Med. J. Cairo Univ., Vol. 90, No. 2, March: 417-429, 2022
www.medicaljournalofcairouniversity.net

Additive Role of Digital Tomosynthesis in Detection of Suspicious Mass in Dense Breast

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Abstract

Background: Breast cancer in women is considered a major public health problem throughout the world. It is the most common cancer among women both in developed and developing countries, accounting for 22.9% of all female cancers.

Aim of Study: Our study aimed to compare sensitivity and specificity of DBT and FFDM in detection of BC represented as a mass in women with dense breasts (categories C and D according BI-RADS Atlas) and correlation with histopathology to confirm superior role of tomosynthesis and it is malignant mass.

Patients and Methods: This is across sectional included 30 patients with dense breasts (categories C and D) with suspicious mass (BIRADS category IV, V) on any imaging modality were included. First imaging modality was FFDM followed by DBT and high resolution ultrasound (HHUS) in order to establish correlation with mammographic findings than finally histopathology to confirm diagnosis of cancer.

Results: The current study based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at category C in 11 patients (true positives). Tomosynthesis did not detect mass lesions in 5 patients (true negatives). Ten patients had false negative results. We found that Tomosynthesis had overall sensitivity, specificity, and diagnostic accuracy of 52.4%, 100% and 61.5% respectively in detecting the breast mass in our patients. Positive predictive value was 100% while the negative predictive value was 33.3%. Based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at category D in 2 patients (true positives). Tomosynthesis did not detect mass lesions in 2 patients (true negatives). Two patients had false negative results. We found that Tomosynthesis had overall sensitivity of 50% with Positive predictive value was 100%. Based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at all ACR categories in 13 patients (true positives). Tomosynthesis did not detect mass lesions in 5 patients (true negatives). Twelve patients had false negative results. We found that Tomosynthesis had overall sensitivity, specificity, and diagnostic accuracy of 54.2%, 100% and 62.07% respectively in detecting the breast mass in our patients. Positive predictive value was 100% while the negative predictive value was 31.25%. Our results showed that 100% of lesions detected by tomosynthesis were malignant tumors. 83.3% of lesion detected were invasive ductal carcinoma, 6.7% were invasive lobular carcinoma, 3.3% Inflammatory carcinoma and 6.7% were DCIS. The present study showed that there were high statistically significant differences between digital mammography and tomosynthesis in BIRADS.

Conclusion: We concluded that DBT showed higher sensitivity and specificity and diagnostic accuracy than Mammography as it allows better detection and characterization of breast lesions with decrease of false positive and negative cases.

Key Words: *Digital tomosynthesis – Suspicious mass – Dense breas.*

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Introduction

THE role of digital breast tomosynthesis (DBT) in medical practice has been increasing continuously over the last decade. A number of early clinical studies has showed a higher accuracy of DBT compared to standard full-field digital mammography (FFDM) **[1]**.

DBT is a form of limited-angle tomography **[2]**. During acquisition of tomosynthesis images, an X-ray source takes a series of low-dose exposures, providing multiple images of the breast in different planes that are 3D reconstructed, while moving in a limited arc above the compressed breast **[3]**.

Multicenter studies have identified major advantages of DBT as compared to FFDM, but the role of tomosynthesis for women with dense breasts has not been fully established yet **[4]**.

Breast density is relative amount of radiopaque epithelial and stromal tissue elements compared with the amount of radiolucent fatty tissue seen in mammography. Usually palpable breast firmness during physical examination does not correlate with mammographic density **[5]**.

Younger, pre- or perimenopausal women are known to have a higher proportion of dense breast tissue, as breast density decreases with age. Breast tissue is subject to physiologic involution changes when glandular tissue is being replaced by fat, thus breasts become less dense and more mammographically transparent with age [6].

Higher breast density is reported to be one of the main risk factors for breast cancer (BC) [5]. Different parenchymal densities were first described by Leborgne and were later described as one of possible BC risk factors by Wolfe [7]. The fourth edition of Breast Imaging-Reporting and Data System (BI-RADS) Atlas introduced density distribution by percentage ratio of fat and fibroglandular tissue (<25% of glandular tissue-1 category, 25-50% of glandular tissue-2 category, 51-75% of glandular tissue-3 categories and >75% - glandular tissue 4 category) [8].

However, in the newest 5th edition American College Radiology returned to original description of breast density, which was used in the first editions, and removed the numeric values to avoid confusion with BI-RADS diagnostic categories and replaced the numbers with the letters 1-A, 2-B, 3-C, 4-D. Now breast density is based on the visual assessment of the breast parenchyma by interpreting radiologist and does not correspond to the percentage of fat and fibroglandular tissue [9].

Aim of the study:

The aim of the study is to compare sensitivity and specificity of DBT and FFDM in detection of BC represented as a mass in women with dense breasts (categories C and D according BI-RADS Atlas) and correlation with histopathology to confirm superior role of tomosynthesis and it is malignant mass.

Patients and Methods

Type of study: Cross sectional (prospective study).

Study setting: This study carried out at the Radiology Department of Ain Shams University Hospitals from April 2021 to Dec. 2021.

Study population: 30 patients age group from 18-60 years.

Inclusion criteria:

Patients with dense breasts (categories C and D) with suspicious mass (BIRADS category IV, V) on any imaging modality were included. First imaging modality was FFDM followed by DBT and high resolution ultrasound (HHUS) in order to establish correlation with mammographic findings than finally histopathology to confirm diagnosis of cancer.

Exclusion criteria:

- Patients with breast categories A and B.
- Pregnant and lactating female.

Sample size:

Using pass 11 program for sample size, at setting power 80% significance level 0.05 and by reviewing study results Mahmoud et al., [10] showed the diagnostic accuracy of digital breast tomosynthesis in diagnosis of breast mass among women with dense breast in terms of sensitivity and specificity were (90.4% and 100% respectively) and the prevalence of mass among women with mass in dense breast was (61.3%); based on that, the required sample size will be at least 30 patients to be sufficient to achieve study objective.

Study tools or procedure:

All patients had been subjected to:

1- Written consent.

2- Completehistory taking: Including g age, previous mammograms, prior surgeries, complains if present, superficial marks (such as prominent moles, scars from an incision), family history of breast cancer and history of hormonal pills.

3- Clinical examination with proven breast suspicious mass.

4- Mammography X-ray machine. Mammographic examination was performed using full field digital mammography machine with DBT (Senographe Essential GE healthcare and Hologic Selenia dimension 2D). All patients undergone bilateral mammography in two standard projections (CC and MLO) as a first step of imaging to either identify presentence of mass and characterize its mammographic feature (ill defined mass, present of micro calcification, obscure margin finding suggest it is suspicious mass (BIRADS category IV, V) nor no mass present inspite of patient complain.

This step followed by tomosynthesis:

In tomo mode, X-ray tube moves in an arc over the compressed breast capturing multiple images of each breast from angles –7.50° to +7.50°. The obtained images are then reconstructed into 1mm thick slices.

The interpretation of the images performed on 2 monitors with a matrix resolution of 5 Mpc.

Result of this step is to clear conflict about nature of mass, suspicious malignant mass had been clearly in tomo (ill-defined mass, irregular outline, speculated margin, micro calcification) had not been missed or under estimated due to surrounding dense parenchyma.

5- Ultrasonography: The US examinations were performed with high-resolution linear transducer L6_12, Mindray DC7, China. The physician had spread a clear, warm gel over the breast, and then had moved a small transducer over the gel gently over the breast; it had take less than 20 minutes. The study usually begins with images clockwise, horizontal and transverse.

6- Histopathology: After taking biopsy, histopathology is gold standard to confirm nature of lesion and confirm it is malignant lesion.

Ethical approval:

- The study protocol had been revised and approved by the Ethical Research Committee of Radiology Department, Faculty of Medicine, Ain Shams University.
- Informed written consent had been taken from all patients after thorough explanation of the purpose and procedure of the study.
- Any recruited women have the right to withdraw from the study at any phase without being adversely affected regarding the medical service she should receive.

Data management and statistical analysis:

The data had been collected, reviewed, coded and entered to excel sheet. Data will be analyzed by using SPSS software. Descriptive statistics had been done in terms of frequency and percentages for categorical variables. Mean (±SD) or median (interquartile range) had been used for continuous variables. Statistical tests for comparing between groups had been used according to type of data. Differences had been considered significant at a p-value less than or equal to 0.05.

Results

This cross-sectional prospective study on 30 female patients, aged from 21 to 56 years old with mean age was 39.13±8.997 years, their breast composition was of categories C and D with suspicious mass (BIRADS category IV,V).

11 (36.7%) of the patients in our study had a single or multiple first-degree relative who were positive for breast cancer, the patients in our study were asymptomatic and symptomatic referred to perform either screening or diagnostic digital mammography examination respectively.

After all the patients did both digital mammography and Tomosynthesis, we compared the results from both modalities in terms of; breast lesions detection in each clinical presentation in terms of non-mass and mass breast lesions, diagnosis of dominant radiological features, associated combined radiological features, mass lesions properties as shape, margin, lesion density and size, also calcifications, BIRADS categorization, changes in BIRADS after Tomosynthesis, best modality to show breast lesions, statistical analytical values, we also commented on the other modalities we used besides digital mammography and Tomosynthesis and last not least the final diagnosis in our study as will be detailed below.

Table (1): Age distribution of study participants.

Age (years)	Study cases (N=30)
Mean±SD	39.13±8.997
Median	38.0
Range	21.0–56.0

This table shows that mean age of studied cases was 39.13 years, median age was 38.0 years, minimum age was 21.0 years and maximum age was 56.0 years.

Table (2): Marital status in study participants.

Side of lesions	Study cases (N=30)	
	No.	%
Married	23	76.7
Single	7	23.3

This table show that 76.7% women were married and 23.3% were single.

Table (3): Lactation history in study participants.

Side of lesions	Study cases (N=30)	
	No.	%
Breast feeding	17	56.7
No	13	43.3

This table show that 56.7% women were breast feeding and 43.3% were not.

Table (4): Site of lesions in study participants.

Side of lesions	Study cases (N=30)	
	No.	%
Right breast	8	26.7
Left breast	22	73.3

This table show the lesion detected in right breast of the studied women 26.7% and left breast lesion 73.3%.

Table (5): Clinical presentations of study participants.

Clinical presentations	Study participants (N=30)	
	No.	%
Asymptomatic	3	10.0
Breast lump only	21	70.0
Breast lump with breast edema	3	10.0
Breast lump with pain	3	10.0

This table shows that 70% of study participants had breast lump only, 10% were asymptomatic, 10.0% had breast lump with breast edema and 10.0% had breast lump with pain.

Table (6): Digital mammography findings of study participants.

Digital mammography findings	Number of lesions (N=30)	
	No.	%
Mass	13	43.3
Asymmetry	6	20.0
Architecture distortion	5	16.7
Micro-calcification with no underlying mass	3	10.0
Negative (dense breast)	3	10.0

This table shows that, on digital mammography, 43.3% of study participants had mass, 20% had asymmetry, 16.7% had architecture distortion, 10% had calcification and 10.0% were normal.

Table (7): Characteristics of masses detected by digital mammography in study participants.

Lesions characteristics	Detected masses (N=13)	
	No.	%
Lesion margins:		
Obscured	7	53.8
Ill-defined	5	38.5
Well-defined	1	7.7
Lesion shape:		
Irregular	7	53.8
Round	4	30.8
Oval	1	7.7
Macro lobulated	1	7.7

This table shows that 53.8% of detected masses had obscured margins, 38.5% had ill-defined margins and 7.7% had well-defined. 53.8 % of detected masses had irregular shape, 30.8% were round, 7.7% were oval and 7.7% were macro-lobulated.

Table (8): Tomosynthesis findings of study participants.

Tomosynthesis findings	Number of lesions (N=30)	
	No.	%
Mass	25	83.3
Architecture distortion	1	3.3
Dilated ducts	0	0.0
Micro-calcification	2	6.7
Asymmetry	2	6.7

This table shows that, on tomosynthesis, 83.3% of study participants had mass, 3.3% had architecture distortion, 6.7% had micro-calcification and 6.7% had asymmetry.

Table (9): Characteristics of masses detected by tomosynthesis in study participants.

Lesions characteristics	Detected masses (N=25)	
	No.	%
Lesion margins:		
Well-defined	0	0.0
Speculated	24	96.0
Ill-defined	1	4.0
Lesion shape:		
Irregular	11	44.0
Round	10	40.0
Oval	3	12.0
Macro lobulated	1	4.0

This table shows that 96% had speculated margins and 4% had ill-defined. 44% of detected lesions had irregular shape, 40% were round, 12% were oval and 4% were macro lobulated.

Table (10): Frequency distribution of study participants according to ACR classification.

ACR Category	Study participant (N=30)	
	No.	%
C	26	86.7
D	4	13.3

This table shows that 86.7% of study participants were C category, and 13.3% were D category.

Based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at category C in 11 patients (true positives). Tomosynthesis did not detect mass lesions in 5 patients (true negatives). Ten patients had false negative results. We found that Tomosynthesis had overall sensitivity, specificity, and diagnostic accuracy of 52.4%, 100% and 61.5% respectively in detecting the breast mass in our patients. Positive predictive value was 100% while the negative predictive value was 33.3%.

Table (11): Comparison between mass detection by digital mammography and tomosynthesis in ACR C category.

Mass detection	Tomosynthesis					Sensitivity	Specificity	PPV	NPV	Accuracy	*p*-value
	Positive (N=21)		Negative (N=5)		Total						
	No.	%	No.	%							
Digital mammography:											
Positive	11	42.3	0	0.0	11	52.4%	100%	100%	33.3%	61.5%	0.046
Negative	10	38.5	5	19.2	15						
Total	21	80.8	5	19.2	26 (100%)						

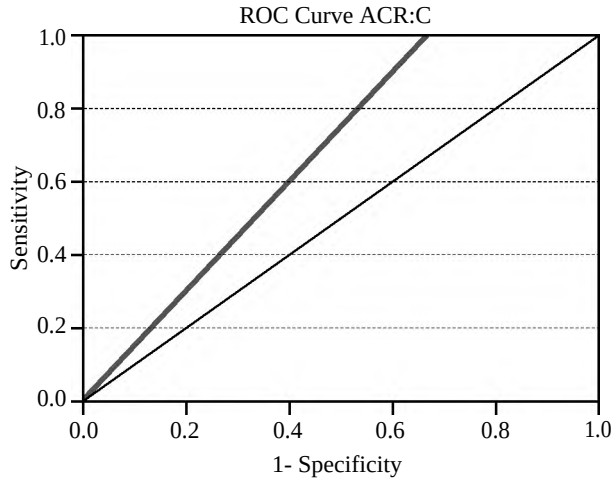

Fig. (1): ROC curve for mass detection by digital mammography and tomosynthesis in ACR C category.

Table (12): Comparison between mass detection by digital mammography and tomosynthesis in ACR D category.

Mass detection	Tomosynthesis					Sensitivity	Specificity	PPV	NPV	Accuracy	*p*-value
	Positive (N=4)		Negative (N=0)		Total						
	No.	%	No.	%							
Digital mammography:											
Positive	2	50.0	0	0.0	2	50.0%	0.0%	100%	0.0%	NA	NA
Negative	2	50.0	0	0.0	2						
Total	4	100	0	0.0	4 (100%)						

Based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at category D in 2 patients (true positives). Tomosynthesis did not detect mass lesions in 2 patients (true negatives). Two patients had false negative results. We found that Tomosynthesis had overall sensitivity of 50% with Positive predictive value was 100%.

Table (13): Comparison between mass detection by digital mammography and tomosynthesis in all ACR categories.

Mass detection	Tomosynthesis					Sensitivity	Specificity	PPV	NPV	Accuracy	*p*-value
	Positive (N=21)		Negative (N=5)		Total						
	No.	%	No.	%							
Digital mammography:											
Positive	13	43.3	0	0.0	13	54.2%	100%	100%	31.25%	62.07%	0.043
Negative	12	40.0	5	16.7	17						
Total	25	83.3	5	16.7	30 (100%)						

Based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at all ACR categories in 13 patients (true positives). Tomosynthesis did not detect mass lesions in 5 patients (true negatives). Twelve patients had false negative results. We found that Tomosynthesis had overall sensitivity, specificity, and diagnostic accuracy of 54.2%, 100% and 62.07% respectively in detecting the breast mass in our patients. Positive predictive value was 100% while the negative predictive value was 31.25%.

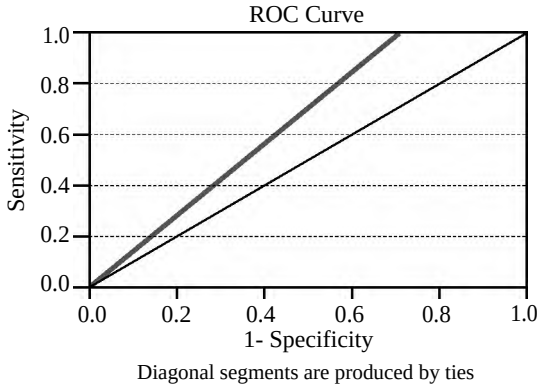

Fig. (2): ROC curve for mass detection by digital mammography and tomosynthesis in All ACR.

Table (14): Final diagnosis (by pathological diagnosis and follow-up radiology) of study participants.

Final diagnosis	Study participant (N=30)	
	No.	%
Malignant lesion	30	100.0
Non-malignant	0	0.0

This table shows that 100% of lesions detected by tomosynthesis were malignant tumors.

This table show that 83.3% of lesion detected were invasive ductal carcinoma, 6.7% were invasive lobular carcinoma, 3.3% Inflammatory carcinoma and 6.7% were DCIS.

Table (15): Number of performed breast biopsies and results of pathology specimen (total number 30).

Pathological	N=30	%
Malignant:	30	
Invasive ductal carcinoma	25	83.3
Invasive lobular carcinoma	2	6.7
Inflammatory carcinoma	1	3.3
DCIS	2	6.7

This table shows that there were high statistically significant differences between digital mammography and tomosynthesis in BIRADS.

This table shows that, after tomosynthesis, 0.0% of study participants had the same BIRADS as digital mammography & 100% had upgraded BIRADS.

Table (16): BIRADS results by digital mammography and tomosynthesis in study participant.

BIRADS	Digital mammography		Tomo-synthesis		MN	*p*
	No.	%	No.	%		
III	6	20.0	0	0.0	4.63	0.031 (S)
IV a	18	60.0	0	0.0	22.9	<0.001 (HS)
IV b	6	20.0	0	0.0	4.63	0.031 (S)
IV c	0	0.0	18	60.0	22.9	<0.001 (HS)
V	0	0.0	12	40.0	12.6	<0.001 (HS)

Table (17): Changes in BIRADS results after using tomosynthesis in study participants.

BIRADS after using tomosynthesis	Study participants N=82	
	No.	%
Same as digital mammography	0	0.0
Upgraded	30	100.0
Downgraded	0	0.0

Cases:

Clinical background:

- 54-year-old female coming for screening mammography.

Mammography revealed:

- Breast density: ACR c.
- Left breast shows areas of focal asymmetry associated with architectural distortion in the upper outer and lower inner aspect of the left breast (BIRADS IVA) (Fig. 3A,B).

3D Tomosynthesis revealed:

Left breast shows two small irregular, ill-defined lesions with speculated margins seen at upper outer quadrant (BIRADS IVC). (Fig. 3C,D)

Histopathology:

Invasive ductal carcinoma.

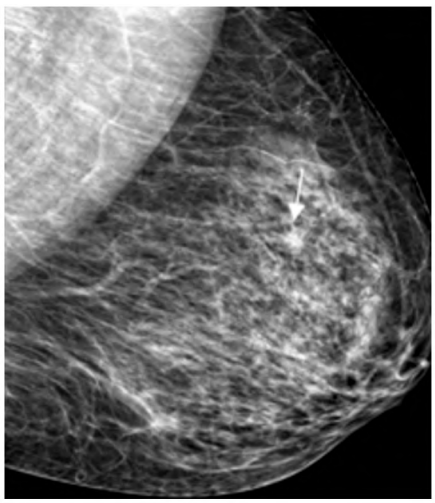

Fig. (3A): Mammo MLO view.

Fig. (3B): Mamo CC view.

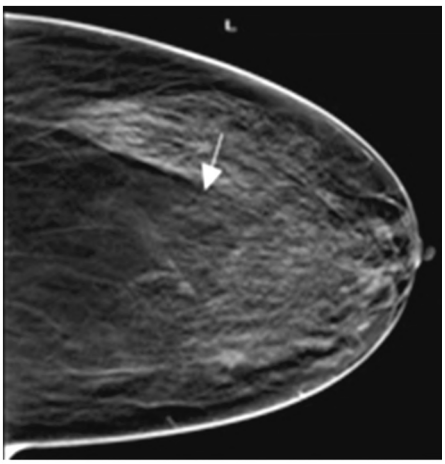

Fig. (3C): Tomo cc.

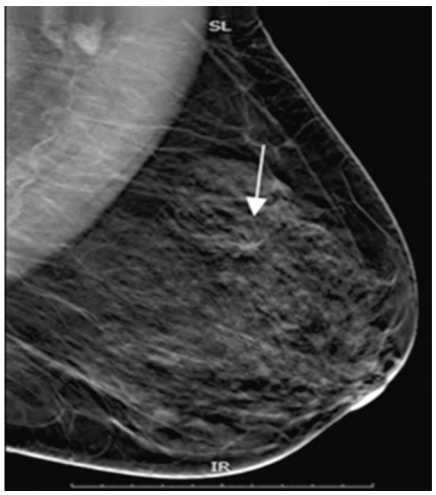

Fig. (3D): Tomo MLO.

Conclusion:

3D digital breast tomosynthesis easily detects two small spiculated lesions at UOQ and LIQ of the left breast and this changes BIRADS from IVa to IVc. Tomosynthesis upgrades two left breast lesions which proved to be invasive ductal carcinoma.

Discussion

Breast cancer in women is considered a major public health problem throughout the world. It is the most common cancer among women in both developed and developing countries, accounting for 22.9% of all female cancers. In Egypt, breast cancer accounts for 37.7% of the total new cancer cases. It is the leading cause of cancer related mortality accounting for 29.1% of the cancer related deaths [11].

Early detection of breast cancer is an important task to reduce the morbidity and mortality associated with breast cancer cases. Mammography is the basic breast imaging modality for early detection and diagnosis of breast cancer. Full Field Digital Mammography developments have been rapid, enabling high-quality breast images with higher contrast resolution, an improved dynamic range, and rapid processing of data and images when compared with Screen Film Mammography. However, some limitations still persist [12].

Mammography has low sensitivity and specificity in women with radiographically dense breast due to decrease contrast between a possible tumor and surrounding breast tissue and summation of tissues may obscure lesions. Breast Tomosynthesis by reducing or eliminating tissue overlap can markedly solve most of these problems [13].

Digital breast tomosynthesis (DBT) is often considered the new, better mammogram based on observed increases in specificity and breast cancer detection compared with digital mammography (DM) alone. However, most of the published studies about DBT, whether from prospective trials or observational studies, use data from first- or prevalent-round screening rather than incident-round screening in which breast cancer detection and recall rates are expected to be lower. In addition, only some of the studies contain patient-level data such as age and breast density, and even fewer contain information about molecular subtypes for both screen-detected and interval cancers. Studies including molecular subtypes are limited but suggest that breast cancers detected by DBT are smaller, less aggressive estrogen receptor-positive cancers compared with cancers detected by DM. Patient-level factors and tumor subtype data coupled with screening performance and outcome metrics are necessary to estimate the long-term outcomes of DBT, especially for women aged 40 to 49 years, for whom routine screening remains controversial. These data incorporated into simulation modeling approaches, such as those used by the Cancer Intervention and Surveillance Modeling Network consortium, will allow population-level estimates of both long-term outcomes and cost-effectiveness of DBT screening [14].

The main aim of this study was to compare sensitivity and specificity of DBT and FFDM in detection of BC represented as a mass in women with dense breasts (categories C and D according BI-RADS Atlas) and correlation with histopathology to confirm superior role of tomosynthesis and it is malignant mass.

This cross sectional (prospective study) was conducted at the Radiology Department of Ain Shams University hospitals including 30 females with dense breasts (categories C and D) with suspicious mass (BIRADS category IV,V). On any imaging modality were included. First imaging modality was FFDM followed by DBT and high-resolution ultrasound (HHUS) to establish correlation with mammographic findings than finally histopathology to confirm diagnosis of cancer. The duration of the study ranged from 6-12 months.

The main results of this study were as following:

The mean age of studied cases was 39.13 years, median age was 38.0 years, minimum age was 21.0 years and maximum age was 56.0 years. 76.7% women were married and 23.3% were single. 56.7% women were breast feeding and 43.3% were not.

Our results were supported by study of Hashem et al., [15] as they reported that the mean age of this study population was 48 years (range 19-75 years). Two hundred thirty two out of the 283 (82.0%) women had children, and 51/283(18.0%) had no children. Two hundred thirty nine out of the 283 (84.5%) women had history of breast feeding, and 44/283 (15.5%) gave history of artificial feeding.

While, in the study of Conant et al., [16] among 96-269 women, the mean (SD) patient age was 55.9 (9.0) years for all examinations; patient age was 56.4 (9.0) years for DM and was 54.6 (8.9) years for DBT. Of 180-340 examinations, 129-369 examinations used DM (71.7%) and 50-971 examinations used DBT (28.3%). In this population, use of DBT was slightly more common among younger women, women with dense breasts, and those undergoing their first screening.

The present study showed that the lesion detected in right breast of the studied women 26.7% and left breast lesion 73.3%. 70% of study participants had breast lump only, 10% were asymptomatic, 10.0% had breast lump with breast edema and 10.0% had breast lump with pain.

However, in the study of Mahmoud et al., [10] they performed their study on 80 female patients with 86 lesions: 46 (56.3%) lesions at right and 32 (40%) at left breast. Cases were presenting with; breast lump only 49 cases (61.3%), breast lump with breast edema 4 (5%), lump with nipple retraction in 4 (5%) cases and asymptomatic in 23 (28.7%).

Every woman is at some risk that ranges from low to high for breast cancer. Women with increased breast density are doubly unlucky; they are at higher risk of developing breast cancer and at greater risk that cancer will be undetectable and radiologically masked by increased density. Even though, mammography plays an important role in screening and diagnosis of breast cancer, imaging approach has changed over time to a more personalized, risk-based approach [17].

The current study showed that on digital mammography, 43.3% of study participants had mass, 20% had asymmetry, 16.7% had architecture distortion, 10% had calcification and 10.0% were normal. 53.8% of detected masses had obscured margins, 38.5% had ill-defined margins and 7.7% had well-defined. 53.8%of detected masses had irregular shape, 30.8% were round, 7.7% were oval and 7.7% were macro-lobulated.

In accordance with our results, study of Mahmoud et al., [10] as they reported that 47.5% of detected masses had obscured margins, 37.5% had ill-defined margins and 15% had well-defined.

Digital breast tomosynthesis (DBT) is an advanced imaging technique increasingly used in breast cancer screening. Standard full-field digital mammography (FFDM) has limitations arising from overlapping fibro glandular breast tissue that can delay diagnosis in 15-30% of cancers. DBT is believed to resolve these limitations through tissue superimposition by acquiring multiple low-dose radiographic projections and reconstructing pseudo-tomographic images [18].

In the study in our hands, on tomosynthesis, 83.3% of study participants had mass, 3.3% had architecture distortion, 6.7% had micro-calcification and 6.7% had asymmetry. 96% had speculated margins and 4% had ill-defined. 44 % of detected lesions had irregular shape, 40% were round, 12% were oval and 4% were macro lobulated.

While, in the study of Mahmoud et al., [10] they reported that 47.7% of detected masses had well-defined margins, 39.5% had speculated margins and 15.8% had ill-defined.

Helvie et al., [19] reported that tomosynthesis improves characterization of malignant lesions compared to mammography. It allows more accurate assessment of shape and margin of the lesions. They also reported that DBT revealed 77% of the perimeter of visible mass while conventional mammography showed 53% of the perimeter of the mass.

In a retrospective study done by Yang et al., [20] stated that breast cancer cases were better described by DBT due to better lesion detection regarding shape and margin of masses and also subtle spiculated margins can be depicted by the use of thin slide.

Furthermore, Skaane [21] also verified that using DBT enables better assessment of shape and margin of breast lesions due to elimination of overlapping tissue. It can distinguish superimposed tissue from breast lesions with increased specificity as compared with conventional mammography.

The present study showed that regarding ACR classification; 86.7% of study participants were C category, and 13.3% were D category.

However, in the study of Hashem et al., [15] twenty four out of the 283 (8.5%) cases were ACR A and B (non-dense), while 259/283 (91.5%) cases were ACR C and D (dense).

In the study of Caumo et al., [22] the estimated CDRs were 9.2/1000 (95% CI 8.3-10.3) DBT screens versus 5.2/1000 (95% CI 4.4-6.1) DM screens: The difference in CDR was 4.0/1000 (95% CI 2.7-5.4) screens, $p<0.001$.

The addition of digital breast tomosynthesis has been shown to increase the cancer detection rate when it is used in conjunction with conventional digital mammography. Single and multicenter studies have shown increases in cancer detection ranging from 10% to 51 %. There remains limited data on the biology of the additional cancers detected with the use of tomosynthesis in regard to the pathologic type, histologic grade and lymph node status at time of diagnosis. A prospective study by Skaane [21]. demonstrated increased detection of predominantly low-grade invasive cancers, while a multicenter retrospective study by Greenberg et al., yielded no significant difference in the types of cancers detected with the addition of tomosynthesis. Characterizing the biologic features of these additional cancers detected with tomosynthesis has value as these features have demonstrated prognostic significance for long-term disease free and overall survival [23].

The current study based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at category C in 11 patients (true positives). Tomosynthesis did not detect mass lesions in 5 patients (true negatives). Ten patients had false negative results. We found that Tomosynthesis had overall sensitivity, specificity, and diagnostic accuracy of 52.4%, 100% and 61.5% respectively in detecting the breast mass in our patients. Positive predictive value was 100% while the negative predictive value was 33.3%. Based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at category D in 2 patients (true positives). Tomosynthesis did not detect mass lesions in 2 patients (true negatives). Two patients had false negative results. We found that Tomosynthesis had overall sensitivity of 50% with Positive predictive value was 100%.

Based on Digital mammography as a reference standard, Tomosynthesis detect mass lesions at all ACR categories in 13 patients (true positives). Tomosynthesis did not detect mass lesions in 5 patients (true negatives). Twelve patients had false negative results. We found that Tomosynthesis had overall sensitivity, specificity, and diagnostic accuracy of 54.2%, 100% and 62.07% respectively in detecting the breast mass in our patients. Positive predictive value was 100% while the negative predictive value was 31.25%.

While, in the study of Mahmoud et al., **[10]** Digital Breast Tomosynthesis (DBT) detected new 10 lesions not seen in digital mammography. It overcomes the problem of breast densities in DM and detected 36 masked masses not seen in DM. They found 3 (7.5%) lesions with benign morphology on mammography proved to be irregular on Tomosynthesis, while 3 (7.5%) lesions were described as irregular and proved to show benign shape morphology. Regarding the margin of mass lesions, Tomosynthesis changed the identified margin in 12 (27%) mass lesions. So Tomosynthesis is better in margin and shape characterization as it overcome tissue overlap. The use of DBT allows proper BIRADS categorization and reduces unnecessary biopsies.

They found that sensitivity of mammography decreases with increase breast density due to masking of glandular tissue to underlying lesion, the calculated sensitivity was 60% in dense breast (ACR C and D) compared to 66.7% in non-dense breast (ACR A and B) while adding tomosynthesis increase sensitivity in each breast density with decrease false positive results. They found that adding DBT to digital mammography in non-dense breast (ACR A and B) raised sensitivity for detection of malignant lesions from 66.7% to 93.3%, specificity from 68.4% to 94.7%, PPV from 62.5% to 93.3%, NPV from 72.2% to 94.7% and accuracy from 67.6% to 94.1%, while in dense breast (ACR C and D) raised sensitivity from 60% to 88%, specificity from 54.1% to 82.2%, PPV from 47% to 88%, NPV from 66.7% to 92% and accuracy from 56.5% to 90.3%, so the difference in sensitivity, specificity, PPV, NPV and accuracy between DBT and DM in dense breast (ACR C and D) was more than in non-dense breast (ACR A and B) **[10]**.

Also,Waldherr et al., **[24]** in a study comparing the role of Mammography and Tomosynthesis in the diagnostic work up showed that digital mammography revealed sensitivity 70.5%, specificity 80.8%, PPV 86.1% and NPV 61.8%. They showed that Digital Breast Tomosynthesis had sensitivity 84%, specificity 83.9%, positive predictive value 89.4% and negative predictive value 76.5%.

Tamaki et al., **[25]** performed a retrospective analysis of mammography findings in 1267 Japanese women. They calculated sensitivity, specificity and positive predictive value were 92.8, 31.4 and 63.1 %, respectively.

Furthermore, Elizalde et al., **[26]** reported that sensitivity of DM after addition of tomosynthesis increase from 69.05% by DM alone to 86.9 by combination of both modalities. But they found that specificity decrease after addition of DBT from 88.2% to 83.5%, as BIRADS 3 lesions were considered as positive, and this is a possible explanation for the lower specificity of additional DBT in this study.

Moreover, Lei et al., **[27]** reported that DBT has a higher sensitivity and specificity in breast diagnosis than DM. The sensitivity and specificity of DBT as 90.0% and 79.0%, and for DM they were 89.0% and 72.0%, respectively.

In addition, Niell et al., **[28]** which stated that the sensitivity of mammography decreases in women with dense breast, measuring 30% to 64% for extremely dense breasts compared with 76% to 98% for fatty breasts. Addition of Tomosynthesis to FFDM increased the invasive cancer detection rate by 40% and decreased false positives by 15%, compared with FFDM alone.

Our results showed that 100% of lesions detected by tomosynthesis were malignant tumors. 83.3% of lesion detected were invasive ductal carcinoma, 6.7% were invasive lobular carcinoma, 3.3% Inflammatory carcinoma and 6.7% were DCIS.

However, in the study of Hashem et al., **[15]** one hundred seventy seven out of the 283 (62.5%) cases were malignant, and 106/283 (37.5%) cases were normal or benign lesions. Out of the malignant cases, 21/177 had bilateral malignant process, and 28/177 had multiple ipsilateral malignant lesions (multifocal or multicentric).

In the study of Drukker et al., **[29]** in 11 women, microcalcifications were present as a secondary finding (six malignant and five benign findings), and these were included in their analysis. All malignant masses were invasive cancer.

Moreover, Ray et al., **[30]** revealed that a total of 19 lesions were identified at DBT that were occult to DM. Seven cases were infiltrating ductal carcinomas and three were infiltrating lobular carcinomas.

The present study showed that there were high statistically significant differences between digital mammography and tomosynthesis in BIRADS.

Our results were supported by study of Mahmoud et al., **[10]** as they compared changing in BIRADS category between tomosynthesis and digital mammography in each breast density they found that in ACR B; 12 cases (41.4%) showed the same diagnosis by DM and DBT while 17 cases (58.6%) either upgrades or downgrades and in ACR C; 7 cases (15.2%) showed the same diagnosis by both DM and DBT while 39 cases either upgrades or downgrades (84.8%). So, change in BIRADS grading after addition of DBT more in ACR C than B.

Furthermore, Rangarajan et al., **[31]** also reported that in ACR A and B (80.9% and 81.5% respectively) of cases there were no change in BIRADS categorization after addition of DBT and in ACR C and D (64% and 57.5%, respectively), while in dense breast (ACR C and D) (77.3%) of cases there were superior categorization.

Conclusion:

We concluded that DBT showed higher sensitivity and specificity and diagnostic accuracy than Mammography as it allows better detection and characterization of breast lesions with decrease of false positive and negative cases.

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الدور المضاف للتصوير الرقمى الطبقى التركيبى للثدى فى توضيح كتلة مشبوهة فى السيدات ذات الثدى الكثيف

المقدمة: يعتبر سرطان الثدى عند النساء مشكلة صحية عامة رئيسية فى جميع أنحاء العالم. إنه أكثر أنواع السرطان شيوعاً بين النساء فى كل من البلدان المتقدمة والنامية، حيث يمثل ٢٢.٩٪ من جميع السرطانات النسائية. فى مصر، يمثل سرطان الثدى ٣٧.٧٪ من إجمالى حالات السرطان الجديدة. مراسلة: د. أمنية مختار، قسم الأشعة، المعهد القومى للسرطان بالقاهرة، مصر. إنه السبب الرئيسى للوفيات المرتبطة بالسرطان ويمثل ٢٩.١٪ من الوفيات المرتبطة بالسرطان.

الهدف من الدراسة: هدفت دراستنا إلى مقارنة حساسية وخصوصية DBT و FFDM فى الكشف عن BC والمتمثلة فى كتلة عند النساء ذوات الثدى الكثيف (الفئتان C و D وفقاً لأطلس BI-RADS) والارتباط مع التشريح المرضى لتأكيد الدور المتفوق للتركيب المقطعى وهو خبيث. الجماعية.

المرض وطرق العلاج: تم تضمين هذا المقطع العرضى ٣٠مريضاً يعانون من ثدى كثيف (الفئتان C و D) مع كتلة مشبوهة (BIRADS فئة V,IV) على أى طريقة تصوير. كانت طريقة التصوير الأولى هى FFDM متبوعة بDBT والموجات فوق الصوتية عالية الدقة (HHUS) من أجل إقامة علاقة مع نتائج التصوير الشعاعى للثدى بدلا من التشريح المرضى لتأكيد تشخيص السرطان.

النتائج: الدراسة الحالية القائمة على التصوير الشعاعى للثدى الرقمى كمعيار مرجعى، تكتشف Tomosynthesis آفات جماعية فى الفئة C فى ١١ مريضاً (إيجابيات حقيقية).لم يكشف التخليق Tomosynthesis عن آفات جماعية فى ٥ مرضى (سلبيات حقيقية). عشرة مرضى لديهم نتائج سلبية خاطئة. وجدنا أن تركيب توموسينثيس لدية حساسية عامة وخصوصية ودقة تشخيصية بنسبة ٥٢.٤٪ و١٠٠٪ و٦١.٥٪ على التوالى فى الكشف عن كتلة الثدى لدى مرضانا . كانت القيمة التنبؤية الإيجابية ١٠٠٪ بينما كانت القيمة التنبؤية السلبية ٣٣.٣٪. استاداً إلى التصوير الشعاعى للثدى الرقمى كمعيار مرجعى. يكشف تركيب توموسينثيسيون آفات جماعية فى الفئة د فى مريضين (إيجابيات حقيقية). لم يكشف التخليص Tomosynthesisعن آفات جماعية فى مريضين (سلبيات حقيقية). كان لدى مريضين نتائج سلبية خاطئة. وجدنا أن Tomosynthesis كانت حساسية إجمالية قدرها ٥٠٪ مع قيمة تنبؤية إيجابية كانت ١٠٠٪. أظهرت نتائجنا أن ١٠٠٪ من الآفات المكتشفة عن طريق التخليق المقطعى كانت أورام خبيثة. ٨٣.٣٪ من الآفات المكتشفة كانت سرطان الأقنية الغازية، ٦.٧٪ سرطان الفصيص الغازى، ٣.٣٪ سرطان التهابى و٦.٧٪ سرطان القنوات الموضعية. أظهرت الدراسة الحالية وجود فروق ذات دلالة إحصائية عالية بين التصوير الشعاعى للثدى الرقمى والتركيب المقطعى فى الطيور.

الاستنتاج: خلصنا إلى أن DBT أظهر حساسية ونوعية ودقة تشخيصية أعلى من التصوير الشاعى للثدى لأنه يسمح باكتشاف وتوصيف آفات الثدى بشكل أفضل مع تقليل الحالات الإيجابية والسلبية الكاذبة.