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Laboratory Assessment of Gastrointestinal Cancer Patients Pre and Post Chemotherapy

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Authors' contributions

This work was carried out in collaboration among all authors. Author RK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors CB and LG managed the analyses of the study. Authors SB, NR and YS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Chemotherapy-induced neutropenia is a common side effect in cancer patients. Other hematopoietic lineages are also decreased in cancer patient. Altered laboratory parameters would prevent patients from chemotherapy. Thus this study identified the significance of blood parameters during chemotherapy among Gastrointestinal (GI) cancer patients.
Study Design: Laboratory based descriptive study.
Place and Duration of Study: Cancer Institute, Georgetown Public Hospital Cooperation, Guyana between 2011 to 2015.
Methodology: A total of 47 patients were included in the study who were diagnosed with GI cancer. Mean±SD was used to measure biochemical and hematological means.
Results: Mean of the patients age was 59.9. Most prevalent GI cancer was of colon (44.7), followed by rectum (12.8). Cancer of maxilla, oesophagus, gall bladder, liver and rectum all had

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almost the same prevalence (2.1). Most patients used Fluorouracil (74.5%) and Oxaliplatin (72.3). And 42.6% of the patients underwent radiation. There was a variation noted in the values of the hematological and biochemical parameters.

Conclusion: The cancer patients showed a huge variations in the biochemical and hematological parameters.

Keywords: Chemotherapy; laboratory assessments; Guyana.

1. INTRODUCTION

Cancer of the gastrointestinal track is known to be most common types of cancer [1] due to its lethal character. So it is important to have an advanced technology to detect and treat cancer in its early stage [2], although 30% of the deaths still occur in the developed countries. Cancer in the GI tract is also one of the deadliest diseases worldwide, since it can cause metastasis throughout the body. In 2017 alone an estimated 1·2 million patients were diagnosed with stomach cancer and nearly 865 000 patients died from this disease worldwide [3]. It is a fact that chemotherapy drugs lead to myelosuppression and have their greatest effect on rapidly growing cells. Recent data shows that more than 14 million people per year are victims of cancer worldwide, and 2.1 million present pathologies most commonly in the colorectal, esophagus or stomach. In 2012, 14.1 million new cancer cases were diagnosed with 8.2 million deaths. Center for disease control (CDC) estimates that by 2025, 19.3 million incidences are expected to be diagnosed yearly [4].

Low blood cell count is known to be a complication during cancer treatment [5, 6]. Different causes are known to cause anemia amongst cancer patients: an already low hemoglobin (Hb) level before the onset of cancer, or as consequence of cancer, cancer chemotherapy or radiotherapy. Anemia has been shown to be a useful biomarker in patients treated with rituximab-CHOP (combining cyclophosphamide, hydroxydaunorubicin, oncovin and prednisone or prednisolone) immunotherapy [7]. Both red blood cells (RBCs) and white blood cells (WBCs) originates from bone marrow. WBCs are produced enormously due to inflammatory cytokines. Because upregulation of WBCs causes reduced formation of RBCs due to effective inhibition of erythropoiesis [8]. The fact that about 33% of cancer patients experience an infection due to exposure to chemotherapy, most of which (57%) are associated with neutropenia. This could be a fact that neutropenia affects patient's clinical care and quality of life (QoL). Neutropenia exposes cancer patient to increased risk of infection [9, 10]. Therefore, it is very important to have a close monitoring of laboratory parameters before and after treatment of cancer patients. The purpose of this study is to compare the hematological and biochemical status of GI cancer patients before and after chemotherapy at the Oncology Department of GPHC, Georgetown, Guyana.

2. MATERIALS AND METHODS

For this study, a retrospective chart review was conducted on patients receiving chemotherapy at the cancer institute, Guyana for a period 5 years from 2011-2015. The laboratory investigations collected for evaluations included 2 categories of routine blood tests:

(1) **Complete blood count:** hemoglobin, white blood cell, and platelet.
(2) **Hepato-renal function:** Sodium (Na), Potassium (K), Chloride (Cl), Alanine transaminase (ALT), Aspartate Transaminase (AST), Blood Urea Nitrogen (BUN), Total Bilirubin, Direct Bilirubin, Indirect Bilirubin and Serum Creatinine.

All the descriptive data were given as means ± SD. Interpretation of p-value: If $P<0.05$, is considered to be statistically significant. All analysis was done in Minitab software.

3. RESULTS

A significant change was observed in laboratory parameters among GI cancer patients pre and post chemotherapy. The general characteristics of all participants with GI cancer were demonstrated in Table 1. During the study period, significantly higher percentage of cancer patients were enrolled during 2015. Higher percentage of participants were Afro-Guyanese, females and from region 4.

Table 1. General characteristics of GI cancer patients

Variables	n (%)	p-value
Year		
2011	1(2.1)	
2012	6 (12.8)	
2013	8 (17.0)	
2014	7 (14.9)	
2015	25 (53.2)	P<0.05
Ethnicity		
Afro Guyanese	25 (53.2)	
Indo Guyanese	19 (40.4)	
Amerindian	2 (4.3)	
Chinese	1 (2.1)	P<0.05
Gender		
Male	23 (48.9)	
Female	24 (51.1)	P<0.05
Region		
Region 1	1 (2.1)	
Region 3	5 (10.6)	
Region 4	22 (46.8)	
Region 5	6 (12.8)	
Region 6	9 (19.1)	
Region 9	2 (4.3)	
Region 10	2 (4.3)	P<0.05

Table 2 showed clinical characteristics of GI cancer patients. Most common GI cancer was colon cancer followed by rectum. Common treatment given for cancer patient was Fluorouracil followed by Oxaliplatin. The haematological and biochemical changes were observed at the time of admission and after treatment among the GI cancer patients. The haematological parameters observed were Hb, WBC, platelets count. The mean and standard deviation of haematological values were lower in post treatment group than pre level. This haematological changes exists statistical significant at p<0.001 as reflected in Table 3. The biochemical parameters observed were BUN, creatinine, Na, K, Cl, ALT, AST and bilirubin levels. All haematological and biochemical parameters showed a significant variation among cancer patients pre and post chemotherapy (except creatinine) (p<0.0001).

4. DISCUSSION

This study showed a significant change in the laboratory parameters. Routing laboratory values are important in monitoring cancer patients before and after chemotherapy/radiation. Other studies have reported the prevalence of inflammatory anemia in cancer patients from 30% and 77% [11]. Colorectal cancer is the second-most cancer among women and third-most common cancer among men. In 2012, an estimated 614,000 women and 746,000 men were diagnosed with colorectal cancer worldwide [12].

Table 2. Clinical characteristics of GI cancer patients

Clinical characteristics	n (%)	p-value
Colon	21 (44.7)	
Rectum	6 (12.8)	
Larynx	4 (8.5)	
Tongue	3 (6.4)	
Caecum	4 (8.5)	
Stomach	2 (4.3)	
Anus	2 (4.3)	
Maxilla	1 (2.1)	
Oesophagus	1 (2.1)	
Gall Bladder	1 (2.1)	
Liver	1 (2.1)	
Rectum with Liver Metastasis	1 (2.1)	P<0.05
CA treatment		
Injection Cyclophosphamide	1 (2.1)	
Injection Fluorouracil	35 (74.5)	
Injection Cisplatin	11 (23.4)	
Injection Adriamycin	1 (2.1)	
Injection Gemeitabine	1 (2.1)	
Injection Mitomycin	2 (4.3)	
Injection Capecitabine	3 (6.4)	
Injection Oxaliplatin	34 (72.3)	
Radiology	20 (42.6)	P<0.05
Injection Indansetran	100 (100)	
Injection Dexeranethasone	100 (100)	
Injection Ranitidine	45 (95.7)	
Injection Mannitol	11 (23.4)	
Injection Leucovorin	27 (57.4)	P<0.05

Evidence shows that platelets protect tumor cells from immune elimination thus promoting aggressive tumor behaviors [13]. Therefore, increased platelet counts could have negative effects on cancer patient survival. Lymphocytes are known to play an important role in tumor-derived inflammatory responses by inducing cytotoxic cell death [14,15]. Increased filtration of lymphocytes at tumor site is an indication of better survival outcomes in cancer patients [16,17].

Table 3. Post and pre chemotherapy laboratory values

Parameters	PreC Mean±SD	PC1 Mean±SD	PC2 Mean±SD	P value
Biochemistry				
BUN	14.6±7.8	14.4±6.9	12.3±6.1	0.000*
Creatinine	1.0±0.4	4.2±20.9	0.8±0.3	0.091
Na	139.9±2.8	139.9±3.8	186.4±245.4	0.000*
K	4.3±0.6	7.3±3.8	4.1±0.6	0.000*
Cl	104±3.1	103.0±4.5	102.4±4.3	0.000*
ALT	27.3±18.3	24.9±11.7	20.8±9.3	0.000*
AST	33.1±14.9	29.8±8.9	29.2±8.0	0.000*
T-bilirubin	0.8±0.3	0.7±0.4	0.7±0.3	0.000*
I-bilirubin	0.6±0.4	19.4±80.2	14.8±75.5	0.000*
D-bilirubin	0.2±0.1	0.2±0.15	0.2±0.1	0.000*
Haematology				
Platelets	263.6±131.7	523.5±1226.9	457.7±651.5	0.000*
WBC	6551±3375.3	6224.9±3481.5	6047.4±2349.7	0.000*
Hb	12.0±1.4	12.1±1.7	11.8±1.4	0.000*

**Statistically significant at p<0.001; (SD-standard deviation; pre C-prechemotherapy; PC-post chemotherapy)*

One of the major concern during chemotherapy and radiotherapy is neutropenia. Moreover, chemotherapeutic drugs have an affect on the production of folic acid and synthesis of DNA, RNA and protein by acting as anti-metabolites, thus leading to bone marrow destruction [18,19, 20,21]. Some known chemotherapeutic drugs actinomycin, asparaginase, cytarabine, busulfan, cisplatin, daunorubicin, etoposide, fluorouracil, ifosfamide, and methotrexate are highly associated with neutropenia development [18, 20,22].

Studies have found that many inflammatory indicators like (Neutrophil to lymphocyte ratio) NLR, platelet to lymphocyte ratio (PLR), or CRP, are diagnostic and prognostic biomarkers for various cancers [23]. NLR especially is known as a prognostic indicator for several other solid cancers such as urinary [24] and colorectal [25, 26] cancer. A meta-analysis study indicate that an elevated NLR denotes a pretreatment inflammatory condition which correlated with poor prognosis for patients with gastric cancer [27]. Therefore, it is very important to have an overall analysis of hematological and biochemical parameters to understand the influence of treatment as well the current status of the patient.

5. CONCLUSION

The findings of this study indicates that there has been an increase in incidence of patients with gastro- intestinal cancer in Guyana. According to the findings, there are alterations in both hematological and biochemical laboratory values due to the chemotherapy. Treatment options and effectiveness is significant; however, among cancer treatments is the incidence of adverse effects.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Permission was sought from the Ministry of Health and Institutional Review Board, Guyana to access patients' records. Additionally, permission was sought from the Director of Georgetown Public Hospital Corporation (GPHC) and Head of the Oncology Department. No patient's identity was used in this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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