Sudan University of Sciences and Technology
College of Graduate Studies

A study of Breast Masses using Ultrasonography Viruses Mammography

دراسة أورام الثدي بإستخدام الموجات فوق الصوتية وأشعة الثدي

A thesis Submitted for Partial Fulfillment for Requirements of Master MSc. degree in Medical Ultrasound

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الايـة

قال تعالى:

(و الوالدات يرضعن أولادهن حولين كاملين لمن أراد أن يتم الرضاعة و على المولود له رزقهن وكسوتهن بالمعروف لا تكلف نفس إلا وسعها لا تضار والدة بولدها ولا مولود له بولده و على الوارث مثل ذلك فان أرادا فصالا عن تراض منهما و تشاور فلا جناح عليهما و إن أردتم أن تسترضعوا أولادكم فلا جناح عليكم إذا سلمتم ما ءاتيتم بالمعروف و اتقوا الله و اعلموا أن الله بما تعملون بصير)

صدق الله العظيم

سورة البقرة الآية (233)

Dedication

I dedicate This work to :The Soul of my Father……

Also I dedicate it to my Mother……..

who sought to blessed comfort and happiness, she gave everything to push me in a way of success … .

her love being in my vessels and my hearts. My thanks to her will be extended beyond my life … my sister , my brothers and my husband

The shining moon who illuminated my way and gave me the time of care and adequate attention to complete this research, my supervisor Dr / Mona Ahmed and those who gave me a lot of time to help , my colleagues Dr / Asma Ibrahim and Dr / Ahmed Abukonna dean of Faculty of radiological sciences and medical imaging of Sudan university of science and technology

With my love and appreciation

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Abstract

This is a prospective, analytic, and descriptive study which is conducted in khartoum state, Sudan. The aims of this study to confirm which modality mammography or ultrasounography is useful to detect breast masses in women aged 20-75 years.

The research made comparative study between the above modalities to find out which of the two is more efficient in detect breast masses and to evaluate it is characteristic.

In this study we collected data from 100 female patient came to Khartoum advance diagnostic center- Khartoum, Dr .Al-Jenaid Awad Yousif diagnostic clinic-Khartoum and Omar Sawi Hospital during the period from may 2015- janewary 2016 .

In this study we used Statistic package for social sciences (SPSS) to analyze the data collected and presented them on tables and graphs.

The study showed that (100%) of masses detected by ultrasound while the masses detected by mammography was only(82%) (dense breast and lactating),the main age affected was 30<45years(47%),the benign masses constitute about (84%) the common type was fibroadenoma (45.1%) and the malignant masses was (16%) the common type was ductalcarcinoma (86%) of malignant masses, the common site of masses was UOQ(48%) ,mammography detected (19%) micro calcification while ultrasound detect only(5%) .

There for the study concluded that ultrasound is more efficient than mammography on detecting the breast masses in female with dense breast(great glandular tissue) and the mammography more efficient than ultrasound on detecting the micro calcifications.

The study recommended that both ultrasound and mammography should be available in all hospital and in all diagnostic center to help in early detection of breast masses to safe women life.

ملخص الدراسة

هذه الدراسة دراسة وصفية, تحليلية, مستقبلية أجريت في ولاية الخرطوم-السودان بأقسام الأشعة والموجات فوق الصوتية تهدف هذة الدراسة إلى البحث عن وسيلة فعالة للكشف عن أورام الثدي باستخدام جهاز تصوير الثدى بالاشعة وجهاز فحص الثدى بالموجات فوق الصوتية لدى النساء تتراوح اعمارهم بين ال 20-75 سنة.

أجرت الدراسة مقارنة بين الجهازين أعلاه لمعرفة أيهما أفضل في الكشف عن هذه الأورام وتقييم خصائصها .

لهذا جمع الباحث عينه حجمها مائة حاله من الحالات الواردة لمركز الخرطوم للتشخيص المتطور,عيادة دكتور الجنيد التشخيصيه بالخرطوم ومستشفى عمر ساوى (الشرطة).

واستخدم الباحث برنامج (SPSS) لتحليل البيانات أعلاة وعرضها فى شكل جداول ورسومات بيانية.

أوضحت الدراسة أن نسبة الاورام التى كشف عنها جهاز الموجات الصوتية بلغت (100%) بينما بلغت نسبة الاورام التى كشف عنها جهاز تصوير الثدى بالاشعه (82%)من العينة قيد الدراسة (لزيادة كثافة الثدى ومرضعات) اكثر الاعمار اصابة بالاورام من 30 واقل من 45 بنسبة (47%) ,والاورام الحميدة مثلت (84%) واكثرها شيوعآ الورم الليفى بنسبة (4501%) ومثلت الاورام الخبيثة (16%) واكثرها شيوعآ سرطان قنوات الثدى بنسبة (86%) من جملة الاورام الخبيثة,اكثر جزء من الثدى وجدت به الاورام هو الربع الطرفى العلوى بنسبة (48%) وكشف جهاز تصوير الثدى بالاشعة (19%) من الاورام بها تحجر بينما كشف جهاز الموجات فوق الصوتية (5%) فقط (لوجود تحجرات دقيقة)

وبالتالى استنتج الباحث أن جهاز الموجات الصوتية أكثر كفاءة من جهاز تصوير الثدي بالأشعه فى الكشف عن اورام الثدى لدى النساء ذوثدى كثافته عالية ومرضعات وأن جهاز تصوير الثدي بالأشعه أكثر كفاءة من جهاز الموجات الصوتية في الكشف عن التحجرات الدقيقة بالاورام

ولذلك نوصى بتواجد جهاز تصوير الثدى بالاشعة وجهاز الموجات فوق الصوتية بجميع المستشفيات والمراكز التشخيصية للمساعدة فى الكشف المبكر لاورام الثدى وانقاذ حياة النساء.

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LIST OF ABBREVIATIONS

AP	Antro-Posterior
ACR	American college of radiology
BI-RADS 1-5	Breast Imaging Reporting And Data System
BRCA	Breast Cancer Antigen
BSE	Breast-Self-Examination
CA	Cancer
CC	Caudo-Cranial
CT	Computed Tomography
HRT	Hormonal Therapy
L/N	Lymph Node
LMQ	Lower Medial Quadrant
LLQ	Lower Lateral Quadrant
MMG	Mammography
MHz	Mega Hertz
MIP	Maximum Intensity Projections
MLO	Medio-Lateral Oblique
MRI	Magnetic Resonance Imaging
M/T value	Maximum/Transverse value
NAF	Nipple Aspirate Fluid
R	Right
RAD	Radial
SA	Subareolar
UMQ	Upper Medial Quadrant
ULQ	Upper Lateral Quadrant
USG	Ultrasounogrphy
MG	Mammography
FNAC	Fine Needle Aspiration Cytology

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Chapter One
Introduction

1.1 Introduction:

Breast cancer is the most common type of cancer in women today, accounting for 1 of every 3 cancers diagnosed. A woman's chance of developing invasive breast cancer at some time in her life is approximately 1 in 8 (12%). It is one of the leading causes of cancer mortality among women(American cancer society 2008).

Breast cancer is a heterogeneous disease with multiple causes. Epidemiological studies have identified many risk factors that increase the chance for a woman to develop breast cancer. Important risk factors for female breast cancer include early age at onset of menarche, late age at onset of menopause, a first full-term pregnancy after the age of 30 years, a history of premenopausal breast cancer for a mother and a sister, and a personal history of breast cancer or benign proliferative breast disease. Obesity, null parity, and urban residence have also been associated with an increased risk of breast cancer.(American cancer society 2008).

Mammography plays a major role in early detection of breast cancers, detecting about 75% of cancers at least a year before they can be felt. There are 2 types of mammography examinations: screening and diagnostic. Screening mammography is done in asymptomatic women. Early detection of small breast cancers by screening mammography greatly improves a woman's chances for successful treatment. Screening mammography is recommended every 1-2 years for women once they reach 40 years of age and every year once they reach 50 years of age. In some instances, physicians may recommend beginning screening mammography before age 40 if the woman has a strong family history of breast cancer. Studies have shown that regular mammograms may decrease the risk of late-stage breast cancer in women 40 years of age and older. (Schonberg et al &Badgwell et al)

Diagnostic mammography is performed in symptomatic women, when a breast lump or nipple discharge is found during self-examination or an abnormality is found during screening mammography. Diagnostic mammography is more involved and time- consuming than screening mammography and is used to determine exact size and location of breast abnormalities and to image the surrounding tissue and lymph nodes. Mammography is known to a have a certain false-negative rates. According to data from the Breast Cancer Detection Demonstration Project, the false-negative rate of mammography is approximately 8 to 10 %. Approximately 1 to 3 % of women with a clinically suspicious abnormality, a negative mammogram, and a negative sonogram may still have breast cancer. Possible causes for missed breast cancers include dense parenchyma obscuring a lesion, poor positioning or technique, perception error, incorrect interpretation of a suspect finding, subtle features of malignancy, and slow growth of a lesion(Kopans 2002).

Ultrasonography has been playing an increasingly important role in the evaluation of breast cancer. Breast ultrasound is the preferable method in the case of a symptomatic patient, after clinical examination. In the case of a patient without symptoms, breast ultrasound is ascribed a higher sensitivity for detecting breast cancer in women with dense breast tissue, women under the age of 50 and high-risk women. Many specific indications for breast US have been enumerated, including: evaluation of a palpable mass in- completely evaluated at mammography; differentiation of a cyst from a solid nodule; evaluation of palpable lesions with associated mammographic asymmetry, no mammographic findings, the presence of implants, or a history of lumpectomy or segmentectomy. Mammographically occult cancers can be detected by ultrasound in 10 to 40% of the cases depending on the patient's breast density and age. (Hille et al2004&Vercauteren et al2008&Boyd et al2005).

The question of this study was to determine which is more accurate imaging test mammography or ultrasound for diagnosis of breast masses?

- **1-2 Problems of study:**

- Using breast ultrasonography to study breast masses to reduce the risk of radiation to the patient.

1-3 Objectives:-

- **1-3-1general objective**

Study of breast masses using ultrasonography versus mammography

- **1-3-2 Specific objective:**

- To study the characteristic of breast masses by ultrasound
- To study the characteristic of breast masses by mammography.
- To study the efficiency of ultrasound in diagnosis breast masses .

1.4.Hypothesis

It is expected that this study is imprtant to guide in categorizing breast masses according to it's appearance on ultrasound and mammography to improve acuracy for early detection of breat lesions as possible. As the prognosis of breast cancer depends on the stage of the disease at the time of the diagnosis.

Chapter Two

Literature Review

2.1. Breast Anatomy

The breast (mammary gland) is located on the anterior part of the thorax within the superficial fascia. It lies mainly on the pectoralis major muscle and is separated from the muscle by the fat filled retromammary space. This space permits free movement of the breast on the muscle layer(CD.Haigensen 1986)

The upper outer portion of the gland extends toward the axilla and is called the axillary tail.(John 1978)

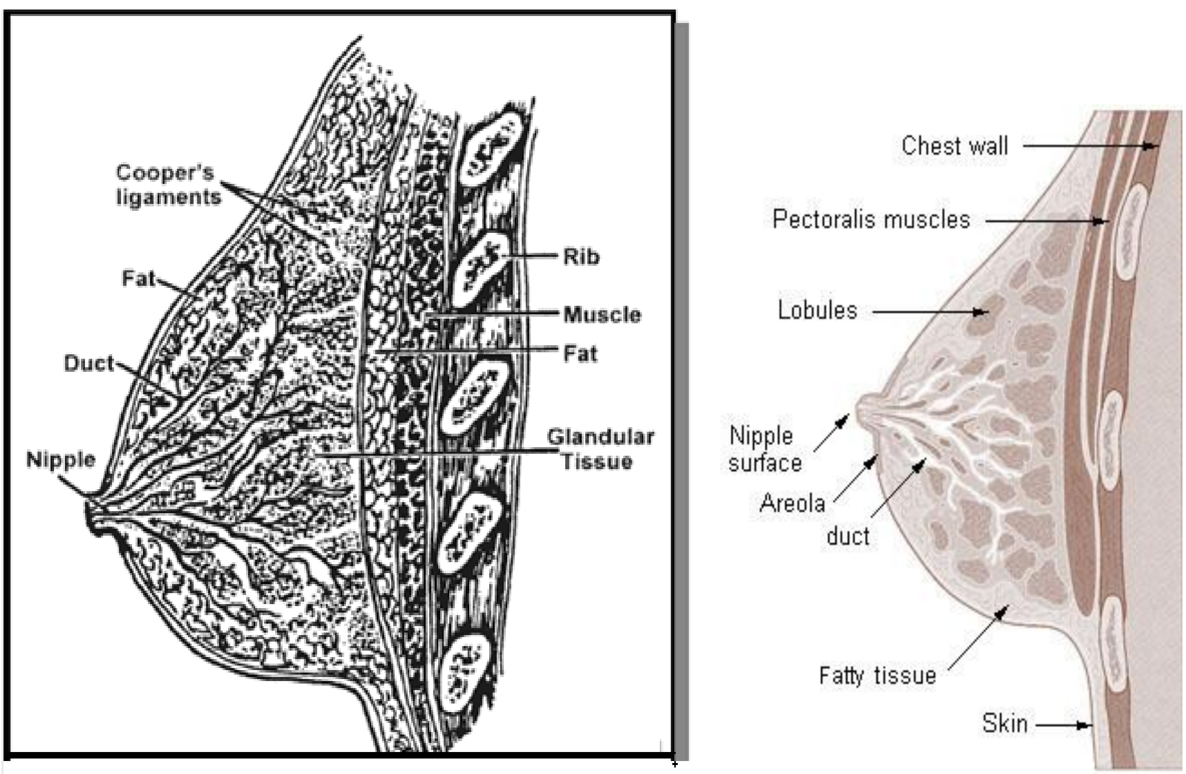


Figure (2.1): diagram illustrates the anatomy of the breast(John 1978)

The breast consists of fibrous bands of tissue called Cooper's ligaments or suspensory ligaments that attach anteriorly to the overlying skin and posteriorly to the deep fascial covering of the pectoralis muscle. The ligaments are arranged in a sponge like fashion rather than a linear one. These ligaments divide the gland into lobes and lobules and are best developed in the upper part of the breast(Stanvros 1999)

The glandular tissue is arranged in lobules that form a cone shaped mass with the apex corresponding to the nipple and the base overlying the pectoralis muscle. The lobules consist of secretory epithelial tissue often referred to as alveoli. Any irregularities between the lobules are filled with fat (adipose tissue). The entire breast is also covered by a thick layer of fat except immediately beneath the nipple . (Stanvros 1999)

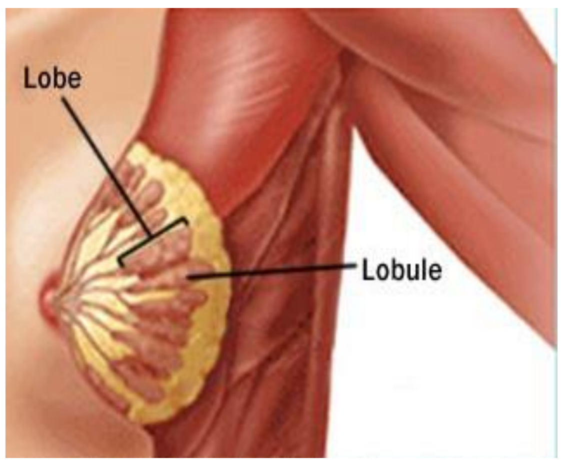
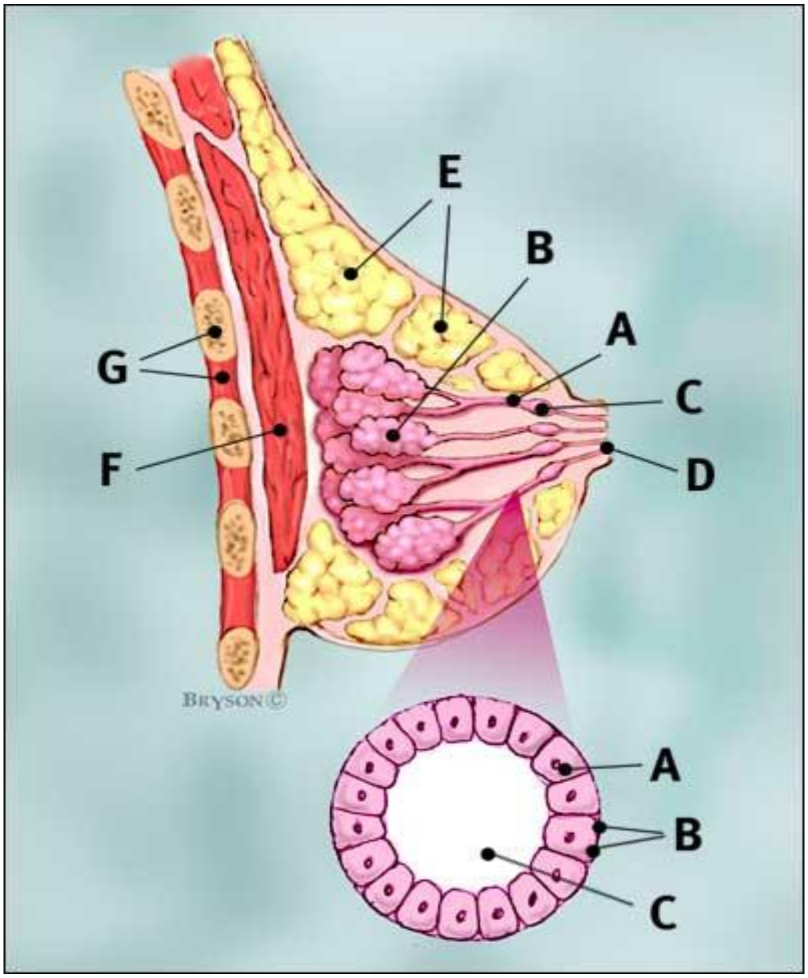


Figure (2.2): illustrates breast lobes. (Stanvros 1999)

Each lobe has its own milk or lactiferous duct which opens individually onto the nipple. Each duct is dilated just posterior to the nipple to form the ampulla or lactiferous sinus. These sinuses store milk(Stanvros 1999)

The nipple occupies a variable position but is approximately in the middle of the anterior surface of the breast along the midclavicular plane. It contains the openings of the 15-20 lactiferous ducts. The nipple is surrounded by a pigmented area of skin called the areola which contains sebaceous (oil) glands to lubricate the nipple (Stanvros 1999)



Figure(2.3)shows the breast profile:(http://www.breastdiseases.com/anat.htm)

A ducts . **B** lobules. **C** dilated section of duct to hold milk . **D** nipple

E fat. **F** pectoralis major muscle. **G** chest wall/rib cage

Lower part of the figure:

A normal duct cells

B basement membrane

C lumen (center of duct)

The blood supply is abundant. Branches from the descending thoracic aorta, the subclavian and axillary arteries supply the breast (Stanvros 1999)

The lymphatics are numerous and important in the spread of disease. The principal drainage is into the axillary nodes. Some drainage occurs into the subclavian, parasternal and mediastinal nodes. There is also some communication with the lymphatics in the abdomen and the other breast.

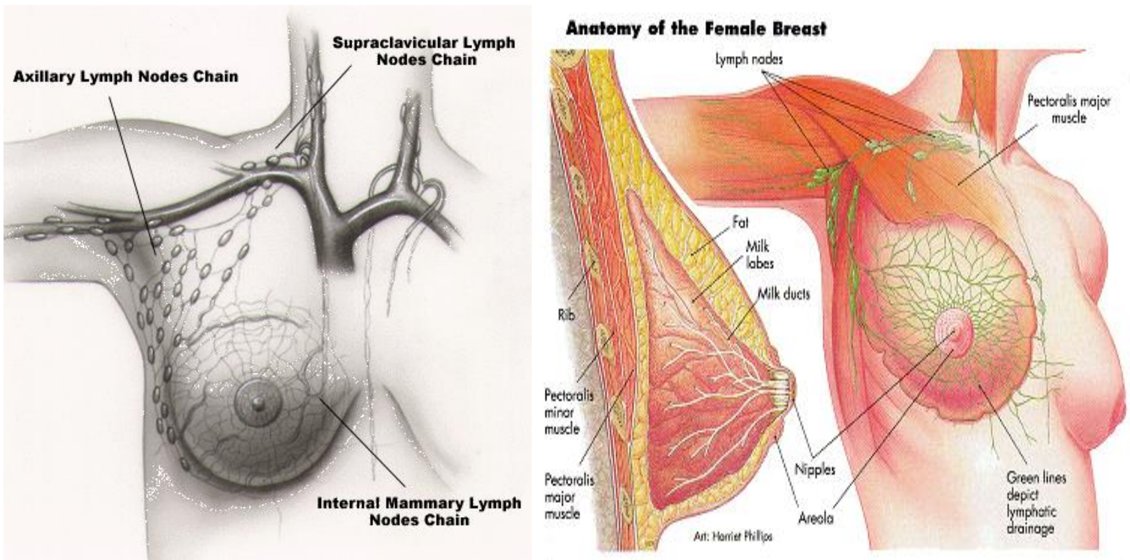


Figure (2.4): illustrates the lymphatic drainage of the breast.(C.K. Warrick,C.B.E.1976)

The breast lies over the musculature that encases the chest wall. The muscles involved include the pectoralis major, serratus anterior, external oblique, and rectus abdominus fascia. (Stanvros 1999)

2.2. Breast Physiology

2.2.1.Initial Breast Development :

Human breast tissue begins to develop in the sixth week of fetal life. Breast tissue initially develops along the lines of the armpits and extends to the groin (this is called the milk ridge). By the ninth week of fetal life, it regresses to the chest area, leaving two breast buds on the upper half of the chest. In females, columns of cells grow inward from each breast bud, becoming separate sweat glands with ducts leading to the nipple. Both male and female infants have very small breasts and actually experience some nipple discharge during the first few days after birth(John .Hole 1978)

Female breasts do not begin growing until puberty . Puberty usually begins for women around age 10 or 11. After pubic hair begins to grow, the breasts will begin responding to hormonal changes in the body. John .Hole 1978)

During puberty, the female breasts increase rapidly in size due to the production of estrogen from the ovaries. The ducts elongate and produce sprouts for future lobules. Considerable fibrous tissue growth occurs which is responsible for the increased size and firmness of adolescent breasts. Once ovulation occurs, progesterone formed by the corpus luteum promotes the formation of the glandular tissue. (Stanvros 1999)

This is associated with further fat deposition. Only a small amount of glandular tissue is present until pregnancy occurs, at which time the duct system and glandular tissue proliferates and the lumen of the ducts dilate to allow for the milk. During lactation, milk storage and secretion account for about one-third the volume of the breast. Following lactation the alveoli atrophy. Fat deposition increases with each successive pregnancy and lactation. During menopause any remaining glandular tissue atrophies and the breasts consist of mainly fat. (Stanvros 1999)

Table (2.1): illustrates initial breast development.

Before puberty	**Early puberty**	**Late puberty**
The breast is flat except for the nipple that sticks out from the chest	the areola becomes a prominent bud; breasts begin to fill out	glandular tissue and fat increase in the breast, and areola becomes flat

(http://training.seer.cancer.gov/ss module01 breast/unit02 sec01 anatomy)

2.2.2.Age Dependant Anatomical Changes of the Breast:

With age, the breast tissue will change. In a young woman, the breast tissue is dense and parenchyma rich. As the woman ages, the fat content of the breast tissue will increase. This explains the overall aspect of the breast, as it will begin to droop.(John .Hole 1978)

2.2.2.1.Normal Menstrual Changes:

The mature premenopausal breast undergoes cyclic changes, which may increase breast size by up to 10-15% during the late luteal phase, bringing on mild breast tenderness, swelling, pain, and/or lumpiness in 60% of healthy women and moderate to severe symptoms in another 10%(John .Hole 1978)

An effect of estrogen is to increase cellular proliferation, and progesterone potentiates this effect. As a result, cell populations increase during the follicular phase of the cycle and expand further during the luteal phase. Breast tissue is slightly denser on the mammogram during the luteal phase of the cycle. Transient hormone deprivation results in cell death or apoptosis, a process that is at its maximum during menstruation.(John .Hole 1978)

2.2.2.2.Normal Menstrual Effects

Week 1: Onset of menses, Regression of epithelial secretory activity and tissue edema and Minimum breast volume on days 5-7

Week 2: Estrogen rise, Epithelial tissue proliferation and Follicular development

Weeks 3 and 4: Progesterone rise, Postovulatory luteal phase ,Duct dilatation, Intraluminal secretions, Maximal breast blood flow 3-4 days before menses and Breasts swollen and tender . (http://wwwbreastdisease.com/anat.htm)

Mammograms, clinical breast exam, and self-breast examination are best performed during days 5-7 of the cycle (just after menstruation). The tissue will be least tender and least lumpy at this time(John .Hole 1978)

2.2.3Breast Changes During Pregnancy:

Marked ductal, lobular, and alveolar growth occur due to the influence of luteal and placental sex steroids, placental lactogen, prolactin, and chorionic gonadotropin. Prolactin increases slowly during the first half of pregnancy. The two-cell layer of the alveoli sheds to a single layer (this contributes to the high protein content of colostrum).

The First 3-4 Weeks: Ductal elongation occurs, with some branching, and lobular formation. Breast pain is frequently the first symptom of pregnancy, often occurring before a woman notices that she has missed her cycle.

Weeks 5-8 of Gestation: Significant breast enlargement occurs, along with dilation of superficial veins, heaviness, and increased pigmentation of the nipple-areolar complex.

Second Trimester: Lobular formation predominates. Alveoli contain colostrum, but no fat. Lactation may be adequate from the 16th week of pregnancy.

Third Trimester: Breast size continues to increase due to increasing colostrum volume and hypertrophy of myoepithelial cells, connective tissue, and fat(John .Hole 1978)

2.2.4.Lactation:

At parturition, prolactin increases, which, when combined with growth hormone, insulin, and cortisol effects, converts mammary cells from a presecretory to a secretory state(J.C.E Underwood 2000)

Tactile stimulation of the nipple results in release of oxytocin from the pituitary gland, which causes myoepithelial cells surrounding the lobules and small ducts to contract, thus expressing milk. (J.C.E Underwood 2000)

2.2.5.Breast Changes After Menopause:

When a woman reaches menopause (typically in her late 40s or early 50s), her body stops producing estrogen and progesterone. The loss of these hormones causes a variety of symptoms in many women including hot flashes, night sweats, mood changes, vaginal dryness and difficulty sleeping. During this time, the breasts also undergo change. For some women, the breasts become more tender and lumpy, sometimes forming cysts (accumulated packets of fluid). (John .Hole 1978)

The breasts’ glandular tissue, which has been kept firm so that the glands could produce milk, shrinks after menopause and is replaced with fatty tissue. The breasts also tend to increase in size and sag because the fibrous (connective) tissue loses its strength. (John .Hole 1978)

2.3. Breast Pathology

2.3.1. Benign mass lesions:-

2.3.1.1. Cysts:-

Cysts are the most common cause of a discrete breast mass, although they are often multiple and bilateral. They are common between the ages of 20 and 50 years, with a peak incidence between 40 and 50 years. Simple cysts are not associated with an increased risk of malignancy and have no malignant potential. (Grainger et al 2002)

2.3.1.2. Fibroadenomas and related conditions:-

Fibroadenomas are the most common cause of a benign solid mass in the breast. They present clinically as smooth, well demarcated and mobile lumps. They are most frequently encountered in younger women with a peak incidence in the third decade. With the advent of screening, many previously asymptomatic lesions are detected. (Grainger et al 2002)

Fibroadenomas must be distinguished from well circumscribed carcinomas; this is done by percutaneous biopsy. Phyllode tumor can have a similar appearance to fibroadenoma, leading to diagnostic difficulties. The pathological characteristics can also be similar to those of large fibroadenomas. The majority of phyllode tumors are benign, but some (less than 25%) are locally aggressive and may even metastasize. When a diagnosis of phyllode tumor is made, surgical excision must be complete with clear margins to prevent the possibility of recurrence. Many larger fibroadenomas (over 3 cm) and those that show a rapid increase in size, tend to be excised, in order to avoid missing a phyllode tumor. (Grainger et al 2002)

2.3.1.3. Papillomas:-

Papillomas are benign neoplasms, arising in a duct, either centrally or peripherally within the breast. Many papillomas secrete watery material leading to a nipple discharge. As they are often friable and bleed easily, the discharge may be bloodstained. (Grainger et al 2002)

2.3.1.4. Lipoma:-

Lipomas are benign tumors composed of fat. They present clinically as soft and lobulated masses. (Grainger et al 2002)

2.3.1.5. Hamartoma:-

Hamartomas are benign breast masses composed of lobular location. Sometimes structures, stroma and adipose tissue, the components that make up normal breast tissue. They occur at any age. On imaging they may be indistinguishable from other benign masses, such as fibroadenomas. (Grainger et al 2002)

2.3.2Malignant masses lesion:-

2.3.2.1. Invasive carcinoma:-

Breast carcinomas originate in the epithelial cells that line the terminal duct lobular unit (TDLU). When malignant cells have extended across the basement membrane of the TDLU into the surrounding normal breast tissue, the carcinoma is invasive. Malignant cells contained by the basement membrane are termed noninvasive or in situ. (Grainger et al 2002)

2.3.2.2. Classification of invasive breast cancer:-

There is much confusion regarding the classification of breast cancer. Some tumors show distinct patterns of growth, allowing certain subtypes of breast cancer to be identified. Those with specific features are called invasive carcinoma of special type, while the remainders are considered to be of no special type (NST or ductal NST). Special type of tumors include lobular, modularly, tubular, tubular mixed, mucinous, cribriform and papillary.

Different types of tumor have different clinical patterns of behaviour and prognosis. It should be understood that when a tumor is classified as of a special type this does not imply a specific cell of origin, but rather a recognizable morphological pattern1. (Grainger et al 2002)

2.3.3. Benign microcalcifications:-

Many benign processes in the breast can cause microcalcifications, including fibrocystic change, duct ectasia and fat necrosis. Fibroadenomas and papillomas can also become calcified. Sometimes normal structures, such as the skin or small blood vessels calcify. Calcifications can also develop in atrophic breast lobules or normal stroma. (Grainger et al 2002) .

2.3.4. Malignant micro calcifications:-

Microcalcifications are found associated with invasive breast cancer and ductal carcinoma in situ (DCIS). Calcifications are more likely to be malignant if they are clustered rather than scattered throughout the breast, if they vary in size and shape (pleomorphic), and if they are found in a ductal or linear distribution. (Grainger et al 2002)

2.3.5. Developmental abnormalities:-

Congenital abnormalities are rare:-

Polymastia and polythelia (accessory nipples) may occur along the milk line and are subject to the same disorders as normally situated breast.

Failure of development of breasts at puberty is very uncommon and usually associated with ovarian agenesis, as in turner's syndrome. Precautious development may occur, occasionally related to the presence of an ovarian granulosa- cell tumor, but usually for unexplained reasons

Adolescent or juvenile hypertrophy is the commonest developmental abnormalities found. At onset of puberty the breasts grow rapidly and out of proportion, they become a severe physical and psychological burden. Rarely the hypertrophy is unilateral. (Roderick Mac Sween 1992)

2.4.Method of Diagnosis of Breast Abnormalities

2.4.1.Breast-Self-Examination (BSE):

2.4.1.1.Look in the mirror: with hands along your side examine your breasts for change in size or shape or texture of the skin. This is a visual examination of each breast. Then raise your arms above your head and reexamine the size and shape of each breast. (http://fcd.cme.virginia.edu/breastcare)

2.4.1.2.Lying Down: Examine each breast, for example, to examine the left breast put a pillow under your left shoulder. Then raise your left arm above your head and rest your arm. Using your right hand, examine the left breast in the following manner: use the pads of your middle fingers to go over the breast in either a circular motion, up and down motion, or a wedge motion (moving fingers in and out towards the nipple). Keep your fingers on the breast until the entire breast is examined including the underarm area. Repeat procedure on the right breast. (http://fcd.cme.virginia.edu/breastcare)

2.4.**1.3.When Showering:** Perform the exam just as you would lying down. It can be easier to slide the hand along the breast when the skin is wet and soapy. The important thing to remember is that you should either use the lying down or shower method routinely so you are more familiar with the characteristics of your breast. (http://fcd.cme.virginia.edu/breastcare)

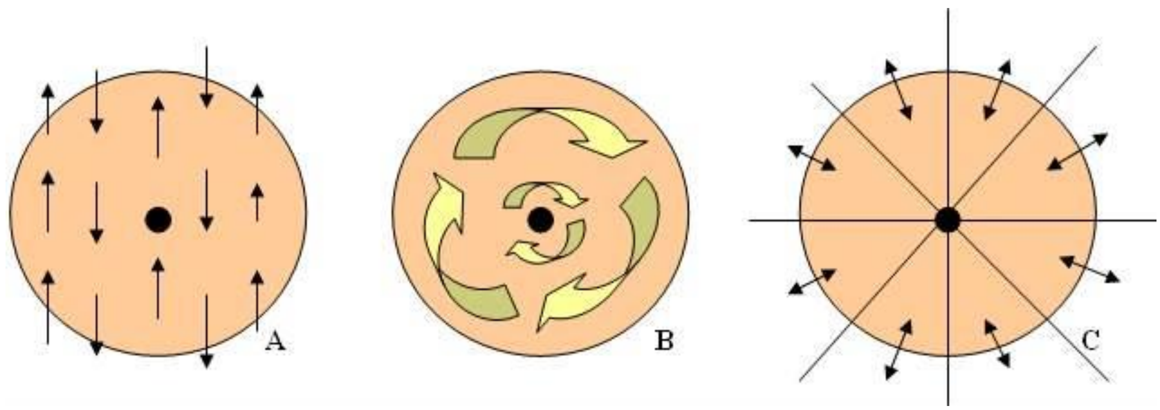


Figure (2.5) shows the three recommended patterns for breast self examination: vertical (A), circular (B), and wedge (C). (http://fcd.cme.virginia.edu/breastcare)

2.4.2.History: Examine the breast to determine the location of the mass and obtain the clinical history. Enquire about recent pregnancies, when the mass was first noticed, any recent increase in size since first noticed, if the mass is painful, any nipple discharge and if the patient's mother had any history of breast disease.

2.4.3.Ductal Lavage: Cannulation of several ducts, followed by injection and aspiration of saline in order to obtain cellular material. (http://fcd.cme.virginia.edu/breastcare)

The rationale for ductal lavage is that the procedure is akin to a pap smear in obtaining cellular material from within the breast. Detection of cells indicative of atypia or carcinoma could precede mammographic findings. This procedure is available in a research setting, as well as in clinical practice at a limited number of centers for high-risk women. (http://fcd.cme.virginia.edu/breastcare)

Figure (2.6) : shows the technique for ductal lavage. (http://fcd.cme.virginia.edu/breastcare)

Lidocaine cream is applied to the nipple for 20-30 minutes prior to the procedure. The nipple-areolar area is cleansed. Suction is applied and ducts that produce nipple aspirate fluid (NAF) are identified(http://fcd.cme.virginia.edu/breastcare)

A duct with NAF is cannulated. A plastic sheath is advanced into the duct. Saline is infused. The breast is massaged and the fluid aspirated. This is repeated several times .The fluid is sent to cytology

2.4.4.Breast Imaging Modalities

2.4.4.1.Mammography

Mammography serves two purposes in the evaluation and diagnosis of breast diseases. The goal of screening mammography is to detect occult breast cancer, whereas diagnostic mammography is used to further evaluate a clinical problem such as a lump, nipple discharge, focal pain, or a focal mammographic abnormality seen on screening mammography. It is important to understand the benefits and limitations of mammography, as well as other breast imaging modalities.

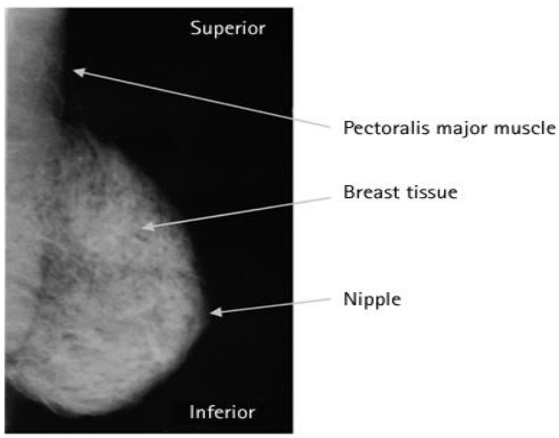


Figure (2.7) :Cranio-caudal mammogram. (C.De felice et al J ultrasound 2007)

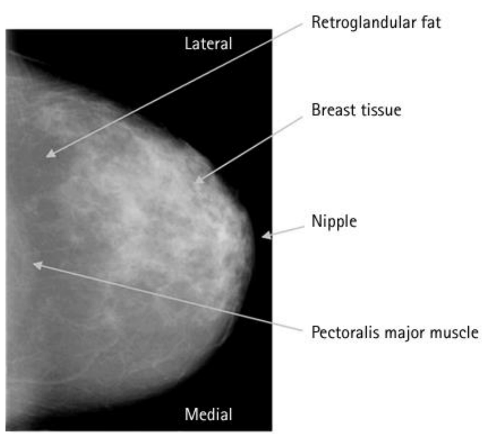


Figure (2.8) : Medio-lateral mammogram. *(C.De felice et al J ultrasound 2007)*

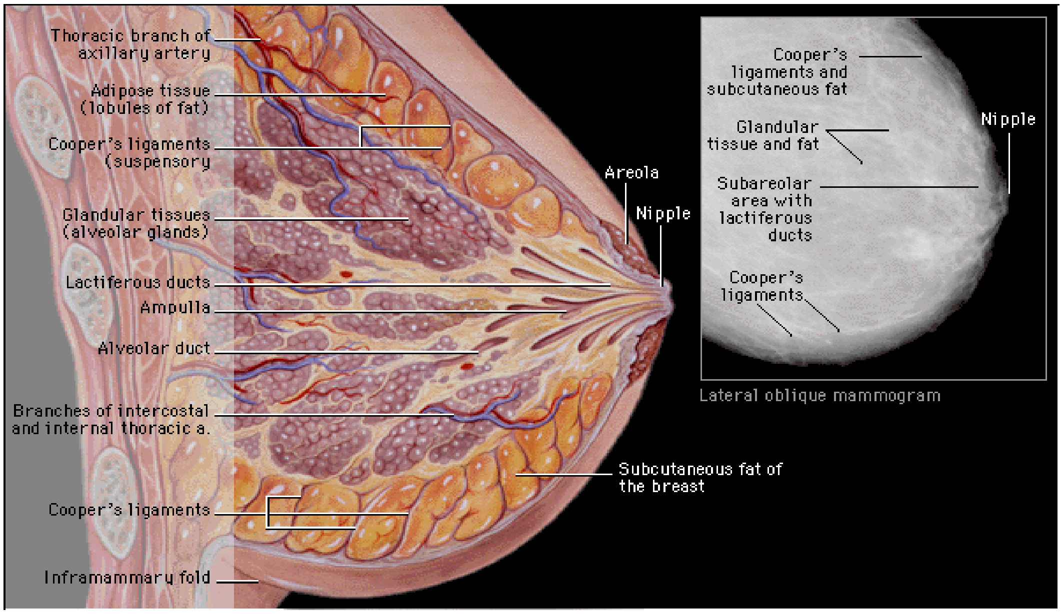


Figure (2.9): diagram illustrates the different structures of the breast in lateral oblique mammogram. (C.De felice et al J ultrasound 2007)

2.4.4.2. Ductography :

Ductography is a procedure that evaluates the ducts when there is a spontaneous, unilateral nipple discharge from a single duct. Radiographic contrast is injected retrograde into the duct and a mammogram performed looking for filling defects within the subareolar ducts. Frequently a benign papilloma is seen. Occasionally intraductal tumor can present with a nipple discharge and can be identified with ductography. (C.De felice et al J ultrasound 2007)

2.4.4.3.Magnetic resonance (MR) :

It is a highly sensitive imaging modality, however specificity still remains less than 75% for malignancy(http/www.ceessentials.net/article40.html).

Breast MR is the best modality for evaluation of extra- and intracapsular implant rupture. MRI can also help differentiate post-surgical and postradiation changes from a recurrent tumor in the setting of lumpectomy. Increasingly, MRI is used to evaluate the extent of disease of known malignancy prior to initial surgery or re-excision.

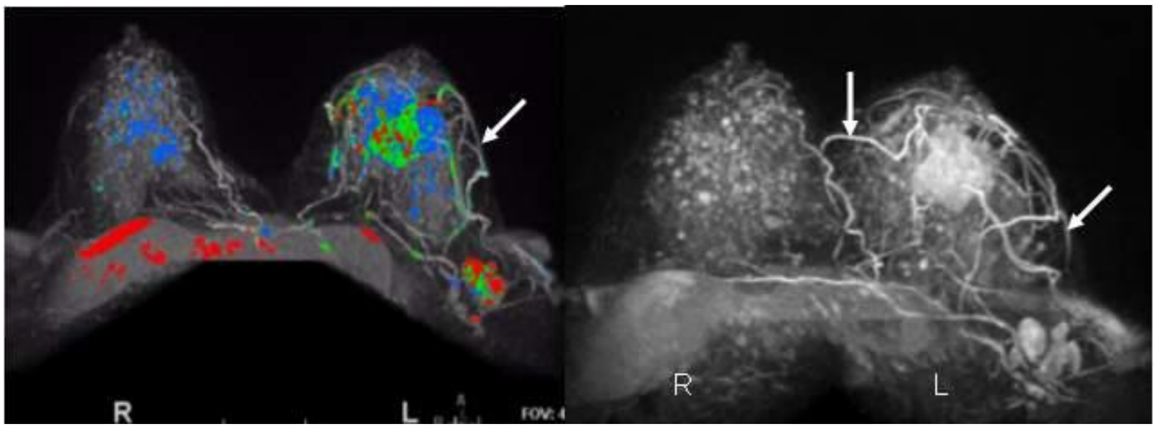


Figure (2.10) : MR images are maximum intensity projections (MIP) 3-D images. This color map shows heterogeneous tissue in question within the left breast. Notice the asymmetry in the color in between the right breast (mostly blue) and the left breast (blue, green, and red). Also notice the increase in vascularity in the left breast (white arrows which is characteristic of a malignant growth. (C.De felice et al J ultrasound 2007)

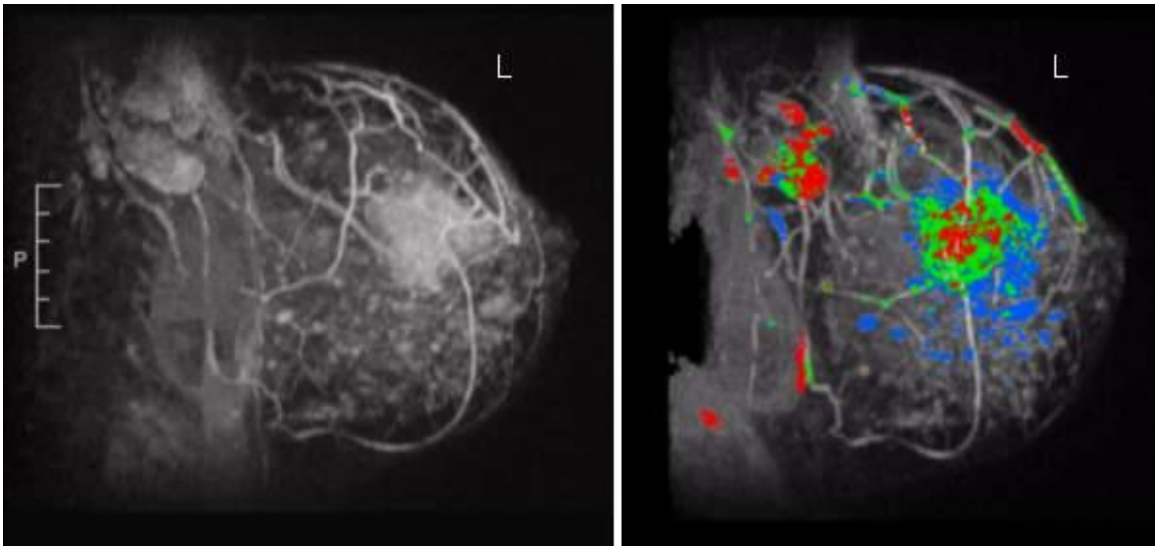


Figure (2.11):MR images of the left breast. The red focal zone in the left breast mass shows the enhancement kinetics of a tumor. The morphology, and angiogenesis favor the diagnosis of malignancy until proven otherwise by tissue biopsy. (C.De felice et al J ultrasound 2007)

2.4.4.4.Computed Tomography

Computed tomography (CT scans) are not used routinely to evaluate the breast. Occasionally a CT scan is performed along with biopsy of the anterior chest wall or for tissue deep in the axilla. For some large breast cancers it is possible in some cases to assess whether the cancer is removable by mastectomy or inoperable because it has moved into the chest wall. (http://www.rad.washington.edu/breast)

CT is routinely used to evaluate lymph nodes, lungs, liver, brain, spine, or other areas searching for metastatic disease. When metastasis is found CT scans to include the head, chest, and abdomen can assess the extent of metastatic disease prior to treatment.

CAT scans are also used periodically during treatment to evaluate response. Sometimes a chest or abdomen CT study identifies primary breast cancer. At times secondary metastasis is seen and the physician must work backwards to find the primary cancer. CT is also useful in staging cancer and evaluating remote organ seeding and lymph node involvement.

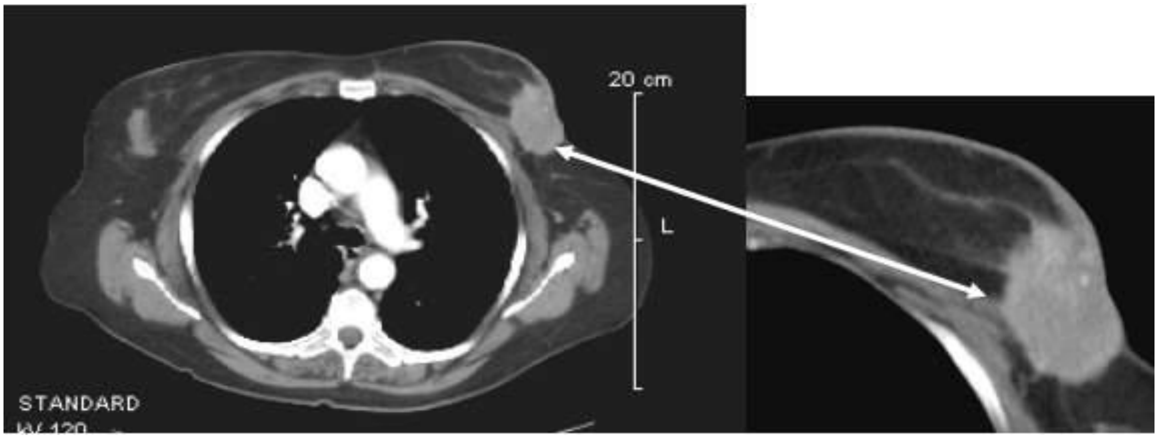


Figure (2.12): An axial CT image shows a large mass in the left breast (white arrow) that was followed with mammogram and biopsy. MRI and CT was performed to determine the type and extent of metastasis. CT can sometimes discover breast cancer although it is not a primary means of imaging the breast. (American cancer socity 2002)

2.4.4.5.Nuclear Medicine:

Sentinel node biopsy has become widespread as an alternative to full axillary node dissection.

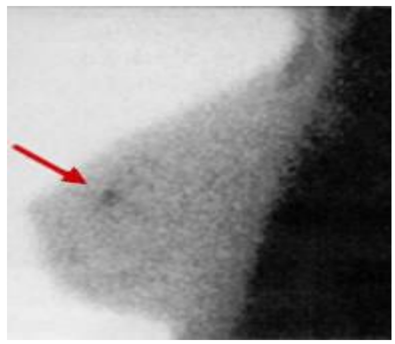


Figure (2.13): A lateral scintigraphy image of the breast showing a focal area of increased tracer uptake. Biopsy showed a small invasive cancer(American cancer society 2002)

2.4.4.6.Breast Ultrasonography

2.4.4.6.1.Indications

To characterize mammographic or palpable masses cystic or solid,To evaluate palpable mass in young (under age of 30 years) , pregnant and lactating patients,To evaluate nonpalpable abnormalities for which the mammographic diagnosis uncertain, To help exclude a mass in an area of mammographic asymmetric density, to confirm or better visualize a lesion seen incompletely or only one mammographic projection (e.g., near the chest wall) and To guide interventional procedures such as cyst aspiration , fine needle aspiration biopsy , and presurgical location .

These uses for breast sonography are also applicable to the postsurgical patient and male breast. Sonography is not used to screen dense breast in its entirety for possible mass because of its high –error rate in these patients .(Carol Rumack et al 1991)

2.4.4.6.2.Ultrasound technique :

A 7.5 to 10 MHz linear array, electronically focused transducer with an elevation plane focal length of about 1.5 cm is the best available for breast ultrasonography. (Devin Dean 2005)

Mixed purpose or peripheral vascular probes are typically focused at about 3 to 4 cm which is too deep for good breast ultrasonography . (Devin Dean 2005)

Sector probes and curved linear probes do not work well for breast imaging because the diverging beam results in too much beam reflection and refraction and critical angle shadowing. This reduces penetration and spatial resolution and causes too many areas of artifactual echo drop-out or shadowing. (Devin Dean 2005)

In general no stand-off technique is required with the linear probe. However, if a nodule is very small and very near the skin, it may not be in the focused part of the beam. In such cases a 1 cm stand-off pad or a large stand-off of jelly will move the focused part of the beam closer to the skin. (Stanvros 1999)

Routine For Hand Held Real Time Units

2.4.4.6.2.1. Method A - A pillow is placed along the supine patient's side so the breast does not fall into the axilla or the patient can be scanned in the erect or seated position with the breast resting on a platform. The breast may be scanned in a radial fashion scanning from outer margin toward the nipple in a series of scans done in a clockwise order. Transverse and sagittal scans are also important. Labeling of the scans is essential. The routine should be standardized throughout the department so scans are reproducible. Additional views running parallel to the axilla are required for the axillary tail. (Stanvros 1999)

2.4.4.6.2.2.Method B :

The patient initially lies supine with the ipsilateral hand raised above her head. Medial quadrant lesions may be scanned in this position. She is then rolled into a contralateral posterior oblique position to a degree which minimizes breast thickness in the quadrant being scanned. Larger breasts require greater obliquity. Positioning the patient in this fashion thins the breast so the near field probes can penetrate to the chest wall. Secondly, the tissue planes of the breast are pulled into a plane which is parallel to the skin line. (Thomas Stavros 2004)

Figure(2.14) illustrate ultrasound technique for the breast (Thomas Stavros 2004)

Scan Planes - all solid lesions is scanned in the radial plane (from outer margin of the breast to the nipple) and the antiradial plane, which is at ninety degrees to the radial plane. These planes optimize visualization of subtle projections that course towards the nipple or branch outward in the breast.If a nodule is scanned only in the conventional method of longitudinal and transverse, these subtle findings may be missed, and the lesion may appear spheroid or ellipsoid, and be misclassified as probably benign.(Lee et al 2000)

Annotation - As mentioned earlier, it is essential to label the scans so they are reproducible. A three part labeling system is recommended. (Devin Dean 2005)

The lesion is located according to its **clock position**, e.g. 1 o'clock, 3:30 o'clock etc, The **peripheralness** of the lesion is noted. SA is subareolar, or AX is axilla and 1 through 3 represent 3 equal width rings around the areola . (1 is central and 3 is peripheral) and The **depth** of the lesion is noted. A is the superficial third (i.e. anterior), B is the middle third (the mammary zone) and C is the deepest third of the breast. Therefore, a right breast lesion located 4 cm directly superior to the nipple and 3.0 cm deep, scanned in the radial plane would be described: R 12 2C RAD. A left breast lesion in the upper outer quadrant about 6 cm from the nipple, near the chest wall and scanned in the antiradial plane is described: L 1:30 3C AR. (Stanvros 1999)

The Skin Line - Protrusion, flattening, dimpling, edema and thickening are all important indicators of underlying pathology and should be documented. (Stanvros 1999)

Scars - Any scar should be noted so the physician can interpret the skin irregularity in the proper context. Keloids are benign tumors that originate in scars from surgery, burns or injury. These should be noted and the history of the origin obtained since they could be mistaken for other lesions. (Stanvros 1999)

Machine Settings - Locate some fatty tissue in the breast and set the gain so fat is medium gray (similar to the thyroid gland). All breast lesions are then compared to fat echogenicity. Glandular tissue and most benign lesions, such as fibroadenomas, will be isoechoic to mildly hypoechoic compared to fat. Malignant lesions can be mildly hypoechoic to markedly hypoechoic and cysts will be markedly hypoechoic to fat. The structures that are hyperechoic compared to fat are skin, fibrous tissue and calcifications. (Lee et al 2000)

2.4.4.7Core biopsy (14 gauge) of the breast

It has become widely used in excisional or open biopsy. This can be performed by palpation for palpable lumps, by mammography (stereo tactic guidance) or by ultrasound guidance. Core biopsy using 11 gauge vacuum-assisted biopsy device has largely supplanted 14-gauge spring-loaded needles for stereo tactic-guided biopsies. Because these devices allow larger samples, there is less underestimation of disease. These are increasingly used for ultrasound-guided biopsies as well.(Joaquin Santolaya et al 1998)

2.5.Sonographic appearance

2.5.1.Normal Ultrasound Appearances of the Breast:

The anatomic components of the breast and the surround structures have characteristic sonographic features. (Carol Rumack et al 1991)

skin hyperechoic about 2 mm thick, subcutaneous fat containing Cooper's ligaments Cooper's ligaments are hyperechoic coursing within medium echogenicity fat, premammary fascia echogenic linear structure, mammary zone contains ductal, fibroglandular and glandular tissue medium echogenicity or mildly hypoechoic to fatarea where most pathology
detected by BUS is located, retromammary fascia echogenic linear structure,
retromammary zone contains fat – medium echogenicity so compressed with
breast ultrasonography is difficult to identify and pectoralis muscle
hypoechoic (Stanvros 1999)

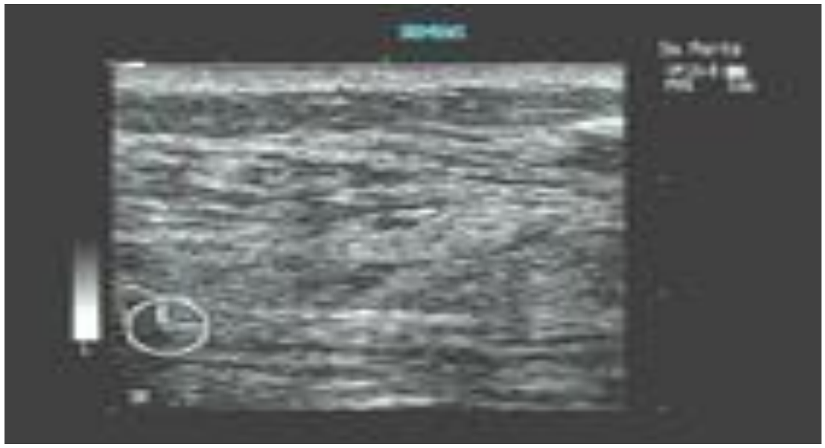


Figure (2.15):ultrasound image shows the subtle differentiation of glandular tissue in a normal breast. (C.De felice et al J ultrasound 2007)

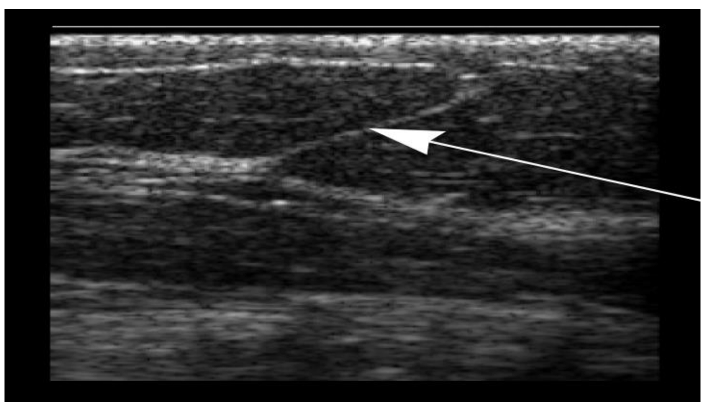


Figure (2.16): ultrasound image illustrates cooper's ligaments . (C.De felice et al J ultrasound 2007)

2.5.2.Sonographic Description of Breast Masses :

Location , Number , Size , Margin , internal contents : solid , cystic , mixed,Homogeneous or heterogeneous and Parenchymal interface : visible , echogenic rim .posterior sound transmition , enhancement , shadow , no change , skine thickness. (Carol Rumack et al 1991)

Sonographic Appearance Of Breast Lesions :

However, it is unable to differentiate benign and malignant masses. over 80% of all sonographic nodules were benign. (Thomas Stavros 2004)

A Palpable Lump - Breast biopsy can be avoided if it can be shown that the lump is due to a simple cyst or due to fibroglandular tissue. Both can cause palpable lumps or ridges. (Stanvros 1999)

Merely showing a simple cyst or echogenic fibroglandular tissue in the general vicinity of a palpable lump, however, is inadequate proof that it is the cause of the lump .

Only by palpating a cyst or focal collection of fibroglandular tissue while we are demonstrating it sonographically can we be sure that it is the cause of the palpable abnormality. (Sandra Hagen 2001)

2.5.2.1.Correlating Breast Ultrasonography with Mammography :

Only if the size, shape, location, and density of surrounding tissues are similar on mammography and breast ultrasound can we be sure the simple cyst or fibrous pseudo tumor is the cause of the mammographic density. When correlating breast ultrasound with mammography, one should compare the CC(caudo-cranial) view of the mammogram with the transverse view on breast Ultrasonography . The MLO(medio-lateral) view of the mammogram may vary from 30 degrees to sixty degrees. It is difficult to reproduce the exact degree of obliquity on the breast ultrasonography that was used on the MLO view of the mammogram.(Rapp 1999)

2.5.2.2.Benign Versus Malignant Appearances Of Breast Masses:

Benign: remain within tissue planes an intensely hyperechoic mass an ellipsoid shape with a thin echogenic capsule (considered to be a pseudo capsule of compressed adjacent normal breast tissue) two or three well defined lobulations plus a thin echogenic capsule absence of any malignant findings.(Rapp 2000)

Malignant: growth across normal tissue planes spiculation (has many small processes) angular margins, marked hypoechogenicity, shadowing, calcifications, duct extension, branch pattern, microlobulation. (Rapp 1999)

2.5.2.2.1.Carcinoma

One in nine women will develop breast cancer during her lifetime, provided she lives to age 85. Most breast cancer is not genetically linked - less than 16% . (Stanvros 1999)

The most commonly occurring breast cancer is invasive ductal carcinoma. Characteristically it appears as a hypoechoic mass with irregular borders. Indirect or secondary signs associated with malignancy include diffuse disruption of breast architecture, skin distortion echoes or thickening, nipple retraction, and axillary adenopathy. All of these secondary signs may occur with nonmalignant lesions and are therefore nonspecific for malignancy. The majority of cancers occur in the right upper quadrant. It is essential that the tail, which is part of the right upper quadrant, is well demonstrated to rule out lesions in this area. (Thomas Stavros 2004)

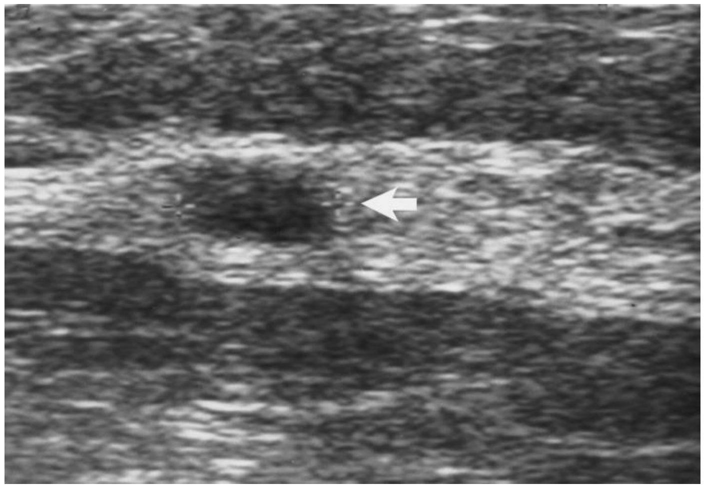


Figure (2.17): breast ultrasound image for 45-year-old woman with lymph node containing metastases of adenocarcinoma in left axilla (C.De felice et al J ultrasound 2007)

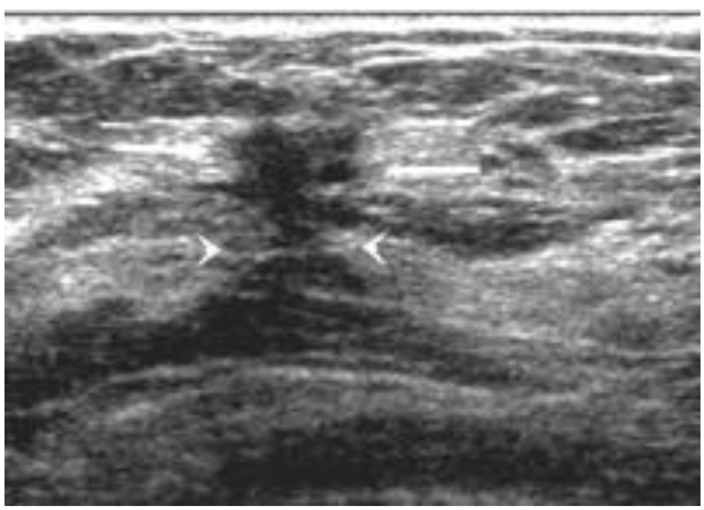


Figure (2.18): breast ultrasound image for 72-year-old woman with recurrent invasive ductal carcinoma, Sonogram of left breast shows carcinoma as hypoechoic mass with spiculated margins (*arrows*) and posterior shadowing (*arrowheads*). Mass was seen abutting surgical scar and was highly suspicious for malignancy based on sonographic morphology. (C.De felice et al J ultrasound 2007)

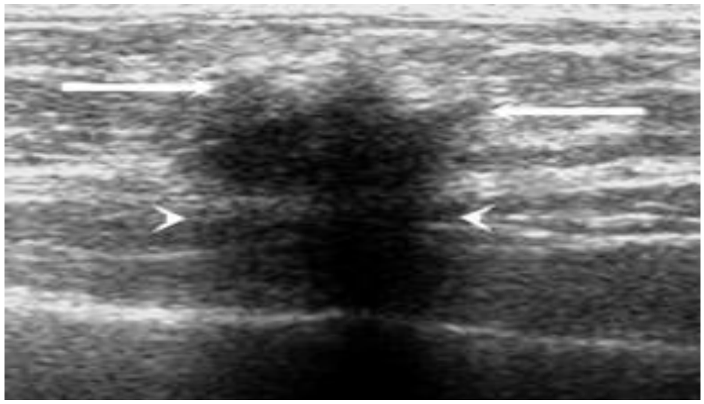


Figure (2.19): breast ultrasound image for 68-year-old woman with invasive lobular carcinoma presented with palpable lump. Sonogram of right breast shows ill-defined hypoechoic mass with spiculated margins (*arrows*) and posterior shadowing (*arrowheads*). Mass is highly suspicious for malignancy based on sonographic features. (C.De felice et al J ultrasound 2007)

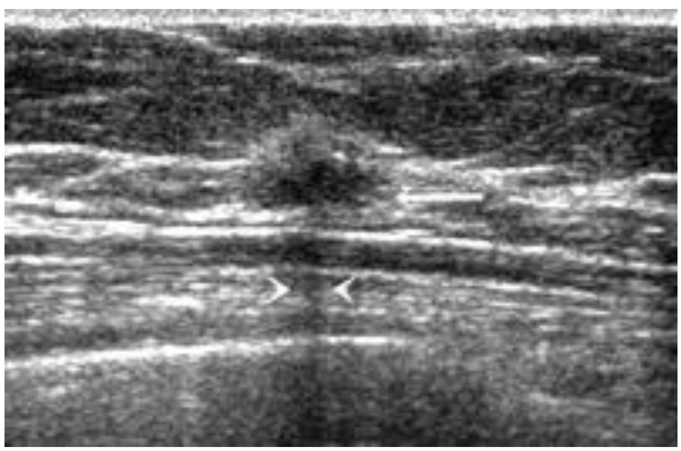


Figure (2.20): breast ultrasound image for 75-year-old woman with tubular carcinoma. Gross tumor size on pathology measured 8 mm. MRI showed no evidence of lesion enhancement. Sonogram of right breast shows ill-defined hypoechoic mass with spiculated margins (*arrow*) and posterior shadowing (*arrowheads*). Mass is highly suspicious for malignancy based on sonographic features. (C.De felice et al J ultrasound 2007)

Figure (2.21): breast ultrasound image for invasive lobular cancer. (C.De felice et al J ultrasound 2007)

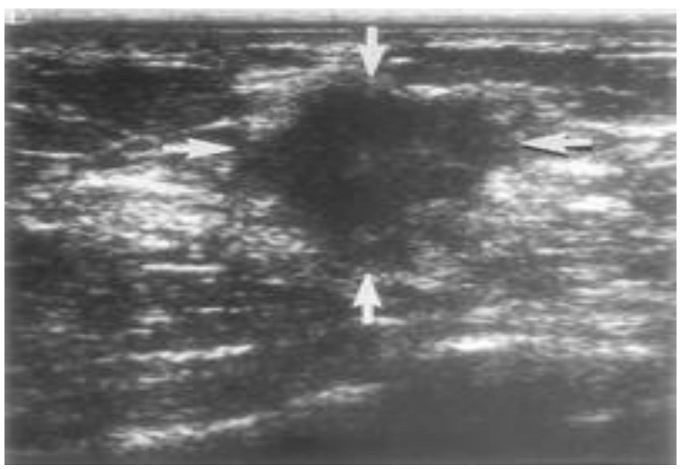


Figure (2.22): breast ultrasound image shows features of a malignant mass (arrows). The mass has an irregular shape, indistinct margins, and a width-to-AP dimension ratio of 1.0. Biopsy results revealed invasive ductal carcinoma. (C.De felice et al J ultrasound 2007)

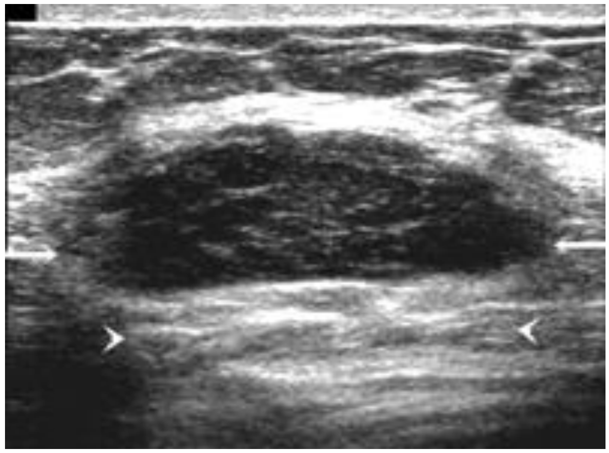


Figure (2.23): breast ultrasound image for 48-year-old woman with primary non-Hodgkin's lymphoma of breast presented with a palpable lump. Sonogram of left breast shows hypoechoic, lobulated oval mass, with ill-defined margins (*arrows*) and posterior acoustic transmission (*arrowheads*). Mass has indeterminate features on sonography (C.De felice et al J ultrasound 2007)

2.5.2.2.2.Metastatic Tumors To The Breast

A solitary metastasis of the breast can mimic a circumscribed primary carcinoma and may require fine needle aspiration or open excision biopsy to determine the difference in patients with known primary malignancies located elsewhere in the body. (Lee et al 2000)

When mammographic and sonographic findings of metastatic tumors to the breast are compared, both modalities demonstrate relatively small, superficially located, poorly defined, irregular nodules without calcification . However, when metastatic lesion is diffuse, the appearance is indistinguishable from that of inflammatory breast carcinoma. (Stanvros 1999)

2.5.2.2.3.Fibroadenoma

A fibroadenoma is the most common benign solid mass of the breast and accounts for up to 40% to 50% of all breast biopsies.The classic appearance is an oval, hypoechoic solid mass with an echogenic pseudocapsule. The mass is wider than it is tall. Posterior enhancement or shadowing may be present. (Rapp 1999)

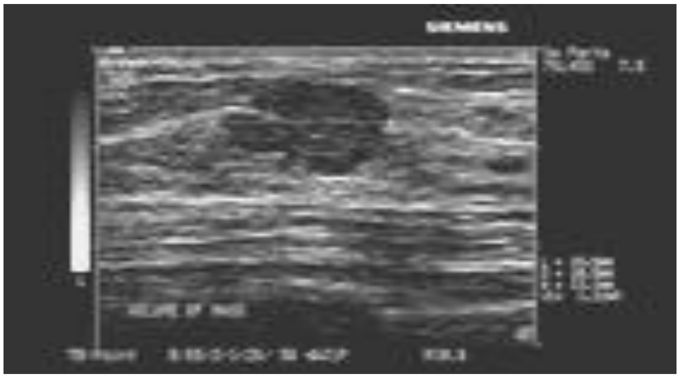


Figure (2.24): breast ultrasound image illustrates circumscribed, slightly lobulated fibroadenoma. (C.De felice et al J ultrasound 2007)

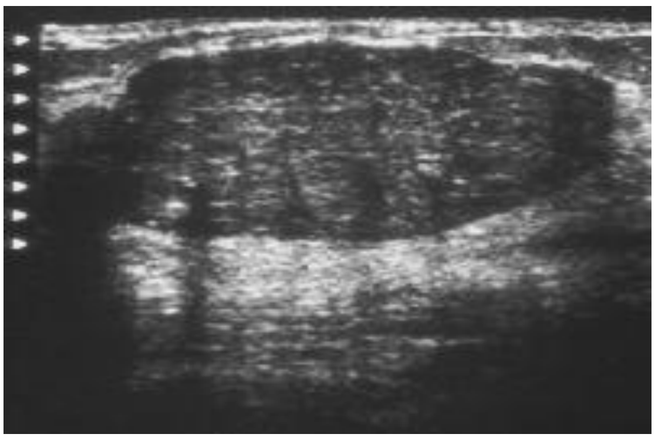


Figure (2.25): breast ultrasound image demonstrates a hypoechoic mass with smooth, partially lobulated margins typical of a fibroadenoma. (Journal of ultrasound in medicine 2007)

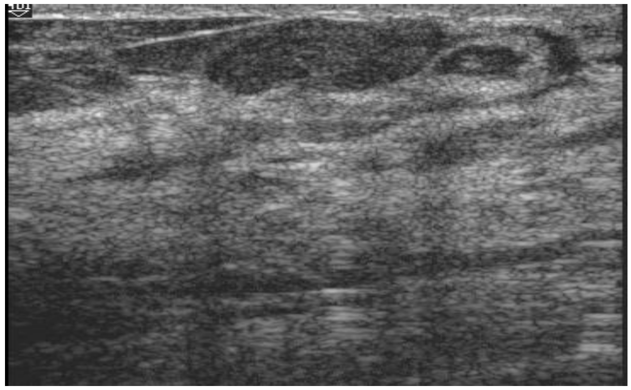


Figure (2.26): breast ultrasound image shows Superfacial fibroadenoma. (Alexander Margulis 1973)

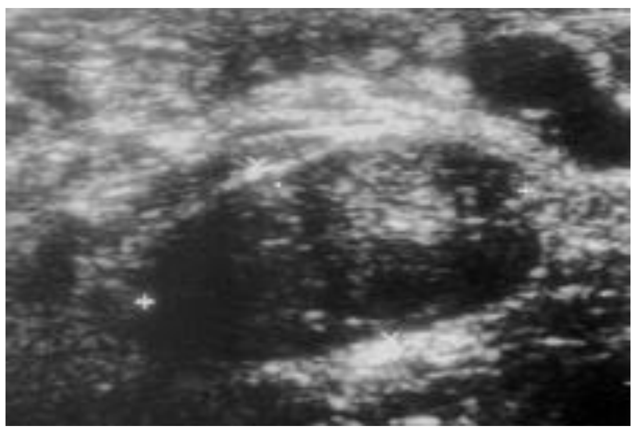


Figure (2.27): breast ultrasound image shows a mass with benign features. The mass is oval and has circumscribed margins and a width-to-AP dimension ratio greater than 1.4 (actual ratio = 2), which are the most predictive benign US features. Note that the echotexture is heterogeneous; however, the echotexture proved not to be a reliable feature for benign versus malignant differentiation. Biopsy results revealed fibroadenoma. (Journal of ultrasound in medicine 2007)

2.5.2.2.4.Abscesses

Abscesses have irregular, thick borders. Their centers have hypoechoic or mixed echogenicities.(Syed Amir Gilani 2001)

The goal of ultrasound is to differentiate between abscesses and uncomplicated mastitis. Mastitis appears as increased parenchymal echogenicity sometimes associated with skin thickening.

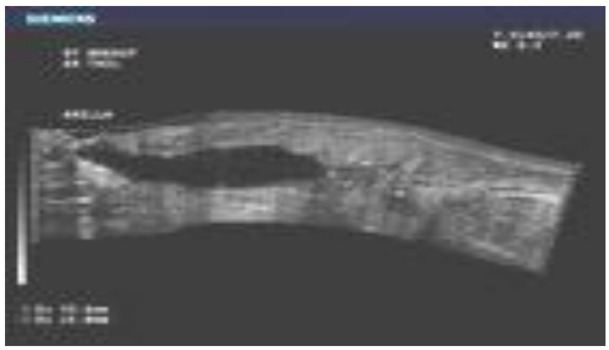


Figure (2.28): breast ultrasound image (Extend Field of View) shows full visualization of a breast abscess . (Journal of ultrasound in medicine 2007)

2.5.2.2.5.Dilated Lactiferous Ducts

Good equipment will demonstrate normal ducts in the range of 1 to 2 mm in diameter. During late pregnancy and lactation and in the elderly, ectatic ducts may be up to 8 mm in diameter and are visualized as tubular structures extending from the glandular tissue to the nipple region. (Syed Amir Gilani 2001)

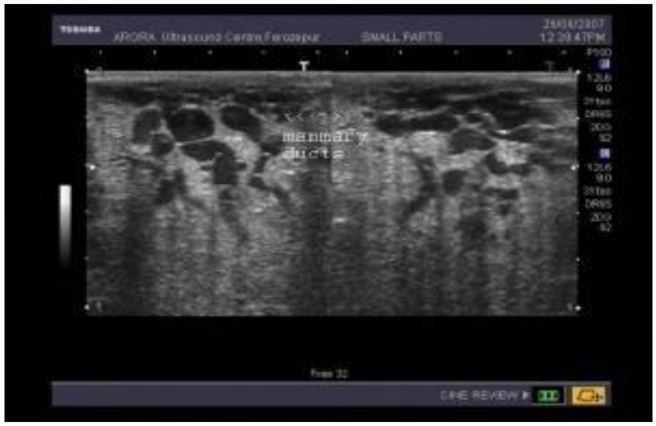
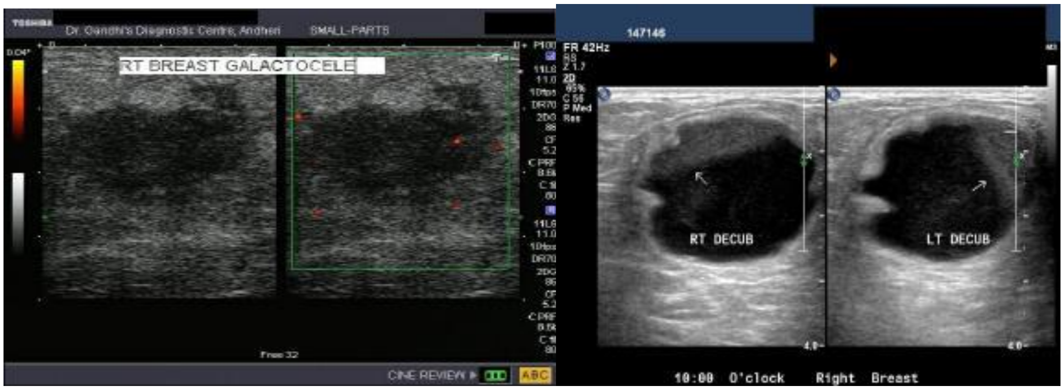


Figure (2.29): breast ultrasound image shows lactating breast. (Journal of ultrasound in medicine 2007)

2.5.2.2.6.Glactocele :

Lactating patient presents with slowly enlarging non tender mass of the breast, Sonography of the breast shows enlarge lactiferous ducts ,hypoechoic (almost cystic) lesion with through transmission. Color doppler images of the breast shows no signficant enhancement of vascularity. These suggest Galactocele. Galactoceles are formed by cystic dilatation of the lactiferous ducts and contain milk. They are seen in lactating women.



a) b)

Figure (2.30): a) ultrasound image shows galactocele with fluid level, b) ultrasound image shows a galactocele with a fat-fluid level. The echogenic material is seen to move with change in patient position (arrowed). (Journal of ultrasound in medicine 2007)

2.5.2.2.7.Fibrocystic Disease:

This is a disorder in which normal tissue is replaced with fibrous tissue and later cysts appear within the fibrous tissue. The cysts may be very small but sizes up to 5 cm are also possible. Fibrocystic disease is part of a spectrum of breast disorders referred to as "the dysplastic breast".(Stanvros 1999)

Breast sonography is extremely accurate in detecting cysts, even cysts as small as 2 mm will exhibit the characteristic features of a cyst. The fibrosis appears as a uniform, highly echogenic background in which the cysts are evident.(Thomas Stavros 2004)

2.5.2.2.8.Simple Cyst

These are well defined, anechoic spherical lesions demonstrating posterior enhancement. When these features are demonstrated, a breast cyst can be regarded as benign with 96 to 100% accuracy. The ability to diagnose benign simple cysts accurately prevents unnecessary biopsy and aspiration. (Smith,Darell 2001)

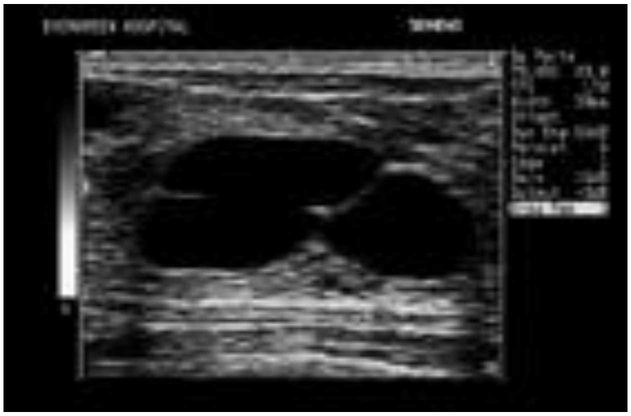


Figure (2.31) : Breast ultrasound image shows sharp cystic walls and internal septation by cyst membrane. (Journal of ultrasound in medicine 2007)

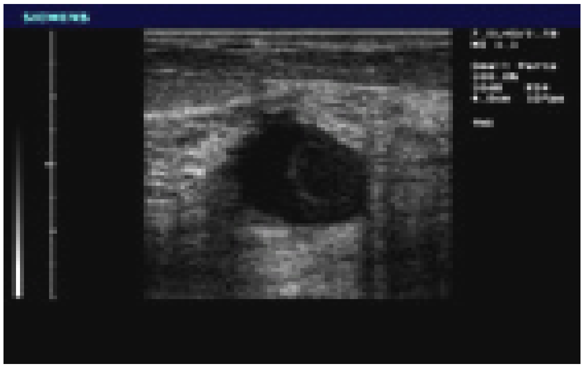


Figure (2.32): Breast ultrasound image shows subtle contents within cyst. (Journal of ultrasound in medicine 2007)

Figure (2.33): Breast ultrasound image shows large cyst with layered debris and a solid component. (Journal of ultrasound in medicine 2007)

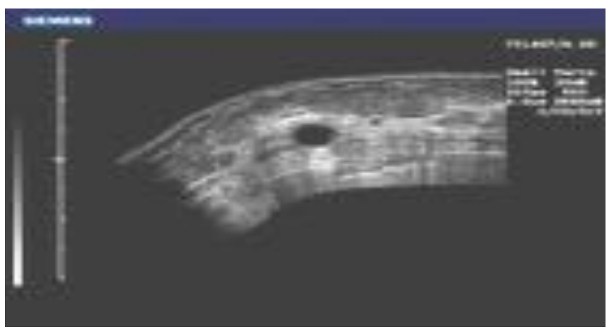


Figure (2.34): Breast ultrasound image (extend field of view) of a simple breast cyst within the glandular layer (Journal of ultrasound in medicine 2007)

2.5.2.2.9.Silicone Breast Implant Rupture

The body develops a fibrous tissue capsule around the surgically inserted implant. This capsule may harden resulting in breast pain. Other complications associated with breast implants are rupture of the capsule, rupture of the implant and extrusion of the viscous silicone into surrounding tissues.Symptoms suggesting implant rupture include a change in appearance or consistency of the breast, development of tenderness or a burning sensation in the area, or a breast lump. (Stanvros 1999)

An intracapsular rupture occurs when the implant ruptures within an intact fibrous capsule. Sonographically there are multiple parallel linear or curvilinear echogenic lines within the implant due to extravasation of silicone gel surrounding the collapsed implantshell. (Thomas Stavros 2004)

Sonographically an extracapsular rupture appears as echogenic noise called the snowstorm appearance. If the gel is anteriorly located it will obscure the anterior margin of the implant shell. Large extracapsular silicone globules may appear as cyst-like structures lying within the echogenic noise. Silicone gel located posterior to the implant is difficult to demonstrate sonographically. MRI is emerging as the gold standard for evaluating silicone implants. (Smith,Darell 2001)

2.6.Doppler sonography

The detection of visualization in the lesion was the first doppler feature used to differentiate between benign and malignant tumors, and this sign has shown a significant association with malignancy of lesions However, higher detection rates of flow in malignant tumors are not necessarily due to tumoral angiogenesis. (Thomas Stavros 2004)

There are also other breast nodule characteristics that are significantly associated with more frequent detection of flow on doppler sonography, such as the size of the lesion or whether it is palpable. This has been observed due to the fact that the detection of vessels on the inside of a nodule is easier if the lesion being studied is close to the transducer, as frequently occurs with palpable lesions.

Also, it seems to be more likely to detect vessels in a lesion that, because of its larger size, contains more and larger vessels. In fact, in the cases we have studied, malignant tumors have shown a significant larger average size and have been palpable more frequently than benign lesions.

Doppler sonography is, by itself, of little use when it comes to evaluating solid breast lesions. However, when it is used in conjunction with conventional sonography examinations, it can help provide a more accurate characterization of certain lesions. The detection of vessels on the inside of a breast nodule is significantly linked with malignancy. (Devin Dean 2005)

The detection of a diastole with null or reversed flow on spectral Doppler imaging is a sign, albeit infrequent, of very high positive predictive value; thus, when that sign is present, the lesion should be classified as probably malignant. On the other hand, doppler sonography is useless to predict the prognosis of patients with breast carcinomas. (Devin Dean 2005)

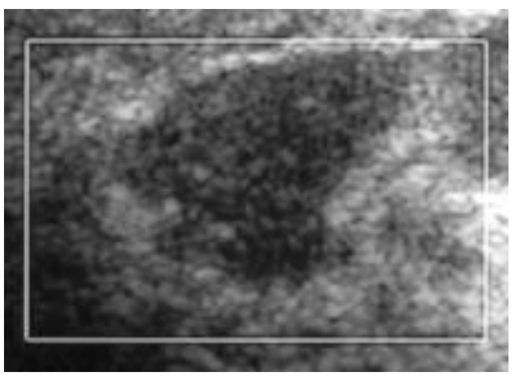


Figure (2.35): 43-year-old woman with fibroadenoma. Power Doppler sonogram shows no color signals. (Journal of ultrasound in medicine 2007)

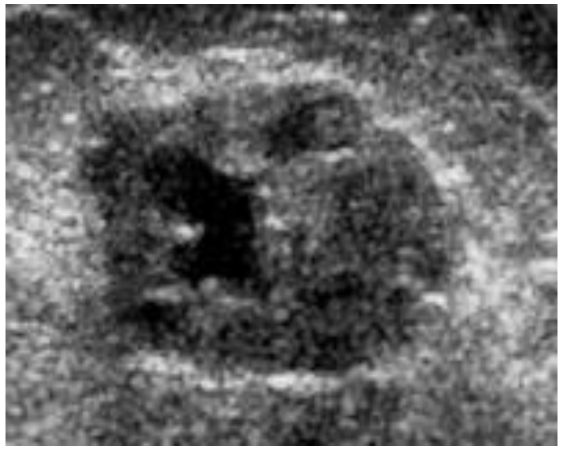


Figure (2.36): 53-year-old woman with fibroadenoma. Gray-scale sonogram reveals lobulated heterogeneous nodule. (Journal of ultrasound in medicine 2007)

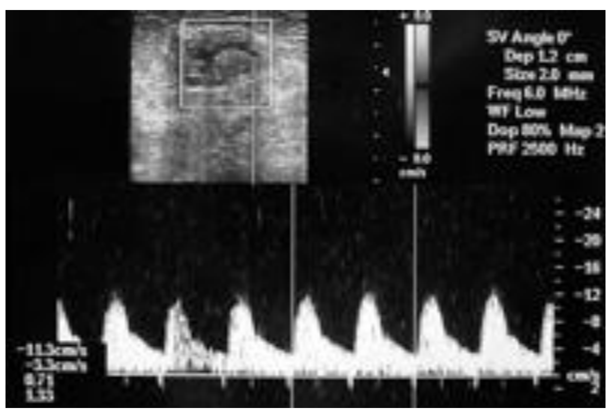


Figure (2.37): 53-year-old woman with fibroadenoma. Duplex Doppler sonogram of vessels in tumor shows low-resistance pulsatile signal. (Journal of ultrasound in medicine 2007)

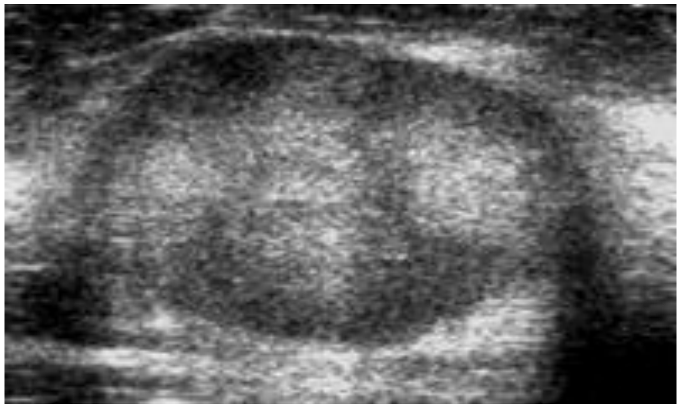


Figure (2.38): 63-year-old woman with invasive lobular carcinoma. Gray-scale sonogram reveals homogeneous, well-circumscribed, slightly hyperechoic solid mass with slight posterior enhancement. Lesion had appearance of a typically benign lesion. (Journal of ultrasound in medicine 2007)

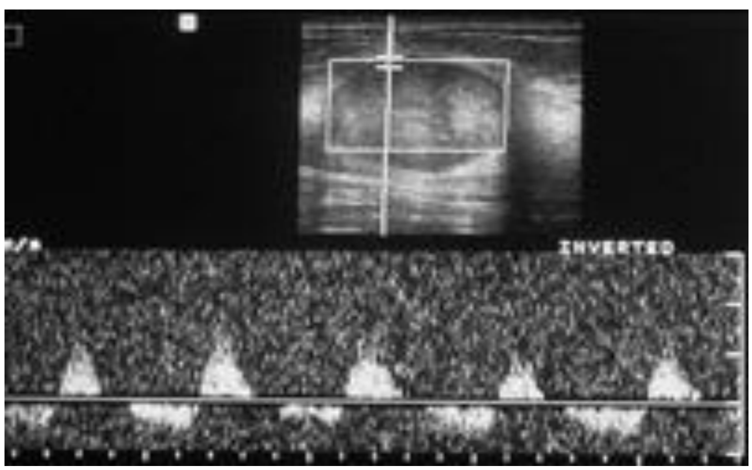


Figure (2.39): Same patient ,duplex Doppler sonogram shows high-resistance flow, with inversion of flow in diastole. (Journal of ultrasound in medicine 2007)

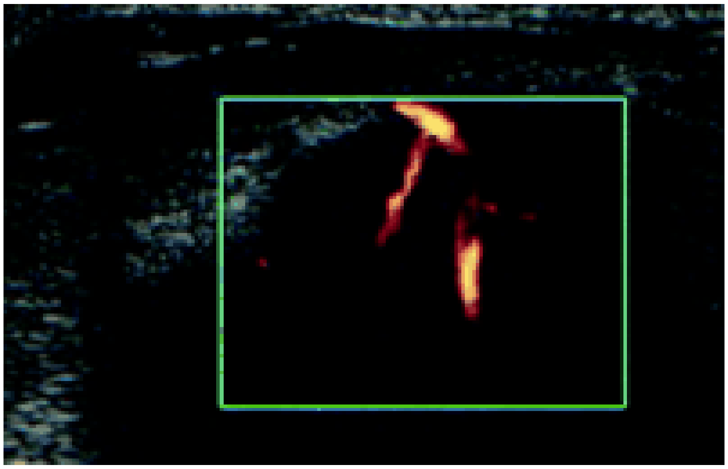


Figure (2.40): 45-year-old woman with invasive ductal carcinoma. Power Doppler sonogram shows vessel that penetrates lesion and branches. (Journal of ultrasound in medicine 2007)

2.7.1. Mammography:-

Is the radiographic examination of the breast and is utilized for the early detection of cancer. It is one of the most challenging radiographic examinations because it requires imaging of both small, high –contrast calcifications and large, low-contrast mass. For this reason, special x-ray tubes and B-size films are used. (Robert Fosbinder et al 2002)

Mammography use low-KVP values, in the range from 20 to 35 KVP. This voltage is lower than that for conventional radiography to increase differential absorption and improve subject contract. The poor penetration of the low-energy x-ray is not a disadvantage because most breasts are less than 10 centimeters (cm) thick. (Robert Fosbinder et al 2002)

2.7.1.1. X-ray tube:-

Special mammographic x-ray units have molybdenum anodes to produce low-energy x-ray beams that are optimized for breast imaging. The molybdenum anode produces K characteristic x-ray with energies of 17.4 and 19.9 kiloelectron volts (KeV). Changing the applied KVP does not change the energy of the K characteristic x-ray. (Roderick et al 1992)

Some mammographic units have provision to select a rhodium anode and/or a rhodium filter. The binding energies of the K and L shells in rhodium are slightly higher than those of molybdenum. Rhodium produce K characteristic x-ray with energies of 20 and 22 KeV. (Robert et al 2002)

2.7.1.2. Filtration:-

The purpose of mammographic filters is to remove low- and high-energy x-ray. Lower energy x-ray does not penetrate through the breast but increase the patient dose. Higher-energy x-ray decrease image contrast. A0.03-

millimeter (mm) molybdenum filter.The half-value layer (HVL) of mammographic x-ray units are typically 0.3 to 0.4 mm aluminum (AL) equivalent. (Robert et al 2002)

2.7.1.3. Heel effect :-

Mammographic x-rays tubes are oriented with the cathode-anode axis perpendicular to the chest wall, with the cathode at the chest wall side. This orientation produces an image with a more uniform density because the heel effect produces greater intensity at the thicker chest wall and less intensity toward the nipple. (Robert et al 2002)

2.7.1.4. Focal spot sizes:-

Mammographic tubes have tow focal spots size, a large (0.3-mm) focal spot for routine mammography and a small (0.1-mm) focal spot for magnification mammography. (Robert et al 2002)

2.7.1.5. Grids:-

The purpose of grid to remove scatter and improve image contrast. Moving grids are used for routine mammographic examinations. Grid ratios of about 4:1 and grid frequencies of 10 lines per centimeter are routinely employed in screening mammography. Using a grid in mammography both improve contrast and increases the patient dose by about a factor of 2. (Robert et al 2002)

2.7.1.6. Compression:-

Compression of the breast with a radiolucent compression device improves image quality by reducing patient motion and providing more uniform tissue thickness. The decreased breast thickness reduces scatter and patient dose. Compression of the breast by 1 cm reduces the dose by a factor of 2 because the HVL in tissue is about 1 cm for mammographic energies. (Robert et al 2002)

2.7.1.7. Film/ screen combinations:-

In mammography, single-emulsion film with a single –screen cassette is generally used to maintain high detail imaging. A high-speed rare earth screen is used to reduce exposure time, patient motion, and radiation dose. (Robert et al 2002)

2.7.1.8. Film processing:-

Mammographic film can be developed using conventional or extended automatic processing. Extended processing uses the same chemical and temperatures as regular processing, but the film processing time is increased. Total processing time is increased from 90 seconds(s) to 3 minutes (min) by increasing the film transport time. Extended processing increases film speed and contrast and allows for a decrease in patient dose. (Robert et al 2002)

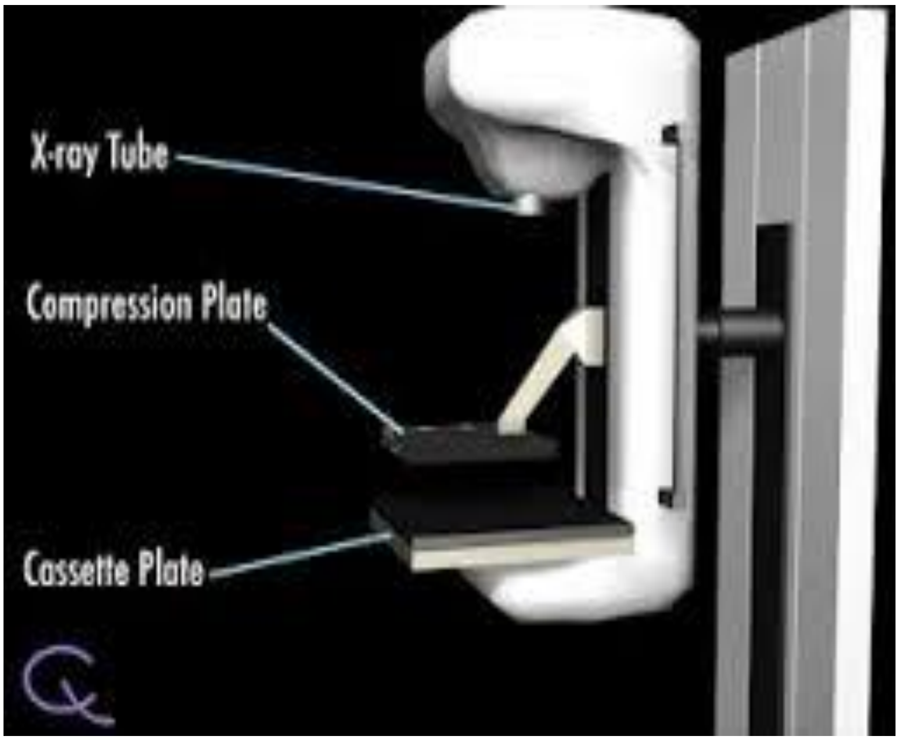
2.7.1.9. Automatic exposure control (AEC):-

The correct selection of MAS exposure factors is critical in producing a high-quality mammographic image. The automatic exposure control (AEC) circuit achieves proper image density by measuring the amount of exit radiation and terminating the exposure at the proper time. (Robert et al 2002)

2.7.1.10. Radiation dose:-

The radiation dose to the breast is reported as an average glandular dose. Glandular breast tissue is the tissue at risk for radiation-induced breast cancer.

The average glandular dose for each view imaged using a grid is usually about 1.4 MGY (140 mrad). Typical screening examinations consist of a craniocaudad and a mediolateral view, resulting in a dose to each breast of 2.8 mGy (280 mrad) per examination. (Robert et al 2002)



(Figure 2.41) mammography device (Robert et al 2002)

2.7.2. Mammographic technique:-

2.7.2.1. Indications for mammography:-

Screening asymptomatic women aged 50 years and over,Screening asymptomatic women aged 35 years and over who have a high risk of developing breast cancer,Women who have one or more first degree relatives who have been diagnosed with premenopausal breast cancer,

women with histologic risk factors found at previous surgery, e.g. atypical ductal hyperplasia and Investigation of symptomatic women aged 35 years and over with a breast lump or other clinical evidence of breast cancer.(David Sutton 1963-1984)

2.7.2.2.Mammography projections &normal appearance:-

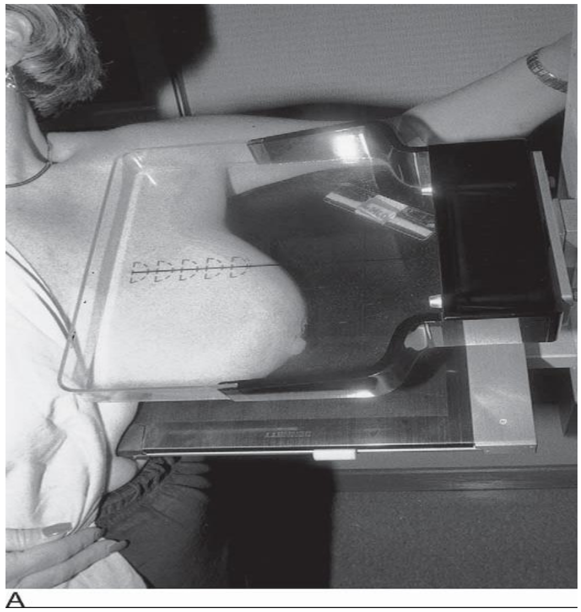
Standard projections:-

There are two standard mammographic projections:-

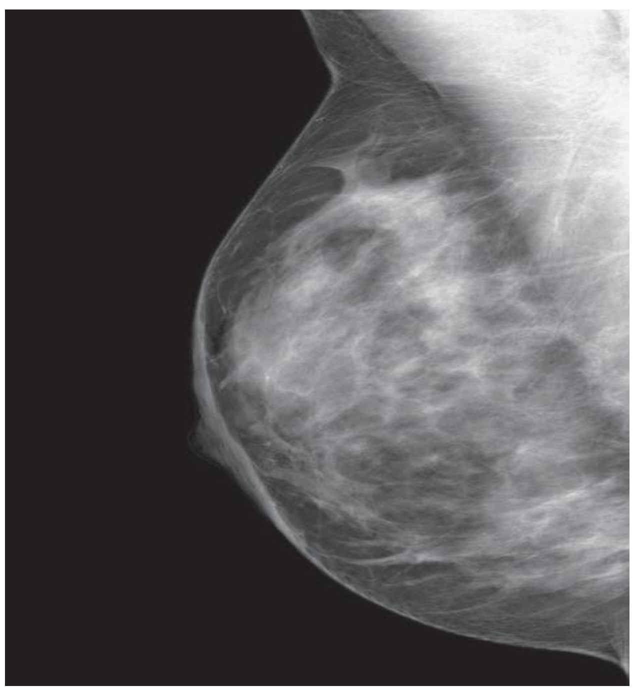
2.7.2.3. Mediolateral oblique (MLO):-

The MLO is taken with the X-ray beam directed from superomedial to inferolateral, usually at an angle of 30–60°, with compression applied obliquely across the chest wall, perpendicular to the long axis of the pectoralis major muscle.

The MLO projection is the only projection in which all the breast tissue can be demonstrated on a single image. A well-positioned MLO view should demonstrate the inframammary angle, the nipple in profile and the nipple positioned at the level of the lower border of the pectoralis major, with the muscle across the posterior border of the film at an angle of 25–30° to the vertical. (Robert et al 2002)



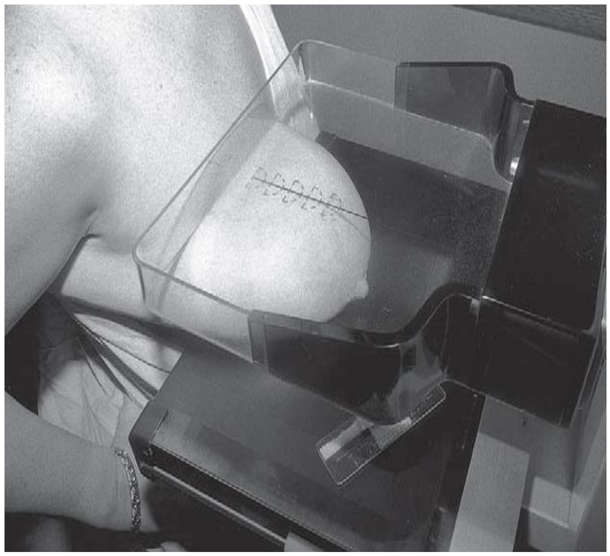
(Figure 2.42.): Image shows breast positioning for the mediolateral oblique. (Robert et al 2002)



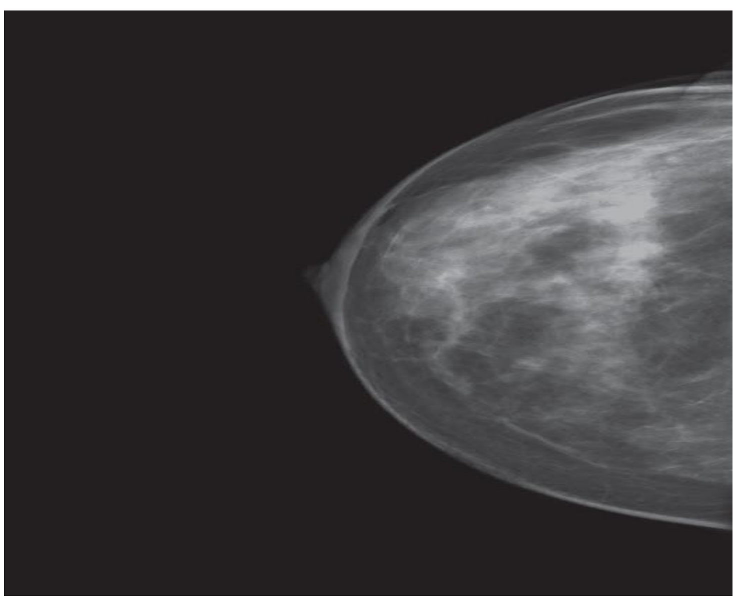
(Figure 2.43.)**:** Image shows Standard set of mammograms consists of the mediolateral oblique (MLO) view. (Robert et al 2002)

2.7.2.4. Craniocaudal (CC) view:-

For the CC view, the X-ray beam travels from superior to inferior. Positioning is achieved by pulling the breast up and forward away from the chest wall, with compression applied from above. (Robert et al 2002)



(Figure 2.44.) Breast positioning. Craniocaudal views. (Robert et al 2002)



(Figure 2.45.) Standard set of mammograms consists of the

Craniocaudal (CC) view. (Robert et al 2002)

2.7.2.5. Supplementary views:-

For demonstration of tissue in the most posterolateral part of the breast, an extended craniocaudal view is used with the patient rotated medially to bring the lateral aspect of the breast and axillary tail over the film. .(David Sutton 1963-1984)

2.7.2.6. Magnification views:-

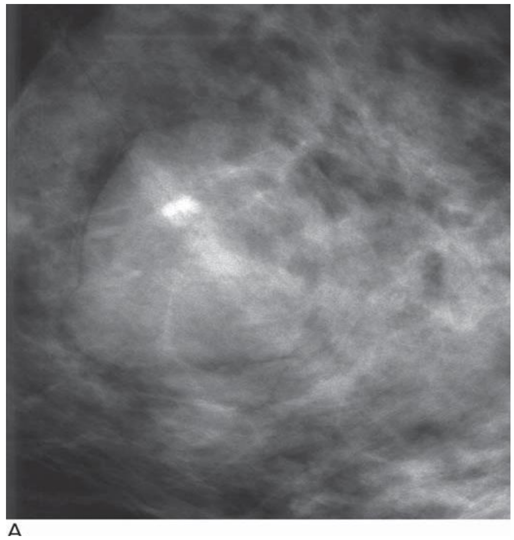
Are obtained by increasing the object-film distance, producing an `air gap', and using a fine focal spot to increase resolution. A magnification factor of 1.5 is usual and the increased resolution obtained is particularly helpful for detailed analysis of microcalcifications and the margins of small mass lesions. .(David Sutton 1963-1984)

2.8. Mammographic (radiographic) and sonographic appearance of different breast pathology:-

2.8.1. Cysts:-

2.8.1.1. Radiographic appearance:-

On mammography they are seen as well-defined, round or oval masses. Sometimes a characteristic halo is visible on mammography.



(Figure.2.46.) Cyst. (A) Well-defined rounded mass, with an associate lucent halo characteristic of a cyst. (Grainger et al 2002)

2.8.1.2. Sonographic appearance:-

Cysts can be readily diagnosed with ultrasound. They have well-defined margins, are oval or round in shape, and show an absence of internal echoes indicating the presence of fluid. (Grainger et al 2002)

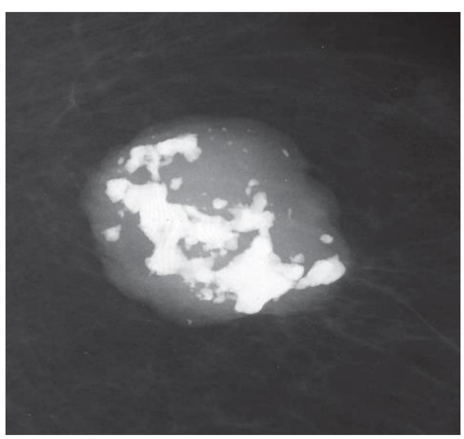
The area of breast tissue behind a cyst appears bright on ultrasound (Posterior enhancement) due to improved transmission on the ultrasound beam through the cyst fluid .When these features are present; a cyst can be diagnosed with certainty. Aspiration is easily performed under ultrasound guidance to alleviate symptoms or when there is diagnostic uncertainty. Cytology on cyst fluid is not routinely performed unless there are atypical imaging features or the aspirate is bloodstained. (Grainger et al 2002)

(Figure 2.47.) Cyst. (B) The absence of internal echoes and the posterior enhancement of the ultrasound beam are diagnostic of a cyst. (Grainger et al 2002)

2.8.2. Fibroadenomas:-

2.8.2.1. Radiographic appearance:-

On mammography, fibroadenomas are seen as well-defined, rounded or oval masses. In the majority of cases they are solitary, but in 10–20% they are multiple. Coarse calcifications may develop within fibroadenomas, particularly in older women. (Grainger et al 2002)



(Figure 2.48) Fibroadenomas may develop coarse ‘pop-corn’ type calcifications. (Grainger et al 2002)

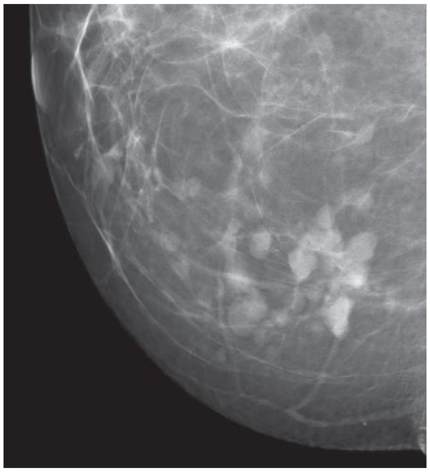
2.8.2.2. Sonographic appearance:-

Ultrasound features have been described that are characteristic of benign masses. These include hyperechogenicity compared to fat, oval or well-circumscribed, lobulated, gently curving shape and the presence of a thin, echogenic pseudocapsule. If several of these features are present and there are no features suggestive of malignancy, then a mass can be confidently classified as benign. (Grainger et al 2002)

2.8.3. Papillomas:-

2.8.3.1. Radiographic appearance:-

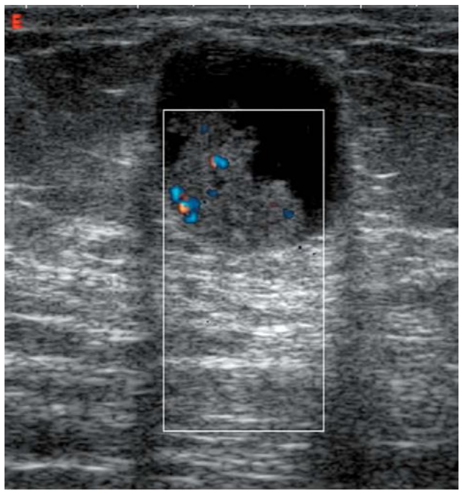
On mammography, they may be seen as a well-defined mass; commonly in a retroareolar the mass is associated with microcalcifications. (Grainger et al 2002)



(Figure2.49.) (A) Multiple small papillomas. Papillomas are frequently well defined on mammography, although part of the mass may have an irregular or ill-defined contour. (Grainger et al 2002)

2.8.3.2. Sonographic appearance:-

On ultrasound, they typically appear as a filling defect within a dilated duct or cyst. On aspiration, any cyst fluid may be bloodstained. As it is impossible to differentiate papillomas from papillary carcinomas on imaging criteria, percutaneous biopsy is required. (Grainger et al 2002)

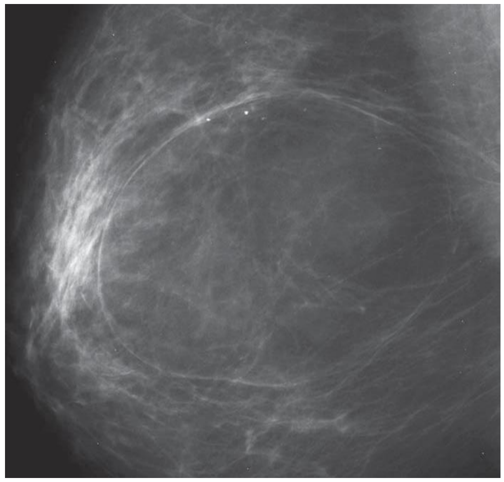


(Figure.2.50.) (B) On ultrasound, the presence of a filling defect within a cystic structure suggests the diagnosis. Colour Doppler can be useful to distinguish debris within a cyst from a soft tissue mass. (Grainger et al 2002)

2.8.4. Lipoma:-

2.8.4.1. Radiographic appearance:-

Large lipomas may be visible on mammography as a radiolucent mass (Grainger et al 2002).



(Figure.2.51) Lipoma. (A) On mammography, a lipoma may be seen as a well-defined mass of fat density, contained within a thin capsule. (Grainger et al 2002)

2.8.4.2. Sonographic appearance:-

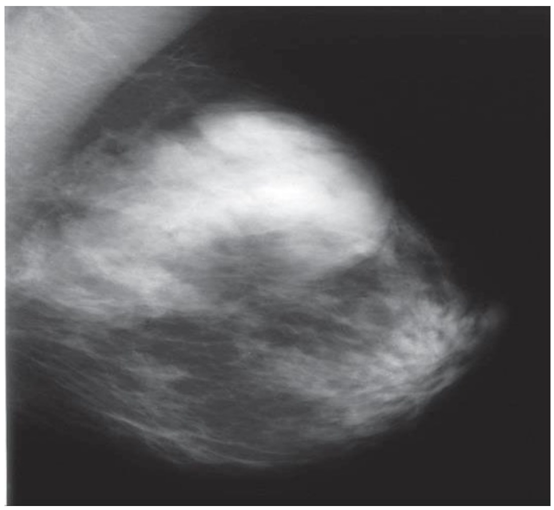
On ultrasound their characteristic appearance is that of a well-defined lesion, and hyperechoic lesion compared to the adjacent fat. (Grainger et al 2002)

(Figure.2.52) (B) On ultrasound, a well-defined hyperechoic lesion characteristic of a lipoma is seen. (Grainger et al 2002)

2.8.5. Hamartomas:-

2.8.5.1. Radiographic appearance:-

Sometimes large hamartomas, detected on screening mammograms, are impalpable. On mammography they classically appear as large, well-circumscribed masses containing a mixture of dense and lucent areas, reflecting the different tissue components present. Diagnostic difficulty may be encountered because percutaneous biopsy specimens may be reported as normal breast tissue. (Grainger et al 2002)



(Figure.2.53.) Hamartoma. Hamartomas are frequently encountered on screening mammograms as large, lobulated masses with areas of varying density reflecting the presence of elements which are of fat and soft tissue density. (Grainger et al 2002)

2.8.6. Invasive breast cancer:-

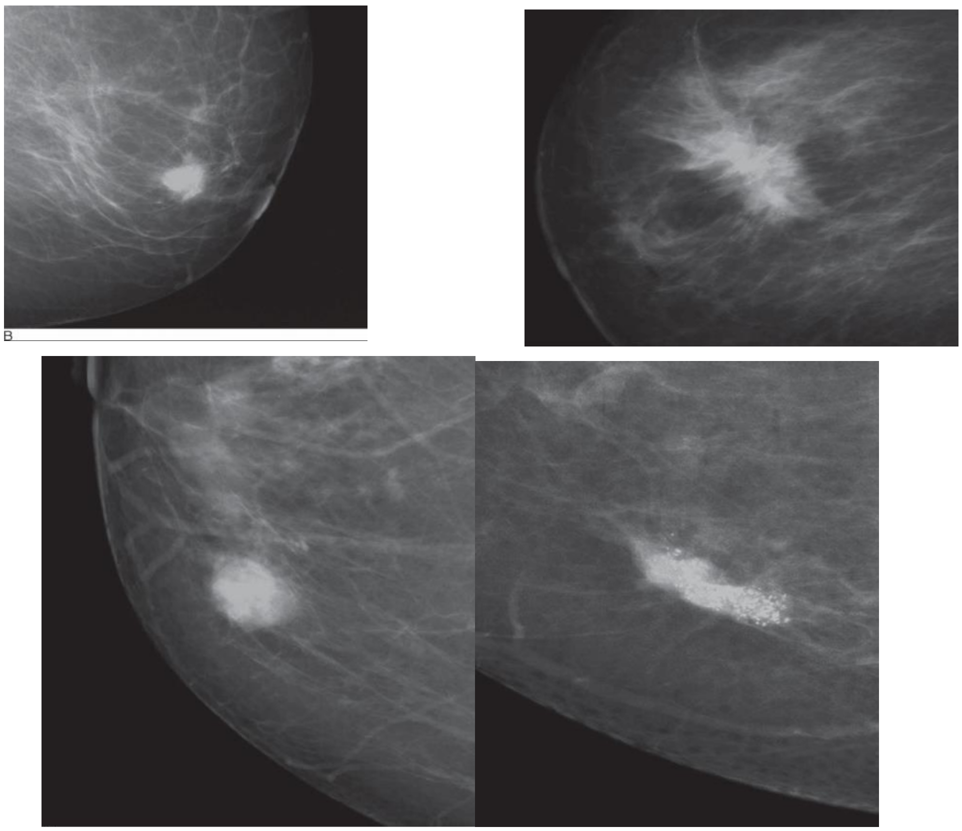
2.8.6.1. Radiographic appearance:-

Mammography Carcinomas typically appear as ill-defined or speculated masses on mammography). Lower grade cancers tend to be seen as speculated masses, due to the presence of an associated desmoplastic reaction in the adjacent stroma. Higher-grade tumors are usually seen as an ill-defined mass, but sometimes a rapidly growing tumor may appear relatively well defined, with similar appearances to a benign lesion such as a fibroadenoma. Many breast cancers arise from areas of ductal carcinoma in situ (DCIS) and are associated with microcalcifications on mammography. This is particularly true for high-grade invasive ductal carcinomas that are often associated with high-grade DCIS22. (Grainger et al 2002)

Special types of tumors have particular mammographic Characteristics:-

Lobular carcinomas can be difficult to perceive on a mammogram due to their tendency to diffusely infiltrate fatty tissue. Compared with ductal NST tumors, lobular cancers are more likely to be seen on only one mammographic view, are less likely to be associated with microcalcifications, and are more often seen as an ill-defined mass or an area of asymmetrically dense breast tissue, Tubular and cribriform cancers often present as small speculated masses, Papillary, mucinous and medullary neoplasms may appear as new or enlarging multilobulated masses and may be well defined, simulating an apparently benign lesion and small spiculated mass will be easily visible in a fatty breast, whereas even large lesions can be obscured by dense breast parenchyma. (Grainger et al 2002)

Sometimes the only clue to the presence of an invasive tumor may be abnormal trabecular markings, known as an architectural distortion, or the presence of microcalcifications, which tend to be visible even when the breast parenchyma is dense. The ability to perceive small or subtle cancers on a mammogram is improved by having the two standard mammographic views available and seeking out previous studies for comparison. An increase in the size of a mass or the presence of a new mass is suspicious of malignancy, whereas a lesion that remains unchanged over many years is invariably benign. Multiple masses in both breasts would favour a benign disease such as cysts or fibroadenomas. (Grainger et al 2002)



(Figure.2.54.) Mammographic appearances of invasive carcinoma. Speculated and ill-defined masses are typical features of malignancy. The speculated mass (A) and the ill-defined mass (B) were found to be ductal NST carcinomas of intermediate grade on core biopsy. (C) Sometimes high-grade tumors that exhibit rapid growth may appear more well -defined. (D) Calcifications typical of high-grade DCIS may be found associated with invasive carcinomas. (Grainger et al 2002)

2.8.6.2. Sonographic appearance:-

There are characteristic malignant features on ultrasound:-

Carcinomas are seen as ill-defined masses and are markedly hypoechoic compared to the surrounding fat.

Carcinomas tend to be taller than they are wide (the anterior to posterior dimension is greater than the transverse diameter).

There may be an ill-defined echogenic halo around the lesion, particularly around the lateral margins, and distortion of the adjacent breast tissue may be apparent, analogous to speculation on the mammogram.

Posterior acoustic shadowing is frequently observed, due to a reduction in the through transmission of the ultrasound beam via dense tumor tissue. (Grainger et al 2002)

A

(Figure.2.55) Ultrasound appearances of invasive carcinoma.

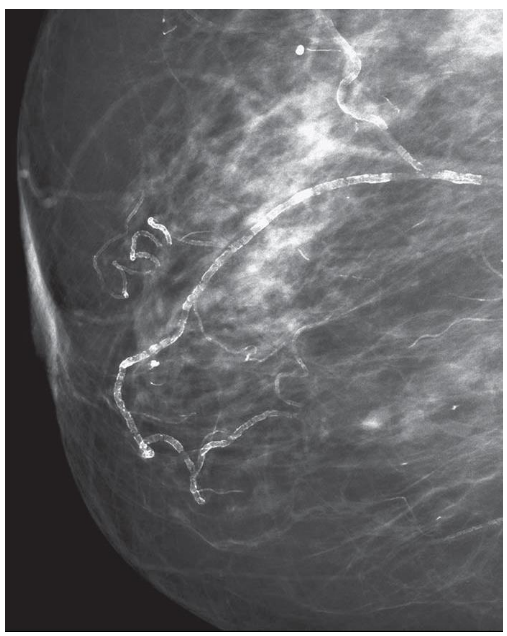
(A) This irregular hypoechoic mass with acoustic shadowing and an echogenic halo is typical of a carcinoma. (Grainger et al 2002)

2.8.7. Benign microcalcifications:-

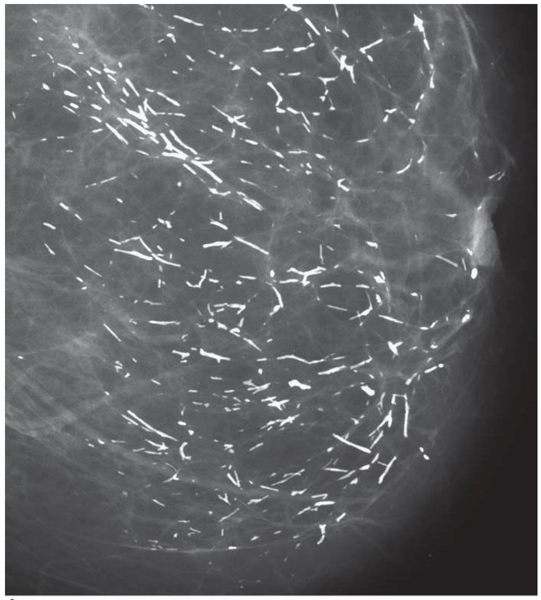
2.8.7.1. Duct ectasia:-

2.8.7.1.1. Radiographic appearance:-

Vascular calcifications have a characteristic ‘tramline’ appearance caused by calcification in both walls of the vessel; duct ectasia has a classical appearance that rarely causes diagnostic difficulty. In this condition, coarse rod and branching calcifications are recognized due to calcification of debris within dilated ducts. These calcifications have been described as having a ‘broken needle’ appearance and are usually bilateral .Sometimes the debris may extrude from the ducts into the adjacent parenchyma, leading to an inflammatory type reaction.



(Figure2.56) Vascular calcifications. (Grainger et al 2002)



A

(Figure 2.57) Duct ectasia. (A) Broken needle appearance, typical of duct ectasia. (Grainger et al 2002)

2.8.7.2. Fat necrosis:-

2.8.7.2.1. Radiographic appearance:-

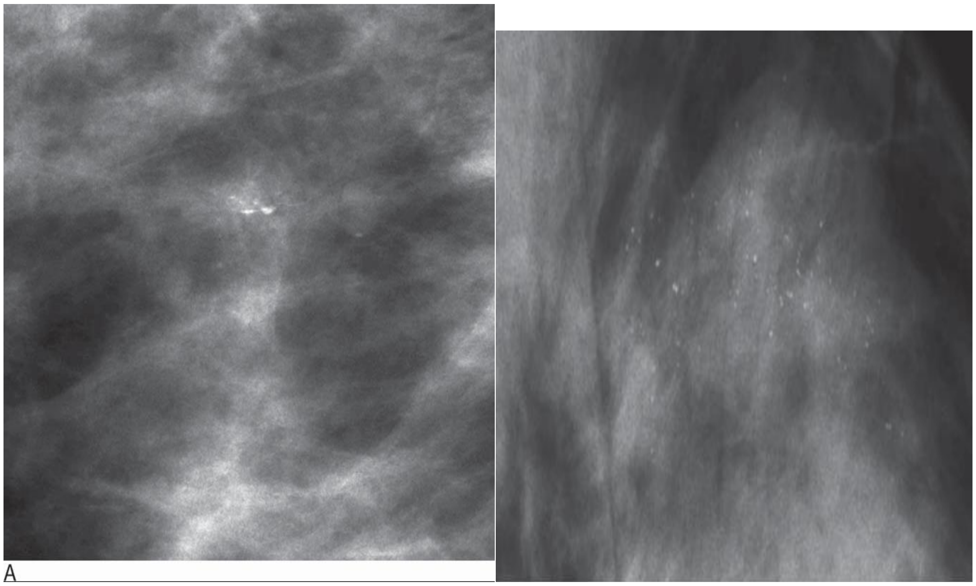
Fat necrosis may then occur and the calcifications take on a characteristic ‘lead-pipe’ appearance .In many cases the diagnosis is obvious, but sometimes biopsy may be required, particularly if the calcifications are unilateral or focal. (Grainger et al 2002)

(Figure2.58.) (B) Sometimes thicker, more localized calcifications can be seen, giving a 'lead-pipe' appearance. (Grainger et al 2002)

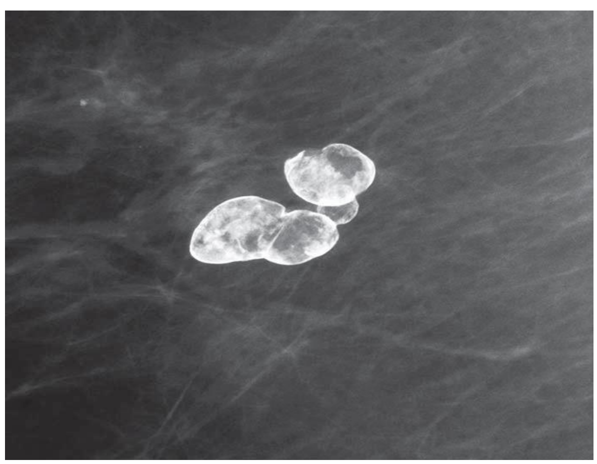
2.8.7.3. Fibrocystic change:-

2.8.7.3.1. Radiographic appearance:-

Fibrocystic change is a common cause of microcalcifications. On a lateral magnification view, layering of calcific fluid contained within microcysts can be appreciated, producing a characteristic 'teacup' appearance. However, in many cases, percutaneous biopsy is required to exclude DCIS. Fat necrosis is a frequently encountered cause of benign calcifications, particularly when there is a history of trauma or previous surgery. It may present as 'egg shell' calcifications within the wall of an oil cyst or as coarse dystrophic calcifications associated with areas of scarring.



(Figure2.59) Fibrocystic change. (A) 'Teacups' representing the layering out of calcific material in the dependent portion of microcysts on a lateral magnification view. (B) As calcifications associated with areas of fibrocystic change may not exhibit this characteristic appearance, stereotactic core biopsy is required. (Grainger et al 2002)



(Figure2.60) Egg shell' calcifications of fat necrosis. (Grainger et al 2002)

2.8.7.4. Fibroadenomas:-

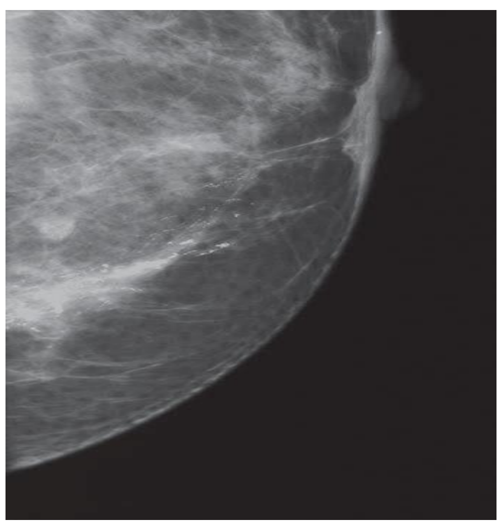
2.8.7.4.1. Radiographic appearance:-

Fibroadenomas may become calcified, particularly after the menopause. Classically, the calcifications have a coarse, 'popcorn' appearance .However, they can be small and punctuate, necessitating a biopsy to establish the diagnosis.

2.8.8. Malignant micro calcifications:-

2.8.8.1. Radiographic appearance:-

Malignant microcalcifications associated with high histological grade ductal carcinoma in situ (DCIS) are classically rod shape and branch. These calcifications are known as casting or come do microcalcifications and represent necrotic debris within the ducts, hence their linear, branching structure. (Grainger et al 2002)



(Figure2.61) Ductal carcinoma in-situ (DCIS). Mammography shows the segmental distribution of pleomorphic microcalcifications. Granular, rod-shaped and branching calcifications can be identified. The appearances are typical of high-grade DCIS.

(Grainger et al 2002)

2.9.Previous studies:-

The study done by EMINE DEVOLLI-DISH et al 2009,they examined 546 patient with breast symptom by mammography and ultrasound In the 259 women who had both tests, ultrasound had a higher sensitivity than mammography in women younger than 45 years, whereas mammography had a higher sensitivity than ultrasound in women older than 60 years. The sensitivity according to age was 52.1% for mammography and 72.6% for ultrasound. The specificity according to age was 88.5% for ultrasound and 73.9% for mammography. Comparing the sensitivity of mammography and ultrasound according to the breast density indicates that mammographic sensitivity was 82.2% among women with predominantly fatty breast, but 23.7% in women with heterogeneous dense breasts, with the increase of fi bro glandular density the level of sensitivity with mammography decreases, while ultrasonographic sensitivity was 71.1% among women with predominantly fatty breast and 57% for heterogeneous dense breasts.There data indicate that sensitivity and specificity of ultrasound was statistically significantly greater than mammography in patients with breast symptoms for the detection of breast cancer and benign lesions particularly in dense breast and in young women.

The study done by Teixidor et al 1977,they examined 20 patient with breast masses by both method The results of this combined evaluation were compared to those of mammography alone. Of 115 pathologically proven lesions, 44 were fluid-filled cysts. Sonography correctly diagnosed all 44 cysts, while mammography was equivocal in 27 (61%) of them. Of the remaining 71 solid masses, 38 were benign and 33 malignant. Mammography alone correctly diagnosed 31 carcinomas (94%), whereas sonography correctly diagnosed 26 (78.8%). While the infiltrating carcinomas have a typical sonographic appearance, circumscribed carcinomas may have the same sonographic features as fibro adenomas; the value of sonography here was to establish whether the mass was solid. In other solid masses such as those produced by dysplasias, abscesses, and mastitis, sonography was helpful in differentiating between diffuse and discrete lesions. The combined mammographic-sonographic evaluation of breast masses was more accurate than either method alone.

The study done by Leconte et al 2003 they examined 4236 patient Sensitivities of mammography and subsequent sonography for the detection of non palpable breast cancers were 69% and 88% in grades 1-4, 80% and 88% in grades 1 and 2, and 56% and 88% in grades 3 and 4 breasts, respectively. The relative risk for detecting nonpalpable breast cancers using sonography was statistically significantly greater than that for detecting non palpable breast cancers using mammography in grades 1-4 (relative risk, 1.29; $p = 0.024$) and in grades 3 and 4 (relative risk, 1.57; $p = 0.013$) but not in grades 1 and 2 (relative risk, 1.1; $p = 0.445$) breasts. Sonography is a useful adjunct after mammography for the detection of non palpable breast cancer, particularly in the dense breast.

The study done by Corsetti et al 2006 they examined 17883 patients total mammographies, 167 cancers were diagnosed (detection rate: 0.93%). Out of 257 suspicious mammographies, 138 cancers were detected. Out of 17,626 negative mammographies, 6,449 (36.5%) were classified as "dense breast" and underwent ultrasonography: 29 cancers were detected (detection rate: 0.44%, or 17.3% of total cancers). Out of 25 cancer cases reviewed, negative mammography and asymptomatic status was confirmed in 15 (detection rate 0.23%, or 8.9% of total cancers). The cancer detection rate was 0.11%, 0.22%, 0.32% and 0.14% for age groups <40, 40-49, 50-59 and >59, respectively. The cost per additional carcinoma detected by ultrasonography alone was euro 25,847.85 whereas that per examined woman was euro 21.68. The study confirms the possibility that ultrasonography can detect mammographically occult breast carcinoma in dense breasts. The evidence is insufficient to recommend this policy in routine screening practice but suggests that, at least in current clinical practice, adding ultrasonography in dense breasts may be useful despite the substantial costs.

The study done by Osako et al 2007 they examined 165 patient aged 30 to 39 years, 147 patients (89%) mammographically showed dense breasts.In all carcinomas, the sensitivity of US (95%) was higher than that of MMG (85%). The sensitivity of US for invasive carcinoma (99%) was higher than that of MMG (85%). On the other hand, the sensitivity of MMG for DCIS (89%) was much higher than that of US (68%). US is more sensitive to detect breast cancers than MMG in this age range, especially for invasive carcinoma. On the other hand, MMG is useful for detecting DCIS, especially when it manifests with micro calcifications.

The study done by Chan et al 2008 they examined 1485 patients Altogether, 222 patients (17%) had positive imaging findings on USG only, among which 22 (13%) patients had nonpalpable tumors. Performing USG increased the cancer detection rate among clinically and mammographically occult breast lesions by 14.3%. The mean size of the tumors detected only by

USG was 1.98 cm, which was not significantly different from the mean size of tumor detected by MMG (1.46) (p = 0.23). This remains true in the group of patients with non palpable tumors (1.36 vs. 1.46 cm, p = 0.88). The sensitivity of USG is 91%, which is significantly higher than that of MMG (78%) (p = 0.001). This remains true in patients age <40 or > or = 40, tumor grading I toIII, and LVI +/- cases. However, MMG had higher sensitivity in the group of patients with non palpable tumors (73% vs. 62%, p = 0.01) and noninvasive cancers (72% vs. 69%, p = 0.01).The use of high-resolution USG may lead to detection of a significant number of occult cancers that are no different in size from non palpable mammographically detected lesions.

The study done by Brancato et al 2007 they examined 49044 patients There findings show a low cancer detection rate, substantially lower compared to other clinical studies of ultrasonography in dense breasts, though in accordance with preliminary evidence from an Italian randomized clinical trial within a population-based screening program. The policy of adding ultrasonography to negative mammography in dense breasts seems to have very limited cost-effectiveness, and should not be adopted in routine practice before results of ongoing clinical trials are available.

The study done by Prasade and House 2007,they examined 62 patient,the study confirmed that combined MG and USG had higher sensitivity rate than the sensitivity rate observed for either single modality. The diagnostic accuracy for carcinomas of the breast appear to improve when MG was combined with USG, even in cases which showed no evidence of micro calcification or other signs of abnormalities. There study implies that, USG may be the only viable modality in pregnant and lactating women as it does not involve ionizing radiation and also in dense breast tissue, as density is a limiting factor for MG.

The study done by Rungnapa et al 2013,they examined 3129 patient. Breast imaging is still valuable in settings where health resources are limited. Single breast imaging (only either ultrasonography or mammography) is adequate for cancer diagnosis. It is therefore unnecessary to perform both imaging modalities. Accuracy of the diagnosis may be improved by FNAC, if available.

The study done by Hong et al 2015,they examined 274 patient ,and they concluded that US was better than MG in the preoperative evaluation of breast diseases of Chinese women. These results suggest that US could be more useful for detecting breast lesions in China, especially for younger women with dense breasts

Chapter Three: Material and Methodology

3- The type of the study:-

This is comparative and descriptive study, carried out in the area of the study. Each patient is scanned; list the findings in details according to the study variables and recorded in the data collecting sheets.

3.1. The material:-

The study was conducted at Khartoum state hospitals in x-ray and ultrasound departments of Khartoum Advanced Diagnostic Center, Dr.Ajenaid Awad Yousif diagnostic Clinic and Omer Sawi hospital. Was carried out within the period: from May 2015_february 2016.Among Sudanese women came to the area and the time of the study for breast mammogram and ultrasound. The data was collected out from those women. The study was carried out in 100 women's who were came with breast masses, age range 25-75 years.

- **Inclusion criteria**: any women with breast masses came to department without diagnosis to here mass
- **Exclusion criteria**: women without breast abnormality and women with diagnosed to her breast mass and came for follow up.

Source of date collection:

1. The patient histry This was obtained using a special designed questionnaire (appendix 1) collected information about the patients , age , marital status, family history of breast cancer contraceptive pills , previous mammogram investigations clinical or self examinations.

2.The data collecting sheet which designed specially for the study.

3.2.Methdology:-

3.2.1. Mammographic and sonographic techniques:-

Mammographic techniques:-

Craniocaudal (CC) view:

Technical Factors: IR size -18x24 cm crosswise.

Shielding: Waist apron

Patient position: standing

Part position :

***** IR height is determined by lifting the breast to achieve a 90o angle to the chest wall the IR will be at the level of the infra-mammary crease at its upper limits .

* The breast is pulled forward onto the IR centrally with the nipple in profile

* The arm on the side being imaged is relaxed and th**e** shoulder is back out of the way .

* The head is turned away from the side being imaged.

* Wrinkles and folds on the breast should be smoothed out and compression applied until taut.

* The marker and patient ID information is always placed on the axillary side .(so that not to overlap on breast tissue)

Central Ray

- perpendicular ,centered to the base of the breast .the chest wall edge of the IR ;CR not movable .
- SID ; Fixed ;varies with manufacturer ,about 60cm
- Respiration Suspend breathing
- Both breast are imaged separately for comparison.

A mediolateral oblique (MLO) view:-

This projection allows evaluation of abnormalities in the deep lateral aspect of breast tissue.

Technical factors&Patient position is the same as craniocaudal.

Part position ;

Tube& IR remain at right angles to each other ;CR is angled about 45^o ,CR enters the breast medially perpendicular to the patient's pectoral muscle.

We increase the angle to 60^o in a large-breasted women

- IR at the level of the axilla.
- Pull breast tissue and pectoral muscle anteriorly and medially away from chest wall.

- Apply compression with the breast held away from the chest wall and up to prevent sagging.
- **Central ray** : Perpendicular ,centered to the base of breast ,wall edge of the IR
- No additional projections were needed .

Mammographic findings were reported by an expert radiologist.

3.2.2. Sonographic technique:-

A 7.5 MHz linear array probe was used. The patient is examined in the sitting position, supine and supine oblique with the ipsilateral arm on the examined side lifted on the head so as to spread the breast.Various scanning methods have been proposed, for diagnostic imaging e.g. systemic scanning in the radial and anti-radial planes were performed .Palpation Dynamic test was preformed

Using electronic printer, photocopies were obtained for each breast lesion , this was done on a sensitive paper – roll films.

.**3.2.3.Equipment used for the data collection: -**

1.An U/S machine(TOSHIPA) , having the same probe (linear) with the same frequency (7.5-10 MHz) .

2.AnU/S machine (ALOKA SSP 1200CV), having the same probe (linear) with the same frequency (7.5-10 MHz) .

3. Mammographic x-ray machine(METALTRONICA),having KVP(20-30kvp) and MAS(25mas).

3.3. The method of data analysis used in the study:-

After data collection, the data sheets was symbolized, classified and analyzed by computer program called Statistic Package for Social Sciences (SPSS) The complex tables are used in the analysis and caried out the relationship between different variables and the important statistical indicators are drawn from the study and the data was presented by using tables and graphs.

3.4. The ethical considerations:-

The Study was deal with the patients who was already send to the Ultrasound and mammography. No patient identification or individual patient details was published, and all specific information relating to patient's identities was protected in the same way.

Chapter Four
The Results

4.1.Results

Table (1-4)shows age distribution in patient of breast masses

Age group	No of patient	percent
< 30	16	16
3o<45	47	47
45<6o	25	25
60-75	12	12
Total	100	100

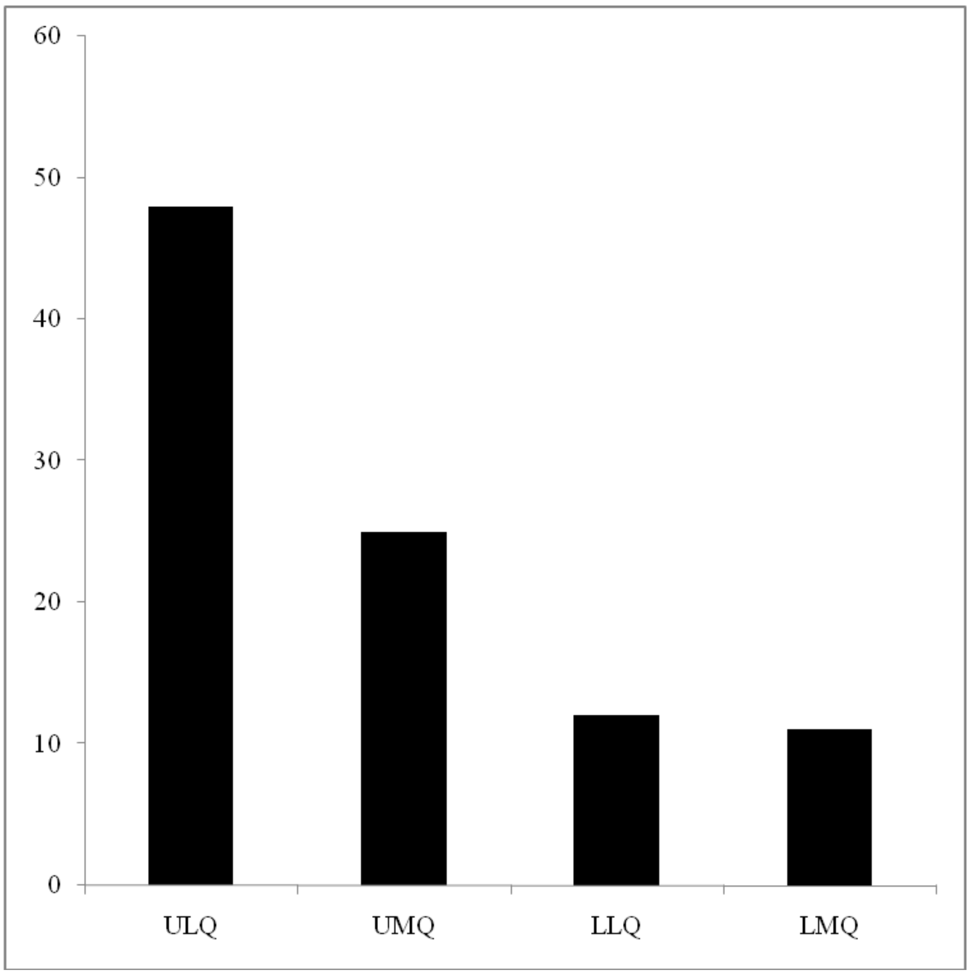
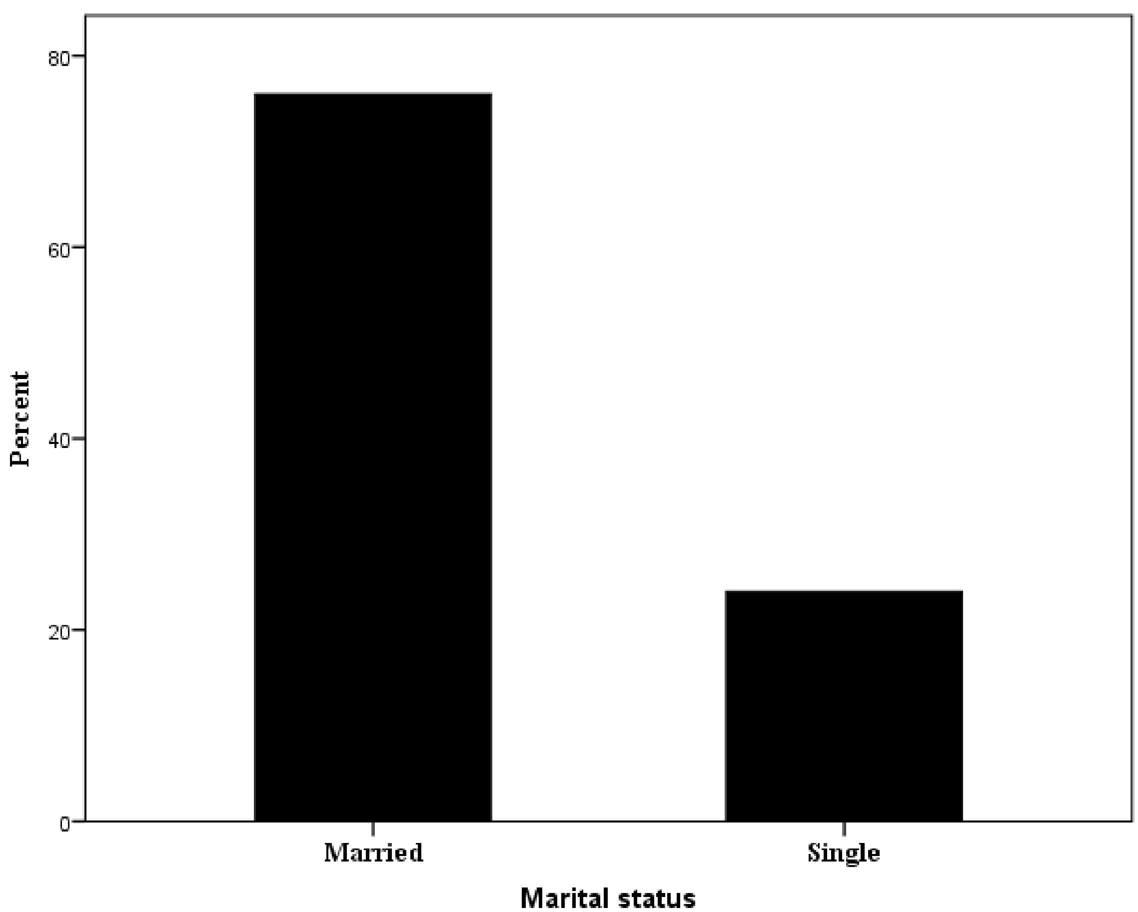


Figure (1-4) Age group in patient of breast masses

Table (2-4)shows marital status in patient of breast masses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	76	63.9	76.0	76.0
	Single	24	20.2	24.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		



Figure(2-4) marital status in patient of breast masses

Table (3-4) shows parity in patient of breast masses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	27	22.7	27.0	27.0
	1	14	11.8	14.0	41.0
	2	12	10.1	12.0	53.0
	3	14	11.8	14.0	67.0
	4	8	6.7	8.0	75.0
	5	12	10.1	12.0	87.0
	6	7	5.9	7.0	94.0
	7	4	3.4	4.0	98.0
	8	2	1.7	2.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

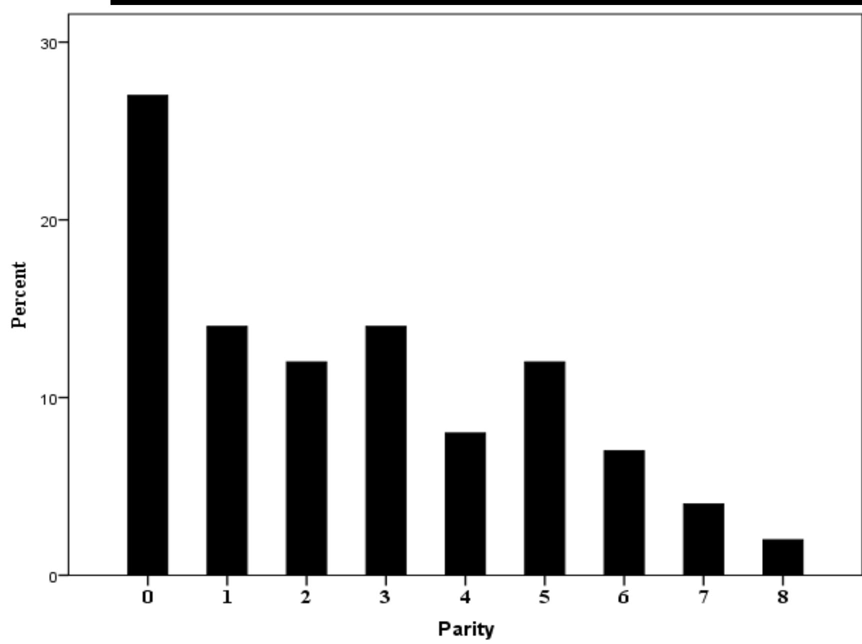


Figure (3-4)shows parity in patient of breast masses

Table(4-4) shows lactation in patient of breast masses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	5.9	7.0	7.0
	No	93	78.2	93.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

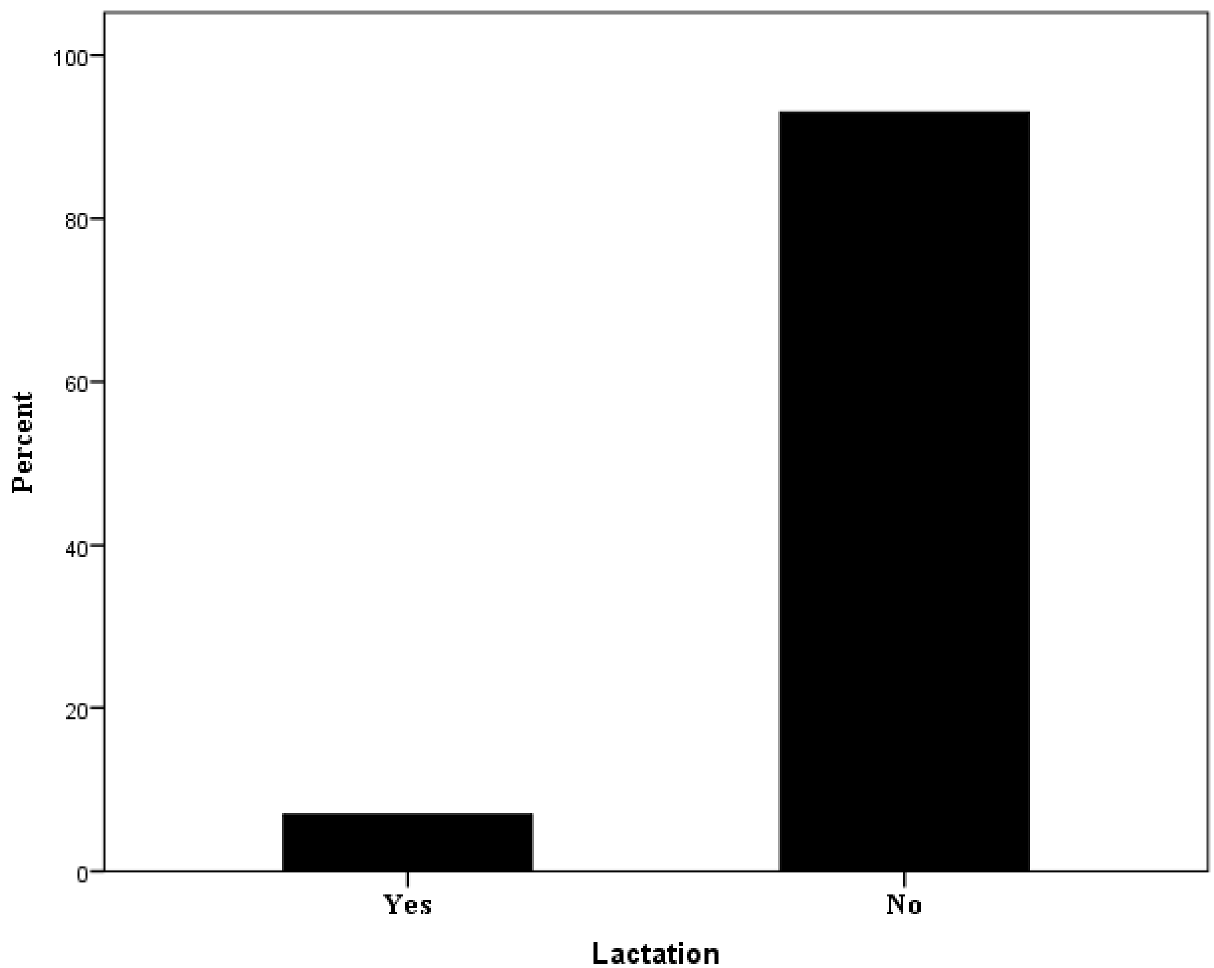
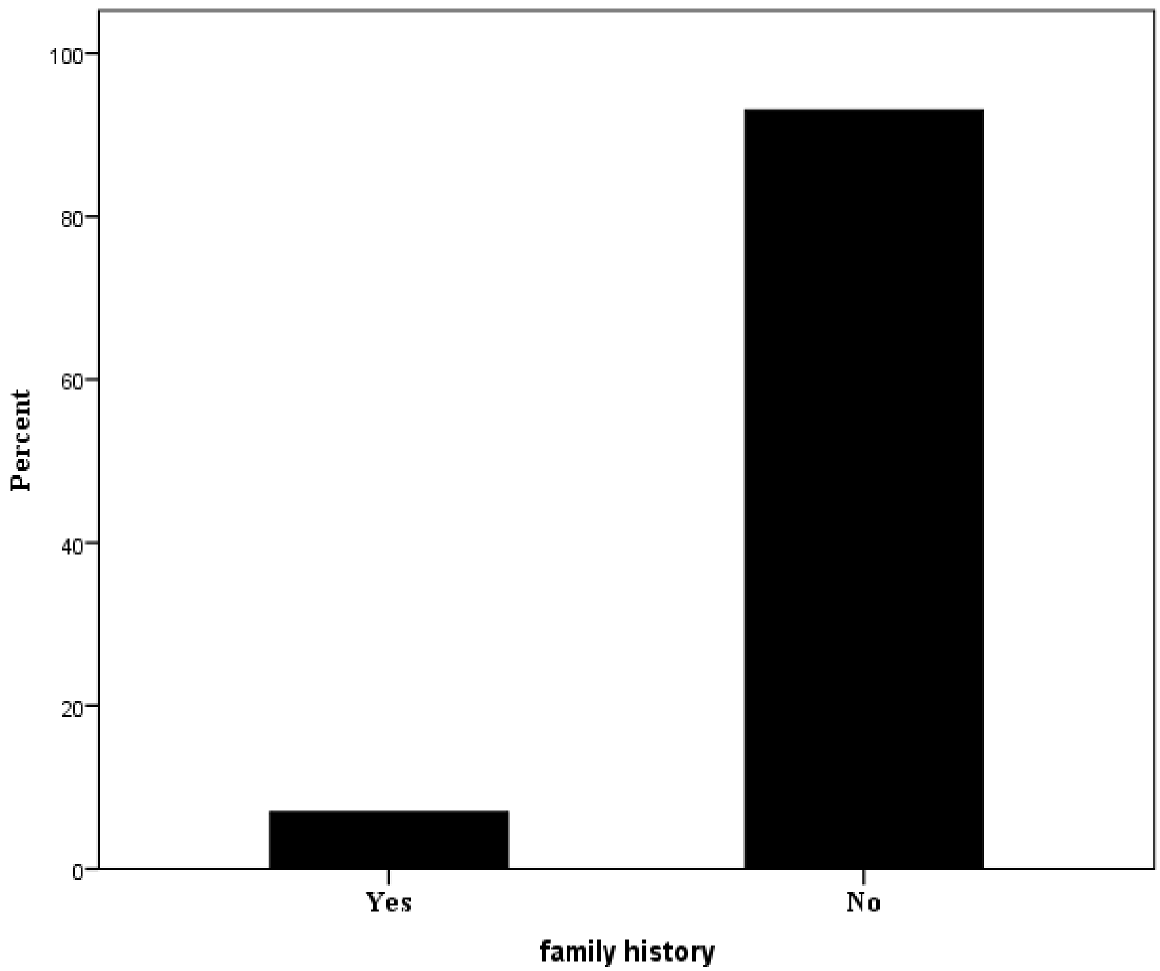


Figure (4-4) shows lactation in patient of breast masses

Table (5-4)shows family history in patient of breast masses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	7	5.9	7.0	7.0
	No	93	78.2	93.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		



Figure(5-4)shows family history in patient of breast masses

Table (6-4) shows uses contraceptive in patient of breast masses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	21	17.6	21.0	21.0
	No	79	66.4	79.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

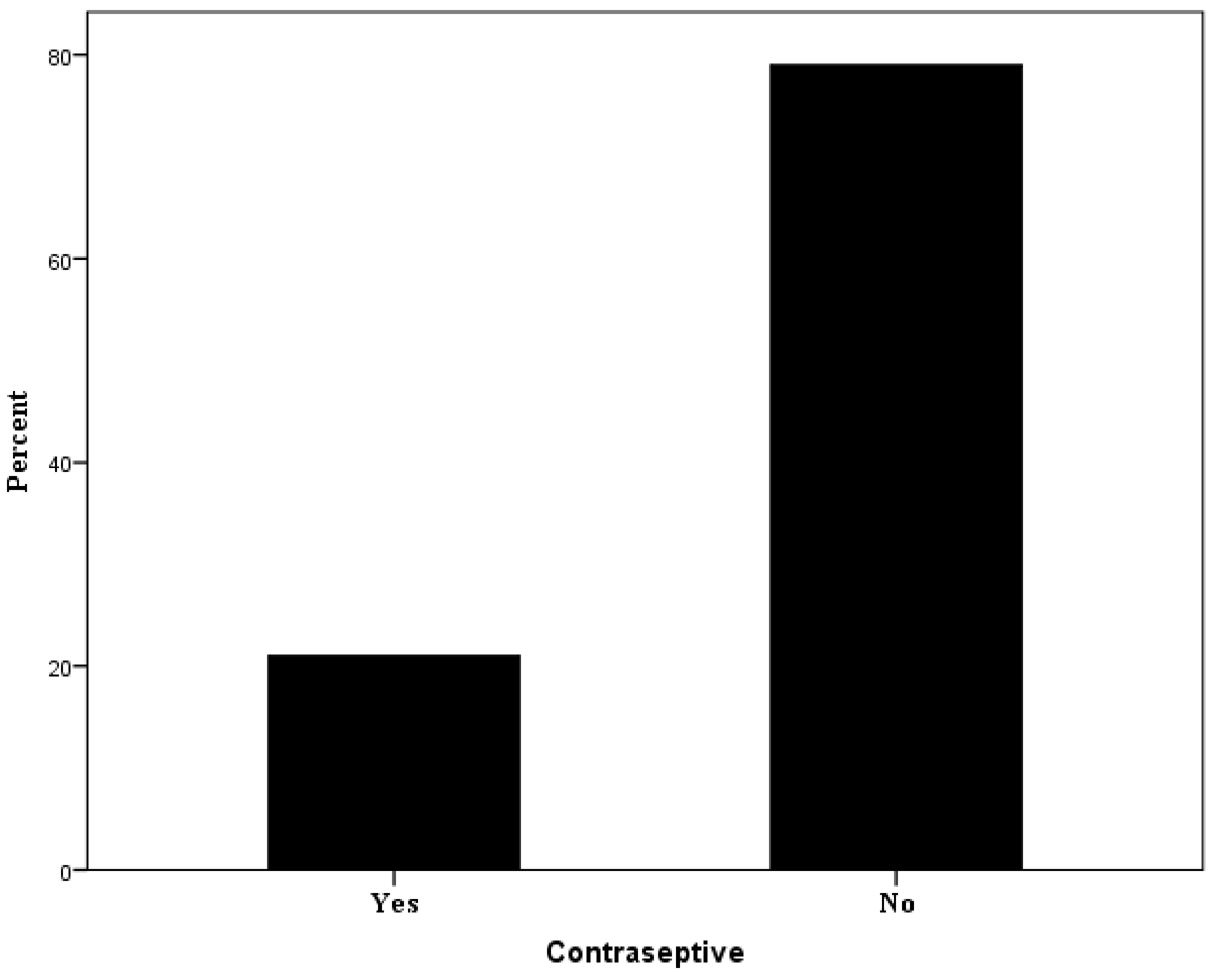


Figure (6-4) uses contraceptive in patient of breast masses

Table (7-4) shows density of the breast in mammography

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fatty(ACR I)	19	16.0	19.0	19.0
	Scatter(ACR 2)	38	31.9	38.0	57.0
	Heterogeneous (ACR 3)	32	26.9	32.0	89.0
	Dense(ACR 4)	11	9.2	11.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

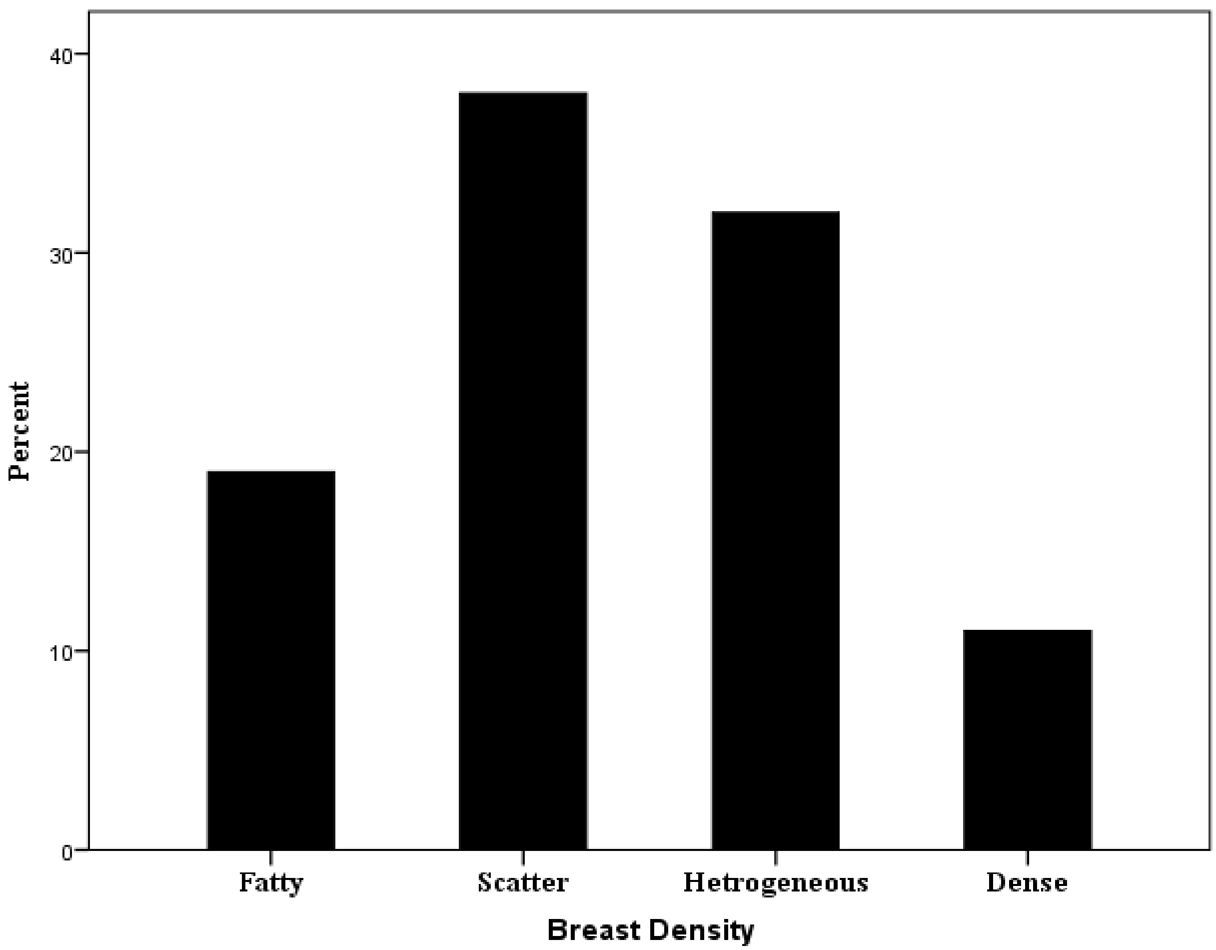


Figure (7-4) shows breast density in mammography

Table (8-4) shows location of breast masses in the breast

Location	No of patient	Percent
ULQ	48	48
UMQ	25	25
LLQ	12	12
LMQ	11	11
Central	4	4
Total	100	100

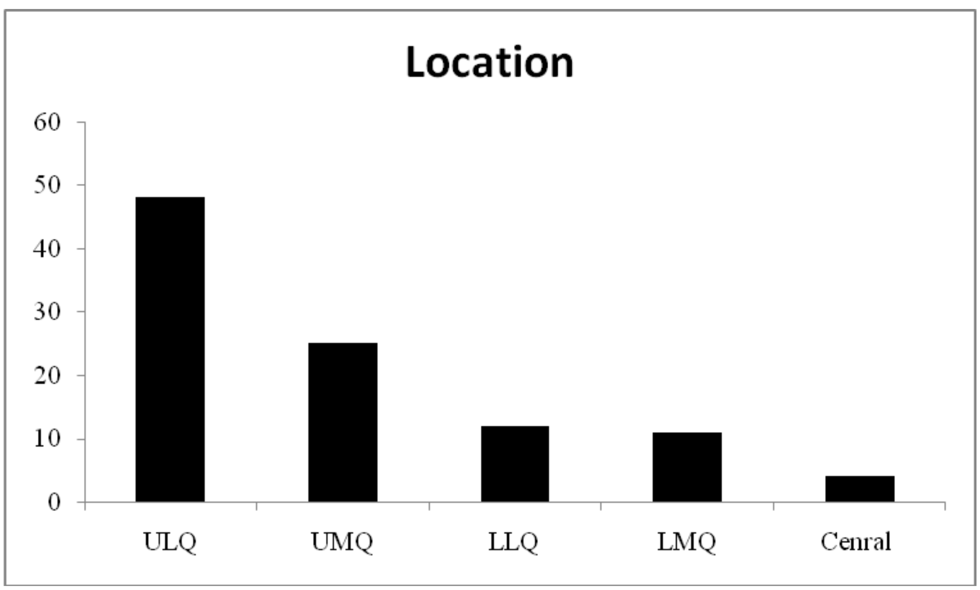


Figure (8-4) shows location of breast masses in the breast

Table (9-4) shows present of axillaries L/N in patient of breast masses by U/S

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	21.0	25.0	25.0
	No	75	63.0	75.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

Table (10-4) shows echogenicity of breast masses in ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hypoechoic	61	51.3	61.0	61.0
	Hyperechoic	11	9.2	11.0	72.0
	Anechoic with internal echo	21	17.6	21.0	93.0
	Anechoic	7	5.9	7.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

Table (11-4) shows masses texture in ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Homogeneous	68	57.1	68.0	68.0
	Heterogeneous	32	26.9	32.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

Table (12-4) shows masses out line in ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Well-define	83	69.7	83.0	83.0
	Ill-defined	17	14.3	17.0	100.0
	Total	100	84.0	100.0	

Table (13-4) shows posterior phenomena of masses in ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Enhanced	53	44.5	53.0	53.0
	No	30	25.2	30.0	83.0
	Shadow	17	14.3	17.0	100.0
	Total	100	84.0	100.0	
Missing	System	19	16.0		
Total		119	100.0		

Table (14-4) shows diagnosis of breast masses by ultrasound

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fibroadenoma	39	32.8	39.0	39.0
	Simple Cyst	14	11.8	14.0	53.0
	Lipoma	9	7.6	9.0	62.0
	Fibrocystic	8	6.7	8.0	70.0
	Abscess	3	2.5	3.0	73.0
	Ductal Carcinoma	13	10.9	13.0	86.0
	Intramammilary LN	1	.8	1.0	87.0
	Hematoma	2	1.7	2.0	89.0
	Ductectasia	3	2.5	3.0	92.0
	Glactocele	1	.8	1.0	93.0
	lobar Carcinoma	3	2.5	3.0	96.0
	Phyllode Tumor	4	3.4	4.0	100.0
	Total	100	84.0	100.0	

Table (15-4)shows density of breast masses in mammography

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hyperdense	72	60.5	74.2	74.2
	Hypodense	2	1.7	2.1	76.3
	Isodense	8	6.7	8.2	84.5
	Normal	15	12.6	15.5	100.0
	Total	97	81.5	100.0	

Table (16-4) shows shape of breast masses in mammography

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Regular	65	54.6	67.0	67.0
	Irregular	17	14.3	17.5	84.5
	Normal	15	12.6	15.5	100.0
	Total	97	81.5	100.0	

Table (17-4) shows skin status in patient of breast masses in mammography

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	79	67.2	81.6	81.6
	Thick	18	15.1	18.4	100.0
	Total	97	82.4	100.0	

Table (18-4) shows micro calcification in U/S &mammography cross tabulation

Count

		Minco calcification Mammo		Total
		Yes	No	
Micro calcification US	Yes	5	0	5
	No	14	78	92
Total		19	78	97

Table (19-4) shows finding in U/S & mammography cross tabulation

		Mammographic findings					
		Negative	Benign	Probably Benign	Suspicious abnormal	Suggestive Malignant	Total
US Findings	Fibroadenoma	10	29	0	0	0	39
	Simple Cyst	0	14	0	0	0	14
	Lipoma	3	4	2	0	0	9
	Fibrocystic	2	4	2	0	0	8
	Ductal Carcinoma	0	0	0	0	13	13
	Intramammilary LN	0	1	0	0	0	1
	Hematoma	0	0	1	1	0	2
	Ductectasia	0	0	1	0	2	3
	Glactocele	0	1	0	0	0	1
	Lobar Carcinoma	0	0	0	0	3	3
	Phyllode Tumor	0	2	2	0	0	4
Total		15	55	8	1	18	97

Chapter Five

Discussion,Conclusion and Recommendations :-

5.1.Discussion:-

On this study we compare between mammography and ultrasound in detection of the breast masses among Sudanese women and was carried out in 100 women, age 25 to 75 years who were came to the area of the study with breast masses.

Our result show that ultrasound detected masses in all 100 patient (100%) but mammography detected the masses in only 85 patient (85%) the 15 patient (15%) diagnose as normal because they were younger women and had dense breast table (19-4) this record agrees with EMINE DEVOLLI-DISH et al 2009 study sensitivity and specificity of ultrasound was statistically significantly greater than mammography in patient with breast symptom for the detection of breast cancer and benign lesion particularly in dense breast and in young women.

Ultrasound detected 84 patients (84%) had benign masses and 16 patient (16%) had malignant masses, mammography detected 63 patient (63%) were benign and 18 patient (18%) were malignant 1 patient (1%) suspicious abnormal table (19-4), this record agrees with Osako T et al 2007 study, mammography is useful for detecting DCIS, especially when it manifests with micro calcification than ultrasound.

U/S detected 3 patient (3%) of patient with breast abscess and they were lactating MMG not done table (14-4) this record agrees with Prasad SN and Houserkova D 2007, U/S may be the only viable modality in pregnant and lactating women as it does not involve ionizing radiation and also dense breast tissue.

Mammography detected 19 patient (19%) with calcification and 78 patient (78%) without, ultrasound detected only 5 patient (5%) with calcification and 95 patient (95%) without, this record agrees with Osako T et al 2007 study, mammography is useful for detecting DCIS, especially when it manifests with micro calcification than ultrasound. Table(18-4)

U/S detected 39 patient (39%) of patient with fibro adenoma, MMG detected only29 patient (29%) the 10 patient (10%) normal they had dense breast table(7-4) and table (19-4),this record agrees with EMINE DEVOLLI-DISH et al 2009study,sensitivity and specificity of ultrasound was statistically significantly greater than mammography in patient with breast symptom for the detection of breast cancer and benign lesion particularly in dense breast and in young women.

U/S detected 9 patient (9%) of patient with lipoma, MMG show that 3 patient(3%)were normal 4 patient (4%) benign lesion 2 patient (2%) probably benign, table(7-4) and table (19-4), this record agrees with EMINE DEVOLLI-DISH et al 2009study,sensitivity and specificity of ultrasound was statistically significantly greater than mammography in patient with breast symptom for the detection of breast cancer and benign lesion particularly in dense breast and in young women.

U/S detected 8 patient (8%) of patient with fibrocystic disease, MMG shows 2 patient (2%) were normal 4 patient (4%) benign lesion 2 patient (2%) probably benign, table(7-4) and table (19-4), this record agrees with EMINE DEVOLLI-DISH et al 2009study,sensitivity and specificity of ultrasound was statistically significantly greater than mammography in patient with breast symptom for the detection of breast cancer and benign lesion particularly in dense breast and in young women.

U/S detected 2 patient (2%)of patient with hematoma, MMG shows 1 patient (1%)probably benign 1 patient (1%) suspicious abnormal, table (19-4),this record agrees with Teixidor HS,Kazam E 1977 study, U/S was helpful in differentiating between diffuse and discrete lesions.

U/S detected 3 patient (3%)of patient with ductectasia, MMG shows 1 patient (1%) probably benign 2 patient (2%) suggestive malignant, table (19-4),this record agrees with Teixidor HS,Kazam E 1977 study, U/S was helpful in differentiating between diffuse and discrete lesions.

U/S detected 4 patient (4%) of patient with phyllode tumor,MMG shows 2 patient (2%) benign 2 patient (2%) probably benign, table (19-4),this record agrees with Teixidor HS,Kazam E 1977 study, U/S was helpful in differentiating between diffuse and discrete lesions.

Characteristic of masses in ultrasound,61patient (61%)of masses shows hyper echoic,11 patient(11%) hypo echoic, anechoic were 7 patient (7%) and anechoic with internal echoes were 21 patient (21%) table(10-4),texture of masses 68 patient (68%) were homogenous and only32 patient (32%) were heterogonous table(11-4),outline of masses 83 patient (83%) were well define and 17 patient (17%) ill define table(12-4),posterior phenomena 53 patient (53%) shows enhancement, 17 patient (17%) with shadow and 30 patient (30%) without table (13-4),this duo to most of cases were benign .

Characteristic of masses in mammography 72 patient (74.2%) of masses shows hyper dense, 2 patient (2.1%) were hypo dense, 8 patient (8.2%) were isodense and 15 patient (15.5%) were normal, table(15-4).65 patient (67%) of masses shows regular in shape and only 17 patient (17.5%) were irregular and 15patient (15.5%) were normal, table (16-4).79 patient (81.6%) of patient shows normal skin status and only 18 patient (18.4%)shows thick skin, table (17-4).This all duo to most of patient had benign masses.

Ultrasound shows Fibro adenoma 39 patient (39%), simple cyst 14 patient (14%), lipoma 9 patient (9%), fibrpcystic disease 8 patient (8%), intramammilary lymphnode 1 patient (1%), hematoma 2 patient (2%), ductectassia 3 patient (3%), glactocele 1 patient (1%), phyllode tumor 4 patient (4%), abscess 3 patient (3%), ductal carcinoma 13 patient (13%) and lubar carcinoma 3 patient (3%). Table(19-4)

Mammography shows according to BI-RADS Negative finding 15 patient (15%) BI-RADS 1, benign masses 55 patient (55%) BI-RADS 2, probably benign8 patient (8%) BI-RADS 3, suspicious malignant 1 patient (1%) BI-RADS 4 and suggestive malignant 18 patient (18%) BI-RADS 5.Ther was 3 patient lactating and had breast abscess mammography not done duo to tenderness and density of breast. Table(19-4)

In Our result, the main age group affected with breast masses was (30<45)years 47 patient (47%),and the lower incidence in age group(60-75)years 12 patient(12%) table (1-4),the married women are more affected than single 76patient (76%) table (2-4),the higher incidence in para(0) 27 patient(27%) than multiparty 2 patient (2%) in para 8 table(3-4),the non lactating women more affected than lactating 93 patient (93%) table(4-4), 93 patient (93%) of women had no family history of breast masses table(5-4), the high incidence in women no used contraception than used 93 patient(93%)

table(6-4),the lateral upper quadrant is more affected than other site 48 patient (48%) table(8-4) and most of patient had no lymph nodes 75 patient (75%) table(9-4), this all due to randomization of sample collection.

5-2 CONCLUSION :

Our results indicate that breast density and age are important predictors of the accuracy of mammography.

Breast ultrasound is more accurate than mammography in symptomatic women 40 years or younger, mammography has progressive improvement in sensitivity in women 40 years or older. The accuracy of mammograms increased as women's breasts became fattier and less dense.

Also ultrasound was helpful in differentiating between diffuse and discrete lesions, also ultrasound may be the only aviable modality in pregnant and lactating women as it does not involve ionizing radiation. To evaluate non palpable abnormalities for which the mammographic diagnosis uncertain, to help exclude a mass in an area of mammographic asymmetric density, to confirm or better visualize a lesion seen incompletely or only one mammographic projection (e.g., near the chest wall) and to guide interventional procedures such as cyst aspiration , fine needle aspiration biopsy , and pre surgical location . Overall accuracy of ultrasound is better than Mammography and it is cost friendly so can be used as screening of suspected Ca breast lesion routine basis.

Mammography was better than ultrasound in diagnosis micro calcification.

5-3. RECOMMENDATIONS:

1. Ultrasound, mammography and biopsy should be available in all hospitals or diagnostic centers in Khartoum and the rural areas to save the patient time to help in early detection and diagnosis of the breast masses.
2. further studies are recommended by other diagnostic modalities such as computed tomography, magnetic resonance imaging, nuclear medicine for further evaluation of the breast masses.
3. Ultrasound should be use as screening tool for evaluation of the breast masses in young females under the age of 30 years
4. Women should be told about the benefits of breast self-exam, and the procedure for application (this should be started as health education in secondary school for all female students

REFERENCE:

1. Alexander R. Margulis, Charles. Gooding . Diagnostic radiology. First ed. library of Congress; USA: 1973. P. 308-312.
2. American Cancer Society., Detailed Guide: Breast Cancer What Are the Key Statistics for Breast Cancer?. American Cancer Society Cancer Resource. http://www.cancer.org/ docroot/home/ index.asp [Access May 16, 2008.]
3. Badgwell B.D., Giordano S.H., Duan Z.Z., Fang S., Bedrosian I., Kuerer H.M. et al. Mammography before diagnosis among women age 80 years and older with breast cancer. J. Clin. Oncol. 26 (15) 2482 – 2488
4. Boyd N.F., Rommens J.M., Vogt K. et al. Mammographic breast density as an intermediate phenotype for breast cancer. Lancet Oncol. 2005; 6798 - 808.
5. Brancato B[1], Bonardi R, Catarzi S, Iacconi C, Risso G, Taschini R, Ciatto S./Negligible advantages and excess costs of routine addition of breast ultrasonography to mammography in dense breasts/ Tumori. 2007 Nov-Dec;93(6):562-6.
6. C D. Haigensen. Diseases of the breast. 3rd ed. Sunders; Philadelphia: 1986.P. 3-32.
7. C.K. Warrick, C.B.E. Anatomy and physiology for radiographers. 5th ed. Edward Arnold; new Castle: 1976 .P.238-239
8. Carol M. Rumack, Stephanie R. Wilson, J. William charponeau. Diagnostic ultrasound. vol. 1. Mosby; London: 1991. P. 541-561.

9. Chan SW[1], Cheung PS, Chan S, Lau SS, Wong TT, Ma M, Wong A, Law YC/Benefit of ultrasonography in the detection of clinically and mammographically occult breast cancer/ World J Surg. 2008 Dec;32(12):2593-8.

10. Corsetti V[1], Ferrari A, Ghirardi M, Bergonzini R, Bellarosa S, Angelini O, Bani C, Ciatto S./Role of ultrasonography in detecting mammographically occult breast carcinoma in women with dense breasts../ Radiol Med. 2006 Apr;111(3):440-8. Epub 2006 Apr 11.

11. Crystal P., Strano SD., Shcharynski S., Koretz MJ. Using sonography to screen women with mammographically dense breasts. Am. J. Roentgenol. 2003; 181(1):177-182.

12. David Sutton. Textbook of Radiology and Imaging Volume II. St mary's hospital and medical school; London,UK:1963-1984.P(1454-1455)

13. Devin Dean. ultrasonography of the abdomen and superfacial scanning. part two. The burwin institute of diagnostic medical ultrasound; Lunenburg, Canada: 2005. P. 24 -33.

14. EMINE DEVOLLI DISHA, SUZANA MANXHUKA –KERLIU, HALIT YMERI, ARBEN KUTUOVCI: COMPARATIVE ACCURACY OF MAMMOGRAPHY AND ULTRASOUND IN WOMEN WITH BREAST SYMPTOMS ACCORDING TO AGE AND BREAST DENSITY/ BOSNIAN JOURNAL OF BASIC MEDICAL SCIENCES 2009; 9 (2): 133-136.

15. Grainger RG, Allison D.J. Grainge and Allisons Diagnostic Radiology Textbook of Medical Imaging. 5th ed. Churchill Livingstone an Imprint of Elsevier; UK: P. (1179-1188).

16. Hille H., Vetter M., Hackelöer BJ. Re-evaluating the role of breast ultrasound in current diagnostics of malignant breast lesions] Ultraschall Med 2004 ; 25 (6) :411-417

17. Hong Zhao,# Liwei Zou,# Xiaoping Geng, and Suisheng Zheng/Limitations of mammography in the diagnosis of breast diseases compared with ultrasonography: a single-center retrospective analysis of 274 cases/Eur J Med Res. 2015; 20(1): 49. Published online 2015 Apr 21. doi: 10.1186/s40001-015-0140-6

18. htp/www.ajronline.org/cgi/content/full/184/6/1788# SEC3/SEC3

19. http//plastic/fulltopic/topic113.htm, breast anatomy, Breast Parenchyma And Support Structures

20. http/www.breastcancer.org

21. http/www.cpmc.org/services/women/breast/breast_cyst.html##

22. http://faculty.washington.edu/alexbert/MEDEX/Fall/BreastPath_Obj

23. http://faculty.washington.edu/alexbert/MEDEX/Fall/BreastPath_Obj.7

24. http://fcd.cme.virginia.edu/breastcare/page.php?id=62

25. http://radiology.rsnajnls.org/cgi/content/full/213/3/889#SEC2/SEC2

26. http://radiology.rsnajnls.org/cgi/content/full/213/3/889/F

27. http://www.breast-cancer.ca/staging/solid-breast-nodules.htm

28. http://www.ceessentials.net/article40.html

29. http://www.imaginis.com/breasthealth/breast_anatomy.asp

30. http://www.imaginis.com/breasthealth/breast_image /15-20.html

31. http://www.jultrasound med.org/cgi/external_ref?, (Journal of Ultrasound in Medicine, Vol 15, Issue 9 637-644, Copyright © 1996 by American Institute of Ultrasound in Medicine) .
32. http://www.panafrican-med-journal.com/content/article/7/1/full
33. J.C.E Underwood. General and systemic pathology. 3rd ed. Churchill Livingstone; London: 2000. P. 469-494 .
34. Joaquin Santolaya, Forgas, Didier Lemery. Interventional ultrasound in obstetrics, Gynecology and the Breast. First ed. Blackwell Science; London:1998. P. 243-264 .
35. John W. Hole Jr. Human anatomy and physiology. First ed. Brown; USA: 1978.P. 745-747.
36. Journal of ultrasound in medicine. vol.26. number 6. june2007.P.807-824.
37. Kailash Singh, Tariq Azad, Ghanshyam Dev Gupta. The Accuracy of Ultrasound in Diagnosis of Palpable Breast Lumps. JK science. Vol. 10 No. 4, Oct-Dec 2008. P.186-188.
38. Kaplan S.S. Clinical utility of bilateral whole-breast US in the evaluation of women with dense breast tissue. Radiology 2000; 21(4):317-324
39. Kolb T.M., Lichy J., Newhouse J.H. Comparison of the performance of screening mammography, physical examination, and breast US and evaluation of factors that influence them: an analysis of 27,825 patient evaluations. Radiology 2001; 22(1): 221-224

40. Kopans D.B., Negative mammographic and US findings do not help exclude breast cancer. Radiology. 2002 ; 222 (3) : 857-858

41. Leconte I[1], Feger C, Galant C, Berlière M, Berg BV, D'Hoore W, Maldague B /Mammography and subsequent whole-breast sonography of nonpalpable breast cancers: the importance of radiologic breast density/. AJR Am J Roentgenol. 2003 Jun;180(6):1675-9.

42. Lee, S.H. et al. Metastatic Tumors to the Breast: mammographic and ultrasonographic findings, J.ultrasound med 19 : 2000.P.257-262.

43. Moy L., SlanetzP.J., Moore R. et al. Specifi city of mammography and ultrasound in the evaluation of a palpable abnormality: retrospective review. Radiology 2002; 225:176-181.

44. Osako T[1], Takahashi K, Iwase T, Iijima K, Miyagi Y, Nishimura S, Tada K, Makita M, Akiyama F, Sakamoto G, Kasumi F/Diagnostic ultrasonography and mammography for invasive and noninvasive breast cancer in women aged 30 to 39 years/ Breast Cancer. 2007;14(2):229-33.

45. Prasad SN[1], Houserkova D/.A comparison of mammography and ultrasonography in the evaluation of breast masses./ Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2007 Dec;151(2):315-22.

46. Rapp C. Breast Ultrasound: from fundamentals to future. AIUM,2000.

47. Rapp C. Sonography of the Breast: multi-specialty symposium. Toranto, Canada: 1999.

48._ Robert A.Fosbinder, Charles A.Kelseky.Essentials of Radiologic Science. Interrnational edtion.MC. Graw-hillcompanics; United State of America: 2002.P. (273-279).

49. Roderick N M Mac Sween and Keith Whaley. Muir's textbook of pathology. 13th ed. Arnold; London: 1992. P. 139-155.

50. Roderick N M Mac Sween and Keith Whaley. Muir's textbook of pathology. 13th ed. Arnold; London: 1992. P. (139-155).

51. Rungnapa Chairat, ، Adisorn Puttisri, Asani Pamarapa, Sahatham Samintharapanya, Chamaiporn Tawichasri, and Jayanton Patumanond /Are Both Ultrasonography and Mammography Necessary for Cancer Investigation of Breast Lumps in Resource-Limited Countries?/ ISRN Oncol. 2013; 2013: 257942. Published online 2013 Aug 28. doi: 10.1155/2013/257942

52. Sandra L.Hagen – Ansert. Text book of diagnostic ultrasonography. 4th edition. Vol. 1. Mosby; USA: 2001. P. 333-349

53. Schonberg M.A., Ramanan R.A., McCarthy E.P., Marcantonio E.R. Decision making and counseling around mammography screening for women aged 80 or older. J. Gen. Intern Med. ; 21 (9) 979-985

54. Smith, Darell. Breast Ultrasound. Radiologic Clinics of North America vol. 39, No 3. 2001.

55. Stanvros,J . Breast ultrasound . Winnipeg ; Canada:1999.

56. Syed Amir Gilani, Four Weeks Basic Ultrasound training course book let.3. P. 1-9.

57. Syed Amir Gilani. Guidelines and protocols for medical diagnostic ultrasound. First ed. The burwin institute of ultrasound Asian and middle east branch; Lahore, Pakistan: 2002. P. 255-259 .

58. Syed Amir Gilani. Tips to basic ultrasonography. 2d edition. the burwin institute of ultrasound Asian and middle east branch; Lahore, Pakistan: 2001. P. 70-74.

59. Teixidor HS, Kazam E/Combined mammographic-sonographic evaluation of breast masses/. AJR Am J Roentgenol. 1977 Mar;128(3):409-17

60. Thomas Stavros. Breast Ultrasound. lipincott Williams; London: 2004. P.16-55.

61. Vercauteren L.D., Kessels A.G., van der Weijden T., Koster D., Severens J.L., van Engelshoven J.M., et al. Clinical impact of the use of additional ultrasonography in diagnostic breast imaging. Eur. Radiol. 2008; 18(10):2076-2084

62. Vinay Kumar, Ramzi S. Cortan, Stanley L. Robbins. Basic pathology. 3rd ed. Saunders; Philadelphia: 1981. P.585-594.

63. W.A.D Anderson, Thomas M.Scotti. Synopsis of pathology. 10th ed. Mosby; London: 1980. P. 667-679.

64. Wang J., Chang K.J., Kuo W.H., Lee H.T., Shih T.T. Efficacy of mammographic evaluation of breast cancer in women less than 40 years of age: experience from a single medical center in Taiwan. J Formos Med Assoc. 2007; 106(9): 736-747.

65. Zonderland H.M., Coerkamp E.G., Hermans J., et al. Diagnosis of breast cancer: contribution of US as an adjunct to mammography. Radiology. 1999; 213(2):413-422

66. Zonderland HM. Th e role of ultrasound in the diagnosis of breast cancer. Semin Ultrasound CT MR. Aug 2005; 11(7): 167-172.

67. Zwiebel,W. Sohaey,R. Introduction to ultrasound. Saunders; Philadelphia: 1998.

Figures: sonographic images which are collected from the study.

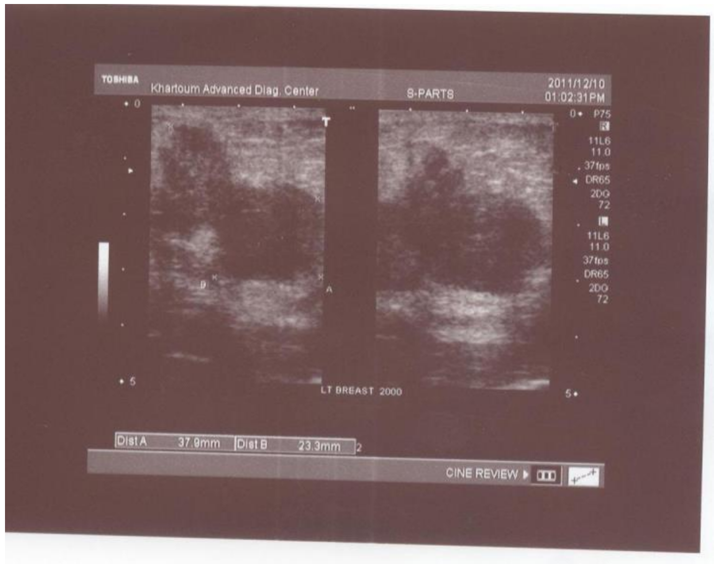


Figure (5.1): breast ultrasound image of 65 years old female showed irregular, hypoechoic mass located in the left UOQ at 2:00 o'clock measured 3.8x2.3cm, the diagnosis was invasive ductal adenocarcinoma.

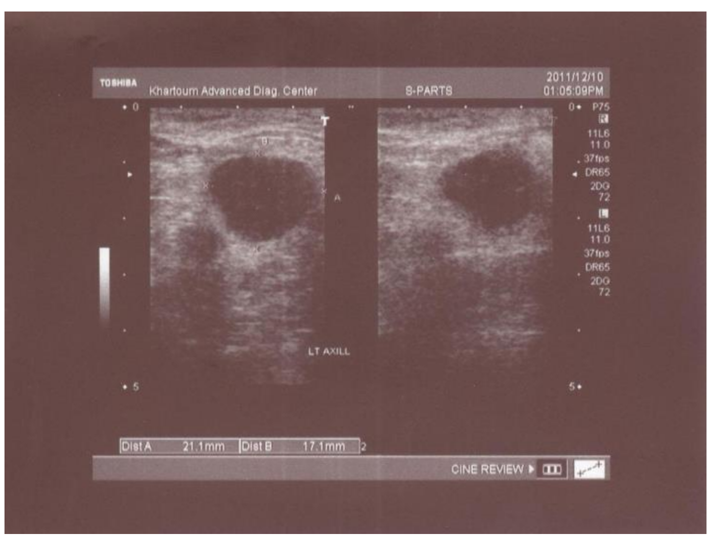


Figure (5.2): Enlarged left axillary lymph node measures 2.1x1.7cm found in the same patient mention above.

Figure (5.3): breast ultrasound image of 40 years old female showed irregular, hypoechoic mass with ill-defined margins located in the left UIQ at 11:00 o'clock measured 1.9x1.4cm, the diagnosis was ductal adenocarcinoma.

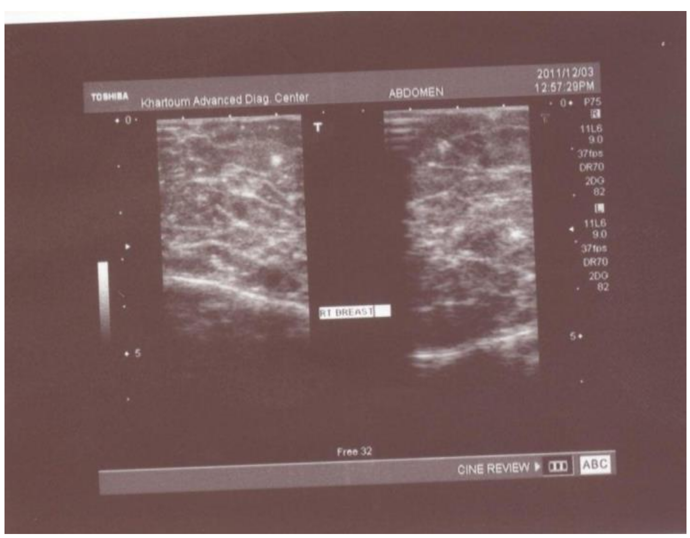


Figure (5.4): breast ultrasound image of 37 years old female showed, hypoechoic mass spread over all left breast with micro calcifications, the diagnosis was invasive ductal adenocarcinoma.

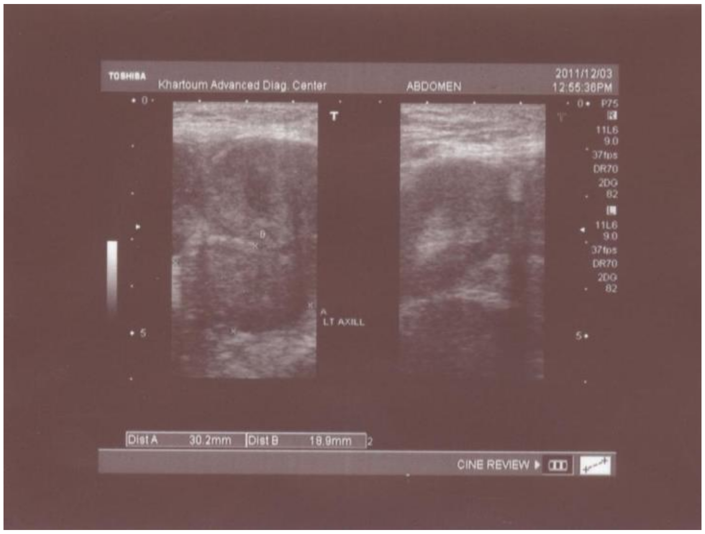


Figure (5.5): Enlarged left axillary lymph node measured 3x1.9cm found in the same patient mention above.

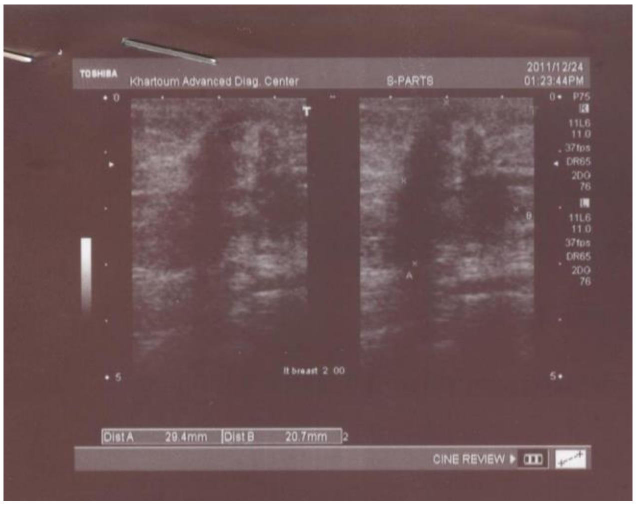


Figure (5.6): breast ultrasound image of 70 years old female showed irregular, hypoechoic mass located in the left UOQ at 2:00 o'clock measured 2.9x2.1cm, the diagnosis was invasive ductal adenocarcinoma.

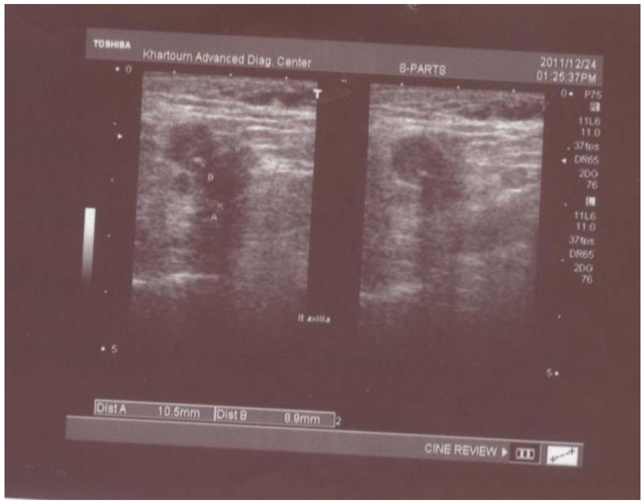


Figure (5.7) :Enlarged left axillary lymph node found in the same patient mention above.

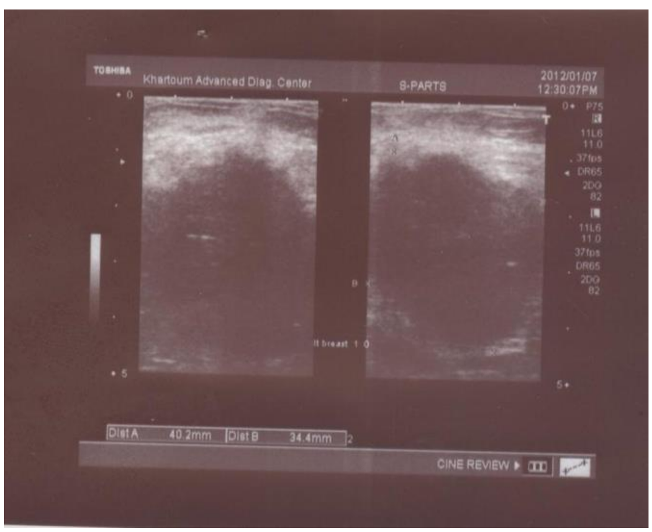


Figure (5.8): breast ultrasound image of 65 years old female showed irregular shape, hypoechoic mass with ill-defined margins located in the left UOQ at 1:00 o’clock measured 4x3cm, the diagnosis was ductal adenocarcinoma

Figure (5.9): Enlarged right axillary lymph node measures 2.5x2.1cm found in the same patient mention above.

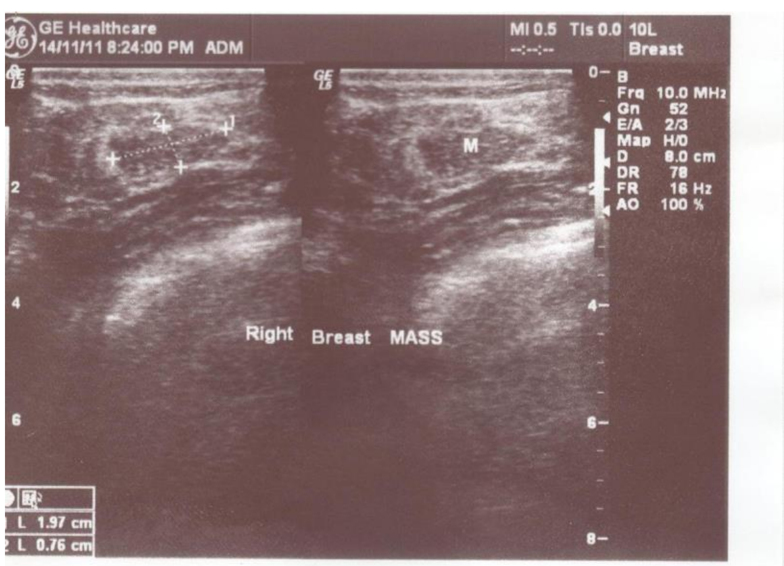


Figure (5.10): breast ultrasound image of 38 years old female showed hypoechoic mass located in right UOQ at 11:00 o’clock measured 2x0.8cm, diagnosis was fibroadenoma.

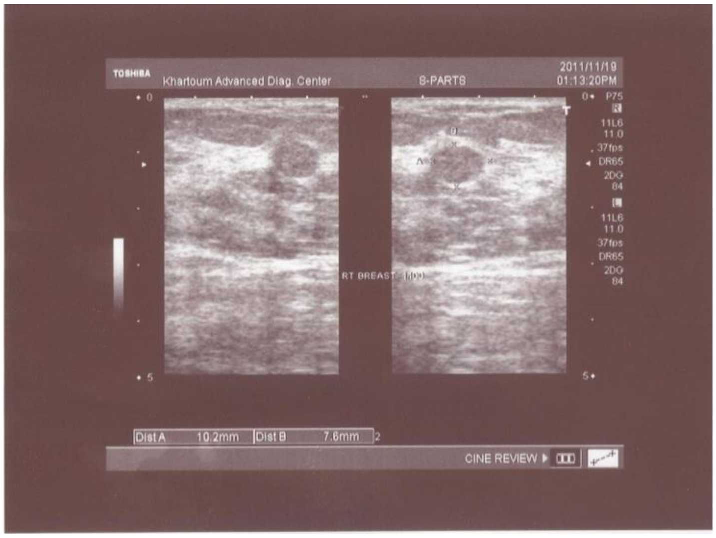


Figure (5.11): breast ultrasound image of 23 years old female, hypoechoic mass with posterior enhancement in right UIQ at 2:00 o'clock measured 1x0.8cm diagnosis was fibroadenoma.

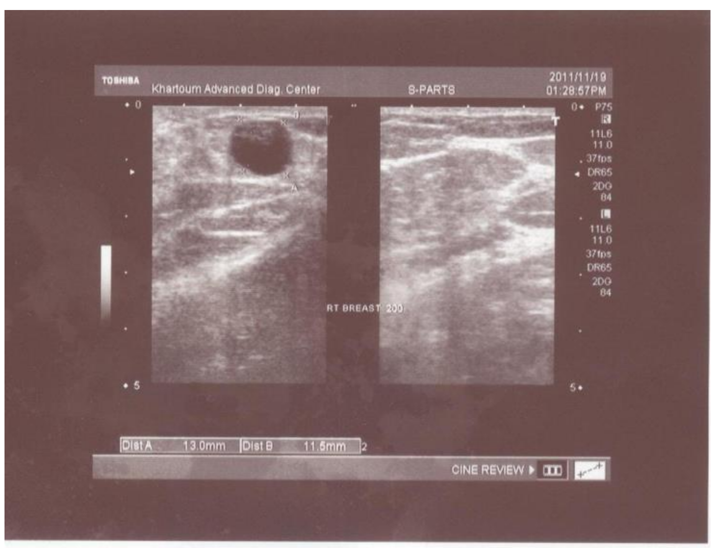


Figure (5.12): breast ultrasound image of 32 years old female, right breast cyst located in UIQ at 2:00 o'clock measured 1.3x1.2cm.

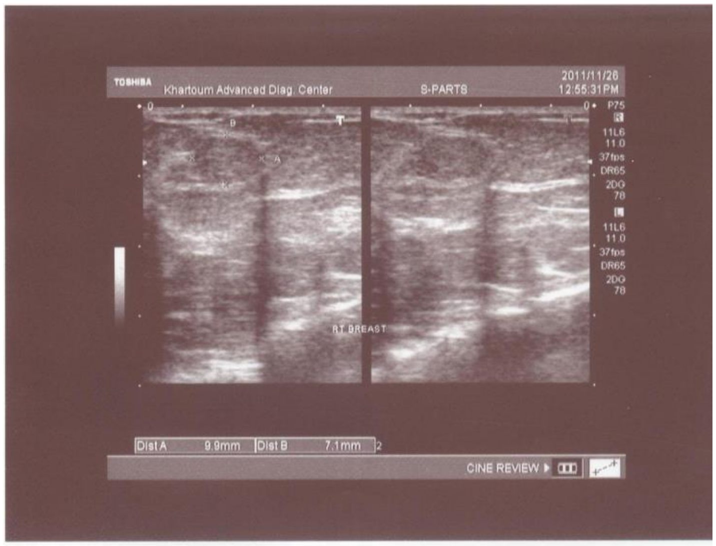


Figure (5.13): breast ultrasound image of 41 years old female showed hypoechoic mass with edge shadowing and posterior enhancement located in right UIQ at 2:00 o'clock measured 1x0.7cm, diagnosis was fibroadenoma.

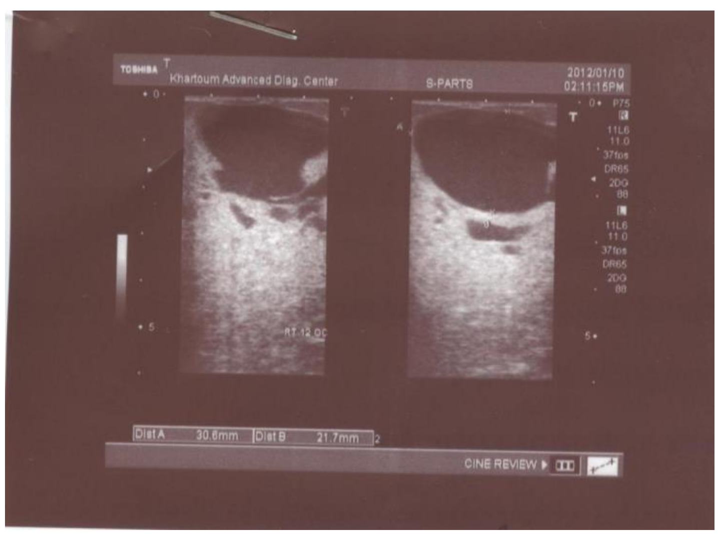


Figure (5.14): breast ultrasound image of 30 years old lactating female showed homogenous anechoic area with hypoechoic grains moving during the ultrasound scan, with posterior enhancement located in right UOQ at 12:00 o'clock measured 3.1x2.2cm, the diagnose was glactocele.

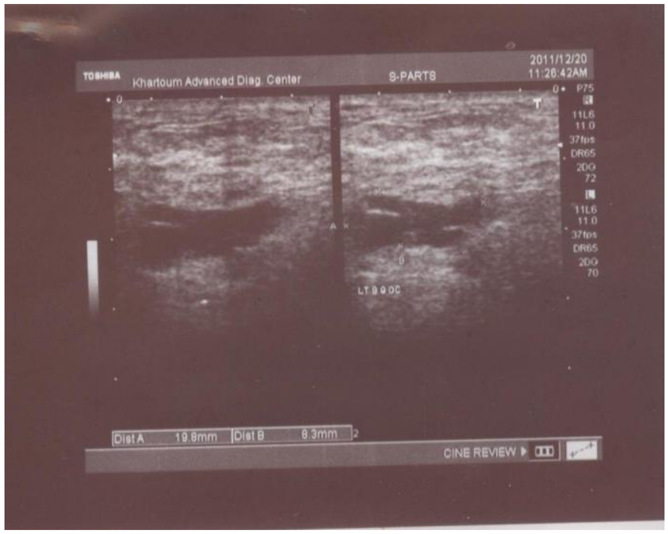


Figure (5.15): breast ultrasound image of 25 years old female showed, regular wall hypoechoic and anechoic areas with posterior enhancement located in left LIQ at 8:00 o'clock measured 2x0.8cm, the diagnosis was fibrocystic changes.

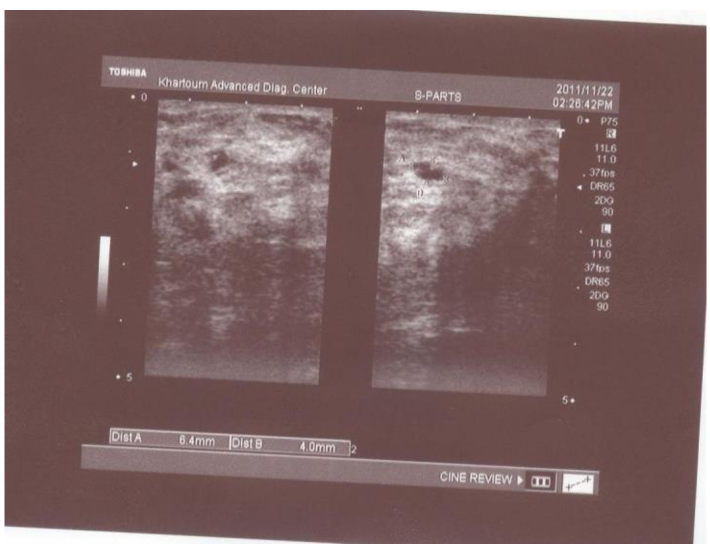


Figure (5.16): breast ultrasound image of 25 years old female showed, regular wall hypoechoic and anechoic areas with posterior enhancement located in left LIQ at 8:00 o'clock measured 2x0.8cm, the diagnosis was fibrocystic changes.

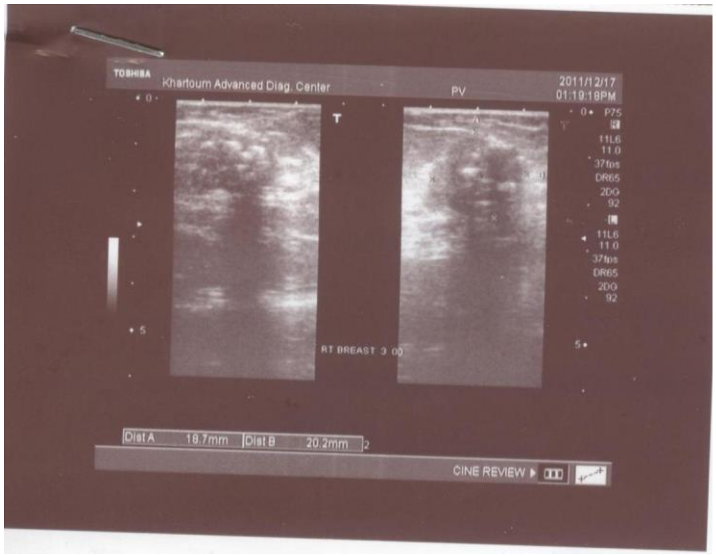


Figure (5.17): breast ultrasound image of 60 years old female showed well circumscribed, hypoechoic mass with macro calcifications with shadowing located in right UIQ at 3:00 o'clock measured 1.9x2 cm, the diagnosis was calcified fibroadenoma.

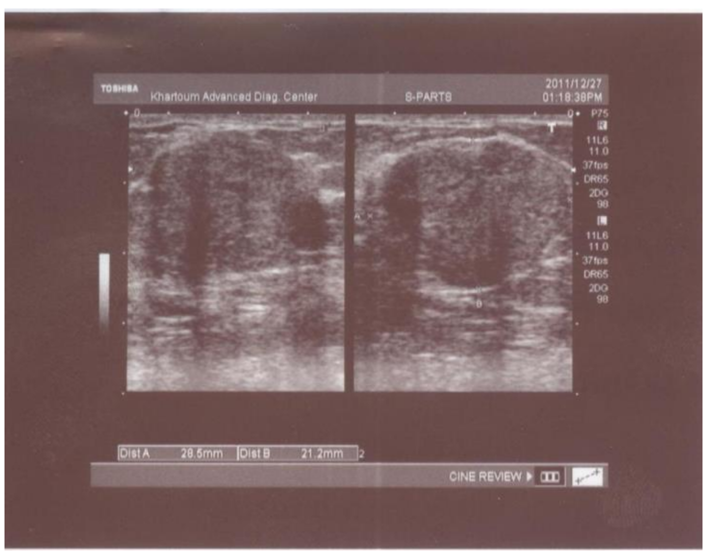


Figure (5.18): breast ultrasound image of 30 years old female showed an oval, well circumscribed, hypoechoic mass with posterior enhancement located in right LIQ at 4:00 o'clock measured 2.9x2.2cm, the diagnosis was fibroadenoma.

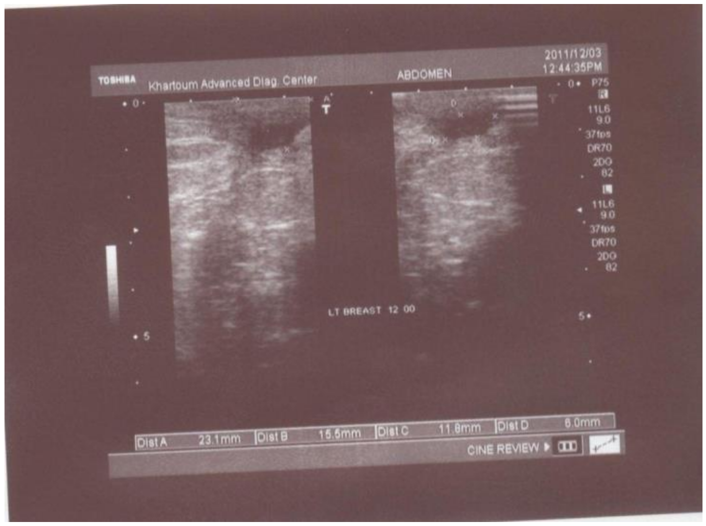


Figure (5.19): breast ultrasound image of 42 years old female showed mass with mixed echogenicities(hypo and anechoic)with posterior enhancement located in left UOQ at 12:00 o'clock measured 2.3x1.6cm, the diagnosis was breast abscess.

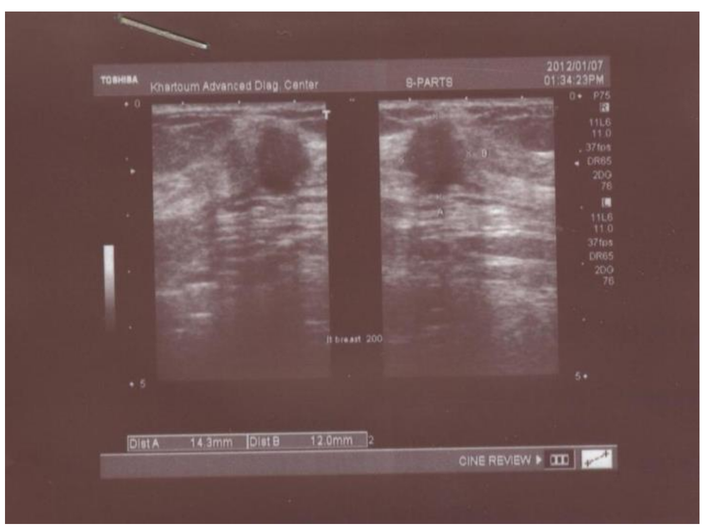


Figure (5.20): breast ultrasound image of 60years old female, left breast cyst located in UOQ at 2:00 o'clock measured 1.4x1.2cm.

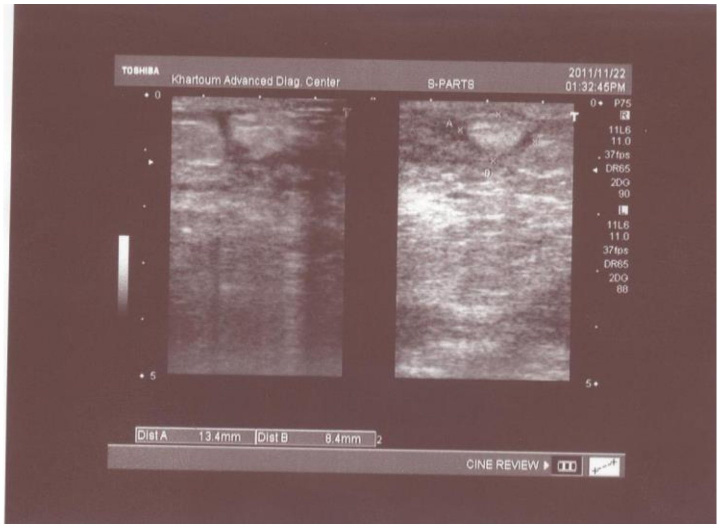
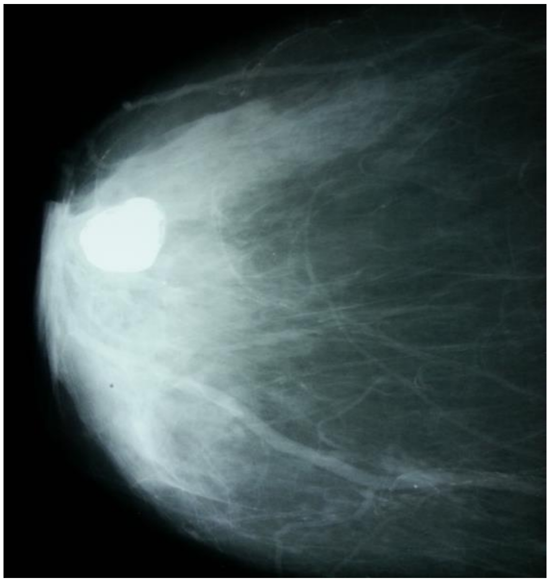


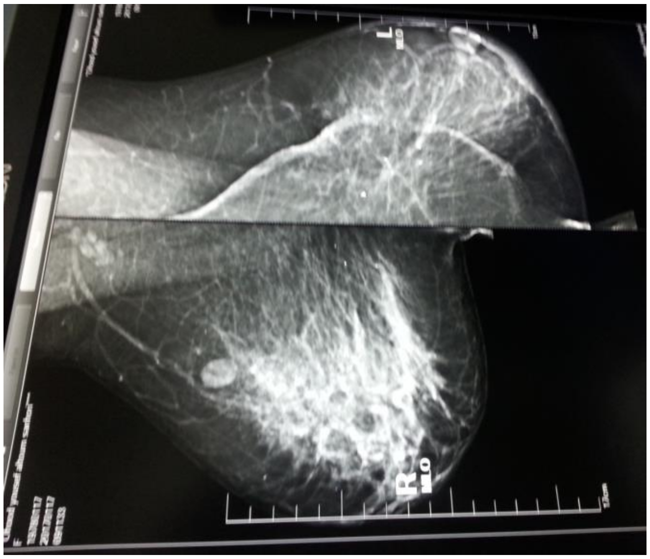
Figure (5.21): breast ultrasound image of 32 years old lactating female showed homogenous hyperechoic area located in right UOQ at 11:00 o'clock measured 1.3x0.8cm , the diagnose was glactocele.

Figure (5.22): breast ultrasound image of 65 years old female showed oval, homogenous, hyperechoic lesion with regular shape located in the right UOQ at 12:30 o'clock measured 2.7x1cm, the diagnosis was lipoma.

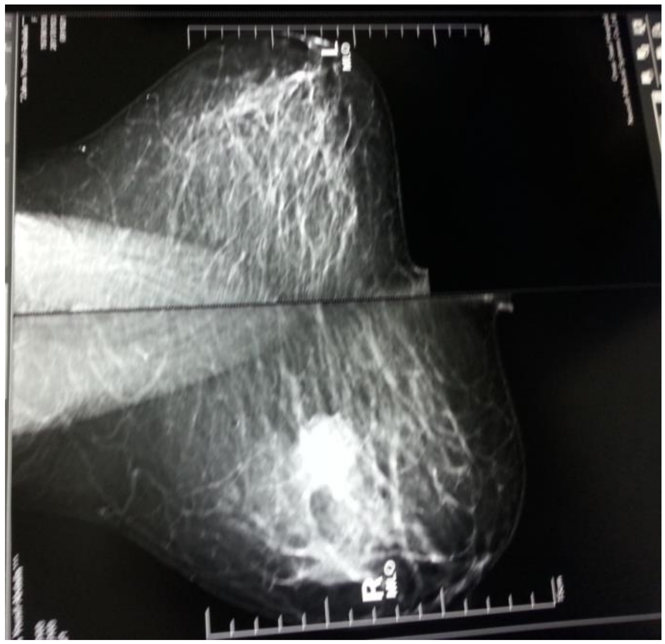
Figure: mammography image which were collected from study:



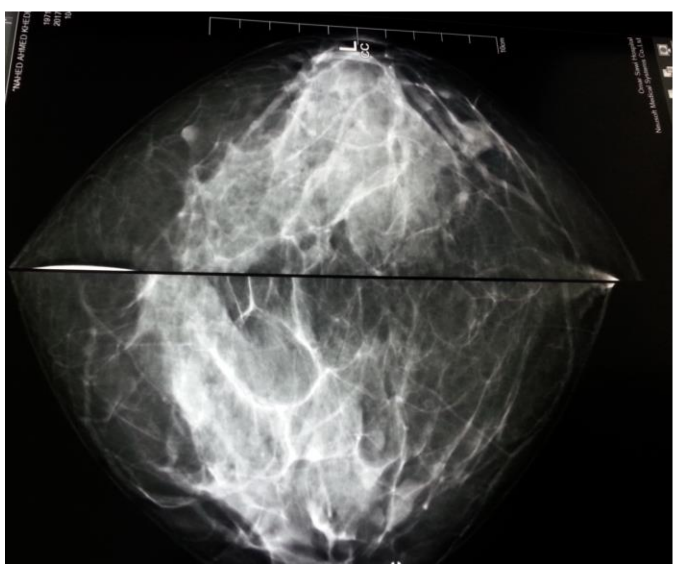
(Figure 5.23) breast mammography image of 73 years old female showed calcification.



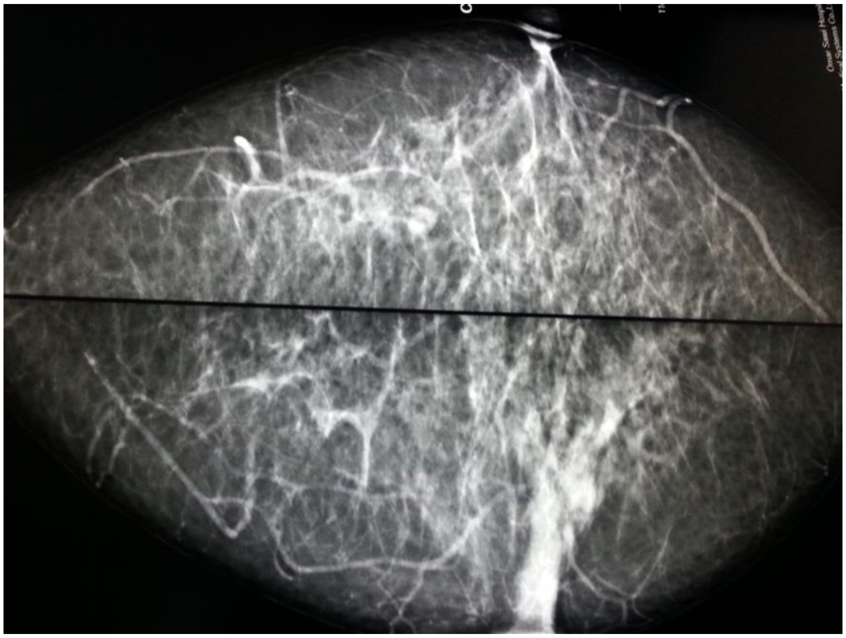
(Figure 5.24) breast mammography image of 37 years old female showed intra mamilary L/N



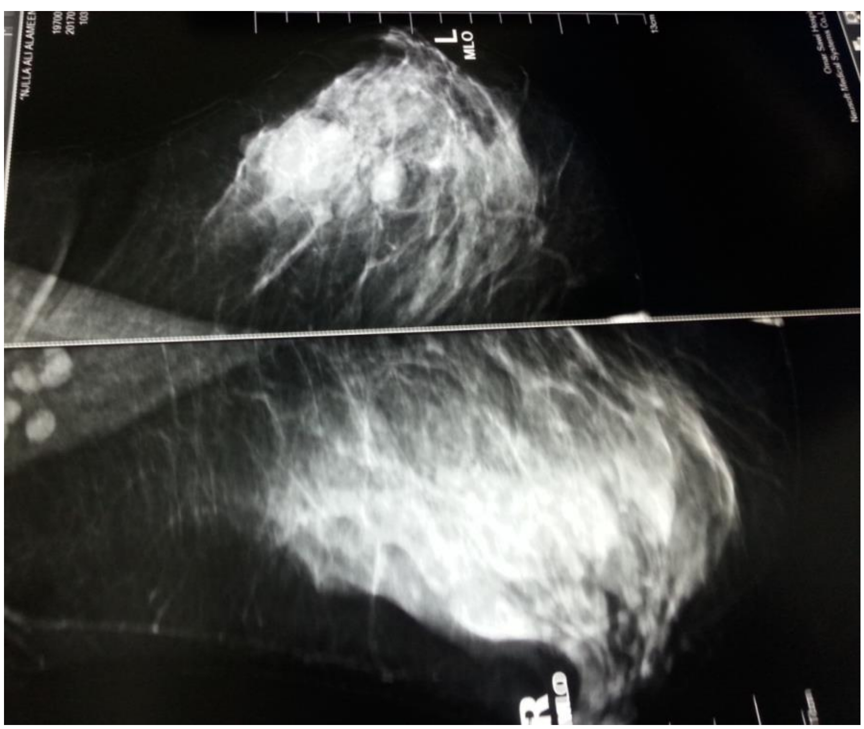
(Figure 5.25) breast mammography image of 73 years old female showed fibro adenoma



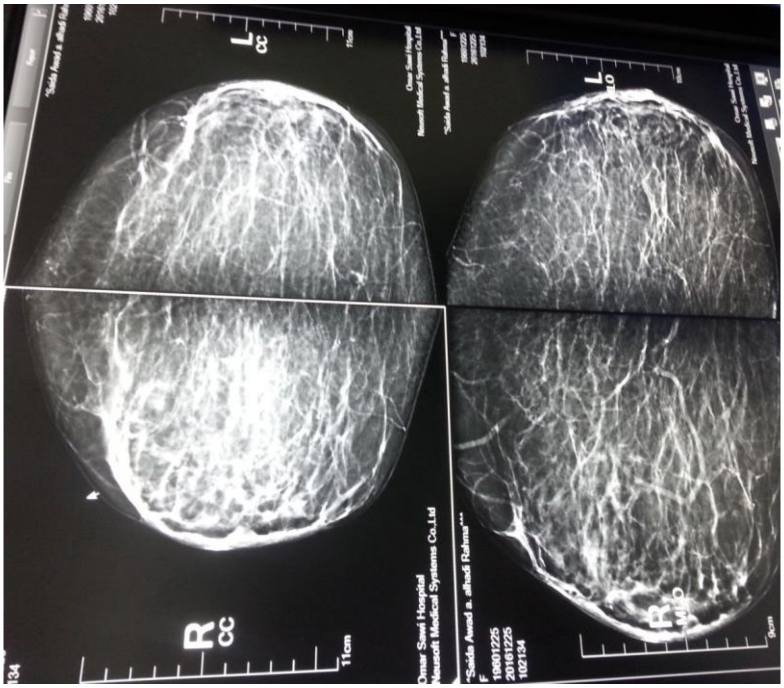
(Figure 5.26) breast mammography image of 43 years old female showed normal



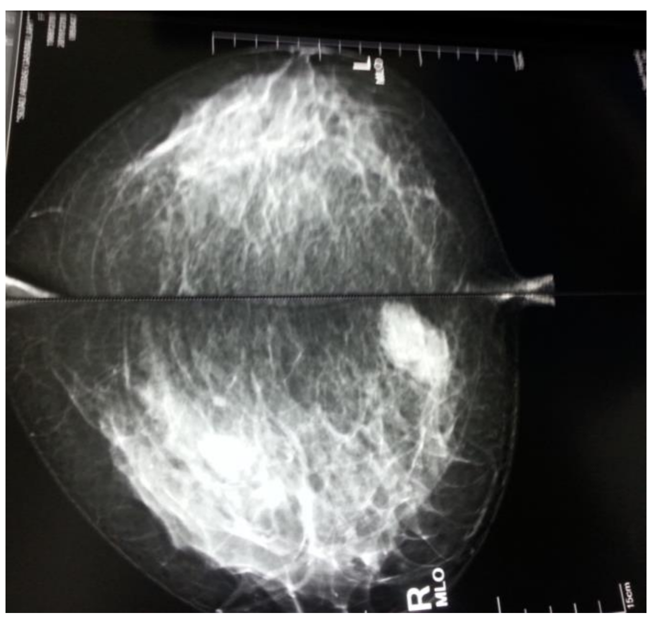
(Figure 5.27) breast mammography image of 55 years old female showed ductectasia



(Figure 5.28) breast mammography image of 55 years old female showed axillaries L/N



(Figure 5.29) breast mammography image of 70 years old female showed normal



(Figure 5.30) breast mammography image of 43 years old female showed fibro adenoma

Sudan University of Science and Technology, Khartoum- Sudan

Deanship of Graduate Studies and Scientific Research

Master in Diagnostic ultrasound

The role of ultrasound and mammography in the diagnosis of breast masses

Date: ………………………………… No: ( )

Patient data:

1-patient age ……………………………..

2-Clinical history …………………………………………………

3-Past medical history ……………………….........................

4-Family history: yes( ) ………… No( )

5- married : Yes ( ) No ( )

6- parity : …………………………..

7- use contraception Yes ( ) ………….. No ( )

8 - Clinical finding:

……………………………………………………………………………………

…………………………………………………………

Ultrasounf findings :

9-Shape: oval ( ) round ( )

lobulated( ) irregular ( )

10-margins :

well circumscribed ( ) ill defined ( )

11-posterior echoes :

enhanced ( ) unaffected( ) decreased(shadow) ( )

12- echogenicity (intensity of internal echoes compared to breast tissue) :

hyper echoic ( ) hypoechoic ( ) anechoic ( )

13- echotexture (homogeneity of internal echoes) :

homogenous ( ) heterogeneous ( )

14- presence of calcifications :

macro calcifications ( ) micro calcifications ( )

No calcifications ( )

15- Final diagnosis ……………………………………

Mammography finding:

16-Shape: regular ( ) irregular ( )

17- Density compare to surrounded tissues:-

hyperdense ( ) hypodense ( ) isodense ( ) none (

18-Presence of calcification:

Yes ( ) No ( )

19-Final diagnosis………………………………………………..