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Some full blood count parameters among women of African descent with breast cancer in Sokoto, North Western Nigeria

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Abstract

Breast cancer is the most common female malignancy both in Nigeria and globally. The aim of this case- control study was to determine the changes in some haematological parameters among breast cancer patients in Sokoto, Nigeria. The study included a total of 46 breast cancer subjects (mean age 42.91 ± 5.83 years) visiting the Specialist Hospital, in Sokoto, North Western Nigeria. A total of 46 apparently healthy age-matched women were monitored as control. Some haematological (packed cell volume, total white blood cell count and platelet count) were analyzed using the auto-haematology analyzer (Genesis, HA6000). Breast cancer staging was determined using the TNM classification. Data were analyzed using SPSS 22.0 statistical package. A p-value ≤0.05 was considered significant in all comparisons. The result indicated that patients with breast cancer had a lower mean packed cell volume (29.20 ± 0.50 %) compared to controls (36.20 ± 0.42 %) (p=0.000). The mean total white blood cell count of patients was also statistically lower among breast cancer patients (3.91 ± 0.19×10^9/l) compared to controls (4.38 ± 0.13×10^9/l) (p=0.045). There were no statistically significant differences in the mean value of platelet counts of breast cancer patients (197 ± 5.06×10^9/l) and controls (207 ± 5.84×10^9/l) (p=0.217). Newly diagnosed patients who were not on therapy had significantly lower mean values of PCV compared to controls (p<0.05). There were no statistically significant differences in the mean values of total white blood cell counts and platelets count of newly diagnosed patients that are not on therapy and controls (p>0.05). The mean PCV levels were significant lower as compared to controls (p<0.05) Patients that were on chemotherapy had significantly lower values of PCV, total white cell counts and platelets compared to patients who were not yet on any therapy (p <0.05). There were no statistically significant differences in the PCV, total white blood cell counts and platelets based on the different stages of breast cancer (p >0.05). Findings of this study have shown that breast cancer patients had a lower PCV and TWBC count compared to controls. Chemotherapy further exerts adverse effects on patients as seen with the significantly decreased values of haematological parameters on patients on therapy. Findings of this study also shows that breast cancer patients have low PCV and WBC count compared to controls. Haematological investigation should be taken as an essential tool in the investigation and management of breast cancer. Active breast cancer awareness campaign should be carried out on the need for early diagnosis. More research should be carried out to investigate the pattern of other haematological parameters in breast cancer disease.

Introduction

Cancer is defined as an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of the normal tissues. This growth persists in the same excessive manner after the cessation of the stimuli that evoked the change [1]. Cancer can develop in tissues of breast, usually the ducts (tubes that carry milk) and lobules (glands that produce milk) and therefore, are known as breast cancer. Cancer can occur in both men and women, although breast cancer in men is rare [2].

Breast cancer most commonly develop from the lining of milk ducts and the lobules that supply the ducts with milk. There are two most commonly used screening methods which are physical examination of the breasts by a healthcare provider and mammography. These two methods can offer an approximate likelihood that a breast lump is cancer, and may also detect some other lesions, such as a small cyst [3]. When these examinations are inconclusive, a sample of the fluid in the lump can be removed for microscopic analysis (a procedure known as fine needle aspiration, or fine needle aspiration and cytology—FNAC) for the establishment of diagnosis [3].

A number of risk factors such as reproductive and hormonal factors, alcohol consumption, cigarette smoking, family history, obesity, dietary factors and chronic inflammation have been identified for breast cancer. The mechanisms by which they increased risk of the disease are not always clear [4]. Although 10–15% of breast cancer cases have some family history of the disease, only 5% can be explained by rare, highly penetrant mutations in genes such as BRCA1 and BRCA2 [5].

Worldwide, breast cancer is the second most common cause of cancer-related death in women after lung cancer [6]. Also, it is the most prominent cause of cancer death among women in low-and

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middle-income countries, accounting for 269,000 deaths (12.7% of all cancer deaths) in 2008 [7-8]. The breast cancer burden differs between countries and regions showing variations in incidence, mortality and survival rates [9-10]. Breast cancer-related deaths in Nigeria reached 13,264 or 0.70% of total deaths and showed that Nigeria ranks 4th in the world [11].

Adebamowo and Ajayi [12] stated that breast cancer is the most common cancer in Nigeria. In the North-West geopolitical zone of Nigeria, cancer of the breast is second most common cancer after cancer of the cervix, while at University College Hospital (UCH), Ibadan (situated in the South-West geopolitical zone of Nigeria) it is leading malignancy among women [123-14]. Also, in the North-Central geopolitical zone of Nigeria, breast cancer constitutes 22.41% of new cancer cases registered in 5 years and accounts for 35.41% of all cancers in women [15].

In Western countries, breast cancer is the most commonly diagnosed cancer in women and the second leading cause of mortality and morbidity in women. International Agency for Research on Cancer (IARC) provide statistics on the incidence, prevalence and mortality rates of cancers in 184 countries and reported that breast cancer is affecting women in 145 countries which includes US, UK, Australia, Canada and Denmark were ranked higher than Africa and Asia [16]. The current estimates in the United States indicate that 226,870 women are diagnosed with breast cancer, with 39,510 deaths in the year 2012 [17].

Complete blood count (CBC) is a blood test that gives important information about the kinds and numbers of cells in the blood, especially red blood cells, white blood cells and platelets. CBC helps health professional check any symptoms, such as weakness, fatigue, or bruising. CBC support the diagnosis of several diseases, such as anaemia, acute infections, haemorrhagic states, allergic disorders, cancers, and immune disorders, health screening and pre-operative evaluations [18]. Blood contains a variety of cells in appropriate proportions in normal persons. Any kind of severe disease or abnormality has a direct impact on blood parameters. It is necessary to study the changes in haematological parameters in breast cancer patients, at regular intervals during treatment (chemotherapy and radiotherapy).

Haematological parameters have been correlated with prognosis in several malignancies. The white blood cell count (total and differentials) and packed cell volume predict disease severity and mortality risk [19-20]. Many studies have asserted that thrombocytopenia is observed in various malignancies [21]. Platelets are important cellular particles for haemostasis and vascular integrity. They are produced from bone marrow precursor cells, megakaryocytes. Abnormalities in their normal circulating number either in the form of thrombocytosis or thrombocytopenia are associated with many pathologic conditions. Cytokines that stimulate thrombopoiesis are often elevated in cancer, and as a result, various cancers have been associated with thrombocytosis. In addition, thrombocytosis has been found to be an adverse prognostic factor in many types of common cancers.

Breast cancer cases cause about 370,000 related deaths in women each year even with all the significant progress in its diagnosis and treatment [22]. WHO [23] found out that breast cancer deaths in Nigeria reached 13,264 or 0.70% of total deaths and showed that Nigeria ranks 4th in the world [11].

Despite the great concern posed by breast cancer in our locality, there is little or no information towards the changes in haematological parameters among breast cancer patients. There is paucity of data to assess the changes in both the haematological parameters among breast cancer patients in Sokoto State. Based on these facts, this study was designed to investigate the changes in some haematological parameters among breast cancer patients in Specialist Hospital, Sokoto, North-Western Nigeria. Findings from this study can potentially enhance better management and follow-up of patients with breast cancer. The aim of this study is to determine changes in some haematological parameters (PVC, TWBC and platelets) among breast cancer patients aged 18 years and above in Specialist hospital, Sokoto, North- Western Nigeria.

Materials and methods

The study area

The study was carried out in the Department of Haematology, and the Department of Surgery, Specialist Hospital, Sokoto, Nigeria. Specialist Hospital Sokoto is a tertiary health facility located in Sokoto, the Sokoto State Capital. It serves as a referral center for residents in Sokoto and neighboring Niger in the West African sub-region. The state is located in the extreme Northwest of Nigeria, near the confluence of the Sokoto River and the Rima River. The State is in the dry Sahel, surrounded by sandy savannah and isolated hills, with an annual average temperature of 28.3^{o}c (82.9^{o}F). Sokoto is, on the whole, a very hot area. However, maximum daytime temperatures are for most of the year generally under 40^{0}c (104.0^{0}F) and the dryness makes the heat unbearable. The warmest months are February to April when day time temperature can exceed 45^{0}c (113.0^{0}F). The rainy season is from June to October during which shower are a daily occurrence. Sokoto city is a major commerce center in leather crafts and agricultural products. As at 2006, the state has a population of 3.6 million.

Study population

The study population for this study included 46 female breast cancer patients aged 18 years and above (subjects) and 46 healthy females who were monitored as controls. Both subjects and controls were recruited from Specialist Hospital, Sokoto.

Inclusion criteria

Consenting adults (18 years and above) with histologically confirmed breast cancer including those that have started treatment and those that have not started were recruited as subjects.

Exclusion criteria

Non-consenting adults, non- adults (<18 years) and non-breast cancer patients, pregnant breast cancer patients and those with benign breast tumor were excluded.

Study design

The research is a case-control study involving 46 breast cancer patients who served as subjects. The control participants consisted of 46 non- breast cancer apparently healthy adults. Qualitative data were elicited using a structured interviewer-administered questionnaire administered to each patient and information on patient's demographic and socioeconomic characteristics including gender, age, marital status, occupation, and education were obtained. Information on the patient nutritional status, stage of breast cancer and whether they were under therapy or newly diagnosed were also obtained. While quantitative data were gotten by estimating the levels of some haematological parameters (platelets counts, white blood cell counts and haematocrit).

Ethical consideration

Ethical approval for the study was obtained from the Ethical Committee in Specialist Hospital, Sokoto.

Informed written consent

Written informed consent was obtained from all the participants (subjects and controls).

Subject selection

All the breast cancer patients were consecutively selected from the population of breast cancer patients attending the Surgical Clinics of Specialist Hospital, Sokoto. All breast cancer patients who satisfied the study inclusion criteria were selected until the desired sample size was attained.

Analytical method

Questionnaire: Questionnaire was used to collect bio data and related information from the subjects and control participants.

Full Blood Count (Complete Blood Count): The full blood count was carried out using Auto Haematology Analyzer (Genesis HA6000, Perlong Medical Equipment, China) to analyze some haematological parameters which include: Packed Cell Volume (PCV), Total White Cell Count (TWBC) and Platelet Count.

Results

Analysis of the study population

A total of 46 histologically confirmed breast cancer female patients with mean age of 42.91 ± 5.83 years and 46 age and gender- matched apparently healthy controls with mean age 42.83 ± 5.80 years were enrolled for the study. The results are presented as mean ± standard error of mean. Table 1 shows the socio-economic and demographic characteristics of the subjects and controls and reveals that majority of the patients; 20 (43.5%) and control group; 23 (50%) were in the age range of 40-49 years. The distribution of patients and control group based on ethnicity shows that majority of subjects and controls were Hausa/Fulani; 42 (91.3%) and 29 (63%) respectively. The distribution of the subjects based on educational status shows that 6 (13%) had tertiary education, 11 (23.9%) had secondary, 12 (26.1%) had primary education and 17 (37%) had no formal education as compared with control where 6 (13%) had tertiary education, 14 (30.4%) had secondary education, 19 (41.3%) had primary education and 17 (37.0%) had no formal education.

Occupational distribution of the subjects indicated that 6 (13%) were employed while the remaining 40 (87%) where either unemployed/ full time housewives as compared to control where 22 (47.8%) were employed, 17 (36.9%) were unemployed/full time housewives, or 7(15.20) were students. Most of the subjects and controls were married, 44 (95.7%) and 42 (91.3%) respectively.

The classification of the patients based on cancer staging shows that 2(4.3%) were in stage 1, 17(37%) were in stage 2, 22(%) were in stage 3 and 5(10.9%) were in stage 4. Table 2 revealed that PCV, WBC, Neutrophils and Lymphocyte levels were significantly lower among breast cancer patients as compared to controls ($p<0.05$). The platelet counts of breast cancer subjects did not differ significantly when compared with controls ($p>0.05$).

Table 3 shows the comparison of haematological parameters of newly diagnosed non-therapy patients and controls. The mean PCV levels were significant lower as compared to controls ($p<0.05$) whereas the mean TWBC and platelets were not significantly different as compared to controls ($p>0.05$).

Table 1. Socio-demographic Characteristics of Controls and Patients.

Characteristics	Patients		Controls	
	N=46	Percentage (%)	N=46	Percentage (%)
Age groups(years)				
20-29	3	6.5	2	4.3
30-39	12	26.1	18	39.1
40-49	20	43.5	23	50
50-59	9	19.6	3	6.5
60-69	1	2.2	-	-
≥70	1	2.2	-	-
Marital Status				
Married	36	78.3	37	80.4
Single	3	6.5	5	10.9
Widowed	1	2.2	-	-
Divorced	6	13	4	8.7
Tribe				
Hausa/Fulani	42	91.3	29	63
Yoruba	2	4.3	9	19.6
Igbo	1	2.2	7	15.2
Others	1	2.2	1	2.2
Education Level				
Tertiary	6	13	6	13
Secondary	11	23.9	14	30.4
Primary	12	26.1	19	41.3
Non-formal	17	37	17	37.0
Occupation				
Employed	6	13	22	47.8
Unemployed/ House wives	40	87		
Students	-	-	17	36.9
Brest cancer staging				
Stage 1	2	4.3	7	15.2
Stage 2	17	37		
Stage 3	22	47.8		
Stage 4	5	10.9		

Key: *N= Number, % =Percentage*

Table 2. Mean comparison of some Haematological parameters for patients and controls

Parameters	Patients	Controls	t-test	p-value
PCV (%)	29.2± 0.5	36.20±0.42	-10.69	0.000(s)
WBC ($\times 10^9$/l)	3.91±0.19	4.38±0.13	-2.03	0.045(s)
PLT ($\times 10^9$/l)	197±5.06	207±5.84	-1.24	0.217

Data are presented as mean ± SEM.
Key: *PCV = packed cell volume, WBC = white cell, PLT = platelet, (s) =statistically significant.*

Table 3. Comparison of Haematological parameters of newly diagnosed non-therapy patients and controls

Parameters	Non-therapy patients (N=22)	Controls (N=46)	t-test	p-value
PCV (%)	30.67± 0.67	36.21±0.42	7.205	0.000(s)
WBC ($\times 10^9$/1)	4.53±0.30	4.38±0.13	-0.562	0.576
PLT ($\times 10^9$/1)	217±8.23	207±5.84	-0.959	0.341

Data are presented as mean ± SEM.
Key: *PCV = packed cell volume, WBC = white cell, PLT = platelets, (s) =statistically significant.*

Table 4 shows the mean difference in the haematological parameters between patients on therapy and those not yet on therapy. The mean values of PCV, TWBC, and PLT were significantly lower in those on therapy as compared to those not on therapy ($p<0.05$).

Table 5 is an overview of the difference in the pattern of full blood count of the patients according to the stages of cancer. None of the parameters differed significantly in the four stages of cancer ($p>0.05$).

Table 4. Haematological and Biochemical Parameters of Subjects based on the presence or absence of therapy.

Parameters	Therapy		P value	Remark
	Yes (N=24)	No (N= 22)		
PCV (%)	27.87±0.6	30.67±0.69	0.001	SS
WBC ($\times10^9$/1)	3.33±0.18	4.53±0.30	0.001	SS
PLT ($\times10^9$/1)	178.58±6.74	217.18±8.2	0.001	SS

Values are mean ± standard error of mean; Level of significance is considered when p<0.05
Key: *N= number of subjects, Yes= patients that have started therapy, No= newly diagnosed patients, PCV= Packed cell volume, WBC= White blood cell, PLT= Platelet, (s) =statistically significant.*

Table 5. Haematological and biochemical parameters based on staging

Parameters	TNM Classification				P value	Remark
	Stage I (N=2)	Stage II (N=17)	Stage III (N=22)	Stage IV (N=5)		
PCV (%)	33.15±0.07	29.84±0.56	28.23±0.9	29.8±0.02	0.156	NS
WBC ($\times10^9$/1)	4.45±0.25	4.07±0.37	3.71±0.26	3.94±0.60	0.797	NS
PLT ($\times10^9$/1)	226±3.5	205±12.3	192.5±6.9	175±14.6	0.310	NS

Values are mean ± standard error of mean, Level of significance is considered when p<0.05
Key: N= number of subjects; PCV=packed cell volume, WBC=white blood cell count, PLT=platelet, Vit C=vitamin C, Vit B5=vitamin B5, SS= statistically significant, NS= not significant.

However, the mean values of PCV, TWBC counts, Neutrophil and Lymphocytes where higher in stages 1 and 2 compared to the advance stages (3 and 4) (p<0.05). There was no statistically significant difference in the Vitamin B5 level (pantothenic acid) based of the stage of breast cancer (p<0.05).

Discussion

Cancer is still one of the leading causes of death and equally prevalent all over the world. Only early diagnosed tumor with none to less metastasis can be treated either by radiotherapy, surgery or chemotherapy. Chemotherapy are used to kill the neoplastic cells without damaging healthy surrounding tissues [24-25]. In this study the peak age of incidence of breast cancer was 40-49 years (5^{th}decade). This is in accordance with the findings from previous reports; South Africa [26]; Kenya, [26]; Ilorin, Nigeria [15] and Sudan [27] which reported the peak age of incidence of breast cancer to be the 5^{th} decade. Our finding is however in variance with reports from Norway [28] and Philippines [29] which indicated peak age of incidence in the 6^{th} and 8^{th} decade respectively. Similarly, a previous report from Khartoum, Sudan [30] indicated that the peak age was above 50years. The variation in peak age of incidence of breast cancer may be attributed to the onset of breast cancer aetiopathogenesis which have been found to include, early menarche, late menopause, late age at first birth, and other reproductive factors [31].

It was observed that majority of patients are predominantly Hausa/ Fulani (91.3%). Our finding is in agreement with the study carried in Zaria [32]). The reason for this observation may be due to the fact that the Hausa and Fulani are the major ethnic groups in Sokoto, North Western Nigeria.

We observed in this study that the majority (37%) of the breast cancer patients had no formal education; the remaining 63% had tertiary, secondary or primary education. This is in consonant to the report of study from Sudan [30] which indicated that 40.9% of their cohort of breast cancer subjects was illiterate. However, the findings in Lagos [33] are at variance with the findings in this present study. The difference may be due to low level of enrollment in primary, secondary and post education level in this study area (Northern Nigeria) than in Lagos (Southern Nigeria).

This study also shows that the most of the patients are full time housewives/ unemployed. This is in agreement with the finding in Sudan (Mohammed and Daoud, 2013) and in contrast with the findings in Lagos [33]. This is also related to the low level of education in this study area.

We observed in this study that majority of the subjects (47.8%) presented with stage 3 disease. Our finding is in agreement with the study carried out in Zaria [32] which indicated that half of their breast cancer patients presented with stage 3 diseases.

Full blood count is a prerequisite investigation requested for all cancer patients before surgery, use of chemotherapy and/ or radiotherapy. Several studies have also established that poor parameters adversely influence the outcome of cancers. Studies have also correlated haematological parameters and markers of the systemic inflammatory response with prognosis in several malignancies. Poor parameters adversely influence the outcome of cancers. Haematological parameters and markers of the systemic inflammatory response have been correlated with prognosis in several malignancies. The white blood cell count (total and differentials) and packed cell volume predict disease severity and mortality risk. For example, elevated WBC counts predict a worse prognosis in patients with cancer or coronary artery disease and anaemia predicts increased risk of death of cancer patients with heart failure [34-35].

White blood cells exist in the blood, the lymphatic system and the tissues and are an important part of the body's defense system. Some diseases like cancer trigger a response by the immune system and cause an increase in the number of white blood cells. A mounting body of evidence indicates that inflammation has a role in the development and progression of several types of cancer. In this study, it was observed that the TWBC counts of patients were significantly lower compared to controls (p<0.05). This finding is in agreement with previous reports [36-38]. However, our finding is at variance with a previous report in India [39] where no significant difference was observed between TWBC counts of breast cancer subjects and controls. The discordance could be due to different testing methods used. A low white blood cell count, also known as leukopenia is one of the most serious and frequent effects of chemotherapy. It can necessitate a delay in treatment or a reduction in dose. White blood cells are essential for the body to fight infections and when they are decreased, an individual becomes susceptible to infections. The white blood cell count (total and differentials) predict breast cancer disease severity and mortality risk [40]. Full blood count help health professionals check any symptom patients may have such as fatigue, weakness or bruising. It also helps in the diagnosis of other opportunistic diseases [18]. Neutrophils and lymphocytes are white blood cells that are dispatched as part of the body's immune system response to harmful invaders, including cancer cells. Neutrophil-to-lymphocyte ratio is the most studied parameter in breast cancer. Several studies have reported that a high NLR is associated with a poor outcome in several different types of cancer [41]. Total leucocyte count, if elevated, predicts poorer prognosis [42] (Grim *et al*., 1985). Studies have shown of a remarkable increase in the white blood cell counts in breast cancer prior to chemotherapy [37, 39]. Akinsegun [40] found the white blood cell count to be higher in patients when compared to controls.

This study indicated that the packed cell volume was significantly lower among breast cancer subjects compared to the apparently healthy controls (p<0.05). This finding is consistent with previous reports [18, 37]. The PCV is the volume percentage of red blood cells in whole blood. It is considered an integral part of a full blood count.

Along with haemoglobin concentration can be used as a reference of its capability to deliver oxygen. It is often used as an index for the diagnosis of anaemia. The decreased in PCV observed among breast cancer patients is consistent with findings in previous reports which showed that anaemia is a constant feature among breast cancer patients [39, 40, 43]. The anaemia seen in these patients may be due to the effect of chemotherapy and or anaemia due to chronic diseases. Anaemia is defined as a haemoglobin level less than 14 g/dl for men and less than 12 g/dl for women. It has been subdivided into mild (10 g/dl-normal), moderate (8-10 g/dl), severe (6.5-8 g/dl) and life threatening (<6.5 g/dl or unstable patient) anaemia [44]. Haemoglobin and packed cell volume are indirectly associated with increased risk of cardiac failure in cancer patients. Several studies have shown that anaemia is a frequent finding in cancer patients, occurring in >40% of cases [45-47]. Similarly, a study by Shrivrastava *et al.* (2017) [39] has shown low level of haemoglobin and RBC count in breast cancer. A case control studies carried out by Akinsegun [40] on breast cancer found 58 out 100 of the cases to be anaemic. However, [48] in a study to assess the perioperative blood count in breast carcinoma found no significant correlation between cancer patients and anaemia. Anaemia is associated with shorter survival in cancer patients and this association has been established for breast cancer and almost all types of cancer studied [18, 49-50]. Anaemia has also been identified as an adverse prognostic factor. Cancer promotes inflammatory cytokine production which suppresses erythropoiesis and erythropoietin production [51].

There was no significant difference in platelet counts between the breast cancer subjects and controls ($p>0.05$). Our finding is in agreement with previous study report [39] (Shrivastava, *et al.*, 2016). However, the finding from this study is at variance with a previous report in Babylon reported by Liqaa (2014) [18] which indicated a significant increase of platelets among breast cancer subjects. The reason for the non-significance difference in the platelet count between breast cancer subjects and controls in this study may be due to the fact that this study was carried out in a malaria endemic environment. Platelet activation has been associated with malaria infection [52]. Plasmodium can interact with different receptors on human platelet which shortens their life span and pathogens can induce removal of platelets from the circulation by stimulating their sequestration in organs or by triggering their clearance by phagocytosis [52].

Studies have shown that in women in whom breast cancer has been diagnosed, an increased circulating platelet count (thrombocytosis) is associated with a poor cancer prognosis, suggesting a potential direct role for platelets in the pathogenesis of the disease [53-54]. An increased risk of thrombosis as well as increased platelet activation has been observed for decades in women with breast cancer, but until recently, these clinical observations have been considered a paraneoplastic phenomenon [55-56]. Studies have shown a decreased platelet counts when compared to controls [18, 39, 40, 57].

This study observed that the mean values of the haematological parameters of patients on therapy were significantly lower than those that were newly diagnosed ($p<0.05$). This finding is in agreement with previous studies [58-59]. About 33% of cancer patients experience an infection as a result of chemotherapy, of which 57% are associated with neutropenia. This suggests that the risk of neutropenia has a significant impact on patients' clinical care and quality of life. Neutropenia is a common and potentially life-threatening side effect of some chemotherapeutic regimens, due to the heightened risk of infection [60-61]. Thrombocytopenia can be a serious complication [62]. It can be caused by bone marrow suppression, as a side effect of chemotherapeutic drugs or as a direct consequence of cancer (i.e., infiltration of the bone marrow, which results in impaired production of platelets).

Conclusion and recommendation

Conclusion

Findings of this study has shown that breast cancer patients had a lower PCV, TWBC count and ascorbic acid level compared to controls. There was no significant positive correlation between the hematological parameters and the biochemical parameters. Chemotherapy further exerts adverse effects on patients as seen with the significantly decreased values of haematological parameters on patients on therapy. Findings of this studies also shows that breast cancer subjects prior to treatments have low PCV, and vitamin C levels but elevated TWBC and Platelets counts. There was no specific trend in the mean values of the haematological and biochemical parameters across the stages of the disease.

Recommendations

This study recommends that; active breast cancer awareness campaign should be carried out on the need for early diagnosis. Haematological investigation should be taken as an essential tool in the investigation and management of breast cancer. Recombinant erythropoietin should be used alongside Chemotherapy to manage anaemia in breast cancer. More research should be carried out to investigate the pattern of other haematological parameters and biochemical parameters in breast cancer disease. Investigation of Ascorbic acid level (Vitamin C) should also be included as a tool for diagnosis and management of breast cancer.

References

1. Kumar AF, Charles EA, Douglas C (2004) Neoplasm In: Robbins and Contra Pathologic Basis of Disease, 7th Edition, Elsevier: 270.
2. Kufe DW, Pollock RE, Weichselbaum RR, Bast RC (2003) Cancer Medicine. BC Dencker Incorporated: 22.
3. Saslow D, Hannan J, Osuch J, Alciati MH, BainesC, et al. (2004) Clinical breast examination: Practical recommendations for optimizing performance and reporting. *CA Cancer J Clin* 54: 327- 344. [Crossref]
4. Mitrunen K, Hivonen A (2003) Molecular Epidemiology of Sporadic Breast cancer: The role of Polymorphic Genes involved in Oestrogen Biosynthesis and Metabolism. *Mutat Res* 544: 9-41. [Crossref]
5. Newman B1, Austin MA, Lee M, King MC (1988). Inheritance of human breast cancer: evidence for autosomal dominant transmission in high risk families. *Proc Natl Acad Sci U S A* 85: 3044–3048. [Crossref]
6. American Cancer Society (2013): Breast cancer facts and figures 2012-2013. Atlanta. American Cancer Society Inc.
7. Lancet T (2011). The good news about cancer in developing countries. *Int J Cancer* 378: 1605.
8. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, et al. (2010) Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer* 127: 2893-2917. [Crossref]
9. Coughlin SS, Ekwueme DU (2009). Breast cancer as a global health concern. *Journal of Cancer Epidemiology* 33: 315-318.
10. World Health Organization (2009). Fight against breast cancer: strategies. Geneva.
11. Ojewusi A, Obembe T, Arulogun O, Olugbayela T (2016). Breast Cancer awareness, attitude and screening practice in Nigeria; A systematic review. *Academic Journals, Clinical Review and Opinions*; 7:11-25.
12. Adebamawo CA, Ajayi OO (1999). Breast cancer in Nigeria. *West African Journal of Medicine* 19: 179-191.
13. Ogunbiyi JO, Fabowale AO, Ladipo AA (2010) Breast cancer in: Cancer incidence and top ten cancers in eleven local government areas in Ibadan, Nigeria and its ENVIRONS, 2004-2008. Ibadan M. Alofe (Nig.) Enterprises: 11-17.

14. Afolayan EAO (2008). Cancer in North Western Region of Nigeria. An update analysis of Zaria cancer registry data. *Western Nigeria Journal of Medical Sciences* 1: 37-43.

15. Afolayan EAO, Ibrahim OOK and Ayilara GT (2012). Cancer patterns in Ilorin: An analysis of Ilorin cancer Registry statistics. *The Tropical Journal of Health Sciences* 9: 42-47.

16. International Agency for Research on Cancer (IARC). (2008). Factsheets. Lyon.

17. American Cancer Society. (2012): Breast cancer facts and figures 2011-2012 Atlanta: American Cancer Society Inc

18. Liqaa O (2014). Study effect of breast cancer on some haematological and biochemical parameters. IOSR *Journal of Pharmaceutical and Biological Science* 9: 20-24.

19. Fine MJ, Auble TE, Yealy DM, Hanusa BH, Weissfeld LA, et al. (1997). A prediction rule to identify low risk patents with community acquired pneumonia. *New England Journal of Medicine* 336: 243-250.

20. De Labry LO, Campion EW, Glynn RJ, Vokonas PS. (1990). White blood cell count as a predictor of mortality: results over 18 years from the Normative Aging Study. *Journal of Clinical Epidemiology*; 43: 153–157.

21. Beresford MJ, Burcombe R, Ahsee ML, Stott D, Makarls A (2006). Pre-treatment haemoglobin levels and the prediction of response to neoadjuvant chemotherapy in breast cancer: *Clin Oncol (R Coll Radiol)* 18: 453-458. [Crossref]

22. Schneider AP 2nd, Zainer CM, Kubat CK, Mullen NK, Windisch AK (2014) The breast cancer epidemic: 10 facts. *Linacre Q* 81: 244-277. [Crossref]

23. World Health Organization (2014): World Cancer Report. Geneva.

24. Motzer RJ, Michaelson MD, Redman BG, Hudes GR, Wilding G, et al. (2006): Activity of SU11248, a multitargeted inhibitor of vascular endothelial growth factor receptor and platelet-derived growth factor receptor, in patients with metastatic renal cell carcinoma. *J Clin Oncol* 24: 16-24. [Crossref]

25. Ferrara N, Hillan KJ, Gerber HP, Novotny W (2004): Discovery and development of bevacizumab, an anti-VEGF antibody for treating cancer. *Nat Rev Drug Discov* 3: 391-400.

26. Parkin DM, Ferlay J, Hamdi-Cherif M, Sitas F, Thomas JO, et al. (2003). Cancer in Africa. IARC Scientific Publication No. 153.

27. Alawad AA, Alshiekh AA, Alhaj AM (2013) Demographic Characteristics and Review of Patients with Locally Advanced Breast Cancer in Sudan. *AFRIMEDIC Journal* 4: 5-8.

28. Longmark F (2007): Cancer in Norway. Cancer Incidence, Mortality, Survival and Prevalence in Norway. Cancer Registry of Norway Institute of Population – *Based Cancer Research 10*: 17–64.

29. Radaniel MTM, Laudico AV, Lumague MRM, Mapua CA, Patama T, et al. (2008): Cancer in the Philippines Vol. IX Part I Cancer incidence in 1998 -2002. *Manila Philippine Cancer Society* 23: 1-69.

30. Mohammed SG, Daoud FM (2013): The Effect of Chemotherapy on Nutritional Status of Women with Breast Cancer. *Indian Journal Science Research* 4: 1-14.

31. Freddy S, Perkin DM (2008): Part II Cancer in Indigenous Africans – Causes and Control. *Cancer Oncology* 9: 786-795.

32. Kene TS, Odigie VI, Yusufu LM, Yusuf BO, Shehu SM, et al. (2010) Pattern of presentation and survival of breast cancer in a teaching hospital in north Western Nigeria. *Oman Med J* 25: 104-107. [Crossref]

33. Popoola AO, Igwilo AI, Sowunmi A (2013): Influence of educational status on the knowledge and practice of breast cancer screening. *Translational Journal of Science and Technology* 3: 55-67.

34. Chang R, Wong GY (1991). Prognostic significance of marked leukocytosis in hospitalized patients. *J Gen Intern Med;* 6: 199- 203. [Crossref]

35. Knaus WA, Wagner DP, Draper EA. (1991): The APACHE III prognostic system. Risk prediction of hospital mortality for critically ill hospitalized adults. *Chest* 100: 1619-1636. [Crossref]

36. Iqbal M, Younis M, Shoutkat N, Shaikh S, Akram N, et al. (2015): Hematological study of cancer patients with radio- chemotherapy. *Science Letters* 3: 75-79.

37. Ufelle SA, Ukaejiofo EO, Neboh EO, Achukwu PU, Ikekpeazu EJ, et al. (2012): Some hematological parameters in Pre- and post-breast cancer patients in Enugu, Nigeria. *International Journal of Biomedical Science* 2: 188-190.

38. Blayney DW, Longo DL, Robert CY, Mark HG, Susan MH, et al. (1987): Decreasing risk of leukemia with prolonged follow-up after chemotherapy and radiotherapy for Hodgkin's disease. *N Engl J Med* 316: 710-714. [Crossref]

39. Shrivastava S, Neelima S, Akshay K, Reetike S, Sarvesh K (2017). *International Journal of Research Medical Science* 5: 311- 315.

40. Akinsegun A, Abiodun P, Adewumi A, Adedoyin D, Olajumoke O, et al. (2013). Full blood count pattern of pre-chemotherapy breast cancer patients in Lagos Nigeria. *Caspian J Intern Med* 4: 574-579. [Crossref]

41. Yersal O, Çetinkünar S, Aktimur R, Aziret M, et al. (2017). Neutrophil/Lymphocyte and Platelet/Lymphocyte Ratios are Not Different among Breast Cancer Subtypes. *Asian Pac J Cancer Prev*: 2227–2231. [Crossref]

42. Grim RH, Neaton JD, Ludwig W (1985). Prognostic importance of the white blood cell count for coronary, cancer and all cause of mortality. *JAMA* 254: 1932-1937. [Crossref]

43. Chen BO, Davan DA, Xiaonhong AI, Xi C, et al. (1991): Prognostic significance of marked leukocytosis in hospitalized patients. *J Gen Intern Med* 6: 199-203.

44. Beutler E, Waalen J. (2006). The definition of anemia: what is the lower limit of normal of the blood hemoglobin concentration? *Blood*: 1747–1750. [Crossref]

45. Scwartz RN. (2007): Anemia in patients with cancer. Incidence, causes, impact, management and uses of treatment guideline and controls. *American Journals of Health Systemic Pharmacist* 64: 5-13.

46. Knight K, Wade S, Balduca L. (2004): Prevalence and outcomes of anemia in cancer: a systematic review of the international journal of cancer. *American Journal of Medicine* 7: 11-26.

47. Mercadante S, Gebbia V, Marrazo A (2000): Anaemia in cancer: Pathophysiology and treatment. *Cancer Treatment Revolution* 26: 303-311.

48. Rana AP, Kaur M, Zonunsanga B, Puri A, Kuka AS (2015) Preoperative Peripheral Blood Count in Breast Carcinoma: Predictor of Prognosis or a Routine Test. *Int J Breast Cancer* 2015: 964392. [Crossref]

49. Stasi R, Abriani L, Beccaglia P, Terzoli E, Amadori S (2003) Cancer-related fatigue: evolving concepts in evaluation and treatment. *Cancer* 98: 1786-1801. [Crossref]

50. Caro, J.J., Salas, M. and Ward, A. (2001). Anemia as an independent prognostic factor for survival in patients with cancer: A systematic quantitative review. *Journal of Cancer* 91: 2214-2221.

51. Spivak JL, Gascón P, Ludwig H (2009) Anemia management in oncology and hematology. *Oncologist* 14 Suppl 1: 43-56. [Crossref]

52. Gupta, N.K., Bansal, S.B., Jain, U.C., Sahare, K. (2013). Study of thrombocytopenia in patients of malaria. *Tropical Parasitology* 3: 58-61.

53. Sierko E, Wojtukiewicz MZ (2004). Platelets and angiogenesis in malignancy. *Seminar in Thrombosis and Hemostasis* 30: 95-108.

54. Taucher S, Salat A, Grent M, Kwasny W, Mlineritsch B, et al. (2003) Australian Breast Cancer and Colorectal Cancer Group (2003). Impact of pretreatment thrombocytosis on survival in primary breast cancer. *Thrombosis and Hemostasis* 15: 1098-1106. [Crossref]

55. Chew HK, Wun T, Harvey DJ, Zhou H, White RH (2007): Incidence of Venous Thromboembolism and the impact on survival on breast cancer patients. *J Clin Oncol* 15: 70-76. [Crossref]

56. Alonso-Escolano D, Strongin AY, Chung AW, Deryugina EI, Radomski MW (2004). Membrane type-1 matrix metalloproteinase stimulates tumour cell induced platelets aggregation: role of receptor glycoproteins. *Br J Pharmacol* 141: 241-252. [Crossref]

57. Black A, Guilbert E, Costescu D, Dunn S, Fisher W, et al. (2016) Canadian Contraception Consensus (Part 3 of 4): Chapter 7--Intrauterine Contraception. *J Obstet Gynaecol Can* 38: 182-222. [Crossref]

58. Akinbami A, Popoola A, Adediran A, et al. (2013) Full blood count pattern of pre-chemotherapy breast cancer patients in Lagos, Nigeria. *Caspian J Intern Med* 4: 574-579. [Crossref]

59. Padma R, Sundaresan S (2016): (Hematological and biochemical changes in pre and post treatment of buccal mucosa carcinoma patients. *Int J Pharm Sci Res* 7: 3002-3006.

60. Kuderer NM, Dale DC, Crawford J, Cosler LE, Lyman GH (2006): Mortality, morbidity, and cost associated with febrile neutropenia in adult cancer patients. *Cancer* 106: 2258–2266.

61. Shaikh AJ, Bawany SA, Masood N, Khan AA, Abbasi AN, et al. (2011): Incidence and impact of baseline electrolyte abnormalities in patients admitted with chemotherapy induced febrile neutropenia. *J Cancer* 2: 62–66. [Crossref]

62. Elting LS, Rubenstein EB, Martin CG, Kurtin D, Rodriguez S, et al. (2001): Incidence cost and outcomes of bleeding and chemotherapy dose modification among solid tumor patients with chemotherapy-induced thrombocytopenia. *J Clin Oncol* 19: 1137-1146. [Crossref]