs), including coronary artery disease, stroke, and heart failure. This may be due to the fact that poor nutritional status can lead to inflammation and oxidative stress, both of which are known to contribute to the development and progression of CVDs. But it's important to remember that the connection between the CONUT score and CVDs is complicated and depends on, e.g., parameters like age, sex, and other health problems. Therefore, the CONUT score should be used as part of a comprehensive assessment of a patient's nutritional status and CV risk rather than as a standalone tool for diagnosis or treatment.

Conflict of interest
The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

Funding
The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

Ethical statement
The work was conducted in accordance with the Declaration of Helsinki.

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