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Female Breast Cancer in Northern Ghana: A Retrospective Histo-Pathological Study at the Department of Pathology of the Tamale Teaching Hospital (TTH) (2012 to 2021)

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ABSTRACT

Background: Data on breast cancer (BC) in northern Ghana is scant. The aim of this study was to provide data on the clinicopathological, prognostic and molecular characteristics of BC in females of northern Ghana.

Methods: Data on breast cancer patients (n = 1,913) in the Department of Pathology of the Tamale Teaching Hospital (TTH) was collected from 1st January, 2012 to 31st December, 2021 and analysed at four levels: introduction, clinico-pathological features, prognostic stratification using the NPI score and the molecular subtypes of BC based on IHC Status. Associations between variables were determined by Fisher's exact test.

Results: There were 1,191 (62.3%) benign and 722 (37.7%) malignant tumors. A gradual rise in the relative proportions of the female BCs over the period was observed. The mean age (years) of BCs diagnosed in small to medium size samples was 47.7±16.0, and 36.4% were aged <40 years. The commonest clinical presentation of BC was a palpable breast lump (65.5%). Majority of the BC patients presented 3 months after the onset of the illness. Invasive ductal carcinoma was the commonest subtype of BC (78.0%), and the great majority (93.1%) had a combined (II & III) high histological grade (P<0.0001). Stratifying women diagnosed with BC into prognostic categories using the NPI, 15.4% had excellent prognosis, compared to 49.2% with poor prognosis.

Conclusion: The study identified breast cancer as a common breast disease among women in the study area with advanced clinico-pathological features at presentation, and therefore, poor prognosis even at the time of diagnosis.

INTRODUCTION

Breast cancer is a major cause of cancer-related morbidity and mortality in the developed and more importantly in the developing countries with relatively less established health infrastructures and unequal distribution of health personnel.[1-6] The incidence of breast cancer in developing countries such as Ghana is not known due to the absence of population-based cancer registry.[7] Many publications on breast pathology concentrated on the malignant lesions[6-13], with very few data on the relative proportions of benign to malignant breast lesions.[10-13] There is a decline in the incidence of breast cancer in the developed countries[14,15], while available data from

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previous institution-based research report a rising trend in the incidence of breast cancer among the study populations in Africa.[10,16-20] Several reasons have been mentioned for this rising pattern.[19-23] For instance, Kocaöz *et al*.,[19] in their study attributed the rising trend in breast cancer to the impact of health education. Similarly, Ouyang *et al*.,[20] attributed the observed rise in breast cancer to community health education. Others described the rise as a component of the rapid epidemiological transition towards non-communicable disease (NCD) in sub-Saharan Africa.[24-26]

Breast cancer in females is currently a disease diagnosed in the elderly.[27,28] However, previous studies in Ghana and other parts of Africa reported breast cancer as a disease that affected relatively young women who presented very late to health facilities for medical care with advanced disease, with skin involvement and hence poor treatment outcomes.[9,16,29,30-35] Furthermore, the literature available in Ghana and other parts of Africa reported that the women with histologically confirmed breast cancers are of high Bloom-Richardson grades, increased nodal involvement, high pathological stage (pTNM Stage) and increased prevalence of positive tumour margins.[10,20,36-39]

Published data on the prognostic stratification (categories) and the expected 5-year survival rates of women diagnosed with breast cancer using the calculation of the Nottingham Prognostic Index (NPI) score are very scant in Ghana and other parts of Africa.[16,37] This index is the gold standard for stratifying BC patients into prognostic categories, and based on the prognostic score, females with breast cancers are grouped into excellent, good, moderate, and poor categories, and the expected 5-year survival rates.[16,40-42]

Advances in the technology of genetic profiling for invasive BC have led to improved understanding of tumor subtypes associated with varying degrees of malignant virulence.[43,44] In clinical practice, we typically rely on immunohistochemistry (IHC) to detect expression patterns of three common molecular markers as a surrogate strategy to characterise the cancers of newly-diagnosed patients.[43,44] This technique stains cancer cells according to the presence of estrogen receptor (ER), progesterone receptor (PR) (referred to as hormone receptors) and human epidermal growth factor-2 (HER2) receptors.[43-45]

However, data on the molecular subtypes of breast cancer based on the immunohistochemical profiles are very scant in Ghana and other countries in Africa with varying frequencies.[31,45-48]. For instance, studies from Africa indicate that African women have a high proportion of high-grade tumors with an aggressive subtype, the triple-negative breast cancer (TNBC).[46-48] These tumors develop at a young age with an advanced stage at diagnosis.[46] The TNBC subtype has been reported to be very common among Ghanaians, Africans and African American women.[31,45-48]

Breast cancer is currently a public health problem in Ghana. Published data on BC in northern Ghana on the morbidity and mortality of the disease is limited. However, available data from the review of duplicate copies of medical certificate of cause of death (MCCD) at TTH, indicate that BC is the leading cause of cancer-related deaths in northern Ghana (unpublished). Women diagnosed with breast cancer do not routinely have IHC studies conducted on the tissue due to the non-availability of the service at the TTH and the high cost involved in handling the test conducted outside the region. Therefore, very few cases of BC diagnosed in the Department of Pathology of the TTH have had IHC conducted, although the current management of BC is not to treat without IHC results. There is, therefore, the need to review the current data on BC cases diagnosed in northern Ghana, to provide a better understanding of the disease patterns and to direct future research.

This was a cross-sectional descriptive study conducted in the Department of Pathology of the Tamale Teaching Hospital to evaluate the distribution and correlation of some pathologic factors of breast cancer in breast samples submitted to the unit from 1st January, 2012 to 31st December, 2021.

METHODS

Study Design and Site: This was a descriptive histopathological review in the Department of Pathology of the Tamale Teaching Hospital (TTH) from 1st January, 2012 to 31st December, 2021. The TTH is the largest tertiary referral hospital serving all the regions in northern Ghana and beyond, particularly, neighbouring Burkina Faso.

Data collection and analysis: Data were collected on age (≤39-years and ≥40-years) at histological diagnosis, tumor size (cm), histological subtype, Bloom-Richardson histological grade (I – III) for invasive cancers, lymph node status (N1 – N3) and positive margins, (defined as breast cancer cells within 2.0mm of the resection margins). The TNM staging (pathological) used was the system recommended by the American Joint Committee on Cancer (AJCC 6th edition of the cancer staging manual, 2002, New York). Primary breast tumors (T) were divided into three categories based on size (cm):

- Tumor less than or equal to 2.0cm (T1)
- Tumor larger than 2.0cm but less than or equal to 5.0cm (T2)
- Tumor larger than 5.0cm (T3).

Data were entered into a spread sheet and analysed using SPSS software version 26 (Chicago). The means for continuous variables were calculated, frequencies and percentages of categorical variables were also computed. The results were presented in frequency tables and bar charts. A 95% confidence interval was chosen and P-value <0.05 was considered as statistically significant.

A classification of the molecular subtypes of BCs diagnosed in TTH based on the available data was carried out. The subtypes were defined using estrogen receptor (ER), progesterone receptor (PR) (hormone receptors HR) and human epidermal growth factor 2 (HER2) status as: luminal A-like (ER+ PR+ HER2-), luminal B-like/HER2- (ER+ PR- HER2-), luminal B-like/HER2+ (ER+ PR- any HER2+), HER2+ (ER-PR-HER2+) and triple-negative breast cancer (TNBC) (ER-PR-HER2-). The different breast cancer subtypes represent distinct biological and clinical behaviours; some have more aggressive behaviour and worse prognosis, and respond differently to treatment options.

The confirmed invasive breast cancers in mastectomy samples were stratified into prognostic categories and the expected 5-year survival rates using the Nottingham Prognostic Index (NPI) scores were calculated (Table 1).

Table 1. Calculation of the Nottingham Prognostic Index (NPI) score, the categories and the expected 5-year survival rates

NPI Score	Test results (n%)	Prognosis	Expected 5-year survival rate
2.0 – 2.4		Excellent	93.0%
2.5 – 3.4		Good	85.0%
3.5 – 5.4		Moderate	70.0%
>5.4		Poor	50.0%

Breast cancers that met the following criteria were included in the calculation of the NPI:

1. Must be graded using the modified Bloom-Richardson grading system.
2. Must have stated gross primary tumor size (cm).
3. Must have lymph nodes retrieved from the axillary content.

The NPI was calculated as follows:

NPI = G + L + (S × 0.2).

G = Tumor grade (1, 2 or 3)

S = maximum size of invasive primary tumor

L: lymph node involvement (1 – 3)

No LN involved = 1

1-3 LN nodes involved = 2

> 3 LN nodes involved = 3

RESULTS

We reviewed the histopathological reports of 1,913 women diagnosed with breast pathology in the Department of Pathology from January 2012 to December 2021. There were 1,191 (62.3%) benign and 722 (37.7%) malignant tumours (P<0.0001), with malignant to benign ratio of 2:1. The great majority, i.e., 582 or 80.6%, of the malignant tumors were diagnosed in small- to medium-sized (core, incision and excision biopsies) samples, while 140 (19.4%) were in mastectomy specimens (P<0.0001).

Age characteristics of women with BCs diagnosed in small and medium-size breast biopsy in northern Ghana

The mean age (years) was 47.7±16.0, with a modal age group of 30 – 39 (26.9%), (Figure 1). There were 207 (36.4%) aged ≤ 39 years compared to 362 (63.6%) aged ≥40.

A total of 13 (2.2%) patients had no stated age at the time of data collection.

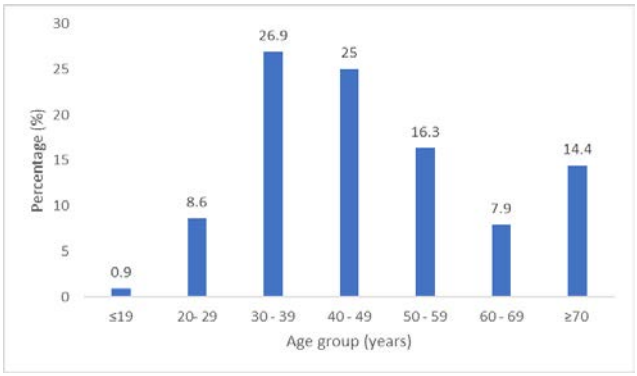

Figure 1. Age groups of women with confirmed breast cancer at the TTH

Relative proportions of female breast cancers diagnosed in northern Ghana over the period 2012 – 2021

There was a gradual rise in the proportions of female breast cancers diagnosed in the women over the period of review, more so in women aged ≥ 39 years (Figure 2).

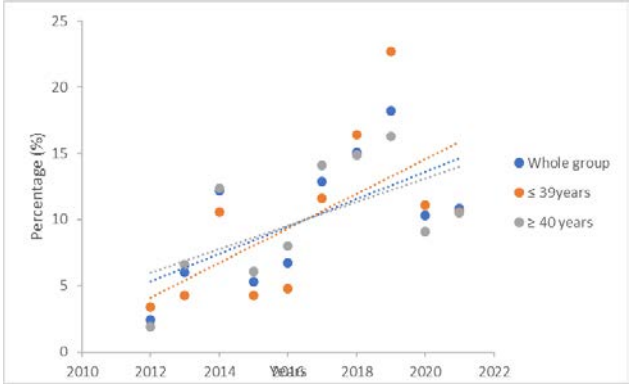

Figure 2. Trends in female breast cancers diagnosed in northern Ghana

Clinical presentation and duration of female breast cancer in northern Ghana

The commonest presentation of female breast cancer in northern Ghana was a painless palpable lump in 381 (65.5%) cases, followed by those with ulcerated masses - 143 (24.6%) (Table 2, Figure 3). Breast cancer commonly involved the left breast 306 (52.6%) (Table 1). The great majority (87.7%; P<0.0001) of the women diagnosed with breast cancer presented to a health facility for management 3 months (late) after the onset of their illness (Table 2).

Figure 3. Clinical presentation of female breast cancer in northern Ghana
A. A 78-year-old woman with advanced BC. B. A 49-year-old woman with fungating BC

Table 2. The clinical presentation of female breast cancer in northern Ghana

	Whole group (n/%)	≤39-years	≥40-years
Presenting symptom			
Painless lump	381(65.5)	132(63.8)	239(66.0)
Lump with skin ulceration	143(24.6)	50(24.2)	90(24.9)
Lump with nipple discharge	8(1.4)	3(1.14)	5(1.4)
Lump with nipple retraction	9(1.5)	3(1.14)	6(1.7)
Lump fixed to chest wall	6(1.0)	3(1.14)	4(1.1)
Painful lump	35(6.0)	17(8.2)	18(5.0)
Total	582(100.0)	208(100.0)	362(100.0)
Laterality of symptoms			
Right breast	271(46.6)	96(46.2)	169(46.7)
Left breast	306((52.6)	110(52.9)	196(54.1)
Bilateral breast	5(0.9)	1(0.5)	4(1.1)
Total	582(100.0)	208(100.0)	362(100.0)
**Duration (months) of symptoms (n = 481)*			
≤3	59(12.3)	24(13.8)	35(11.4)
4.-6	217(45.1)	84(48.3)	133(43.3)
7.-12	149(31.0)	46(26.4)	103(33.6)
>12	56(11.6)	20(11.5)	36(11.7)
Total	481(100.0)	174(100.0)	307(100.0)

Histological subtypes of BC in northern Ghana

The top five common histopathological subtypes of female breast cancers were: invasive ductal carcinoma (NOS) (78.0%), mucinous (3.1%), medullary (2.2%), invasive lobular (2.1%) and papillary carcinoma (2.1%), (Table 3). A very significant finding in this study was the relative frequency of malignant Phyllodes tumor (1.4%).

Histopathological grade of invasive breast female cancer in northern Ghana

Bloom-Richardson grade II was common (58.8%) among women aged ≥ 40 years; however, grade III was common among aged ≤39-years (43.5%) (Figure 4).

Stratification of breast cancer mastectomy samples into prognostic categories using NPI scores (n=140, 19.4% of all BC in women)

Approximately, 47.0% of the study population at the time of histopathological diagnosis had poor prognosis and hence a 5-year survival rate of 50.0%. However, there was a slight difference between those aged ≤39-years (42.2%) and ≥40-years (49.5%). (Table 4) *Nodal involvement of breast cancer diagnosed in mastectomy samples*

The mean numbers of positive lymph nodes were: 3.6±5.0 (Whole group), 2.8±4 (≤39-years) and 4.0±5.3 (≥40-years). Many of the cases had no lymph nodes involved by tumor (Figure 5).

Table 3. Histopathological subtypes of female breast cancer diagnosed in northern Ghana

Histological subtype of invasive breast cancers	Frequency (n)	Percent (%)
Invasive ductal (NOS)	452	78
Invasive lobular	12	2.1
Mucinous	18	3.1
Papillary carcinoma	12	2.1
Neuroendocrine carcinoma	5	0.9
Apocrine carcinoma	1	0.2
Malignant Phyllodes tumor	8	1.4
Sarcoma	10	1.7
Medullary carcinoma	13	2.2
Metaplastic carcinoma	11	1.9
Tubular carcinoma	5	0.9
Paget's disease of the nipple	2	0.3
Signet ring carcinoma	2	0.3
NOS+DCIS	12	2.1
Cribriform carcinoma	3	0.5
Inflammatory carcinoma	2	0.3
Invasive intracystic carcinoma	7	1.2
Mixed carcinoma	1	0.2
Invasive squamous cell carcinoma	2	0.3
Others	4	0.7
Total	582	100
Bloom-Richardson grade		

NOS; Not otherwise specified, DCIS; Ductal carcinoma in situ.

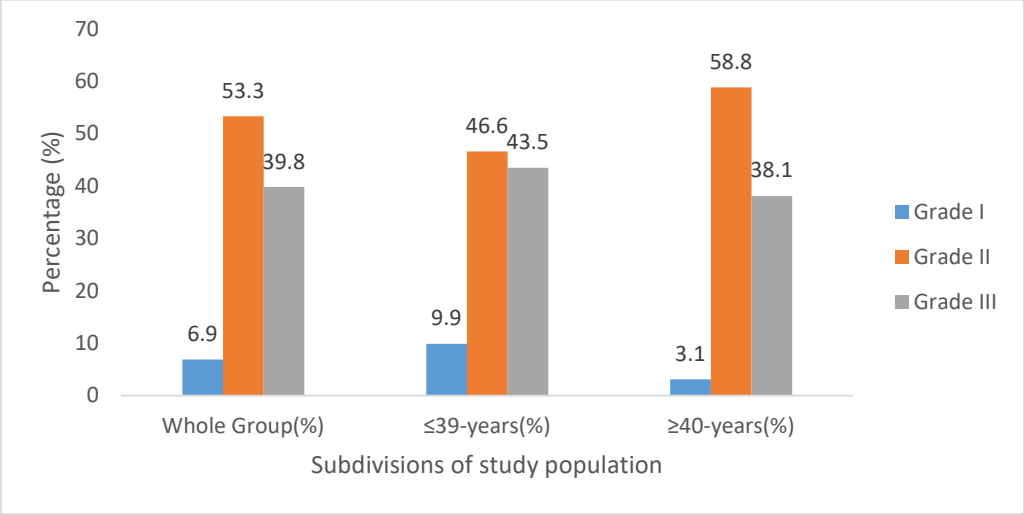

Figure 4. The Bloom-Richardson grades for breast cancer diagnosed in small to medium size breast samples

Table 4. Stratification of BC diagnosed in TTH into prognostic categories using NPI scores

	NPI	Finding (n/%)	Prognosis	Expected 5-year survival rate
Whole group	2.0 - 2.4	11(7.9)	Excellent	93.0%
	2.5 - 3.4	22(15.7)	Good	85.0%
	3.5 - 5.4	41(29.3)	Moderate	70.0%
	>5.4	66(47.1)	Poor	50.0%
≤ 39-years	2.0 - 2.4	4(8.9)	Excellent	93.0%
	2.5 - 3.4	8(17.8)	Good	85.0%
	3.5 - 5.4	14(31.1)	Moderate	70.0%
	>5.4	19(42.2)	Poor	50.0%
≥40-years	2.0 - 2.4	7(7.4)	Excellent	93.0%
	2.5 - 3.4	14(14.7)	Good	85.0%
	3.5 - 5.4	27(28.4)	Moderate	70.0%
	>5.4	47(49.5)	Poor	50.0%

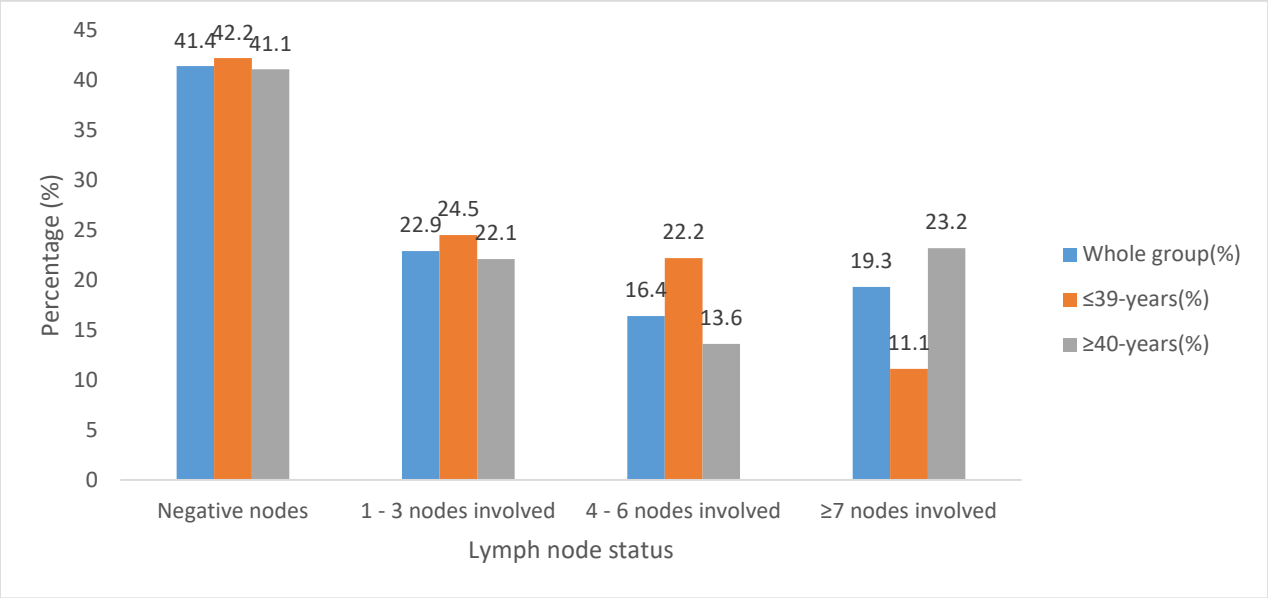

Figure 5. The lymph nodes status of breast cancer diagnosed in mastectomy samples

The pathological stage (pTNM) of breast cancer at the time of diagnosis in mastectomy samples

Pathological TNM stage III, was the commonest (35.3%) stage among the study population, more so with women aged ≥ 40 years (40.4%). Again, many of the study population had a high combined (III and IV) stage (58.1 %), compared64.9% for women aged ≥ 40 years (64.9%) (Figure 6).

The relative frequency and the age characteristics of molecular subtypes of confirmed breast cancer based on the IHC profiles

A total of 124 (17.2%) confirmed breast cancers diagnosed in the Department had IHC conducted on them. TNBC was the commonest molecular subtype (50.0%). BC patients aged ≥40 years recorded the highest rate of TNBC (54.1%)

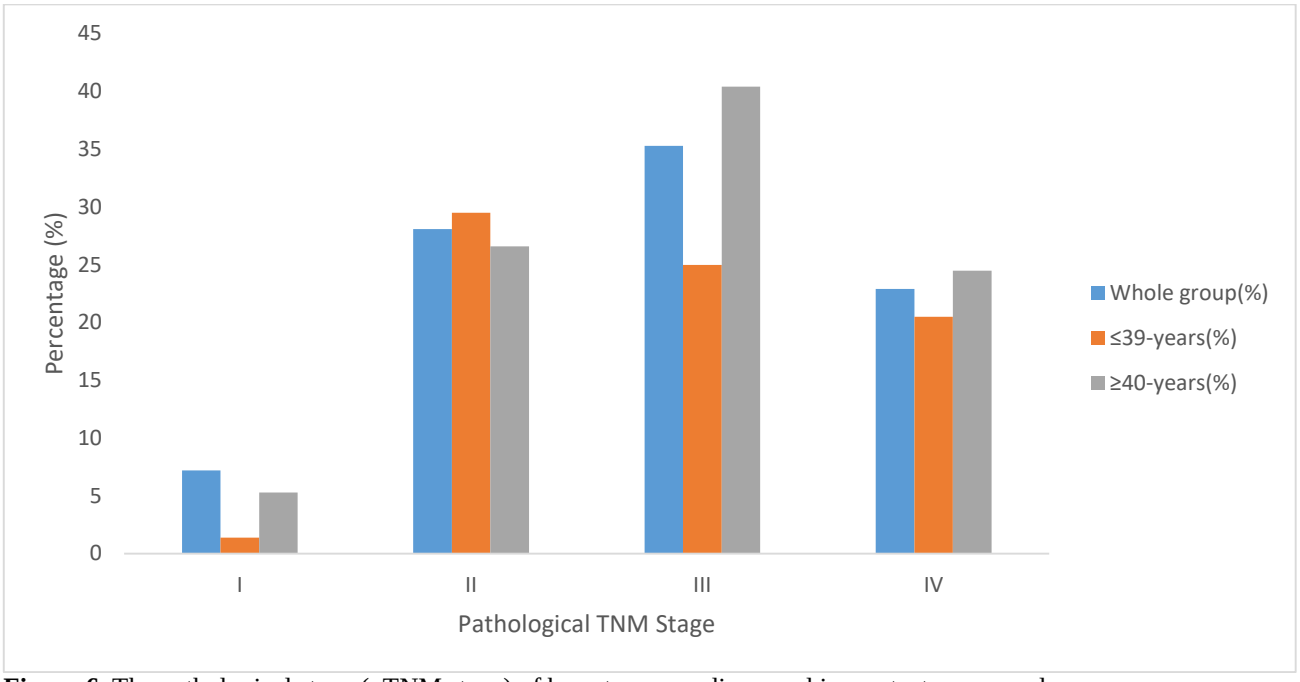

Figure 6. The pathological stage (pTNM stage) of breast cancers diagnosed in mastectomy samples

Table 5. Molecular subtypes of confirmed breast cancers in TTH based on IHC profile (n = 124)

Molecular subtypes	Whole group (n/%)	≤39-years (n/%)	≥40-years (n/%)
TNBC	62(50.0)	22(44.0)	40(54.1)
$HR^-/HER2^+$	13(10.5)	6(12.0)	7(9.5)
$HR^+/HER2^-$	45(36.3)	19(38.0)	25(33.8)
$HR^+/HER2^+$	4(3.2)	3(6.0)	1(1.4)
ER^+, PR^-, $HER2^-$	9(7.3)	2(4.0)	7(9.5)
ER^-, PR^+, $HER2^-$	1(0.8)	0(0.0)	1(1.4)
Total	124(100.0)	50(100.0)	74(100.0)

DISCUSSION

Breast cancer is a growing problem in low-resource settings and should be regarded as a major public health threat.[1-6] The incidence of breast cancer in most developing countries such as Ghana is not known due to the absence of a population-based cancer registry in such countries.[7] Published data on the disease are, therefore, derived mostly from single institution-based studies, particularly in the tertiary and teaching hospitals.[6-13]

In this current study conducted in a tertiary hospital in northern Ghana, many (62.3%) of the women had benign lesions, compared to their malignant counters (37.7%) (P<0.0001). The approximate malignant to benign tumor ratio was 1:2. This pattern directly contradicts with the 32.82% benign and 67.18% malignant tumors (malignant to benign ratio, 2:1) reported by Balekouzou *et al.*,[10] in central Africa. This further differs from the 75.0% malignant and the 25.0% benign tumors (malignant to benign ratio: 3:1) reported by Choe *et al.*,[11] years ago. The current findings are, however, in line with previous studies in other parts of Africa.[12,13] For instance, Der *et al.*,[12] in Accra, Ghana, reported the rates as 32.7% malignant and 67.3% benign (malignant to benign ratio: 1:2) tumors in 2013. The authors are not certain about the reasons for the wide disparity between the malignant tumors and the benign ones as stated above, but opined that it may be a reflection of the study type, method, sample size, the geographical location, and the experience and speciality of the clinician who examined and excised the lump.

The current study observed a rise in the relative proportions of confirmed female breast cancer cases in northern Ghana, irrespective of the age category, although it was steeper for patients aged ≤39 years. This pattern differs from published data decades ago from the developed countries that reported a decline in the rates of confirmed female breast cancers among their study populations.[14,15] The current pattern, however, supports previous studies conducted in the southern and northern parts of Ghana respectively.[16,17] A similar pattern was observed by Balekouzou *et al.*,[10] in Central Africa Republic. The reasons for the rise, as already mentioned by previous studies, are not very clear, but may be due to the level of education, increased awareness of the disease, the increasing use of non-invasive methods (ultrasound) of breast examination in health facilities, the practice of breast self-examination and early reporting.[17-19] For instance, Kocaöz *et al.*,[19] in their study attributed the rising trend in breast cancer to the impact of health education. Similarly, Ouyang *et al.*,[20] attributed the observed rise in the trend of breast cancer to community health education. Furthermore, rapid urbanization with the associated changes in life style, and the use of hormonal birth control pills has been found in previous studies to be major driving forces[21-23] for the rising trend in female breast cancer cases reported in health facilities. Breast cancer is a non-communicable disease (NCD), and as previous studies have reported, sub-Saharan Africa (SSA) is experiencing an epidemic of NCD as a result of the rapid epidemiological transition to urbanization and the adoption of western lifestyles.[24,25] As a result of this, the incidence of NCD in SSA has been on a rise in the recent past[26], and northern Ghana is not an exception.

In the current study, breast cancer was diagnosed in relatively young women with a mean age of 47.7±16.0 years, many (26.9%) being within the age group of 30 – 39. Again, the great majority (87.7%) of the women presented late (after 3 months) with clinically advanced disease. This disagreed with the age characteristics of women diagnosed with breast cancer in Europe, where it is reported to be a disease of elderly women. [27,28] However, the younger age at diagnosis and late presentation of breast disease in health facilities in northern Ghana support findings of previous studies in Ghana[9,16,29-32] and other parts of Africa (33,34,35) several decades ago. What is clear from the current study is that breast cancer is still diagnosed very late in relatively young women with advanced stage of the disease, and these parameters impact negatively on the treatment outcome and the survival rate. For instance, late presentation of breast cancer with skin involvement had been reported decades ago by Quartey-Papafio *et al.*,[30] and Der *et al.*,[12] and the picture is still the same in the current study. This calls for a united effort aimed at creating awareness of the disease, breast self-examination,

early reporting to health facilities for prompt diagnosis and treatment as advocated by previous researchers.[20,36]

Approximately, 93.1% of the study population had high (combined grade II and III) Bloom-Richardson (histopathological) grades tumors; women aged ≥ 40 years were more affected as compared to those aged ≤ 39 years [350 (96.9%) vs 187(90.1%)], P<0.0001. High grade invasive breast cancers have been reported in previous studies in Ghana and other areas. Thus, the current findings support previous studies[12,17,32,37,38] on this topic. For instance, Aamir *et al.*,[37] recorded a combined grade II and III value of 92.0% in their study among Sudanese women. Similarly, Der *et al.*,[32] recorded a combined histopathological grade of 94.7% in their study among Ghanaian women.

Many (58.2%) of the breast cancers diagnosed in the mastectomy samples were of high (combined III and IV) pathological stage. This was more obvious in the women aged ≥ 40 years (64.9%). High stage at diagnosis with breast cancer in women has been reported in Ghana too.[12,16,17,30-32] This, however, differs from a study by Walters *et al.*,[39] who found fewer women to be diagnosed with high TNM stages of breast cancers in the countries where their study was conducted. For instance, they observed that in Canada, 82.9% of the breast cancer patients were in stage I and II combined compared to 17.1% in stage III and IV combined. Again, in the UK, they reported 87.4% with I and II combined compared to 12.6% for stage III and IV combined.

In the current study, conducted in northern Ghana, women who had mastectomy as a treatment option for their cancers were stratified using the NPI score into: excellent (7.9%), good (15.7%), moderate (29.3%) and poor (47.1%), respectively. The corresponding expected 5-year survival rates were 93.0%, 85.0%, 70.0%, and 50.0%. There were some slight differences regarding the age groupings. For instance, 8.9% of women aged 39 years or less had excellent prognosis, compared to 7.4% for those aged 40 or more years. Again, 43.9% of women aged less than 39 years had poor prognosis compared to 51.1% for those aged 40 years or more. The pattern of prognostic categories observed in this study is close to that reported by Aamir *et al.*,[37] among Sudanese women. For instance, they reported the pattern as excellent in 1.3%, good in 13.3%, moderate in 37.3% and poor in 48.0% of the patients.[37] However, the rate for the poor prognostic category observed in the current study is much higher than rates in previous studies across the globe.[16,40-42] For instance, Der *et al.*,[16] in Accra, Ghana, reported a rate for poor prognosis of 31.9%, while Kene *et al.*, in neighbouring Nigeria reported a value of 24.5%[40]. The current poor rate value is, however, lower than the 56.4% reported in Uganda by Gakwaya *et al.*[41] and the 64.0% rate among black women in South Africa by Swaminathan *et al.*[42] The varying rates, the prognostic categories and the expected 5-year survival rates observed among previous studies and the current study in northern Ghana may be attributed to the study location, method of study and the sample size.

Advances in the technology of genetic profiling for invasive BC have led to improved understanding of tumor subtypes associated with varying degrees of malignant virulence.[43,44] In clinical practice, we typically rely on immunohistochemistry (IHC) to detect patterns of expression of three common molecular markers as a surrogate strategy to characterise the cancers of newly-diagnosed patients.[43,44] This technique stains cancer cells according to the presence of estrogen receptor (ER), progesterone receptor (PR) (hormone receptors) and human epidermal growth factor-2 (HER2) receptors.[43-45]

Approximately, 17.2% of the invasive breast cancers in this study had IHC studies conducted. The patterns of molecular subtypes observed were: TNBC (50.0%), $HR^+/HER2^-$ (36.3%), $HR^-/HER2^+$ (10.5%) and $HR^+/HER2^+$ (3.2%). We observed that TBCs were common (54.0%) in women aged ≥40 years, but the other subtypes were commoner among those aged ≤39 years. The relative proportion of TNBC observed in the current study is close to that reported in Accra, Ghana, by Der *et al.*[31] Der and co-authors reported the IHC patterns in that study as follows: TNBC (58.3%), $HR^+/HER2^-$ (8.1%), $HR^-/HER2^+$ (23.3%), $HR^+/HER2^+$ (10.3%). The current value of 50.0% is far lower than the 83% reported in the middle belt of Ghana by Sark *et al.*[45] and 73% reported by Huo *et al.*[46] in Nigeria and Senegal. However, the proportions of breast cancers in the northern Ghana study (50.0%) are much higher than the 18% reported in Tunisia by Ben Abdelkrim *et al.*[47] and the 44% in Kenya by Bird *et al.*[48] TNBC is now considered to be a hallmark of inherited susceptibility for breast cancer especially from deleterious mutations in the BRCA1 gene, prompting a genetic counselling referral when detected in women up to age 50 years.[38] Earlier studies into the TNBC subtype on invasive breast cancer found it to be more common in African American compared to white American women.[45] Furthermore, the frequency of TNBC is also higher in women of sub-Saharan Africa compared to those of other developing countries, suggesting that African ancestry may be the common denominator linked to TNBC risk.[31,38,45] The reasons for the wide variations in the frequency of TBNC are not very clear, but may be due to the sample size, population of study and the

method used for the study. For instance, Der *et al.*[31] in Ghana used a sample of 223 patients and reported 58.3% TNBC, Stark *et al.*[45] also in Ghana with a sample size of 75 reported the value at 83%. However, Ben Abdelkrim *et al.*,[47] in Tunisia with a study population of 194 reported a lower value of 18%; also, Bird *et al.*[48] in Kenya reported a value of 44%. Furthermore, many of the previously used archival paraffin embedded blocks were stored over years and this may have affected the antigenicity and hence the intensity of staining of the neoplastic cells, since potency decreases with duration of storage. A prospective population base study is highly recommended in Ghana, and for that matter in Africa, to ascertain the actual prevalence of the various molecular subtypes of breast cancer among the black population.

Limitations

- Not all breast samples are reported in our department, with some reported outside the department, and, thus, the data presented may not be a true reflection of the breast cancer burden in northern Ghana.

- Certain demographic factors like education, marital status, parity and contraceptive history are not routinely documented by clinicians and thus their effects on clinico-pathological features and prognostic significance could not be discussed.

- Very few cases had IHC conducted and this may have affected the relative proportions of the molecular subtypes of breast cancer in this study.

CONCLUSION

One out of two breast samples submitted to the Department was malignant, with a significant number being younger than 40-years of age. There was a rising trend in the number of BC cases in northern Ghana. Only few BC cases had IHC conducted in northern Ghana during the period of review, and the prognosis of BC in northern Ghana was poor, even at the time of diagnosis. Again, other demographic variables of prognostic significance were not stated by clinicians.

CONFLICT OF INTERESTS

We the authors have no conflict of interest to declare.

ETHICAL CONSIDERATIONS

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