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Hematology Profiles in Colorectal Cancer Patients in Bali

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A B S T R A C T

Colorectal cancer is a leading cause of cancer-related deaths worldwide. This study explores blood profile and cancer staging in colorectal cancer patients in Bali. It was a descriptive-analytical study that collected demographic and clinical data from medical records of colorectal cancer patients at Prof. Dr. I.G.N.G. Ngoerah Hospital. The results of the study showed the basic characteristics and hematology profiles of 100 colorectal cancer patients. The average age of patients was 55.6 ± 11.4 years, with 54% of the total sample being male. The average body mass index (BMI) was 21.1 ± 3.6 kg/m², with an average height of 161.9 ± 6.1 cm and an average weight of 55.3 ± 10.0 kg. Laboratory tests revealed an average hemoglobin (Hb) level of 11.0 ± 3.6 g/dL, red blood cell count of 4.0 ± 0.9 million/µL, white blood cell count of 11.2 ± 7.3 thousand/µL, and platelet count of 302.8 ± 154.8 thousand/µL. The average hematocrit (HCT) level was 33.7 ± 6.6 L/L. Liver function parameters indicated average aspartate aminotransferase (AST/SGOT) levels of 45.6 ± 63.6 U/L and alanine aminotransferase (ALT/SGPT) levels of 24.6 ± 29.4 U/L. Renal function was described by an average blood urea nitrogen (BUN) level of 21.8 ± 21.0 mg/dL, urea levels of 21.9 ± 21.2 mg/dL, and creatinine levels of 2.3 ± 11.5 mg/dL. Our study highlights the importance of hematology profiles in colorectal cancer patients as part of cancer screening examination. Further study with a larger number of samples and more diverse populations is needed to analyze the relation between variables.

INTRODUCTION

Colorectal cancer accounts for approximately 10% of all diagnosed cancer cases globally and has become one of the leading causes of cancer-related deaths. In women, colorectal cancer is the second most frequent cancer diagnosed, while it ranks third among men. Its incidence has become the highest in developed countries, though developing nations are also experiencing a significant rise in cases. By 2023, the global incidence of colorectal cancer is estimated to reach 2-5 million new cases. In Indonesia, colorectal cancer ranks third among the most diagnosed cancers and fourth as a cause of cancer-related deaths (Sung et al., 2021).

Clinical manifestations of colorectal cancer vary, including visible or occult rectal bleeding, changes in bowel habits, anemia, and abdominal pain. Diagnosis is typically established through colonoscopy, which provides direct visualization of the colon mucosa to detect lesions. Early-stage mucosal lesions are often inconspicuous, appearing as laterally spreading flat polyps that seem harmless, complicating early detection (Siegel et al., 2019).

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Colorectal cancer screening is critical, particularly for high-risk populations, as most patients are asymptomatic in the early stages. Symptoms only appear when the cancer has reached advanced stages, resulting in a poor prognosis. Regular screening in at-risk populations is expected to detect the disease early, thereby reducing morbidity and mortality rates and significantly improving patient prognosis (Rex et al., 2015). Individuals aged 45 years or older with new-onset rectal bleeding are advised to undergo colonoscopy. For younger patients, further evaluation is necessary to determine the risk, including family history, changes in bowel habits, unexplained weight loss, and the presence of blood in stools. This approach enables early detection across broader populations, improving clinical outcomes and increasing patient survival rates (Demb et al., 2024).

Various diagnostic modalities have been developed to support the diagnosis and evaluation of colorectal cancer, ensuring accurate diagnosis and optimal management planning. Radiological imaging, such as CT colonography, is often used as an additional method if colonoscopy results are insufficient. To detect metastases, both locoregional and distant, modalities like MRI and CT scans are highly useful, particularly for assessing cancer spread to organs such as the liver and lungs (Mármol et al., 2017).

Laboratory examinations also play a vital role in diagnosing and evaluating colorectal cancer. Complete blood counts, liver and kidney function tests, and occult blood detection tests in stools, such as fecal occult blood tests (FOBT) and fecal immunochemical tests (FIT), are frequently used in screening tests. Additionally, carcinoembryonic antigen (CEA) levels are also monitored; high CEA levels are often associated with poor prognosis. If postoperative CEA levels do not return to normal, it may indicate residual disease (Srivastava et al., 2001).

Histopathological examination is required to determine the disease stage, forming the basis for therapeutic management decisions. Modern tumor markers, such as mismatch-repair testing and immunoscore, are now routinely used in some medical facilities. Mismatch-repair testing is conducted through immunohistochemistry, and if the results are inconclusive, PCR-based microsatellite instability (MSI) testing is performed for clarity (Graham & Cassidy, 2012).

The etiology of colorectal cancer is multifactorial, involving complex interactions between genetic, lifestyle, and environmental factors. Risk factors include advanced age, unhealthy diet, obesity, physical inactivity, and smoking habits. A family history of colorectal cancer also affects the risk, with 10-20% of patients having affected relatives. This risk varies depending on the number of affected family members, the degree of kinship, and the age of diagnosis. The combination of genetic and environmental influences plays a significant role in the pathogenesis of colorectal cancer, and understanding these interactions provides deeper insight into the disease mechanisms (Schoen et al., 2015).

This study aimed to describe the hematology profile in colorectal cancer patients in Bali. The results of this study are expected to provide a strong scientific basis for understanding the nature of the disease and developing strategies for prevention, early diagnosis, and management for colorectal cancer in the future.

METHOD

This study was a descriptive-analytical study aimed to understand various factors through an observational approach by collecting data at a specific time. The study population included all colorectal cancer patients undergoing therapy at Ngoerah Hospital, Bali who met the established inclusion and exclusion criteria. Data was collected from patient medical records containing demographic data and laboratory test results. The data collection process was started in January 2024. Ethical approval for the study was granted by the Ethics Committee of the Faculty of Medicine, Udayana University, and Ngoerah Hospital with registration number 0488/UN14.2.2.VII.14/LT/2024.

A non-probability sampling technique was employed, as defined by Sarwono (2013), meaning that not all population elements had an equal opportunity to be selected as a sample. The method used was consecutive sampling, in which samples were selected sequentially based on inclusion criteria until the required sample size was achieved within a specific time frame. Sample size calculations were performed using the G*Power application with the following parameters: test family = $\chi 2$ tests, effect size = 0.6, alpha error probability = 0.05, power = 0.90, and degrees of freedom (df) = 1. Based on these calculations, a minimum sample size of 90 participants was required. To anticipate data loss during the research process, an additional 10% of the total sample size was included, bringing the minimum sample size to 99 participants. Data analysis was conducted using the SPSS software program. Demographic data and hematological profiles were presented descriptively using mean values for numerical data or percentages for categorical data. The data generated will serve as the foundation for further research, whether cross-sectional, longitudinal, or experimental.

RESULT

Based on data collection from patient medical records at Ngoerah Hospital, Bali, who met inclusion and exclusion criteria, a total of 100 samples were obtained. Table 1 describes the basic characteristics of colorectal cancer patients. The average age of the patients was 55.6±11.4 years, with males comprising 54% of the total samples. The mean body mass index (BMI) was 21.1±3.6 kg/m², with an average height of 161.9±6.1 cm and weight of 55.3±10.0 kg. The cancer stage was classified from 0 to 4, with 17 patients unclassified. The number of patients for stages 0, 1, 2, 3, and 4 were 10, 4, 11, 19, and 39, respectively, suggesting that many patients were diagnosed at advanced stages.

Hematology profiles are described in Table 2 and Table 3. Table 2 describes complete blood count (CBC) results, including hemoglobin (HGB), erythrocyte (RBC), leukocyte (WBC), thrombocyte (PLT), and hematocrit (HCT). The results showed a mean HGB level of 11.0±3.6 g/dL, RBC count of 4.0±0.9 million/µL, WBC count of 11.2±7.3 thousand/µL, and PLT count of 302.8±154.8 thousand/µL, and the average HCT value was 33.7±6.6 L/L.

Table 1. Basic characteristics of colorectal cancer patients

The characteristics of the respondents	Mean±SD or n (%)
Age, years old	55.6±11.4
Sex, Male	54 (54)
Body mass index, kg/m^2	21.1±3.6
Height, cm	161.9±6.1
Weight, kg	55.3±10.0
Cancer stage	
Not Classified	17
Stage 0	10
Stage 1	4
Stage 2	11
Stage 3	19
Stage 4	39

kg/m²: kilograms per square meter; cm: centimeter; kg: kilogram; SD, standard deviation; n, number of participants.

Table 2. Complete blood count results

Laboratory Parameter	Mean ± SD or N (%)
Hemoglobin (HGB), g/dl	11.0±3.6
Erythrocyte (RBC), mil/µL	4.0±0.9
Leukocyte (WBC), 10^3µL	11.2±7.3
Thrombocyte (PLT), 10^3µL	302.8±154.8
Hematocrit (HCT), %	33.7±6.6

g/dl, gram per deciliter; mil/µL, million cell per microliter; 10^3µL, thousand cell per microliter; %, percentage; SD, standard deviation; n, number of participants.

Table 3. Blood chemistry results

Laboratory Parameter	Mean ± SD or N (%)
Aspartate aminotransferase (AST)[1], U/L	45.6±63.6
Alanine aminotransferase (ALT)[1], U/L	24.6±29.4
Blood urea nitrogen (BUN)[2], mg/dL	21.8±21.0
Ureum[3], mg/dL	21.9±21.2
Creatinine[4], mg/dL	2.3±11.5

U/L, unit per liter; mg/dL, miligram per deciliter; SD, standard deviation; n, number of participants; 1, n=91; 2, n=96; 3, n=94; 4, n=95.

Table 3 describes blood chemistry results. Liver function parameters indicated a mean aspartate aminotransferase (AST) concentration of 45.6±63.6 U/L and alanine aminotransferase (ALT) concentration of 24.6±29.4 U/L. Kidney function parameters showed mean concentrations of blood urea nitrogen (BUN) at 21.8±21.0 mg/dL, ureum at 21.9±21.2 mg/dL, and creatinine at 2.3±11.5 mg/dL. These data provide an overview of basic characteristics and hematology profiles of colorectal cancer patients in Bali.

DISCUSSION

Previous studies have shown a relationship between colorectal cancer symptoms, disease stages, and prognosis. Early detection of colorectal cancer has been proven to significantly improve patients' survival rates (Maida et al., 2017). Our study provides some valuable data about basic characteristics and hematology profiles of colorectal cancer patients in Bali, that can be utilized for further study about risk factors and cancer pathogenesis.

Basic characteristics of the colorectal cancer patients showed an average age of 55.6±11.4 years, suggesting that the disease mostly happened in late adulthood. This finding followed a previous study that reported older patients aged more than 50 years as high-risk populations (Sung et al., 2021). The cancer stadium was classified from 0 to 4. The result showed that most of the patients were diagnosed at a late stage, 19 patients at stage 3 and 39 patients at stage 4. American Society of Colorectal Surgery reported that 70% of colorectal cancer cases were diagnosed in later stages when the patients had developed symptoms, including hemorrhage or occlusion (Vogel et al., 2022). Therefore, routine screening in the high-risk population becomes critical to prevent advanced disease.

In our patient samples, the average value of CBC results was within the normal range. However, as one of the CBC parameters, HB serves as an important parameter for the disease. Anemia, caused by low HB levels, frequently occurs in colorectal cancer patients, which is a result of gastrointestinal bleeding, systemic inflammatory processes, and side effects of cancer treatment. Gastrointestinal bleeding, whether visible like bloody stools (hematochezia) or occult, leads to chronic blood loss, resulting in iron deficiency anemia. Anemia, caused by gastrointestinal bleeding, is one of the clinical manifestations of malignancies in the colon and rectum. Hematochezia is commonly observed in colorectal cancer patients and can be used as a significant predictor for determining the stage of colorectal cancer (Schult et al., 2021).

Being routinely evaluated through HB measurement, anemia, as a symptom, offers advantages due to its specificity, ease of measurement, and high positive predictive value (PPV) compared to other clinical symptoms. Severe anemia has been identified as a crucial predictive factor for advanced-stage colorectal cancer. More advanced cancer has a higher risk of anemia caused by severe bleeding and inflammation. Pre-operative anemia symptoms have also been proven as an effective indicator for assessing cancer prognosis based on the stage (Saraste et al., 2017). Furthermore, optimal anemia management not only supports the overall health of patients but also enhances the success of ongoing cancer therapies (Majano et al., 2022). These findings underscore the importance of anemia evaluation within the clinical context of colorectal cancer, both for early detection and prognosis assessment.

Based on the blood chemistry results, we found a high serum creatinine level in our patient samples. Serum creatinine is an important parameter used to calculate the estimated glomerular filtration rate (eGFR), which is used to evaluate kidney function. Creatinine serum concentration had been studied for

years as a prognosis marker for several malignancies, including ovarian cancer, liposarcoma, and renal cell carcinoma (Lafleur et al., 2018).

Some studies have also evaluated the association between kidney functions, especially creatinine serum concentration, and the outcome of colorectal cancer patients. A multi-center cohort study found creatinine serum concentrations and overall survival of colorectal cancer patients. Furthermore, the study discovered that abnormal (low or high) creatinine serum concentration was associated with lower overall survival. Another cohort study also noted the fact that higher serum creatinine concentrations were associated with a 39% increase of all-cause mortality in patients with rectal cancer, but not colon cancer (Ose et al., 2023). Finally, another observational study observed that low eGFR as an independent risk factor for stage III colon cancer. In this study, a combination of preoperative eGFR and CEA levels would be beneficial in predicting postoperative adjuvant chemotherapy responses and patients' prognosis (Chiang et al., 2019).

CONCLUSION

Our study highlights the importance of hematology profiles in colorectal cancer patients as part of cancer screening examination. Further study with a larger number of samples and more diverse populations is needed to analyze the relation between the hematology profiles, especially HB and creatinine serum concentrations.

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