Utilizing of gray scale &unenhanced power Doppler ultrasound in differentiation of malignant & begin palpable breast lesions :Does vascularity in power Doppler correlate with lymph node status?

Amjaad Majeed Hameed*

الخلاصة

تعتبر الأمواج فوق ألصوتيه في الوقت الحالي من وسائل التشخيص الرئيسة في أمراض الثدي وهناك صفات تشخيصية للأورام الحميدة والخبيثة .استخدام البور دوبلر في تشخيص الاورام الحميدة الصلبة من الاورام الخبيثة الصلبة.

تهدف الدراسة :

1.الغرض من الدراسة هو لمعرفة حساسية الامواج فوق الصوتية في تشخيص اورام الثدي الخبيثه من اورام الثدي الحميدة .2.تقيم دور الامواج فوق الصوتية باستخدام الدوبلر للتفريق بين اورام الثدي الحميدة والخبيثة وكيفية علاقتة مع انتشار المرض الى الغدد اللمفاويه .

هذة الدراسة هي دراسة وصفية تضمنت 55مريضة لديها عقدة في الثدي في شعبة الاشعة التشخيصية في مستشفى الديوانية التعليمي احيلوا من مركز فحص الثدي للفترة من حزيران 2008-كانون الثاني 2010جميعهن لديهن اورام في الثدي وخضعن للتداخل الجراحي ،المريضات المستثنات من الدراسه من كانت لهن اورام ثدي ورفضت التداخل الجراحي ،صنفت اورام الثدي حسب ايجادات الامواج فوق الصوتيه والبور دوبلر الى اورام حميدة وخبيثة وقورنت النتائج مع الفحص النسيجي .

تضمنت النتائج 55 مريضة بمعدل عمر 44سنة ،معدل حجم الاورام من 1-6سم،معظمها في الربع الوحشي العلوي .جرت مقارنت ايجادات الامواج فوق الصوتيه مع الفحص النسيجي للحصول على حساسيه المواج فوق الصوتية 90% وحساسيه البور دوبلر70% ،معظم الورام الخبيثه)78% التي كانت لها نتائج ايجابيه في البور دوبلر وجد فيها انتشار المرض الى العقد اللمفاوية الابطية .

البور دوبلر يجب ان ياخذ بنظر الاعتبار مع فحص الامواج فوق الصوتية في تشخيص اورام الثدي .

تحتاج فحص الثدي الى دراسة اخرى اكثر تطورا باستخدام بور دوبلر مع الصبغة لزيادة حساسية الامواج فوق الصوتية .

Abstract

US (ultrasound) is currently one of the main diagnosing breast disease .In gay scale US there are typical characteristic features of benign & malignant mass. Used of power Doppler has also been exploited in aiding the benign & malignant differentiation of solid masses.

***Al-Qadisiya university Collage of medicine**

1.The purpose of this study was to investigate sensitivity of gray scale US features in differentiating benign from malignant solid breast masses .
2.To evaluate the role of power Doppler imaging to differentiate benign & malignant solid breast masse & how power Doppler findings correlate with lymph node involvement .
The study involved 55 female present with breast lesion , in Department of Diagnostic radiology in AL Dewanyia teaching hospital refered from breast centre in period July 2008 – January 2010 , the inclusion criteria was the presence of breast lesion, undergo surgery , exclusion criteria female with breast lesion & refused surgery. Tempt was made to categories lesions as benign , malignant by using US criteria & power Doppler correlate this findings with pathological results .
A total of 55 female patients with solid breast mass. Mean age was (44year) . Size of breast lesion range from 1-6cm , most common sit of the tumor was upper lateral quadrant in both malignant & benign breast mass. Comparison of US & histological findings was made , this enable to calculate sensitivity (90%) of gray scale ultrasound , sensitivity of power Doppler was 70% & majority of malignant tumors (78%) that demonstrate vascularity in power Doppler showed axillary lymph node invasion .
Power Doppler sonography should be considered together with the established criteria in gray scale ultrasound.
Further study is indicated by using more advanced procedures like enhanced power Doppler US(using levovist) to increase sensitivity of US.

Key word :breast mass , power Doppler

Introduction

Sonography is currently one of the main diagnosing breast disease. Using this technique has become common practice since the introduction of high frequency probes nowadays US included in most routine procedures to detect and indentify breast lesions . Similarly, sonography is one of the most widely used imaging

technique for guiding breast intervention procedures such as needle biopsy or marking lesions for surgery (1).

In gay scale sonography there are typical characteristic features of benign & malignant mass lesions such as shape of the lesion(oval in benign & variable in malignant), its alignment (wider than deeper in benign while deeper than wide in malignant, lesion margin(smooth in benign lesions while irregular spiculated in malignant), echotexture (variable in benign & low level or marked hypoechoioc in malignant), uniform in benign , non uniform in malignant, lateral shadowing in benign lesion & posterior enhancement in benign lesion while posterior attenuation with obscuring posterior margin in the malignant lesions .Its however important to be aware of the shortcomings & limitation of relying purely on morphological appearance the presence of posterior acoustic enhancement & well define margins that occur with benign masses such as fibroadenoma also associated with high grad malignancy as well as mucinous or medullary carcinoma . Conversely hypoechoic attenuation lesions with irregular margin typical of malignant disease can also be demonstrated in benign pathology such as fat necrosis, scarining or fibrosis . The used of power Doppler has also been exploited in aiding the benign & malignant differentiation of solid masses(2,3).

Tumor angiogenesis is essential for tumor growth because a tumor can not grow more than 1-2mm without recruitment of new capillary blood vessels, he vascularity observed by Doppler ultrasound is important in elucidating tumor growth (4,5) .

Doppler ultrasound imaging is another method to detect & quantify tumor related vessels & its sensitive in determining lymph node invasion .Its not invasive, repeatable procedure and available at most medical center (4.5). The ability of image –directed color & power Doppler sonography to assist in diagnosis of breast carcinoma has been examined in a number of studies (6,7,8,9, 10, 11) .Power doppler sonography has certain advantage over color Doppler sonography that makes it more sensitive in the detection vascular flow .(12, 13)

Power Doppler US basis on total intergrated power of the Doppler spectrum is now considered superior to color Doppler in demonstration of vascular flow because of such advantage as high sensitivity to slow flow , no angle dependency, and no alising (14, 15).

Recently developed microbuble US contrast agents also improve the detection of characteristic neovascular morphologic features by enhanced the signal strength in small vessels & its superior to non enhanced power Doppler in demonstration & characterization of tumor vascularity in breast lesion (13&16).

Aim of study

1.The purpose of this was to investigate the general applicability & sensitivity of gray scale US features in differentiating benign from malignant solid breast masses .

2.To evaluate the role of power Doppler imaging to differentiate benign & malignant solid breast masse & to determine how breast cancer vascularity that reveled by power Doppler sonography correlate with lymph node involvement .

Patients & methods

The present prospective descriptive study involved 55 female present with breast lesion , in Department of Diagnostic radiology in AL Dewanyia teaching hospital in Iraq refered from breast centre in period July 2008 – January 2010, the inclusion criteria was the presence of breast lesion , undergo surgery & excisional biopsy, exclusion criteria female with breast lesion & refused surgery .

The patients is examined in supine position .The side being examined is raised & the arm placed above the head to ensure that breast tissue is evenly distributed over the chest wall, breast lesions were evaluated through the gray scale US, on the basis of morphologic characteristic seen sonogrsaphicaly, tempt was made to categories lesions as benign , malignant by using US criteria. All lesions were measured in transverse & anteroposterior the largest dimension of tumor was selected for subsequent analysis &

subsequently seating of power Doppler ultrasound , were optimized to detect vascularity using Simenes vers pro US machine the color box adjusted to include the lesion and also small margin of adjacent healthy breast tissue , the color gain was adjusted the region of interest was scanned slowly with minimal probe pressure, presence or absence of signal echoes in the power Doppler is recorded. Excisional biopsy was done to all included lesions, the confirmation of US diagnosis was done by histopathology which is done by pathologiest in department of pathology.

Satirical analysis was done by using frequency , percentage , sensitivity , specific , positive predictive value & negative predictive value were use

Result

A total of 55 female patients with solid breast mass included in this study , There were 33(60%) of patients present by feeling breast lump & follow by 17 (31%)having pain & lump 5(9%) of patients having lump with nipple discharge in histological result there were 35 benign lesions & 20 malignant breast lesions.

Age of the patients included in this study rang from 18-75 years old , mean age was (44year). Size of breast lesion range from 1-6cm (mean 3.5cm). Majority of benign lesions 14(25.5%)were found in females with age group 29-38year & majority of malignant lesions 6(11.2%) found in age group rang 39-48 years old .

Table -1-Distribution of breast mass in relation to the age of the patients .

Age	Benign	Malignant	Total
18-28	9(16.4%)	2(3.6%)	11(20%)
29-38	14(25.5%)	2 (3.7%)	16(29.2%)
39-48	9(16.4%)	6(11.2%)	15(27.6%)
49-58	2(3.5%)	4(7.1%)	6(10.6%)
59-68	1(1.8%)	4(7.2%)	5(9%)
69-79	-	2(3.6%)	2(3.6%)
Total	35(63.6%)	20(36.4%)	55(100%)

As shown in figure -1-most common sit of the tumor was upper lateral quadrant in both malignant 10(50%) & benign 12(34.2%) breast lesions.

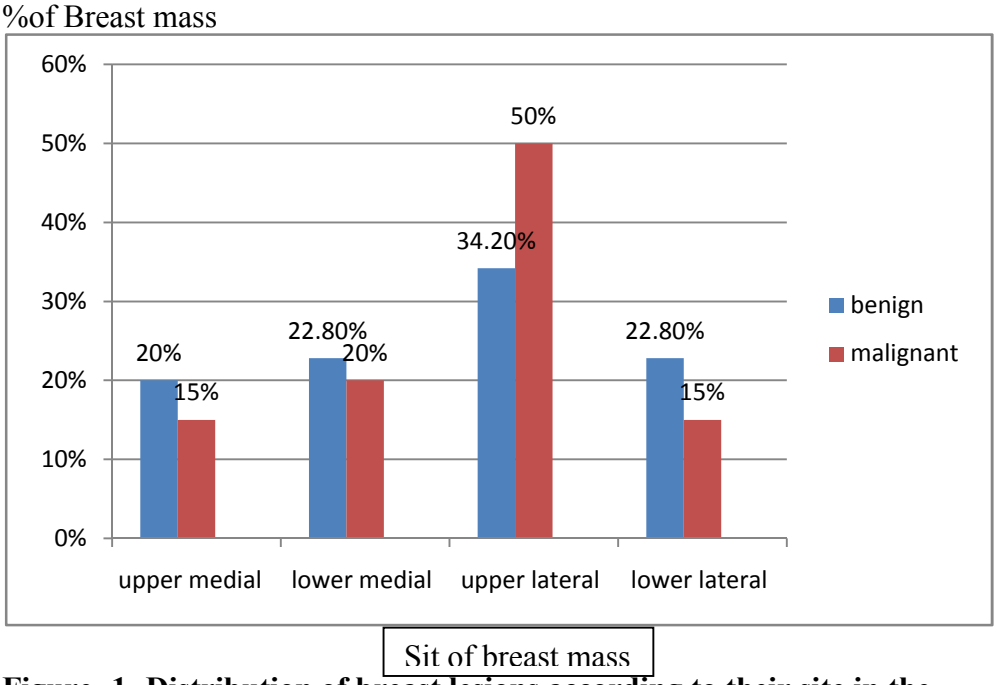

Figure -1- Distribution of breast lesions according to their site in the breast .

According to histological result there are 35benign , 20 malignant lesions while according to US gray scale findings only 32 out of 35 lesions had benign US morphology and 18 lesions out of 20 had malignant US features. Comparison of sonogrsphy & histological findings was made , this enable to calculate sensitivity ,specificity, positive predictive value , negative predictive value of gray scale ultrasound .

Table -2-Validity,positive & negative value for diagnosing malignant & benign breast lesions.

	Malignant	Benign	Total
US positive	18(TP)	3(FP)	50
US negative	2(FN)	32(TN)	5
Total	20	35	55

TP(true positive) , FP(false positive) , FN (false negative) , TN(true negative) Sensitivity =90%, Specificity= 91%, Positive predictive value =85%, Negative predictive value =94%

Table 2 Histological result of 35 benign breast lesion .

Histological diagnosis	No.	%
Lipoma	5	14.3
Adenosis	5	14.3
Fibroadenoma	21	60
Fibrosis	2	5.7
Breast abscess	2	5.7
Total	35	100

As shown in table 2 according to histological findings the majority of lesions were fibroadenoma 21(60%).

Table -3-Histological result of 20 malignant breast lesion.

Histological result	No. &% of lesions had malignant US features	No.(%)of final diagnosis
Lobuar carcinoma	3(16.7%)	4(20%)
Invasive Ductal carcinoma	13(72.3%)	13(65%)
Mixed type carcinoma	2(11%)	2(10%)
Mucinous carcinoma	0	1(5%)
Total	18(100%)	20(100%)

In histological study there were 20 malignant lesions, majority of them was invasive ductal carcinoma 13(72.3%), all of these malignant except 2 lesions had malignant US features .
As shown in figure 2.Result of power Doppler of 35 benign breast lesions , 23 (65,7%) of them shows no vascularity & 12 (34.3%) shows vascularity &8(75%) of benign vascular breast lesions have maximum diameter greater than or equal to 2cm .

Of the 20 malignant breast lesions 14(70%)showed vascularity, size of 12(85%) of them either equal or larger than 2 cm in their greater diameter, 6(30%) showed no vascularity .

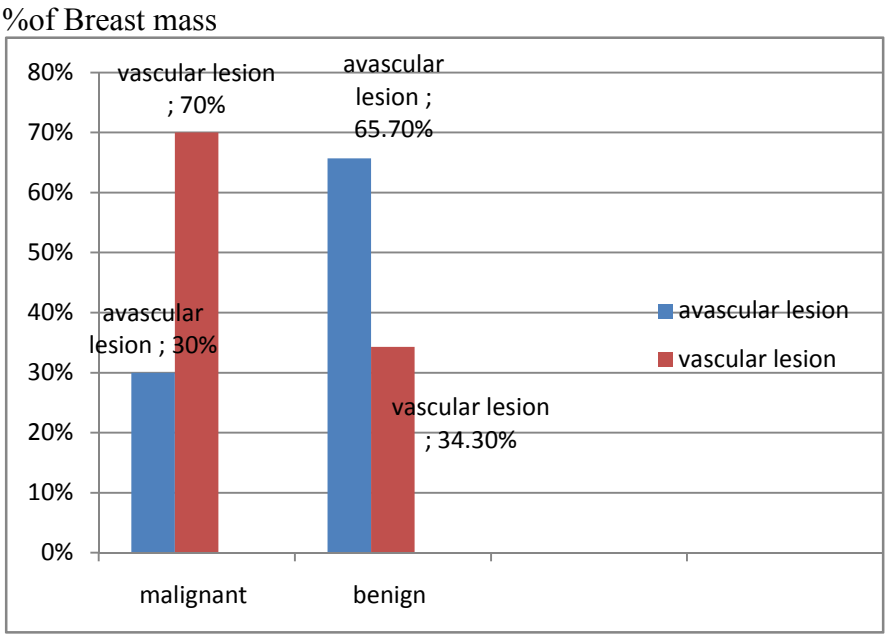

Figure -2- percent of vacularity in benign & malignant breast lesions

Power Doppler had sensitivity 70%,specificity 65%, positive predictive value 54%& negative predictive value 79% in differentiation between malignant & benign lesion .

Pattern of vacularity was predominantly penetrating (71.4%) more often in malignant lesions than in benign lesion4 (33%).

As shown in figure(3) & figure(4). 78% (11)of breast lesions who demonstrate vascularity in power Doppler showed axillary lymph node invasion in power. While 33% of avascular malignant lesion had axillary lymph node invasion .

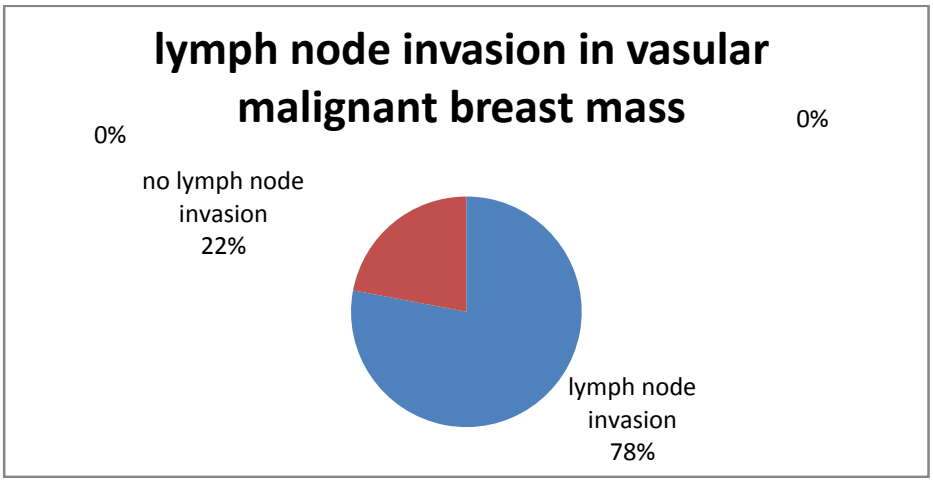

Figure 3 lymph node invasion in vascular malignant breast lesion .

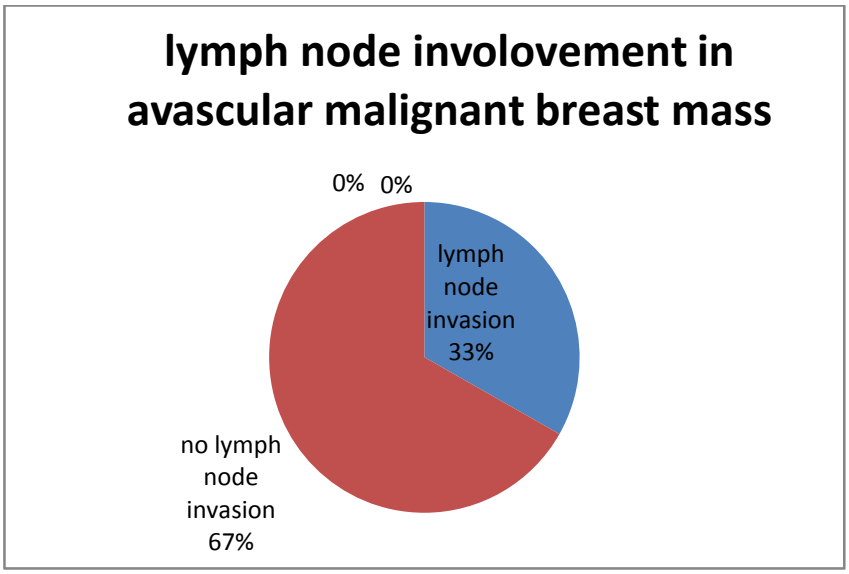

Figure 4 Lymph node invasion in avascular malignant breast lesions

Discussion

Breast disease range from mild changes in the tissue to full-fledge malignant changes. These changes cause considerable physical & psychological morbidity. A palpable breast mass in a women represent potentially a serious lesion & requires prompt evaluation. Lymph node status is a major prognostic indicator in patients with breast cancer .However axilary lymph node dissection is

responsible for much of morbidity associated with breast surgery(17,18, 19).

Fifty percent of the masses were present in the outer upper quadrant of the breast which is also go with findings of Kailash *et al* (20)who found 54% of the masses were in outer upper quadrant & also close to findings of Nicholas et al (21) who found 40% of breast masses in upper outer quadrant. The high level of upper lateral quadrant mass is due to solely to greater amount of target epithelial tissue in that region(22).

The commonest benign breast lesions was fibroadenoima that is go with many other study like Ron G et al & Kailash *et al* studies (23,20)as fibroadenoma assumed to be aberration of normal breast development or product of hyperplastic process ,rather than true neoplasm (23).

Using gray scale US the sensitivity was 90%, specificity 91%, negative predictive value 85%& positive predictive value 94%which is close to finding of Per S *et al* (24)who found the sensitivity was 99% also accordance with findings of Kailash *et al* (20). who found sensitivity of US 95% & its online with findings of Pand *et al* (sensitivity 95%, specificity 94.10%, positive & negative predictive value 93.75%) (25).

Three of benign lesions, diagnosed in US as malignant lesions (one of them is fibroadenoma, other one is abscess & 3rd one fibrosis after previous surgery) because of irregularity in their outline. All of malignant(20) except 2 lesions had malignant US features , one of these two lesions was mucinous carcinoma other one was lobular carcinoma. Both of them had US features of benign breast lesion (homogenous texture , hyperechoic, well define regular outline & their width more than their length) .

In power Doppler Vascularity detected in 70% of malignant breast lesions & in 34.3% of benign breast lesion which is consistent with finding of Jose et al (1) who found vasculaity in 68%of malignant lesions 36%of benign breast lesions also its online with findings of Shine *et al* (26) who demonstrate vascularity in power Doppler more often in malignant than in benign lesion (65% and 39% respectively) our result also similar

to the result of Raza *et al* (6) who found 74%of breast cancer had vascularity & with findings of Tejas *et al* (27) who found 73% of malignant breast lesion shows vascularity this explain by malignant tumors growth & metastasis depend on angiogenesis & neovascularisation & power Doppler more sensitive than other Doppler technique in detection vascularity (28, 29).

Disagreement our power Doppler findings in 30% of malignant breast that not detect vascularity all of them are less than 2cm in their greater diameter this finding is online with finding of Woo *et al* who found that sensitivity of power Doppler in detected vascularity in malignant breast lesion tend to be decrease in small non palpable breast lesions (16) That may explain by tumor development have two stages included prevascular phase , which may persist years & be associated with limit tumor growth , and vascular phase ,which is usually associated with rapid tumor growth & an increased possibility for metastasis (30)also can explain by tendency toward a decreased amount of detected power signals as the lesion size decrease in both malignant & benign breast lesions (31) .

Disagreement found in 34.3% of benign breast lesion that shows vascularity in power Doppler may account for at least by number of benign breast lesions greater than 2cm in their maximum diameter , the vascularity nature of these benign lesions & increasing sensitivity of power Doppler imaging to visualized small & slow flow vessels (13).

Pattern of vacularity was predominantly penetrating (71.4%) more often in malignant lesions than in benign lesion (33%) which is also go with finding of Shine et al who found penetrating vacularity in 65% of malignant lesion against 34% of benign lesions (36) & with findings of Raza *et al*(6) .

Sensitivity of power Doppler in differentiation benign & malignant tumor was 70% & specificity was 65% & close to findings of Shine et al who found sensitivity (64%)& with findings of Milz *et al* who found sensitivity was between 74.5-78.8%(31).

Tumor vascularity revealed by power Doppler sonography strongly correlate with detection of lymph node involvement as 78 % of malignant lesions with positive vascularity demonstrate lymph node invasion in histological study this findings go with Muhammed *et al* (32)findings who found that power Doppler have high sensitivity in detection lymph node invasion ,this findings had good agreement with Tajas *et al* findings who found 74% of malignant lesion with vasclarity in power Doppler showed lymph node invasion & they explain this finding that tumors may spread to the lymph node through either a hematogenous route or lymphatic drainage & the later can explain correlation between vascularity in power Doppler sonography & lymph node invasion (27).

Conclusions

Gray scale US has high sensitivity & useful in differentiation of malignant from benign breast lesions, vascularity in power Doppler sonography is a important feature in differential diagnosis of breast lesions & should be considered together with the established criteria in gray scale ultrasound. Pattern of flow was predominantly penetrating in malignant breast lesions, benign lesion greater than 2 cm may shows signal echoes in power Doppler US .Tumor vascularity revealed by power Doppler sonography correlate strongly with detection of lymph node involvement .

Recommendation

In breast lesion we must rely primarily on clinical sonographic , characteristic include both gray scale & power Doppler features to provide the most comprehensive and beneficial individualized patient care.

Further study is indicated by using more advanced procedures like enhanced power Doppler US(using levovist) to increase sensitivity of US in differentiation between malignant & benign breast lesions but unfortunately its not available in our country.

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