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The role of using the kaiser score as a clinical decision rule for diagnosis in multi-parametric breast MRI

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Abstract

Introduction: Breast cancer is the most prevalent type of cancer among women. Around 1,500 000 women worldwide suffered from breast cancer each year. An equally crucial modality of mammography and the US is breast Magnetic resonance imaging (MRI). Breast cancer staging, breast cancer screening for high-risk women, and neoadjuvant chemotherapy response assessment are its main indications.

Aim of the study: The current study aimed to detect the value of applying Kaiser scoring during the interpretation of breast MRI for better detection and characterization of benign and malignant breast disease.

Subjects and methods: We conducted this study at the Radiology Department at Fayoum University Hospital. Forty-one patients with an abnormality on breast MRI, after being referred from either the Oncology or General Surgery clinics with breast masses were included.

Results: Kaiser score was more sensitive in the diagnosis of malignant cases than the BI-RADS score with a sensitivity of (100% versus 78.3%), but the specificity of the BI-RADS score was higher (88.9% versus 83.3%).

Conclusions: The Kaiser score was found to have 100% sensitivity and 83.3% specificity for the identification of malignant breast lesions. The MRI breast's overall accuracy was 90%.

Keywords: Kaiser score; breast; MRI; cancer and diagnosis.

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1. Introduction

Breast cancer is the most prevalent type of cancer among women. Around 1,500 000 women worldwide are suffering from breast cancer each year. According to the WHO, 570,000 women died from breast cancer in 2015, accounting for over 50% of all cancer-related deaths among women. Therefore, in terms of the treatment strategy and prognosis, early differentiation and detection of breast abnormalities are highly helpful [1].

As significant as mammography and ultrasound (US), Magnetic resonance imaging (MRI) is a modality. Its primary indications are the staging of breast cancer, screening for breast cancer in women at high risk (including those with genetic predispositions like a BRCA1 or

BRCA2 gene mutation or a first-degree relative with one of these mutations), and assessing the effectiveness of neoadjuvant chemotherapy. MRI is a functional approach as opposed to mammography and ultrasound. In the 1980s, Heywang, Kaiser, and Zeitler each individually discovered this technique [1].

Through the use of an intravenous contrast agent (gadolinium chelate), which shortens the local T1 time and increases the signal on T1-weighted images, contrast material-enhanced MRI measures the permeability of blood arteries. The basic concept is that neo-angiogenesis causes leaky arteries to develop, which speeds up the extravasation of contrast chemicals. As a result, multiparametric MRI techniques are now the standard [2].

In the early stages of diagnosis, clinical interest in Multi-Parametric MRI (MP-MRI), a noninvasive technique for tissue characterization, is developing. The morphology and various patterns of breast lesion enhancement determine the sensitivity of the MRI, which can reach 100%, but limits specificity for identifying the lesions [1].

MP-MRI is used more frequently these days to evaluate various breast lesions. As a result, the performance of MRI in the detection of various breast diseases is improved when conventional dynamic contrast-enhanced MRI is combined with other functional MRI techniques such as MR perfusion (dynamic curve), diffusion-weighted MRI (DW-MRI), and proton MR spectroscopy (1 H-MRS). The DWI (diffusion-weighted images), which can be employed in addition to DCE-MRI, is one of the non-contrast sequences. Proton MR Spectroscopy explains the biochemistry of the tumor and the concentrations of several metabolites. It can be used in common MRI protocols to distinguish benign from malignant tumors [2].

BI-RADS classification in MP-MRI is not only a clinical decision rule, but also a lexicon that provides a common language for lesion description [3]. We created such a clinical decision rule, previously known as the Tree flowchart [4], and called it the "Kaiser score" in honor of Werner A. Kaiser, the father of MRI, who established the basis for its creation.

In breast MRI, the Kaiser score is a clinical decision criterion that uses evidence to distinguish between malignant and benign tumors. Speculations, margin descriptions, breast MRI enhancement curves, interior enhancement patterns, and edema are all relevant factors. The diagnostic score, which ranges from 1 (minimum) to 11 (maximum), is obtained after the reader completes the flowchart in three sections (maximum). Always take into account, the clinical condition and further imaging findings when making diagnostic choices and subsequent clinical recommendations. Scores more than four should generally be biopsied [4].

The current study aimed to identify the value of applying Kaiser scoring during the interpretation of breast MRI for better detection and characterization of benign and malignant breast disease.

2. Subjects and methods

2.1. Subjects

The current observational prospective study was conducted at the Radiology Department of the Fayoum University Hospital. Patients were referred from the Oncology and General Surgery outpatient-clinics, after obtaining the approval of the institutional Research and Ethics Committee (ethical committee number: EC2104). 41 Female patients with an abnormality on breast MRI, after being referred from either the Oncology or General Surgery clinics with breast masses.

2.2. Inclusion criteria

Female patients with breast masses on breast MRI.

2.3. Exclusion criteria

Patients with contraindications for MRI such as, metallic implants, MR-incompatible pros-thetic heart valves, claustrophobia, pacemakers, pregnancy, contrast allergy, patients unable to lie prone as a result of marked kyphosis or kyphotic sclerosis, and obese patients were excluded.

2.4. Methods

Authors took the medical history from the patients about (age, symptoms, and family history of breast cancer). Then, the clinical data about the presence of palpable masses, nipple discharge, edema, nipple retraction, or axillary lymph nodes were collected. Later, we examined young and older patients with ultrasound and sono-mammography, respectively, to detect the characteristics of the breast lesions. MRI was performed using Toshiba Vantage Titan 1.5T Cloed MRI Machine (Toshiba, Tokyo, Japan). Cases were imaged in the prone position using a double breast coil. Finally, ultrasound-guided Tru-cut biopsy was taken from the breast lesions for histopathological assessment.

MRI protocol included the following: -

Pre-contrast study

- Sagittal T1-weighted spin echo sequence for localization purposes.
- T1-weighted fast spin echo (TR= 125 msec, TE=5.3 msec) in the transverse orientation.
- T2-weighted fast spin echo sequences (TR= 3740 msec, TE=90 msec) in the transverse orientation.
- T2 short T1 Inversion Recovery pulse sequence (STIR). (TR= 3510 msec, TE=72 msec, and T1= 170 msec).

Post-contrast study

- A bolus of Gadopentetate dimeglumine (Gd-DTPA) was injected (0.1 mmol/Kg) (in less than 15 seconds).
- Imaging was repeated using either THRIVE (T1 High-Resolution Iso-tropic Volume Excitation with fat suppression) (TR =3 msec, TE=2 msec) or FFE (Fast Field Echo) (TR =5.5 msec, TE=2.2 msec). It was possible to collect multiple post-contrast images at uniformly spaced intervals, usually 1 to 1.5 minutes. Normally, 5-7 post-contrast scans were documented.

Image post-processing

To draw attention to the image's enhancing features, the subtraction technique was applied. Using the software subtraction feature on the post-processing workstation, it will be done in the same axial plane between the post-contrast images and the pre-contrast images.

Analysis of the pattern of enhancement with proper selection of the region of interest (ROI) to be greater than 3 pixels and corresponding to the part of the lesion showing the strongest and fastest enhancement. The signal intensity in ROI was plotted over time to obtain the specific Kinetic curve.

Color-coded parametric maps helped detect the area of maximum contrast uptake in order to determine regions in which the ROI is applied.

Multiplanar reformatting (MPR) was used to pinpoint the location of enhancing lesions in the breast and examine internal structure and margins from a different perspective. Image reformatting of 3D data took advantage of the true three-dimensional MRI.

Maximum intensity projection (MIP) images were used for demonstrating the distribution of the disease in the breast in relation to the skin, nipple, chest wall, and large vessels.

Kaiser scoring was applied to the interpretation of the MRI images with a correlation of its results to those of histopathology.

2.5. Statistical Analysis

Data was gathered, coded to make data manipulation easier, double-entered into Microsoft Access, and then analyzed using SPSS software version 22 on a Windows 7 computer (SPSS Inc., Chicago, IL, USA). Simple descriptive analysis using percentages and numbers for qualitative data, arithmetic means for measuring central tendency, and standard deviations for quantifying dispersion for parametric quantitative data. For qualitative data, Chi-square test was used to compare two of more than two qualitative groups. Sensitivity and specificity test were performed by analyzing the Receiver Operating Characteristic (ROC) curve. The *P-value< 0.05* was considered statistically significant.

3. Results

The mean age among the study group was (38.9±14.4) years old, ranging between (16 and 70) years. Nine patients (22%) had positive family history of breast cancer, while 32 (78%) were negative. 22% of cases had bilateral lesions versus 78% had unilateral lesions. 31.7% of cases had a lesion on the right side, but 46.3% had one on the left side. The highest percentage of lesions 31.7% were located in the upper outer part of the breast followed by diffuse lesions 24.4% of cases, while the lowest percentage were in the lower outer part (7.3%) (Table 1 and Figure 1).

In the US assessment, the mean number of masses on both sides was 2±2. 7.3% of cases had multiple masses in both breasts. 48.8% of cases had ill define masses. 51.2% had Spiculated margin, 73.2% had minimal vascularity, and 14.6% had associated manifestations such as, skin edema, lymph nodes, and nipple retraction (Table 2).

Table 1: Frequency of different lesion characters among the study group.

Variables (n=41)		Frequency
Lesion distribution	Unilateral	32 (78%)
	Bilateral	9 (22%)
Side of lesion	Right	13 (31.7%)
	Left	19 (46.3%)
	Bilateral	9 (22%)
Site of lesion	Upper outer	13 (31.7%)
	Upper inner	5 (12.2%)
	Lower outer	3 (7.3%)
	Diffuse	10 (24.4%)
	Retro-areolar	9 (22%)
	Lower inner and Retro-areolar	1 (2.4%)

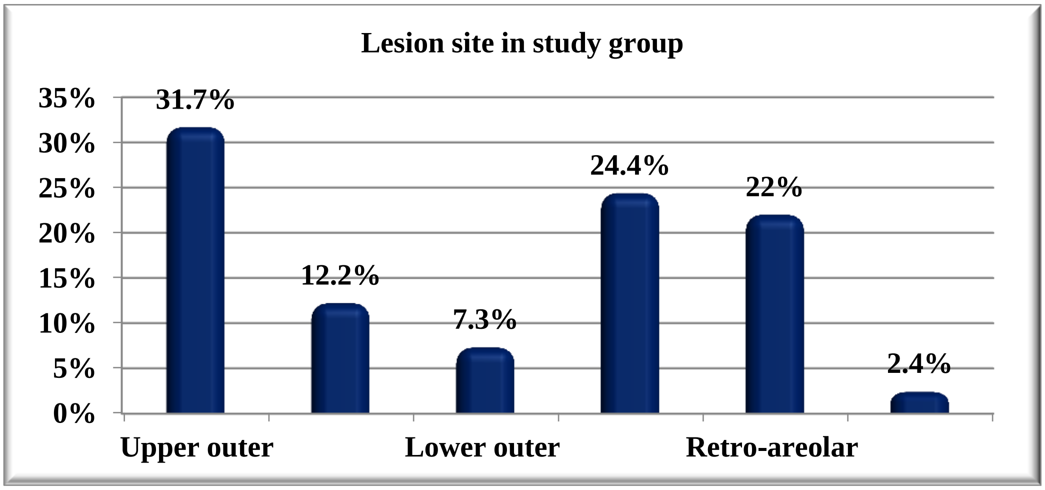

Figure 1: Lesion site in study group.

Table 2: Frequency of different ultrasound findings among the study group.

Variables (n=41)		US findings
No. of masses	Right side	1-6
	Left side	1-6
Multiple masses	Right side	3 (7.3%)
	Left side	3 (7.3%)
Lesion shape (n=40)	Oval	4 (9.8%)
	Rounded	2 (4.9%)
	Well define	14 (34.1%)
	Ill define	20 (48.8%)
Margin (n=40)	Well circumscribed	6 (14.6%)
	Macro-lobulated	11 (26.8%)
	Micro-lobulated	1 (2.4%)
	Spiculated	21 (51.2%)
	Ill-defined	1 (2.4%)
Vascularity (n=40)	Absent	1 (2.4%)
	Minimal	30 (73.2%)
	Diffuse	9 (22%)
Associations	Non	24 (58.5%)
	Skin edema	2 (4.9%)
	Lymph nodes	6 (14.6%)
	Nipple retraction	2 (4.9%)
	All of the above	6 (14.6%)
	Nipple erosion	1 (2.4%)

39% of cases

have a classification 5 of BI-RADS classification, followed by 22% for classification 2 of BI-RADS, and the lowest percentage was for classification 4b (4.6%), as shown in Table 3 and Figure 2.

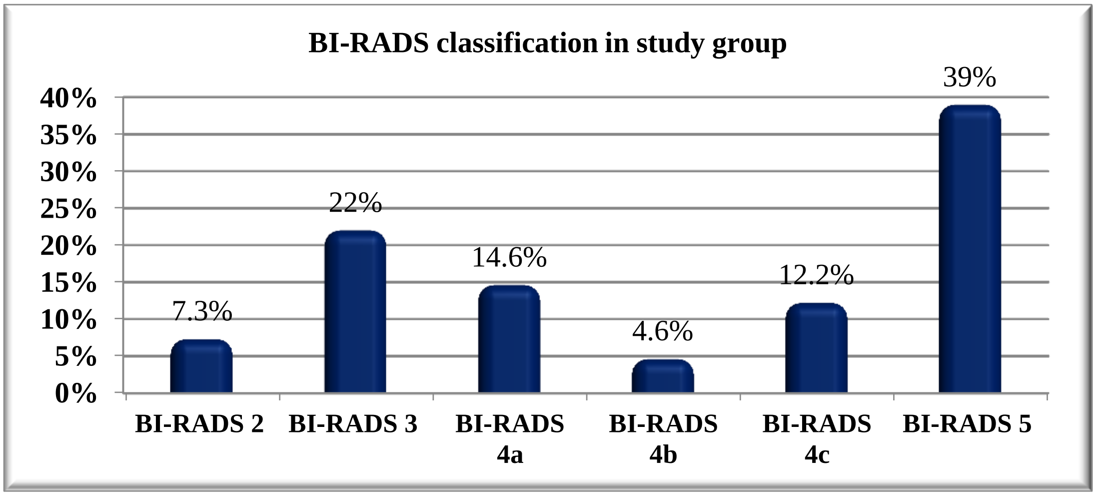

Figure 2: BI-RADS classification in study group.

Table 3: Frequency of different BI-RADS classifications among the study group.

Variables (n=41)		Frequency
BI-RADS 2		3 (7.3%)
BI-RADS 3		9 (22%)
BI-RADS 4	4a	6 (14.6%)
	4b	2 (4.9%)
	4c	5 (12.2%)
BI-RADS 5		16 (39%)

In MRI assessment, the mean number of masses on both sides was 2±2 masses on the right side and 3±2 masses on the left side. 12.2% and 14.6% of cases showed multiple masses on the right and left breast sides, respectively. Among all cases, 48.8% showed ill define mass, 53.7% had Spiculated margin, 56.1% showed a heterogeneous pattern, 58.6% showed Washout type III type of kinetic curves, and 14.6% had lymph node association (Table 4).

Table 4: Frequency of different MRI findings among the study group.

	Variables (n=41)	US findings
No. of masses	Right side	1-6
	Left side	1-6
Multiple masses	Right side	5 (12.2%)
	Left side	6 (14.6%)
Lesion shape	Oval	5 (12.2%)
	Rounded	1 (2.4%)
	Well define	15 (36.6%)
	Ill define	20 (48.8%)
Margin	Well circumscribed	5 (12.2%)
	Macro-lobulated	11 (26.8%)
	Micro-lobulated	2 (4.9%)
	Spiculated	22 (53.7%)
	Ill-defined	1 (2.4%)
Pattern	Homogenous	2 (4.9%)
	Heterogeneous	23 (56.1%)
	Homogenous with non-enhancing septations	11 (26.8%)
	Rim enhancement	3 (7.3%)
	Heterogeneous and Rim enhancement	2 (4.9%)
Kinetic curves	Persistent type I	6 (14.6%)
	Plateau type II	11 (26.8%)
	Washout type III	24 (58.5%)
Associations	Non	24 (58.5%)
	Edema	1 (2.4%)
	Lymph nodes	6 (14.6%)
	Skin edema	2 (4.9%)
	Nipple retraction	2 (4.9%)
	All of the above	5 (12.2%)
	Nipple erosion	1 (2.4%)

The mean Kaiser score was (7.1 ±3.3) ranging between 1 and 11. By BI-RADS classification 70.7% of cases were diagnosed as malignant lesions versus 80.5% were diagnosed by Kaiser score and 56.1% by histopathology (Table 5). On the other hand, there was a statistically significant difference ($P<0.05$) as regards diagnosis of malignancy by BI-RADS, and Kaiser score with 11.1% of cases showing false positive results in BI-RADS versus 16.7% for Kaiser (Table 6).

Table 5: Frequency of final diagnoses among the study group.

Variables (n=41)		US findings
BI-RADs Diagnosis	Benign	12 (29.3%)
	Malignant	29 (70.7%)
Kaiser score Diagnosis	Benign	8 (19.5%)
	Malignant	24 (58.5%)
	Variable percentage of malignancy	9 (22%)
Pathology diagnosis	Benign	18 (43.9%)
	Malignant	23 (56.1%)
Types of diagnoses by pathology		
Benign	Cellular fibroadenoma	5 (12.2%)
	Intracanalicular fibroadenoma	2 (4.9%)
	Intraductal papilloma	3 (7.3%)
	Lobular mastitis	3 (7.3%)
	Sclerosing adenosis	3 (7.3%)
	Fibrosis	2 (4.9%)
Malignant	Invasive duct carcinoma	11 (26.8%)
	Infiltrating duct carcinoma	9 (22%)
	Squamous cell carcinoma	1 (2.4%)
	Duct carcinoma in situ	2 (4.9%)

Table 6: Comparisons of inaccuracy of BI-RADS and Kaiser score in the detection of malignancy.

Variables (n=41)		Pathology diagnosis		*P-value*
		Benign	**Malignant**	
BI-RADs Diagnosis	**Benign**	16 (88.9%)	5 (21.7%)	<0.001*
	Malignant	2 (11.1%)	18 (78.3%)	
Kaiser score Diagnosis	**Benign**	15 (83.3%)	0	<0.001*
	Malignant	3 (16.7%)	24 (100%)	

**Significant at P<0.05.*

The sensitivity and specificity test for BI-RADS and Kaiser score illustrated that the Kaiser score was more sensitive in the diagnosis of malignant cases than the BI-RADS score with a sensitivity of (100% versus 78.3%) but the specificity of the BI-RADS score was higher (88.9% versus 83.3%) (Table 7 and Figure 3). Examples of US and MRI images were given in Figure 4.

Table 7: Sensitivity and specificity of BI-RADS and Kaiser Score in the diagnosis of malignancy.

Variable	Sensitivity	Specificity	AUC	*P-value*
BI-RADS	78.3%	88.9%	83.6%	0.001*
Kaiser score	100%	83.3%	91.7%	0.001*

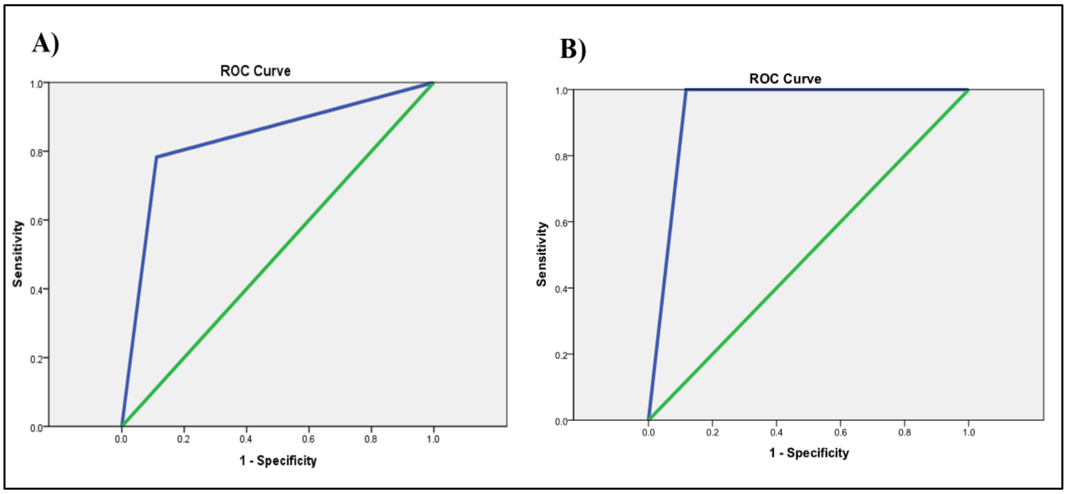

Figure 3: ROC curve for the diagnosis of malignancy. A) BI-RADS, B) of Kaiser Score.

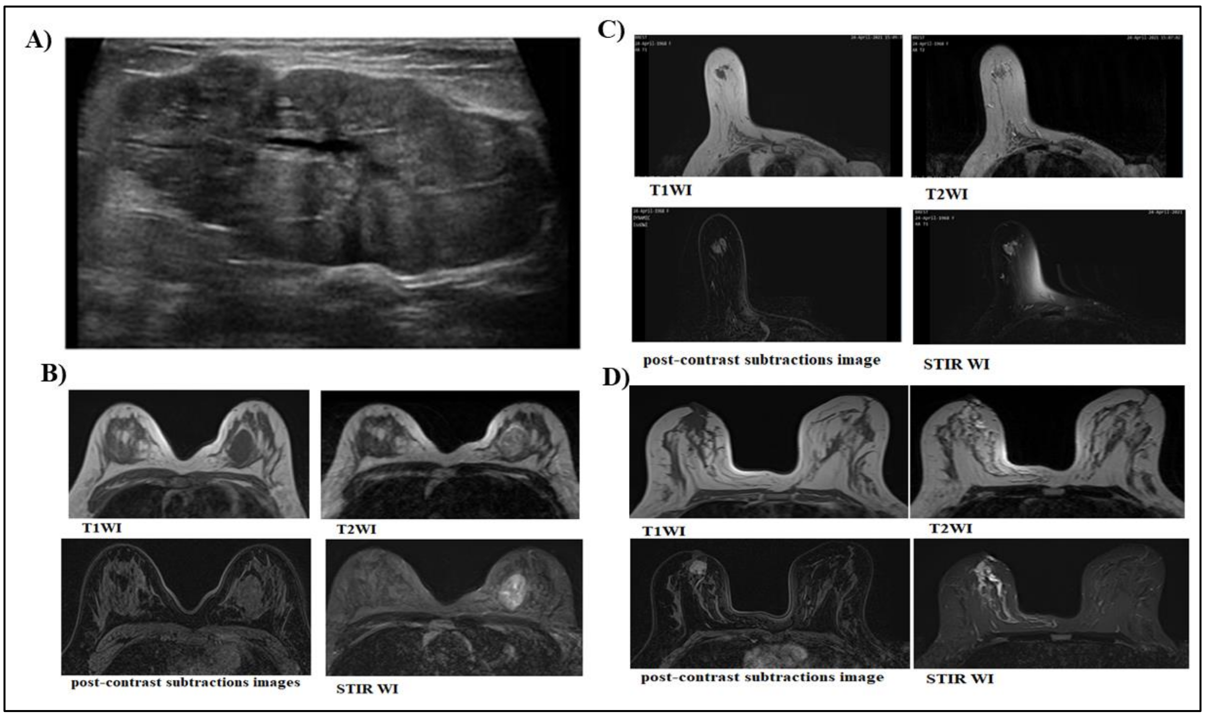

Figure 4: Example of our included patients. A) and B) demonstrates US picture of two palpable masses and MRI images of the lesions of a twenty-three years old female patient presented with a left palpable painless breast mass. C) shows the MRI findings of a fifty-four years old female patient who underwent a modified radical mastectomy of the left breast two years before and received chemo and radiotherapy, then in her annual follow-up revealed two retro areolar right breast masses, the patient has a family history of breast cancer. D) provides the findings of the MRI of a forty-three years old female patient presented with right breast retro-areolar painless palpable mass, patient has a family with no history of breast cancer.

4. Discussion

The most frequent malignancy in women is breast cancer, which is considered the most leading cause of death for females. Therefore, early detection and classification of breast lesions are crucial to develop possible treatment strategy and the outcome [1].

It is crucial to screen the high-risk population. These include the first-degree relatives, patients with a gene mutation, those with a genetic susceptibility such as, a BRCA1 or BRCA2 gene mutation. Patients with a history of chest wall radiation at a young age, those with a strong family history of breast cancer, and some with a personal history of breast cancer are also included in that category [5].

The high-risk group is mainly young aged females with dense breasts, who need annual follow up. Breast MRI is very useful in such cases because its accuracy is not affected by the density of the breast [4].

Breast MRI is utilized for screening in individuals, who have a high risk of developing breast cancer due to its great sensitivity and has become a crucial supplemental diagnostic tool in the breast clinic. DCE-MRI is a complex technology that provides numerous images [2].

In DCE-MRI of the breast, the BI-RADS classification is a lexicon that offers a common language for lesion description in addition to being a clinical decision rule [3]. In breast MRI, the Kaiser score is a clinical decision criterion that uses evidence to distinguish between malignant and benign tumors. It depends on the presence of speculations, breast MRI enhancement curves, description of margins, internal enhancement patterns, and edema.

The Kaiser score directs a three-step lesion assessment based on four diagnostic criteria using a decision tree organized as a flowchart. Following the flowchart from top to bottom yields a diagnostic score, which ranges from 1 to 11, reflecting an increasing probability of malignancy [6].

In our study, we examined 41 patients with different breast lesions to detect the value of applying Kaiser scoring during the interpretation of breast MRI for better detection and characterization of benign and malignant breast diseases. The sensitivity and specificity are 100% and 83.3 %. That was compared with Wengert e*t al.*, 2020, who reported sensitivity and specificity of about 96% and 95% [7].

In our study, the patients' age ranges from (16 to 70 years old). About 22% had a family history of breast cancer, where about 78% had no family history of breast cancer. 43% proved to be benign and 57% to be malignant by histopathological assessment. 22% of cases had bilateral lesions versus 78% had unilateral lesions. 31% had lesions on the right side, but 47 % had on the left side. The highest percentage of lesions (31.7%) were located in the upper outer part of the breast, followed by diffuse lesions 24.4% of cases, where the lowest percentage of (7.3%) were in the lower outer part.

The Kaiser score depends on the presence of speculations, description of margins, breast MRI enhancement curves, internal enhancement patterns, and edema. The presence of spiculated margins is suspicious for carcinoma, having a near 99% positive predictive value for malignancy [8]. The Kaiser score is between one and eleven. Each score value represents a particular set of diagnostic criteria that reflects the lesion phenotypes connected to common disorders. This aspect is useful for teaching, documenting, and differential diagnosis in addition to differential diagnosis. Scores below 5 should be regarded as benign for clinical decision-making, while the biopsy is recommended to start at a score of 5 [4].

In our study, we found speculated margins in 91.3% of malignant lesions and 5.8% of benign lesions (Such as sclerosing adenosis and lobular mastitis). Macro-lobulated margins were found in 52% of benign lesions and 9.5% of malignant lesions. Circumscribed margins were found in 35% of benign lesions and none of the malignant lesions. These findings were consistent with El Bakry *et al.*, 2015, who demonstrated that benign tumors typically had smooth margins, whereas malignant lesions typically had uneven or speckled margins [9].

There are three different types of time signal intensity curves in our study, and we discovered that type I persistent curve was present in 46% of benign lesions but not in malignant lesions, type II plateau curve was present in 30% of benign lesions but not in malignant lesions, and type III washout curve was present in 23% of benign lesions but not in malignant lesions. Therefore, differentiating between benign and malignant lesions requires understanding distinct time signal intensity curve types. Progressive curve types are more common in benign findings, while plateau and washout curve types are more common in malignant findings.

These findings were consistent with a previous study in which type I persistent curves were present in 89.5% and 13.9%, type II plateau curves were present in 7.9% and 25%, type III washout curves were present in 2.6% and 61.1% of benign and malignant lesions, respectively [9].

Differentiating between malignant and benign tumors requires a careful examination of the enhancing pattern. In our research, we discovered that heterogeneous enhancement was present in 86.9% of malignant lesions and 16.7% of benign lesions, while homogeneous enhancement was present in 11.1% of benign lesions and 0% of malignant lesions. Only 15% of malignant lesions and 44.4% of benign lesions had homogenous enhancement with non-enhancing septations. Of benign lesions, 27.8% had rim enhancement.

In our study, when we compared using BI-RADS classification in multi-parametric MRI of the breast and using the Kaiser score, the sensitivity was about (78% and 100%) respectively, and the specificity was about (89% and 83%) respectively. The most common benign lesion is fibroadenoma, which is characterized mainly by circumscribed or macro-lobulated margins, type I or type II time-intensity curve, and homogenous or homogenous with non-enhancing septations as a pattern of enhancement. Typical fibroadenomas according to the Kaiser score ranges from 1 to 5 (Do not need biopsy). The most common malignant lesion is invasive duct carcinomas, which are characterized by spiculated margins, type III or type II time-intensity curve, and heterogenous pattern of enhancement. Both range from 8 to 11, according to the Kaiser score, while the biopsy is mandatory. The low percentage of false positive results for malignancy are noted. Two cases of intraductal papilloma's present in Dynamic breast MRI with similar behavior of malignant masses due to their washout kinetic curve and their lobulated margin. Because of this, the outcome of the MR analysis is occasionally insufficient to classify the mass as malignant or benign. Imaging can show striking similarities between papillary carcinomas and intraductal papilloma. Both can show a "not very even "outline because both fill and take the shape of the dilated duct. Both can show early conspicuous contrast uptake (because both have direct feeding vessels). This is why we usually keep this differentiation for pathology.

A kind of adenosis known as sclerosing adenosis occurs when stromal fibrosis that surrounds larger acini causes a little distortion.

Although the breast's natural lobular architecture is preserved, it is enlarged and deformed. Abnormal lesions with unusual shapes, architectural distinctions, or microcalcifications are seen on Sono-mammographic images [10].

In our study, two cases of sclerosing adenosis are noted. In the first case, a 28- year-old female presented with left breast masses. Ultrasound revealed a small irregularity-shaped mass with lobulated margins, and few micro-calcifications noted. According to the Kaiser score, the lesion’s score was 5. The histopathological assessment revealed sclerosing adenosis without atypia. In the second case, a female patient 43 years old presented with breast induration with no palpable masses, the ultrasound revealed an irregularly shaped mass with architectural distortion in mammography. According to the Kaiser score, the lesion’s score was 9. The histopathological assessment revealed sclerosing adenosis with atypia. That means the Kaiser score can be very useful in cases with sclerosing adenosis.

Depending on the level of inflammation, MRI results in GM can vary. In previously reported cases, heterogeneous, poorly defined masses and non-mass enhancement were found. Previous research has documented inconsistent kinetic analysis curve results between patients and lesions. Frequently, patterns of plateau or persistent enhancement predominate [11]. A case of GM was encountered in this study and presented as regional clustered non-mass enhancement with Kinetic curve analysis showing a type II curve pattern.

Patient management, imaging techniques, and setup must be standardized to produce high-quality DCE-MRI. A systematic procedure should be followed while reading DCE-MRI data. The internal enhancement pattern, edema, SI-time curve type, circumscribed, irregular, and spiculated borders (the latter of which is also known as the root sign) should all be present in lesions. These requirements are taken into account by the Kaiser score, an evidence-based diagnostic flowchart that may be used with a variety of MRI protocols and MRI systems. With low inter-observer variability and good diagnostic accuracy, the Kaiser score can be simply converted into BI-RADS category assignments. The conclusion of the report should include a management recommendation [7].

Conclusions

The sensitivity and specificity of the Kaiser score for diagnosis of malignant breast lesions were found to be 100% and 83.3% respectively. The overall accuracy of the MRI breast was 90%. A small number of patients are participating in this single-center study. To confirm the generalizability of this study's findings, future large-scale multi-center studies are advised. The current study suggests Chest US for the easy and precise detection of successful pleurodesis and follow-up.

Ethical Approval Statement: The study was approved by the Faculty of Medicine, The Ethical Committee of The Fayoum University.

Informed Consent Statement: Informed written consent from patients who were invited to participate in the research was obtained.

Authors' contributions: The corresponding author, Dr. Nahla R. Ibrahem, contributed to the idea and design of the investigation, the analysis of the radiological data, the revision of the statistics, results, and discussion, and the initial text of the publication. Dr. Mohamed A. Mohamed was in charge of gathering data, analyzing radiological findings, formulating the findings, and doing review research. Dr. Dalia S. Elmesidy was in charge of conceptualizing, designing, and editing the final version of the work.

Availability of data and materials statement: The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Conflicts of Interest: All authors declare no conflict of interest.

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