RESEARCH ARTICLE

pISSN: 0126-074X | eISSN: 2338-6223
https://doi.org/10.15395/mkb.v57.3846
Majalah Kedokteran Bandung. 2025;57(1):69–73

Majalah Kedokteran Bandung (MKB)

Received: February 20, 2024
Accepted: March 10, 2025
Available online: March 31, 2025

Comparison of CONUT Score, SGA Score, and GLIM Score as Gold Standard for Colorectal Cancer Patients

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Abstract

Malnutrition in colorectal cancer increases toxicity, worsens quality of life, and reduces body functions. Early identification of malnutrition is crucial to determine treatments. This study compared the Global Leadership Initiative on Malnutrition (GLIM) score as the standard nutritional status screening tool to the Controlling Nutritional Status (CONUT) and Subjective Global Assessment (SGA) scores. This study expected to identify a new nutritional status screening tool for colorectal cancer patients. This was a cross-sectional diagnostic study on 60 colorectal cancer patients treated at Dr. Hasan Sadikin General Hospital, Bandung, Indonesia from August 16, 2022 to July 16, 2023. Results revealed that the CONUT score had a sensitivity, specificity, accuracy, and effectiveness values of 80.4%, 0.0%, 85%, and 85%, respectively, in detecting malnutrition. The SGA score had a sensitivity value of 100%, a specificity value of 21.95%, an accuracy value of 85%, and an effectiveness of 85% in detecting malnutrition. When compared with the GLIM score as the gold standard, which is assumed to have a sensitivity and specificity values of 100%, the SGA score was better than the CONUT score for detecting malnutrition in colorectal cancer patients. The SGA score is closest to the GLIM score as the gold standard for assessing malnutrition in colorectal cancer patients..

Keywords: Colorectal cancer, controlling nutritional status, global leadership initiative on malnutrition, malnutrition, subjective global assessment

Introduction

Colorectal cancer is one of the leading causes of cancer-related mortality in the United States. Each year, the American Cancer Society provides updated statistics on the incidence and mortality of colorectal cancer using data from population-based registries and the National Center for Health Statistics. In 2020, an estimated 147,950 individuals were diagnosed with colorectal cancer, and approximately 53,200 deaths were attributed to the disease. Notably, this included 17,930 new cases and 3,640 deaths among individuals under the age of 50.

Malnutrition is a condition where the body experiences weight loss and a decrease in the body's working capacity, which impairs quality of life and worsens prognosis.[1] Malnutrition is a serious problem in cancer patients with a prevalence from 20% to more than 70% according to studies worldwide.[2] Malnutrition in cancer patients is caused by cancer-associated inflammatory cytokines, metabolic changes, and reduced nutrient availability, due to anorexia caused by cancer and the systemic treatment. Malnutrition in colorectal cancer can increase the risk of toxicity, worsening quality of life, and reduce body function. Approximately 10-20% of cancer patient deaths are caused by malnutrition, not the malignancy itself. Therefore, the diagnosis of malnutrition must be made as early as possible and the patient immediately receives the best treatment.[1] Nutritional status always changes over time. Therefore, it is important to assess the nutritional status of colorectal cancer patients periodically during various phases of the treatment course.[3]

Nutritional status can be evaluated using various objective and subjective measurement methods. Responding to the need for clinical nutrition assessment, in 2019, the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN) published

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a consensus namely the Global Leadership Initiative on Malnutrition (GLIM) as the gold standard for assessing nutritional status in adult patients.[4] This study will use the GLIM score as the gold standard in assessing the nutritional status of colorectal cancer.[5] GLIM score has the advantage of being able to completely assess various aspects of a patient. However, it also has shortcomings because it is considered impractical and there are quite a lot of criteria. Also, the degree of malnutrition in GLIM is considered more extreme because it is directly stated as moderate and severe malnutrition, there is no category for mild malnutrition. Therefore, this study investigates the alternative nutritional status screening tools that have good sensitivity, specificity, and accuracy. This study aims to compare the SGA score and CONUT score with the GLIM score to find a faster, more practical, and more accurate screening tool for assessing malnutrition in patients with colorectal cancer.

Methods

This diagnostic study utilized a cross-sectional design involving 60 colorectal cancer patients at Dr. Hasan Sadikin General Hospital, Bandung, from August 16, 2022, to July 16, 2023. The study was conducted following approval from the Health Research Ethics Committee of Dr. Hasan Sadikin Hospital (Ethical Approval Number: LB.02.01/X.6.5/49/2023). Data were obtained through medical record review, patient interviews, and physical examinations. Inclusion criteria comprised patients diagnosed with colorectal cancer, aged over 18 years, who were undergoing chemotherapy and provided informed consent to participate in the study.

The exclusion criteria were patients having malignancy other than colorectal cancer, having undergone laparotomy at the same time as surgery on other parts of the body, and having comorbidities such as diabetes mellitus, liver cirrhosis, and heart and kidney disease were excluded. Informed consent regarding the research and the patient's clinical condition was carried out to the patient or family. The patient's nutritional status is assessed using the GLIM and SGA scores. The patient's blood was taken to check albumin, total lymphocytes, and total cholesterol levels. Then, the patient's nutritional status is assessed using the CONUT score. The CONUT score consists of three assessments, namely serum albumin levels, peripheral lymphocyte counts, and total cholesterol concentrations. The research was conducted until the sample size was met. Patients with incomplete data, patients who had diseases that interfered with nutritional assessment which interfered with nutritional therapy, patients having other morbidities during treatment, and patients who died before or after surgery or chemotherapy were excluded. Data was analyzed using the 29th version of SPSS for sensitivity, specificity, accuracy, and efficacy score.

The SGA score assesses nutritional status based on the patient's medical history and physical examination. The medical history assessment included changes in the patient's weight, gastrointestinal symptoms (anorexia, diarrhea, nausea, vomiting), functional capacity, along with diseases and their relationship to nutritional needs. Physical examination was performed to evaluate subcutaneous fat loss, ankle edema, sacral edema, muscle wasting, and ascites. This assessment will divide patients into good nutrition (SGA-A), moderate malnutrition (SGA-B), or poor nutrition (SGA-C) groups.[6]

Diagnosing malnutrition using the GLIM score is carried out by examining the phenotypic and etiological criteria. An individual is categorized as malnourished if they fulfill at least one phenotypic criterion and one etiological criterion. Phenotypic criteria consisted of undesirable weight loss, low body mass index, and low muscle mass. Etiological criteria consisted of reduced food intake or impaired food assimilation, as well as assessing inflammatory conditions using blood albumin or C-reactive protein (CRP) levels. Only phenotypic criteria are used to determine severity.

Results

A total of 60 colorectal cancer patients were included in this study, with 31 males and 29 females, reflecting an almost equal gender distribution, as presented in Table 1. The average age, weight, and height characteristics of the patients are detailed in Table 2.

All of the patients who were declared as not malnourished by the CONUT score were malnourished according to the GLIM score. Moreover, all patients who were not malnourished according to the GLIM score were diagnosed as malnourished by the CONUT score. Therefore, the CONUT score had a low specificity and negative predictive value (NPV). NPV is defined as the patient who tests negative does not have the disease, while positive

Table 1 Characteristics of Colorectal Cancer Patients in Dr. Hasan Sadikin Hospital

Characteristics	Mean±SD	Median (Min.-Max.)	%
Age	51.87±12.44	51 (20–80)	-
Height	157.03±7.97	158.5 (140–172)	-
Weight	51.51±9.89	50 (29–75)	-
Male Gender	-	-	51.7%

Table 2 Cross Tabulation of GLIM and CONUT Score Results

GLIM	CONUT		Total
	Malnourished	Not Malnourished	
Malnourished	37	14	51
Not Malnourished	9	0	9
Total	46	14	60

predictive value (PPV) is defined as a person who tests positive actually has the disease. This concluded that malnourished patients assessed with the CONUT score might be misdiagnosed as not malnourished. Instead, patients without malnutrition will be misdiagnosed as malnourished by the CONUT score.

All patients who were declared malnourished by the SGA score were also declared malnourished by the GLIM score. Therefore, the SGA score had good sensitivity and Negative Predictive Value (NPV). However, a few patients who were declared malnourished by the GLIM score were also declared malnourished by the SGA score. There were 32 patients among 51 patients who were not detected as malnourished by the SGA score. Thus, the SGA score had low specificity and Positive Predictive Value (PPV).

The results of this diagnostic study are explained in Table 4. In comparison with the GLIM score as a gold standard for diagnosing malnutrition among colorectal cancer patients, the SGA score was far more superior than the CONUT score in terms of accuracy, sensitivity, specificity, and NPV. Sensitivity is defined as the ability of a test to correctly identify those with the disease (true positives), while specificity is defined as the ability of a test to correctly identify those without the disease (true negatives). Accuracy is defined as the overall correctness

Table 3 Cross Tabulation of GLIM and SGA Score Results

GLIM	SGA		Total
	Malnourished	Not Malnourished	
Malnourished	19	32	51
Not Malnourished	0	9	9
Total	19	41	60

Table 4 Diagnostic Value of the SGA and CONUT Score Compared with the GLIM Score as the Gold Standard for Detecting Malnutrition in Colorectal Cancer Patients

Diagnostic Value	CONUT	SGA
Accuracy	85.0%	85.0%
Sensitivity	80.4%	100.0%
Specificity	0.0%	21.95%
Positive Predictive Value (PPV)	72.5%	37.25%
Negative Predictive Value (NPV)	0.0%	100.0%
Likelihood Ratio	0.80	2.28

of a test, measuring how well it distinguishes between diseased and non-diseased individuals.

The CONUT score had higher PPV because the SGA score was only able to detect 19 out of 51 malnourished patients while the CONUT score detected 37 out of 51 malnourished patients according to the GLIM score as gold standard. Nevertheless, the SGA score had a higher likelihood ratio than the CONUT score which had <1 likelihood ratio.

Discussion

Colorectal cancer currently is the second leading cause of cancer deaths worldwide. Patients with colorectal cancer tend to experience high levels of malnutrition due to impaired intestinal function. such as obstruction and malabsorption.[7] This study had equal gender distribution. It shows that the incidence of malnutrition in male and female colorectal cancer patients was equal. This result follows a study by Song et al.,[8] in which the number of malnourished patients with colorectal cancer is relatively equal between male and female patients.The mean age of patients in this study was 51.87±12.44 years, which supports the observation that the incidence of colorectal cancer increases with age, particularly in individuals over 50.[9] The mean height and weight were 157.03±7.97 cm and 51.51±9.89 kg, respectively, which are consistent with the general demographic characteristics of patients in similar studies..

The lack of universal screening tools to assess nutritional status in colorectal cancer patients increased the patient's and hospital's burden. The GLIM score was issued by the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN) as a gold standard for diagnosing malnutrition in colorectal cancer patients.[5] GLIM proposes a two-step model. the first step is using a validated screening tool. then the second step is the assessment of the malnutrition severity level. However. the GLIM score was impractical. and it had no mild malnutrition criteria. The severity levels are divided into undernutrition and severe malnutrition. In this study. out of 60 patients. 51 patients were diagnosed as malnourished by the GLIM score.

The CONUT score had a low capability in ruling out malnourishment in colorectal cancer patients. There were 9 out of 9 patients who were not malnourished according to the GLIM score but were diagnosed as malnourished by the CONUT score. Therefore, the specificity and the NPV of the CONUT score were 0%. The CONUT score could detect 37 out of 51 malnourished patients. It had a sensitivity value of 80.4% and a positive predictive value of 72.5%.

The Controlling Nutritional Status (CONUT) score has been widely used as a nutritional assessment tool and is known to be practical and accurate. The CONUT score only focuses on assessing laboratory parameters in the patient's blood. As explained beforehand. inflammatory cytokines produced by cancer cells might reduce albumin synthesis. Hence. hypoalbuminemia often occurs in cancer patients. Peripheral lymphocytes. which play an important role in the immune response to tumors. are known to indicate a person's immunological and nutritional status. Lymphocytes create an immune response against cancer cells. so a reduction in lymphocytes results in a reduced ability to destroy tumor cells in the body. Total cholesterol concentration is known as an indicator of a patient's calorie reserves. Total cholesterol levels have been reported to correlate with cancer development because cancer tissue reduces the body's plasma cholesterol levels and caloric intake. Therefore. cancer causes hypocholesterolemia. The CONUT score results were expected to be more accurate because they directly assess the patient's blood parameters. and it is more practical to carry out because there was no need for history taking and physical examination. However. the CONUT score required expensive laboratory costs.[7]

In another way. this study found that the SGA score had 100% sensitivity and 100% Negative Predictive Value (NPV) because all significantly nourished patients diagnosed based on the GLIM score were also labeled nourished by the SGA score. However. it only had 21.95% specificity and 37.25% Positive Predictive Value (PPV) because 32 out of 51 malnourished patients were not detected as malnourished by the SGA score (Table 4).

Subjective Global Assessment (SGA) is a nutritional status screening tool that is often used worldwide. The SGA score was designed to be practical and can be filled in by the patients themselves. The SGA score was quick. easy to interpret. and did not require expensive costs. However. the SGA score had drawbacks. because it does not use laboratory tests for albumin levels or CRP levels in the blood.[10]

Previous studies also found similar results. Rosnes et al. compared the GLIM score with the PG-SGA score in 2021. The GLIM score identified

36% of the patients as malnourished and the SGA score identified 69% of the patients as malnourished.[11] Wang et al. in 2021 also found the SGA score to be similar to the GLIM score.[12]

A limitation of this study is that the severity of malnutrition based on the GLIM score was not analyzed. Additionally, factors that may influence malnutrition status, such as responses to systemic treatments and the stage of colorectal cancer, were not controlled in the inclusion and exclusion criteria. Future studies should explore these factors in greater detail, particularly focusing on the SGA scoring system as an alternative tool for detecting malnutrition in colorectal cancer patients..

This study concluded that the SGA score outperformed the CONUT score when compared with the GLIM score as the gold standard for diagnosing malnutrition in colorectal cancer patients. However, the SGA score demonstrated low specificity and positive predictive value (PPV). Notably, all patients diagnosed as malnourished by the SGA score were also classified as malnourished by the GLIM score. Conversely, patients classified as not malnourished by the SGA score may still be diagnosed as malnourished by the GLIM score. Therefore, patients who are not identified as malnourished by the SGA score should undergo further assessment to avoid the risk of misdiagnosis.

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