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Concordance of Breast Imaging Reporting and Data System with Routine Interpretation of Digital Mammography

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Abstract
The American College of Radiology's (ACR) Breast Imaging Reporting and Data System (BI-RADS) provide a lexicon that give a standard way of reporting mammogram that help ensure better follow up of suspicious findings.The study conduct to assess the concordance of final findings of mammograms reported using BI-RADS lexicons and the final impression of radiologist those using routine interpretation of mammogram. The data descriptively analyzed and Kappa value was determined to measure the concordance. The result appeared as the concordance of the breast composition was (k = 0.5) that point Moderate agreement. According to mass, the presence of the mass was (k = 0.83) that was a Very Good agreement, the shape of the mass was (k = 0.53) that a Moderate agreement, the margin of the mass was (k = 0.475) that point Moderate agreement, the density of the mass was (k = 0.74) that point a good agreement, in addition the associate calcifications was (k = 1) that point a total agreement. According to calcification the Kappa value was for presence (k = 0.87) that point to Very Good agreement, the morphology of the calcifications was (k = 0.85) that point to Very Good agreement and distribution was (k = 1) that point Very Good agreement. In addition, the architectural distortion was (k = 0.85) that point to Very Good agreement, and A symmetry was (k =0.138) it was poor agreement. The intramammary lymph node was (k = 0.65) that point a good agreement and the overall agreement and concordance to the final finding was (k = 0.58) that point to a moderate agreement. As the conclusion the study revealed that there is a wide variation in wording of the mammography report between the radiologists. Therefore, it is very important to follow the BIRAD lexicon in order to avoid any misunderstanding or confusion.

Keywords: BIRADS, Mammography, Breast imaging

المستخلص

يوفر نظام بيانات و تسجيل تصوير الثدي (BI-RADS) التابع للكلية الأمريكية للأشعة (ACR) معجمًا يوفر طريقة قياسية لتشخيص صور الثدي بالأشعة السينية(ماموقرام) مما يساعد على ضمان متابعة أفضل النتائج للحالات السرطانية المشكوك فيها. اجريت الدراسة لتقييم توافق النتائج النهائية التي تم تصويرها باستخدام أشعة الماموجرام باستخدام طريقة BI-RADS والتشخيص النهائي لأخصائي الأشعة الذين يستخدمون الطريقة الروتينية للماموجرام. تم تحليل البيانات الوصفية وتم تحديد قيمة Kappa لقياس التوافق. وكانت النتيجة ظهور توافق في تكوين الثدي (ك = 0.5) تشير إلى اتفاق متوسط. وفقًا للكتلة ، كان وجود الكتلة (ك = 0.83) كان اتفاقًا جيدًا للغاية ، وكان شكل الكتلة (ك = 0.53) اتفاقًا معتدلاً ، كان حافة الكتلة (ك = 0.475) اتفاق معتدل ، كانت كثافة الكتلة (ك = 0.74) تشير إلى اتفاق جيد ، بالإضافة إلى وجود التكلسات كانت (ك = 1) تشير إلى اتفاق كلي. وفقًا للتكلس ، كانت قيمة Kappa هي التواجد (k = 0.87) التي تشير إلى اتفاق جيد جدًا ، كانت مورفولوجيا التكلسات (ك = 0.85) تشير إلى اتفاق جيد جدًا بينما التوزيع والانتشار كان (ك = 1) بناتج اتفاق جيد جدًا. اضافة إلى ذلك ، كان تشوه التركيب (ك = 0.85) يشير إلى اتفاق جيد جدًا ، وكان عدم التماثل (ك = 0.138) كان اتفاقًا ضعيفًا. اما تقييم العقدة الليمفاوية داخل الثدي (ك = 0.65) تشير إلى اتفاق جيد .الاتفاق العام والتطابق مع النتيجة النهائية كان (ك = 0.58) التي تشير إلى اتفاق معتدل. في ختام الدراسة ، هناك صيغة واسعة لصياغة تقرير التصوير الشعاعي للثدي بين أخصائيي الأشعة. لذلك ، من الأهمية بمكان أن تشبه صياغة تقرير التصوير الشعاعي للثدي تجنب أي سوء فهم أو تشويش ، وتطبيق معجم BIRAD.

Introduction

BIRAD system has a very significant impact in the diagnosis and detection of breast lesions and it helps in early detection of breast cancer(Ferreira *et al.* ,2011). The American College of Radiology designed the Breast Imaging Reporting and Data System(BI-RADS),which included six assessment categories numbered of 0–5 with associated management recommendations (Taplin e*t al.* ,2002),and also category 6 for proven malignancy (Balleyguier *et al.*, 2007).Since developed the BIRAD system terms used in reporting have been developed to describe breast composition, lesion morphology, final impression, and recommendations (Berg *et al.*, 2004). Because the wide variability of the mammography practice and difference in description of the lesions between radiologist comes the importance of the BIRAD system (Lazarus *et al.*, 2006), that provide a complete system to standardize both lesion description and management recommendations(Burnside *et al*., 2009).

The BI-RADS is designed for everyday practice and should make it possible to issue meaningful and unambiguous breast imaging reports. BI-RADS was always intended to be a dynamic and evolving document that would adapt to changes in the practice of breast imaging and be of practical use to interpreting physicians.

Many studies evaluated the use of the American College of Radiology BI-RADS considerations in routine clinical practice. Important work has been done to evaluate the positive predictive value of BI-RADS assessments (Orel *et al*., 1999; Liberman *et al*., 1998) and between-reader variation in the characterization of the findings (Berg *et al*., 2000). The questions to be answered: is the radiologist assessment report is cope with the BI-RADS suggestions.

Materials and Methods

The subjects of the study were 300 mammograms taken by different digital mammography machines. The study conduct between 2015 and 2018 to evaluate, the BI-RAD in interpretation of mammography image, and define the degree of concordance between them.

The mammographic images reported using the BI-RAD system was collected, and re-reported by different radiologist according to traditional way of reporting, or vice versa then, all the data recorded into recording data sheet according to categories have been assessed. The study excluded a mammogram of women with a history of breast or ovarian cancer, breast implants. So the BIRADS Category 6 was not included in this study.

Collection of Data

Digital mammogram were collected from different medical institutions and re-diagnosed by various radiologists. The subjects were digital mammograms randomly selected for women between the ages of 15 to 90 years and the two basic projections of mammography (CC and MLO) were adopted**.**The mammograms diagnosed by radiologists using the usual interpretation of mammography and re-diagnosed again by different radiologist using BIRAD system.The data from different reports collected using two different data collection sheets, for the two types of reporting. Each sheet includes: patient age, breast composition, the mammographic finding (Mass, Calcifications, Architectural distortion, Asymmetry, Intramammary Lymph node, solitary Dilated ducts and Associated features), and the final diagnosis or BIRAD Category.

Data collection sheet:

The items of sheet determine using breast imaging lexicons of BIRAD system.

Age:

The ages of the patients grouped according to range of patient's age from 15 to 90.The total patient's ages were divided into five different groups with 15 years interval, the first one (15-30), the second group (31-45), the third group (46-60), the forth group (61-75) and the fifth group (76-90).

Breast Composition:

The breast composition determined by radiologist for each mammogram according to classification categories (fatty, scattered fibroglandular, heterogeneous fibroglandular or dense breast) for the usual interpretation. And by letters ("a" for fatty, "b" for scattered fibroglandular, "c" for heterogeneous fibroglandular or "d" for dense breast) according to BIRADS lexicons.

Mass:

The term mass selected by the radiologist when found a 3D occupying space lesion and described the mass according to its shape either oval, round or irregular. The researcher added a fourth descriptive term found in the reports "lobulated". In addition described the margin of the mass either Circumscribed or any related word (Well defined, Sharp), Obscured (Partially well defined), Microlobulated, Indistinct (ill defined), Speculated, or Irregular.And also defined mass density as High, equal (Iso), low, and fat containing according to X-ray attenuation of the mass either greater than the attenuation of fibroglandular tissue of the breast, equal, or low also fat containing mass like oil cyst and determined the associated calcification. The location of mass was determined according to one or two of localization systems preferred to use in localization of the lesion. The selected terms sited according to reports of the mammograms. It was Retroareolar, Central, Upper inner, Upper outer, Lower inner, Lower outer, Upper anterior, Lower anterior,

Upper posterior, Upper middle (upper central), Central posterior, Central anterior, Different locations (Multiple) and Axillary tail.

Calcification:

The presence of calcification was checked and classified according to types either typically benign like (Skin, Vascular, Coarse (Popcorn-like), Large rod-like, Round, Rim (egg shell), Dystrophic, Milk of calcium, Suture), or Suspicious Morphology like (Amorphous, Coarse heterogeneous, Fine Pleomorphic (fine calcification), Fine Linear branching calcifications). In addition, the location of calcifications was identified as (Diffuse or scattered, Regional. Grouped, Linear, Segmental and single). Moreover, the location of the calcification determined as same as for mass.

Architectural Distortion:

It was identified when the parenchyma is distorted with no definite mass visible.

Asymmetry:

It was identified when the area of fibroglandular tissue that is visible on only one mammographic projection. Presence of asymmetry identified.

Intramammary Lymph node:

It was determined in each mammogram either present or absent.

Solitary Dilated Ducts:

It was determined in each mammogram either present or absent.

Associated Features:

It was determined in each mammogram according to what feature appear into the image (Skin retraction, Nipple retraction, Skin thickening, Trabecular distortion, Axillary lymph Adenopathy , Multiple small lesions, Dilated superficial vessels), if any two or more features appear together, they were determined (Nipple retraction and skin retraction, Nipple retraction and Lymph Adenopathy, Nipple retraction and Skin Thickening, Skin thickening and Lymph Adenopathy and Nipple retraction, skin thickening and Lymph Adenopathy).

Diagnosis and BIRADS Category:

Each mammogram diagnosed finally twice by different radiologist using routine interpretation and BIRADS system.The diagnosis included (Normal finding, Benign, Probably Benign, Malignant, Highly malignancy) according to diagnosis write by radiologists.The BIRADS Category included (0 incomplete, 1 Normal finding, 2 Benign, 3 probably benign, 4 Suspicious Malignancy and Highly suggestive Malignancy).

Statistical Analysis

The data analyzed used SPSS version 10, to maintained accurate analysis and results. Then the Kappa value was determined for each finding.

Result

The data were collected, reported, and analyzed to found the agreement between BIRAD and Interpretation of the mammography. The Kappa Scale and strength of agreement was presented in table (1). The K-value of different findings of mammography and final finding were studied and were presented in table (2). The first parameter was breast composition the K-value was 0.465 that was Moderate agreement. In overall description of mass (presence, shape, margin, density, associated calcifications and location), the agreement was good. Regarding to calcification it reflected a good agreement. The Architectural Distortion was 0.852 K-value and considered a very good agreement. In addition, the K-value of 0.138 among A Symmetry was considered a Poor agreement. In Inflammatory lymph node the K-value was 0.65, that a Good agreement. Associated Features was 0.360, which consider a Fair agreement. Finally, the final finding was 0.58 in K-value scale, which consider a Moderate agreement.

Table 1 : The Kappa Scale and strength of agreement

KAPPA SCALE *	STRENGTH OF AGREEMENT
<0.20	Poor
0.21 to 0.40	Fair
0.41 to 0.60	Moderate
0.61 to 0.80	Good
0.81 to 1.00	Very Good

*kappa equation

$$\kappa = \frac{p_o - p_e}{1 - p_e} = 1 - \frac{1 - p_o}{1 - p_e}$$

where:

P_o = the relative observed agreement among raters.

P_e = the hypothetical probability of chance agreement

Table 2: show the K-value of different findings of mammography and final finding

| PARAMETER		K- VALUE
Breast Composition		0.465
Mass	presence	0.835
	Shape	0.529
	Margin	0.475
	Density	0.742
	Associated calcification	1.000
	Location	0.222
Calcification	Presence	0.877
	Morphology	0.846
	Distribution	1.000
	Location	0.250
Architectural Distortion		0.852
A Symmetry		0.138
Inflammatory lymph node		0.650
Solitary dilated duct		0.000
Associated Features		0.360
Final findings		0.581
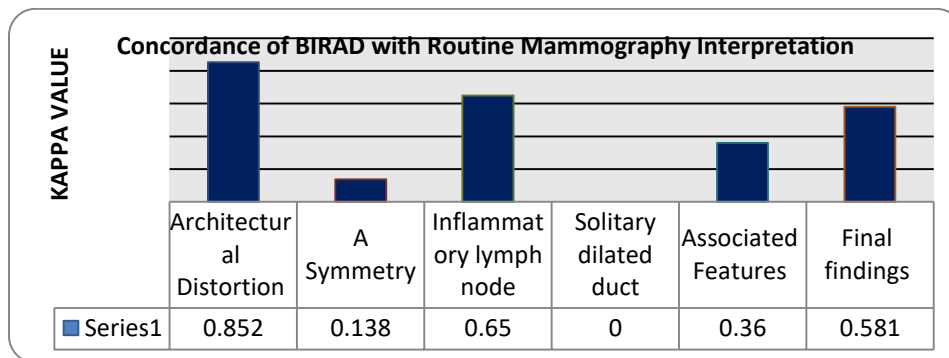
Figure1: show the concordance of BIRAD with routine interpretation of mammography and the degree of agreement according to Kappa value

Discussion

This study conduct to found the concordance of reporting of mammography using two reporting system, BIRAD and routine interpretation of the digital mammography, regarding to breast density, the degree of agreement was moderate agreement (k=0.46) that reflect the difference in visual assessment of radiologist. The overall weighted kappa value for breast composition achieved by Ekpo and Ujong was 0.83(Ekpo *et al.* ,2016). Regarding to Mass, a very good agreement was achieved for the presence of mass (k=0.83), and for the mass shape the agreement was moderate (k=0.529), that reflect the difference in word used to describe mass shape between BIRAD system and routine interpretation. As compared to the result achieved by (Lazarus *et al.* ,2006)regarding the evaluation of interobserver variability between breast radiologists by using terminology of the fourth edition of the Breast Imaging Reporting and Data System (BI-RADS); the result was (k=0.48) for the mass shape. In addition, among the margin of the mass (k=0.475) reflected a Moderate agreement. As regard to Mass density the kappa value was (k=0.742) as a good agreement.

Conclusion

The results reflected the importance of the controlling and standardizing the wording using in diagnosis of Mammogram. This study provided an evidence-base showing that there is a wide variation in wording of the mammography report between the radiologists. Therefore, it is very important to follow the BIRAD lexicon in order to avoid any misunderstanding or confusion.

Acknowledgements

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