

Research



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Mammographic outcomes among women attending a large imaging facility in Ilorin, Nigeria: a retrospective chart review

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Abstract

Introduction: breast cancer is the most common cancer among women in developed and developing countries. Breast cancer has recently overtaken lung cancer as the most diagnosed cancer in the world, as one in eight of all new cancers diagnosed worldwide each year is a cancer of the female breast. Breast cancer remains one of the leading causes of morbidity and mortality among women worldwide. Early detection is vital in reducing breast cancer-related morbidity and mortality through routine screening in women aged 40 years and above. Unfortunately, women do not usually present themselves for routine breast cancer screening. Most breast cancer cases were discovered accidentally by physicians following presentations of related symptoms. We, therefore, conducted a retrospective chart review of mammographic outcomes of women in a large imaging facility in Nigeria. **Methods:** we conducted a retrospective study of women who underwent breast cancer screening from 2014-2017 in one center, Harmony Advanced Diagnostic Centre (HADC), a large imaging facility in Ilorin, Kwara State. We reviewed the mammographic films and radiologists' reports of 111 women presented at the facility between 2014-2017. We reviewed the following mammographic breast features: the reason for the scan, breast symmetry, glandular distortion, calcification, nipple, and surrounding tissue, breast density, axillary lymphadenopathy, periareolar ductal system and lesion, opacity, suggestive diagnosis, and doctors' recommendations. The data were analyzed by SPSS version 20. We used descriptive statistics to generate proportions, and Chi-square was used to test for the association of categorical variables at $p < 0.05$ significant level.

Results: the mean age of the patients was 51.9 (± 8.7) years, with the majority (57.3%) between the ages of 50 - 69 years. The highest (34.2%) number of scans was recorded in 2016. Fifty (45.9%) of the scans were recommended by doctors because of complaints of abnormal feelings in the breast and surrounding tissues. Fifty-six (54.1%) of the scans were done for medical checkups or routine breast cancer screening. Of the 56 scans done for routine breast cancer screenings, 44.6% were solely the patients' idea as part of their yearly routine cancer screening exercise, while 55.4% of the scans were suggested by doctors in the absence of any suggestive breast cancer-related features or problems. Breast lump was the most common complaint leading to breast cancer screening. Most Breast tissue opacity was in the upper outer quadrant and upper inner quadrant at 46.0% and 23.0%, respectively. More than half (55.4%) of the patients were suggestive of having BI-RADS I and BI-RADS II at 27.7% each, respectively. About half (51%) of the patients were recommended for biopsy only, 40% for ultrasound, and 9% for both. Breast tissue calcifications and suggestive diagnosis were associated with the doctor's recommendations at $p = 0.004$ and 0.001 , respectively. **Conclusion:** women presenting voluntarily for routine breast cancer screening were low, suggesting poor breast cancer awareness in this population. Breast lumps are the most self-reported condition leading to a scan. A finding that is not surprising because breast lumps can be self-detected in most cases. A considerable number of women in this population exhibited mammographic breast features suggestive of breast cancer, suggesting that they are at a high risk of developing breast cancer. Biopsy was the preferred further investigation of choice among the doctors for confirming mammographic outcomes.

Introduction

Breast cancer continues to contribute significantly to deaths among women as the most common cancer among women in high-, middle- and low-income countries. It was estimated that about 13% of all cancer diagnoses around the world are cancer of the breast [1]. Reports by World Health Organization (WHO) in 2018 put the number of new cases at greater than 15 million, and envisaging deaths to increase to 12 million by 2020 [2]. Overall, breast cancer has overtaken lung cancer as the most commonly diagnosed cancer on the global scale in terms of cancer occurrence ranking, with an estimated 2.3 million breast cancer cases and about 685,000 yearly deaths in women [1]. Currently, breast cancer follows the global statistics, representing about 23% of all cancer cases and approximately 18% of all deaths [3]. The global burden is in developed countries, albeit the incidence rates are rapidly rising in developing countries. Paradoxically, the survival rates in developed countries, especially in the United States of America (USA), are over 90% [4] relative to that in developing countries like Nigeria, where survival rates are less than 10% [5,6]. In Nigeria, changes in lifestyle and urbanization may be attributable to the increased breast cancer rate. Currently, breast cancer follows the global statistics as the most commonly diagnosed cancer type, representing about 23% of all cancer cases and approximately 18% of all deaths [3]. The low survival rate in Nigeria is due to low awareness, poor health-seeking behaviours, cultural and religious beliefs, and poverty [7-11] which may precondition late presentation that is common to this part of the world [12-14].

Mammographic screenings and clinical examinations are the leading-recommended strategies by the American Cancer Society (ACS) for the early detection of breast cancer [15]. A mammogram is the imaging of choice for breast cancer screening globally because of its high affinity for breast cancer compared to other imaging techniques [5]. Early detection of breast

cancer has been shown to contribute to survival rates in breast cancer patients, especially in the Global North [4]. However, Nigeria and most African countries are below par in terms of breast cancer screening coverage [16-18] because of inadequate breast cancer screening programs and a lack of government commitments. The low breast cancer screening may be responsible for the late presentations and may be the reason for the low survival rates currently experienced in Nigeria and most developing countries. Breast cancer screening coverage is low in this part of the world. However, it is necessary to characterize the mammographic outcomes of the few women presented for screening to serve as a benchmark for breast cancer suggestive diagnosis in this homogeneous population and to use the information in breast cancer awareness campaigns. Therefore, we conducted this study to determine the proportion of women who presented for routine breast cancer screening, including those presenting for voluntary routine screening, in the absence of a doctor's recommendation or underlying conditions. Secondly, we characterized the mammographic outcomes of all the women presented for screening in this facility to determine the most frequent breast features suggestive of breast cancer common to this population. Lastly, we categorized the cancer stage based on the Breast Imaging-Reporting and Data System (BI-RADS) staging convention from radiologists' reports.

Methods

Study design and setting: this study was a retrospective chart review of patients' mammographic scan data. The data were for patients attending Harmony Advanced Diagnostic Center (HADC), a state-of-the-art modern imaging and laboratory facility in Ilorin, Kwara State. HADC has two major units, imaging, and laboratory services. The imaging unit provides CT and MRI scans, fluoroscopy, mammography, X-ray, and other scanning services with the most up-to-date equipment, including 3D image modules. The

laboratory unit provides various services including a haematology analyzer, automated coagulation analyzer, etc. HADC is a sole investor enterprise of the Kwara State Government (KWSG) managed by Medequip Medical Services, an international healthcare company headquartered in the USA. It won the award for Radiology Service Provider of the Year in 2018 in the Nigeria Healthcare Excellence Awards (NHEA).

Participants and variables: we reviewed all women data who underwent mammographic breast screening at HADC from 2014 to 2017. Figure 1 shows samples of mammographic scans. The data were obtained from their mammographic reports and case notes. We extracted data on age, year of the scan, and breast characteristics suggestive of malignant. The breast characteristics data collected include the medical indication for scan, breast symmetry, glandular distortions, calcifications, breast density, soft tissue opacity, periareolar ductal system, axillary lymphadenopathy, suggestive diagnosis, and recommendations for further investigative techniques. We obtained ethical approval from the University of Ilorin College of Health Sciences Ethical Committee. Since the study was retrospective, there was no contact with the subjects. The data or information collected relied solely on the already available data from the subjects' scan reports/charts. However, all identifiable such as names, phone numbers, and locations of the women, were not included in the data. Confidentiality was maintained as no one had access to the data except the research assistants and the investigators for privacy. Since the study depends mainly on a review of retrospective case charts, the risk was minimal.

Statistical methods: all data collected were entered into Excel spreadsheets and analyzed using the Statistical Package for Social Sciences (SPSS) software, version 20. We used descriptive statistics to generate proportions, and Chi-square to test for the association of categorical variables at $p < 0.05$ significant level.

Ethical considerations: research staff received training on Good Clinical Practice, Protection of Human Subjects, and Social and Behavioural Research conducted at the West African Bioethics Program. All ethical issues in the Helsinki Declaration document were strictly adhered to. Ethical approval was sought from the University Ethical Review Committee, University of Ilorin.

Results

We reviewed a total of one hundred and eleven scans. The majority (57.3%) of the patients were between 50 and 69 years (mean age is 51.9 ± 8.7 years). The highest (34.2%) number of scans was recorded in 2016, while the lowest (6.4%) was recorded in 2014. Fifty (45.9%) of the scans were recommended by patients' doctors because of complaints of abnormal feelings in the breast and surrounding tissues. Fifty-six (54.1%) of the scans were done for medical checkups or routine breast cancer screening. Of the 56 scans done for routine breast cancer screenings, 44.6% were solely the patients' idea as part of their yearly routine cancer screening exercise, while patients' doctors suggested 55.4% in the absence of any suggestive breast cancer-related features or problems, as shown in Table 1. Of the 50 patients scanned because of breast abnormalities diagnosed by doctors, 25 (44.2%) had lumps in either breast separately (right, 13 (22.6%); left, 9 (17.0%) or in both breasts, 3 (2.7%) together. Seven women (13.2%) had nipple discharge from both breasts. Eight (15.1%) complained of pains in their breasts, right breast (5.7%), left breast (1.9%), and both breasts (7.5%) (Figure 2).

Looking at the characteristic features of the breast seen on the mammogram, a heterogeneously dense pattern of breasts accounted for over 90% of the breast density pattern among women. Detailed results are in Table 2. We looked at the location of soft tissue opacity; of the 35 soft tissue opacity observed in the patients, about 70% was in the upper outer quadrant (46%) and lower inner quadrants (23%) of the breasts. More details in

Figure 3. Of the 83 patients whose data were available for the BI-RADS categorization, more than half (55.4%) of these women were suggestive of having BI-RADS I and BI-RADS II at 27.7% each, respectively. Of the 35 patients recommended for further investigation, more than half (51%) of the patients were recommended for biopsy only, 40% for ultrasound only, and 9% for both (Table 3).

Discussion

Breast cancer screening is arguably the best way to prevent aggressive breast cancer treatments like surgery, mastectomy, and chemotherapy, which are the available options for late-stage cancer treatment for breast cancer patients. Early detection of breast cancer is essential for improving treatment outcomes. A mammogram, though not perfect, is the most used imaging modality for breast cancer screening because it is readily available and affordable even in developing countries. This study presents a chart review of women screened for breast cancer in a large imaging facility in Ilorin, Kwara State, Nigeria. Out of the 111 women who presented for breast cancer screening in this facility, only about half presented for routine screening. Out of this, less than 50% were there of their own volition as part of their yearly routine screening. The other half was through referral as part of the ongoing medical investigation from other hospitals. Overall, only about 23% of the total women who presented for mammogram scans in this facility came for self-routine breast cancer screening, suggesting a low breast cancer screening awareness in this region. Inadequate breast cancer screening awareness may be responsible for low breast cancer screening coverage and low breast cancer survival rate in Nigeria compared to developed countries [13-15]. Other factors contributing to low coverage of breast cancer screening and low survival rates for breast cancer patients may be poverty and lack of adequate support from the government.

The second aim of this study was to characterize breast features suggestive of breast cancer based on mammographic reports and physical examinations. These features include breast asymmetry, breast lumps, glandular distortion, abnormal calcifications, abnormal nipple, peri-areolar ductal system, axillary lymphadenopathy, lesions, soft tissue opacity, and density. We found breast lump as the most self-reported breast abnormality, in line with previous findings [19,20]. Abnormal breast lumps can be self-detected and may inform patients to consult a doctor for medical advice. This may suggest why we recorded more women with abnormal breast lumps presenting for breast cancer screening. Breast asymmetry is common among breast cancer patients [21]. Only about a third of our patients have asymmetrical breasts. Breast calcification is tiny bits of calcium in the breast [22]. More than one-fifth of our patients presented with abnormal calcifications. Media *et al.* reported an association between microcalcification and perimenopausal status. They posited that patients with heterogeneously dense breasts were likelier to have microcalcification on mammograms. Interestingly, more than 90% of women in our study have heterogeneously dense breast patterns. A body of evidence has linked mammographic density to increased susceptibility to breast cancer [23-25]. Axillary lymphadenopathy can indicate metastasis and breast cancer prognosis [26]. More than half of the women in our study had axillary lymphadenopathy, indicating more likelihood of having breast cancer. Mammograms detect breast lesions as either benign or malignant. In this study, we did not classify breast lesions. However, we reported the percentages of women with breast lesions as detected by the mammogram. Only about a third (34.7%) of the women whose data on lesions were available had breast lesions. This finding is slightly higher than the reported lesion (26.3%) among women in South-eastern Nigeria [27]. Most soft tissue opacities were seen in the upper outer quadrant of the breast among women in this study. The upper outer quadrant is

the most preferred site for breast cancer [28]. Therefore, we can posit that women whose mammograms show opacities in their breasts' upper outer quadrants are more likely to develop breast cancer.

Breast Imaging-Reporting and Data System (BI-RADS) is a reporting system recommended by the American College of Radiology (ACR) for classifying breast lesions on a mammogram. BI-RADS is used to sort results into seven categories numbered 0 to VI: A BI-RADS 0 means incomplete finding; BI-RADS I mean negative finding; BI-RADS II means benign (non-cancerous) finding; BI-RADS III means probably benign, a short time frame follow-up is usually suggested; BI-RADS IV means suspicious abnormality - Biopsy is needed to confirm finding; BI-RADS V means highly suggestive of malignancy and BI-RADS VI means known biopsy (proven malignancy). BI-RADS V and VI require appropriate action to be taken [29]. Sixty percent of our patients fall in the BI-RADS I and II categories, suggesting that most of the women were cancer-free at the time of the scan. However, about 40% fall in BI-RADS III to V category. This is a cause for concern because many of these women may be lost to follow-up, and appropriate treatment may not be administered. This may in part contribute to the low survival rate typical to this part of the world. We also looked at the relationship between the doctor's plans/recommendations for further or alternative investigations based on mammogram outcomes with suggestive diagnosis based on BI-RADS staging. It is not surprising that we found doctors' plans highly dependent on BI-RADS staging. These findings confirmed that Radiologists/doctors in this center strictly adhere to global standard practice. Our findings on the age of women at scan conform with previously reported findings - women between 50-69 years have the highest attendance rate [30,31]. The attendance rate of this age bracket in our study is about 60%. American Cancer Society recommends yearly breast cancer screening for women between the ages 45 to 54 years [19], suggesting that women

below the age of 50 years in our study are well-represented.

A few limitations of our study include the following: the study relied only on doctor's reports, which may be a potential source of bias. The diagnoses made were not definitive but suggestive. The mammographic film of each patient was read by a single radiologist, hence subjective.

Conclusion

In this study, less than a third of women presented voluntarily for routine breast cancer screening, suggesting poor breast cancer awareness in this population. We found a heterogeneously dense pattern of breast tissue and distortion of the glandular tissue as the leading mammographic features suggestive of breast cancer in this population. More than a third of women in this study were below the BI-RADS safe zone, suggesting a late presentation.

What is known about this topic

- Globally, breast cancer is the most commonly diagnosed cancer type, representing about 23% of all cancer cases and approximately 18% of all cancer deaths;
- Breast cancer screening coverage is low in Nigeria and Africa;
- The global burden is higher in developed countries compared to developing countries; paradoxically, the survival rate is higher in developed countries relative to developing countries.

What this study adds

- Less than a third of women presented voluntarily for routine breast cancer screening;

- The common mammographic features suggestive of breast cancer in this population are heterogeneously breast tissue and glandular distortion;
- More than a third of women fall between the BI-RADS III and V categories.

Competing interests

The authors declare no competing interest.

Authors' contributions

Abdulummin Ibrahim and Aisha Oluwakemi Olagunju conceptualized, designed, implemented the study, and drafted the manuscripts. Abdulummin Ibrahim, Aisha Oluwakemi Olagunju, Kentse Mpolokeng, Muhammad Kabir Abdulkadir, Khadijat Oluwakemi Mashood, Sadiya Musa Gwadabe, Abdulrasheed Ajao Abdullahi, Aminu Imam and Risikat Eniola Kadir were involved in the analysis and revised the drafted manuscript for intellectual content. All the authors have read and agreed to the final manuscript.

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Tables and figures

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Figure 2: observed breast abnormalities that lead to a scan

Figure 3: locations of soft tissue opacity

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Table 1: patients' characteristics	
Socio-demographic characteristics	(N = 111)
Age group (years)	n = 110
30 – 39	7 (6.4%)
40 – 49	36 (32.7%)
50 – 59	44 (40.0%)
60 – 69	19 (17.3%)
70 and above	4 (3.6%)
Mean age ($\pm$ S.D) years	51.9 ($\pm$ 8.7)
Years of scan	n = 111
2014	9 (8.1%)
2015	29 (26.1%)
2016	28 (34.2%)
2017	35 (34.5%)
Range (min-max)	9 – 38
Clinical indications	n = 109
Routine-self	25 (22.9)
Routine-doctor	31 (31.2)
Problem (suggestive)	50 (45.9)
N = total number of charts reviewed, n = number of data available for analysis	

Table 2: characteristic features of scanned breasts	
Socio-demographic characteristics	(N = 111)
Breast symmetry	n = 54
Symmetrical	37 (68.5%)
Asymmetrical	17 (31.5%)
Glandular distortion?	n = 86
Yes	19 (22.1%)
No	67 (77.9%)
Abnormal calcifications	n = 94
Yes	21 (22.3%)
No	73 (77.7%)
Abnormal nipple?	n = 92
Yes	5 (5.5%)
No	87 (84.5%)
Peri-areolar ductal system	n = 63
Dilated	2 (3.2%)
Normal	61 (96.8%)
Axillary lymphadenopathy?	n = 94
Yes	48 (51.1%)
Nil	46 (48.9%)
Lesion?	n = 49
Yes	17 (34.7%)
Nil	32 (65.3%)
Soft tissue opacity	n = 100
Yes	35 (38.9%)
No	65 (61.1%)
Density	n = 33
Heterogeneously dense pattern	31 (93.9%)
Non-heterogeneously dense pattern	2 (6.1%)
N = total number of charts reviewed, n = number of data available for analysis	

Table 3: suggestive diagnosis and plans/recommendations for further or alternative diagnosis	
Doctor's diagnosis and plans	N = 111
Suggestive diagnosis	n = 83
BI-RADS 0	4 (4.8%)
BI-RADS I	23 (27.7%)
BI-RADS II	23 (27.7%)
BI-RADS III	14 (16.9%)
BI-RADS IV	13 (15.7%)
BI-RADS V	6 (7.2%)
Recommendation for further investigation	n = 35
Biopsy	18 (51.4%)
Ultrasound	14 (40.0%)
Both	3 (8.6%)
N = total number of charts reviewed, n = number of data available for analysis	

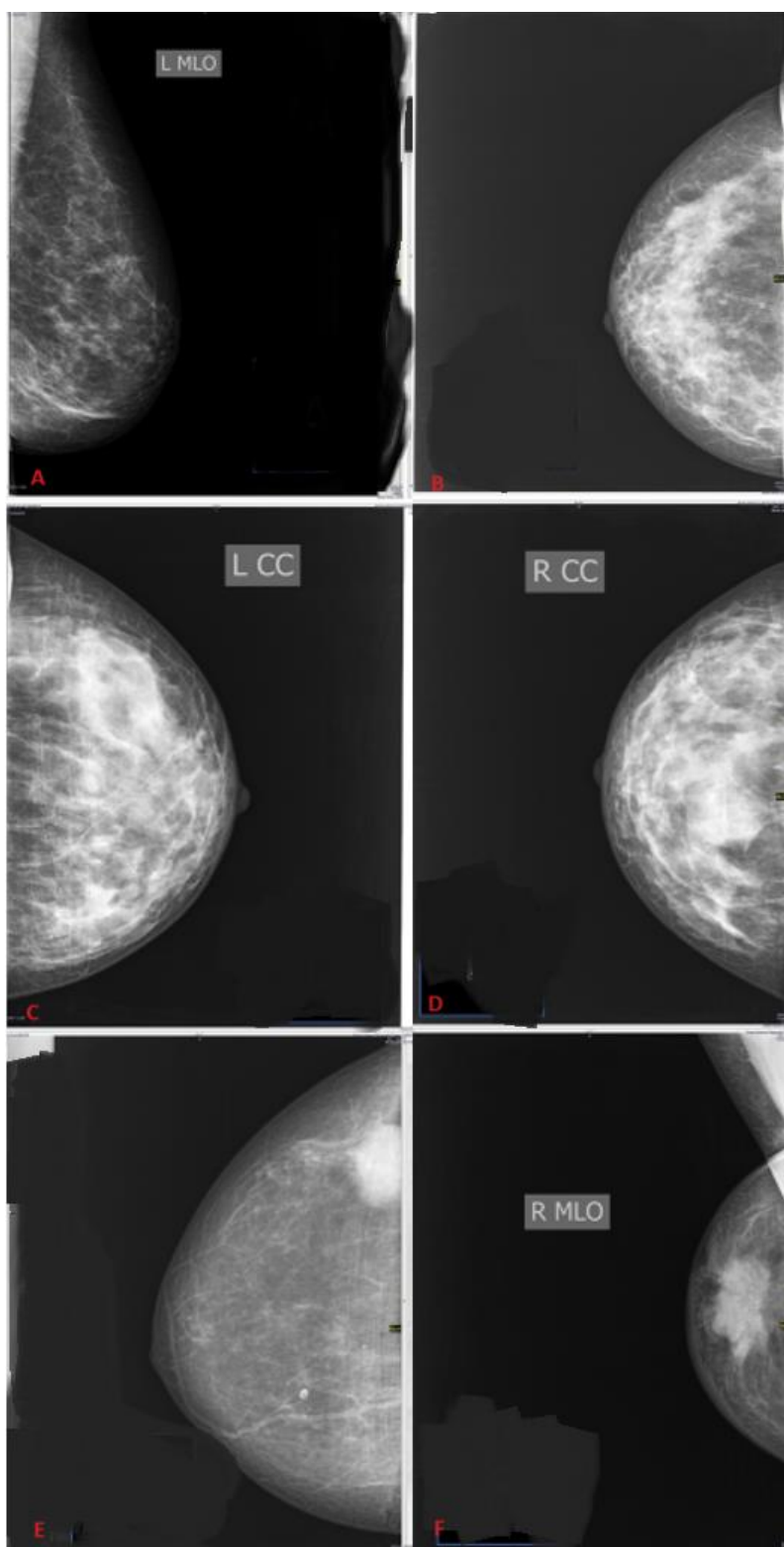


Figure 1: (A, B, C, D, E, F) samples of mammographic scans

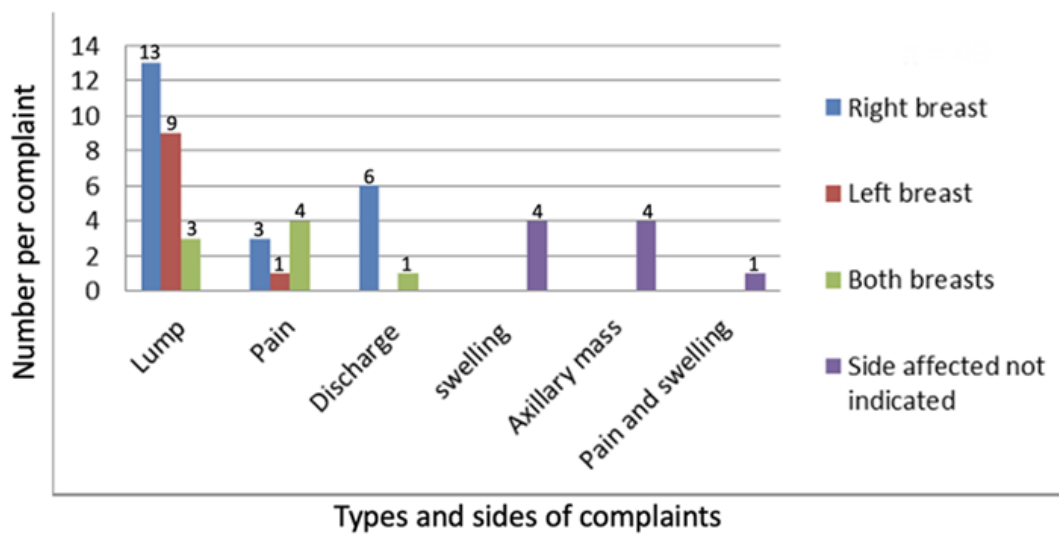


Figure 2: observed breast abnormalities that lead to a scan

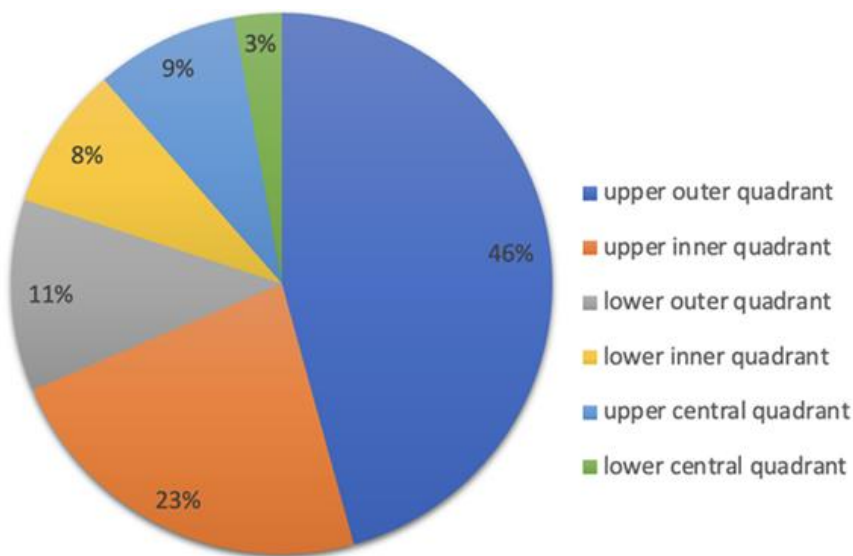


Figure 3: locations of soft tissue opacity