Glandular density distribution in digital mammography

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ABSTRACT

Objectives

The aim of this study was to evaluate the breast density distribution in digital mammography of patients.

Materials and Methods

This prospective study was performed in the Department of Radiology and Imaging of Tribhuvan University Teaching Hospital (TUTH). Data was collected over a period of 4 months from July to October 2019 and included one hundred and seventy patients who came for diagnostic or screening mammography, which was recorded as indication for the test. Appropriate statistical methods were used for analysis.

Results

The mean age of women included in this study was 48.09 ± 9.13 years. Nearly 43% of the patients had dense breasts. According to Breast Imaging, Reporting and Data System (BIRADS) classification of lesions, maximum mammograms i.e.,77.7% were normal or benign while 4.7% were BIRADS category 0 and 17.7% were of BIRADS category 3, 4 or 5. A negative correlation was observed between age and breast density category. The relationship between breast density and BIRADS category or indication for the test was insignificant while a weak correlation was observed between it and mammographic findings.

Conclusion

Our study showed an inverse linear relationship between age and mammographic density which is consistent with the fact that mammography has higher sensitivity in older age group usually with lesser density. No or weak correlation was present between breast density and BIRADS category, indication or findings on mammography. All patients in BIRADS 0 category had dense breasts.

Key words: **BIRADS, glandular density, mammogram.**

Introduction

Breast cancer is the most common malignancy of women with the world age-standardized incidence rate of 43.3 per 100,000 person-years[1,2]. A study in 2014 revealed that breast cancer was the most prevalent cancer and fourth leading cause of cancer-related mortality among women in Asia[3]. In Nepal, the most common cancer sites in females were found to be cervix uteri, breast and lungs[4]. The risk of breast cancer increases exponentially up to the age of menopause, and at a slower rate thereafter[5].

Screening mammography is an established modality for early cancer detection which can avoid mastectomy, reduce the probability of recurrence, decrease morbidity and mortality[6]. Various

societies provide guidelines for screening exam for early detection in the breast with American College of Radiology (ACR) recommending annual screening from 40-74 years of age[7]. Mammography involves projection of 3D anatomical structures on a 2D film screen or image sensor with two imaging projections of each breast, craniocaudal (CC) and mediolateral oblique (MLO) views, are routinely obtained for better understanding of overlapping structures and confirm presence of any lesions[8].

There are a number of established risk factors for breast cancer, including personal and family history as well as mammography density[9]. Higher breast density, on one hand is a risk factor itself and on the other obscures abnormalities on mammograms, thus decreasing its sensitivity[10,11]. Breast density depends upon the amount of radiodense epithelium and stroma to radiolucent fatty tissue and is higher in younger age, females with lower body mass index and hormone replacement therapy. The breast density has been divided into four categories by the 5th edition of Breast Imaging, Reporting and Data System (BIRADS) based on masking effect of dense tissue and is subjective unlike percentage of dense tissue in the 4th edition. The first two categories i.e., a and b are considered less dense and other two, c and d, as dense breasts[12].

The purpose of this study was to evaluate distribution of breast density and evaluate its relationship with age, indication for the test and BIRADS categories for lesion and mammographic findings, which may have implications for age-specific and risk-specific guidelines for breast cancer screening.

Materials and Methods

This was a quantitative, cross sectional descriptive study conducted in the Department of Radiology and Imaging, Tribhuvan University Teaching Hospital (TUTH) for the period of four months from July to October 2019. All the subjects who visited for mammography and gave verbal consent to participate, were included in this study and purposive sampling used. Post mastectomy patients were excluded. Two basic projections of mammography were done for all subjects with the digital mammographic unit (MAMMOMAT Fusion). These mammograms were reported by radiologists with more than 7 years of experience and findings in report were noted along with other patient information in predesigned data collection sheet.

The glandular density was categorized according to the ACR-BIRADS[12] as:

a. Almost entirely fatty
b. Scattered areas of fibroglandular density
c. Heterogeneously dense
d. Extremely dense.

Verbal consent was obtained and privacy of the patients maintained.

Statistical analyses were carried out with the help of Microsoft Excel and SPSS version 25.0. Descriptive analyses were used to examine the association breast density with age, BIRADS category, indication and findings. To evaluate the significance of a linear association, we conducted the Spearman's rank-order correlation analysis. All p-values were obtained from two-tailed tests.

Results

During the period of study, the sample consisted of 170 female patients, age varying from 22 to 79 years with mean of 48.09 ± 9.13 years. The largest proportion of patients was in the age group 40–49 years (43.5%), while least frequency in 70-79 years age group. A total of five women in age group 20-29 years and 17 women in age group 30-39 years were included in our study, which is below the recommended age for screening. Out of five patients of age group 20-29 years, two patients were in screening category with family history of breast cancer and other three had diagnostic indication presenting of mass, nipple discharge and unusual enlargement of breast. Likewise, of the 17 patients of age group 30-39 years, six patients had screening and rest diagnostic mammography presenting mostly with mastalgia, lump, swelling, fibrocystic changes and nipple discharge.

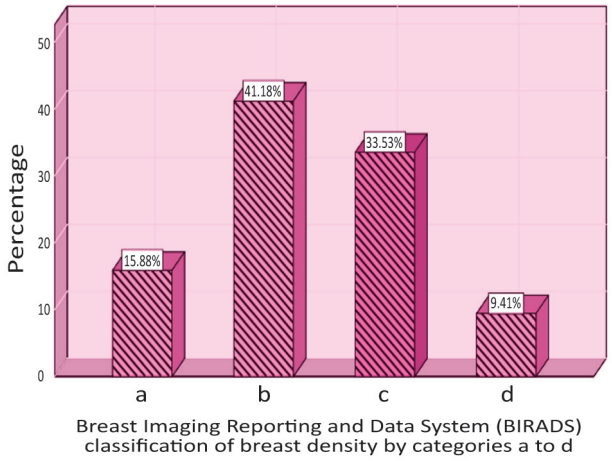

Figure 1. *Bar diagram showing Percentage Distribution of mammographic density in categories a-d.*

The glandular density of breast was categorized according to the ACR BIRADS as a-d and included 15.88 % (n=27), 41.18 % (n=70), 33.53 % (n=57) and 9.41 % (n=16) in categories a, b c and d, respectively (Fig. 1).

The density distribution in various age groups is as shown in table 1. As expected, a majority of patients i.e., 27.1% (n=46) between the ages of 40 and 49 years had high-density breast tissue belonging to categories c and d.

Table 1. Distribution of mammographic density in various age groups

Mammographic Density				
Age groups	a n(%)	b n(%)	c n(%)	d n(%)
20 - 29	1 (0.6)	1 (0.6)	1(0.6)	2(1.2)
30 - 39	0(0.0)	7(4.1)	7(4.1)	3(1.8)
40 - 49	9(5.3)	19 (11.2)	36 (21.2)	10(5.9)
50 - 59	7(4.1)	35(20.6)	11(6.5)	1(0.6)
60 - 69	7(4.1)	8(4.7)	2(1.2)	0(0.0)
70 - 79	3(1.8)	0(0.0)	0(0.0)	0(0.0)
Total	27(15.9)	70(41.2)	57(33.5)	16(9.4)

Using Spearman's rank-order correlation analysis, it showed a significant negative correlation between age and breast density category with p value <0.001 (Fig. 2).

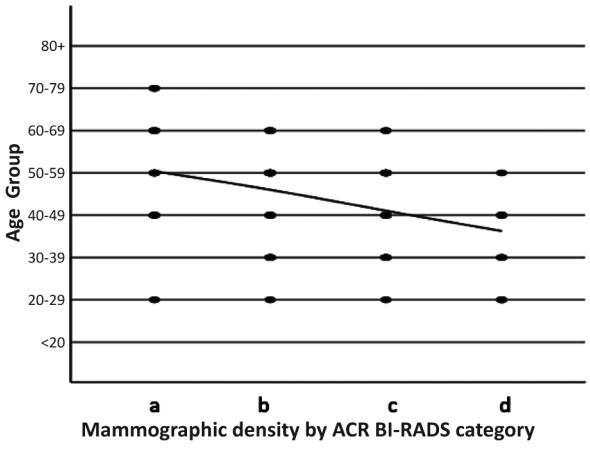

Figure 2. *Simple scatter plot showing significant negative correlation between increasing age and breast density.*

The distribution of BIRADS classification of the lesions and density showed BIRADS 0 suggestive of additional imaging in 4.7% (n=8) cases (Table 2). However, dense breast showed insignificant relationship with BIRADS category (P-value 0.103). BIRADS 4 and 5 suggestive of suspicious malignancy was present is 8.3% (n=14).

Table 2. Distribution of mammographic density with BIRADS categories

Mammographic Density				
BIRADS Category	a n(%)	b n(%)	c n(%)	d n(%)
0	0(0.0)	0(0.0)	1(0.6)	7(4.1)
1	10(5.9)	32(18.8)	23(13.5)	5(2.9)
2	15(8.8)	24(14.1)	21(12.4)	2(1.2)
3	1(0.6)	6(3.5)	8(4.7)	1(0.6)
4a	0(0.0)	5(2.9)	1(0.6)	1(0.6)
4b	0(0.0)	2(1.2)	0(0.0)	0(0.0)
4c	0(0.0)	1(0.6)	2(1.2)	0(0.0)
5	1(0.6)	0(0.0)	1(0.6)	0(0.0)
Total	27(15.9)	70(41.2)	57(33.5)	16(9.4)

Table 3. Distribution of mammographic density and indications

Indication	*Mammographic Density*				*P-value*
Diagnostic	a n(%)	b n(%)	c n(%)	d n(%)	0.865
	13(7.6)	49(28.8)	33(19.4)	10(5.9)	
Screening	14(8.2)	21(12.4)	24(14.1)	6(3.5)	
Total	27(15.9)	70(41.2)	57(33.5)	16(9.4)	

Most of the mammograms i.e. 61.8% were diagnostic and remaining 38.2% were for screening purposes (table 3). The most frequent clinical indications were mastalgia (23%) and lump or masses (21.2%). Though greater percentage of cases with higher breast density was seen in diagnostic mammography, no significant relationship was demonstrated between indications and density (P-value 0.865).

Mammographic findings were categorized as normal and abnormal with 67 (31.8%) being normal. Abnormal findings (n=103 cases i.e., 60.6%) included mostly benign calcification 54(39.4%). Notably, greater percentage of patients with abnormal findings had more dense breasts and Spearman's rank-order correlation analysis showed a weak correlation (p<0.005).

Discussion

Higher glandular density on mammogram is a risk factor for malignancy and also masks lesions - both appearing hyperdense and thus, decreases mammographic sensitivity[10,11]. So, in certain

countries, it is necessary to report the breast density as it limits the diagnostic accuracy and is an independent risk factor for cancer. With the change in basis of glandular density categorization basis from percentage to the more subjective masking effect of glandular tissue, in the 5th edition of ACR BIRADS, there is an overall increase in number of dense assessments. This may be because even a mammogram with less than 50% fibroglandular tissue density which was categorized as '2' previously, may mask underlying cancer and qualify to be categorized as category c or heterogeneously dense according to the current 5th edition[12].

In our study, about 12.9% of patients were younger than 40 years which is not the usual recommended age for screening. However, these patients either had family history of breast cancer or had come for diagnostic mammography. Women at high risk of malignancy like those with genetic mutations or family history of breast cancer, screening should start early, most societies suggesting 25 years of age preferably with contrast enhanced MRI or ultrasound. The majority of women who were examined were in 40-49 years age group which is similar to other studies[13,14].

The most prevalent breast density pattern in our study was the scattered fibroglandular pattern accounting for 41.18%, similar to other studies[15,16]. However, study by Obajimi et al. showed predominantly fatty, ACR-BIRADS category-a as the most prevalent breast pattern which could be due to greater age of included patients in their study[17]. The inverse relationship between breast density and patient age is in agreement with most of the existing literature[18-20]. High breast density was predominant in younger age groups less than 50 years, while lower breast density was seen in older women.

The most frequent clinical indications were diagnostic - breast pain (mastalgia) and breast lump. In some other national studies, breast lumps were the most common indication for diagnostic mammography[17,21]. In our study, only 4.7% mammograms were BIRADS category 0, similar to findings by Bello[22]. This lower number of BIRADS 0 can be explained by our protocol of performing adjunct sonography in most patients with dense breasts and ensuring more definite conclusion in terms of normal, benign or malignant as a lot of our patients are lost to follow up. Results from Van der Waal et al. concluded mammographic sensitivity to be lower for women with dense breasts compared with fatty ones[23].

BIRADS 4 and 5 accounted for 8.3% of the cases, needing further histopathological correlation, being suspicious of malignancy. This figure is much lower than the findings by Adebamowo et al. where 44.5% of women had suspicious mammograms[24]. Abnormal mammograms were mostly benign and present in 60.86% cases. This finding compares favorably with findings from similar studies with range from 29% - 83%[25].

Conclusions

Our study shows an inverse linear relationship between age and mammographic density. However, this does not imply that age is an accurate surrogate for breast density. We did not find significant relationship between breast density and mammographic findings or BIRADS category. Mammography is a sensitive tool for the early detection of breast cancer in women with less dense breast which may include younger patients. On the other hand, even older women especially with high risk and dense glandular tissue may need additional modalities such as tomosynthesis, ultrasound or MRI.

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