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Effects of Chemotherapy on the Haematological Profile of Cervical Cancer Patients in Douala General and Laquintinie Hospitals

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Cervical cancer is the second most diagnosed cancer and third leading cause of death from cancer among females in developing countries including Cameroon. Chemotherapy is a widely used treatment modality for this cancer, aimed at destroying cancerous cells and preventing their further growth and spread. However, this also destroys healthy blood cells precursors in the

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bone marrow. Hence evaluating the effects of chemotherapy on haematological parameters in cervical cancer patients is crucial for optimizing treatment strategies and managing potential complications.

Methods: This study was a hospital based prospective study carried out in the Littoral Region of Cameroon. The study participants consisted of 92 diagnosed cervical cancer patients scheduled to undergo chemotherapy who were followed up carefully for a month while receiving their chemotherapeutic treatment. Data were collected through laboratory analysis, medical record review and patient interviews. The R-software was used to analyze data and student's t-test was used to compare group means before and during chemotherapeutic treatments. The Person's Chi-square test was used to compare frequencies of haematological disorders before and following one month of chemotherapeutic treatments at 95% confidence interval. A $p \leq 0.05$ was considered statistically significant.

Results: A total of 92 cervical cancer patients were recruited in the study, with an average age of 56.0±9.1 years. Majority of the patients had no history of cigarette smoking or alcohol consumption. Prior to receiving chemotherapetic treatment, 17.4% of the participants had leukocytosis, 76% had erythropenia, and only 8.7% had thrombocytosis. After one month of receiving chemotherapeutic treatment, 34.8% of the participants experienced leukopenia, 78.3% had erythropenia and 13% thrombopenia. Anaemia was the most prevalent hematological disorder observed before and during treatment (70% and 83% respectively). There were significant differences in the mean hematological disorders before and during chemotherapy ($P<0.001$).

Conclusion: Cervical cancer and its chemotherapeutic treatment cause abnormal changes on blood parameters, hence there is need for cautious and adjusted follow-up of Cameroonian cervical cancer patients through surrogate markers such as blood parameters in order to optimize treatment.

Keywords: Cervical cancer; chemotherapy; haematological profile; littoral region; Cameroon.

1. INTRODUCTION

Abnormal uncontrolled division of cells in the human body leads to cancer [1]. Cervical cancer is a preventable malignancy arising from the transformation of epithelial cells of the cervix. Cervical cancer is a mostly caused by the human papilloma virus (HPV) [2]. Cervical cancer is a very progressive disease, starting with intra-epithelial lesion, neoplastic, then cancerous after 10 years or more [3]. The most common symptoms of cervical cancer are bleeding apart from periods, post-coital bleeding, post-menopausal bleeding, discomfort during sexual intercourse, foul smelling vaginal discharge, blood stained vaginal discharge, abdominal and pelvic pain [4]. Main risk factors of cervical cancer include human papillomavirus, viral, fungal and bacterial infections, sexual behavior, smoking, pregnancy and childbirth, and other factors (family history and menopause earlier than 45 years) [5].

Epidemiologically, cancer is the second cause of mortality worldwide after heart disease [6]. Cervical cancer is 4th most common cancer in women, and second highest in women between age 15–44 [7]. Globally in 2020, there were an estimated 604 127 cervical cancer cases and 341 831 deaths, with a corresponding age-standardized incidence of 13·3 cases per 100 000 women-years (95% CI 13·3–13·3) and mortality rate of 7·2 deaths per 100 000 women-years (95% CI 7·2–7·3) [8]. The incidence of cervical cancer in developing countries continues to rise due to the absence of effective population-level screening programmes, poor awareness about prevention, inequitable access to health services, poverty and low socioeconomic status [9]. The highest regional incidence and mortality rates are seen in Africa [10]. In Cameroon, cervical cancer is a major public health problem with a high incidence and mortality rate [11].

Treatment options for cervical cancer include surgery, radio (chemo) therapy and chemical therapy [12]. Complete blood count is requested from all cancer patients before the initiation of surgery, chemotherapy and radiotherapy [13]. As cervical cancer progresses, it causes changes in haematological parameters such as red blood cells, white blood cells and haemoglobin [14]. There is limited data on the impact of chemotherapy on haemotological parameters of cervical cancer patient in Cameroon. So, it was necessary to review the changes in hematological parameters in cervical cancer patients, at regular intervals during treatment.

2. METHODOLOGY

2.1 Study Design/Study Site/Participants/ Eligibility Criteria

This hospital-based prospective study was carried out from January to June, 2024 at the the Oncology units of the Douala General Hospital, Douala Laquintinie Hospital and the Cameroon Oncology Center, Littoral Region, Cameroon. These two hospitals serve as referral hospitals in the region whereas the Cameron Oncology Center receives and manages cancer patients in Cameroon and other countries in the Central African Region. 92 confirmed cases of cervical cancer patients, aged 21 years and above and about initiating chemotherapy were recruited by an exhaustive sampling technique. Cervical cancer patients who were undergoing any other form of cancer treatment other than chemotherapy and those who were on treatment or supplementation for chronic illnesses like diabetes and human immunodeficiency virus/acquired immunodeficiency syndrome were excluded from the study.

2.2 Sociodemographic and Medical History of Patients

A structured and pretested questionnaire was used to document the socio-demographic, lifestyle and medical history of participants.

2.3 Blood Sample Collection

About 4mL of venous blood was collected from the participants into ethylene diamine tetra-acetic acid tubes. The sampling was done before the first dose chemotherapy and after the completion of one month of chemotherapy. Haematology profile were determined using an Auto analyzer (Mindray BC-5180**)**. The analyzer uses the Coulter principle to detect the number and volume distribution of white blood cells, basophils, red blood cells, and platelets; the hemoglobin concentration is measured by colorimetry; the four-category statistical count of white blood cells is obtained by semiconductor laser flow cytometry.

2.4 Statistical Analysis

The descriptive statistics R-software was used for data analysis. The demographic and clinical characteristics of study participants are summarized as frequencies and percentages. The student's t-test was used to compare group means of haematological parameters before and after one month of chemotherapeutic treatments. The Pearson's Chi-square Test was used to compare frequencies of hematological disorders before and during chemotherapeutic treatments. A $p<0.05$ was considered statistically significant at 95% confidence interval.

3. RESULTS

A total of 92 cervical cancer patients were recruited in the study, with an average age of 56.0±9.1 years. 34.8% of the participants were in stage IIIB of cervical cancer. Furthermore, 56.6% participants had a tertiary education and 70.7%lived in semi-urban areas. Most of the participants were married (66.3%). 94.6% and 84.0% of the patients had no history of smoking or alcohol consumption respectively.

Table 1. Sociodemographic characteristics of patients

Variables	Categories	Frequency	%
Age group (years)			
Premenopausal	29-49	29	31.5
Menopausal	50-75	63	68.5
Stages of cancer			
	I	0	0.0
	IIA	4	4.3
	IIB	24	26.1
	IIIA	4	4.3
	IIIB	32	34.8
	IVA	24	26.1
	IVB	4	4.3
Educational status			
	No formal	00	0.0
	Primary	9	9.7

Variables	Categories	Frequency	%
	Secondary	31	33.7
	Tertiary	52	56.6
Residence			
	Rural	14	15.2
	Semi-urban	65	70.7
	Urban	13	14.1
Marital status			
	Married	61	66.3
	Single	5	5.4
	Divorced	26	28.6
Occupation			
	Unemployed	14	15.2
	Employed	31	33.7
Alcohol consumption	Housewife	47	51.7
	Yes	12	13
	No	80	87
Smoking	Yes	05	5.4
	No	87	94.6

Table 2. Comparison of mean ± SD of hematological parameters of cervical cancer patients before and after one month of cancer chemotherapy

Parameter	Before (mean±SD)	During (mean±SD)	t-test	*P*-value
WBC (10^3/µL)	7.28 ± 3.53	4.74 ± 1.98	22.92	<0.001
RBC (10^5/µL)	3.59 ± 0.79	3.35 ± 0.68	47.52	<0.001
Hb (g/dL)	10.80 ± 1.86	10.07 ± 1.74	55.68	<0.001
Platelets(g/L)	251.09 ± 98.40	260.61± 124.50	24.08	<0.001
Neutrophils(10^3/µL)	3.96 ± 2.38	2.48 ± 1.61	14.80	<0.001

Table 3. Haematological characteristics of participants before and after one month of cancer chemotherapy

Variables	Categories	Before (n=92)	During n(%)	Chi-square	*P*-value
WBC	Normal	68(73.9)	60(65.2)	23.541	<0.001
	Leukopenia	8(8.7)	32(34.8)		
	Leukocytosis	16(17.4)	0(0.0)		
	Total	**92(100)**	**92(100)**		
RBC	Normal	16(17.4)	20(21.7)	69.726	<0.001
	Erythropenia	76(82.6)	72(78.3)		
	Total	**92(100)**	**92(100)**		
Hemoglobin	Normal	28(30.4)	16(17.4)	44.271	<0.001
	Anaemia	64(69.6)	76(82.6)		
	Total	**92(100)**	**92(100)**		
Platelets	Normal	84(91.3)	72(78.3)	92.0	<0.001
	Thrombocytosis	8(8.7)	12(13.0)		
	Thrombopenia	0(0.00)	8(8.7)		
	Total	**92(100)**	**92(100)**		
Neutrophils	Normal	72(78.3)	44(47.8)	69.697	<0.001
	Neutropenia	8(8.7)	40(43.5)		
	Neutrocytosis	12(13)	8(8.7)		
	Total	**92(100)**	**92(100)**		

Table 4. Prevalence of hematological disorders among cervical cancer patients before and after one month of chemotherapy

Haematological disorders	Before n (%)	After n (%)	Chi square	*P*-value
Leukopenia	8(8.7)	32(34.8)	18.4	<0.001
Leukocytosis	16(17.4)	0(0.0)	17.52	<0.001
Erythropenia	76(82.6)	72(78.3)	0.552	0.46
Anaemia	64(69.6)	76(82.6)	4.3	0.04
Thrombocytosis	8(8.7)	8(8.7)	0	1.00
Thrombocytopenia	0(0.0)	12(13.0)	12.838	<0.001
Neutropenia	8(8.7)	40(43.5)	28.86	<0.001
Neutrocytosis	12(13.0)	8(8.7)	0.808	0.37

Table 2 demonstrates that baseline mean white blood cell count, red blood cell count, haemoglobin concentration and neutrophil counts were higher than the means following one month of cancer chemotherapy ($p<0.001$). However, mean platelets count following one month of chemotherapy was higher than the baseline ($p<0.001$).

There were significant differences in the prevalence of hematological abnormalities before and following one month of chemotherapy as shown in Table 3.

Erythropenia was the most overall prevalent hematological disorder before initiation of chemotherapy with a percentage of 82.6%, followed by anaemia (69.6%). Also, leukocytosis was the most prevalent white blood cell disorder with a percentage of 17.4%, followed by leukopenia (8.7%). Thrombocytosis was the only platelet disorder before initiation of chemotherapy (8.7%). After the first month of treatment, anaemia was the most prevalent hematological disorder (82.6%), followed by erythropenia (78.3%). Also, leukopenia was the only white blood cell disorder (34.8%) within one month of chemotherapy. Thrombopenia and thrombocytosis were platelet disorders seen after the first month of treatment with a percentage of 13% and 8.7% respectively.

The prevalence of leukopenia, anaemia, thrombocytopenia and neutropenia significantly increased one month following chemotherapy ($p<0.05$) while the prevalence of leukocytosis significantly decreased ($p<0.001$) as shown in Table 4.

4. DISCUSSION

For many years, chemotherapy has remained the anti-cancer treatment of choice [15]. However chemotherapy, is known to have adverse effects on the hematological and parameters causing neutropenia, thrombocytopenia and anaemia [16]. Our study has provided findings to support this observations. Our study revealed that cervical cancer is mostly observed in menopausal women. This supports reports from Douala, Cameroon by Idress et al. [17] in which majority of the study participants were above 54 years. It is also similar to findings from a study conducted in Western Libya by Fikry et al., [18] with mean age of cervical patients 53.37±11.6 years. This is due to the fact the development of cervical cancer from HPV infection is a slow asymptomatic process, typically taking 15 to 20 years for most individuals with healthy immune system. Anaemia as the most prevalent haematological abnormality in cervical cancer patients before and after one month of chemotherapy reported in our study confirms the findings of Okwesili et al in Sokoto, North Western Nigeria [19] and Wang et al., [20] who reported a significant decrease in the red blood cell count and hemoglobin concentration among cervical cancer patients. Severe blood loss and bone marrow disease in cervical cancer patients may lead to low red blood cell count and low hemoglobin levels, anemia [21]. The current study further observed that mean white blood cell count was higher before compared to during cancer chemotherapy. This finding is in line with Connors et al who reported a statistically significant decrease in white blood cell count after chemotherapy when compared to pre-chemotherapy [22]. The decrease in WBC count after treatment could be due to chemotherapy suppressing hematopoietic stem cells, which are necessary for WBC proliferation. In contrast to our findings, a recent study found that WBC decreased non-significantly after chemotherapy when compared to prechemotherapy [23]. Similarly, postchemotherapy red blood cell count showed a substantial decrease compared to prechemotherapy. This confirms reports by Mohanty et al who found that, due to decreased

new RBC synthesis, RBC count decreased considerably in post-chemotherapy compared to pre-chemotherapy [24]. Ineffective erythropoiesis due to chemotherapy is responsible for the drop in red blood cell count. Furthermore, Post-chemotherapy hemoglobin levels were statistically lower than pre-chemotherapy values. This finding is in line with previous studies [24]. Chemotherapy causes nephrotoxicity, which causes anaemia by reducing erythropoietin production in the kidneys. Lastly, the current study did not observed thrombocytopenia following chemotherapy as reported by previous studies [24-25].

5. CONCLUSION

Cervical cancer and chemotherapy have adverse effects on haematological parameters. These parameters should be regularly monitored in cervical cancer patients undergoing chemotherapy.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

Potential participants provided written informed consent before recruitment into the study.

ETHICAL APPROVAL

Ethical approval for this study was obtained from the Institutional Review Board of the Faculty of Health Sciences, University of Buea (Reference: 2024/2309-01/UB/SG/IRB/FHS)). Administrative authorizations were obtained from the Douala General Hospital, Douala Laquintinie Hospital, and Cameroon Oncology Center, Littoral Region, Cameroon.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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