CORRELATION BETWEEN ULTRASONOGRAPHY AND HISTOPATHOLOGY IN BREAST ABNORMALITIES AT KENYATTA NATIONAL HOSPITAL

A dissertation submitted in part fulfillment for the degree of:

MASTER OF MEDICINE IN DIAGNOSTIC RADIOLOGY

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BY DR KAGIA J.N MBChB (Nbi).

DECLARATION

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This dissertation is my original work and has not been presented for a degree in any other University.

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DEDICATION

Dedicated to my mother Ndiko, wife Flora and children Martin and Karen for their forbearance, encouragement and support.

ACKNOWLEDGEMENT

Exceptional gratitude goes to my supervisor Prof Joseph M. Kitonyi, who gave me unlimited support, ideas and positive criticism during the study.

I thank the Departments of Radiology, Surgery, Pathology and Medical records of Kenyatta National Hospital and the Department of Diagnostic Imaging and Radiation Medicine University of Nairobi for allowing me to conduct my study in their premises.

Greatly appreciated is the good work done by Mr. P Ayieko, statistician at KEMRI for analyzing the data.

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ABBREVIATIONS

BUS	Breast ultrasound
BIRADS	Breast Imaging Report And Data Systems.
DDIRM	Department of Diagnostic Imaging and Radiation Medicine.
DCIS	Ductal carcinoma in situ
KNH	Kenyatta National Hospital
MRI	Magnetic resonance imaging
MHZ	Mega Hertz
TDLU	Terminal ductal lobular units
UON	University of Nairobi

INTRODUCTION

Breast abnormalities are a major cause for referral for ultrasonography at the Radiology Departments of Kenyatta National Hospital and Department of Diagnostic Imaging and Radiation Medicine University of Nairobi. Breast ultrasonography enables one to characterize breast abnormalities detected on palpation or mammography and make a specific diagnosis. It has a greater ability than mammography to differentiate among types of normal tissue and to characterize complex cysts and solid nodules. Due to its non-use of ionizing radiation unlike mammography, BUS is recommended for patients under 35 yrs of age. Ultrasound machines with transducers designed for high resolution, near field imaging i.e. electronically focused linear array configuration transducers with a nominal frequency of 7 MHZ are the main tools for BUS. Correlation of ultrasonographic images with histology findings have led to a substantial understanding of breast abnormalities. Chen S.J et al in 2005, developed a statistical feature matrix that could be applied to quantify the texture difference of sonographic images for benign and malignant breast masses. When this was correlated with histological findings, results showed that cellular and fibrous content and their spatial distribution in breast masses determines the texture difference of sonographic images [9]. As per existing

records no study done locally has correlated ultrasonographic findings in breast abnormalities with histopathology. This study was therefore to investigate this correlation in the management protocol for breast abnormalities locally.

BREAST ANATOMY

The adult female breast is a hemispheric structure with an axillary tail(of Spence).Normally, there are two breasts each situated in front of the thorax and each consisting of 15 to 20 lobes. A lobe consists of;

(i)Parenchymal elements i.e. ducts and lobules .

(ii) Supporting stromal tissues i.e. fibrous tissue and fat.

A lobule consists of an intralobular segment of a terminal duct, ductules (acini) and intralobular stromal fibrous tissue. The Terminal Ductal Lobular Unit (TDLU) is the functional unit of the breast and consists of a lobule and an extra lobular terminal duct. The TDLU is the site of origin for most pathology and aberrations of normal development and involution of the breast. The breast is entirely invested by an anterior and posterior mammary fascia. The anterior mammary fascia forms radial septa, the Cooper's ligaments, which divide the gland into lobules and attach it to the skin and the underlying posterior mammary fascia over the pectoralis muscle. The two fascial layers divide the breast into;

(i) Premammary zone.

(ii) Mammary zone.

(iii) Retromammary zone.

The premammary zone is subcutaneous and lies between the skin and the anterior mammary fascia. Lesions arising primarily from this zone are not true breast lesions but lesions of skin and subcutaneous tissue. The mammary zone lies between the anterior and posterior fascia. It contains the ducts, the TDLUS and most of the fibrous stromal element of the breast. The retromammary zone contains fat, blood vessels and lymphatics. The base of the breast extends from the 2^{nd} to the 6^{th} rib and from the side of the sternum to near the mid axillary line. The breast lies mainly on the pectoralis major muscle but extends laterally over the serratus anterior muscle, the external oblique muscle and its aponeurosis.The nipple projects from the anterior surface of the breast. It is surrounded by the areola and its position is variable, but it usually lies over the 4^{th} intercostals space in the non pendulous breast.

In the male and prepubertal female the breast is a rudimentary organ. During adolescence the growing breast becomes increasingly glandular. In pregnancy and lactation the tissue undergoes marked proliferation with glandular tissue predominating. When lactation stops the glandular tissue involutes to less than pre-pregnancy state. Apart from the situation during pregnancy and lactation,

parenchymal atrophy starts in early adulthood and is accelerated at menopause, with diminishing amounts of glandular tissue and an increasing amount of fat.

SONOGRAPHIC ANATOMY

The anatomic components of the breast and surrounding structures have characteristic sonographic features which should be recognized. The skin is seen as two thin echogenic lines demarcating a narrow hypoechoic band the dermis. Normal skin measures up to 0.2cm in thickness (may be thicker near the infra mammary fold). Fat, loose stromal fibrous tissue and individual TDLUS are isoechoic structures. Cooper's ligaments, the two mammary fascial layers, duct walls and compact stromal fibrous tissue are sonographically hyperechoic. The mammary ducts are arranged radially around the nipple in 7-20 segments and are recognized as tubular structures measuring 1 to 3mm in diameter and exhibiting progressive luminal enlargement as they converge on the nipple. The nipple is of medium echogenicity and attenuates sound with resultant posterior acoustic shadowing. Axillary vessels present as tubular structures .Lymph nodes are visible in the axilla and breast parenchyma as reniform structures with echogenic fatty hilus. Most masses appear as hypoechoic or anechoic structures. Visualization of the pectoral muscle and the ribs (seen as periodic

structures with posterior acoustic shadows behind the pectoralis muscle) is confirmation that the breast has been adequately penetrated.

PATHOLOGY

The pathologic categorization of breast disease is based on a combination of the architecture, cytologic features and cell type of the lesion. The basic cell types are epithelial lining of the ducts and lobules, myoepithelium surrounding the ducts and lobules, fibroblasts of the stroma, stromal blood vessels and nerves and adipocytes that make up the bulk of breast tissue. In addition reactive and inflammatory processes may recruit tissue macrophages (histiocytes) and inflammatory cells to the breast. Each of these cell types can give rise to pathology and hence breast diseases can be broadly classified into inflammatory, epithelial, fibroepithelial, secondary lesions and other entities.

1. INFLAMMATORY LESIONS.

These include;

1.1 .Breast abscess.

This is due to duct obstruction during lactation leading to rupture, resulting in inflammation and abscess formation. Process is usually subareolar.

1.2 .Mammary duct ectasia.

This condition of unknown etiology involves dilatation and filling of central ducts with proteinaceous material. Usually affects middle to older aged patients who present with nipple discharge or bleeding.

1.3 .Fat necrosis.

This condition is fairly common. It may be spontaneous or may be due to trauma, surgery or radiation. Fat cells (adipocytes) are disrupted and this is accompanied by hemorrhage and histiocyte infiltration. Over time adipocytes degenerate and are surrounded by lymphoplasmacyte infiltrate. Calcification and stromal fibrosis become prominent.

2. EPITHELIAL LESIONS.

These form the bulk of breast pathology. This category consists of fibrocystic changes, papillary proliferations, benign and atypical hyperplasia, carcinoma in situ and invasive carcinoma.

2.1. Fibrocystic changes.

These are a constellation of benign alteration of ducts and stroma that occur alone or in combination with others. They are common and include cysts, unusual ductal hyperplasia, adenosis and sclerosing adenosis.

2.2. Papillary proliferations.

These are lesions with a pattern of sequential branching of a fibrovascular stromal skeleton lined by a layer of epithelium. They include papilloma, papillary carcinoma and papillary proliferations partially involved by benign hyperplasia or carcinoma in situ.

2.3. Benign and atypical hyperplasia.

This includes lactational adenoma and atypical ductal hyperplasia. The former occurs in pregnancy while latter are ductal lesions with a degree of cytologic atypia that falls short of criteria for low grade ductal carcinoma in situ.

2.4. Carcinoma in situ.

This refers to malignant epithelium without disruption of underlying basement membrane or invasion of stroma. Carcinoma in situ can either be of ductal or lobular differentiation.

2.5. Invasive carcinoma.

This is sub classified as either ductal or lobular differentiation. Invasive ductal carcinoma is defined by presence of glandular differentiation and cellular cohesion. A subset of invasive ductal carcinomas includes tubular, mucinous, cribriform, papillary, medullary, metaplastic and mucopapillary carcinomas. Invasive lobular carcinoma is defined by lack of cell to cell cohesion and lack of gland formation. Inflammatory carcinoma is a clinical description of invasive carcinoma with extensive involvement of dermal lymphatic spaces. Paget disease is an eczema-like condition of the nipple, associated with an underlying primary breast carcinoma in which a biopsy of the nipple reveals tumor cells within epithelium of skin.

3. FIBROEPITHELIAL LESIONS.

These entities comprise of a stromal and epithelial component. They include fibroadenoma which are benign, phylloides tumor which have a propensity for recurrence after excision, tubular adenoma, hamartoma, pseudoangiomatous stromal hyperplasia, fibromatosis and sarcomas. Breast sarcomas are uncommon and reported cases include malignant fibrous histiocytoma, osteosarcoma, chondrosarcoma, leiomyosarcoma, liposarcoma and rhabdomyosarcoma.

4. SECONDARY NEOPLASM

Secondary neoplasms of the breast are infrequent. They include lymphoma, melanoma, small cell carcinoma and adenocarcinoma from primaries in the stomach, kidney, ovary, cervix and thyroid.

5. OTHER ENTITIES.

These include lipoma, hemangioma, collagenous spherulosis and calcification. Breast calcification is found in a wide range of entities including normal stroma, fibrocystic change, fibroadenoma, carcinoma in situ and invasive carcinoma. It forms in duct lumens, stroma or blood vessels.

LITERATURE REVIEW

In order to improve communication between the referrer and the radiologist and avoid ambiguity various colleges of radiologists have developed scoring systems for the classification of breast imaging reports. The American college of Radiology has developed an official breast imaging reporting and data system – ultrasound (BIRAD-US) lexicon in the hope of standardizing reporting and data [10]. BIRADS-US terminology and assessment categorization was developed using techniques similar to those used for mammography BIRADS. Proposed terminology was presented and tested at several meetings including the Society of Breast Imaging Biennial Meeting in San Diego in 2001.Statistical analysis of interobserver consistency in usage showed good agreement among participants

BIRADS 1 category corresponds to normal tissues that cause mammographic and clinical abnormality.

BIRADS 2 category corresponds to benign entities and includes intramammary lymph nodes, ectatic ducts, simple cysts, and definitely benign nodules, such as lipomas.

BIRADS 3 category corresponds to probably benign lesions that have a 2% or less chance of being malignant and includes complex cysts, small intraductal papillomas and a subset of fibroadenomas.

BIRADS 4a category corresponds to mildly suspicious lesions with a 3 to 49% chance of being malignant.

BIRADS 4b category corresponds to moderately suspicious lesions with a 50 to 89% chance of being malignant.

BIRADS 5 category corresponds to malignant lesions (> 90% risk of malignancy).

BIRADS 6 known biopsy proven malignancy

The Royal College of radiologists Breast Group Classification System [11] has:

Category 1; normal findings.

Category 2; benign findings.

Category 3; indeterminate/ probably benign findings. There is a small risk of malignancy.

Category 4; findings suspicious of malignancy. There is a moderate risk of malignancy.

Category 5; findings highly suspicious of malignancy. There is a high risk of malignancy.

I intend to use the BIRAD-US lexicon classification in data collection.

Berg W.A et al did a 5 year study ending in September 2001 to understand the pathologic basis for sonographic features of cystic lesions of the breast and determine appropriate assessment and management recommendations for these lesions based on sonographic appearance. Of 150 lesions 16 were simple cysts, 38 were complicated cysts and one a cyst with thin septations. None of these proved malignant nor 16 lesions characterized as clustered microcysts. Of 23 masses with thick indistinct walls or thick septations, 7 proved malignant. Of 18 intracystic or mixed cystic and solid masses 4 proved malignant. Of 38 predominantly solid masses with eccentric cystic foci 7 proved malignant [12].

In a 2003 study of suspicious solid nodules, Piccoli C.W demonstrated that ductal extension and branch pattern of a lesion suggested intraductal growth pattern of the lesion. This was seen in periductal fibrosis, benign intraductal papilloma and Ductal Carcinoma in Situ (DCIS)[13].

A study to demonstrate in vivo microcalcification using high resolution BUS by Yang W.T et al showed that BUS had a sensitivity of 87% and an accuracy of 91% in detection of microcalcification which is a reliable sign of DCIS[14] [15].

In a 2005 study to describe the sonographic and histopathologic basis of breast malignancies that show non enhancement on MRI, Ghai S. et al analyzed six

nodules whose histopathology included invasive ductal carcinoma, tubular carcinoma, invasive lobular carcinoma, mixed invasive ductal and lobular carcinoma. They found the most common sonographic appearance of these lesions was of a solid, hypoechoic nodule associated with speculated margins and posterior acoustic enhancement [16].

Wenstein S.P et al in 2004 study demonstrated that although posterior acoustic shadowing is commonly associated with breast malignancy this finding may also be found with some benign breast lesions such as fibroadenomas, granular cell tumors, radial and post surgical scars, fat necrosis, focal fibrosis, sclerosing adenosis and diabetic mastopathy[17].

Though vascularization on color Doppler ultrasonography is associated with most breast malignancies (>90%), Strano S et al in a study conducted to characterize the spatial distribution of blood vessels in breast fibroadenomas demonstrated blood flow in 24 out 29 (83%) of fibroadenoma[18] [19].

Sakr A.A et al reviewed 10 cases of proven tuberculous mastitis. On BUS 60% had hypoechoic masses, 40% focal or sectorial ductal ectasia and 50% axillary adenopathy. Analysis of 11 women with idiopathic granulomatous lobular mastitis by Lee J.H et al in 2006 showed irregular or tubular hypoechoic masses with minimal parenchymal distortion on BUS [20] [21] [22].

OBJECTIVES

General objective

To compare gray scale and Doppler ultrasonographic and histopathological findings in the diagnosis of breast masses.

Specific objectives

1. To determine the sonographic pattern of breast masses as seen at the DDIRM-UON and KNH Radiology Department.
2. To correlate the Ultrasonographic and histopathological findings in breast masses.

STUDY JUSTIFICATION

The breast is a highly esteemed organ whose disease and treatment may have many physical, physiological and cosmetic effects on the female. Moreover, breast cancer is of great concern worldwide. In Kenya today, breast cancer is the commonest malignancy in the female. Management of breast disease is very much dependent on early and correct diagnosis. This calls for diligent use of all diagnostic tools, Ultrasonography being the most affordable and accessible.

As per existing records no study has been done in Kenya to correlate the Ultrasonographic and the Histopathological findings of breast masses to date. This study was therefore to investigate this correlation and make recommendations aimed at improving patient management.

RESEARCH QUESTION

Will evaluating the Ultrasonographic characteristics of breast masses such as shape, echogenicity, margins, calcification, echogenic fluid or debris, septations, shadowing and vascularity help in reaching a correct diagnosis?

METHODOLOGY

Study area

The study was conducted at the DDIRM-UON, Radiology Department KNH and the Pathology Department KNH.

Study population

This included all patients referred for BUS from the wards and clinics of KNH and thereafter underwent an ultrasound guided core biopsy or excisional biopsy of the breast mass and tissue obtained taken to Pathology Department KHN for histopathological analysis.

Study design

This was a cross sectional descriptive study.

Sampling procedure

All consecutive patients referred to DDIRM-UON and Radiology Departments of KNH for BUS with clinical suspicion of breast disease were recruited for the study.

Sample size

Derived from Fisher's formula:

$$N = \frac{Z^2P(I-P)}{d^2}$$

N:Sample size

Z: Standard distribution=1.96

P: Known prevalence for factor of interest under study = 3.3%.

d: level of significance desired= 0.05.

Minimum number of patients as calculated using this formula was 50 patients.

Exclusion Criteria

1.Patients referred from distant clinic/hospitals due to difficulty in follow up.

2.Patients with ultrasound reports and no Histopathological reports and vice versa.

Inclusion Criteria

1.Only patients with BUS done at DDIRM-UON and KNH.

2.Only patients who have had a biopsy taken and histology studies performed.

Limitation

Unavailability of histological or radiological report.

Equipment and technique.

Patients were scanned using a Philips ultrasound machine with a 7.5MHz linear transducer at KNH and a General Electric machine with a similar transducer at DDIRM-UON. These machines had facilities for color Doppler and Duplex

imaging. Ultrasound gel was used as a coupling medium. A thermal printer and printing paper was used to record images.

DATA MANAGEMENT AND ANALYSIS.

Data was entered into a microcomputer using SPSS/PC+ for windows version 10 data entry programme. Validation was done before analysis. Analysis was carried out using SPSS/PC+ programme and involved descriptive terms like mean, standard deviation, proportions and frequency distributions derived. To determine concordance cross tabulation between BUS and histopathology findings was done.

Ultrasonographic and histopathological findings were recorded as per guidelines in Appendix C.

ETHICAL CONSIDERATIONS

Confidentiality was maintained in that only the hospital number and not the name was used to identify the patient. Patients name, religious background or ethnicity was not required in this study.

The patients were informed that BUS was a relatively harmless examination.

The BUS examination and biopsy was part of the patients' management protocol and the clinician's request was not influenced by the study.

A written consent was obtained from the patient for both the BUS and biopsy. The patient was informed about the study and that the result of the study would be used for research purposes without her name appearing in the research document.

RESULTS

A total of 56 patients with breast abnormalities, presenting for treatment at KNH were included in the study. The patients' mean age was 34.6 years (SD 14.1) with an age range from 15-74 years. The sample included 55 female patients and only one male patient. All the 56 patients (100%) were symptomatic, and 25 patients (44.6%) had more than one clinical finding. As shown in Table 1 breast mass was the most common clinical sign among the patients with breast abnormality and occurred in 52 (92.9%) patients.

Approximately one-quarter (23.2%) of the patients had enlarged breasts. At least 10% had skin retraction, and a similar proportion presented with either skin thickening or lymphadenopathy.

Similar to clinical presentation, breast masses were the most frequent sonographic findings detected in 54 (96.4%) patients. Sonography also had a high true positive rate for detecting breast masses. Ninety-four percent of the symptomatic breast masses were visible on sonography. The false negative sonographic results consisted of one case of symptomatic mass palpable on clinical examination.

Lesion boundaries were visible on sonography in 36 cases , 26 (46.4%) with abrupt interface and 10 (17.9%) with echogenic halo . Other features of the

lesions visible using sonography including shape, orientation, and echogenicity are shown in Table 2.

As shown in Figure 1, most patients (n = 26, 46.4%) with breast abnormalities were classified in category 2 which corresponds to benign entities including intramammary lymph nodes, ecstatic ducts and simple cysts. The next dominant category accounting for 30.4% of patients was category 4 comprising moderately suspicious lesions with a high chance (50-89%) of malignancy. Each of the remaining categories had less than ten patients: category 5 (n = 8); category 1 (n = 2); category 3 (n = 2); category 6 (n = 1).

Four main types of lesions: benign (n = 28, 50%), risk (n =2, 3.6%), locally aggressive (n =3, 5.4%) and malignant (n = 23, 40.1%) were detected on histolopathology. The subtypes of each lesion types are presented in the following section.

Among the 28 benign lesions identified, fibroadenomas were the most common subtype accounting for 64.3% (n =18) of the lesions (Figure 2). The other benign lesions are presented in Figure 2 and included fibrocystic changes (n=3), lipoma (n = 1), abscess (n=1) and mastitis (n=1).

The two patients (3.6%) with risk lesions both had papilloma subtype of risk lesions.There were three (5.4%) patients with locally aggressive lesions, and all of them had phylloides tumor.

As shown in Figure 3, a total of 23 malignant lesions were identified. Most of these lesions (n = 21, 37.5%) were invasive ductal carcinomas.

The correlations between ultrasonography and histopathology findings are presented in Tables 3. Analysis of visible masses using ultrasonography showed the following: shape, orientation, margins, boundary and posterior acoustic features of masses were significantly associated with histopathology findings (Fischer's exact test; $p<0.05$). There was no significant association between histopathology findings and surrounding tissue ($p=0.34$) or echopattern ($p=0.95$).

An oval mass with circumscribed margins and parallel orientation which had a boundary with an abrupt interface and no posterior acoustic phenomena was more likely to be associated with a benign histopathologic finding ($p<0.05$). Conversely an irregularly shaped mass, with a non-parallel orientation, indistinct, angular or speculated margins, a boundary with an echogenic halo and posterior acoustic shadowing was more likely to be associated with malignant histopathologic findings.

As shown in Table 3 the histopathology findings were significantly associated with the American college of Radiology BIRAD-US assessment categorization (Fischer's exact test; $p < 0.0001$). Masses in ACR BIRADS-US category 1 and 2 were more likely to be benign on histopathology while category 4, 5, and 6 were likely to be malignant on histopathology examination.

Two cases of macrocalcification seen in the study were associated with malignant lesions . Microcalcification in mass occurred in lesions that were histologically defined as either locally aggressive (n = 2) or malignant (n = 5).No microcalcification out of mass was seen in the study. There were very few special cases and vascularity was rarely reported.

TABLE 1

Clinical signs and symptoms occurring among patients presenting with breast abnormalities at KNH

Clinical sign or symptom	Frequency (n = 56)	Percent (%)
Breast mass	52	92.9
Breast enlargement	13	23.2
Skin retraction	6	10.7
Skin thickening	6	10.7
Lymphadenopathy	6	10.7
Nipple discharge	5	8.9
Nipple retraction	4	7.1
Breast tenderness	2	3.6
Breast pain	2	3.6
Gynaecomastia	1	1.8

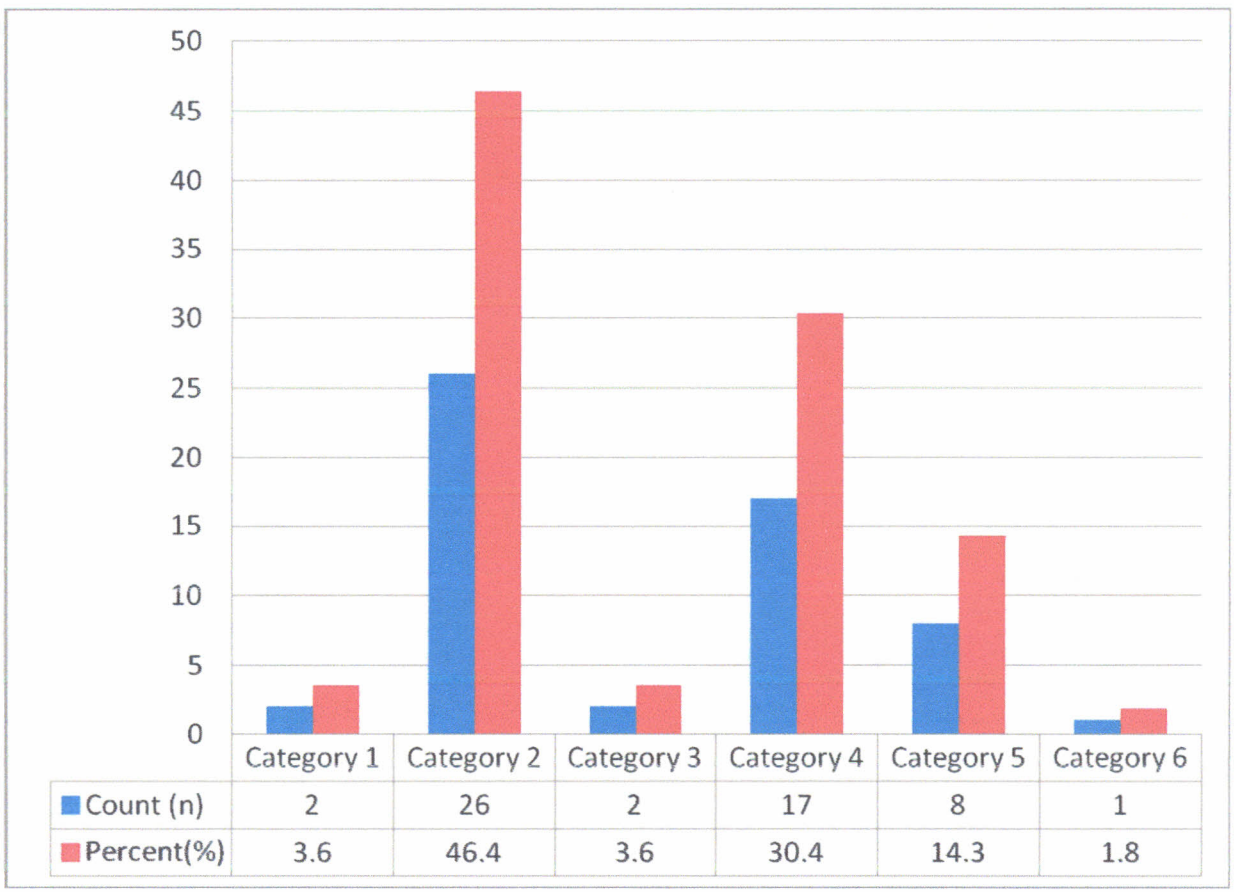
TABLE 2

Sonographic findings among 56 patients with breast abnormalities

Shape	Frequency (n = 56)	Percent (%)
Oval	23	41.1
Round	12	21.4
Irregular	10	17.9
Missing	11	19.6
Orientation		
Parallel (Wider than tall)	27	48.2
Not parallel (Taller than wide)	16	28.6
Missing	13	23.2
Echopattern		
Anechoic	2	3.6
Hyperechoic	2	3.6
Complex	9	16.1
Hypoechoic	36	64.3
Isoechoic	1	1.8
Missing	6	10.7
Posterior acoustic features		
None	11	19.6
Enhancement	10	17.9
Shadowing	6	10.7
Missing	29	51.8
Surrounding tissue		
Architectural distortion	1	1.8
Skin thicken	1	1.8

FIGURE 1

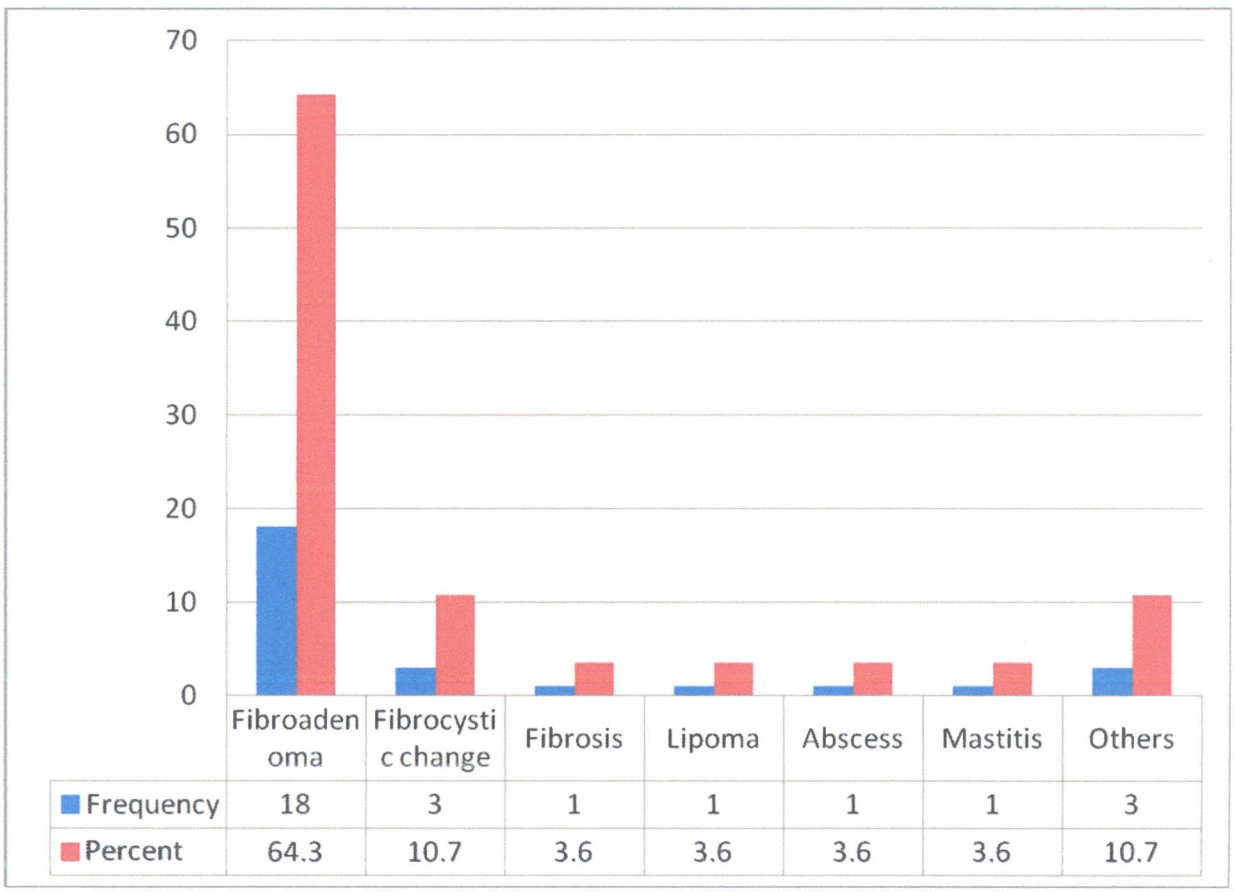
ACR BIRADS-US assessment categories for 56 patients with breast abnormalities



	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
Count (n)	2	26	2	17	8	1
Percent(%)	3.6	46.4	3.6	30.4	14.3	1.8

FIGURE 2

Subtypes of benign lesions identified among patients with breast abnormalities



	Fibroadenoma	Fibrocystic change	Fibrosis	Lipoma	Abscess	Mastitis	Others
Frequency	18	3	1	1	1	1	3
Percent	64.3	10.7	3.6	3.6	3.6	3.6	10.7

FIGURE 3

Subtypes of malignant lesions identified among patients with breast abnormalities

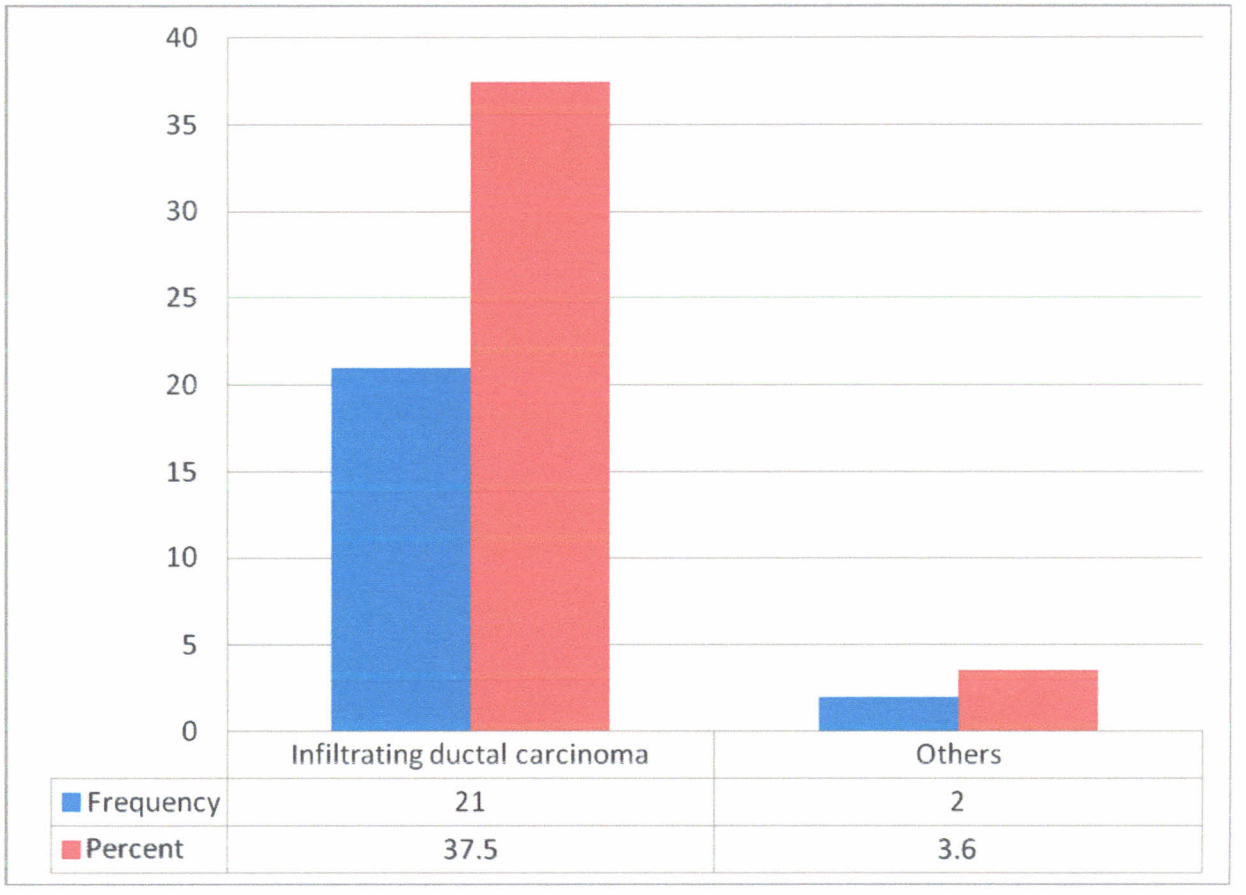


TABLE 3

Correlation between sonographic and histopathologic findings of 56 patients with breast abnormalities at KNH.

	Histopathologic findings				
Imaging findings	Benign lesion (n = 28)	Risk lesion (n = 2)	Locally aggressive lesion (n = 3)	Malignant lesion (n = 23)	Total (n = 56)
Mass absent	2(7)	0	0	0	2(4)
Mass present	26(93)	2(100)	3(100)	23(100)	54(96)
Shape					
Oval	18(69)	1(50)	1(33)	3(13)	23(41)
Round	4(15)	1(50)	0	7(30)	12(21)
Irregular	1(4)	0	0	9(39)	10(18)
Margins					
Circumscribed	20(77)	2(100)	1(33)	4(17)	27(48)
Indistinct	1(4)	0	0	6(26)	7(13)
Angular	0	0	0	5(22)	5(9)
Spiculated	0	0	0	3(13)	3(5)
Microlobulated	3(12)	0	1(33)	1(4)	5(9)
Lesion boundary					
Abrupt interface	17(65)	2(100)	3(100)	4(17)	26(46)
Echogenic halo	1(4)	0	0	9(39)	10(18)
Echo pattern					
Anechoic	1(4)	0	0	1(4)	2(4)
Hyperechoic	2(8)	0	0	0	2(4)
Complex	4(15)	0	1(33)	4(17)	9(16)
Hypoechoic	17(65)	2(100)	2(67)	15(65)	36(64)
Isoechoic	0	0	0	1(4)	1(2)
Posterior acoustic features					
None	7(27)	0	0	4(17)	11(20)
Enhancement	7(27)	1(50)	2(67)	0	10(18)
Shadowing	0	0	0	6(26)	6(11)
Combined	0	0	0	0	0
Sorrounding tissue					
Architectural distortion	0	0	0	1(4)	1(2)
Skin thickening	0	0	0	1(4)	1(2)
Skin retraction	0	0	0	0	0

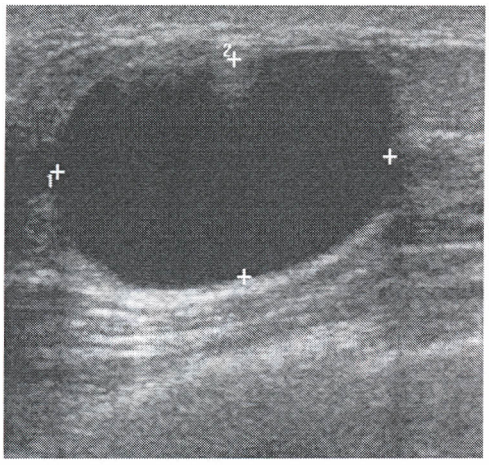
TABLE 3-continued

Correlation between sonographic and histopathologic findings of 56 patients with breast abnormalities at KNH.

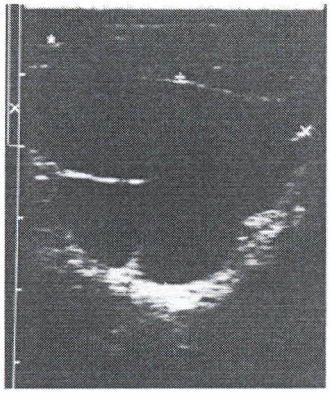
	Histopathologic findings				
Imaging findings	Benign lesion (n = 28)	Risk lesion (n = 2)	Locally aggressive lesion (n = 3)	Malignant lesion (n = 23)	Total (n = 56)
Calcification					
Macrocalcification	0	0	0	2(9)	2(4)
Microcalcification out of mass	0	0	0	0	0
Microcalcification in mass	0	0	2(67)	5(22)	7(13)
Special cases					
Clustered microcysts	0	0	0	0	0
Complicated cysts	0	0	0	0	0
Mass in or on skin	0	0	0	0	0
Foreign body	0	0	0	0	0
Intramammary lymph node	1(2)	0	0	0	1(2)
Axillary lymph node	1(2)	0	0	6(26)	7(13)
Vascularity					
Not present/ not assessed	8(14)	0	2(67)	8(35)	18(32)
Present in lesion	0	0	0	0	0
Present adjacent to lesion	0	0	0	0	0
Diffusely increased in surrounding tissue	0	0	0	0	0
ACR BIRAD-US assessment category					
Category 1	2(3)	0	0	0	2(4)
Category 2	24(41)	1(50)	0	1(4)	26(46)
Category 3	0	1(50)	0	1(4)	2(4)
Category 4	2(3)	0	3(100)	12(52)	17(30)
Category 5	0	0	0	8(35)	8(14)
Category 6	0	0	0	1(4)	1(2)

ILLUSTRATIONS

PLATE 1

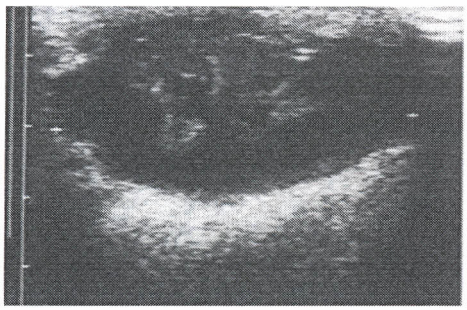


Oval anechoic breast mass with shaply defined margin and posterior acoustic enhancement. Typical ultrasound features of a simple cyst.

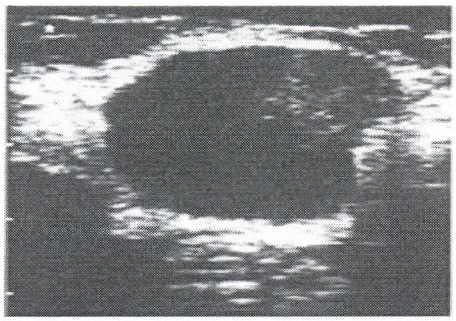


Septated cyst on BUS

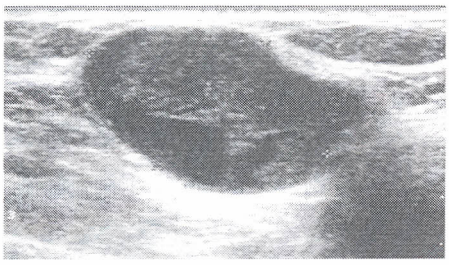
PLATE 2



Cystic hypoechoic breast lesion with internal echoes and posterior acoustic enhancement. Proved to be an abscess at aspiration.

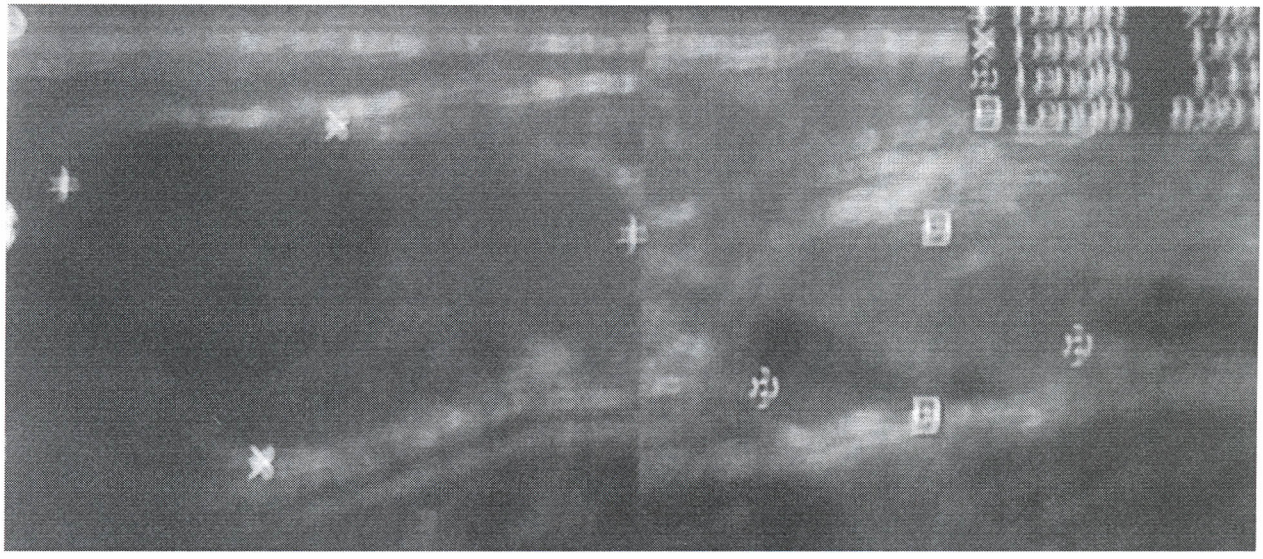


A complex mass with a cystic and solid component and posterior acoustic enhancement. Proved to be an intracystic papilloma on histopathology.



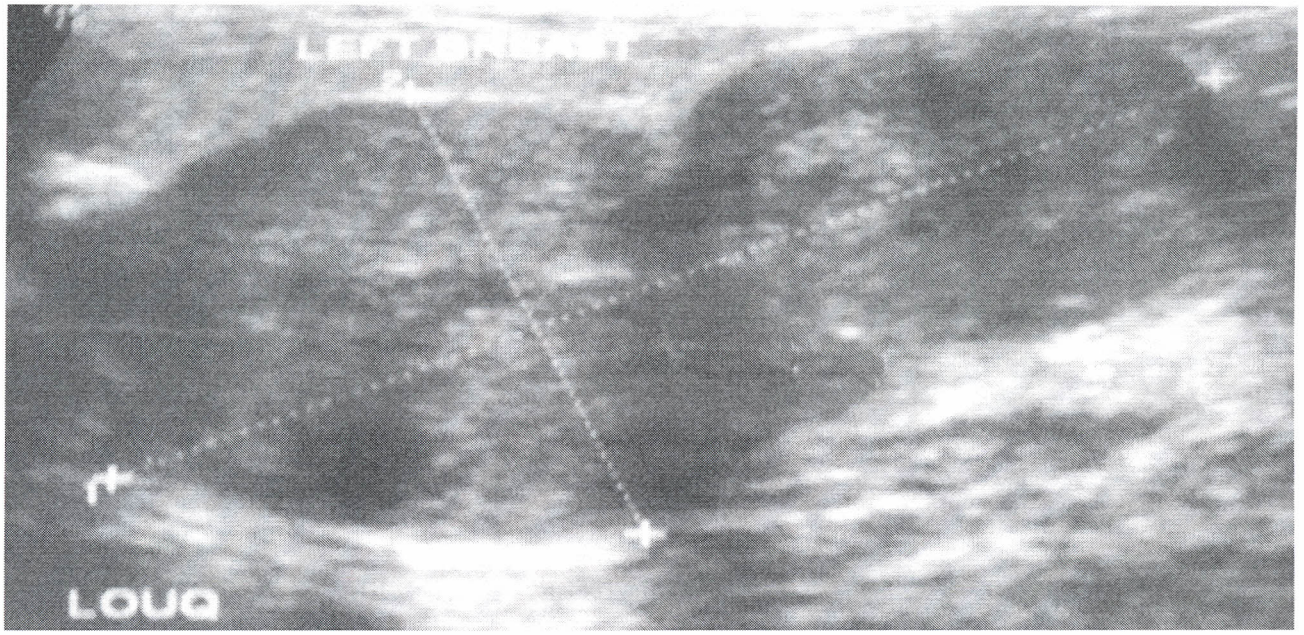
A complex mass with cystic and solid components. An intracystic papillary carcinoma was found at histopathology.

PLATE 3



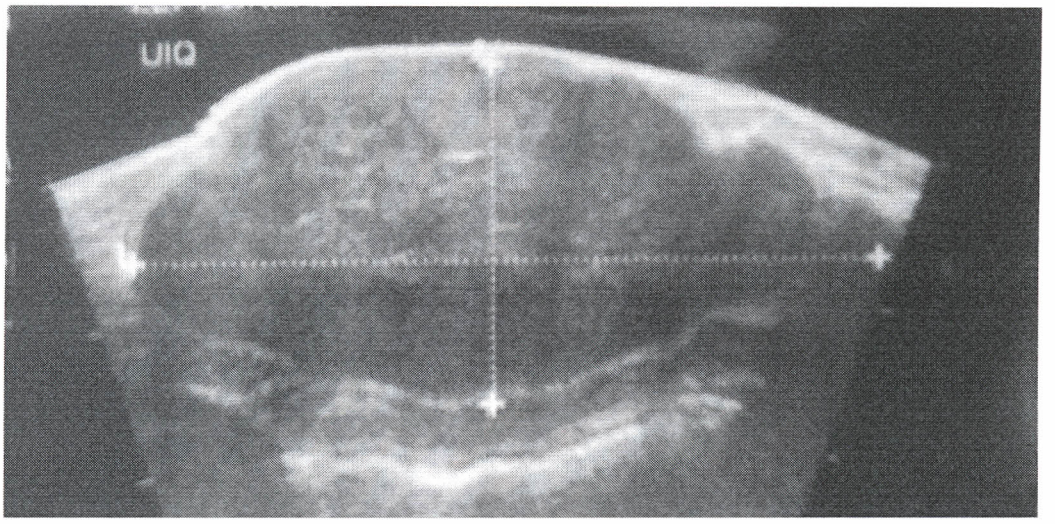
Longitudinal and transverse ultrasound images of a breast mass confirmed to be a fibroadenoma on histology

PLATE 4



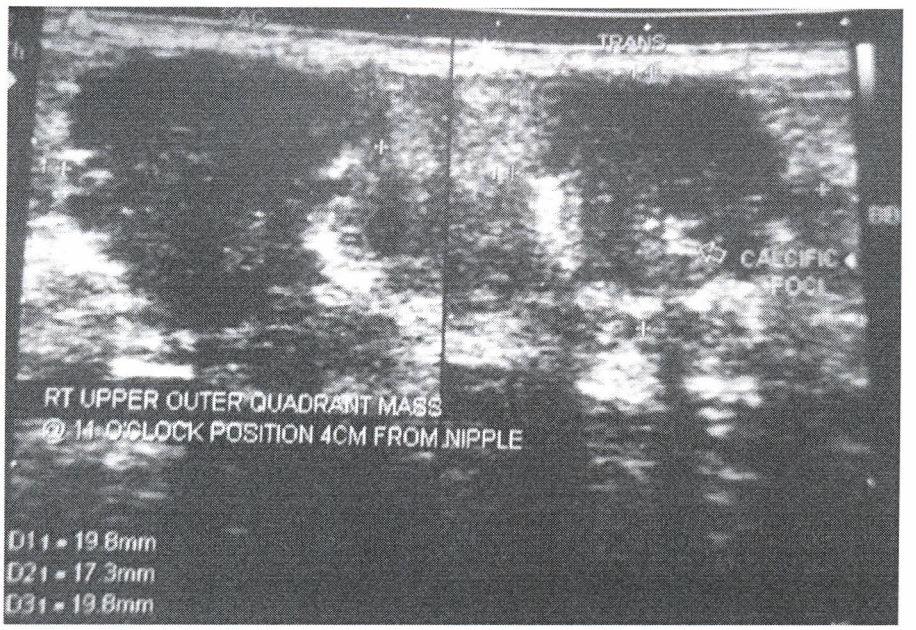
Longitudinal ultrasound image of a lobulated hypoechoic breast mass with well circumscribed margins. Proved to be a fibroadenoma on histopathology.

PLATE 5



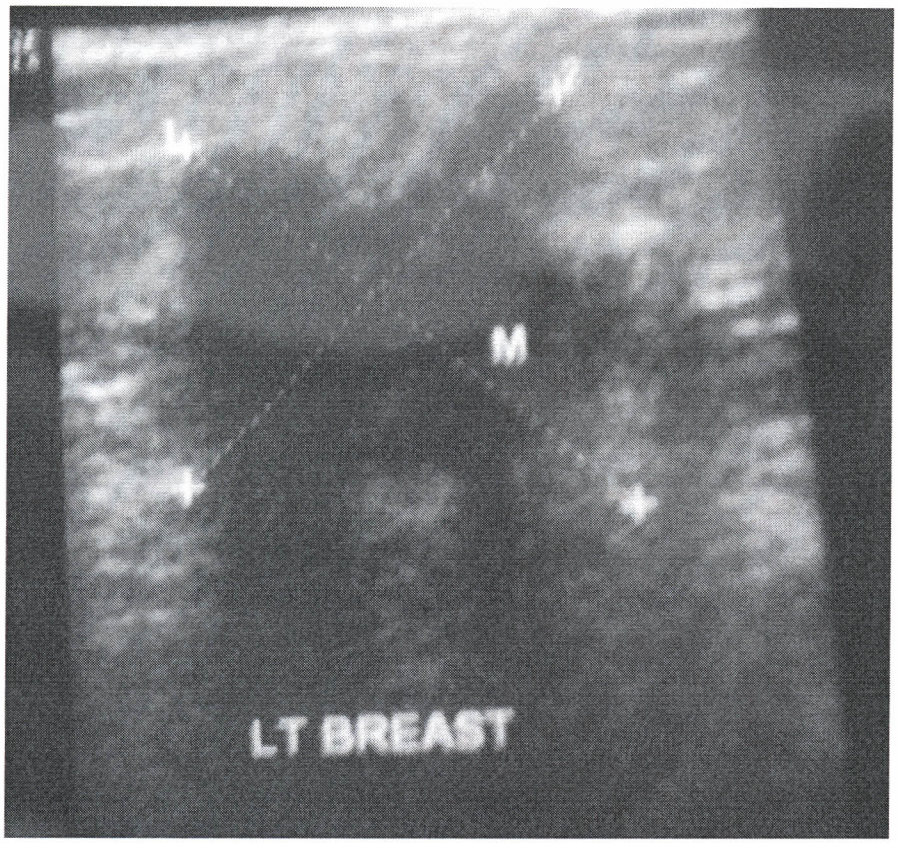
Longitudinal ultrasound image of a breast mass with well circumscribed margins. Confirmed to be a fibroadenoma on histopathology.

PLATE 6



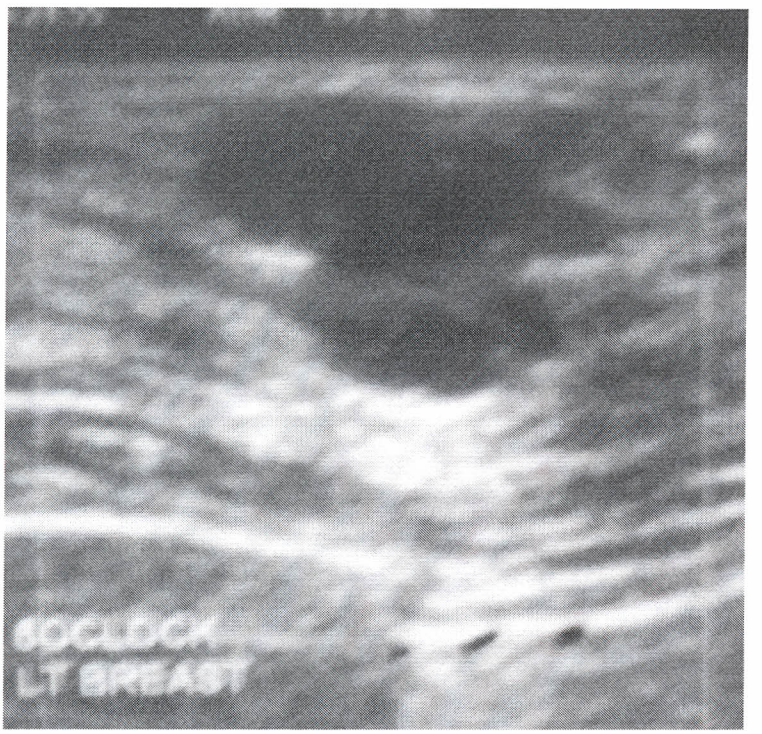
Longitudinal and transverse ultrasound images of a breast mass which is taller than wide and has angular margins. There are calcifications within the mass with posterior acoustic margins. Histopathology showed it was a ductal carcinoma

PLATE 7



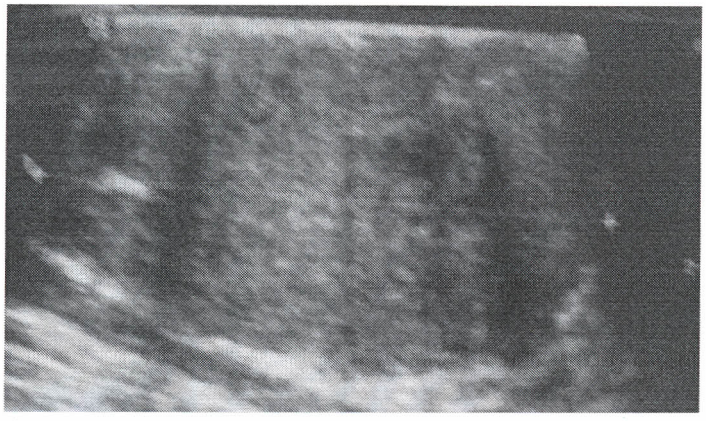
Longitudinal ultrasound image of a lobulated hypoechoic breast mass with posterior acoustic shadowing. It turned out to be a ductal carcinoma.

PLATE 8

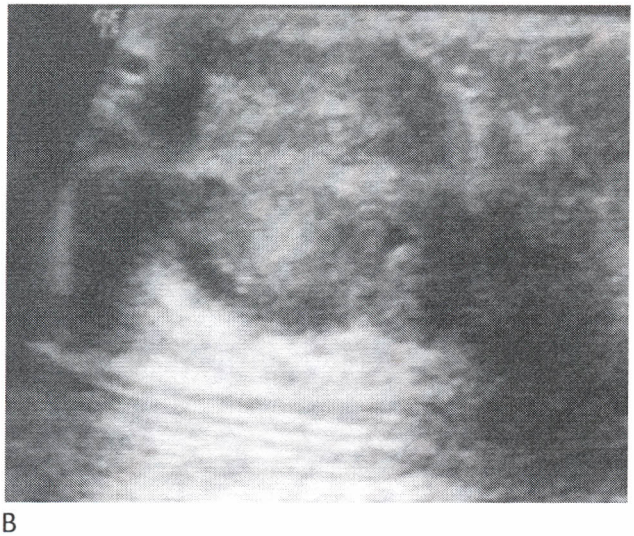


Longitudinal ultrasound image of a lobulated, taller than wide hypoechoic breast mass with posterior acoustic enhancement. Proved to be a ductal carcinoma on histopathology.

PLATE 9



A



B

Longitudinal (A) and transverse (B) ultrasound images of a wider than tall, complex mainly echogenic breast mass with posterior acoustic shadowing. It was a phylloides tumor on histopathology.

PLATE 10

Longitudinal ultrasound image of an ovoid echogenic brest mass with indistinct margins. Confirmed to be a lipoma on histopathology.

DISCUSSION.

In this study a total of 56 patients whose ages ranged from 15 to 75 years were reviewed. The mean age was 35 years with a standard deviation of 14.1.

The majority comprising 26 cases (46.4%) had breast abnormalities classified in ACR-BIRADS category 2 which corresponds to benign entities. The next common category comprising of 17 cases (30.4%) was ACR-BIRADS category 4 corresponding to suspicious lesions with a 3 to 89% chance of being malignant. ACR-BIRADS category 5 corresponding to malignant lesions followed with 8 cases (14.3%).

On histopathology the majority of lesions comprising 28 cases (50%) were found to be benign significantly correlating with sonographic findings. Among these fibroadenomas were the most common accounting for 64.3% benign lesions and 32% (n=18) of all lesions. A total of 23 malignant lesions (41%) were identified and most of these, 21 cases (37.5%) were invasive ductal carcinoma. Other lesions identified on histopathology included fibrocystic change (3 cases), phylloides tumor (3 cases) and papilloma (2 cases)

Invasive ductal carcinoma.

This was the commonest histologically proven breast lesion comprising 21 cases (37.5%). Majority were hypoechoic (65%), irregular in shape with indistinct or angular margins. A quarter of the lesions showed posterior acoustic shadowing, 22% had microcalcifications within mass and 26% were associated with axillary lymphadenopathy.

Paulinelli R.R and colleagues in 2010 examined 1403 patient with breast lesions by ultrasound in an effort to create an individualized predictive tool for the risk of malignancy in solid masses based on echogenicity and clinical characteristics. On histology 20.7% of the lesions were found to be infiltrating ductal carcinoma. Ultrasound features which when present related to greater probability of tumor malignancy included irregular/ noncircumscribed margins, heterogeneous echotexture, posterior acoustic shadowing and taller than wide orientation [29].

A study by Chiasawas P et al published in April 2011 correlating ultrasonography and histology in ACR-BIRADS 4 and 5 small breast lesions among Thai patients concluded that irregular shape and shadowing were the most common malignant signs while increased vascularity and speculated margins were the most predictive

signs for malignancy. In this study 64.4% of the 45 breast lesions analysed were malignant and among these 48.9% were invasive ductal carcinoma [30].

Fibroadenoma.

In this study this was the second commonest tumor comprising of 18 cases (32%) of the reviewed lesions. Majority were hypoechoic, oval in shape and with well circumscribed margins with an abrupt interface.

A study of breast lesions in 1189 patients between the ages of 10 and 93 years carried out in Jamaica by Shirley S.E, Mitchell D.I.G et al showed fibroadenoma to be the most common breast lesions (39.4%) in all biopsies [26]. In another clinicopathologic study of 65 breast specimen done in Ghana by Chhanda Bewtra 48% were found to be fibroadenoma [27].

In a study by Fornage B.D, Lorigan J.G et al to review the sonographic appearances of 100 fibroadenoma most (92%) were hypoechoic, majority were oval in shape and 27% showed irregular margins [28].

Using four BUS features of shape, margins, width: AP ratio and echogenicity to characterize 100 breast lesions Singh K et al found round or oval, circumscribed margins and width: AP ratio > 1.4 to be the most reliable features in predicting benign lesions. Clinical impression about diagnosis based on the 4 BUS features found majority (31%) to be fibroadenoma, 14% cysts, 13% fibroadenosis, 6%

phylloides tumor and 3% abscess. This correlated with histopathology at 38%, 14%, 38%, 6% and 5% respectively for the aforementioned diagnoses.

These studies compare favorably with the results from my study.

CONCLUSION.

1.Evaluating the ultrasonographic features of breast masses helps in reaching a correct diagnosis.

2.Analysis of ultrasonographic characteristics of breast masses such as shape, orientation, margins, lesion boundary, posterior acoustic features, calcification and assigning the mass an ACR-BIRADS assessment category will help in differentiating benign from malignant lesions.

RECOMMENDATION.

In all cases of breast masses referred for breast ultrasonography, lesion characteristics such as shape, orientation, margins, lesion boundary, echopattern, posterior acoustic features and calcification should be analyzed, documented and the lesions assigned an ACR-BIRADS assessment category. This will help in differentiating benign from malignant lesions and assist clinicians in making appropriate patient management decision.

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APPENDIX A

PARTICIPATION CONSENT FORM STUDY NUMBER.....

Title: CORRELATION BETWEEN ULTRASONOGRAPHY AND HISTOPATHOLOGY IN BREAST ABNORMALITIES AT KENYATTA NATIONAL HOSPITAL.

Investigator:
DR JAMES NJENGA KAGIA
UNIVERSITY OF NAIROBI,
DEPARTMENT OF DIAGNOSTIC IMAGING & RADIATION MEDICINE
P.O.BOX 19676
NAIROBI
TEL 0721209894

Introduction

My name is James Njenga Kagia. I am a doctor and M.Med. student at the Department of Diagnostic Imaging and Radiation medicine, University of Nairobi. I am doing a study on the correlation between ultrasonography and histopathological findings of breast masses. I request you to be included in the study.

Benefits and Risks

There will be no direct benefits for those participating in the study; neither will there be any risks.

Confidentiality

All the information received from you plus the sonographic and histopathological findings will be handled with great confidentiality and used only for the purpose of the study.

Voluntary Participation

Participation in this study is voluntary and participants are free to accept or not accept to take part in the study and to withdraw at any time.

Consent

Signature .....
Date.....
Signature of researcher.....

APPENDIX B

FOMU YA IDHINI YA MSHIRIKA KWENYE UTAFITI NAMBARI.....

Mtafiti:

DR JAMESNJENGA KAGIA

UNIVERSITY OF NAIROBI,

DEPARTMENT OF DIAGNOSTIC IMAGING & RADIATION MEDICINE

P.O.BOX 19676

NAIROBI.

TEL 0721209894

Jina langu ni James NJenga Kagia.Mimi ni daktari na pia mwanafunzi katika chuo kikuu cha Nairobi. Ninafanya utafiti kuhusu magonjwa yanayokumba matiti.Ningeomba uwe mshiriki kwenye utafiti huu.

Faida na hasara

Hakutakuwa na faida ya moja kwa moja wala hasara kwa washiriki wa utafiti.

Siri

Yale yote utakayonieleza au yatakayopatikana kukuhusu itakuwa ni siri na itatumika kwa madhumuni ya utafiti.

Ushiriki wa hiari

Ushiriki kwa utafiti huu niwa hiari na mshiriki ana haki ya kushiriki au kutoshiriki.

Idhini

Sahihi: .....

Tarehe: .....

Sahihi ya mtafiti: .....