The comparison of GNRI versus HALP score as an outcome predictor in geriatric rectal cancer patients

Singgih Annas Fuadhi, Adeodatus Yuda Handaya, Nurcahya Setyawan, Agus Barmawi, Imam Sofi

ABSTRACT

Background: Colorectal cancer is the third most common cancer worldwide. Along with the development of science and technology, life expectancy has also increased, but the number of geriatric patients suffering from colorectal cancer and undergoing surgery has also increased. Geriatric patients have many factors that can affect the patient's prognosis. Thus, a screening tool to predict the outcome of rectal cancer geriatric is needed.

Methods: An observational analytic study with a retrospective cohort study design. This research was conducted by taking medical record data and laboratory results of patients with rectal cancer who were treated at Dr. Sardjito General Hospital, Yogyakarta.

Results: Patients with malnutrition, decreased levels of hemoglobin, albumin, and increased platelets affect mortality and postoperative complications of rectal cancer patients. In the analytical test, a significant association was found between the geriatric nutritional risk index (GNRI) and preoperative Hemoglobin, Albumin, Lymphocyte, and Platelet (HALP) score on mortality and postoperative complications in geriatric patients with rectal cancer. GNRI associated with length of stay in geriatric patients with rectal cancer. There is no relationship between HALP score preoperative on length of stay in geriatric patients with rectal cancer.

Conclusion: Both screening predictors of rectal cancer outcome, namely GNRI and HALP score, have a significant relationship with patient mortality and complications.

Keywords: Colorectal cancer, geriatric, GNRI, HALP score.

INTRODUCTION

Colorectal cancer is the third most common cancer worldwide. According to Globocan Indonesia data, in 2020, there were 34,189 new cases and 17,786 colorectal cancer deaths. In Indonesia, colorectal cancer ranks fourth. The highest incidence is in Jakarta, Central Java, and Yogyakarta provinces. With increasing life expectancy, the number of geriatric patients with colorectal cancer who undergo surgery also increases.

Geriatric patients are patients over 60 years of age. There is an aging process in geriatric patients, such as decreased intestinal motility and food absorption. Geriatric patients with malnutrition will increase the risk of morbidity, mortality, and length of stay in the hospital, which will reduce activity, performance status, and immune function.

Surgical therapy is the main therapy for rectal cancer, but the presence of malnutrition can cause slower wound healing, longer postoperative recovery, increased postoperative complications, and increased mortality in cancer patients. Nutritional status is an important factor affecting the therapeutic response and prognosis of cancer patients.

Geriatric colorectal cancer patients need to assess the nutritional-related prognosis. The tools that can be used are Geriatric Nutritional Risk Index (GNRI) and Hemoglobin, Albumin, Lymphocyte, and Platelet (HALP) score. GNRI was discovered by Bouillanne et al in 2005 to assess nutritional risk in elderly (geriatric) patients. GNRI is used to evaluate the risk of malnutrition associated with morbidity and mortality, the prognosis of chronic diseases, and cancer.

Systemic inflammation and nutritional status are very important in cancer patients. The HALP score combines several parameters to describe the immune system and nutritional status. Anemia and hypalbuminemia are associated with a poor prognosis. The combination of GNRI and HALP score is expected to be very helpful in assessing the prognosis of colorectal cancer.
**METHODS**

This is an observational analytic study with a retrospective cohort study design. This research was conducted by taking medical record data and laboratory results of patients with rectal cancer treated at Dr. Sardjito General Hospital, Yogyakarta. The study was conducted after the ethical approval was issued. The research subjects inclusion criteria are geriatric patients with rectal cancer based on anatomical pathology results, patients who had curative resection with complete preoperative data (hemoglobin, albumin, lymphocytes, platelets, weight, and height), and postoperative data (postoperative complications, mortality, and length of stay), and routine blood tests ≤ 2 weeks before surgery at dr. Sardjito, Yogyakarta from January 2020 to December 2022. Exclusion criteria for this study included patients who underwent neoadjuvant chemoradiotherapy, had only a biopsy, had synchronous tumors, were in emergency patients, and were recurrent. The research sample was taken using a non-probability sampling technique using consecutive sampling. The required sample size based on cohort calculations is 43 samples.

The Statistical Package for Social Sciences for Windows 25.0 was used for analysis. Univariate analysis was carried out to describe the research variables by making a frequency distribution table. In order to test the numerical data, the data normality test for each variable was carried out using the Kolmogorov-Smirnov or Shapiro-Wilk test. Meanwhile, the bivariate analysis uses the Chi-Square test if the data is categorical (nominal). Data with a numerical scale (ratio) uses a parametric test (product-moment correlation) if the data is normally distributed and if the data is not normally distributed, a non-parametric test is used, namely Spearman’s rank. Kaplan Meier analysis to see postoperative patient mortality. The statistical significance level was \( p < 0.05 \).

The independent variables assessed were the GNRI and HALP score. GNRI is calculated using the formula: \( 1.489 \times \text{hemoglobin (g/dL)} + [41.7 \times \text{(PBW/IBW)}] \). PBW is the present body weight and IBW is the ideal body weight calculated using the formula: \( \text{height body}^2 \times 22 \). GNRI patients were divided into without risk and with risk by calculating the cut-off from the sample data calculation. HALP score was calculated using the formula: \( \text{hemoglobin (g/dL)} \times \text{albumin (g/dL)} \times \text{lymphocytes (10}^3/\text{ml}) / \text{platelet (10}^3/\text{ml}) \). The patient’s HALP score was divided into 2 according to cut off, namely a low score and a high score. The power of the HALP score and the GNRI were analyzed using ROC curve analysis.

The dependent variables in this study were postoperative complications, length of stay, and mortality. Postoperative abdominal complications are based on Clavien-Dindo classification, the standard classification popularized by Clavien and Dindo.

**RESULTS**

The mean age of the patients was 66.33±5.01 years. The percentage of male samples is higher than females, namely 55.1%. The average weight of the study sample was 51.76 ± 12.2 kg, and the height was 157.94 ± 7.34 cm. At the same time, the average body mass index is 20.65 ± 3.49 kg/m2. The average hemoglobin, lymphocytes, platelets, and albumin can be seen in Table 1 below. The length of...
### Table 2. Relations between demographic, clinical, and histopathology factors with mortality

<table>
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<th>Mortality (n=89)</th>
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<tr>
<td>Stage II</td>
<td>29 (36.30)</td>
<td>1 (11.1%)</td>
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<tr>
<td>Stage III</td>
<td>40 (50.00)</td>
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<tr>
<td>Stage IV</td>
<td>11 (13.80)</td>
<td>7 (77.8%)</td>
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<td>Low anterior resection</td>
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<td>Ultra-low anterior resection</td>
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<td>1 (11.10)</td>
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<td>Miles</td>
<td>14 (17.50)</td>
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<td>Location, n (%)</td>
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<td>24 (30.00)</td>
<td>3 (33.30)</td>
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<td>Differentiation, n (%)</td>
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<td>Well-differentiated</td>
<td>27 (33.80)</td>
<td>2 (22.20)</td>
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<td>50 (62.50)</td>
<td>7 (77.80)</td>
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<td>Poorly differentiated</td>
<td>3 (3.80)</td>
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<td>Age (Years) (Mean±SD)</td>
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<td>66.00±5.06</td>
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<td>157.91±7.54</td>
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<td>BMI (kg/m²) (Mean±SD)</td>
<td>20.90±3.56</td>
<td>18.49±1.65</td>
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<td>Hemoglobin (g/dL) (Mean±SD)</td>
<td>11.92±1.58</td>
<td>11.19±1.77</td>
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<td>Lymphocyte (10³/ml) (Mean±SD)</td>
<td>1.66±0.78</td>
<td>1.20±0.50</td>
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<td>Platelet (10³/ml) (Mean±SD)</td>
<td>330.16±109.99</td>
<td>447.29±105.93</td>
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<tr>
<td>Albumin (g/dL) (Mean±SD)</td>
<td>3.74±0.55</td>
<td>3.07±0.64</td>
<td>0.001*</td>
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</table>

The cut-off point value for determining GNRI was 87.0, and it divided the sample into risk and without risk. The cut-off point value to determine HALP score was 15.16, and it will part the sample as high and low scores. GNRI without risk is 74.2% and GNRI with risk is 25.8%. The percentage of high score HALP is 69.7% and the low score is 30.3%.

Table 2 shows that only four demographic, clinical, pathological factors have a significant relationship with mortality (p<0.05). These factors include the stage of cancer, BMI, platelets, and albumin. Several factors influencing complications in rectal cancer patients include cancer stage, body weight, BMI, platelets, and albumin (Table 3).

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Table 3 shows the significantly high percentage of stage III rectal cancer, Low anterior resection (LAR) surgery method, class II Clavien-Dindo classification, moderately differentiated has the highest percentage.

The majority of risk-free GNRI groups are in Class II Clavien Dindo classification (41 patients) and with risk in Clavien Dindo class II (16 patients) (p=0.008), which means there is a significant relationship between GNRI and Clavien Dindo classification (Table 6). In the HALP group, there is a significant relationship between the HALP score and the Clavien Dindo classification. While Table 7 shows that the HALP score is not significantly related to the patient’s length of stay (p>0.05).

### DISCUSSION

The statistical test results found that the predictor factors significantly associated with mortality were cancer stage, BMI, platelets, and albumin. Cancer diagnosed at an early stage has a better prognosis. In this study, it was found that 7 patients who died were at stage 4 with liver, peritoneal, and lung metastases. These results are consistent with previous studies, which stated that most deaths from colorectal cancer were caused by metastases to the liver, peritoneal cavity, and lungs.15

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This study also assessed the relationship between demographics, clinical, and histopathology of patients with a length of stay. LOS was divided into two groups, namely <7 and ≥7 days. Based on Table 4 data, there was no significant relationship between the LOS group and all variables assessed (p>0.05).

Table 5 explains that the majority of GNRI rectal cancer patients with a survival risk of 21.3% and without a risk of 78.8%. Whereas for GNRI with a risk of death of 66.7% and a p-value was 0.003. GNRI and HALP score has a significant relationship with death (p<0.05).

Table 6 shows that the HALP score is not significantly related to the patient’s length of stay (p>0.05).
BMI or body mass index and albumin describe malnutrition. In this study, the average BMI in cases of death was 18.49 ± 1.65 kg/m² with 4 underweight patients and 5 normoweight patients. In this study, the average BMI in patients who died was lower than in patients who were alive (20.90 ± 3.56 kg/m²). The prevalence of malnutrition in cancer patients ranges from about 20% to more than 70%. Malnutrition causes 20% of deaths in cases of malignancy in the world. Malnutrition can cause death because it increases the risk of infection. As found in the results of the study, the mortality cases were found to be caused by sepsis and pneumonia. Malnutrition is a consequence of the presence of tumors, anti-cancer therapy, and surgery on cancer. The presence of cancer causes an increase in inflammatory mediators, such as cytokines, interleukin-1 (IL-1), interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and interferon-gamma (IFN-γ) which affect function muscle, brain, liver, and fat. This systemic inflammation results in changes in central nervous system signals that lead to anorexia, changes in liver metabolism, depress drug clearance, and increase the risk of chemotherapy-related toxicity, muscle wasting, decreased muscle mass and strength, and thinning of fat deposits. The systemic inflammatory processes and loss of muscle and cell mass associated with weight loss lead to fatigue, ultimately reducing physical activity. In addition, anti-cancer therapy often causes gastrointestinal disturbances such as nausea or diarrhea, changes in smell and taste, drug side effects, psychological stress, and pain, all of which can lead to reduced food intake, reduced mobility, and ends with loss of muscle mass.

This study found that the death case group had lower average hemoglobin and albumin levels and higher platelets than the group of alive patients. Decreased hemoglobin levels are related to malnutrition caused by the presence of tumor cells, anti-cancer therapy, surgery, and chronic blood loss. Serum albumin is also considered an indicator of nutritional status. Albumin levels reflect the severity of inflammation and disease. Serum albumin is also an independent prognostic indicator in several cancers. Serum albumin is a negative acute phase marker synthesized by the liver. Hypoalbuminemia can be caused by malnutrition or hypercatabolism, and it can also be caused by systemic inflammation and increased cytokine release, which can lead to a weak immune response against cancer cells. Meanwhile, the average platelet level in this study was higher in the death case group. This could be due to an increase in platelets associated with increased recurrence. Platelets act as metastasis promoters due to their ability to coat tumor cells, so natural killers cannot be recognized.

A low HALP score is associated with an increased risk of death. GNRI with risk values are associated with postoperative complications and tumor recurrence in geriatric colorectal cancer patients. The research data found that the GNRI cut-off point value as a predictor of outcome in geriatric rectal cancer patients divided into those with risk and without risk was 87.0. The cut-off point value to determine

### Table 3. Relations between demographic, clinical, and histopathology factors with Clavien Dindo classification

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<tr>
<th>Variable</th>
<th>Clavien-Dindo classification</th>
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<th>Grade V</th>
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<td>Female</td>
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<tr>
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<td>25 (44.60)</td>
<td>5 (55.60)</td>
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<tr>
<td>Stage, n (%)</td>
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<tr>
<td>Stage II</td>
<td>6 (26.10)</td>
<td>22 (39.30)</td>
<td>1 (11.10)</td>
<td>0.000*</td>
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<tr>
<td>Stage III</td>
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<td>25 (44.60)</td>
<td>1 (11.10)</td>
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<tr>
<td>Stage IV</td>
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<td>10 (17.54)</td>
<td>7 (77.80)</td>
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<td>The operation, n (%)</td>
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</tr>
<tr>
<td>Anterior resection</td>
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<td>18 (32.10)</td>
<td>5 (55.55)</td>
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<td>1 (11.11)</td>
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<td>Ultra-low anterior resection</td>
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<td>7 (10.70)</td>
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<td>Miles</td>
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<td>9 (16.10)</td>
<td>2 (22.22)</td>
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<td>Location, n (%)</td>
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<td>Differentiation, n (%)</td>
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<td>Weight (kg) (Mean±SD)</td>
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<td>157.30±7.67</td>
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<td>BMI (kg/m2) (Mean±SD)</td>
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<td>Hemoglobin (g/dL) (Mean±SD)</td>
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<td>Lymphocyte (10^3/ml) (Mean±SD)</td>
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Table 4. Relations between demographic, clinical, and histopathology factors with LOS

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<td>The operation, n (%)</td>
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<td>Anterior resection</td>
<td>16 (47.10)</td>
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<td>12 (35.30)</td>
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<td>Ultra-low anterior resection</td>
<td>2 (5.90)</td>
<td>9 (16.40)</td>
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<tr>
<td>Miles</td>
<td>4 (11.80)</td>
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</tr>
<tr>
<td>Age (Years) (Mean±SD)</td>
<td>66.36±5.11</td>
<td>66.23±4.80</td>
<td>0.916</td>
</tr>
<tr>
<td>Weight (kg) (Mean±SD)</td>
<td>52.73±11.96</td>
<td>48.82±8.24</td>
<td>0.158</td>
</tr>
<tr>
<td>Height (cm) (Mean±SD)</td>
<td>158.40±7.51</td>
<td>156.55±6.79</td>
<td>0.306</td>
</tr>
<tr>
<td>BMI (kg/m²) (Mean±SD)</td>
<td>20.84±3.80</td>
<td>20.08±2.26</td>
<td>0.376</td>
</tr>
<tr>
<td>Hemoglobin (g/dL) (Mean±SD)</td>
<td>11.93±1.58</td>
<td>11.61±1.69</td>
<td>0.425</td>
</tr>
<tr>
<td>Lymphocyte (10³/ml) (Mean±SD)</td>
<td>1.58±0.73</td>
<td>1.73±0.89</td>
<td>0.436</td>
</tr>
<tr>
<td>Platelet (10³/ml) (Mean±SD)</td>
<td>333.73±103.70</td>
<td>358.55±137.49</td>
<td>0.373</td>
</tr>
<tr>
<td>Albumin (g/dL) (Mean±SD)</td>
<td>3.70±0.55</td>
<td>3.58±0.70</td>
<td>0.384</td>
</tr>
</tbody>
</table>

Table 5. Relations between GNRI and HALP score with mortality

<table>
<thead>
<tr>
<th>Variable</th>
<th>Alive (n=80)</th>
<th>Death (n=9)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNRI, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without risk</td>
<td>64 (78.80)</td>
<td>2 (22.20)</td>
<td>0.003</td>
</tr>
<tr>
<td>Risky</td>
<td>16 (21.30)</td>
<td>7 (77.70)</td>
<td></td>
</tr>
<tr>
<td>HALP, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>60 (75.00)</td>
<td>1 (11.10)</td>
<td>0.001</td>
</tr>
<tr>
<td>Low</td>
<td>20 (25.00)</td>
<td>8 (88.80)</td>
<td></td>
</tr>
</tbody>
</table>

HALP as a predictor of outcome in geriatric rectal cancer patients divided into high and low is 15.16. In the data, it was found that two patients who died were GNRI without risk and one of them had high HALP values. The three patients were stage 4 patients with class V Clavien-Dindo classification. These patients deaths were caused by metastases and complications such as pneumonia and sepsis.

The results showed a significant relationship between GNRI and HALP score and mortality in geriatric rectal cancer patients. Previous studies by Kataoka et al. and Huang et al. stated that to determine the prognosis of colorectal cancer has been carried out using nutritional status, including GNRI.9,20 GNRI is used to assess the risk of malnutrition associated with morbidity and mortality.

HALP score is a score that can be used as a cancer prognosis. HALP score, which uses a combination of several parameters (hemoglobin, albumin, lymphocytes, and platelets), is better than one parameter to see the patient's prognosis. This assessment is an easily quantified marker of systemic inflammation and nutritional status. The HALP score is an important prognostic indicator for patients with multiple tumors.21,22 The HALP score has served as a prognostic factor in gastric cancer, esophageal squamous cell cancer, advanced colorectal cancer, and genitourinary cancer, including bladder, prostate, and renal cell carcinoma.21,24 The HALP score may be associated with anemia caused by advanced stages, malnutrition, and chronic blood loss. Malnutrition caused by cancer can reduce the immune system and increase postoperative morbidity and mortality. Geriatric patients with malnutrition will increase the risk of morbidity, mortality, and length of stay in the hospital, reducing activity, performance status, and immune function.1,25

Each HALP score component has a role in inflammation and body nutrition. The role of nutrition and immunity in predicting the prognosis of cancer patients has recently received attention. Nutritional
status influences tolerability to surgery and chemotherapy. Patients with advanced cancer are prone to malnutrition, leading to postoperative complications and poorer survival. Malnutrition is also associated with chemotherapy-related toxicity and reduced survival. Inflammation is often associated with the development and progression of cancer. Cancer cells that cause inflammation are caused by mutations that can later develop into malignancies through the recruitment and activation of inflammatory cells. Chronic inflammatory processes, mutations, and divisions occur, which create a conducive environment for the development of cancer cells.²⁶,²⁷

The hemoglobin level was significantly associated with survival and tumor progression in cancer patients. Conditions of decreased hemoglobin or anemia and thrombosis exacerbate inflammation, while lymphocytes reduce inflammation. Platelets have been shown to interact with tumor cells and promote their survival and metastasis through different mechanisms. Platelet stimulation is related to metastasis, and platelets can also protect cancer cells from the body’s immunity. Platelets inhibit tumor necrosis via TNF-α. By collecting platelets, tumor cells can escape the human immune system. Other studies have shown that platelets protect tumors from tumor necrosis factor-α (TNF-α). It can therefore be concluded that hemoglobin, albumin, and lymphocytes are beneficial risk factors; while platelets may be unfavorable. The interpretation of the HALP score is that the higher the score, the better the prognosis of a disease, while a low result is associated with a poor prognosis.¹¹,²⁶-²⁸

Cancer patients with malnutrition can cause 10-20% death due to malnutrition. Gastrointestinal disorders such as nausea, diarrhea, side effects of cancer drugs, stress, and the consequences of weight loss and cachexia occur.²⁹-³¹ Cachexia and malnutrition can be used to predict the prognosis of cancer patients. Cachexia resulting from cancer is associated with decreased physical function, reduced tolerance of anti-cancer therapy, and decreased survival.³² This progressive decline in physical function and significant loss of skeletal muscle mass is also called sarcopenia.³³

Complications after abdominal surgery, in this case, colorectal cancer, already has a standard classification, namely the Clavien-Dindo classification. Surgeons in various hospitals in various countries have used this classification.³⁴-³⁵ Postoperative complications can occur while the patient is still in the hospital for up to 30 days postoperatively or is admitted again due to complications.³⁶ Postoperative complications can occur systematically or specifically in surgical procedures and wounds. Clavien-Dindo classification grades I, II, and V were found in this study. Based on the study results, there were 23 patients with grade I and 57 patients with grade II. Clavien-Dindo classification grade V is an end-stage complication, which is death. Postoperative complications found in this study included pneumonia and sepsis. Patients with colorectal cancer are prone to pneumonia and sepsis. The incidence of pneumonia after colorectal surgery is 6.2%. Postoperative pneumonia can be caused by additional lung injury during surgery, this makes cancer patients more susceptible to developing pneumonia. A study conducted by Mulita et al found that the number of postoperative sepsis was 12.77% of patients. Postoperative sepsis is common among patients over 65 years of age. Common etiologies of postoperative sepsis include anastomotic leaks and surgical wound infections.³⁴,³³ Several factors are significantly related to the Clavien-Dindo classification, namely the cancer stage, the patient’s weight, BMI, hemoglobin, platelets, and albumin. The average weight and BMI of grade V Clavien-Dindo classification patients are lower than the other degrees. As previously explained, underweight or malnutrition can increase the risk of infection in cancer patients. The average albumin levels decreased significantly from grade I (4.04 ± 0.40 g/dL), II (3.61 ± 0.56 g/dL) to grade V (3.13 ± 0.64 g/dL). This can indicate that the poorer the patient’s nutrition, the more severe the complications that arise. Meanwhile, the levels of platelet metastasis promoters were higher in the grade V group. In addition, it was also known that in grade V, there were 7 patients with stage 4, and the other two patients were stages 2 and 3. Previous studies found a relationship between metastatic patients with postoperative complications.³⁵-³⁷

There is a significant relationship between GNRI and HALP score with the Clavien-Dindo classification.¹¹ Several factors that can affect postoperative hospitalization time include the patient’s age, the presence of co-morbidities, the location and stage of the tumor, and the type of surgery performed. These factors may influence the length of stay observed in rectal cancer surgery patients. There is no significant

### Table 6. Relations between GNRI and HALP score with Clavien Dindo classification

<table>
<thead>
<tr>
<th>Variable</th>
<th>Clavien-Dindo classification</th>
<th>Grade I (n=17)</th>
<th>Grade II (n=44)</th>
<th>Grade V (n=7)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNRI, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without risk</td>
<td>23 (34.8%)</td>
<td>41 (60.6%)</td>
<td>2 (4.5%)</td>
<td>0.008*</td>
<td></td>
</tr>
<tr>
<td>Risky</td>
<td>0 (0.00%)</td>
<td>16 (69.6%)</td>
<td>7 (30.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HALP, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>19 (30.6%)</td>
<td>41 (66.1%)</td>
<td>1 (3.2%)</td>
<td>0.002*</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>4 (14.8%)</td>
<td>16 (56.6%)</td>
<td>8 (29.6%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 7. Relations between GNRI and HALP score with LOS

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS (Days)</td>
<td>0.341</td>
<td>0.001*</td>
</tr>
<tr>
<td>GNRI</td>
<td>0.061</td>
<td>0.570</td>
</tr>
</tbody>
</table>
relationship between HALP score and length of stay in geriatric patients with rectal cancer. While GNRI and length of stay, there is a significant relationship. \( p=0.015<0.05 \).

Limitations of this study are a retrospective study and only from one hospital. It is hoped that this research can be used as a basis for multicenter research so that it is more useful in colorectal patients to reduce postoperative complications. With an easy and simple GNRI and HALP score measurement, it is hoped that it can be performed on all colorectal patients.

CONCLUSION

There is a significant relationship between GNRI and HALP score preoperative on mortality and postoperative complications in geriatric patients with rectal cancer. GNRI is associated with the length of stay in geriatric patients with rectal cancer. There is no relationship between HALP score preoperative on length of stay in geriatric patients with rectal cancer. GNRI and HALP score assessments in geriatric rectal cancer patients undergoing hospitalization should be carried out routinely, considering their simplicity and ability to predict outcomes, so that they can help clinicians in sorting out patients who need more intensive nutritional intervention.

CONFLICT OF INTEREST

The authors whose names are listed immediately below certify that they have no affiliations with or involvement in any organization with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

ETHICAL CLEARANCE

Ethical approval was issued by the Medical and Health Research Ethics Committee of the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta with number KE/FK/0261/EC/2023.

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REFERENCES


