

Correlates of Demands for Blood Transfusion in Cancer Patients Receiving Chemotherapy in Oncology and Palliative Care Clinic in Federal Medical Centre Makurdi, Benue State, Nigeria

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ABSTRACT:

Introduction: From time to time, the administration of chemotherapy to patients diagnosed with cancer is delayed partly due to confirmation of anaemia from their PCV test results.

Objective: This study aimed to examine the probable disease and treatment related variables that are likely to cause deficit in the percentage level of patients' blood during the course of receiving chemotherapy.

Method: A descriptive-correlation research design was employed with the use of secondary data obtained from 145 patients' case folders accessed from Medical Record Units in the Department of Oncology and Palliative Care.

Results: The findings shows statistically significant correlation for three research questions out of four as; patients with sarcomas had higher demand for blood transfusion compared to those who had carcinomas (30.5% vs 26.5%, $p=0.741$). Patients with advanced stage cancer disease had higher demand for blood transfusion compared to those who did not have advanced stage cancer (86.8% vs 5.6%, $p=0.000$). Patients who had 7-10 cycles of chemotherapy had higher demand for blood transfusion with 15(83.3%, $p=0.000$) than those who had 11-14 cycles of chemotherapy. Lastly, patients who had single-agent chemotherapy had higher demand for blood transfusion than those who had combined chemotherapy agents (30.0% vs 25.3%). But, the correlation was not statistically significant at ($p>0.05$).

Conclusion: Overall, the findings from this study has confirmed evidence from previous studies that incidence of anaemia detected in cancer patients during administration of chemotherapy is often induced by both the patient's disease complications and noxious effect of chemotherapy agents.

KEYWORDS: Blood Transfusion, Cancer Patients, Anaemia, Chemotherapy, Type of cancer

INTRODUCTION

Cancer represents one of the leading non-communicable diseases globally accounting for 18.1 million new cases and 9.6 million deaths in 2018 (1). The treatment of cancer is a multifaceted approach that includes surgery, radiotherapy, systemic therapy and palliative care (2). Even as treatment is promising and the desirable expected outcome can be reasonably achieved, late cancer presentation characterized by disease progression, spread, high turnover and bone marrow metastases could induce complications such as anaemia. Anaemia is a clinical condition of insufficiency of the quantity of blood required in the body of patients. It has been established that cancer patients receiving cytotoxic chemotherapy in many cases develop anaemia, which could need blood transfusion. The shortage of blood in cancer patients receiving chemotherapy often interfered with adherence and consistency for chemotherapy administration. The anaemic condition in cancer patients is associated with many factors that are on one hand disease, and treatment procedure(s) induced, and on the other hand due to some functional abnormalities in the body.

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Some researchers have reported that anaemia is a common complication that always result from dead red blood cell production, increased destruction of circulating red blood cells or bleeding from the cancer (3). Others found that diseases metastases in patients could also lead to development of cytopenia such as leucopenia, thrombocytopenia with or without anaemia. Whichever is the associated causes, PCV deficit may require transfusion of prescribe units of blood or use of some blood stimulating agents to correct and maintain the required quantity in the patient body while on treatment, or use of newer agents such as administration of recombinant growth factors (4-7). The anaemic condition frequently observed in cancer patients has made blood transfusion to be an essential part of cancer treatment for the management of tissue hypoxia, acute anaemia from blood loss, chemotherapy induced anaemia (8). Red blood cells (RBCs) may be needed because of chemotherapy induced anemia in the setting of chronic disease (9).

A hospital based study demonstrated that 34% of blood donated in a health facility were transfused to cancer patients (10). In the United States, 15.1% of all blood donated were utilized by cancer patients (11). Haematological malignancies in Sub-Saharan Africa found that anaemia of $Hb \leq 10g/dl$ occurred in over 90% of these patients while 62% of them received at least one blood transfusion during the course of their treatment. Furthermore, 58% of patients were found to have thrombocytopenia during their course of treatment and 39% of them had received platelet transfusion (12). Patients with anaemia require blood transfusion or haematinics and use of other blood stimulating agents to increase production of blood in the body to an acceptable percentage that will be suitable and safe for treatment with chemotherapy.

LITERATURE REVIEW

Anaemia is an interplay of multiple factors and studies have reported that many cancer patients developing anaemia is due to a combination of malnutrition, adjuvant or neoadjuvant chemotherapy, concurrent systemic infections, spontaneous tumour bleeding, or surgical blood loss (4). Nevertheless, a systemic review study findings from patients with advanced cancers found with anaemia to be 68% to 77% revealed that a few receiving blood transfusion were due to unclear reasons (4). Furthermore, Among 90 patients analyzed, the median RBC unit required was 1.7units/week and PLT transfused was 1.5events/week. Patients requiring transfusion at disease presentation had significantly higher intensity of RBC and PLT transfusions (13). Besides, transfusion need was higher in patients with high disease burden at diagnosis (13).

Based on disease related factors, some researcher's study reported that 33% of patients required at least one blood transfusion but the proportion varied from 19% for breast cancer to 43% for lung during the first four courses of chemotherapy (14). But after the fourth course of chemotherapy, the proportion of anaemic patients was significantly higher in the ovarian and lung cancer groups than in patients with breast or testicular cancer. Patients with lung or ovarian cancer were significantly more likely to receive transfusions than those with breast or testicular tumours (42% for lung/ovarian vs 20% for breast/testicular). Overall, patients with metastatic breast, ovarian or testicular cancer were significantly more likely to receive a transfusion than patients with non-metastatic disease (44% vs 15% for breast $P = 0.002$, 64% vs 43% for ovarian $P < 0.001$, 73% vs 28% for testicular $P < 0.001$). Similarly, patients with haematological aberrations, anaemia emerges as the most prevalent in breast cancer patients (Varma, Sahu, Paneri, & Kachhawa, 2014; Shilpa, Kalyani, & Sreeramulu) as cited in (16). Furthermore, Koulis et al (2020) have established that post-treatment haematological irregularities can be attributed not only to the malignancy itself, but also to the impact of chemotherapeutic medications administered to patients (16).

Despite the recognition that blood transfusion in cancer treatment is an essential evil for safe management of patients, it is unfortunate though pertinent to understand that in Nigeria, the present donation rate is 0.2 donations/1000 population and an estimated 1.5 million units of blood will be required annually. This suggests that the demand for blood transfusion cannot be adequately met as the incidences of cancer keeps growing along with persistent increase of late presentation as well as predominant use of chemotherapy which is more accessible by majority of patients. Invariably, the use of blood transfusions in patients under-going cancer treatment with cytotoxic chemotherapy has been long recognized but the research has been less studied and published in Nigeria. Thus, this study seeks to investigate the correlates of demand for blood transfusion in cancer patients receiving chemotherapy in the Oncology and Palliative Care Clinic in Federal Medical Centre Makurdi, Benue State Nigeria.

Aim of the Study

This study aimed to determine the disease and treatment related variables that are associated with demand for blood transfusion in patients in the course of receiving the prescribed cycles of chemotherapy for the cancer they are diagnosed to have.

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Research Questions

1. Would the types of cancer significantly correlate with demand for blood transfusion in cancer patients during the course of receiving chemotherapy?
2. Would stage of cancer diagnosed significantly correlate with demand for blood transfusion in patients during the course of receiving chemotherapy?
3. Would cycles of chemotherapy significantly correlate with demand for blood transfusion in patients during the course of receiving chemotherapy?
4. Would single or combination of chemotherapy significantly correlate with demand for blood transfusion in patients during the course of receiving chemotherapy?

METHOD

Research Design

The study was a descriptive-correlation research, which primarily made use of cancer patients' case folders to serve as secondary data accessed and obtained from Medical Record Units in the Department of Oncology and Palliative Care, Federal Medical Centre Makurdi. The aim was to derive findings that would be use to describe the relationship between the disease and treatment factors are likely to predict the demand for blood transfusion in cancer patients during the course of administration of cytotoxic chemotherapy.

Data Collection

Data for the study was derived from in the case folders. The histories of patient's disease and treatments were examined for the purpose of identifying those cases of blood transfusions during chemotherapy and what were the clinical reasons necessitating the demand for blood transfusion to treat anaemic conditions detected. The data include patient's biodata, type of cancer diagnosis, stage of disease, treatments procedures used, type of chemotherapy used.

Data Analyses

The data collected was analyzed using the Statistical Package for Social Sciences (SPSS) version 22. The descriptive statistics (frequency and percentage distribution) and Chi-square statistics were employed for analysis of the data to get the results that was used to answer the stated research questions.

Ethical Considerations

The permission to access the patients' case folders to obtain the required information for this study was granted by the hospital research and ethics committee (HREC) in Federal Medical Centre Makurdi, Benue State, Nigeria. Similarly, the head of unit of the Oncology and Palliative Care Medical Records received the approval letter from HREC and granted us permission to the volumes of the patients' case folders on the shelves.

RESULTS

The purpose of the study was to determine the correlates of demand for blood transfusion in cancer patients undergoing treatment with chemotherapy in Oncology and Palliative Care clinic in Federal Medical Centre Makurdi. The statistical results of data collected and analysed to answer the research questions are presented below in tabulation along with interpretation.

Table 1: Frequency distribution of examined disease and treatment variables

Variables	Frequency	Percentage
Type of Cancer		
Cancer Cervix	51	35.2
Breast Cancer	49	33.8
Skin Cancer	6	4.1
Prostate Cancer	3	2.1
Gastric Cancer	3	2.1
Cervical Cancer	3	2.1
Adenocarcinoma	3	2.1
Fibrosarcoma	3	2.1
Ovarian cancer	3	2.1

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Non-Hodgkin cancer	3	2.1
Nephroblastoma	3	2.1
Thyroid cancer	3	2.1
Choriocarcinoma	3	2.1
Rhabdomyosarcoma	3	2.1
Neuroendocrine cancer	2	1.4
Colon cancer	2	1.4
Retinoblastoma	2	1.4
Cancer Classification		
Carcinoma Cancer	132	91.0
Sarcoma Cancer	13	9.0
Cancer stage		
Stage I	31	21.4
Stage II	76	52.4
Stage III	37	25.5
Stage IV	1	0.7
Anemia		
No	106	73.1
Yes	39	26.9
Advanced stage cancer		
No	107	73.8
Yes	38	26.2
Cycles of Chemotherapy		
3-6	126	86.9
7-10	18	12.4
11-14	1	0.7
Number of Chemotherapy		
Single	50	34.5
Combined	95	65.5

The result presented in table 1 shows frequency and percentage distributions on study variables. Over one-third of the patients had cancer of the cervix 51(35.2%) closely followed by breast cancer 49(33.8%). Colon cancer and Retinoblastoma had 2 (1.4%) respectively. Regarding cancer classification, a majority of the patients 132(91.0%) developed carcinoma cancer, while 13 (19.0%) had sarcoma type of cancers. More than half of the patients 76(52.4%) had their cancer at stage II, stage III 37(25.5%) and stage IV 1(0.7%). Apparently, 107(73.8%) of the patient's cancer were not at the advanced stage disease, but 38(26.2%) of the patients their cancer was at the advanced stage. Concerning chemotherapy, majority of the patient 126 (86.9%) had 3-6 cycles of chemotherapy, 18(12.4%) had 7-10 cycles and 1(0.7%) had 11-14 cycles of chemotherapy respectively.

Table 2: Association between demand for blood transfusion and variables

Variables	Anemia		Test statistics	p-value
	Yes n=39 n(%)	No n=106 n(%)		
Type of cancer			0.10	0.741
Carcinoma Cancer	35(26.5)	97(73.5)		
Sarcoma Cancer	4(30.8)	9(69.2)		
Cancer stage			96.01	0.000*
Stage I	0(0.0)	31(100.0)		
Stage II	6(7.9)	70(92.1)		
Stage III	33(89.2)	4(10.8)		

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Stage IV	0(0)	1(100.0)		
Advance stage cancer			94.11	0.000*
No	6(5.6)	101(94.4)		
Yes	33(86.8)	5(13.2)		
Cycles of Chemotherapy			36.66	0.000*
3-6	23(18.3)	103(81.7)		
7-10	15(83.3)	3(16.7)		
11-14	0(0.0)	0(0.0)		
Use of Chemotherapy			0.37	0.541
Single	15(30.0)	35(70.0)		
Combined	24(25.3)	71(74.7)		

*= *Statistically significant*

Table 2 shows disease and treatment variables that correlates with demand for blood transfusion in patients. Demand for blood transfusion was higher among patients who had sarcoma cancers compared with those who had carcinoma cancers (30.5% vs 26.5%, $p=0.741$). But there was no statistically significant correlation between sarcoma or carcinoma cancer and demand for blood transfusion. Patients who had advanced stage III cancer had higher demand for blood transfusion 33 (89.2%) than those with stage I cancer disease and the association was statistically significant ($p<0.05$). Patients who had advanced stage of cancer had higher demand for blood transfusion when compared to those who did not have advance stage cancer (86.8% vs 5.6%, $p=0.000$). This correlation was statistically significant.

Regarding the cycle of chemotherapy, patients who had 7-10 cycles of chemotherapy had higher demand for blood transfusion with 15(83.3%) and the least demand was those who had 11-14 cycle of chemotherapy 0(0.0%). This result was statistically significant at ($p<0.05$). Patients who had single-agent chemotherapy had higher demand for blood transfusion compared with those who had combined cytotoxic chemotherapy (30.0% vs 25.3%). However, this association was not statistically significant ($p>0.05$).

DISCUSSION

The challenging issue in cancer patients such as blood transfusion needs during treatment of the cancer seems to run on the continuum of their entire cancer journey. In this study, the statistical findings from the analyzed data sourced from the documented history of transfusion support in cancer patients formed the basis for the discussion in this section. The results are discussed premised on the following research questions.

Would the types of cancer significantly correlate with demand for blood transfusion in cancer patients during the course of receiving chemotherapy? Medically, there are many types of cancers and these cancers are classified into two major groups, which are Sarcomas and carcinomas. Both sarcomas and carcinomas have sub-classifications. Related to the question statically, the findings shows that demand for blood transfusion was higher among patients who had sarcoma cancers compared with those who had carcinoma cancers (30.5% vs 26.5%, $p=0.741$). But the result was not statistically significant either for sarcoma or carcinoma and demand for blood transfusion. This means that these cancers and their treatment do not necessarily influence demand for blood transfusion. This is because they are patients that may receive blood transfusion for reasons not clearly understood (4). However, there is evidence that patients with sarcoma cancers may require blood transfusion that than those with carcinoma during chemotherapy. This is associated with the nature of sarcoma treatment and the impact of chemotherapy on blood cell production. Raghavan et al in their study reported that the lower intensity of blood transfusion goes along with the response to chemotherapy in terms of complete response (CR) but not overall survival (OS).

2. Would the stage of cancer diagnosed significantly correlate with demand for blood transfusion in patients during the course of receiving chemotherapy? The findings showed that patients who had stage III cancer had higher demand for blood transfusion 33 (89.2%) and the least demand was among patient with stage I and Stage IV with 0(0.0%) respectively and there was a statistically significant correlation at ($p<0.05$). Patients who had advance stage of cancer had higher demand for blood transfusion when compared to those who did not have advance stage cancer (86.8% vs 5.6%, $p=0.000$). Overall, the result revealed a statistically significant correlation between stage of the cancer and demand for blood transfusion in the course of patients receiving cytotoxic chemotherapy. These findings are in tandem with (4, 13) systemic review study findings that 68% of patients with advanced cancers were found with anaemia meeting the criteria for blood transfusion.

3. Would cycles of anticancer drugs used significantly correlate with demand for blood transfusion in patients during the

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course of receiving chemotherapy? The findings showed that 15(83.3%) patient who had 7-10 cycles of chemotherapy had higher demand for blood transfusion compared to those who had 11-14 cycle of chemotherapy. This finding is somewhat dissimilar to the numerous evidences from studies which showed that chemotherapy may induce development of anaemia, which result to an increased demand for blood transfusion in the cancer patient as the number of chemotherapy cycles increases (18, 19, 20). Even though Sharma et al (2022) reported that anaemia requiring transfusion in cancer patients is occasioned by an observable sharp drop in haemoglobin level even with two cycles of chemotherapy. They actually emphasized that the number of cycles of chemotherapy is a strong variable to determine or escalate chances of transfusing blood in a cancer patient in the course of his or her receiving chemotherapy to correct a noticeable haemoglobin deficit,

4. Would single or combination of chemotherapy agents significantly correlate with demand for blood transfusion in patients during the course of receiving chemotherapy? The result shows that patients who received single regimen of cytotoxic chemotherapy had higher demand for blood transfusion compared with those who had combined cytotoxic chemotherapy (30.0% vs 25.3%). But actually, the correlation was not found to be statistically significant at ($p>0.05$). Unfortunately, there are inadequate published studies having evidence that substantially support the findings on the research question. Notwithstanding, despite that there was no statistically significant correlation between single or combination of chemotherapy agents and demand for blood transfusion. From the result, it can be inferred that both have the single-agent and combination of chemotherapy have is a potential risk to myelosuppression leading to anaemia which may necessitate demand for blood transfusion in a cancer patient. Invariably, this has been confirmed from available evidences found in the literature showing that; both single-agent and combination of chemotherapy agents potentially induced increase in demand for blood transfusion in cancer patients (Lebaron, Zeltzer, Lebaron, Scot, and Zeltzer, 1988; Partridge, Burstein, Winer, 2001) as cited in (21).

But generally and validly, the potential toxicity in combination of chemotherapy has been found to strongly correlate with higher demand for blood transfusion support than for single-agent chemotherapy. Combination of chemotherapy involves the use of two or more anticancer drugs simultaneously with the aim achieve a more effective attack to eliminate the targeted cancer cells. This means the combination of multiple chemotherapy agents has higher treatment advantage in the treatment of cancer. Despite that the combination of chemotherapy agents has the advantage to optimize treatment effect; it has also the potential to increase haematological toxicity, which can induces greater incidence and severity of anaemia by affecting bone marrow cells and increasing susceptibility to the host diseases (Lebaron, Zeltzer, Lebaron, Scot, and Zeltzer, 1988; Partridge, Burstein, Winer, 2001) as cited in (21). Even though both single use and combination can impact bone marrow suppression leading to anemia, the incidence is dependent on the specific type of cancer, its stage, type of cytotoxic chemotherapy used, dosage and duration of treatment, the patient's baseline health and the development of treatment related complicated as has been established by previous.

CONCLUSION

The uses of chemotherapy as anticancer drugs as chemical agents is recognized to have prospective positive impact on the treatment of cancer. However, its outrageous harmful side effects and adding to patients' distress due to the experience of myelosuppression and transfusion support procedures cannot be overemphasized. The findings from this study corresponding with many others previously carried out have established that demand for blood transfusion in cancer patients due to noticeable Hb deficit is induced by many factors that are both associated with disease and treatment related factors. Particularly for the this study, the findings showed that; type of cancer cancers, advanced stage cancers, cycles of chemotherapy agents (single or combination administration) can significantly suppressing bone marrow cells cum diminishing the capacity of red blood cells of enough blood production leading to a patient development of anaemia.

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CONFLICT OF INTEREST

The authors cooperatively participated and contributed significantly in the study from the start to completion without expression of any conflict of interest.

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