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Qualitative and Quantitative Association between Breast Background Parenchymal Enhancement and Cancer Incidence

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Abstract

Background: Due to increased utility of MRI as a screening and a diagnostic tool, data concerning BPE became available more than before. BPE may havean important role as a tool for early detection of breast cancer, and identifying population at risk offuture breast cancer.

Aim of Study: To evaluate the association between qualitative and quantitative background parenchymal enhancement (BPE) evaluation at dynamic contrast enhanced MRI and breast cancer incidence.

Patients and Methods: The MRI for 40 premenopausal and postmenopausal females was reviewed. Qualitative MRI interpretation included assessment of the level the BPE and amount of FGT. The BPE was categorized as minimal degree, mild degree, moderate degree, or marked degree. Quantitative assessment of BPE included ROI selection in the parenchyma, and then creation of histogram curve giving quantitative values of the BPE in the selected ROI.

Results: In our study we found that amount of fibroglandular tissue and BPE were influenced by age, with premenopausal women having more amount of fibroglandular tissue, showing more pronounced and extensive degrees ofBPE compared to post-menopausal women. Also, higher qualitative levels and quantitative values of BPE were detected in malignant group. This revealed association of the higher quantitative value of BPE with higher cancer incidence.

Conclusion: From our study we concluded that higher amount of the fibroglandular tissue and higher qualitative degree and quantitative value of BPE are associated with increased breast cancer odds in the same age category, and from that we can predict higher incidence of breast cancer in population with higher degrees and values of BPE.

Key Words: *Background parenchymal enhancement – Breast – Cancer – MRI – Qualitative – Quantitative.*

Introduction

BREAST tissue enhancement seen normally on MRI is known as “background parenchymal enhancement” ((BPE)) **[1,2]** and is generallydescribed in 4 qualitative degrees based on the BI-RADS system. These degreesinclude minimal, mild & moderate & and marked levels of BPE **[3]**. This parenchymal enhancementrepresents a dynamic process and differsamong individuals andfrom time to time in the same person, also it isaffected by many other variables as hormonal levels and the changes of the menstrual cycle **[1]**.

Background enhancement occurs as a result of the changes in the T1-relaxation of tissues that happens after contrast administration, also that enhancement is directly related to the blood supply and vascular permeability. Parenchymal enhancement may be related to internal hormone levels and changes with the menstrual cycle, becomeshigheron weeks 1 and 4 and decreases markedly during the 2nd week. It also, increases in postmenopausal women undergoing hormonal replacement therapy (HRT). BPE changes correlate to endogenous hormonal changes during the menstrual cycle. Estrogen leads to an increase in vasodilatation and vascular permeability, while progesterone causes an increase in the metabolic activity, also an increase in perfusion **[4]**.

The level of BPE in MRI indicatesto the whole volume and enhancement intensity of breast fibroglandular tissue following gadolinium administration **[5]**. The BPE is inversely related to age and positively with the hormonal levels **[6,7]**. Recent lexicon of BI-RADS included the involvement of the fibroglandular tissue amount and degree of BPE on MRI study interpretation **[8]**.

Many studies documented the association of “BPE”degrees with breast cancer incidence, also, BPE may be used as an indication to higher risk of cancer **[9-12]**. Conversely,multiple studies found no association between BPE and breast cancer **[13-16]**. Currently, many studies have been performed on different BPE assessment methods **[17-19]**.

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Due to increased utility of MRI as a screening and a diagnostic tool, data concerning BPE became available more than before. BPE may havean important role as a tool for early detection of breast cancer,and identifying population at risk offuture breast cancer **[20]**.

Aim of the work:

To evaluate the association between qualitative and quantitative background parenchymal enhancement (BPE) evaluation at dynamic contrast enhanced MRI and breast cancer incidence.

Patients and Methods

This retrospective study included 40 female patients underwent dynamic contrast enhanced MRI as a screening or a diagnostic evaluation in the period between May 2022 to April 2023, divided into two groups, the first group included 20 patients with normal or benign findings on MRI, the other group included 20 patients with breast cancer on MRI and confirmed by pathology.

MRI Technique:

In all patients, MRI of the breast was performed using 1.5 Tesla machine (Philips Ingenia, Best, Netherland). All patients were examined in the prone position using dedicated breast coil.

Firstly a localizing sequencewas obtained, a sagittal T2 FAT-SAT sequence (with TR: TE; 4,000: 85, ST, 3mm, interslice gap of 1mm), and a sagittal T1 fast spoiled GE sequence with flip angle about 35°, BW, 32 kHz; FOV, 18-22cm; matrix, 192x256; ST, 3mm), before andafter injection of gadolinium in a dose of 0.1mmol/kg. After the image acquisition, (pixel by pixel subtraction of the un-enhanced images from the 1^{st} contrast-enhanced images is done. Then all MRI images were processed using (computer aided system) evaluation, and then monitoring of the study on PACS monitors with high resolution was done.

MRI interpretation:

All images for the two study groups (breast cancer cases, and normal cases) were reviewed. The level the BPE and amount of FGT were detected. The BPE of the whole breast was qualitatively assessed by using pre-contrast and early post-contrast FAT-SAT T1 weighted and the subtraction images. The BPE was then categorized as minimal degree, mild degree, moderate degree, or marked degree. The fibroglandular tissue amount was evaluated on T2 weighted images, T1 FAT-SAT images and non FAT-SAT images. The amount of FGT wasthen described as fatty (near 25% of breast tissue), scattered fibroglandular tissue (25%-50%), heterogeneously dense breast (51%-75%), or extremely dense (75% or more).

BPE quantitative assessment:

We used (ROI-based) measurements. In this method, a ROI is manually located in an area of the enhancing parenchyma, then propagated to the pre contrast and also post contrast images. Percent of enhancement (PE) was calculated by the softwareas:

$$PE = Spost-Spre/Spre * 100\%$$

Spre is SI mean of the selected ROI in the pre-contrast images and Spost represents mean of SI in the post contrast images.

The selected ROI was placed in breast parenchyma area away from fat, large blood vessels and any enhancing lesions.

From the ROI based measurement, histogram curves of the BPE were obtained for each case, providing more detailed information about the quantitative assessment of the BPE.

Statistical analysis and data interpretation:

Analysis of data was performed by SPSS software, version 25 (SPSS Inc., PASW statistics for windows version 25. Chicago: SPSS Inc.). Qualitative data were described using number and percent. Data were described quantitatively using median (min. and max.) for non-normally distributed data and mean ± SD for normally distributed data after testing normality using Shapiro Wilk test. Obtained results significance was judged at the (0.05) level.

- Chi-Square, Fischer exact test, Monte-Carlo tests were used to compare data between groups as appropriate qualitatively.
- (Mann Whitney U test) were used to compare between 2 studied groups for non-normally distributed data.
- (Student *t*-test) was used to compare 2 independent groups for the normally distributed data.
- The Spearman's rank-order correlation is used to determine the strength and direction of a linear relationship between two non-normally distributed continuous variables and/or ordinal variables.

Results

Our study included 40 cases, 20 normal cases with mean age of 45.4 years, and 20 cases with pathologically proven malignancy, with mean age of 47.4 years. The malignant cases included 11 pre-menopausal, and 9 post-menopausal cases.

While normal cases included 12 pre-menopausal, and 8 post-menopausal cases as shown in Table (1).

Table (1): Patient characteristics distribution according to studied lesion type.

	Malignant n=20	Normal n=20	Test of significance
Age/years:			*t*=0.509
Mean ± SD	47.40±11.99	45.40±12.85	*p*=0.614
Menopausal statusn (%):			
Pre-menopausal	11 (55.0)	12 (60)	χ^2=0.102
Post-menopausal	9 (45.0)	8 (40)	*p*=0.749

t: Student *t*-test. X^2=Chi-Square test.

Amount of the breast parenchyma (fibroglandular tissue), and the degree of background parenchymal enhancement in normal and malignant cases are shown in the following Table (2).

Table (2) shows that heterogeneously dense parenchyma was more seen in the malignant cases (13 cases), while seen in 10 normal cases. Extremely dense breast was seen in equal number in both normal and malignant cases. Scattered areas of fibroglandular densities were more detected in the normal category.

As regard the background parenchymal enhancement, moderate and marked degrees of BPE were more seen in malignant cases (7 malignant cases Vs 5 normal cases). Minimal degree of BPE was seen in 30% of normal cases, while not detected in any of the malignant cases in our study. Asymmetric type of the BPE was only seen in 10% of the malignant cases, not seen in the normal cases. While symmetric type was slightly more common in normal cases.

Distribution of the amount of breast parenchyma, and degree of BPE in normal and malignant cases in relation to menopausal status are shown in Table (3).

In the pre -menopausal category, heterogeneous and extremely dense breast are near equally distributed in both normal and malignant cases. In post-menopausal category, heterogeneous dense breast is more commonly seen in malignant cases (8 cases) Vs 5 normal cases. While scattered areas of fibroglandular densities are more seen in the normal cases.

As regard the degree of BPE, in pre-menopausal category, minimal degree is seen only in normal cases, marked degree is more seen in malignant cases Vs normal cases (3 cases Vs 2 cases respectively). In post-menopausal category, minimal degree of BPE was only seen in normal cases, mild degree was more seen in malignant cases, while moderate degree of BPE was only seen in the malignant group.

Symmetric type of BPE was more seen in the normal cases in pre-menopausal and post-menopausal categories. Asymmetric type was seen only in the malignant cases, one in pre and one in post-menopausal groups.

Table (2): Comparison OF MRI Qualitative assessment between normal and malignant lesions.

	Malignant n=20 (%)	Normal n=20 (%)	Test of significance	Odds ratio (95% CI)
Amount of parenchyma:				
Scattered areas of fibroglanular(R)	1 (5.0)	4 (20.0)	χ^2MC=2.19	1
Heterogenous dense	13 (65.0)	10 (50.0)	*p*=0.334	5.2 (0.50-54.05)
Extremely dense	6 (30.0)	6 (30.0)		4 (0.339-47.11)
BPE:				
Minimal	0	6 (30)	χ^2MC=7.07	Undefined
Mild	13 (65)	9 (45)	*p*=0.07	0.963 (0.133-6.98)
Moderate	4 (20)	3 (15)		0.88 (0.086-9.16)
Marked (R)	3 (15)	2 (10)		1
Symmetry:				
Symmetric	18 (90)	20 (100)	FET=2.11	Undefined
Asymmetric	2 (10)	0	*p*=0.487	

FET: Fischer exact test. MC: Monte Carlo test. *r*: Reference group.

Table (3): Comparison OF MRI Qualitative assessment between normal and malignant lesions according to menopausal status.

Pre-menopausal	Malignant n=20 (%)	Normal n=20 (%)	Test of significance	Odds ratio (95% CI)
Pre-menopausal:				
Amount of parenchyma:				
Scattered areas of fibroglanular	0	1 (8.3)	MC=0.958	Undefined
Heterogenous dense(R)	5 (45.5)	5 (41.7)	*p*=0.619	1
Extremely dense	6 (54.5)	6 (50)		1.0(0.187-5.36)
BPE:				
Minimal	0	2 (16.7)	MC=2.16	Undefined
Mild	5 (45.5)	5 (41.7)	*p*=0.540	0.667(0.075-5.88)
Moderate	3 (27.3)	3 (25)		0.667(0.060-7.35)
Marked (R)	3 (27.3)	2 (16.7)		1
Symmetry:				
Symmetric	10 (90.9)	12 (100)	FET=1.14	Undefined
Asymmetric	1 (9.1)	0	*p*=0.478	
Postmenopausal:				
Amount of parenchyma:				
Scattered areas of fibroglanular(R)	1 (11.1)	3 (37.5)	FET=1.64	1
Heterogenous dense	8 (88.9)	5 (62.5)	*p*=0.294	4.8(0.385-59.89)
BPE:				
Minimal	0	4 (50)	MC=6.29	Undefined
Mild	8 (88.9)	4 (50)	*p*=0.043*	
Moderate (R)	1 (11.1)	0		
Symmetry:				
Symmetric	8 (88.9)	8 (100)	FET=0.944	Undefined
Asymmetric	1 (11.1)	0	*p*=1.0	

Table (4): Comparison of MRI Quantitative assessment of BPE between normal and malignant lesions.

	Malignant n=20	Normal n=20	Test of significance	Odds ratio (95% CI)
Area	94.31 (44.17-151.17)	85.14 (48-151.17)	z=0.230 *p*=0.818	0.775 (0.593-1.01)
Perimeter	32.67 (22.03-41.58)	30.25 (22.48-41.58)	z=0.068 *p*=0.946	3.68 (0.877-15.47)
Average	1739.59 (140-2450.74)	1404.4 (243.59-2095.09)	z=1.46 *p*=0.144	0.999 (0.976-1.02)
SD	117.47 (28.97-210.78)	1765.5 (380-2484)	z=0.501 *p*=0.617	0.987 (0.952-1.02)
MAX. value	2054.5 (208-2712)	1765.5 (380-2484)	z=1.70 *p*=0.09	1.005 (0.992-1.01)
MIN. value	1315 (74-2255)	1336 (132-1926)	z=0.44 *p*=0.457	0.996 (0.983-1.01)
Skewness	0.031 (-0.92 , 1.01)	0.055 (-0.83 , 0.80)	z=0.325 *p*=0.745	0.994 (0.084-11.80)
Kurtosis	3.05 (1.85-5.82)	2.72 (1.92-3.61)	z=0.961 *p*=0.337	3.26 (0.688-15.4)
Shiftn(%):				
Right (R)	6 (30)	9 (45)	MC=3.63	1
Left	7 (35)	2 (10)	*p*=0.163	5.25 (0.801-34.42)
Central	7 (35)	9 (45)		1.17 (0.279-4.87)

Z: Mann Whitney U test, parameters described as median (min-max), number (%), *r*: Reference group.

In Table (4), quantitative histogram analysis of the BPE in malignant and normal cases are shown. This analysis revealed that MAX. value of BPE were more in malignant group Vs normal group (2054.5 Vs 1765.5 respectively) with odds ratio, 1.005 (0.992-1.01), and average value of BPE was higher in the malignant group (1739.59 Vs 1404.4 for normal group) with odds ratio, 0.999 (0.976-1.02). This revealed association of the higher degree of BPE with higher cancer incidence.

Correlation between qualitative and quantitative assessment among malignant cases is shown in the following Table (5).

In Table (5), high correlation between the amount of breast parenchyma, degree of BPE and MAX. value for BPE (p-value of 0.786, 0.861 respectively), and also, high correlation between the amount of breast parenchyma, degree of BPE and average value for BPE (p-value of 0.842, 0.982 respectively).

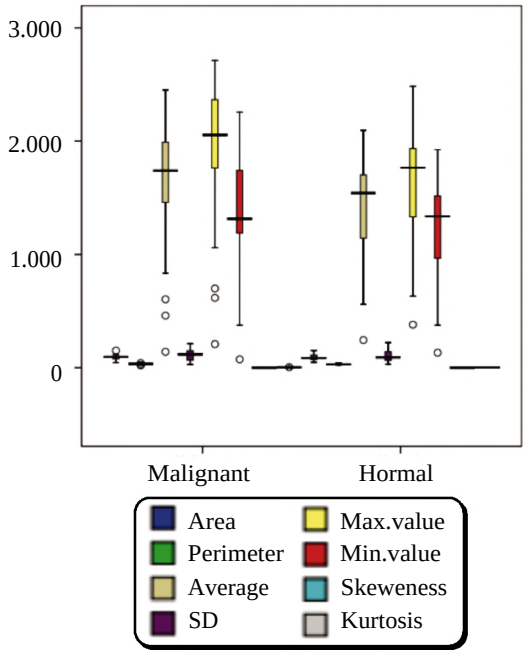

Fig. (1): Box and whisker plot showing median of histogram quantitative values of BPE between malignant and normalcases.

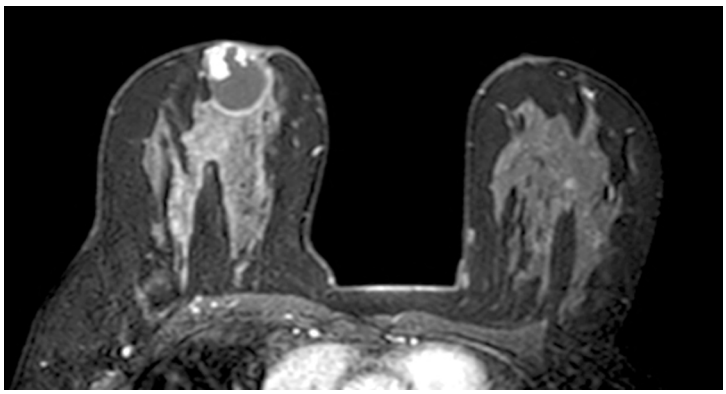

Fig. (2-A): Dynamic MRI showing moderate degree of bilateral BPE in a 54 years old patient with right pathologically proven papillary cystic carcinoma.

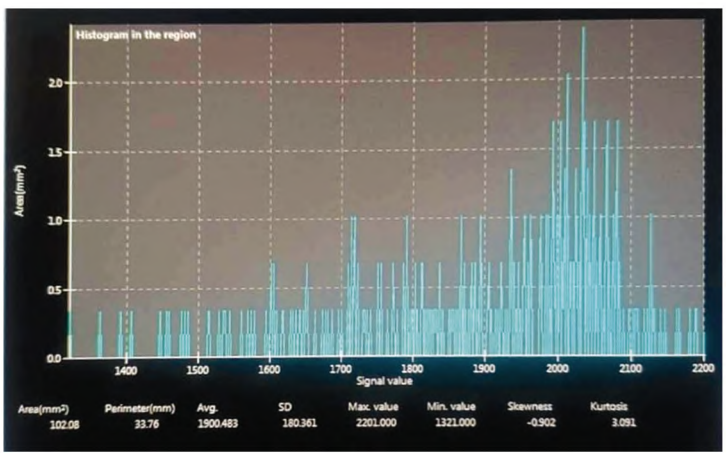

Fig. (2-B): Histogram curve of BPE in a ROI in the right normal breast parenchyma of the same patient showing max.value of BPE OF 2201.

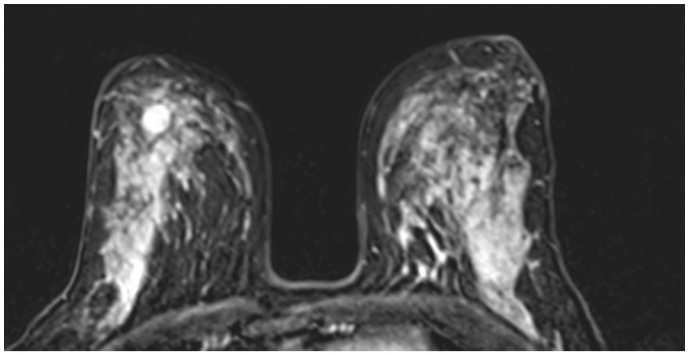

Fig. (3-A): Dynamic MRI showing marked degree of bilateral BPE in a 37 years old female patient with right fibroadenoma.

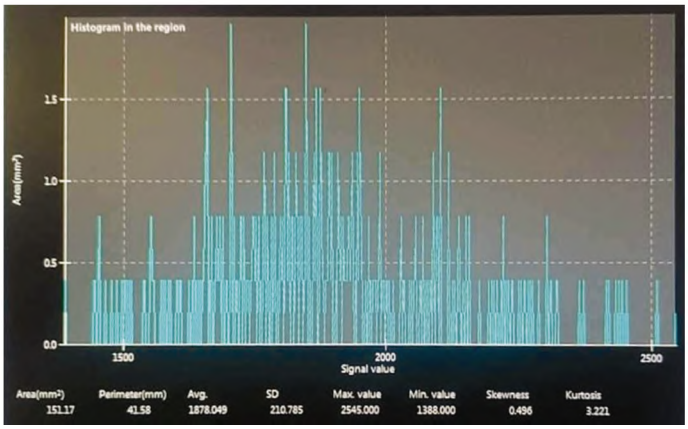

Fig. (3-B): Histogram curve of BPE in a ROI in the right normal breast parenchyma of the same patient.showing max.value of BPE OF 2545.

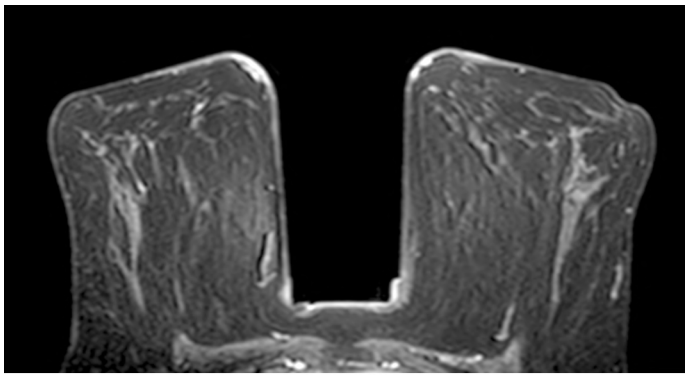

Fig. (4-A): Dynamic MRI showing minimal degree of bilateral BPE in a 51 years old patient with normal study.

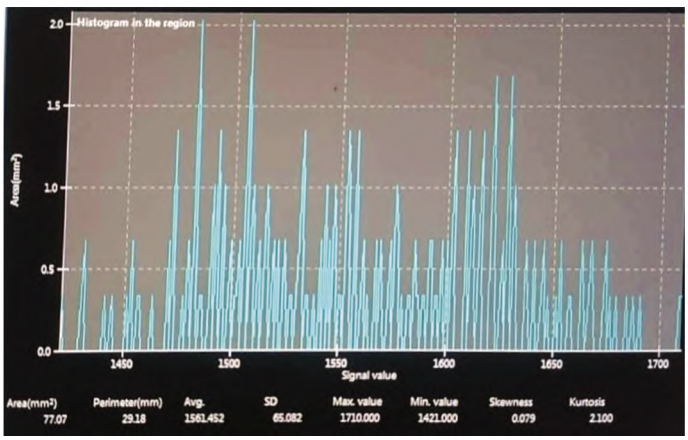

Fig. (4-B): Histogram curve of BPE in a ROI in the right normal breast parenchyma of the same patient showing max. value of BPE OF 1710.

Table (5): Correlation between qualitative and quantitative assessment among malignant cases.

	Amountparenchyma	BPE	Symmetry
Area:			
r	.364	.241	.000
p-value	.115	.306	1.000
Perimeter:			
r	.330	.264	.000
p-value	.155	.261	1.000
Average:			
r	.048	.005	–.029
p-value	.842	.982	.904
SD:			
r	–.077	.027	.173
p-value	.746	.911	.465
Max.value:			
r	.065	.042	–.029
p-value	.786	.861	.904
Min.value:			
r	–.008	–.015	.000
p-value	.973	.950	1.000
Skeweness:			
r	–.093	–.184	–.087
p-value	.695	.438	.716
Kurtosis:			
r	.181	.081	–.231
p-value	.446	.735	.327
Shift:			
r	–.061	–.151	–.230
p-value	.800	.526	.330

Discussion

Background parenchymal enhancement (BPE) is a feature of the normal breast parenchyma on imaging,meaning the amount of the fibroglandular tissue of the breastwhich enhances on MRI. This enhancement may be of diffuse or nodular enhancement patterns, which varies according to the phase of the menstrual cycle **[21]**, beinghigh in women receiving hormonal replacement therapy **[22,23]**, and also become high in the lactating women **[24]**. This BPE is thought to be relatedtothe hormonal levels. The cause of this normal enhancement may be related to higher vascular permeability causedby estrogen and raised metabolic activity related to progesterone **[25]**.

In our study we found that amount of fibroglandular tissue was influenced by age, with pre-menopausal women having more amount of fibroglandular tissue compared to post-menopausal women. Category of extremely dense breast was found in 12 pre-menopausal women, while not detected in the post-menapausal women in our study.

Also, we found that BPE was influenced by age, with pre-menopausal womenshowing more pronounced and extensive degrees of background parenchymal enhancement compared to post-menopausal women. This agreed with (De Martini et al.) who found that this parenchymal enhancement was affected by age, ascases younger than 50 years showing extensive degrees of parenchymal enhancement compared to older women **[26]**. Also agreed with (King et al.) who found that in 28 women breast MRI studies, including pre-menopausal and post-menopausal women, a remarkable number of women showed lower BPE degrees on post-menopausal MRIs compared to pre-menopausal ones **[27]**. Now, evidence of hormone levels relation tothe BPE has been detected, with a study showingthat higher bloodlevels of estrone and estradiol hormones found in post-menopausal women with higher BPE levels on MRI **[28]**.

In our study, in pre-menopausal category, marked degree of BPE was more seen in malignant cases Vs normal cases (3 cases Vs 2 cases respectively). In post-menopausal category, minimal and mild degrees of BPE were more detected in normal cases, while moderate degree of BPE was seen only in the malignant group. This keeps with results of (De Martini et al.) who found that increased BPE was related to a higher abnormal rates of interpretation on MRI, with women showing moderate or marked BPE were more associated with higher BIRADS categories **[26]**.

Also our results agreed with (Thompson et al.) who concluded that in high risk women, moderate and marked degrees of BPE was associated with the breast cancer incidence (n=9; I^2=53.0%; OR, 1.6; 95% CI: 1.0, 2.6; p=.04) **[29]**.

Also, our results are in keeping with results of (King et al.) who found that the odds ratio for breast cancer was found to be increased remarkably with increasing BPE compared to normal controls, and concluded that increased BPE is highly predictive of breast cancer **[30]**.

Multiple studies have discussed the association of high qualitative BPE degrees and breast cancer higher risk **[30-37]**. The relation of BPE with risk of breast cancer firstly was documented by (King et al.) study including more than one thousand women who underwent breast MRI studies as a high risk screening which showed that degrees of moderate or marked BPE was relatedto increased breast cancer diagnosis rates **[30]**. This is in agreement with our study results.

From these results, we can predict higher breast cancer incidence, in cases with higher degrees of BPE in the same age category. (Grimm et al.) detected these results in a study showing a two to three times greater incidence of future breast cancer occurrence in women having mild or greater BPE degrees **[36]**. A study on data from the "Breast Cancer Surveillance Consortium" (on 4247 case, 176 of them had breast cancer 3 months or more after an index MRI) concluded that cases with mild or higher BPE degrees had more likelihood of breast cancer in the future, and that the BPE levels can predict riskof breast cancer apart from the breast density and also future diagnosis of invasive breast cancer strongly **[38]**.

In our study, we performed quantitative assessment of the BPE using method of ROI-based measurement and histogram curve analysis of the BPE quantification. This analysis revealed that MAX. value of BPE were more in malignant group Vs normal group (2054.5 Vs 1765.5 respectively) with odds ratio, 1.005 (0.992-1.01), and average value of BPE was higher in the malignant group (1739.59 Vs 1404.4 for normal group) with odds ratio, 0.999 (0.976-1.02). This revealed association of the higher quantitative value of BPE with higher cancer incidence.

This agreed with (Lam et al.) study of quantitative measurements of BPE who found that cases who further developed breast cancer, hadmore 2D areas of BPE and more BPE signal intensity on quantitative assessments **[31]**.

Also agreed with (Hu et al.) case control study (including normal, benign and malignant cases), who done an fibroglandular tissue automated segmentation in both breasts to assess the enhancement rate of the parenchyma "BPER", meaning the ratio of volume of the enhancing fibroglandular tissue to whole volume of breast fibroglandular tissue. Their study concluded that higher degrees of BPER were related to more being in the cancer cohort in premenopausal or postmenopausal women **[32]**.

Also our results are in agreement with (Wu et, al.) who used an automated segmentation measures to assessthe whole breast quantitative measurements of BPE at the 1st and 3rd post-contrast series in cases with BRCA 1,2 mutations underwent risk-reducing salpigio-oophrectomy "RRSO" **[33]**. They measured the absolute whole volume of BPE by adding voxels numbers showing higher signal from pre-contrast to post-contrast sequence and ratio of BPE to the whole fibroglandular tissue volume (BPE%). They found that caseswho did not have cancer after the salpigio-oophrectomy showed remarkably decreased both absolute whole volume of the BPE and also, BPE% on breast MRIs after the (RRSO) compared with the MRI studies before it **[33]**.

Also, our results are in concordance with results of four studies **[32,33,39,40]** that showed differences in BPE quantitative values between breast cancer cases and controls. Breast cancer cases had a significantly higher percentage of BPE compared with that of controls.

Study limitation:

First, the assessments of BPE in low-risk women not included in the study becausemost studies focused on cases with higher breast cancer risk performing breast MRI as a screening or a diagnostic tool. Future work should include the utility of BPE assessment inlow-risk women. Also, small number of cases was a limitation in this study, future work with larger number of cases may be performed.

Conclusion:

From our study we concluded that higher amount of the fibroglandular tissue and higher qualitative degree and quantitative value of BPE are associated with increased breast cancer odds in the same age category, and from that we can predict higher incidence of breast cancer in population with higher degrees and values of BPE.

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الارتباط النوعى والكمى بين تعزيز متنى خلفية الثدى وحدوث السرطان

نظراً لزيادة فائدة التصوير بالرنين المغناطيسى كأداة فحص وتشخيص، أصبحت البيانات المتعلقة بتحسين متنى الخلفية متاحة أكثر من ذى قبل. قد يلعب تحسين متنى الخلفية دوراً مهماً كأداة للكشف المبكر عن سرطان الثدى، وتحديد المعرضين لخطر الإصابة بسرطان الثدى فى المستقبل.

الهدف من العمل : لتقييم العلاقة بين الخلفية النوعية والكمية لتعزيز متنى الخلفية فى التباين الديناميكى المعزز بالتصوير بالرنين المغناطيسى ووقوع سرطان الثدى.

المرضى والوسائل : تمت مراجعة التصوير بالرنين المغناطيسى لـ ٤٠ من الإناث قبل انقطاع الطمث وبعد انقطاع الطمث. تضمن تفسير التصوير بالرنين المغناطيسى النوعى تقييم مستوى تحسين متنى الخلفية ومقدار الأنسجة الليفية بالثدى. تم تصنيف مستوى تحسين متنى الخلفية على أنه درجة دنيا أو درجة خفيفة أو درجة معتدلة أو درجة ملحوظة. تضمن التقييم الكمى لمستوى تحسين متنى الخلفية اختيار الجزء من الحمة، ثم إنشاء منحنى الرسم البيانى الذى يعطى القيم الكمية لتحسين متنى الخلفية فى الجزء المحدد.

النتائج : وجدنا فى دراستنا أن كمية الأنسجة الليفية وتحسين متنى الخلفية تتأثر بالعمر، مع وجود كمية أكبر من الأنسجة الغدية الليفية لدى النساء فى فترة ما قبل انقطاع الطمث، مما يُظهر درجات أكثر وضوحاً واتساعاً من تحسين متنى الخلفية مقارنة بالنساء بعد انقطاع الطمث. كما تم الكشف عن مستويات نوعية أعلى وقيم كمية لتحسين متنى الخلفية فى المجموعة ذات الأورام الخبيثة، وكشف هذا الارتباط بين القيمة الكمية الأعلى لتحسين متنى الخلفية مع ارتفاع معدل الإصابة بالسرطان.

الخاتمة : خلصنا من دراستنا إلى أن وجود كمية أكبر من نسيج الغدد الليفية ودرجة نوعية أعلى وقيمة كمية لتحسين متنى الخلفية ترتبط بزيادة احتمالات الإصابة بسرطان الثدى فى نفس الفئة العمرية، ومن ذلك يمكننا توقع ارتفاع معدل الإصابة بسرطان الثدى لدى الحالات ذوى الدرجات والقيم الأعلى من تحسين متنى الخلفية.