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Carcinoembryonic Antigen Level and Blood Transfusion Requirements among Breast Cancer Patients Undergoing Treatment in Calabar, Nigeria

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Abstract

Breast tumour could be benign or malignant in nature, thus early detection is of the essence for good management outcome. Associated morbidity and mortality in relation to breast cancer, in particular, are of great concern. Among the different challenges in the management of breast cancer, cytopenia is commonly reported, while, associated blood transfusion dependence has received little attention. This study, therefore, looked into the features of breast cancer patients particularly with regards to disease staging and average blood transfusion needs. This cross-sectional descriptive study enrolled 46 female patients accessing medical care for breast tumour in Southern Nigeria. Bio-data and information on clinical assessment were obtained from patients' case files. Blood sample was collected from each enrolled subject for assessment of carcinoembryonic antigen level by immunochromatographic assay method. Breast tumour was observed to be prevalent among women of reproductive age with a peak at the age range of 36-45 years. Majority of the cases (82.6 %) turned out to be malignant, while 17.4% were benign conditions. Advanced stage 4 cases accounted for 47.4% of the studied group. Increasing prevalence of mortality during therapy was recorded alongside advancement in age as well as stage of the cancer. The carcinoembryonic antigen level varied significantly across the various breast cancer stages. Stage 4 breast cancer showed significantly elevated mean value compared to both stages 1 and 2. There is prevailing late detection of breast cancer in the Nigerian population contributing to high mortality rate and more demands on blood transfusion.

Keywords: Breast cancer, blood groups, blood transfusion.

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INTRODUCTION

Breast tumour occurrence has a female preponderance and is fairly prevalent among persons of child-bearing age (Stachs *et al.*, 2019). Breast tumour may occur as a benign condition with lesser health challenges compared to the more life-threatening malignant type. In both instances, however, timely intervention is of the essence for good management outcome (WHO, 2021). Considering the wide range of morbidity and mortality implications of malignant breast tumour, it has continually derived attention in both clinical practice and research output. Notable among the aspects of concerns are the needs for early detection and accurate diagnosis which in turn require effective healthcare delivery structures (Olasehinde *et al.*, 2021; Fatiregun *et al.*, 2018; Akpotuzor *et al.*, 2011). Unfortunately, this and other vital indices of national growth still plague the developing regions of the world. From insufficient enlightenment of the populace to inadequate health infrastructure, skewed morbidity and mortality rates loom over the health sector (Ndem *et al.*, 2021; Egbe *et al.*, 2018). For conditions that are witnessing improved patient survival as seen in cancer generally, underdiagnosis and misdiagnosis still mare expected global health goals in the sub-Saharan African region. The undaunting burden of breast cancer has earned it a significant place in maternal healthcare (WHO, 2021). Consequently, studies on the characterises of presenting patients as well as identified trend in its medical management are of great importance for better management of patients.

The experiences of cancer patients receiving medical care have been likened to journeys in which case quality of life as well as survival are of essence (de Jong *et al.*, 2006; Sadler *et al.*, 2001). As part of this trying journey, are the various biomedical derangements encountered even while treatment is

going on. Apparently, both the condition and some aspects of treatment contribute to the alterations in biomedical variables. Medical care of this nature therefore encompasses addressing the underlying diagnosis while ensuring that patients are stabilized (Berardi *et al.,* 2019). Among the different challenges in the management of breast cancer, haematological derangements are reportedly common among affected patients in the study area (Udosen *et al.,* 2022). Anaemia in particular has been of concern since it is also prevalent in Nigeria where more than half of women within reproductive age are affected (WHO, 2022, Akwiwu *et al.,* 2019). More specifically, anaemia in association with cancer has been attributed to some mechanisms including decline in erythropoietic activity as a result of bone marrow suppression, iron sequestration, surgery-related blood loss and also cancer-associated loss of appetite (Kifle *et al.,* 2019; Ibrahim *et al.,* 2016). In addition, leucopenia and thrombocytosis arising from possible tumour-mediated immunosuppression and chemotherapeutic interruption of normal haemopoiesis also occur (Steele, 2012). Depending on the degree of reduction in cellular elements of blood, blood transfusion is often required to correct severe situations. However, this aspect of the management of breast cancer is yet to be evaluated and reported within the study area. This study, therefore, looked into the features of presenting patients particularly with regards to disease staging and average blood transfusion needs.

MATERIALS AND METHODS

Study Site

The present study was conducted at University of Calabar Teaching Hospital, Calabar in Nigeria. Ethical approval was obtained from the institutional Health and Research Ethics Committee. Informed consent was obtained from each participant enrolled in the research and confidentiality was maintained.

Subjects

This cross-sectional descriptive study enrolled 46 females accessing medical care for breast tumour purposively. Bio-data, information on clinical assessment and blood transfusion were obtained from patients' case files. Out of all the breast tumour patients, those diagnosed with breast cancer were receiving adjuvant 5-fluorouracil, epirubicin, cyclophosphamide (FEC) chemotherapy following the surgical removal of the tumour. The TNM classification which takes into consideration the tumour size, nodal status and metastasis was employed for staging of the breast cancer cases. Haemoglobin concentration baseline for transfusion was 100g/L. Thus, serial measurement of haemoglobin concentration by automation was carried out duly through the period of treatment. This consisted of pre and post-operative measurements, before each cycle of chemotherapy as well as post chemotherapy.

Sample Analysis

Blood sample was collected from each enrolled subject for assessment of carcinoembryonic antigen level. The carcinoembryonic antigen level was analyzed by immunochromatographic assay method using Carcino-Embryonic Antigen Diagnostic Kit with Dry-Type Immunofluorescence Quantitative Analyzer from Shenzhen Microprofit Biotech Co., LTD (China).

Statistical Analysis

Data analysis to test for variance was carried out using one-way analysis of variance on SPSS 22.0 at 95% confidence level with p-value of ≤ 0.05.

RESULTS

Breast tumour was observed to be prevalent among women of reproductive age with a peak at the age range of 36-45 years. Older age ranges recorded gradual decent from the 43.8% peak. Blood group O dominated in frequency for ABO blood group, followed by blood group A and blood group B. Among all the women presenting with breast tumour, majority of the cases (82.6 %) turned out to be malignant, while 17.4% were benign conditions. Close to half of the breast cancer cases (47.4%) were in advanced stage 4 at the time of hospitalisation. While all the benign cases survived through the therapy period, 36.8% of those with breast cancer could not make it through therapy leaving survival through therapy at 63.2% among the breast cancer patients (Table 1).

Increasing prevalence of mortality during therapy was recorded alongside advancement in age as well as stage of the cancer (Table 2).

The carcinoembryonic antigen level varied significantly across the various breast cancer stages. Stage 4 breast cancer showed significantly elevated mean value compared to both stages 1 and 2.

Age correlated positively with carcinoembryonic antigen level among surviving subjects. Mean blood unit requirement for complete therapy found to increase with advancement in disease stage (Figures 1 and 2).

Table 1: **Characteristics of Patients presenting with Breast Tumour**

Parameter	**Number**	**Percent**
Age		
26-35	6	13.1
36-45	16	34.8
46-55	14	30.4
56-65	10	21.7
Total	**46**	**100**
ABO Blood Group		
A	11	23.9
B	6	13.1
AB	0	0
O	29	63.0
Total	**46**	**100**
Breast Tumour Type		
Benign breast tumour	8	17.4
Breast cancer	38	82.6
Total	**46**	**100**
Stage of Breast Cancer		
1	4	10.5
2	11	28.9
3	5	13.2
4	18	47.4
Total	**38**	**100**
Post-therapy outcome		
Survived (benign tumour)	8 out of 8	100
Dead (benign tumour)	0 out of 8	0
Survived (breast cancer)	24 out 0f 38	63.2
Dead (breast cancer)	14 out of 38	36.8

Table 2: **Characteristics of Breast cancer Patients who survived through chemotherapy**

Parameter	**Able to survive full Chemotherapy course, n = 24**	**Unable to survive full Chemotherapy course, n = 14**
Age		
26-35	2 (8.3%)	0 (0%)
36-45	10 (41.7%)	2 (14.3%)
46-55	10 (41.7%)	4 (28.6)
56-65	2 (8.3%)	8 (57.1)
ABO Blood Group		
A	6 (25.0%)	5 (35.8)
B	3 (12.5%)	1 (7.1%)
AB	0 (0%)	0 (0%)
O	15 (62.5%)	8 (57.1%)
Stage of Breast Cancer		
1	4 (16.7%)	0 (0%)
2	9 (37.5%)	2 (14.3%)
3	4 (16.7%)	1 (7.1%)
4	7 (29.1%)	11 (78.7%)

Table 3: **Age and CEA values of Breast cancer Patients by cancer stage**

Parameters	**Stage 1 n = 4**	**Stage 2 n = 11**	**Stage 3 n = 5**	**Stage 4 n = 18**	**p-Value**
Age	40.50±8.73	44.78±5.47	44.25±7.84	48.86±9.26	0.385
CEA	3.26±0.57$^{\#}$	4.07±2.10$^{\#}$	6.19±2.93	9.03±4.08*	0.008

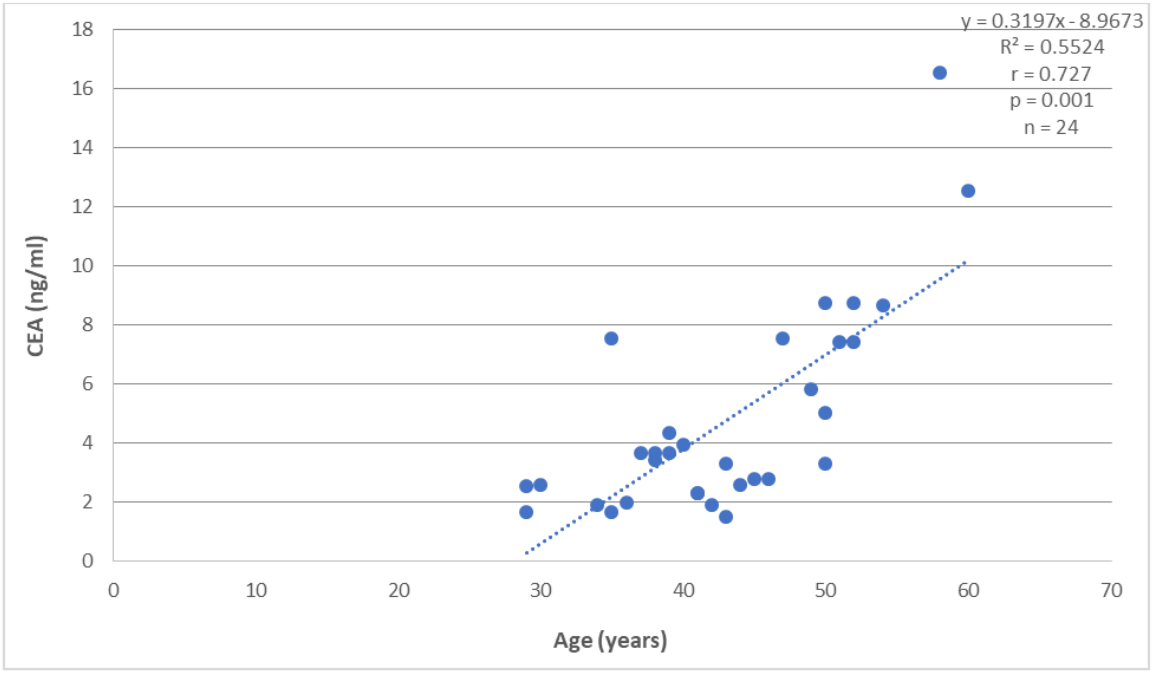

Figure 1: Correlation of Age and CEA among surviving Breast Cancer Patients

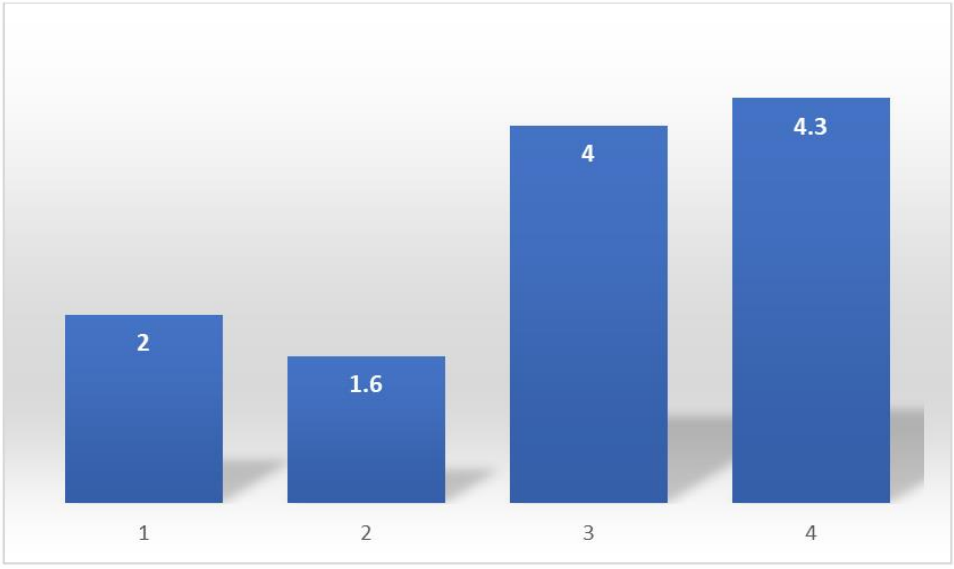

Figure 2: Mean blood units received during chemotherapy for different surviving Breast Cancer stages

DISCUSSION

This study on prevalence of breast cancer stages and blood transfusion needs among patients in a Nigerian population observed breast tumour to be prevalent among women of reproductive age with a peak at the age range of 36- 45 years. Older age ranges recorded gradual decent from the 43.8% peak. Factors contributing to this observation include the implicated hormone-mediated mechanisms for breast tumour oncogenesis (Stachs *et al.*, 2019; McNamara and Sasano, 2015). The recession of female reproductive hormones as menopause approaches is thought to interfere regulatory feedback mechanisms. In addition, further secretion by fat cells has been linked to growth stimulation of the mammary tissues. Such growth may occur as a benign condition with lesser health challenges compared to the more life- threatening malignant type. In both instances, however, timely intervention is of the essence for good management outcome (WHO, 2021; Zielonke *et al.*, 2020). Among all the women presenting with breast tumour in the present study, majority of the cases (82.6 %) turned out to be malignant, while 17.4% were benign conditions. This pattern places malignant breast tumour approximately 4.75 times higher in prevalence than benign breast tumour within the study locality.

Close to half of the breast cancer cases (47.4%) were in advanced stage 4 at the time of hospitalisation. Late reporting to health facilities and

the attendant untimely commencement of medical management is the bane of effective healthcare in developing regions such as the study locality. Similar observations within the study area have been reported previously (Ndem *et al.,* 2021; Egbe *et al.,* 2018; Akwiwu *et al.,* 2021). In general, public health interventions geared towards enlightenment and early detection of breast cancer appears to be insufficient on this side of the globe (Udosen *et al.*, 2022). While all the benign cases survived through the therapy period, 36.8% of those with breast cancer could not make it through therapy leaving survival through therapy at 63.2% among the breast cancer patients. The toll of insufficient efforts at early detection of breast cancer and the subsequent disease progression is seen in the increasing prevalence of mortality during therapy among those with advanced stages of the cancer. This is at variance with reports emanating from regions with developed health infrastructure (Zielonke *et al.,* 2020). Breast cancer progression through the various stages is of great importance in clinical assessment and management of affected patients. The carcinoembryonic antigen level varied significantly across the various breast cancer stages. Stage 4 breast cancer showed significantly elevated mean value compared to both stages 1 and 2. Furthermore, age correlated positively with carcinoembryonic antigen level among surviving subjects. Increasing levels of carcinoembryonic antigen alongside advancement in age appear to cut across both breast cancer patients and apparently healthy persons, thus suggesting age- mediated predisposition to carcinogenesis (Zhang *et al.,* 2022; Touitou *et al.,* 1984).

Blood group O dominated in frequency for ABO blood group, followed by blood group A and blood group B. No blood group AB was recorded in the study. The observed ABO pattern of distribution with prevailing blood group O type is similar to that of the general population as well as the local blood donor population. The blood transfusion needs for breast cancer management, thus, fits into the regular blood donation provisions available locally. However, the late detection and presentation at advanced stages translates to more demands for blood units during therapy as recorded by the study. Anaemia, leucopenia and thrombocytopenia are among the pronounced haematological complication associated with breast cancer. Occasioned by both the disease mechanisms as well as adverse effects from chemotherapeutic agents, adequate monitoring and proper regulation of these indices are factored into medical care of breast cancer patients (Udosen *et al.*, 2022). Challenges in meeting transfusion demands exist. They range from encouraging voluntary donation to ensuring safety of blood products. It is imperative to address both late breast cancer detection and high demand for associated blood transfusion.

CONCLUSION

There is prevailing late detection of breast cancer in Nigeria contributing to high mortality rate and more demands on blood transfusion. There is need for timely detection of breast cancer to reduce the pressure on blood transfusion and also reduce mortality.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORS' CONTRIBUTIONS

- Udosen JE, Akwiwu EC and Akpotuzor JO – Research idea and design.
- Akpotuzor DU and Abunimye DA – Sample analysis and literature search.
- Udosen JE and Akwiwu EC – Data analysis and writing of manuscript.
- Akpotuzor JO – Reviewed the manuscript.

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