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Differential Diagnosis of Breast Masses using Ultrasound Confirmed with Histopathology

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Abstract: ***Breast cancer being the most common female cancer in the west, has been the subject of a large number of biological, pathology and therapeutic studies. The study aim to differentiate between malignant and benign masses from their ultrasound features and compared the obtained results with histopathology results. Materials & Methods: Ultrasound scanning of 62 cases of female breast masses was done in Radiology Department at King Abdul-Aziz Specialist Hospital (KAASH) hospital, Taif city, Saudi Arabia. U/S scans included information regarding the four features of the breast .Results: Study sample age ranged from (13 to 80) years old and the group (31-50 y) represented higher incidence with (33.9%) , mean age was (46.5y) , (87.1%) from them were married. Lesions width to AP ratio distributed as (≥ 1.4 , ≤1.4 and 4) with percentage of (33.9% , 64.5% and 1.6% respectively).Ultrasound diagnosed 24 malignant masses out of 36 correctly with sensitivity of (66.7%) , and overall sensitivity was (69.8%) and out of 30 malignant cases have had vascularity under color Doppler box ultrasound diagnosed 27 case from them with accuracy of (90%). Ultrasound features that most reliably characterized breast masses as benign were round or oval shape (63.2%), circumscribed margins (54.3 %) and (80%) of heterogenous echo texture masses were benign , while features that characterized masses as malignant were irregular shape (91.7%), complex appearance during U/S scan with percentage of (70%) , (74.1%) Ill-defined margins, width: AP ratio ≤1.4 and 4 with percentage of (61.1% , 100 respectively) , (55.6%) of hypoechoic masses were malignant. Only (2.8%) of heterogenous echo texture masses was malignant. Conclusion: Our results revealed an association between songraphic presentation and vascularity under Doppler box of breast masses and histology. Ultrasound is a useful tool in differentiation of cystic from solid masses of the breast. Recommendation: Similar studies with large sample size at regular intervals should be carried out in Taif region.***

Keywords: Ultrasound, Breast, Masses, Benign, Malignancy, Doppler, Histopathology

1. Introduction

Breast cancer being the most common female cancer in the west, has been the subject of a large number of biological, pathology and therapeutic studies including numerous randomized trials and meta-analysis, examining in detail almost all aspects of disease management[1].

Cancer is a leading cause of death worldwide. Globally Cancer of various types effect millions of population and leads to loss of lives. According to the available data through our comprehensive nationwide registries on cancer incidence, prevalence and mortality in India among males cancers of lung, mouth, esophagus and stomach are leading sites of cancer and among females cancer of breast, cervix are leading sites. Literature on management and treatment of various cancers in west is widely available but data in Indian context is sparse. Cancer of gallbladder and esophagus followed by cancer of breast marks as leading site in North-Eastern states. Therefore, cancer research and management practices become one of the crucial tasks of importance for effective management and clinical care for patient in any country. Hence, the need to develop a nationwide consensus for clinical management and treatment for various cancers was felt[1].

Breast cancer is the second most common cancer in the world. A report of the American Cancer Society showed about (1.3) million American women are annually diagnosed with Breast Cancer and about (0.5) million die from the malignancy [2].Saudi Arabia is no exception, where cancer of breast is most commonly prevalent. In one of the epidemiological studies conducted by Ravichandran ,et al.,[3] ,who reported that the incidence of breast cancer in Saudi Arabia was (19.8%) of all the female cancers detected in the Kingdom.

Al-Qahtani[4] showed Breast Cancer as the second most common malignancy in women in Saudi Arabia . Nevertheless, there is a paucity of detailed published epidemiologic data and an updated account of the figures registered. An earlier report according to Saudi National Cancer Registry reported an increasing proportion of Breast Cancer among women of different ages from (10.2%) 2000 to(24.3%) 2005[5] . Ravichandran and Al-Zahrani[6] investigated the incidence of female Breast Cancer in the Gulf Cooperation Council (GCC) countries in relation to the established reproductive factors. A total of 4480 breast cancer cases were diagnosed in women during 1998-2002 among Gulf Cooperation Council (GCC) country nationals. Breast cancer was the most common malignancy ranging from (16.1%) Oman to (35.4%) in Bahrain. The age-standardized incidence rate per 100,000 was highest in Bahrain (46.4), followed by Kuwait (44.3), Qatar (35.5), United Arab Emirates (19.2), Oman (14.4) and Saudi Arabia (12.9). These rates are low compared with most industrialized Western countries. According to a report of

Saudi National Cancer Registry (2000-2004), the incidence of breast cancer was 127.8 per 100,000 women and the mortality rate was reported as 25.5 per 100,000 [7] . A total of 7251 histologically confirmed new cases of cancer (4117 males and 3134 females) were seen in the 6-year period (1979 to 1984) in Riyadh[8].

Breast masses are common in female and amongst all the breast masses, malignant masses are the most feared [9,10], benign masses present clinically with the history of freely movable lump in one or both breasts since few months to years, usually painless, on ultrasound well defined round to oval lesion with homogeneous echotexture and width greater than depth.Malignant masses present clinically with lump in the breast, retracted nipple, pain & bloody discharge, ulceration over the skin. Malignant lesions on mammography reveal irregular mass, speculated or lobulated margins, focal asymmetry, lesion appears taller than wider, retracted nipple, calcification may be linear, branching, granular, clustered with surrounding architectural distortion.

A breast cancer risk factor something that increases the odds of developing breast cancer, such as having an inherited genetic mutation, taking extra hormone medications, and being exposed to particular chemicals. Many people think breast cancer is all about family history and inherited genes. While it is true some women inherit one or more abnormal genes that make their breasts more prone to cancer, these abnormal genes only increase the risk of developing breast cancer. They don't cause cancer by themselves[11]. For breast cancer to develop, other genetic changes still have to occur [12,13,14]. Also, today's higher incidence of breast cancer is not because the breast cancer genes are more common or have recently changed. They have been stable for a long time [15] . Breast cancer risk can also be increased by mutations in multiple other genes that work together. These genes, which are more common, are present in about (20-25%) of all breast cancer cases, but only produce a small to medium increase in risk [16,17].

Today's women are living longer than ever before. On average, women are living nearly 30 years longer than they did a century ago [18],while that's good news for us in general, it's not such good news for our breasts. Aging is the biggest risk factor for breast cancer. The longer we live, the more we have to weather the wear and tear of everyday living [19]. Our genes are more likely to develop new harmful mutations and we are less able to repair the genetic damage [20] . Pregnancy rates have been declining steadily. In fact, since 1990, the average number of pregnancies has declined each year by about (1%)[21]. A woman's first full-term pregnancy protects against breast cancer by making the breast cells mature. Mature breast cells are more likely to grow normally and are less likely to become abnormal and give rise to cancer[22] . Obesity is an epidemic of modern life and an established breast cancer risk factor [11, 23, 24].Alcohol use by women has increased[25]. Alcohol can both interfere with the breakdown of estrogen and increase the production of estrogen[26].It can also make the estrogen receptors inside breast cells more sensitive to estrogen. Longer and greater alcohol use in women produces more harmful effects, leading to a higher risk of breast cancer[27, 28,29,30]. Beyond the strong link between smoking and lung cancer, smoking produces a small increase in breast cancer risk[27,31].Many women have low levels of vitamin D [32]. Some studies show a possible link between low vitamin D levels and a higher risk of breast cancer [33,34].In the history ofU/S in 1951 Wild and Reid[35] , first developed equipment specially designed for breast scanning. Once limited for differentiating between solid and cystic lesions, breast ultrasound now proposes an attempt to characterize the breast nodules and to differentiate them as benign and malignant. Breast ultrasound has evolved as an indispensible problem solving tool in patients with dense breasts, post-radiation breasts, and women less than 35 years of age, pregnant and lactating patients.

For malignancy specificity of mammography is (93.3%) and that of Ultrasound (U/S) is (86.67%). Combining both the modalities specificity is near (97%) [36].

The development of modern equipment in the past 15 years has allowed for accurate detection and differential diagnosis of small lesions [37].

Ultrasound has an established role in assessing breast abnormalities as an adjunct to mammography in older women and as a first line investigation in young women with mammographically dense breasts. Some malignant breast lesions are not visible on mammography but are detected by ultrasound. The use of ultrasound in addition to clinical examination and mammography may result in an increased rate of breast cancer detection[38].

The increased quality of images obtained with ultrasound has allowed investigators to define the characteristics of specific breast masses. Although various classifications are in use, most investigators agree to characterize masses using four categories: shape of the lesion, margin characteristics, depth : width ratio and internal echogenicity. Within these categories, there is known overlap between benign and malignant characteristics [39].

In recent years, ultrasound has become an increasingly important auxiliary tool for assessing breast lesions detected Ultrasonography can be used to differentiate benign from malignant lesions with negative predictive value of (99.5%), specificity of (67.8%) and overall accuracy of (72.9%) [40].No individual features show variable diagnostic value, as So ,this study conducted to evaluate breast lumps by ultrasonography and confirmed by fine needle aspiration cytology or histopathology.So this study aim to differentiate between malignant and benign masses from their ultrasound features and compared the obtained results with histopathology results.

2. Materials and Methods

Setting and research design:
Prospective hospital base study performed in the breast imaging facility at radiology departmentduring the period from Sep 2016 to April 2017 at King Abdul-Aziz Specialist Hospital (KAASH), Taif city , Saudi Arabia.

Study population:
A sample comprised of 62 Saudi female their age ranged from 18 years and above living in Taif city have had different types of breast masses , this sample was collected when the patients were attended ultrasound department for evaluation their breast masses via gray scale and color Doppler ultrasound , the resultsof suspicious masses were confirmed with histopathology.

Inclusion criteria: i) Adults Saudi females, ages 18 and above.

Exclusion criteria: Females who are not willing to participate in the study

Tool of data collection:
A structured questionnaire was designed for data collection by the researchers to perform this study based up on review of literature; a well-structured self-administered questionnaire consists from three parts:

First partcontain: Socio- demographic data (age , marital statusand affected side).

Second partcontain: Ultrasound and Doppler result included information regarding the four features of the breast: Shape (Round, Oval or Irregular), Margins (Circumscribed or Ill- defined), Width: AP ratio($\leq$1.4 , $\geq$ 1.4 or 4 cm) and Echogenicity (Hyperechoic, Hypoechoic or Isoechoic) ;on the basis of these four features a diagnosis was made. The ultrasound diagnosis was confirmed by FNAC or histopathology to categorize lesions as benign, malignant, on indeterminate by using previous criteria.

US features that most reliably characterize masses as benign are : a round or oval shape, circumscribed margins, and a widthtoantero-posterior (AP) dimension ratio greater than 1.4. Features that characterize masses as malignant included irregular shape, microl-obulations, and width-to–AP dimension ratio of 1.4 or less. A few gently curving, circumscribed lobulations (macro-lobulations) are considered as benign features, whereas many small lobulations of 1-2 mm (micro-lobulation) are considered a malignant characteristic in a recent study.

Third partcontain: Histopathology results.

U/S technique and color Doppler protocol:
Breast U/S requires a high frequency transducer (8-15) MHz .Ideally a wide footprint probe. A lower frequency transducer may be required for the larger attenuative breasts, inflammatory masses and the axilla. The use of a standoff may be required for nipple, superficial/or skin lesions. Low PRF color and spectral Doppler capabilities for assessing vascularity of lesions [42].

Patient Preparation:
Patient will be asked to undress from the waist up and to wear a gown during the examination, lie on his back on the examining table and asked to raise the arm above the head. After he positioned on the examination table, the radiologist (a physician specifically trained to supervise and interpret radiology examinations) or sonographer will apply a warm water-based gel to the area of the body being studied. The gel will help the transducer make secure contact with the body and eliminate air pockets between the transducer and the skin that can block the sound waves from passing into the body[43].

The transducer is placed on the body and moved back and forth over the area of interest until the desired images are captured [41] . There is usually no discomfort from pressure as the transducer is pressed against the area being examined. However, if scanning is performed over an area of tenderness, the patient may feel pressure or minor pain from the transducer. Doppler sonography is performed using the same transducer. Once the imaging is complete, the clear ultrasound gel will be wiped off the skin. Any portions that are not wiped off will dry to a powder. The ultrasound gel does not stain or discolor clothing [43].

Ultrasound Protocol
She will be lying on your back on the examination bed in the ultrasound room, the upper body undressed, with one arm above your head on the pillow in a comfortable position. The doctor will put a clear gel on your breast and the ultrasound transducer or probe (see ultrasound) will be slowly moved across the breast to show and identify the lesion on the ultrasound screen. The doctor will clean your breast with an antiseptic liquid and place the needle through the skin and into the lesion guided by the ultrasound images. Local anesthetic on the skin area where the needle is inserted is sometimes given. If the doctor does not provide anesthetic you can ask about this before the needle is inserted. When the needle is inserted into the lesion, the doctor will make several small (less than 1cm) forward and backward, gentle movements with the needle to collect cells or, if the lesion is a cyst, fluid may be collected. Two or three separate samples are usually taken in this way to ensure a good sample has been obtained [44].

Many of the necessary preparations may be before this procedure is no use of aspirin or non-steroidal anti-inflammatory medications (e.g. ibuprofen, naproxen) for one week before the procedure, no food intake a few hours before the procedure ,routine blood tests (including clotting profile) must be completed two weeks before the biopsy ,suspension of blood anticoagulant medications and antibiotic prophylaxis may be instituted. Before the procedure is started, vital signs (pulse, blood pressure, temperature, etc.) may be taken. Then, depending on the nature of the biopsy, an intravenous line may be placed. Very anxious patients may want to be given sedation through this line. For patients with less anxiety, oral medication (Valium) can be prescribed to be taken before the procedure [45,46,47].

Histopathology
Study is carried out by a pathologist experienced in the diagnosis of breast lesions. Malignant lesions are classified into seven categories according to histology: invasive ductal carcinomas not otherwise specified, medullary, apocrine, neuroendocrine carcinoma (A); tubular, mucinous, papillary carcinoma, cribriform carcinoma (B); metaplastic, anaplastic, undifferentiated high grade carcinoma (C); invasive lobular carcinoma (D); mixed ductal and lobular

carcinoma (E); in situ carcinoma (F); and metastatic carcinoma (G), as proposed by Carey et al[15] .For convenient statistical analysis, the lesions were allocated into three broad groups according to lesion hardness, whereby group 1 contained softer lesions (categories B, F, and G), group 2 contained harder lesions (categories A, D, and E), and group 3 comprised category C lesions. No group 3 lesions were included in this study because the five lesions assigned to this category were all non-mass lesions[48].

Histopathology Protocol

Patients underwent biopsy by percutaneous sample collection using a 14 gauge needle coupled with a semiautomatic core biopsy gun or vacuum-assisted breast biopsy using an 11 gauge needle [48].

1) Fine Needle Aspiration Cytology / Biopsy in doubtful cases, post-operative follow up in operative cases.
2) In cases of simple cysts and galactocele no histopathology confirmation was done. Aspiration of cyst was done to confirm.
3) No histopathology done in cases of normal ultra- sound findings and normal mammography in patients complaining of apparent mass felt on clinical examination. Such patients refused to give consent for invasive histopathology study after normal reports and they were labeled as normal. Hence sensitivity and positive predictive value could not be obtained [48].

3. Methods

Official permission to carry out this study was obtained from the previously mentioned settings. Official permission to conduct the study was obtained from the research committee in King Abdul-Aziz Specialist Hospital (KAASH).Validity of tool will be reviewed by five experts from surgical nursing staff and content validity index will be calculated.

Fine-needle aspiration biopsy (FNAC/B)

Fine-needle aspiration cytology/biopsy (FNAC/B) of the breast is a well-established method to obtain fluid/tissue fragments and smears for preoperative diagnosis of breast lesions. FNAB is actually a safe and low-cost procedure that can avoid unnecessary surgery, differentiating with high accuracy benign and malignant lesions , as in figs (A&B). The aim of this study is to evaluate the FNAB role and accuracy in the diagnostic and therapeutic approach to breast carcinoma .The procedure was performed by well-trained pathologists, using vigorous sampling and ultrasound guide fornon-palpable or hardly palpable lesions. To determine whether the use of cell block improves diagnostic accuracy of FNAB ,we compared the cytology diagnosis and the one performed on cell block section[49].FNAC is a diagnostic procedure that a pathologist or radiologist or surgeon uses a very thin needleusually (22- to 25) gaugeconnected to a vacuumed syringe to aspirate a small amount of tissue from the suspicious area. Its use to detect breast lesion became increasingly important from the 1980s as a diagnostic adjunct in the population based screening setting. FNAC is a safe, economical, effective, and accurate technique, but its efficacy largely depends on the experience of aspirators and pathologists[45].

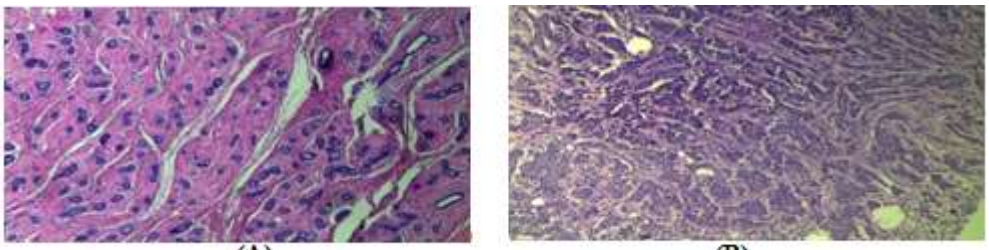

Figure A & B: (A) (Lt) breast mass diagnosed by histopathology as fibroadenoma. **(B)**(Rt) breast mass diagnosed as invasive duct carcinoma grade II(TRU-CUT BIOPSY).(H&E stain X200)

Statistical analysis: Data coded, entered and analyzed using SPSS version 20. Descriptive statistical analysis was used to determine frequency distribution to obtained demographic variables in tables and graphs.

Ethical considerations: Formal approval from ethics committee in (KAASH) was obtained prior to conduct this study.There is no risk for study subjects during application of research. Ethical committee in (KAASH) was assured that the data of this research will not be reused without second permission. No personal information of any patient will be published.

4. Results

Following are the results of the study carried out on differential diagnosis of breast masses using ultrasound and confirmed with histopathology result, total number of patients were 62.

Age: Youngest patient in the study was 13 year old while oldest one was a 80 year, the mean age for study sample was (46.5y), as in **table (1)**.(87.1%) from them were married , as in **fig (1)**.

Table 1: Demonstrate age frequency among study sample.**(n = 62)**

Age \ year		Frequency	%	Cumulative Percent
	13-30	18	29.0	29.0
	31-50	21	33.9	62.9
	51-70	18	29.0	91.9
	71-80	5	8.1	100.0
	Mean age	46.5 years		

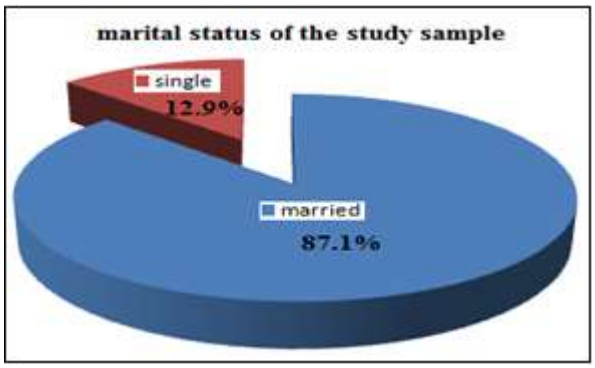

Figure 1: Shows marital status of the study sample. **(n = 62)**

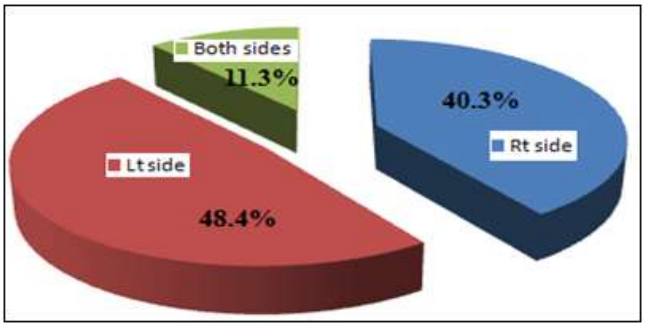

Figure 2: Shows side of breast mass. **(n = 62)**

Table 2: Symptoms of study sample **(n = 62)**

Symptoms	Frequency	%	Cumulative Percent
Axillary L\ node	25	40.3	40.3
Painwith other symptoms	23	37.1	77.4
Palpable mass only	13	21.0	98.4
Bloody nipple discharge	1	1.6	100.0
Total	62	100.0	

Table 3: Demonstrate width: AP ratio of study sample breast masses. **(n = 62)**

Masses width to AP ratio	Frequency	%	Cumulative Percent
>1.4	21	33.9	33.9
<1.4	40	64.5	98.4
4	1	1.6	100.0
Total	62	100.0	

U/S features of breast masses

According to the nature of all breast masses scanned with ultrasound in the study, there were 10 solid, 22 cystic and 30 were found to be complex breast masses, as in fig (3) below.

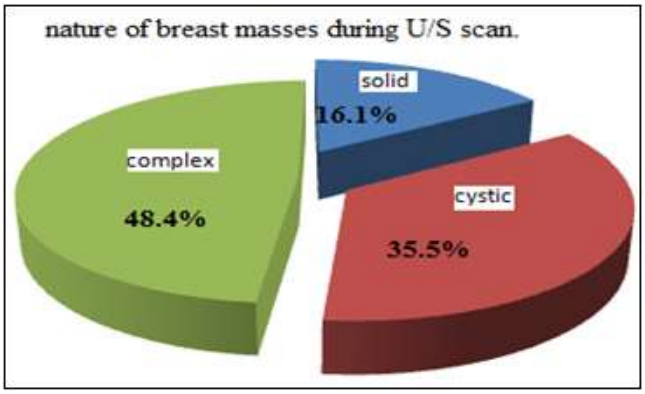

Figure 3: Shows nature of breast masses during U/S scan. **(n = 62)**

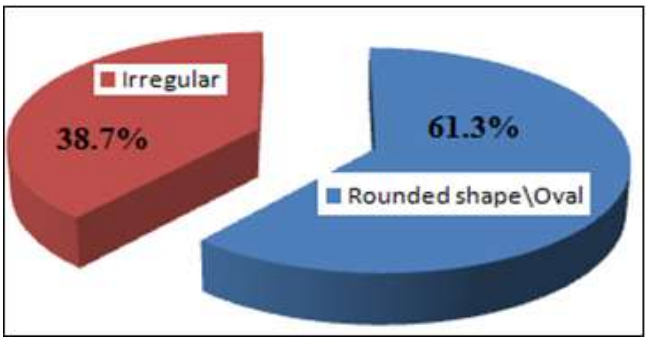

Figure 4: Shows shape of breast masses during U/S scan. **(n = 62)**

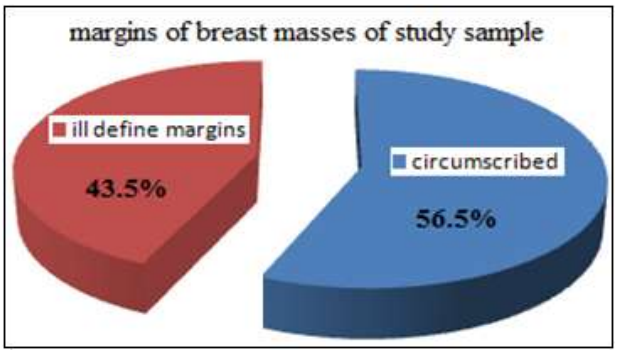

Figure 5: Shows margins of breast masses during U/S scan. **(n = 62)**

Table 4: Shows U/S echogenicity of breast masses.**(n = 62)**

U/S Echogenicity	Frequency	%	Cumulative Percent
Hyper echoic	10	16.1	16.1
Hypoechoic	35	56.5	72.6
Isoechoic	12	19.4	91.9
Heterogenous echo texture	5	8.1	100.0
Total	62	100.0	

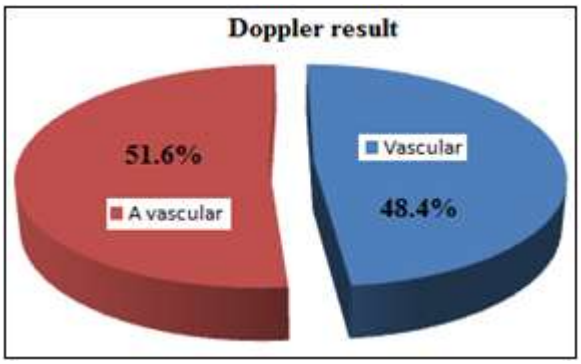

Figure 6: Shows breast masses Doppler flow pattern. **(n = 62)**

Table 5: U/S echogenicity * Histopathology result Cross tab. (n = 44)

Symptoms * Ca type Crosstab					
Symptom		Ca type		Total	Asymp. Sig. (2-sided)
		Benign	Malignant		
	Axillary lymph nodes	5(20%)	20(80%)	25	
	Pain with other symptoms	13(56.5%)	10(43.5%)	23	0.02
	Palpable mass	7(53.8%)	6(46.2%)	13	
	Nipple discharge	1(100%)	0	1	
Total		26	36	62	

*There is sig. correlation between the variables (p = 0.02)

Table 6: Shows significant co-relation between U/S features, Doppler of breast masses and cancer type.**(n = 62)**

U/S features		Histopathology result		Total	Exact Sig.
		Benign	Malignant		
Nature in U/S	Solid	11 (50%)	11 (50%)	22	0.00
	Cystic	6 (60%)	4(40%)	10	
	Complex	9 (30%)	21(70%)	30	
Echogenicity	Hyperechoic	4(40%)	6(60%)	10	
	Hypoechoic	15(42.9%)	20(57.1%)	35	
	Iso- echoic	3(25%)	9(75%)	12	
	Heterogenous echo texture	4(80%)	1(20%)	5	
Shape	Round/Oval	24(63.2%)	14(36.2%)	38	0.00
	Irregular shape	2(8.3%)	22(91.7%)	24	
Margin	Circumscribed	19(54.3%)	16(45.7%)	35	.023
	Ill defined	7(25.9%)	20(74.1%)	27	
Width : AP ratio	1.4 ≤	18 (45%)	22(55%)	40	
	1.4≥	8 (38.1%)	13(61.9%)	21	
	4	0	1(100%)	1	
Doppler flow	Vascular	3 (10%)	27 (90%)	30	.000
	Avascular	23(71.9%)	9 (28.1%)	32	

*There is sig. correlation between the variables (p=0.000& 0.023)

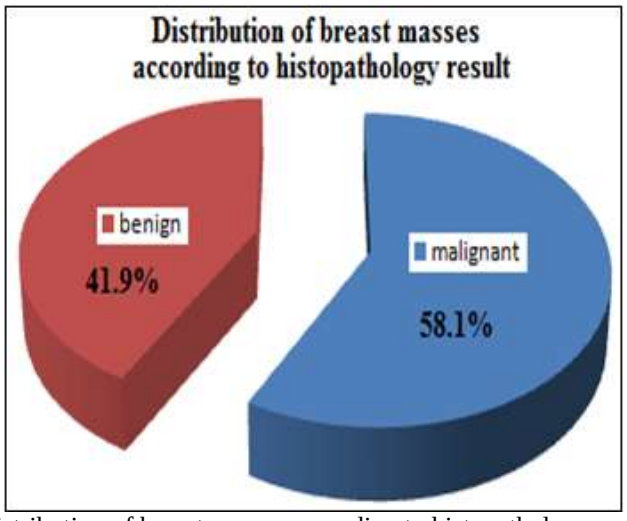

Figure 7: Distribution of breast masses according to histopathology result. **(n = 62)**

Table 7: Histopathology result * Cancer type Cross tab. **(n = 62)**

Histopathology result * Cancer type Cross tab

Histopathology		Cancer type		Total	Asymp. Sig.
		Benign	Malignant		
	Fibrocystic changes	6 (75%)	2 (25%)	8	.002
	Fibroadenomas	1(33.3%)	2(66.7%)	3	
	Granulmatis inflammation	0	3(100%)	3	
	Fibrosis	1(33.3%)	2(66.7%)	3	
	Invasive ductal carcinoma	0	22 (100%)	22	
	Malignant Ductal hyperplasia	0	1(100%)	1	
	Tubular carcinoma	0	1(100%)	1	
	Sclerosis adenoma	0	2(100%)	2	
	Chronic mastitis	0	1(100%)	1	
Total		8	36	44	

*There were 18 benign mass does not proceed for histopathology because of their benign features during U/S scan, forwarded to follow up only. *There is also sig. correlation between the variables (p=0.002).

Table 8: U/S echogenicity * Histopathology result Cross tab. (n = 44)

U/S echogenicity * Histopathology Crosstab												
U/S Echogenicity		Histopathology									Total	Asymp. Sig. 2-sided)
		Fibrocystic Changes	Fibro Adenoma	Granulmatis	Fibrosis	Invasive Ductal Carcinoma	Malignant Ductal Hyperplasia	Tubular Carcinoma	Sclerosis Adenomas	Chronic Mastitis		
	Hyperechoic	0	0	0	1	6	0	0	0	0	7	0
	Hypoechoic	8	2	0	1	13	0	0	1	1	26	
	Isoechoic	0	1	3	1	3	0	1	1	0	10	
	Complex	0	0	0	0	0	1	0	0	0	1	
Total		8	3	3	3	22	1	1	2	1	44	

*There were 18 benign mass does not proceed for histopathology because of their benign features duringU/S scan , forwarded to follow up only. *There is also sig. correlation between the variables (P=0.000).

5. Discussion

Ultrasound U/S is becoming a popular clinical diagnosis modality in the past decades with the major advances in transducer, electrical circuit, digital signal processing and system control, and has already been applied to large varieties of diseases because of its uniqueness of low cost, flexibility, non-invasion, and non-ionization. US has the ability to image and evaluate patient's internal anatomy structure and physiology in real-time with astounding clarity. Therefore, it makes significant contributions to healthcare [50].

In this study sample age ranged from (13 to 80) years old and the group (31-50 y) represented higher incidence with (33.9%) , mean age for sample of the study was (46.5y) as in **table (1)**, while (87.1%) from sample in this study were married as in **fig (1)**.In one study they [51] ., reported that maximum number of patients in our study were in the age group of (20-29) years (40%)followed by (40-49) years (19%). (62 %) of the patients were married. The average age of the patient with palpable breast lumps was (41) years. Also many studies reported that; the average age of the patient with palpable breast lumps was (43) years. The largest number of patients in our study were in the age group of 20-39 years (56.67%) followed by (40-49) years (20%). Khanna et al [52], reported it was (39.8%) in the age group of (21-30) years. Monu Sareen et al [53] ., reported (60%) in age group of 20-39 years followed by (40-49) years (18%) , while in other study (100%) of the study sample were married and all of them were more than 35 years of age [51].

Regarding side involved in this study left breast side represented (48.4%) also malignant masses have had higher percentage in (Lt) side also , while both sides lesions represented (11.3%) **as in fig (2)**.One study reported that(54%) of the masses were present in the outer upper quadrant of the breast. Both breasts were involved in (8%) of the casesin their study [51].

Regarding symptoms among study sample in this study, from 62 cases there were (40.3%) have had axillary lymph nodes and (21%) have had palpable breast mass, while (80%) from axillary lymph nodes and (46.2%) from palpable masses also found to be malignant as in **tables (2 & 5)**.The presence of axillary lymph node metastases in breast cancer is an important symptom in assessing prognosis and determining the treatment plan. Axillary staging is conventionally performed by axillary lymph node dissection. The use of sonography in detecting metastases is feasible and would reduce the number of false-negatives at sentinel node biopsy [51].

In this study from 62 lesions width to AP ratio distributed as (≥ 1.4 cm ,≤1.4 cm and 4 cm) with percentage of (33.9% , 64.5% and 1.6% respectively) as in **table (3)**, (56.5%) have had hypoechoic appearance during U/S scan , as in **table (4)**.In study by Aysegül Özdemir, et al [50]., they reported that lesion size was not recorded in 4 lesions and of the remaining 108, 20 (18.5%) were 10 mm and smaller, and 88 (81.5%) were larger than 10 mm.Ultrasound features most predictive of a benign diagnosis were oval or round shape, circumscribed margins and width AP ratio >1.4. This was similar to the results of Rahbar et al [54]. The features most predictive of a malignant diagnosis were irregular shape, non-circumscribed margins and width AP ratio ≤1.4. Benign lesions show round to oval shape, well defined margins, few lobulations, low soft tissue density and fat containing lesions. Malignant lesions are high soft tissue density, irregular margins, multiple lobulations and speculations with or without micro calcifications [55].

Regarding the nature of all breast masses scanned with ultrasound andfrom 62 cases there were 10 solid (16.1%) , 22 (35.5%) cystic and 30 (48.4%) were found to be complex breast masses , as in **fig (3)**,regarding shape of breast masses there were (61.3%) rounded/oval in shape , (38.7%) have had irregular outline , (56.5%) were circumscribed , (43.5%) have had ill-defined out lines and (56.5%) of breast masses were hypo-echoic during ultrasound scan and about (51.6%) have had vascularity under Doppler box ,as in**figs (4, 5&6)**. Out of 62 case of breast masses 36 (58.1%) were malignant ,as in **fig (7)** , regarding shape and outlines 22 (91.7%) have had irregular outline , (74.1%)ill-defined echo-texture both confirmed as malignant , while only 2(8.3%) irregular outline diagnosed as benign breast lesions, (60%) from cystic masses were benign , (70%) from complex lesion were malignant and (90%) of vascular lesions under the box of color Doppler were found to be malignantUltrasound features that most reliably characterized breast masses as benign were cystic round or oval shape , circumscribed

margins were benign , while features that characterized masses as malignant were irregular shape complex appearance during U/S scan with, Ill-defined margins, width: AP 4 with (100%) were malignant , Regarding vascularity under color Doppler box of breast lesions in this study there were 27 (75%) out of 36 malignant masses were vascular , while 23 (88.5%) out of 26 of benign tumor masses were vascular under box of color Doppler , so vascular features selected as diagnostic criteria were found to be statistically significant in differentiating the malignant from the benign lesions (P < .00) , as in **fig (5)**&**table (6)** ,with sig co-relation (p = 0.000 and 0.023) , There were 18 benign mass does not proceed for histopathology because of their benign features during U/S scan , forwarded to follow up only. *There is also sig. correlation between the variables (P=0.000) , **table (6)**.Most frequent type of malignancy was invasive ductal carcinoma with (61.1%) followed by malignant fibro adenomas (66.7%) , while (75%)of fibrocystic changes were benign , **as in table (7)**, appearance of malignant masses mostly was hypo echoic ,there is sig co-relation between type of lesion and its U/S appearance (p = 0.00) , as in **table (8)**.

In this study sensitivity of the ultrasound in diagnosis of malignant axillary lymph nodes of the breast was (80%) , accuracy of ultrasound in the detection of breast carcinoma was (66.7 %) and overall sensitivity was (58.1 %) and accuracy in diagnosing cystic and for complex masses was (90%). Sunil Kumar[56].,reported that out of the 13 cases diagnosed by the ultrasound, 11 were irregular margins, 9 were non-circumscribed and 9 cases with hypoechoic masses. Benign lesions of the breast were more readily diagnosed by ultrasound than malignant lesions. Sensitivity of the ultrasound in diagnosis of fibroadenomas of the breast was (90.5%). This is consistent with the findings of Fleishcher et al[57].Out of 60 cases in our study 50 were detected by ultrasound for the presence of lump, thus giving a sensitivity of (83.33%). Also this is in close conformity with results reported by Rubin et al [58] (91%), Smallwood [59] (92.5%), and similar results reported by Fleishcher et al [57] (84%), Mansoor et al [60] (86%) and Monu Sareen et al [53] (84%).The well-known phenomenon of tumor angiogenesis is associated with an increase in malignancy [61,62]. Color Doppler in 2 of 39 malignant breast disease patients with the tumor size of 0.6–8.0 cm (median 2.0 cm) did not show any vascularity. In comparison, no blood vessels were found in 10 of 73 benign masses (0.3–4.7 cm with the median of 1.4 cm). In patients with puerperal mastitis, abscess, phylloides tumor, and haemangioma, vascularization was extremely high. Benign and malignant breast lesions have significantly different Doppler US features. There is a remarkable overlap of carcinoma and benign tumor in peak flow velocity [60]. The accuracy for smaller blood vessels, especially for poorly vascularized masses, could be improved using a high-frequency and high-resolution system. Furthermore, color Doppler may also be able to reduce the number of biopsy and histological evaluations for patients with suspicious mammograms [63].The discrepancies between reported studies may be related to the U/S system and the scanning techniques [64].This diagnostic accuracy was better as compared to Kopans et al [65] (52.6%), Mansoor et al [60] (57.14%). Monu Sareen et al [53] reported it to be (84.61%).Of the 112 lesions, 70 (62.5%) were histologically malignant, and 42 (37.5%) were benign. Most of the malignancies were infiltrating ductal carcinomas (61 [87%] of 70), whereas fibroadenomas (15 [35.7%] of 42) dominated in the benign group [66].In this study and out of 36 malignant case confirmed later with histopathology as in **table (7)** , ultrasound diagnose 24 correctly from them with accuracy of (66.7%)and overall sensitivity of (69.8%), and out of 30 malignant cases have had vascularity under color Doppler box ultrasound diagnosed 27 case from them with accuracy of (90%).One study [62]., reported that out of hundred palpable breast lumps ultrasound diagnosed the lump in 95 cases' thus the overall sensitivity of ultrasound was 95% and this is also in accordance with findings of Fleischer et al [57]. (96%) , Mansoor et al [60]. (90.9%) and Monu Sareen et al [64] (100%).No single investigation is (100%) accurate but combination of mammography and ultrasonography can yield near (100%) results[66].

6. Conclusion

Study results revealed an association between sonoelastographic presentation of breast lesions and histology. Ultrasound is a useful tool in differentiation between complex , cystic and solid masses of the breastlesions s in this study also. Improvements in ultrasound equipment's have prompted more recent studies with findings that describe reliable signs for differentiating benign from malignant masses.

7. Recommendations

- Similar studies with large sample size at regular intervals should be carried out in Taif region.
- Awareness campaigns must be activated in rural Taif area's to increase knowledge level of rural women.

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