

Original Research Article

The Efficacy of Hb and RBCs Indices Components of a Full Blood Count Test on Detection of Colorectal Cancer among Adult Sudanese Patients

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Abstract: Background: One of the most dangerous neoplasms affecting the colon, rectum, and/or anus, colorectal cancer (CRC) has a variety of macroscopic and histopathologic features. The third most prevalent cancer worldwide and the fourth most common cancer-related cause of death is colorectal cancer. The second most prevalent gastrointestinal cancer and the fifth most frequent primary tumor in Sudan is colorectal cancer. A complete blood count (FBC) is a routine blood test that can include up to 20 different blood components and is used in both primary and secondary care. This study was done to assess how well the FBC test works for detecting CRC. **Objectives:** We hypothesized that the Hb and RBCs indices (RBCs counts, PCV, MCV, MCH, and MCHC) components of a full blood count test have a value in the detection of colorectal cancer among adult Sudanese patients. **Material and Methods:** This study was a hospital-based retrospective cross-sectional analytical study. The study included 100 patients diagnosed with colorectal cancer. The study was conducted at the Shendi Oncology Hospital and Research Center; University of Shendi. In the period from August 2015 to August 2022. **Result:** The results of the study showed that the mean values of the RBCs, PCV, and MCV for both gender males and females were significantly higher in the healthy adult Sudanese people compared with the colorectal cancer patients ($p=0.000$). The mean value of the MCHC for both genders was significantly higher in the colorectal cancer patients compared with the healthy adult people ($p=0.002$). The mean values of the MCH and Hb were varied according to the gender between the colorectal cancer patients and the healthy adult people. The result also showed that 25 (25%) patients who performed the FBC test before receiving the chemotherapy; had relatively low mean values of Hb, PCV, MCV, MCH, and MCHC compared with 23 (23%) patients who performed the FBC test after they received the chemotherapy. **Conclusion:** An FBC test can be used to screen individuals who are suspected of having colorectal cancer for iron deficiency anemia, which develops as a result of persistent blood loss from rectal bleeding and is the primary symptom of CRC in the early stages.

Keywords: Colorectal Cancer, Complete Blood Count, IDA, Sudan.

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INTRODUCTION

Colorectal cancer (CRC) is one of the most serious neoplasms affecting the colon, rectum, and/or anus, with a variety of macroscopic and histopathologic features. Most cases of this cancer are sporadic, but it can also develop as a complication of inflammatory bowel disease [1]. Approximately 5–10% of all cases occur in

the context of defined hereditary cancer syndromes and pathogenesis is influenced by genetic changes [2, 3]. Rectal bleeding, bowel habits changes, abdominal pain, tenesmus, weight loss, abdominal distension, and anal pain are all possible symptoms [4]. Colonoscopy is the gold standard for diagnosing colorectal cancer [5]. Treatment options and prognosis are determined by staging, which includes tumor size, lymph node

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involvement, and the presence of metastases [6]. In general, surgery is the mainstay of colorectal cancer treatment [7]. With good surgical technique and patient selection, surgery can produce positive outcomes [8]. Radiotherapy and radiochemotherapy may be used to reduce local recurrence and prolong patient survival [9]. In terms of epidemiology, colorectal cancer is the third most common cancer and the fourth leading cause of death from cancer worldwide [10]. In the year 2020, colorectal cancer recorded 1.9 million newly diagnosed cases and about 0.9 million deaths worldwide. The incidence of colorectal cancer is higher in developed countries, however, the incidence of it is increasing in middle and low-income countries [11]. In Sudan, according to national registry data results from 2009-2010 in Khartoum; the capital of Sudan, colorectal cancer is the second most common gastrointestinal malignancy and the fifth among all primary tumors [12]. A full blood count (FBC) is a regular blood test used across both primary and secondary care and encompasses up to 20 blood components [13]. Many studies have investigated the association between specific components of the FBC and the diagnosis of colorectal cancer, such as low hemoglobin [13, 14], and high red blood cell distribution width [15, 16]. This assists in the identification of patients who should be referred for a full colonoscopy as soon as possible [17]. Few studies were reported in the last five years (2015–2019), indicating that there is increasing interest in the use of the FBC for early detection of colorectal cancer [14]. However, there hasn't been enough evidence to investigate this problem in Sudan to date. Therefore, the objective of this study is to evaluate the efficacy of Hb and RBCs indices (RBCs counts, PCV, MCV, MCH, and MCHC) components of a full blood count test on the detection of colorectal cancer among adult Sudanese patients at the Shendi Oncology Hospital and Research Center in River Nile State, Sudan

MATERIALS AND METHODS

Study Design

This study was a hospital-based retrospective cross-sectional analytical study conducted at the Shendi Oncology Hospital and Research Center, University of Shendi. The study included one hundred (100) patients who had colorectal cancer and were admitted to Shendi Oncology Hospital and Research Center during the period from August 2015 to August 2022.

Study Population

A total of 100 patients with colorectal cancer were included in this study. The patients were diagnosed using careful clinical examinations and specific investigations included plain X-rays, MRI and Colonoscopy.

Ethical Consideration

This study was approved by the Shendi Oncology Hospital and Research Center. Written informed consent was obtained from the local ethical

committee and administration of Shendi University. Names and personal data of patients were completely secured to keep the privacy of patients' identities. All protocols in this study were done according to the Declaration of Helsinki (1964).

Data Collection and Analysis

Data was collected carefully via standardized pre-designed questionnaires from the patients' files records that were found in the TTCRC official records and data center during the period of study. After that data was cleaned and checked for consistency before it was entered for analysis. Finally, data was analyzed using the Statistical Package for Social Science (SPSS) version 22, and the results were expressed as tables in the result section.

RESULTS

The study population was one hundred (100%) patients. 55 (55%) of them were male and 45 (45%) were female patients. About 90 (90%) of them were in an age group equal to or above 30 years old and 10 (10%) of patients were less than 30 years old. The mean average of age 42 (42%) of patients was located in the age group between 50 and 70 years old. 52 (52%) patients reside in rural areas and 48 (48%) of patients are living in urban areas. Seventy-nine patients (79%) were not associated with any chronic diseases, 11 (11%) of them had diabetes mellitus, 3 (3%) of patients had hypertension, 6 (6%) had both diabetes mellitus and hypertension, and only one patient had asthma. The primary tumor emerged in the left side of the colon (anus, rectum, sigmoid colon, recto-sigmoid colon, and descending colon) in 87 patients (87%), and in the right side of the colon (cecum, ascending colon, and transverse colon) in 13 patients (13%). The stages of cancer predominantly increase of distribution of the first three stages of cancer among males when compared with females. The distribution was: 13 patients (13%) were in stage I; 32 (32%) were in stage II; 14 (14%) were in stage III; and 35 patients (35%) were in stage IV. 6 patients (6%) with missed data in files records as regards to the stages of cancer. When comparing the mean values of Hb and RBCs indices (RBCs count, PCV, MCV, MCH, MCHC) in both gender males and females, with all four stages of colorectal cancer, before and after they receive the chemotherapy in our colorectal cancer patients with other control group which represented a healthy adult Sudanese people in Khartoum state; the data revealed that the mean values of the RBCs, PCV and MCV for both gender males and females were significantly higher in healthy adult Sudanese people compared with our colorectal cancer patients and the result of those three items was statistically significant ($p=0.000$). On the other hand, the mean values of the MCHC for both genders were significantly higher in colorectal cancer patients compared with healthy adult Sudanese people ($p=0.002$). The mean values of the MCH and Hb were varied according to the gender between the two groups (Table 1). Subgroup analysis was found in 48 (48%) patients out

of all 100 (100%) patients of our study population. The comparison of the mean values of Hb and RBCs indices in both gender males and females in 25 (25%) patients out of 48 (48%) patients who performed the full blood count test (FBC) before receiving the chemotherapy with the rest of the 48 (48%) patients which were 23 (23%) patients who performed the FBC test after receiving the chemotherapy as appearance in (table-2) shown that. The 25 (25%) patients in both genders who performed the FBC test before receiving the chemotherapy; have relatively low mean values of Hb, PCV, MCV, MCH,

and MCHC compared with those 23 (23%) patients who performed the FBC test after they received the chemotherapy. Only the mean value of the RBC count component of the FBC test was shown a little differently. The mean value of RBC count decreased in males after chemotherapy by about (.06 x10⁶ /μL) compared with the value of before chemotherapy and increased in females after chemotherapy by about (0.37 x10⁶ /μL) compared with the value of it before chemotherapy (Table 2).

Table 1: Comparison of the mean values of the Hb and RBCs indices between our study population [N=100] and of healthy Adult Sudanese people in Khartoum state [N=438].

Items	Colorectal cancer group (n=100) (Mean ± SD)		Control group (n=438) (Mean ± SD)		P-value
	Male	Female	Male	Female	
Hb (g/dl)	12.4±2.3	13±1.4	14.9 ±1.5	12.2±1.5	0.005
RBCs	4.3±0.7	4.1±0.8	5.2±0.5	4.5±0.4	0.000
PCV (%)	36.8±7.7	34.7±6.2	46.4±5.3	39.2±5	0.000
MCV (fl)	85±11	83.4±8.2	89.8±9.3	86.2±9.8	0.000
MCH (pg)	28.3±2.9	27.5±2.6	28.7±2.8	27.3±4	0.006
MCHC	32.7±1.5	33±2.6	32.2±2.7	31.4±2.5	0.002

Table 2: Comparison of the mean values of Hb and RBCs indices of both gender in group of patients from our study population before receiving the chemotherapy [N=25] and after receiving the chemotherapy [N=23].

Items	Before (Mean± SD) (n=25)		After (Mean± SD) (n=23)		P-value
	Male	Female	Male	Female	
Hb (g/dl)	11.84±1.64	10.95±2.70	13.09±1.71	12.36±2.77	0.02
RBCs	4.51±.64	33.53±7.25	4.45±.47	4.46±.96	0.32
PCV (%)	36.73±3.97	33.53±7.25	39.94±4.47	37.56±7.45	0.01
MCV (fl)	72.50±20.08	81.62±9.15	89.23±6.36	84.69±5.94	0.01
MCH (pg)	26.15±2.90	27.05±2.96	29.02±2.79	27.66±1.67	0.03
MCHC	32.61±1.35	32.79±1.74	32.62±1.36	33.19±2.06	0.77

DISCUSSION

The link between the FBC and the identification of colorectal cancer has been researched for many years, with the oldest study being published in 1995, as our review made clear. The majority of research were published over the previous five years (2015–2019), demonstrating the growing interest in using the FBC for colorectal cancer detection. Although a study of colorectal cancer symptoms, which include low hemoglobin [14], and wide red blood cell distribution for a variety of tumors that include colorectal [16], exists, to our knowledge there have been no studies of the FBC blood test for identifying colorectal cancer. In Khartoum, we discovered differences between colon cancer patients and healthy adult Sudanese people in terms of the mean values of Hb and RBC indices [18]. As five out of six parameters of the FBC test components were low in both male and female patients with colorectal cancer who performed the FBC test before they received the chemotherapy compared with those patients who performed the FBC test after they received the chemotherapy in the same study population, we noted that there is a clear difference in the mean values of Hb and RBCs indices in patients with colorectal cancer

before and after receiving the chemotherapy. Rectal bleeding is one of the most typical colorectal cancer presentations, and as it predominates in the early stages of tumor development, it can be used to detect the disease early [19, 20]. According to several research, minor changes in the following FBC parameters can occur when cancer is still in its early stages: RBC count, Hb, MCV, RWD, platelet count, WBC count, and mean levels of different types of WBCs [13]. In this study, we focused on certain FBC test parameters—namely, RBC count, Hb, PCV, MCV, MCH, and MCHC—and tracked how those values changed as a result of CRC. These variables are relevant for measuring blood level because they are associated with blood level. Chronic blood loss from colon tumors and adenomas, which manifests as rectal bleeding, causes colorectal cancer patients' blood levels to drop below normal. Chronic blood loss can lead to anemia. Anemia appearance in the FBC test as changes in certain parameters of the FBC test according to the type of anemia. Iron deficiency anemia has a high prevalence rate among patients with colorectal cancer reaching up to 60% of CRC patients [21, 22]. Iron deficiency anemia is associated with changes in some of the FBC test parameters as iron is an important

component of hemoglobin; so parameters like RBC count, Hb, MCH, and MCHC will be affected as a result of iron deficiency anemia. Chronic blood loss can lead to anemia. Depending on the kind of anemia, anemia manifests in the FBC test as alterations in a few of its parameters. Up to 60% of people with colorectal cancer have iron deficiency anemia, which is a significant prevalence rate [21, 22]. Since iron is a crucial component of hemoglobin, iron deficiency anemia is related with changes in certain of the FBC test parameters. As a result, parameters including RBC count, Hb, MCH, and MCHC will be impacted. So those FBC test parameters have value in the detection of the early stage of CRC through the detection of these changes that occur on FBC test parameters as a result of iron deficiency anemia. A study conducted by Dianyu Yang, *et al.*, investigated 85 patients that were diagnosed with CRC and found a significantly increased RDW and platelets ($p < 0.05$), 49 patients (50%) had an elevated red cell distribution width (RDW), and 43 patients (44%) had anemia. A retrospective case-control study by Derrick W. Spell, *et al.*, which looked at 127 patients with right-sided colon cancer, found that the mean corpuscular volume (MCV) had decreased in our study population. Of those 127 patients, 107 (84%) had elevated red cell distribution width (RDW), 87 (69%) had anemia, and 70 (55%) had a low mean corpuscular volume (MCV). Ninety-eight patients had left-sided colon cancer, of whom 22 (22%) had a low mean corpuscular volume (MCV), 49 (50%) had an elevated red cell distribution width, 43 (44%) had anemia, and 49 (50%) had an elevated red cell distribution width [17]. A meta-analysis of 53 research, undertaken by Pradeep S. Virdee *et al.*, revealed a correlation between CRC and the following markers: RBC count, Hb, MCV, WBC count, RDW, and platelets count in the majority of studies [13]. The FBC test parameters are useful for both early colorectal cancer identification and monitoring the prognosis of the disease because several FBC markers may also be used as prognostic indicators. Preoperative hemoglobinemia, thrombocytosis, elevated C-reactive protein values, neutropenia, and leukocytosis, as well as preoperative neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR), have all been shown to affect overall survival and disease-free survival in patients with CRC, though the results are debatable [23]. Although we conducted the file records of colorectal cancer patients through the last eight years, we only found 100 file records of patients. Most colorectal cancer patients in our country Sudan particularly in Shendi City are undiagnosed to most of them are residing in rural areas as about 52 (52%) of our study population were living in rural areas. Patients from rural areas find it difficult to reach Shendi Oncology Hospital to be diagnosed and receive treatment, also they are suffering from financial issues so most of them die before they reach the hospitals.

CONCLUSION

The FBC test is a simple, routine test that is performed in clinical practice and hospitals. Iron deficiency anemia that occurs as a result of chronic blood loss from CRC in the early stage of cancer can be screened through an FBC test in patients who are suspected to have colorectal cancer in order to detect the early stage of colorectal cancer. Our study suggests that RBC count, Hb, MCV, MCH, and MCHC are associated with a diagnosis of colorectal cancer. This study does not provide clinical guidance for the detection of CRC, it only alarms patients who are suspected of having CRC to do further investigations like colonoscopy in order to detect the cancer in the early stage and receive the treatment.

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