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THE CONTROLLING NUTRITIONAL STATUS (CONUT) SCORE AS NUTRITIONAL SCREENING TOOL AND PREDICTOR OF CLINICAL OUTCOMES IN STROKE

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ABSTRACT

Stroke is one of the leading causes of death worldwide and causes a high financial burden. Malnutrition in stroke patients is associated with worse clinical outcomes. However, until now there is no universally agreed gold standard for establishing a diagnosis of malnutrition. The Controlling Nutritional Status (CONUT) score has been reported to have good sensitivity and specificity in detecting malnutrition in hospitals. In addition, the CONUT score has also been shown to have good ability in predicting clinical outcomes of stroke patients. Implementing CONUT Score in clinical practice may provide management consideration.

Keywords*: CONUT, malnutrition, stroke, nutritional status*

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INTRODUCTION

Stroke is the second leading cause of death worldwide, following ischemic heart disease. In 2020, stroke responsible for 7.08 million deaths globally, with an economic burden reaching USD 53 billion (Feigin *et al.*, 2021; Tsao *et al.*, 2022). In Indonesia, stroke stands at 8.3 per 1000 people, with the highest prevalence reported in the Daerah Istimewa Yogyakarta (Kementerian Kesehatan RI, 2023).

Malnutrition in stroke patients increases the risk of complications, prolongs hospital stays, and raises healthcare costs for both hemorrhagic and non-hemorrhagic stroke (Yoo *et al.*, 2008). It is estimated that around 20% of acute stroke patients are malnourished upon admission, primarily due to chronic illness, difficulty in eating, and pre-existing functional disabilities. Early diagnosis of malnutrition is crucial; however, valid biomarkers for nutritional status assessment are not yet established (Bouziana & Tziomalos, 2011).

Assessing nutritional status in stroke patients remains challenging due to the lack of a widely accepted definition of malnutrition and the absence of a standardized nutritional assessment tools (Jensen *et al.*, 2010). Anthropometric measures such as body mass index and mid-upper arm circumference have low sensitivity and specificity in determining nutritional status (Bouziana & Tziomalos, 2011a). Furthermore, measuring body weight and height in stroke patients is often unfeasible due to their functional impairments (Dennis, 2000).

Definition of Malnutrition

Malnutrition in stroke patients is defined as an inadequate intake of energy and protein, leading to a prolonged negative imbalance between nutritional intake and metabolic needs. Malnutrition results in changes in body composition and disrupts various biological functions (Bouziana & Tziomalos, 2011).

Nutritional Assesment in Stroke

Determining nutritional status is challenging as a universally accepted gold standard for diagnosing malnutrition is yet to be established (Corrigan *et al.*, 2011). Body weight and body mass index have low sensitivity and specificity for detecting malnutrition, and accurate measurements of height and weight are often difficult to obtain in stroke patients. Some laboratory parameters are also used in assessing nutritional status. Serum albumin levels and lymphocyte counts are commonly utilized but are significantly influenced by inflammatory processes. In clinical practice, clinicians are encouraged to understand the advantages and limitations of each nutritional marker used and may even consider using a combination of those markers (Bouziana & Tziomalos, 2011).

Malnutrition in Stroke

Malnutrition in acute stroke patients often goes undiagnosed and inadequately treated. Approximately 20% of all acute stroke patients are malnourished. A systematic review indicates that malnutrition prevalence in stroke patients ranges from 6.1% to 62%, a variation attributed to differences in assessment timing, stroke type, comorbidities, and accompanying complications. Malnutrition prevalence increases with longer hospital stays and reduced functional abilities in patients (Corrigan *et al.*, 2011).

Dysphagia at stroke onset raises the risk of malnutrition by 12 times. Even patients without dysphagia are at risk due to inadequate diets, particularly if protein intake is insufficient (Wirth *et al.*, 2013). Elderly, female, poor family care, inadequate rehabilitation, and a history of alcohol consumption increase the risk of malnutrition in acute stroke patients (Sabbouh & Torbey, 2018). Diabetes mellitus increases the risk of malnutrition by 58% (Corrigan *et al.*, 2011). However, stroke type or location, weakness of the dominant arm, socioeconomic status, and education level do not appear to be associated with malnutrition (Chai *et al.*, 2008; Corrigan *et al.*, 2011).

Malnutrition in both ischemic and hemorrhagic stroke patients is linked to poor clinical outcomes. Energy and protein malnutrition upon admission can lead to ischemic brain injury and impede recovery. Malnutrition affects the expression of genes related to brain plasticity, which is essential for recovery after ischemic events (J. Prosser-Loose *et al.*, 2011). Malnutrition prolongs hospital stays and increases the risk of mortality within 3 to 6 months after stroke. Malnourished stroke patients have higher incidences of pressure ulcers, urinary tract infections, and respiratory infections (Badjatia *et al.*, 2010).

METHOD

The Controlling Nutritional Status (CONUT) score

The Controlling Nutritional Status (CONUT) score is a nutritional screening tool developed by Hospital Universitario de La Princesa, Spain. This scoring system is calculated based on serum albumin concentration, absolute lymphocyte count, and total cholesterol levels obtained from venous blood samples. Each component is assigned a score as outlined in Table 1. First introduced in 2005, the CONUT score is used to assess the nutritional status of hospitalized patients. It has a sensitivity of 92.3% and a specificity of 85% for detecting malnutrition at admission (Ignacio de Ulíbarri *et al.*, 2005) Although the components of this scoring system are easily obtainable through blood tests, the CONUT score reflects complex immunity status, protein reserves, and fat metabolism (Kokura *et al.*, 2020).

Tabel 1. CONUT Score

Parameters	Nutritional Status			
	Not Malnourished	Mild Malnutrition	Moderate Malnutrition	Severe Malnutrition
Albumin (g/dL)	3,5 – 4,5	3,0 – 3,49	2,5 – 2,9	< 2,5
Score	**0**	**2**	**4**	**6**
Total Lymphocytes / mL	> 1600	1200 - 1599	800 - 1199	< 800
Score	**0**	**1**	**2**	**3**
Cholesterol (mg/dL)	> 180	140 - 180	100 - 139	< 100
Score	**0**	**1**	**2**	**3**
Total Score	0 - 1	2 - 4	5 - 8	9 - 12

DISCUSSION

CONUT score as Clinical Outcome Prediction Tool in Acute Stroke

Serum albumin is a protein with neuroprotective effects in stroke patients through mechanisms such as reducing hematocrit, increase erythrocyte aggregation, and acting as an antioxidant (Dziedzic *et al.*, 2004). Consumption of antioxidants plays a role in recovery and helps prevent further tissue damage (Wahyudin *et al.*, 2024). Although high cholesterol levels are a risk factor for coronary heart disease, previous studies have found that low cholesterol levels are associated with poorer clinical outcomes in ischemic stroke patients (Zhao *et al.*, 2016). The immune system and inflammatory processes following a stroke also play a role in stroke pathology. Low lymphocyte counts are linked to poorer functional outcomes post-stroke, while elevated leukocyte and neutrophil counts are associated with more severe symptoms upon admission (Kim *et al.*, 2012).

A systematic review and meta-analysis examines the relationship between CONUT scores and various clinical outcomes in ischemic stroke patients. Seven studies included in the review found that a CONUT score ≥5 is an independent predictor of mortality in stroke patients. Additionally, twelve cohorts involved in the review showed a direct association between the CONUT score and disability severity, as measured by the modified Rankin Scale. The CONUT score is also directly linked to infection occurrence as a stroke complication (Chen *et al.*, 2022).

CONCLUSION

Malnutrition in stroke patients is associated with poorer clinical outcomes. The CONUT score has good sensitivity and specificity for detecting malnutrition during hospitalization. Malnutrition, as indicated by the CONUT score, is linked to higher rates of mortality, disability, and infection. Using the CONUT score in clinical practice can provide clinicians with valuable insights for making therapeutic decisions and educating patients.

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