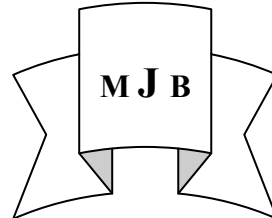


The Assessment of Sonography in Distinguishing Benign from Malignant Solid Breast Mass, Can It Be Improved?

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Abstract

Objective: To determine whether sonography could help accurately distinguish benign solid breast masses from malignant ones and whether its role can be improved .

Patients and Methods: Between November 2007 and January 2009 , 243 female patients with breast lesions diagnosed by their managing surgeons, were sonographically assessed .Those who had solid lesions were selected for a prospective study through comparison with the histopathological finding of the open biopsies taken from the lesions . US features that most reliably characterize masses as benign or malignant had been strictly applied for diagnosing these cases. Sonographic classifications were compared with histopathological reports of the biopsies . The sensitivity, specificity, and negative and positive predictive values of the sonography were calculated.

Results: Sonographically, 108(44%) cases were classified as benign and 135(56%) were malignant . 12 (11%) lesions classified as benign sonographically, were found to be malignant histopathologically. 33 (24%) lesion classified as malignant were found to be benign histopathologically. Thus, the classification scheme had a negative predictive value of 89% and positive predictive value 75%.

Conclusion: Sonography can be used to identify most benign solid lesions for follow up through imaging. Making use of FNA cytology and True-cut needle biopsy, in addition to including mammography will eliminate sonographic mishaps.

تقيم قابلية السونار في تميز الكتل الحميدة من الخبيثة في الثدي، هل من الممكن تحسينه؟

الخلاصة

الغرض: ليقرر فيما اذا كان الفحص بجهاز السونار قادر بدقة علي تميز الكتل الصلبة في الثدي الحميدة من الخبيثة وفيما اذا كان بالإمكان تحسين هذه القابلية .

المرضى وطرائق البحث: ٢٤٣ مريضة مشخصة من قبل الأطباء المعالجين تمتلك كتلة بالثدي تم فحصهن بالسونار .تم اختيار ذوات الكتل الصلبة لدراسة مستقبلية من خلال مقارنة نتائج فحص السونار مع نتائج الفحص النسجي لنماذج جراحية مفتوحة أخذت من الكتل زحيث اعتبرت المعايير المعتمدة لتمييز كونها حميدة او خبيثة. تلك المعايير تم تطبيقها بدقة للتمييز بين الكتل ، تصنيف السونار قورن بنتائج الفحص النسجي للعينات تم حساب .الحساسية ،الخصوصية والقيمة التنبؤية السالبة والموجبة للفحص بجهاز السونار .

النتائج: أظهرت هذه الدراسة ان الفحص بالسونار ٤٤% من كتل الثدي صنفت حميدة ٥٦% كانت خبيثة ، ١١% من الكتل صنفت حميدة بالسونار شخصت خبيثة من خلال الفحص النسجي ، ٢٤% من الكتل صنفت خبيثة بالسونار شخصت حميدة بواسطة الفحص النسجي ، كانت القيمة التنبؤية الموجبة للفحص بالسونار ٧٥% والقيمة التنبؤية السالبة للفحص ٨٩% .

الاستنتاج: نستنتج من هذه الدراسة ان الفحص بالسونار ممكن الاستفادة منه لتمييز اغلب كتل الثدي الصلبة ومتابعة الحميد منها بواسطة فحوصات متكررة بالسونار واخضاع المشكوك من بينها الى الفحص الخلوي او النسجي (ألتغزي).

Introduction

The large number of biopsies performed for benign breast abnormalities has long been recognized as a serious problem, follow up US appears to be an acceptable alternative to biopsy for solid masses with benign morphologic features seen at US [1]. Excessive biopsies for benign lesions have adverse effects on society and on the women who undergo them by increasing the costs of screening projects, causing morbidity, and adding to the barriers that prevent women from using a potentially life-saving procedure [1-3]. Attempts have been made to increase the positive predictive value for biopsy (biopsy yield of cancer) by performing a complete diagnostic work-up that often includes ultrasonography (US).

In the 1970s, use of US decreased the number of biopsies for benign masses 25%–35% by enabling reliable identification of simple cysts [4,5]. In the 1980s, investigators reported US features that occurred more frequently in benign solid breast masses and other features that occurred more frequently in malignant masses [6-8]. However, in subsequent studies, US results were not yet reliable enough to determine whether biopsy should be performed on a solid mass [9-11].

When assessing the general usefulness of the US diagnostic criteria as a method of avoiding unnecessary excisional biopsy, it is also important to remember that there are other options for determining whether a solid mass is benign or malignant. For example, fine-needle aspiration biopsy with cytologic analysis is a relatively inexpensive, minimally invasive procedure that many experienced radiologists find useful in the evaluation of solid masses [12].

Patients and Methods

Between November 2007 to January 2009 female patients with a complaint of breast lesion, those whose clinical examination revealed palpable mass (es), were Referred by their managing surgeons to the radiological Department in Hilla Teaching hospital and private radiological clinics., for sonographic evaluation were selected Those who were diagnosed sonographically to have solid breast masses were prospectively studied . Out of 300 cases with sonographically solid masses , we could obtain the histopathologic results of only 243 cases (age range was 18–65 years, mean age 47 years) .Table (1) .

The results of the histopathological examination of the open biopsy specimens from these cases were compared with the result of ultrasound examination regarding benignancy or malignancy . .

All US examinations were performed with siemens versa with a 7-MHz linear-array transducer. The scanning protocol included both transverse and longitudinal real-time imaging of the solid masses, with representative hard-copy images acquired in each plane.

For the US scans of the solid masses, it was destined to assess the following criteria: shape (oval, round, lobulated, or irregular), margins (circumscribed, ill defined, spiculated, or microlobulated), width-to-anteroposterior (AP) dimension ratio, posterior echoes (enhanced, unaffected, or decreased), echogenicity (intensity of internal echoes), echotexture (homogeneity of internal echoes), presence of calcifications, presence of lateral edge refraction, and presence of a pseudocapsule.

The US features most predictive of a benign tissue diagnosis were oval or round shape,

circumscribed margins, presence of edge refraction, and width-to-AP dimension ratio greater than 1.4 .while the features most predictive of a malignant tissue diagnosis were spiculated or microlobulated margins, irregular shap, ill-defined margins , and width-to-AP dimension ratio equal or less than 1.4. US diagnostic criteria, and final assessment categories were considered. If three criteria of benignancy are calculated the mass will be diagnosed as benign while with criteria of malignancy the mass diagnosis as malignant, Rahbar et al [15].

Results

243 cases with solid lesions sonographically diagnosed; 108 were benign ,135 were malignant. Table (2)

In comparison with the histopathological examination findings,12 (11%)of the benign were proved to be malignant, while 33 (24%) of the sonographically diagnosed as malignant were proved to be benign .the positive predictive value was 89% ,the negative predictive value 74%.

One hundred thirty five(56%) of the masses proved to be malignant, of which 82(60%) were infiltrating ductal carcinomas.

One hundred eight (44%) of the masses proved to be benign ,of which 68(63%) were fibrocystic , 40(37%) were fibroadenoma.

Discussion

The role of US in breast imaging has evolved over the years. In most clinical practices, the use of breast US has been restricted to differentiation of cysts versus solid masses [9-11,16]. It is our experience and the experience of others, however, that breast US is capable of doing much more than that and is an essential

problem-solving tool in the breast radiologist's armamentarium [16].

In our study the US features most predictive of a benign tissue diagnosis were oval or round shape (90% of masses with this feature were benign), circumscribed margins (77% were benign), and width-to-AP dimension ratio greater than 1.4 (86% were benign) (Fig 1).while the features most predictive of a malignant tissue diagnosis were irregular shape (79% were malignant), ill-defined margins (87% were malignant),spiculated or microlobulated margins (73%of masses with this feature were malignant), and width-to-AP dimension ratio of 1.4 or less (56% were malignant) (Fig 2) (table4)

The sensitivity of ultrasound, in our study, 75% while specificity 88% ,finding 33 (25%) histologically-proven malignant cases already considered benign sonographically, lead as to a conclusion that these diagnostic US features should not be generally applied to defer the biopsy of a solid mass because this lead to a great misdiagnosis, we must repeat soographically in 2 views and consider interobserver for suspect lesion .

The findings in our study are inconsistent with finding by Stavros et al [14] who found the sensitivity of ultrasound 98% while specificity 67% this difference can be explained by our little experience compared to Stavros et al [14] in additions to smaller number of studied cases and the shorter period of study in our study compared to Starvors's ones. Our results might be improved if other modality especially mammography were collectively involved in building the sonographically decision .

In this study it was found markedly hypoechoic nodules (Fig.3) (table 3) as a malignant finding is consistent with previous studies mentioning hypoechogenicity as a

malignant finding [17-21]. It is important to compare the echogenicity of the nodule to that of normal breast fat rather than to that of intensely echogenic fibrous tissue. Because hyperechoic fibrous tissue is more echogenic than anything in the breast except calcification, we do not believe that comparison to fibrous tissue provides much useful information.

We have found that 50% fibroadenomas are isoechoic or mildly hypoechoic (Fig. 4) relative to fat, whereas about two-thirds of malignant nodules are markedly hypoechoic compared with fat. However, about one-third of malignant nodules are nearly isoechoic or only mildly hypoechoic (Fig.5). This finding is consistent with finding by Stavros et al [14] whose finding marked hypoechogenicity is sign of malignancy

Some features were not reliable in differentiating between benign and malignant lesions. For example, the effects of masses on posterior echo intensity were not a useful determinant. Of the 114 malignant masses, 21 (37%) showed enhanced rather than decreased through transmission, and of the 129 benign masses, 27(15%) showed posterior echo attenuation rather than enhancement.

Some features that showed excellent correlation with a benign or malignant tissue diagnosis were too infrequent to be generally applicable. For example, a hyperechoic lesion (Fig. 6) table (3).

Research has shown that using a combination of both mammography and ultrasound imaging could result in earlier and more frequent detection of breast cancer [22].

The triple test (TT) method considers the results of the physical examination, imaging (mammography, MRI,ultrasound etc.) results and the cellular (cytological) findings of the

pathologies (based on the biopsy samples). When all of these aspects are considered a FNA is very accurate. The false positive and false negative rates are similar to biopsies obtained by more invasive surgeries. The TT method should always be used to diagnosis a breast mass using FNA[23]

In our study, we found that all the patients underwent open biopsy(incisional and excisional) procedures, as recommended by their managing surgeons, making no use of True-cut needle biopsy in breast mass evaluation being not available. In contrast with other studies found the diagnostic accuracy of sonography was similar to that of palpation-guided FNA for not missing the malignancy [24]. Core-needle biopsy is now widely used for the evaluation of non palpable solid masses and is readily adaptable to US guidance [25,26].

Our study lacks the interobserver participation . Our results would be more solid if mammographic evaluation was included as the literature stated that , there is a higher incidence of incorrectly identifying a mass as cancerous, a false positive, than with mammography[27]. Additionally, ultrasounds are unable to detect microcalcifications (small mineral deposits in the breast that indicate the possibility of malignancy)[27].

Conclusion

In conclusion, the results of this study were encouraging in that we could apply the US for differentiating most solid masses pointing to their benignancy or malignancy status and sonography should not be generally applied to defer the biopsy of a solid mass.

We suggest further studies that include a larger number of cases, a longer period of study and interobserver participation.

We recommend making use of suspicious breast mass evaluation biopsies (FNA and True-cut) in following ultrasound examination.

Table 1 Age range of patient with breast mass

Age of patients	Number
10-20 years	6
21-30 years	27
31-40 years	54
41-50 years	87
50-60 years	60
60-65 years	9
Total	243

Table 2 Validity for diagnosis malignant and benign breast mass by sonography

Histological findings			
US classification	benign	malignant	Total
Benign	TN 96	FN 33	129
Not benign	FP 12	TP 102	114
Total	108	135	243

Sensitivity : $TP/TP+FN = 102/135 = 75\%$

Specificity : $TN/TN+FP = 96/108 = 88\%$

Positive predictive value $TP/FP+TP = 102/114 = 89\%$

Negative predictive value : $TN/TN+FN = 96/129 = 74\%$

- TP:true positive
- TN:true negative
- FP:false positive
- FN:false negative

Table 3 Echogenicity of breast mass

echogenicity	benign	malignant
hpoechoic	25	80
isoechoic	27	24
hperechoic	77	10
Total	129	114

Table 4 Feature of malignant and benign breast mass

	Malignant	Benign
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Shape		
Round or oval	12	117
Irregular	102	12
Margin		
Circumscribed	15	100
Ill defined	99	29
Spiculation		
present	83	19
absent	31	110
Echotexture		
Homogenous	11	109
Heterogeneous	104	20
Posterior echo intensity		
Enhanced	25	86
Unaffected	89	43
Pseudocapsule		
Present	30	102
absent	84	27
Width –AP dimension		
>1.4	50	111
<1.4	64	18



Figure ١ US image shows features of a malignant mass . The mass has an irregular shape, indistinct margins, and a width-to-AP dimension ratio of 1.0. Biopsy results revealed invasive ductal carcinoma.



Figure ٢ The mass is markedly hypoechoic, with pronounced posterior acoustic shadowing ,well defined. biopsy results invasive ductal carcinoma



Figure ٣ A 1.0-cm oval-shaped mass . The mass appears more hypoechoic and the circumscribed margin is clearly delineated. The final assessment "probably benign"



Figure ٤ US scan shows lesion corresponds to oval mass of low echogenicity with echogenic center in upper outer quadrant. The mass was classified as suspicious for benign ,by biopsy result malignant



Figure ٥ Fibroadenoma with nonhomogeneous echotexture. Sonogram shows a well-circumscribed,elongated fibroadenoma Echotexture is nonhomogeneous with echogenic areas on a hypoechoic background.



Figure ٦ Mass,hypoechoic (11 cm) ductesia associated with marked acoustic shadowing.

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