

The prevalence of anemia in patients with malignant tumors: a hospital based cross sectional study

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ABSTRACT

Cancer is a worldwide health problem, and anemia is one of its manifestations. There are no published data on anemia among patients with cancer in Sudan. The current study aimed to investigate the prevalence of anemia among patients with malignant tumors in central Sudan. The medical records of patients with malignant tumors admitted to the National Cancer Institute, University of Gezira, Sudan, from March to December 2020 were reviewed. Among the 471 patients enrolled in the study, 292 (62.0%) were female. The median (interquartile range, IQR) age was 55 (45-66) years. Breast cancer (109, 23.1%), colorectal/anorectal (88, 18.7%), head and neck (83, 17.6%), female genital tract (70, 14.9%), and prostate (35, 7.4%) cancer were the main cancers observed in this study. The median (IQR) hemoglobin was 11.9 (10.5-13.0) g/dl and 237 (50.3%) patients had anemia. The prevalence of anemia ranged from 31.2% in breast cancer patients to 82.9% in those with prostate cancer. Compared with males (120/292, 41.1%), females (117/179, 65.4%) had a significantly higher prevalence of anemia ($P < 0.001$). The median (IQR) age of the patients with anemia was significantly higher than that of those without anemia (57.0 years vs. 51.5 years, respectively; $P = 0.003$). Half the patients with malignant tumors had anemia. Anemia was more common among female patients and elderly patients.

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Introduction

Cancer is a worldwide health problem, with an estimated 19.3 million new cancer cases and almost 10 million deaths due to cancer in 2020.^{1,2} Cancer is a leading cause of death and an important cause of premature death worldwide.² The Global Database on anemia indicated that the prevalence of anemia was 22.8% worldwide between 1990 and 2019.³ The National Comprehensive Cancer Network Guidelines recommend a complete evaluation of the cause of anemia if a cancer patient has a hemoglobin < 11 g/dl or their hemoglobin level drops by 2 g/dl from baseline hemoglobin levels.⁴ Cancer is commonly associated with anemia of chronic illnesses.⁵ Anemia is a common manifestation of malignancies and it is estimated to occur in 30-90% of patients depending on the definition of anemia, can-

cer type, and stage.⁶ In cancer patients, anemia affects the quality of life, survival, and possibly the tumor response to chemo- and radiotherapy.⁷ The presence of anemia on the first presentation of cancer has been reported to be associated with postoperative complications.⁸ Patients with malignant tumors have a high (38%) prevalence of moderate-to-severe anemia, ranging from 26% in colorectal cancer patients to 59% in those with ovarian cancer.⁹ Moreover, it has been observed that hemoglobin levels correlate with tumor stage and are associated with tumor site, with ovarian cancer being most commonly associated with severe anemia.¹⁰ Studies, in different countries,¹¹ have reported different rates of anemia in patients with malignant tumors (e.g., 64% and 65% in India,¹² 53.9% in China,¹³ 39% in Spain,¹⁴ 49.7% in Turkey,¹⁵ 44.1% in the Kingdom of Saudi Arabia,¹⁶ and 35% in Italy).¹⁷ Different factors, such as tumor site, advanced age, and female gender, have been found to be associated with anemia in patients with cancer.^{8,18} While several studies have been conducted on anemia among patients with cancer in Africa,¹⁹ published data on anemia in patients with cancer in Sudan is scarce.^{11,20} Investigations of anemia among patients with cancer is of paramount importance as they could yield the data necessary for interventions. Caregivers and health planners need data on anemia among patients with cancer so that it can be used in evidence-based practice. The current study was conducted to investigate the prevalence of anemia among patients with malignant tumors presenting to the National Cancer Institute in Gezira in central Sudan.

Materials and Methods

Study population

The medical records of patients admitted to the National Cancer Institute, University of Gezira, Sudan, with confirmed malignant tumors (*i.e.*, breast, female genital tract, prostate, colorectal/anorectal, head and neck, lung, urinary system, liver, pancreas, or testicular tumors or lymphoma) were reviewed. The inclusion criteria were male and female patients aged >18 years, admission with histopathologic confirmation of a primary malignancy prior to receiving anticancer treatment, and the availability of all medical history and examination data. The records of patients with the hematological disease, bone marrow malignancy, or anemia due to chronic renal disease, and those who had received a blood transfusion were excluded.

Hemoglobin was measured from venous blood by collecting 2 ml of blood from a forearm vein into an EDTA-containing vacutainer after gently rubbing the injection site with an alcohol pad.

Hemoglobin was estimated using an automated hematology analyzer according to the manufacturer's

instructions (Sysmex, KX-21, City, Japan). Anemia was defined as a hemoglobin level <11.5 g/dL for females and <13.0 g/dL for males.²¹

Statistical analysis

The data were captured using SPSS software for Windows version 22.0 (SPSS Inc., Chicago, IL). The Shapiro–Wilk test was used to assess the normality of the continuous data (*i.e.*, age, body mass index, and hemoglobin). If the variables were not normally distributed, they were expressed as median (interquartile range, IQR), and the different tumor types were compared using a non-parametric test (Kruskal–Wallis test). A chi-square test was used to compare proportions. A two-sided P-value <0.05 was considered statistically significant.

Ethical considerations

The study received ethical approval from the National Cancer Institute, University of Gezira, Sudan. All patients' personal data were fully anonymized.

Sample size calculation

A sample of 471 patients was calculated based on a study in Ethiopia.²² We assumed that the prevalence of anemia was 50.0% (1:1 ratio). It was expected that 53.0% of the females with cancer would have anemia and 40% would not have anemia. This sample had a type I error of 5% and adequate power (80% of power; $\beta=0.2$).

Results

Of the 471 patients enrolled in the study, 292 (62.0%) were female. The median (IQR) age was 55 (45–66) years. Breast (109, 23.1%), colorectal/anorectal (88, 18.7%), head and neck (83, 17.6%), female genital tract (70, 14.9%), and prostate (35, 7.4%) cancer were the main cancers observed in this study (Figure 1).

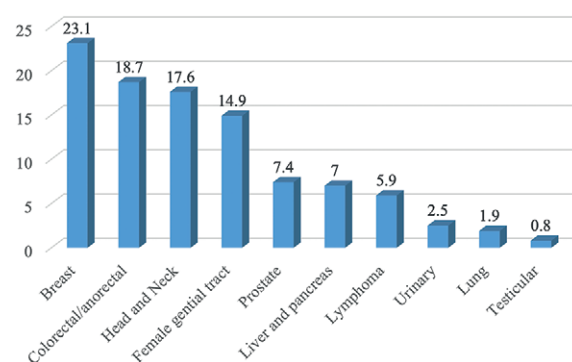


Figure 1. Types of cancer in central Sudan.

Table 1. The median (interquartile range) of hemoglobin level in the different cancer type in central Sudan.

Type of cancer	Median, g/dl	Interquartile range g/dl
Head and Neck	12.4	11.3-13.55
Lung	12.2	10.7-13.4
Breast	12.1	11.4-12.9
Female genital tract	11.85	10.7-13
Colorectal/anorectal	11.75	10.3-13.15
Prostate	11.1	9.4-12.75
lymphoma	11.0	9.2-12.95
Liver and pancreas	10.8	8.7-12.4
Urinary	10.55	8.3-12.1
Testicular	10.1	5.8-14.15

Table 2. Prevalence of anemia among the cancer type in central Sudan.

Type of cancer	Prevalence of anemia
Prostate	82.9
Urinary system	75.0
liver and pancreas	69.7
Lymphoma	64.3
Colorectal/anorectal	59.1
Testicular	50.0
lung	44.4
Head and Neck	43.4
Female genital tract	42.9
Breast	31.2

Although the median (IQR) hemoglobin of the patients was 11.9 (10.5-13.0) g/dl, it was 12 (10.4-13.4) g/dl and 11.8 (10.6-12.9) g/dl for the males and females, respectively (P=0.316).

While the highest median (12.4 g/dl) hemoglobin was observed in patients with head and neck cancer, testicular cancer had the lowest median (10.1 g/dl) hemoglobin (Table 1, Figure 2).

Of the 471 patients, 237 (50.3%) had anemia. The prevalence of anemia ranged from 31.2% in breast cancer patients to 82.9% in those with prostate cancer (Table 2, Figure 1). The patients with prostate, liver, and pancreas cancer had a significantly higher prevalence of anemia (Table 3).

The median (IQR) hemoglobin was 10.5 (9.4-11.4) g/dl and 13.0 (12.3-13.7) g/dl in patients with and without anemia, respectively. Compared with males (n=192), females (n=292) had a significantly higher prevalence of anemia [120/292 (41.1%) vs 117/179 (65.4%)], respectively; P<0.001). The median (IQR) age was significantly higher in the patients with ane-

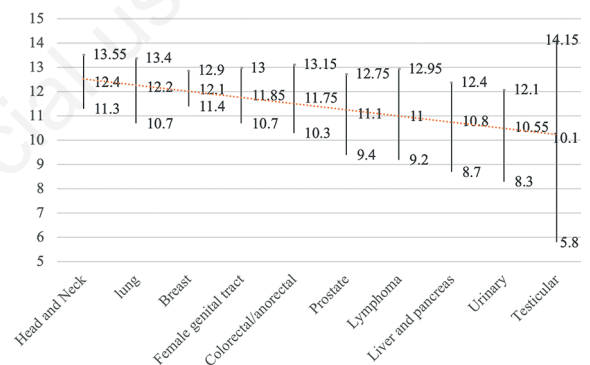


Figure 2. The median (interquartile range) of hemoglobin level in the different cancer types in central Sudan.

Table 3. Comparison of cancer types between anemic and non-anemic groups.

Type of cancer	Anemic patients (number=237)	Non-anemic patients (number=234)	OR (95% CI)	P
Prostate	29(12.2)	6(2.6)	5.2(2.1-13.0)	<0.001
Urinary system	9(3.8)	3(1.3)	3.0(0.81-11.3)	1.141
liver and pancreas	23(9.7)	10(4.3)	2.4(1.12-5.17)	0.029
Lymphoma	18(7.6)	10(4.3)	1.84(0.83-4.07)	0.172
Colorectal/anorectal	52(21.9)	36(15.4)	1.5(0.96-2.47)	0.076
Testicular	2(0.8)	2 (0.9)	0.98(0.13-7.06)	1.000
lung	4(1.7)	5(2.1)	0.78(0.20-2.96)	0.750
Head and Neck	36(15.2)	47(20.1)	0.71(0.44-1.14)	0.184
Female genital tract	30(12.7)	40(17.1)	0.70(0.42-1.17)	0.196
Breast	34(14.3)	75(32.1)	0.35(0.22-56.0)	<0.001

OR, odds ratio; CI, confidence interval.

mia (n=237) than in those patients without anemia [57.0 (48.0-68.0) years vs 51.5 (44.0-65.0) years], respectively; P=0.003).

Discussion

Breast (23.1%), colorectal/anorectal (18.7%), head and neck (17.6%), and female genital tract (14.9%) cancer were found to be the main types of cancers in this study, which was conducted in Sudan. Kifle *et al.* reported that gynecologic (28.9%), breast (22.7%), nasopharyngeal (7.6%), and colorectal (7.1%) cancers predominated in Ethiopia,¹⁸ while breast (29.1%) and colorectal cancer (25.3%) were the main cancers identified in a study in the Kingdom of Saudi Arabia.¹⁶

The main finding of the current study was the presence of anemia in 50.3% of patients with malignant tumors. Previous studies have shown that 65% of women with breast cancer and 8% of patients with colorectal cancer in Sudan had anemia.²³ The present finding was similar to the prevalence of anemia among women with cervical cancer (50.95%) in Tikur Anbesa, Ethiopia.²² On the other hand, the prevalence of anemia among patients with malignant cancer in our study was much lower than that reported among patients with cancer in Tanzania (77%),²⁰ and women with cervical cancer in Nigeria (68.1%).¹⁹ Notwithstanding, the 50.3% prevalence in the current study was much higher than that reported in Addis Ababa, Ethiopia (23%),¹⁸ the Kingdom of Saudi Arabia (44.1%),¹⁶ and Sana'a, Yemen (21.7%).²⁴

The current study showed that the highest prevalence of anemia was in patients with prostate (82.9%) and urinary system (75.0%) cancer, while the lower prevalence was reported in the patients with breast (31.2%) and female genital tract (42.9%) cancer. The high prevalence of anemia in the urinary system could be explained by hematuria, which is reportedly associated with anemia.²⁵ In neighboring Ethiopia, where 23% of patients with cancer were found to have anemia, a higher prevalence of anemia was observed in patients with gynecologic (37.7%) and colorectal (26.7%) cancers.¹⁸ Meanwhile, in the United States, anemia prevalence was shown to range from 26% in patients with colorectal cancer to 59% in those with ovarian cancer.⁹ Beale *et al.* observed that colorectal cancer was a major cause of malignancy-associated anemia in the UK, with its prevalence ranging from 60 to 90%.²⁶ Moreover, previous studies have shown that the prevalence of anemia ranges from 26 to 85% in newly diagnosed patients with gynecologic malignancies.⁴ It has further been observed that the prevalence of anemia differs in patients with different types of gynecologic malignancies (*i.e.*, uterine, ovarian, cervical, and vaginal cancer).²⁷

In this study, we observed that the prevalence of

anemia was significantly higher in the females compared with the males. In addition, the age of patients with anemia compared to those who did not have anemia was significantly higher. This is in line with the results of previous studies that have shown that advanced age and female gender were associated with anemia in patients with cancer.^{8,18}

The anemia present in patients with cancer can be explained by the cytokines and many inflammatory processes that can suppress erythropoiesis.²⁸ Various cancers, such as those of the gastrointestinal, female reproductive, urinary tract, and respiratory systems, can lead to bleeding and anemia.²⁹ Poor nutritional intake and increased utilization may be factors in cancer-related anemia.³⁰

Limitations

In this study, the prevalence of certain of types of cancer was low among patients, so it is difficult to generalize our results. Additionally, other parameters, such as iron studies, investigations of inflammatory markers and the morphology of cells, were not conducted. The cancer grades and their association with hemoglobin levels were also not assessed.

Conclusions

Half the patients with malignant cancer in this study had anemia. Anemia was more prevalent in female patients and elderly patients.

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