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Research

# How accurate is ultrasound in evaluating palpable breast masses?

**Mubuuke Aloysius Gonzaga**[1,&]

[1]Radiology Department, School of Medicine, College of Health Sciences, Makerere University

[&]Corresponding author: Radiology Department, School of Medicine, College of Health Sciences, Makerere University P.O. Box, 7072, phone: +256 772 616788, Kampala, Uganda

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**Abstract**

**Introduction:** Breast masses have become common in women. Such masses pose a potential threat to women especially in the era of increased cases of breast cancer worldwide. Breast carcinoma ranks first among the malignant tumors affecting females in many parts of the world with the rate of breast cancer being 1 in 8 in USA. There are currently more than 600 000 cancer deaths annually in Africa. By 2020, 70% of the 15 million new annual cancer cases will be in developing countries. Ultrasound is a relatively inexpensive and readily accessible imaging modality that can be utilized in the evaluation of clinically palpable breast masses. The purpose of this study was to find out the accuracy of ultrasound in the diagnosis of palpable breast masses. **Methods:** Eighty palpable breast masses were evaluated at ultrasound and information about the characteristic features of the masses was recorded. An impression about the diagnosis was made and results were correlated with histology findings. **Results:** The overall sensitivity of ultrasound in detecting breast lumps was 92.5%. The sensitivity and specificity of ultrasound for detecting breast carcinoma was 57.1% and 62.8% respectively with a positive predictive value of 68.1%, a negative predictive value of 99.5%, a positive likelihood ratio of 39 and a negative likelihood ratio of 0.07. Ultrasound reliably differentiated cystic from solid breast masses. **Conclusion:** Ultrasound is significant in differentiating cystic from solid breast masses. Ultrasound is also important in detecting suspicious breast masses and should therefore be used in the evaluation of symptomatic breast masses.

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## Introduction

In palpable breast masses, it is the worry about breast cancer that mostly makes women seek medical attention. Breast cancer is one of the leading causes of cancer deaths in women worldwide [1]. There are currently more than 600 000 cancer deaths annually in Africa. By 2020, 70% of the 15 million new annual cancer cases will be in developing countries [2]. In South Africa breast cancer is the most common cancer in women. The lifetime risk of developing breast cancer is 1 in 26 women across all population groups. Annually more than 3 000 women die from breast cancer in South Africa. More than 60% of women present with locally advanced breast cancer. It has been speculated that the lack of an early cancer detection programme is responsible for the majority of women presenting at a late, symptomatic stage when cure is impossible [2]. Umanah et al found out that other breast masses like fibroadenoma (54.8%) and fibrocystic changes (17%) were common in adolescents in a study done on an African population [3].

The early diagnosis and management of breast masses is therefore important to reduce mortality. The established management of palpable breast lesions includes the triple assessment of physical examination, mammography and percutaneous biopsy [4]. In the absence of palpable breast masses, mammography is often done even in symptomatic women below 30 years to exclude an occult lesion, although ultrasound is the modality of choice [4]. However, mammography services are expensive and not readily accessible for many women especially in developing countries [1]. Additionally, the cost of biopsies is also high and a large number of biopsies for benign breast abnormalities have been recognized as a serious problem since excessive biopsies have adverse effects on women who undergo them [5]. Therefore, the evaluation of breast masses without resorting to formal biopsies is highly desirable. Ultrasound is an important imaging modality in the assessment of palpable breast masses. Though the use of ultrasound is determined by the patient age and nature of the breast lesion, its main role has been differentiating cystic from solid breast masses.

Ultrasound has become popular even in lower level health centres of developing countries. For example, in Uganda ultrasound services have become available in lower health facilities due to her decentralized health care system [6]. At the same time, there are many training institutions training radiologists, sonographers and sonologists to carry out the ultrasound examinations. All these factors coupled with the fact that ultrasound is cheap compared to mammography or even biopsies, makes women readily go for it when requested by the clinicians. It is evident therefore that the accuracy of ultrasound in evaluating breast masses needs to be documented since many clinicians are requesting for it as the first option in assessing the breast masses. The purpose of this study therefore was to determine the accuracy of ultrasound in diagnosing palpable breast masses as well as relate ultrasound findings to findings from histopathology. Throughout this paper, the word ultrasound may be used interchangeably with sonography.

## Methods

Ultrasound evaluation of eighty cases of palpable breast masses was done in the Radiology department of Mulago Hospital. Permission to carry out this study was granted by the Radiology Department Research Committee.

The ultrasound examinations were done by a sonographer in the presence of a radiologist. Before the examination, an explanation was given to the patient about how the examination was to be done and informed consent was obtained. Every woman had both breasts examined. The patient laid supine, arm raised and placed under the neck to keep the breast firm on to the chest wall and then turned slightly in oblique position to scan the breast. The contra-lateral breast was also scanned in the same way. A high frequency linear probe (7.0 MHz) was used to scan both breasts. Sonographic gel was applied over the skin of the entire breast including the axilla. The probe was gently applied over the mass and both sagittal and transverse scans were done radially. The axilla was scanned to check for any associated lymphadenopathy. This procedure was done on both breasts. From the scans, information regarding four features of the palpable mass was elicited. These features included: 1) Shape: round/oval or

irregular, 2) Margins: well circumscribed or non-circumscribed, 3) Length: Height ratio: wider than taller or taller than wider , 4) Echogenicity: hyperechoic, isoechoic or hypoechoic, 5) Distortion of tissue planes: is there distortion of tissue planes or not.

On the basis of the above features, an impression about diagnosis was made from ultrasound. Confirmation of ultrasound results was made by histopathology done by an expert pathologist.

The quantitative results were entered into a computer and analyzed using Epi Info statistical package.

## Results

Of the 80 women, 40% (32 out of 80) were in the age group of 30-39 years followed by 20% (16 out of 80) in the age group of 20-29 years. Sixty percent of the women were married. Of the 80 palpable breast masses, ultrasound diagnosed the presence of lumps in 74 cases, making a sensitivity of 92.5% and specificity of 98.1%. Presence of a palpable mass alone was the presenting symptom in 80% of the women followed by lump and pain (10%) and lump with nipple discharge (3%). Average duration of the symptoms was 6 months. Of the 74 lumps, 56.7% (42 lumps out of 74 lumps) were in the outer lower quadrant of the breast. Both breasts were involved in 6% of the cases. The accuracy of ultrasound in the diagnosis of solid and cystic breast masses is summarized in table 1. Cystic masses had 100% diagnostic accuracy at ultrasound followed by fibroadenomas. Ultrasound had 100% sensitivity and 100% specificity for differentiating purely cystic masses from solid masses. The sensitivity and specificity of ultrasound for detecting breast carcinoma was 57.1% and 62.8% respectively with a positive predictive value of 68.1%, a negative predictive value of 99.5%, a positive likelihood ratio of 39 and a negative likelihood ratio of 0.07.

Sonographic characteristics that suggested breast masses as either benign or malignant are summarized in table 2. From the table, it can be noted that the sonographic features that most reliably characterized breast masses as malignant were irregular shape, taller than wide, internal vascularity and distortion of tissue planes. No malignant mass was hyperechoic.

## Discussion

Breast ultrasound has become a popular imaging modality for the evaluation of breast diseases including clinically palpable lumps [1]. Breast diseases cause considerable morbidity and palpable breast masses potentially pose serious concerns prompting immediate evaluation especially in the era of breast cancer [7]. In Uganda, ultrasound services have been widely introduced across the country even in rural areas at a relatively inexpensive cost compared to other investigations [6]. Therefore due to the accessibility of these ultrasound services, they form a vital role in evaluating palpable breast masses.

The highest incidence of breast lumps was relatively higher in women of reproductive ages which finding is comparable to what Kailash et al [7] and Khanna et al [8] found out. This is also comparable to the findings reported by Smallwood et al [9]. Breast carcinoma was histologically diagnosed in seven cases of which ultrasound had detected four. This puts the overall sensitivity of ultrasound at 57.1%. This diagnostic accuracy of ultrasound was better than that reported by Kopans et al at 52.6% [10] and was comparable to what Mansoor et al got at 57.14% [11]. In their study, Stavros et al reported 98.4% sensitivity of ultrasound in classifying breast masses as indeterminate or malignant [12]. This therefore means that sonography is a useful imaging modality in giving important clues about breast masses as either being benign or malignant, thus could be used as an initial investigation that could guide other subsequent investigations.

From this study, it can also be concluded that benign masses were more readily diagnosed by ultrasound than malignant masses. For example, the sensitivity of ultrasound in diagnosing fibroadenomas was 75%. This observation concurs well with findings reported by Mansoor et al at 81.8%

[11] and Fleischer et al at 89% [13]. This means therefore that ultrasound is more likely to predict benign masses correctly than malignant masses. However, it appears like the most significant role of ultrasound in the differentiation of cystic masses from solid masses. This was also reported by Fleischer et al [13]. It can be concluded that sonographic features most predictive of benign masses are oval shape and well circumscribed margins, wider than taller and absence of internal vascular flow. Most of these features were also highlighted by Rahbar et al [14].

From the findings in this study as well as findings from previous studies, it can be concluded that ultrasound plays a significant role in evaluating breast masses. This means therefore that ultrasound use should be considered in most cases of clinically palpable breast masses as an initial investigation particularly in women of reproductive age since it is more accessible and relatively cheaper most notably in developing countries. In many communities, mammography is expensive and found only in few areas; therefore, sonography can be used early enough to evaluate any suspicious masses. Even in areas where mammography is accessible and people can afford, still breast ultrasound should be used as an adjunct to mammography which would make the final outcome even better since the two are complimentary.

One major benefit of ultrasound is to directly relate the physical examination findings with real time imaging results. From this study, ultrasound has been found to be useful as well in characterizing palpable breast masses as well as detecting suspicious masses that could be malignant. If utilized, ultrasound may play a vital role in detecting malignant breast masses early enough before metastasizing and thus reduce mortality from breast cancer. As Harvey [15] reported, the negative predictive value of ultrasound imaging for breast malignancy is high, which may reassure women with low-suspicion palpable findings.

## Conclusion

Ultrasound is a relatively inexpensive and a more accessible modality for evaluating palpable breast masses. It should be the first line investigation especially in women in women under the age of 30 years and as an adjunct to mammography over the age of 30 years when mammography is available. In areas where mammography is not accessible or very expensive especially in developing communities, ultrasound may be used as a primary modality to further evaluate a palpable breast mass and for ultrasound guided procedures. Even in the presence of mammography, breast sonography should be included in the work-up of symptomatic breast disease. Limitations: The major limitation of this study is that mammography investigation was not included for the breast masses which would have helped to relate ultrasound, mammography and histology findings. Including mammography would have yielded some more conclusions about the accuracy of ultrasound.

## Competing interests

There are no competing interests.

## Tables

Table 1: Showing the accuracy of ultrasound in diagnosing breast masses
Table 2: Showing association of sonographic features with benign and malignant masses

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**Table 1**: Showing the accuracy of ultrasound in diagnosing breast masses

| Lesion | No. diagnosed by sonography | No. diagnosed by histology | %age of correct diagnosis by ultrasound |
|---|---|---|---|
| Breast abscess | 3 | 5 | 60 |
| Cysts | 25 | 25 | 100 |
| Carcinoma | 4 | 7 | 57.1 |
| Fibrocystic change | 0 | 3 | 0 |
| Fibro-adenoma | 30 | 40 | 75 |

**Table 2**: Showing association of sonographic features with benign and malignant masses

| Sonographic features | Histology diagnosis | |
|---|---|---|
| | Malignant n (%) | Benign n (%) |
| **Shape** | | |
| Round/Oval | 1 (1.5) | 64 (98.5) |
| Irregular | 6 (66.7) | 3 (33.3) |
| **Margins** | | |
| Well circumscribed | 6 (9.1) | 60(90.9) |
| Non-circumscribed | 1(12.5) | 7(87.5) |
| **Length:Height ratio** | | |
| Wider than taller | 2(3) | 65(97) |
| Taller than wider | 5(71.4) | 2(28.6) |
| **Echogenicity** | | |
| Hyperechoic | 0(0) | 3(100) |
| Isoechoic | 1(3) | 32(97) |
| Hypoechoic | 6(15.8) | 32(84.2) |
| **Distortion of tissue** | | |
| Distortion present | 7(87.5) | 1(12.5) |
| Distortion absent | 0(0) | 66(100) |