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ROLE OF ULTRASONOGRAPHY IN DIAGNOSIS OF PALPABLE BREAST LUMPS: ONE YEAR CROSS SECTIONAL STUDY

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Abstract

Background: The breast is commonest site for development of cancer in female and accounts for around 1/5 of all malignancies in the sex. In the past few years ultrasonography of the breast for evaluation of radiologically dense breasts or cysts has been become the 1st line of investigation.

Aims and Objectives: To assess the role of ultrasonography in diagnosis of palpable breast lumps.

The most important clinical use of ultrasound imaging is its ability to differentiate between solid and cystic masses, benign and also by knowing the prior diagnosis the need for open biopsy and followed by surgery, the cost and time involved can be saved. In patients with dense breasts the FNAC may not hit the exact site of mass and can give inconclusive diagnosis. When Ultrasonography can pick up abscess of breast, needle aspiration can be done instead of incision and drainage. Breast ultrasonography should be considered as an extension of physical examination and it will improve the care available to patients and subsequently improve outcomes. Ultrasonography can expedite both diagnosis and treatment

Results: On analysis, 68 patients were included in study. The sensitivity of ultrasonography for malignancy was 89.47%. The specificity of ultrasonography was malignant & benign lesions 100%. The positive predictive value of ultrasonography was 100%.

Conclusion: Ultrasound has higher sensitivity in diagnosing malignant lesions hence should be considered as first line diagnostic tool for breast lesions.

Keywords: Ultrasonography, Breast lump

Introduction

The breast is commonest site for development of cancer in female and accounts for around 1/5 of all malignancies in the sex. In the past few years ultrasonography of the breast for evaluation of radiologically dense breasts or cysts has been become the 1st line of investigation.[23] The most important clinical use of ultrasound imaging is its ability to differentiate between solid and cystic masses, benign and malignant, and also by knowing the prior diagnosis the need for open biopsy and followed by surgery, the cost and time involved can be saved.[23] In patients with dense breasts the FNAC may not hit the exact site of mass and can give inconclusive diagnosis. When Ultrasonography can pick up abscess of breast, needle aspiration can be done instead of incision and drainage. Breast ultrasonography should be considered as an extension of physical examination and it will improve the care available to patients and subsequently improve outcomes. Ultrasonography can expedite both diagnosis and treatment.[23]

The advantage of using ultrasonography in breast is: Painless and cost effective, immediate assessment and diagnosis of lumps in same clinical visit, it is 1st line investigation, it does not require radiation and contrast, readily available and easy to repeat allowing comparison with previous findings, ability to identify benign lesions. accurate surgical planning when preoperative diagnosis is known.[23] Ultrasonic examination of the breast has established a useful place in the diagnosis of breast lesions. It can be a valuable complement to physical examination and mammography. It is non invasive and does not involve radiation exposure.[41] Kobayashi in 1982 reviewed the development of ultrasonic detection.[40] Wild and associates in 1952 began with a unidimensional A-mode display, which rapidly developed into a two dimensional imaging technique described as an Echo graph.[42] Howry and co-workers reported the first echo graphic demonstration of a scirrhous carcinoma using a two dimensional B-mode radio scanner in 1954.[41] Today there are two techniques for breast ultrasonography in use: Hand held real time ultrasonography. Whole breast computed ultrasonography with multiple step sections[41]. In a study done by Rosner and blaird in 1985 showed the accuracy of detecting cancers less than 2cm is 57% and 23% for in situ carcinomas[41]. In an other study done by Rubin and colleagues in 1985showed ultrasonography as a useful adjunct to x-ray mammogram in three groups of patients[41]: patients

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with dense breasts and localized symptoms or a suspicious area on x-ray mammogram, patients with non palpable abnormalities discovered on mammogram, Those with palpable masses considered indeterminate on a mammogram. In an other study done by Mc Sweeney and Murphy in 1985 showed that ultrasonography is most accurate in cyst detection, but inability in picking micro calcifications[41]. In another study done by Lister D; Evans AJ et al in 1998 on 205 clinically palpable breast masses, showed the higher sensitivity and specificity of ultrasound versus mammography in detection of invasive carcinoma[26]. In an other study done by Tariq mansoor et al, in 2002 on 100 palpable breast masses showed the role of ultrasonography in differential diagnosis of palpable breast lumps (sensitivity for ca-57%). Its ability to pick up benign and malignant lesions[23]. In an other study done by Murad M, Bari v in 2004 on 100 solid breast masses showed that ultrasound features can differentiate between benign and malignant masses[32]. In a study done by S.R.C.Benson, MD., F.R.C.S. et al, in 2004,of 796 patients with breast cancer ultrasound was positive in 710 and mammography in 706 ,showing that ultrasound(sensitivity-92%) is better than mammography as a first line diagnostic tool for detecting invasive breast cancer[31]. In an other study done by Ghazala malik et al, in 2006 on 56 patients with breast lump, showed the advantages and ability of sonography (sensitivity-68%) for evaluation of breast masses in young patients and avoiding the need for biopsy[24]. In an study done by Dennis R Holmes, M D et al, 2006 showed the advantages of ultrasonography in breast and ultrasound guided procedures done by surgeons can improve patient compliance and better treatment at one stop breast clinics[29]. In a study done by Hernan I. Vargas, M.D et al, 1n 2004, a study of 176 patients with palpable breast cysts, showed the use of ultrasound in risk stratification of malignancy in breast cysts[30]. In a study done by Margaret Thompson et al, 1n 2007 showed the uses of ultrasound in breast surgery[25].

The human breast makes its appearances in the 6th week of foetal life as an ectodermal thickening extending from the axilla to the groin[37]. This is called mammary ridge or milk line. In human beings the distal 2/3rd of this line disappears rapidly, only pectoral portion thickens and takes the appearance of lens shaped thickening. Gradually from this thickening on the milk line growth of ectoderm occurs in the form of 15 to 20 solid cords to form the rudimentary mammary gland. These cords shows bulbous dilatation at their ends from which alveoli of the gland develops in the 5th months of foetal life and these gradually turns into ducts by hollowing during 7th or 8th months of foetal life[37] .At this period the skin from which ducts develop shows a small depression which corresponds to the nipple and the ducts turns to be milk duct. In the later weeks of foetal life the aneots becomes canalized later on just before or soon after birth the mesenchyma underlying this depression proliferate and makes it everted to form nipple. The 15 to 20 milk ducts and their alveoli ultimately form 15 to 20 lobules at the age of puberty.[37]

Anatomy

The breast is a modified sweat gland lying on the pectoral fascia and musculature of the chest wall and surrounded by skin and subcutaneous fat[37].

1) Transversely it extends from the side of Sternum to near the mid axillary line.

2) Vertically it extends from 2nd to 6th rib.

3) The superolateral part of the breast is prolonged upwards and laterally towards axilla forming the 'axillary tail of Spence' which pierces through deep fascia to lie in close relationship with the pectoral group of axillary lymph nodes. The foramen of the deep fascia through which the axillary tail reaches the axilla is called 'Langer's foramen'. The deep surface of breast is slightly concare and is in direct relation with the deep fascia which separates the breast from the following muscles[37]. Pectoralis major, Serratus anterior, Obliques externs abdominis and the oponeurosis of the last, Muscle as it forms the anterior wall of the sheath of the rectusabdominis[37].

2/3rd of the breast lies on pectoralis major and fascia covering it. Lateral 1/3rd lies on Serratus anterior and inner and lower most small portion lies on aponeurosis of external oblique muscle[37].

Between breast and deep Fascia there is a space containing loose areolar tissue which is known as retro mammary or sub mammary space and this allows breast to move on deep fascia covering pectoralis major.

Processes from the deep surface of the gland cross retro mammary space to fuse with the pectoral fascia. These are called ligaments of cooper.

The nipple is a Cylindrical or conical eminence which projects from just below the Centre of the anterior surface of the breast and usually lies at the level of the 4th Intercostals space. It is traversed by 15 to 20 milk ducts (lactiferous ducts) which opens by minute orifices on its wrinkled tip. The bulk of the nipple is made up of unstrapped muscle fibers arranged circularly and longitudinally[37].

The base of the nipple is encircled by a more pigmented skin which is called areola. The skin of the areola contains numerous sebaceous glands called the areolar glands which become enlarged during pregnancy and lactation to form Montgomery gland. There is no fat immediately beneath the skin of the areola and nipple[37].

Structure of the breast

The breast consist of (1) Gland tissue, (2) Fibrous tissue, (3) Fatty tissue in the interval between the lobes[34]

The gland tissue is of pale reddish firm and lobulated mass. It consists of 15 to 20 lobes connected together by areolar tissue. The lobes in turn are composed of lobules which consist of a cluster of rounded alveoli which opens into smallest branches of the lactiferous ducts[34]. Subcutaneous tissue encloses the gland and sends numerous septa into it to support its various lobules. Fibrous septa run from the pectoralis fascia around the breast lobules through the overlying fat to the superficial fascia and the dermal layer of the skin. These are suspensory ligaments of cooper[34].

Arterial supply of breast

There are three major arterial supply to the breast [37].

(1) Perforating branches of the internal mammary artery which penetrates through the 1st, 2nd, 3rd, and 4th intercostals spaces just lateral to the sternum through the pectoralis major and enter the medial part of the breast. This supplies more than 50% blood to the breast.

(2) Lateral mammary branch of the lateral thoracic artery is the second source of blood supply to the breast lateral thoracic artery is a branch of axillary artery and courses along the pectoralis minor muscle.

(3) The third source of blood supply comes from the pectoral branch of acromiothorasic artery also a branch of axillary artery. This supplies the posterior part of breast.

(4) The other sources of blood supply come from:

(a) Superior thoracic branch of the 1st part of axillary artery.

(b) Lateral perforating branches of the intercostal artery.

(c) Branch from sub scapular artery which contributes very small amount of blood supply[34].

Venous drainage

Classified into - Deep Veins, Superficial veins[33].

Deep veins of the mammary glands drain along the roots of the corresponding arterial supply so the major venous drainage is through the perforating veins into the internal mammary veins. The next way of drainage is though multiple tributaries following the path of the lateral thoracic artery into the axillary veins. Third major venous drainage is along the lateral perforating branches into the intercostal veins. These intercostal veins communicate to the vertebral veins.

Superficial Veins[33]: Superficial veins are quite rich and sometimes become dilated during pregnancy and over underlying neoplasm majority of these superficial veins drains into the internal mammary veins and axillary veins. Some of these veins also drain into the superficial veins of the neck.

The lymphatics

Classified into - Superficial lymphatics - draining skin, Deep lymphatics - draining mammary gland[34].

1. By the most of the lymphatics from the skin overlying the breasts along with the

Subareolar plexus drains into the pectoral group of axillary lymph nodes. Only a small portion overlying the media! Part of the breast drains into the internal thoracic (mammary) group of lymph nodes. The lymphatics from the medial aspect of the breast often decussate in the midline and drain into the internal mammary group of the other side also. Intermammary lymph nodes are 4 to 5 in number on each side.

2. Lymph Vessels of the mammary gland originate in a plexus in the interlobular connective tissue and in the wall of the lactiferous ducts. Efferent vessels from these plexuses pass around the anterior boarder of the axilla pierce the axillary fascia and end into pectoral group of axillary lymph nodes. Some lymph vessels from the upper part of the breast may drain into the infraclavicular or interpectoral nodes in the deltopectoral groove or direct to the apical group of lymph nodes. A few lymph nodes lie between the pectoralis major and minor muscle which are known as Rotter's node. 75% of the lymphatics from the breast drain into axillary lymph nodes. The lymphatics from all the group of axillary lymph nodes ultimately drains into apical group of lyrnph nodes

3. And from these efferent vessels unite to form the 'subclavian trunk' which also drains the supraclavicular lymph nodes and opens into the right lymphatic duct on the right side and to the thoracic duct on the left side [33].

Majorities of the lymph vessels from the medial aspect of the breast which comprises less than 25% of lymph drainage follow the perforating branches into the internal mammary group of lymph nodes only occasionally a few lymph vessels from the breast may follow the lateral cutaneous branches of the posterior intercostal arteries to the intercostal lymph nodes. A few lymphatics from the inferior and medial part of the breast may pierce the rectal sheath to reach the extra peritoneal space here they communicates in this extra peritoneal plexus of lymphatics. This may be a route of peritoneal dissemination of cancer cells in the breast cancer.

Breast Development & Physiology

In many mammalian species full breast development requires the simulation of copulation or pregnancy, human beings do not require either of these two to initiate and complete breast maturation.

Appreciation of stages of breast development is necessary to understand many benign and malignant states that come to clinical attention [37]. Puberty begins

at about 12 years at age during which time these is hormone dependent maturation of the genital organs. In breast this process entails increased deposition of fat, formation of new ducts by branching and elongation and appearances of labour units. This process is under control of estrogen, progesterone adrenal hormones. Pituitary hormones, tropic effect of insulin and thyroid hormones.

Mature breast contains fat, stroma, lactiferous ducts and lobular units. In pregnancy there is diminution of the fibrous stroma to accumulate the hyperplasia of labour units called adenosis of pregnancy. After birth there is sudden loss of placental hormones and continued high levels of prolactin simulation of nipple appears to be the physiological signal for continued pituitary secretion of prolactin and for the acute release of oxytocin. When breast feeding ceases there is a fall in prolactin and no stimulus for release of oxytocin. For the breast menopause results in involution and general decrease in the epithelial elements of the resting breast.

The "lump" in breast[37, 41]

The two disorders of the female breast that assume preponderant importance are fibrocystic disease and carcinomas, since both these entitles give rise to masses or lumps in the breast, the entities gives rise to masses or lumps in the breast, the entire consideration of the pathology of this organ is oriented within the frame work of[37]

- What lesion produces masses?
- may it be confused clinically with carcinoma?
- does the lesion have a tendency to become malignant?

Breast pathologies presenting as Lump

1) Fibrocystic disease
2) Fibro adenoma
3) Carcinoma
4) Mastitis
5) Pagets disease
6) Traumatic fat necrosis
7) Pappilloma[37].

1) Fibrocystic Disease – Mammary dysplasia. Cystic hyperplasia.-

Most commonest involvement of female breast, results from an exaggeration and distortion of the cyclic breast changes that normally occur in the menstrual cycle[37]. Fibrocystic disease encompasses a wide variety of morphologic changes and resultant clinical manifestations that run the gourmet from lesions that consist principally to an overgrowth of fibrous stroma, to lesions in which both stromal and epithelial proliferation participate, to other types in which epithelial proliferation predominates. It is a notoriously pleomorphic disorder in which variable morphologic patterns are encountered in different patients, in different areas of same lesions or even in different microscopic fields of one slide. Despite this variable behavior it is possible to distinguish four dominant patterns of morphologic changes in Fibrosis, Cyst formation, Sclerosing adenosis and in Duct epithelial hyperplasia. However it's still difficult to categorize every case. Together these variants comprise a single most common disorder of the breast and account for one half of all surgical operations on female breast. It is difficult to express an incidence of this condition in the general adult female population because of the variable criteria used for its diagnosis and because of the selected nature of material studied.

Hagensen estimates that at least 1O% of the women develops clinically apparent cystic disease. The condition is unusual before adolescence and rarely, if ever develops after menopause. Hyperesterinism is considered basic to the development of this pathology, it causes over stimulation of ductal epithelium and stromal growth[37].

Fibrosis: Sometimes there is only stromal fibrous tissue over growth with no epithelial hyperplasia especially in younger women and more usually is unilateral. Classically the upper and outer quadrant is involved and the increase in fibrous tissue results in a poorly defined area of rubbery consistency, which commonly varies from 2 to 10 cm in diameter, the line of demarcation from surrounding normal breast is poorly defined, there is no fixation to the skin or underlying structures. It is frequently painful and tender to palpation, particularly in days proceeding menstruation, in a classical case the tenderness may regress following the menstrual period[37].

Cystic disease (Blood good's disease, schi-mmelbuschs disease, Blue dome cyst): is the form of fibro cystic disease characterized by formation of cysts, sometimes accompanied by stromal and epithelial hyperplasia. Micro cysts are found so commonly in all women in the middle years of life that they cannot be construed as disease nor as justification, for surgery, these cystic diseases usually occurs with women near or at the age of menopause is the ages of 45-55. It is considered to be due to hyperplasia of the ductal epithelium and dilatation of ducts with each menstrual cycle, not balanced by sequential regressive changes of atrophy, desquamation of cells and shrinkage of ducts. Accordingly the cystic dilatation arises within the ducts as a distortion of cyclic changes rather than as a consequence of obstruction to ducts. Rarely an isolated cyst may be formed within one breast/ but usually the disorder is multifocal and often is bilateral, the involved areas have an ill defined diffuse increase in consistency and discrete nodularities. Cyst vary up to 4 - 5 cm in diameter, unopened they appear brown

to blue owing to the contained semi translucent, turbid fluid. Usually the cysts are filled with serous, turbid fluid that flows out readily to .disclose a smooth glistening membranous lining devoid of areas of thickening or papillary projection. However, intracystic hemorrhage, inspissations of secretions or inflammation may modify the contents. Clinically the diffuse irregular nodularity usually bilateral can be readily distinguished from the characteristic, discrete focus of carcinoma. However, solitary cyst may pose a problem. Commonly the cyst produce pain and are tender to palpation and are more distressing during the period of premenstrual tension[37, 39].

Sclerosing adenosis: characterized histologically by intra-lobular fibrosis and proliferation of small ductules or acini most commonly found in age group 35- 45, more apt to be unilateral than cystic disease often focal affecting the upper and outer quadrant of breast. It characteristically produces a hard localized mass on palpation, reasonably well delimited but not sharply defined from surrounding breast substance. It has therefore many of the clinical characteristic of malignancy.

When the disorder is bilateral or when cysts are present the clinical diagnosis is more apparent, but unfortunately, such changes are not invariably present. The pain and tenderness of florid adenosis may also serve to differentiate the lesion from neoplasia. Depending upon the extensiveness of morphologic chances, the areas may have a hard cartilaginous consistency that begins to approximate that found in breast cancer, or may be an ill-defined area of firmness. Proliferation of small ducts, canaliculi and gland buds may yield masses of small gland pattern or nets and cords of cells within a fibrous stroma. Usually in such an area, many or at least some well defined glands can be identified, but frequently they are closely aggregated so that glands lined by single or multiple layers of cells are backed up to each other adenosis.To the inexperienced the histologic differentiation of a florid case of sclerosing adenosis from frank carcinoma is most difficult. However when clearly defined cysts and apocrine elements are present or when the epithelial structures preserve their glandular regularity, the distinction is made more readily[37, 39].

Epithelial Hyperplasia: True epithelial hyperplasia most commonly affects the ducts and ductules, and is the histologic variant of fibrocystic disease that is characterized by most investigators to increase the risk of the subsequent development of carcinoma. This is not to say that all foci of epithelial hyperplasia - termed epitheliosis by British Pathologist as premalignant. Indeed only a small proportion apparently does. But in this pattern of alteration that should concern the pathologist who is called to differentiate among benign hyperplasia, atypical but still noncancerous hyperplasia and carcinoma. The more severe and atypical the hyperplasia, the greater is the risk of developing cancer. This appears as ill-defined mass in the breast of women of all ages over 30 but is most common between 35 and 45. Clinically, florid papillomatosis may be associated with a serous or serosanguinou's nipple discharge, but most commonly the patients have ill-defined breast masses, that may be tender, other lesions like pure fibrosis give rise to a well delineated mass with dense stromal fibrous tissue unaccompanied by cysts or epithelial tissue are sometimes seen[37,39].

Radial Scar (benign sclerosing ductal proliferation): is characterized histologically by ductal proliferation with abundant central fibrosis and elastosis giving it the gross and microscopic appearance of a scar. It is often associated with other features of cystic disease. It may be difficult to differentiate from a special type of cancer called tubular carcinoma.

Clinical significance of fibrocystic changes

Many patterns of breast pathology included under the designation of fibrocystic change have clinical importance for two reasons

(1) They produces masses in breast, that require differentiation from Carcinoma

(2) Some may predispose to the subsequent development of carcinoma[37].

A bilateral involvement/ multiple nodules and pain prior to menstrual period do suggest a benign lesion but histopathologic examination is the only certain way of making diagnosis. Also certain morphologic alterations of fibrocystic disease bear a relationship to carcinoma, following correlation have proved too significant:

Morphology		Risk of Carcinoma
Fibrous, Cystic apocrine metaplasia, Sclerosing adenosis, Mild hyperplasia	--	Nil
Moderate to florid Hyperplasia marked Ductal papillomatosis	--	1.5 to 2 times
Atypical hyperplasia Ductal or lobular with duct involvement.	--	5 times
Typical hyperplasia with Family history in all the Above categories	--	10 times

Fortunately only 5% of biopsies reveal atypical hyperplasia, a western study of 3O1 patients when histological diagnosis of atypical hyperplasia was made on biopsy, but

In whom the breast was not removed, the cumulative risk of breast cancer in-situ and infiltrating was 1O% at 55 months[37, 39].

Fibroadenoma

Most common benign tumor of female breast, composed of both fibrous/glandular tissues, occurring during reproductive period, it is some what more common before age 30, usually appears as a solitary, discrete, freely moveable nodule within the breast. Slight increase in size may occur during late phases of each menstrual cycle and pregnancy may stimulate growth. Postmenoausally, regression or calcification may result. Although this lesion presents fairly distinctive clinical characteristics it nonetheless requires surgical excision for absolute verification.

Infrequently fibroadenomas may grow to vary massive proportion reaching diameter of 1O-15 cms, the so called giant fibro adenoma some of these large, bulky tumors become lobulated and cystic and on gross section exhibit leaf like clefts and slits designated as - cystosarcoma phyllodes - an un-fortunate terms since the lesion may be begin or malignant[37,38,39].

Carcinoma

The foremost cancer in women, rare before 25, peak incidence at or after menopause, magnitude of risk is proportional to number of close relatives with breast cancer and the age when cancer occurred in relative, risk increases with early menarche and late menopause, more frequent in nulliparous and those with late (after 30) pregnancy, increased risk in obesity (synthesis of estrogen in fat depots), increased risk with exogenous estrogen treatment, high risk in atypical hyperplasia in benign lesions, contra lateral breast cancer or endometrial cancer increases risk. A combination of genetic, hormonal (increased exposure to estrogen) and environmental factors play an important role. There are also hints of how the estrogen might act; normal breast epitheliums possess estrogen and progesterone receptors. These have been identified in some but not all cancers.

A variety of growth promoters - transforming growth factor (TGF-alpha) and platelet derived growth factor (PDGF) and growth inhibitors (TGF-beta) are secreted by human breast cancer cells and are known to be involved in tumor progression, production of these growth factors is estrogen dependent and it is possible that interactions between circulating hormones, hormone receptors and cancer cells and autocrine growth factors induced by tumor ceils play role in breast cancer progression.

Morphologically carcinoma is more common in bilateral or sequential in the same breast in about 4% of cases. |Also majority arise in upper and outer quadrant of breast, some say that the quadrant of origin influences the pattern of nodal metastases, majority arise in the ductal epithelium[37, 38, 39].

Breast radiology

Conventional x-ray mammography is currently the most important breast imaging method. Other diag-nostic studies include sonography, spectral and color flow Doppler imaging, magnetic resonance imaging (MRI), computed tomography (CT), radionuclide imaging with agents such as 99 mTc sestamibi for cancers and 99 mTc sulfur colloid for sentinel node

labeling, and digital mammography[1].With the exception of ultrasound (US), most of these techniques have limited applications. In the last two decades, sonography has secured an important place in the diagnosis and management of breast disease

There are two different levels of approach to breast evaluation:

- Screening for breast carcinoma; and
- Diagnosis and management of benign and malignant breast disease.

The effectiveness of screening programs relies on the sensitivity and accuracy of the examinations, which should be widely available, affordable, and of documented high benefit and low risks. Breast sonography is suited to breast cancer screening, as many studies using both older as well as current, state-of-the-art automated and hand-held equipment suggest Micro calcifications[5,6], an important sign of early breast cancer, accounting for up to 50% of nonpalpable, mammographically-detected breast cancers, are depicted inconsistently.[7] As a screening examination for masses, breast sonography is highly operator- and technique-dependent, time consuming, and, therefore, costly.[5] Most important will be the results of prospective studies of the usefulness of high-resolution US for detecting occult, non-palpable breast carcinomas.[5,6] The breast symptoms of pain and mass are frequently manifestations of normal cyclical changes and benign disease such as cysts, adenosis, and inflammatory processes. These symptoms are often due to physiologic changes and become more worrisome as women enter the age of higher incidence of breast carcinoma. Here, ultrasound makes its greatest contribution in diagnosis and management of breast disorders. Sonography augments the specificity of mammography and is invaluable in characterizing masses as cystic or solid. In addition to the identification of cysts, advances in instrumentation, higher resolution probes, and improvement in scanning techniques have promoted characterization of solid masses and assignment of levels of suspicion to them. In addition, patient comfort and real-time visualization of the needle's path have made US an increasingly preferred imaging technique to guide interventional procedures. Breast sonography was used as long ago as 1951 when Wild and Reid imaged a 2- to 3-mm tumor with a 15 MHz A-mode transducer8. B-mode studies of the breast were subsequently performed with transducers of lower frequency. Two types of instruments for breast sonography evolved: automated and hand-held. Fear that the ionizing radiation of mammography would induce cancer led to a demand for alternate methods of breast cancer screening, and automated breast ultrasound units were offered in response.10 Both prone and supine versions were developed, having transducer frequencies between 4.0 and 7.5 MHz." Advantages of automated breast scanning units include the more reliable display of multiple lesions, which makes comparison with previous examinations easier, and the lower level of operator dependency. The use of automated breast US instruments has nearly ceased, primarily because of the recognition of their inadequacies as a screening technique. Hand-held transducers are better suited for the characterization of masses, and the examination is performed more rapidly than with automated units. Guidance of interventional procedures is also more easily accomplished with hand-held transducers. These transducers vary widely with their specifications, design, and quality. Dynamically focused phased array, linear array, and annular array transducers of 7 to 10 MHz are available. Standard-sized transducers and the smaller, intraoperative probes are both appropriate for breast sonography, although the standard-sized probes may be more efficient for general breast scanning purposes. Probes of even higher frequency will be soon offered by various manufacturers for breast use. Color flow and spectral Doppler sonography have also been used in breast diagnosis, although their value in differentiating benign from malignant solid masses has not been established.[14-18]

Method of scanning

The US study provides an opportunity for physical as well as sonographic examination of the breast.Sonography of the outer breast is most easily performed with the patient in a supine-oblique position. The patient's shoulder and torso of the side to be examined are elevated by a wedge to minimize the thickness of the upper, outer-quadrant breast tissue. The ipsilateral arm is elevated and flexed at the elbow with the hand resting comfortably under the neck. The contra lateral arm remains at the patient's side. In this supine-oblique position, the bulk of breast tissue falls to the contra lateral side. Adequate sonographic penetration is assured if the underlying pectoral muscles and ribs are visualized. It is most important that US examination of the breast not be reduced to "lumpography." Note should be made of the anatomic landscape of the breast surrounding the lesion so that follow-up examinations can be performed with reidentification of the area of concern by the depth of the lesion and its surrounding pattern of fat lobules, Cooper's ligaments, and fibro-glandular interfaces[20,21]

Sonographic documentation

The sonographic findings can be recorded on film, videotape, digitized systems, or any other enduring device[22]. Although there is no universally accepted method for labeling, the image should show the patient's name, medical record number and/or birth date, the laterality of the breast (right or left), the location of the area depicted, using clock notation, diagram, or other easily understood and reproducible

system, and the position of the probe with respect to the breast or lesion (transverse or longitudinal). It may also be useful to describe whether the, lesion is 1. Retroareolar; 2. in the anterior third of the breast; 3. in the middle portion of the breast; 4. In the posterior third of the breast; or 5. in the axilla or axillary tail of the breast.

To measure the lesion accurately, the longest dimension of a mass should be sought and measured as the longitudinal axis. The dimension perpendicular to this is the short axis of the mass. In the orthogonal plane, the third dimension of the mass can be measured.

Sonographic anatomy

The anatomic components of the breast and surrounding structures (skin, ducts, adipose tissue, parenchyma, nipple, blood vessels, retro mammary muscles, and ribs) have characteristic sonographic features. The skin complex is seen as two thin, echogenic lines demarcating a narrow hypo echoic band, the dermis .23. The normal' skin measures up to 0.2 cm in thickness but may be thicker in the lower breast near the inframammary fold.

Fat lobules are oval in one plane of view and elongated in the orthogonal plane. They are hypo echoic relative to the surrounding glandular tissue24 and may have a central echogenic focus of connective tissue. Subcutaneous fat lobules and those within the breast are usually larger than fat lobules located in the prepectoral area.

The breast glandular parenchyma usually appears homogeneously echogenic as compared with fat lobules but may have hypo echoic zones caused by fatty tissue.

In general, fibro glandular tissue appears echogenic. Whereas most masses appear as hypo echoic or anechoic structures)

Cooper's ligaments provide the connective tissue support for the breast. With US they appear as thin, echogenic arcs.

The terminal duct lobular units (TDLUs) are important anatomic units from which many benign (cysts, adenosis, fibroadenomas) and malignant processes originate.25 The TDLUs may enlarge or involute, reflecting age and physiologic differences. Hyperplastic TDLUs are hypoechoic areas that can be recognized on a US image26. A small, normal TDLU may not be identified as a discrete anatomic structure even with high-resolution breast ultrasound.

The mammary ducts, which are radially arrayed in7 to 20 segments around the nipple, demonstrate progressive luminal enlargement as they converge on the nipple. The nipple is of medium-level echogenicity and attenuates sound, resulting in a posterior acoustic shadow.

The mammary tissue is enclosed within a fascial envelope composed of a superficial and a deep layer.27. These fascial layers may be identified as thin lines, although they are not usually visible. Visualization of the pectoralis muscle assures that breast parenchyma has been adequately penetrated at that site. The ribs are oval, hypoechoic, periodic structures behind the pectoralis muscles.

The axillary vessels present as tubular structures, which are often seen pulsating during the real-time examination. Duplex Doppler or color flow Doppler imaging can provide confirmation of their vascular nature particularly of benefit when needle biopsies of lymph nodes or axillary masses are planned.

Lymph nodes may be seen in the axilla as well as within the breast parenchyma. Normal lymph nodes are often reniform and may have an echogenic fatty hilus[27,28].

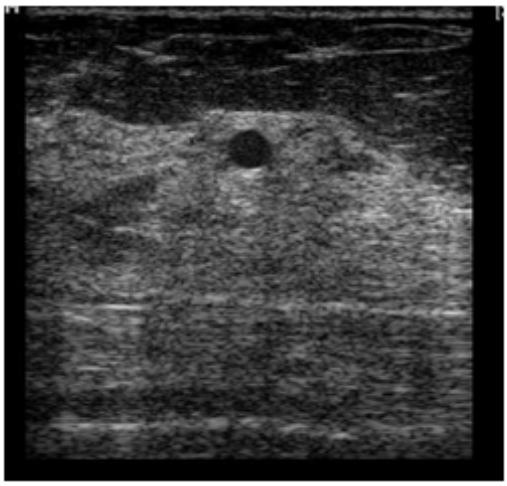
Sonographic descriptors of breast masses

1.Location	8.Heterogeneity
2.Number	Homogeneous
3.Size	Heterogeneous
4.Shape	9.Parenchymal interface
Round	Thin linear
Oval	Echogenic run
Irregular	Irregular
5.Margins	10.Posterior sound transmission
Smooth	Enhancement
Microlobulated	Shadow
Macrolobulated	No change
Irregular or spiculated	11.Associated secondary findings
Poorly defined	Skin changes
Orientation	Ductal dilatation
6.Internal contents	Cooper's ligament thickening
Solid	Compressibility
Cystic	12.Doppler characteristics
Mixed	
7.Echogenicity	
Anechoic	
Hypoechoic	
Hyperechoic	

Cysts

Diagnostic criteria, which should be strictly applied, are the same as those for cysts elsewhere in the body. The lesion should be anechoic, be round or oval, be sharply marginated (particularly the posterior walls).

Fig 1: Sonographic picture of a cyst



Solid and mixed masses

All sonographically visible carcinomas are hypoechoic (relative to adjacent breast parenchyma or fat), many other masses also appear hypoechoic[5,24].

Although the shape of a mass and its borders are the most important predictors of benign or malignant nature, overlap remains. Although fibroadenomas are commonly oval, carcinomas may also be elongated as well as rounded. Carcinoma typically has irregular margins, benign lesions, such as abscesses, hematomas, and fat necrosis, may also have jagged margins

Benign neoplasm's, such as fibroademomas may also exhibit posterior acoustic shadowing and therefore the finding is not finding is not specific for malignancy.

Ultrasound features of a typical breast carcinoma

1) Irregular borders

2) Round shape or orientation of long axis Perpendicular to skin[13-36].

3) Hypoechogenicity relative to adjacent fibroglandular and/or fatty tissues.

4) Heterogeneous echo texture

5) Posterior acoustic shadowing: An echogenic rim of variable thickness that may represent tumor extension, desmoplasia, or compressed breast tissue

6) Popcorn- like clumps of calcification is visualized in fibroadenomas.

Fig 2: Sonographic picture of carcinoma

Methods and Materials

Source of data

All eligible patients both out patient department and in patients at KLES Prabhakar Kore Hospital and Medical Research Centre, Belgaum.

Study period between December 2007- December 2008.

Inclusion criteria

- All females clinically diagnosed as lump in the breast during the period of study.

Exclusion criteria

- Patients who are already diagnosed with FNAC/Biopsy and treated for lump.
- Patients who do not give informed consent.

Method of study

Ultrasonographic evaluation of female breast masses will be done and diagnosis made over one year period between December 2007 to 2008. Fine needle aspiration cytology / histopathology reporting of the operated specimen (which ever was done in the respective case) confirmed the diagnosis made by ultrasonography. All cases will be evaluated with hand held high frequency probe, 7.5-10MHz linear array ultrasound rays that have a penetration depth of 4-6cm. Masses are viewed in both longitudinal and transverse plane employing low and high gain settings for the same transducer position. Each breast was examined by quadrant in survey search pattern. The ultrasound criterion for diagnosis was delineation or non-delineation of breast masses. If mass was delineated, its shape, margins, echogenecity, internal echopattern, retrotumoral pattern, lateral / anteroposterior pattern and compressibility were determined. Both benign and malignant lesions were found between each of the above categories, to determine the ultrasonography in the present study the sonographic diagnosis was classified as correct / false positive / false negative / incorrect. Confirmation of the diagnosis reached at ultrasonography was made by fine needle aspiration cytology / histopathology reporting.

Collection of data

A total of 68 patients were included in the study and underwent sonography.

Observations and Results

Data analysis done by

Screening test results	Diagnosis		*Total*
	Diseased	Non-diseased	
Positive	a (true +ve)	b (false +ve)	a + b
Negative	c (false -ve)	d (true –ve)	c + d
Total	a + c	b + d	a + b + c + d

Evaluation of screening test

- Sensitivity = a / a + c X 100
- Specificity = d / b + d X 100
- Predictive value of positive test = a / a + b X 100
- Predictive value of negative test = d / c + d X 100
- Percentage of false negatives = c / a + c X 100
- Percentage of false positive = b / b + d X 100

Results

Screening test results	H.P.R		*Total*
	Diseased	Non-diseased	
Positive (USG)	17	0	17
Negative(USG)	2	49	51
Total	19	49	68

- Sensitivity = 89.47%
- Specificity = 100%
- Predictive value of positive test = 100%
- Predictive value of negative test = 96.07%
- Percentage of false negatives = 10.52%
- Percentage of false positive = 0%

Discussion

Mammography has been the gold standard investigation in breast cancer detection over last 40 years. Limitations in its ability to detect both small and lobular breast cancers, poor resolution in dense breasts, and a lack of significant improvement in cancer detection has inevitably lead to a search for other modalities to improve the detection of breast cancer. The advent of 6- to 13- MHz breast probe with the speciality of breast medicine has lead to the development of breast ultrasound and practiced by us in our institute. In our study we used ultrasonography as a diagnostic tool to identify the clinically made diagnosis of palpable breast lumps. All patients with lumps were subjected to sonography of breast, done by the consultant of radiology department. The results of the study were compared with gold standard tissue diagnosis (FNAC/HPR).

We have demonstrated that ultrasonography has high sensitivity at detecting malignancy and high specificity with benign lesions. Overall ultrasonography being non- invasive, easily available and cheaper should be considered as a first line diagnostic and screening investigation in detecting breast lesions. It should be considered as an extension of the examining clinicians fingers and be used in routine practice in all breast clinics. Particularly in one stops breast clinics, where it allows for the immediate assessment, diagnosis and any biopsy of any lesion of concern.

Conclusion

In study done by Lister; Evans et al in 1998 on 205 clinically palpable breast masses, showed the higher sensitivity (93%) and specificity (96%) of ultrasound versus mammography in detection of invasive carcinoma[26]. In study done by Tariq mansoor et al, in 2002 on 100 palpable breast masses showed the role of ultrasonography in differential diagnosis of palpable breast lumps. Its ability to pick up benign and malignant lesions[23]. Sensitivity for malignancy is 57.14%, fibroadenoma-81.81%, cystic- 90.9%.

In another study done by Murad, Bari V in 2004 on 100 solid breast masses showed that ultrasound features can differentiate between benign and malignant masses[32]. In a study done by Benson,. et al, in 2004, of 796 patients with breast cancer ultrasound was positive in 710 and mammography in 706, showing that ultrasound is better than mammography as a first line diagnostic tool for detecting invasive breast cancer[31]. sensitivity was 92%. In study done by Ghazala malik et al, in 2006 on 56 patients with breast lump, showed the advantages and ability of sonography for evaluation of breast masses in young patients and avoiding the need for biopsy[24]. sensitivity for malignancy-67%, benign-92%. Based on the results of our study ultrasound has 89.47% sensitivity and 100% specificity in diagnosing malignant breast lesions. In benign lesions it has 100% specificity and sensitivity. Hence it can be considered as first line diagnostic tool in breast clinics for diagnosing breast lesions.

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