Sudan University of Science and Technology

College of Graduated Studies

Characterization of Breast Fibroadenoma using Ultrasonography

توصيف ورم الثدي الغدي الليفي باستخدام التصوير بالموجات فوق الصوتية

A thesis Submitted for Partial Fulfillment of Requirement of the M.SC Degree in Medical Diagnostic Ultrasound

By:

Solafa Adam Abdulraheem Mohammed

Supervisor:

Dr. Ahmed Mostafa Abukonna

August 2016

الآيــة

بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

{ يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ
وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ}

صدق الله العظيم

سورة المجادلة

الآية 11

Dedication

Coming together is a beginning;

Keeping together is a progress;

Working together is a success

Thanks To everyone who

has stood by my side.

Acknowledgement

First full of thanks to Allah…

And a lot of thanks and great fullness to my supervisor Dr. Ahmed Mostafa Abukonna for his valuable and continuous help and guidance…

I owe my most sincere gratitude to the working team who gave me the opportunity to work with them in the department of ultrasound in Khartoum breast center during the process of collection of data.

Abstract

Breast fibroadenomas are common benign breast tumors and detailed descriptions of their sonographic appearances are necessary for differential diagnosis from other benign lesions or breast cancers.

The main objective of this study was to evaluate the sonographic criteria of breast fibroadenoma. The data was collected from Khartoum breast center. A total of 50 women their ages between 17-36 years with palpable breast lump diagnosed by histopathology as fibroadenoma were scanned by ultrasound machine (GE healthcare Logiq 5) with high frequency transducer 7.5 MHz from April 2016 to August 2016.

The result of this study revealed that the mean age affected by fibroadenoma was in the age group (22-26 years). The dominant sonographic features of fibroadenoma were; hypoechoic, well defined homogenous mass with posterior enhancement and width to height ratio ≥1.4. there were no significant difference between all type of fibroadenoma.

Ultrasonography is the modality of choice for the evaluation of a simple breast fibroadenoma with the typical sonographic features and could eliminate the need for further invasive procedures including biopsy.

الخلاصة

ورم الثدي الغدي الليفي يُعد من أكثر الأورام الحميدة إنتشارا" بين السيدات وتحديد المعايير اللازمة لتشخيص الورم بإستخدام الموجات فوق الصوتية ضروري جدا" لتلافي التشخيص الخاطئ. إن الهدف الأساسي من هذه الدراسة هو توصيف الورم الغدي الليفي بإستخدام الموجات فوق الصوتية.

جمعت البيانات المستخدمة في هذه الدراسة من مركز الخرطوم للثدي، تم فحص ٥٠ مريضة تتراوح أعمارهن بين (١٧-٣٦عام) جميعهن كن يعانين من ورم بالثدي تم تشخيصه كورم غدي ليفي بالفحص المعملي، وتم أجراء فحص موجات فوق الصوتية لجميع السيدات بواسطة جهاز الموجات فوق الصوتية (GE healthcare Logiq 5) مع ترددات عالية (٧.٥ - ١٢ميغاهيرتز) في الفترة ما بين أبريل ٢٠١٦ إلى أغسطس ٢٠١٦.

وبعد إجراء الدراسة تبين أن الإناث في عمر (٢٢-٢٦ عام) أكثر عرضة للإصابة بالورم الغدي الليفي. ما يميز شكل الورم في صورة الموجات فوق الصوتية؛ أنه يظهر ذو حدود واضحة ومنتظمة ، منخفض الصدى مقارنة بما حوله من خلايا الثدي، غالبا" ما تظهر محتوياته متجانسة، ونسبة عرض الورم لإرتفاعه $\leq$ ١.٤. لم تظهر الدراسة فرق ذو أهمية بين أنواع الورم في صورة الموجات فوق الصوتية.

List of Abbreviation

FA: Fibroadenoma

USG: Ultrasonography

DCIS: Ductal Carcinoma in Situ

IDC: Invasive Ductal Carcinoma

FNAC: Fine needle aspiration cytology

CNB: Core needle biopsy

TGC: Time gain compensation

List of Figures

Figures caption	Page
Figure 2.1 Mammary glands within the breast	5
Figure 2.2 Changes in breast during pregnancy and lactation	7
Figure 2.3 Breast Hamrtoma mammogram and ultrasound	8
Figure 2.4 Breast lipoma mammogram and ultrasound	8
Figure 2.5 Breast galactocele mammogram and ultrasound	9
Figure 2.6 Breast mastitis	9
Figure 2.7 breast abscess	10
Figure 2.8 breast cyst	10
Figure 2.9- phyllodes tumor	11
Figure 2.10- Intraductal papilloma	11
Figure2.11- DCIS	12
Figure 2.12- IDC	12
Figure 2.13- Lobular carcinoma	13
Figure 2.14- Papillary breast carcinoma U/S	13
Figure 2.15- Paget's disease	14
Figure 2.16-FA age distribution	15
Figure 2.17-Juvenile FA	16
Figure 2.18-calcified FA	17
Figure 2.19-Giant FA	17
Figure 2.20- Typical US features of FA	18

Figure2.21- calcified FA mammogram	19
Figure2.22- FA histopathology	20
Figure 2.23- Normal breast U/S	22
Figure 2.24- Patient position for breast U/S	23
Figure 2.25- Grid scanning pattern for breast U/S	24
Figure 2.26- Radial scanning pattern for breast U/S	25
Figure 2.27- Quasi-grid pattern	25
Figure 2.28- breast anatomy illustration methods	26
Figure 2.29- Labeling of breast lesion depth	26
Figure 3.1- GE U/S machine	30
Figure 4.1- age percent	32
Figure 4.2- Tumor side percent	33
Figure 4.3-Mobility percent	34
Figure 4.4- Width to height ratio percent	35
Figure 4.5- Shape percent	36
Figure 4.6- Margins percent	37
Figure 4.7- Macrolobulation percent	38
Figure 4.8- Internal echo pattern percent	39
Figure 4.9- Lateral acoustic shadow percent	40
Figure 4.10- Posterior acoustic phenomena percent	41
Figure 4.11- Types of fibroadenoma percent	42

List of tables

Tables caption	Page
Table 4-1: Age percentage and frequency	32
Table 4-2: Tumor side percentage and frequency	33
Table 4-3: Mobility percentage and frequency	34
Table 4-4: Width to height ratio percentage and frequency	35
Table 4-5: Shape percentage and frequency	36
Table 4-6: Margins percentage and frequency	37
Table 4-7: Macrolobulation percentage and frequency	38
Table 4-8: Echogenicity percentage and frequency	39
Table 4-9: Internal echo pattern percentage and frequency	39
Table 4-10: Lateral acoustic shadow percentage and frequency	40
Table 4-11: Posterior acoustic phenomena percentage and frequency	41
Table 4-12: Vascularity percentage and frequency	42
Table 4-13: Lumps Histopathology results percentage and frequency	42

List of Contents

Topic	Page
Dedication	i
Acknowledgement	ii
Abstract (English)	iii
Abstract (Arabic)	iv
List of abbreviations	v
List of figures	vi-vii
List of tables	viii
List of contents	ix-x
Chapter one	
1.1 introduction	1-2
1.2 statement of problem	3
1.3 Research questions:	3
1.4 objectives	3
Chapter two	
2-1 Breast Anatomy and physiology	4-7
2-2 common breast pathology	8-14
2-3 specific breast pathology	15-21
2-4 diagnostic ultrasound of the breast	22-27
Previous studies	28-29

Chapter three	
Methodology and Methods	30-31
Chapter four	
Results of study	32-43
Chapter five	
5-1 Discussion	44-46
5-2 Conclusion	47
5-3 Recommendation	48
References	49-51
Appendix	51-57

Chapter one

1. Introduction

1.1 Introduction:

Wild & Neal in 1952 were the first to report the use of diagnostic sonography in the evaluation of breast disease (Wild and Neal 1952).

Ultrasound has the important abilities of enabling determination of the internal matrix of masses. In the breast most palpable masses in young women are caused by fibroadenomas (Bartow et al.1987).

Fibroadenoma is the most common breast tumor in adolescent girls and women younger than 25 years. Although the peak incidence is between the second and third decades of life, it is not uncommon in postmenopausal women, with an increased incidence after hormone replacement therapy (Rosen PP 1996).

Clinically, a fibroadenoma (FA) is firm, rubbery, freely mobile, and clearly delineated from the surrounding breast tissue. It is round or ovoid and smooth or lobulated, and usually does not cause loss of contour of the breast unless it develops to a large size. It rarely causes mastalgia, and it does not change size during the menstrual cycle. Fibroadenomas tend to grow very slowly. A sudden increase in size with acute pain may be the result of hemorrhage within the tumor. Calcification may follow hemorrhage or infarction; thus the tumor may have calcifications and may mimic the appearance of a carcinoma on mammography. Sonographically, fibroadenomas have benign characteristics with smooth, rounded margins and low-level homogeneous internal echoes and may demonstrate intermediate posterior enhancement. Fibroadenomas are normally hypoechoic, but occasionally are hyperechoic to the fat within the breast (Sandra 2012).

Overall, it occurs in approximately 10% of women and accounts for about 50% of breast biopsies performed (Greenberg 1998).

Diagnosis is based on the combination of clinical examination, imaging and non-surgical tissue biopsy (the triple test). A clinical diagnosis of fibroadenoma alone is unreliable and does not exclude malignancy even in younger women. The choice of imaging is mammography, combined with ultrasound in older women, and ultrasound alone in younger women (Houssami et al. 2001).

Modern ultrasound is a reliable technique to diagnose fibroadenoma in the hands of experienced breast radiologists. Therefore, in this age group, it is proposed that a palpable lump that has the ultrasound characteristics entirely consistent with a fibroadenoma need not be biopsied unless there is overriding clinical concern (Jackson1986).

A recent study done in 5 NOV 2015 has approved that Fibroadenoma of the breast had the highest diagnostic accuracy of 85.71%, followed by carcinoma of the breast 81.25% (Ashish et al. 2015).

Another study has reported that ultrasound has a diagnostic sensitivity of (65.8%) in diagnosis 50 out of 76 fibroadenomas (Jackson 1986).

This study will help in limiting the misdiagnosing and difficulties of diagnosis breast fibroadenoma, as well as it will reduce the cost and time of examination.

1.2 Problem of the study:

Fibroadenoma can be misdiagnosed with other breast masses and therefore most of clinicians prefer invasive interventional confirmation and this increase the risk of biopsies complication as well as cost and time.

1.4 Objectives:

1.4.1 General objective:

The general objective of this study is to evaluate breast fibroadenoma using ultrasonography.

1.4.2 Specific objectives:

- To study the sonographic characteristics of the breast fibroadenoma.
- To study the different types of fibroadenoma.
- To study the common affected age with breast fibroadenoma.

Chapter Two

2. Theoretical background and literature review

2.1 Breast Anatomy and physiology:

The breasts consist of mammary glands and associated skin and connective tissues. The mammary glands are modified sweat glands in the superficial fascia anterior to the pectoral muscles and the anterior thoracic wall. The mammary glands consist of a series of ducts and associated secretory lobules. These converge to form 15 to 20 lactiferous ducts, which open independently onto the nipple. A well-developed, connective tissue stroma surrounds the ducts and lobules of the mammary gland, in certain regions this condenses to form well-defined ligaments, the suspensory ligaments of breast (Cooper's ligaments), which are continuous with the dermis of the skin and support the breast (Richard et al. 2012).

2.1.1 Arterial supply:

- laterally, vessels from the axillary artery-superior thoracic, thoracoacromial, lateral thoracic, and subscapular arteries;
- medially, branches from the internal thoracic artery;
- The second to fourth intercostal arteries via branches that perforate the thoracic wall and overlying muscle (Richard et al. 2012).

2.1.2 Venous drainage:

Veins draining the breast parallel the arteries and ultimately drain into the axillary, internal thoracic and intercostal veins (Richard et al. 2012).

2.1.3 Innervation:

Innervation of the breast is via anterior and lateral cutaneous branches of the second to sixth intercostal nerves. The nipple is innervated by the fourth intercostal nerve (Richard et al. 2012).

2.1.4 Lymphatic drainage:

- approximately 75% is via lymphatic vessels that drain laterally and superiorly into axillary nodes;
- most of the remaining drainage is into parasternal nodes deep to the anterior thoracic wall and associated with the internal thoracic artery;
- some drainage may occur via lymphatic vessels that follow the lateral branches of posterior intercostal arteries and connect with intercostal nodes situated near the heads and necks of ribs (Richard et al. 2012)..

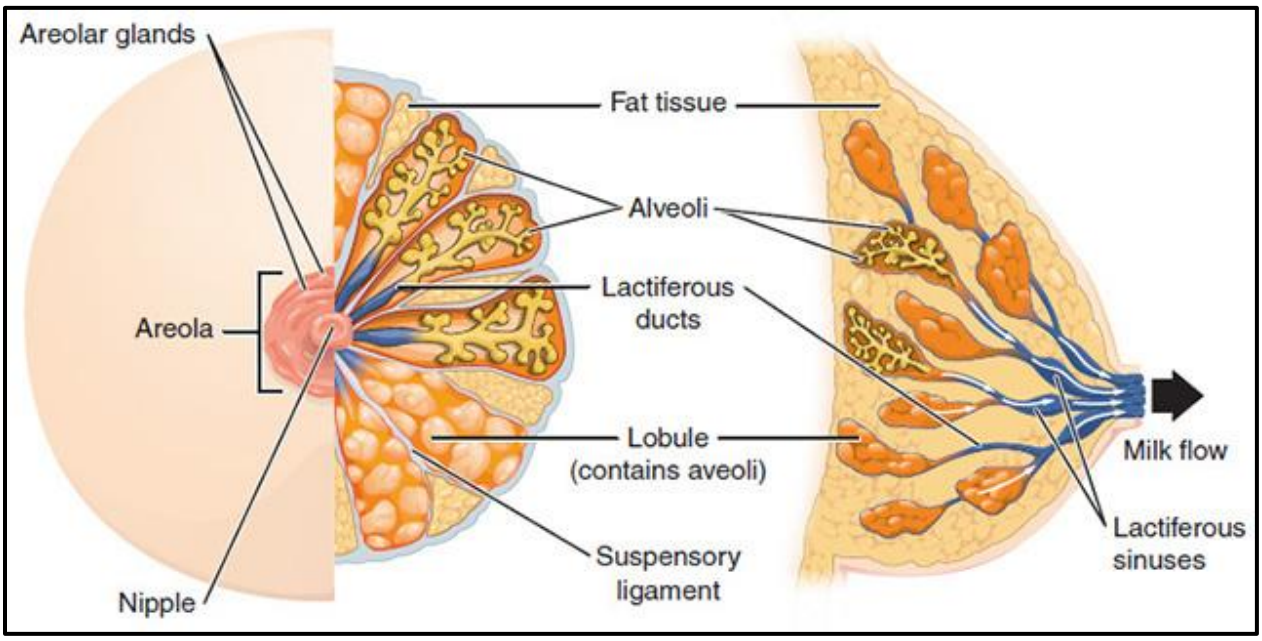


Figure 2.1: Mammary glands within the breast

2.1.5 Classification of breast tissues:

2.1.5.1 prepuberty:

The neonatal breast contains lactiferous ducts but no alveoli. Until puberty, little branching of the ducts occurs, and any slight mammary enlargement reflects the growth of fibrous stroma and fat (Susan 2008).

2.1.5.2 puberty:

In the postpubertal female, the ducts stimulated by ovarian estrogens, become branched. The ends of the branches form solid spheroidal masses of granular polyhedral cells, the potential alveoli. Breast enlargement at puberty is largely a consequence of lipid accumulation (Susan 2008).

2.1.5.3 changes during menstrual cycle:

In the follicular phase (days 3-14) the stroma becomes less dense. Various changes including luminal expansion take place in the ducts. In the luteal phase (days 15-28) there is a progressive increase in stromal density and the ducts have an open lumen that contains secretion.

There are also changes in blood flow, which are greatest at midcycle and an increase in water content of the stroma in the second half of the menstrual cycle (Susan 2008).

2.1.5.4 postmenopausal:

Progressive atrophy of lobules and ducts occur after the menopause, and there is fatty replacement of glandular breast tissue. A few ducts may remain. The stroma becomes much less cellular and collagenous fibres decrease. The breast may return to a condition similar to the prepubertal state (Susan 2008).

2.1.6 Changes associated with pregnancy and lactation:

2.1.6.1 Pregnancy:

As the output of estrogen and progesterone produced first by the corpus luteum and later by the placenta rises during pregnancy the intralobular ductal epithelium proliferates and the cells increases in size. Alveoli develop at their termini and expand as their cells and lumina fill with newly synthesized and secreted milk.

Secretory activity in the alveolar cells rises progressively in the latter half of pregnancy (Susan 2008).

2.1.6.2 Lactation:

True milk secretion begins a few days after parturition as a result of a reduction in circulating estrogen and progesterone, a change which appears to stimulate production of prolactin by the anterior hypophysis. Milk distends the alveoli so that the cells flatten as secretion increases. On hormonal stimulation by oxytocin myoepithelial cells contracts to expel alveolar secretions into the ductal system in readiness of suckling (Susan 2008).

2.1.6.3 Post-lactation:

When lactation ceases, the secretory tissue undergoes some involution, but the ducts and alveoli never return completely to the pre-pregnant state. Two major processes are responsible for the regression of the alveolar-ductal system; a reduction in epithelial cell size and a reduction is cell numbers (Susan 2008).

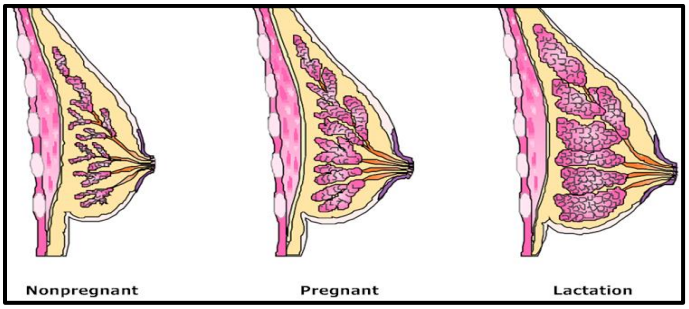
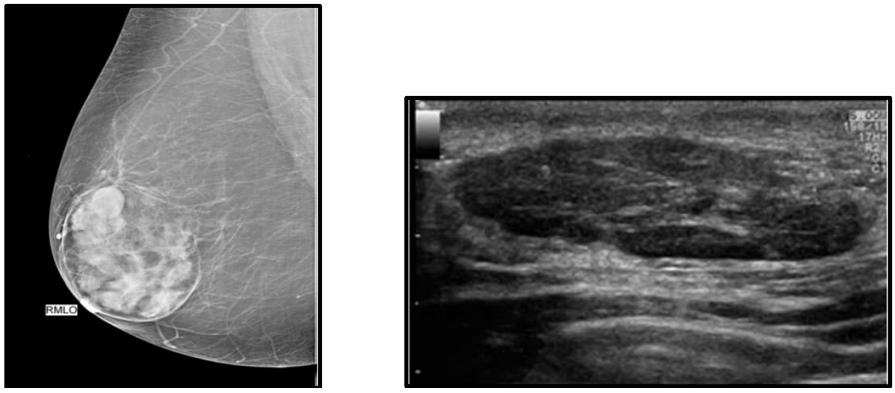


Figure2.2: Changes in breast during pregnancy and lactation (Susan 2008).

2.1 Common breast pathology:

2.2.1 Hamrtoma:

Hamartomas are discrete lesions, usually firm and sharply circumscribed. The lesion appears as a well-defined density surrounded by a narrow zone of radiolucency. It often gives the appearance of being encapsulated (Carol 2005).

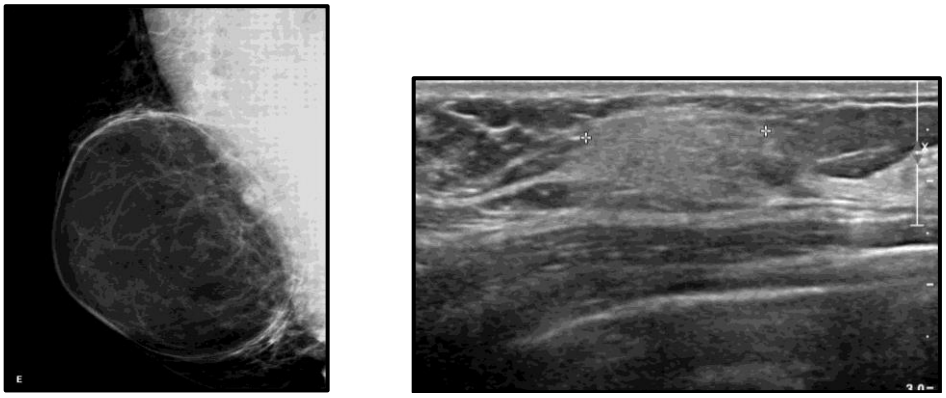


(A) **(B)**

Figure 2.3: Breast Hamrtoma mammogram (A) and ultrasound (B) (Betty 2007)

2.2.2 Lipoma:

It presents as a solitary mass that is soft and freely movable, and usually well delineated. Microscopically, lipomas are composed of the typical round mature lipocytes (Carol 2005).



(A) **(B)**

Figure 2.4: Breast lipoma mammogram (A) and ultrasound (B) (Elisabetta 2013)

2.2.3 Galactocele:

Galactocele is a milk-filled cyst, probably formed by over distension of a lactiferous duct. It usually presents as a firm, occasionally tender mass, commonly in the upper quadrants beyond the areola border. Usually, these lesions occur in younger woman and develop during or after lactation. In U/S appears as an anechoic mass with sharply demarcated smooth margin (Carol 2005).

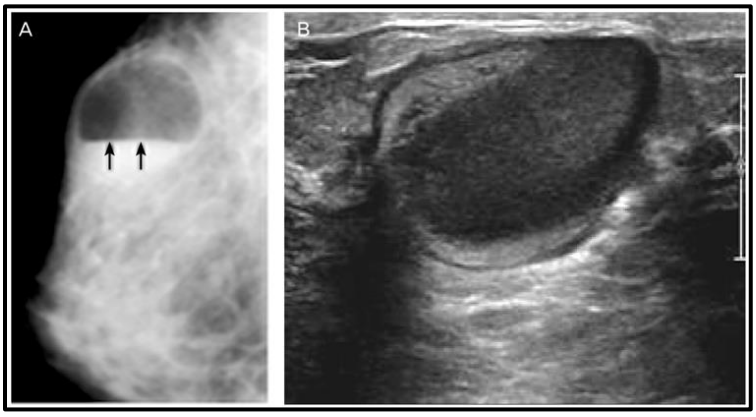


Figure 2.5: Breast galactocele mammogram (A) and ultrasound (A) (Carol 2005).

2.2.4 Mastitis:

Acute nonepidemic mastitis, formerly called (puerperal mastitis) refers to breast soreness, fever, and flulike symptoms that may develop any time during lactation (Carol 2005).

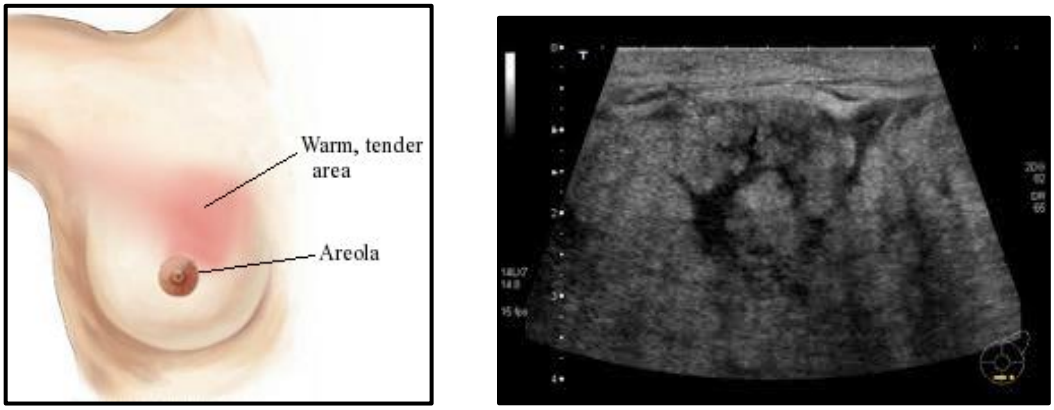


Figure 2.6 breast U/S with interstitial edema suggestive of mastitis (Betty 2007)

2.2.5 Abscess:

Abscesses may be single or multiple. Acute abscesses have a poorly defined border, whereas mature abscesses are well encapsulated with sharp borders. A definite diagnosis cannot be made from a mammogram alone. Aspiration is necessary. Clinical findings include pain, swelling, and reddening of the overlying skin (Sandra L. 2012).

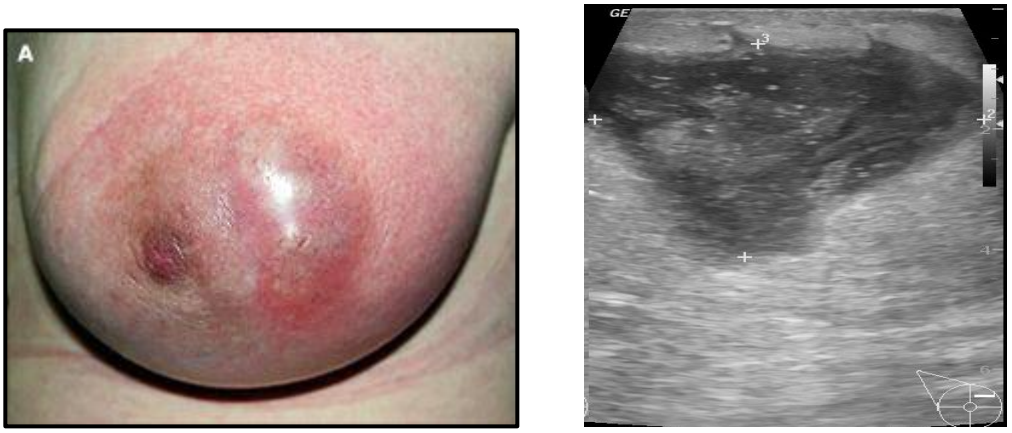


Figure 2.7: Breast abscess (Elisabetta 2013)

2.1.7 Cyst:

A breast cyst is a fluid-filled sac within the breast. They are echo-free, roundish or oval, with well-defined anterior and posterior margins and posterior enhancement. They are usually aspirated (Carol 2005).

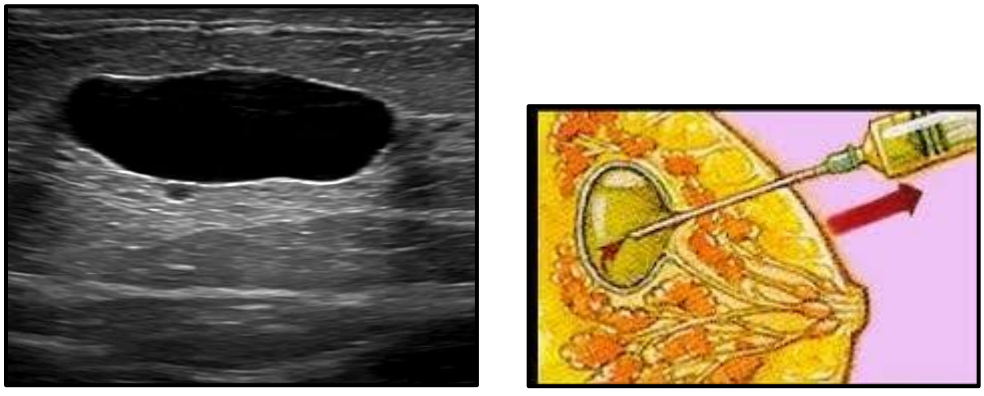


Figure 2.8: Breast cyst

2.2.7 Phyllodes tumor:

Phyllodes tumor applies to mixed epithelial-mesenchymal lesions with often a foliated structure, a double layered epithelial component and an overgrowth of the stromal component. The latter shows increased cellularity and proliferative activity, or even a sarcomatous appearance (Werner 2006).

Figure 2.9: Phyllodes tumor (Werner 2006).

2.2.8 Intraductal Papilloma:

An intraductal papilloma is a small, benign tumor that grows within the acini of the breast. It occurs most frequently in women 35 to 55 years of age (Sandra 2012).

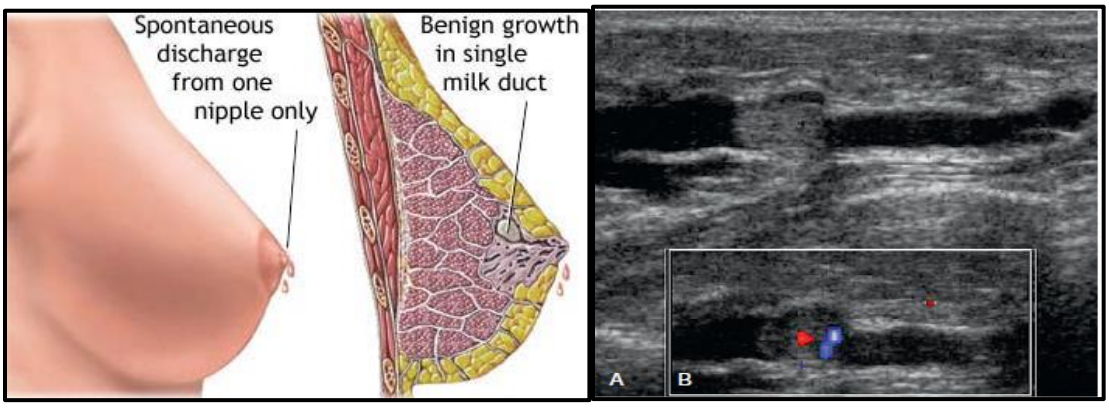


Figure 2.10: Intraductal papilloma (Werner 2006).

2.2.9 Ductal Carcinoma in Situ (DCIS):

DCIS is also known as intraductal carcinoma. DCIS is characterized by cancer cells that are present inside the ducts but have not yet spread through the walls of the ducts into the fatty tissue of the breast (Sandra 2012).

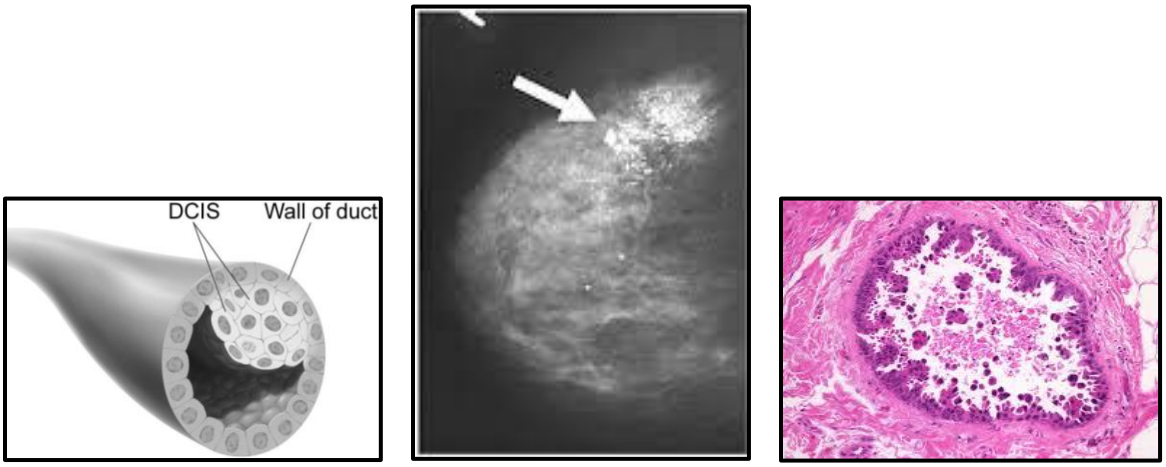


Figure 2.11: DCIS (Werner 2006).

2.2.10 Invasive Ductal Carcinoma (IDC):

IDC accounts for nearly 80% of breast cancers. Similar to DCIS, these cancers begin in the ducts, but in contrast to DCIS, they invade the fatty tissue of the breast and have the potential to metastasize via the bloodstream or the lymphatic system (Sandra 2012).

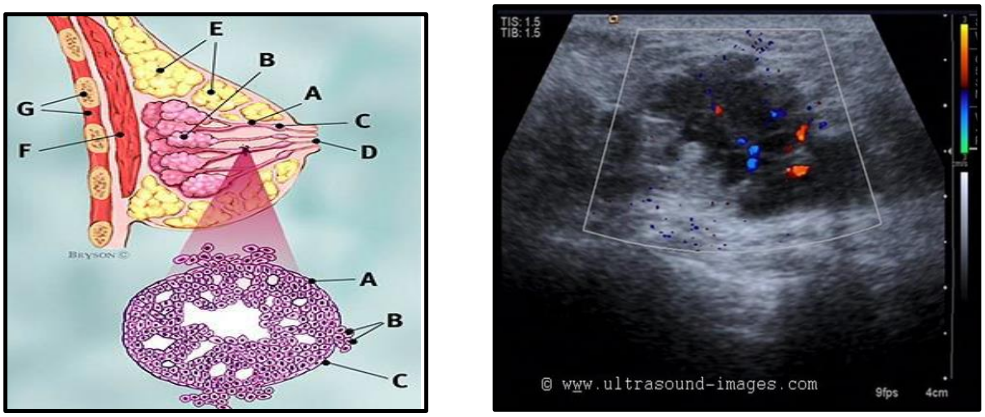


Figure 2.12 shows the infiltrative nature of the IDC

2.2.11 Lobular Carcinoma:

Arise from the lobules classified into lobular carcinoma in situ and invasive lobular carcinoma (Carol 2005).

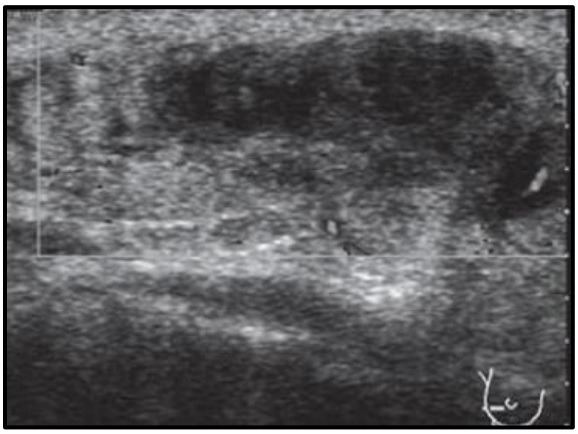


Figure 2.13: Lobular carcinoma with cystic contents (Sandra 2012).

2.2.12 Papillary Carcinoma:

Papillary carcinoma is a tumor that initially arises as an intraductal mass. It may also take the form of an intracystic tumor, which is rare (Sandra 2012).

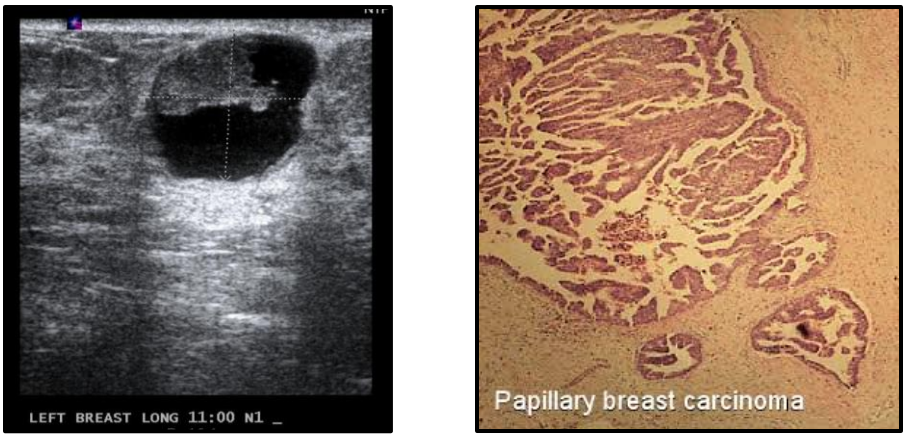


Figure 2.14: Papillary breast carcinoma U/S (Prasad et al 2013).

2.2.13 Paget ’s disease:

Paget’s disease arises in the retroareolar ducts and grows in the direction of the nipple, spreading into the intraepidermal region of the nipple and areola, Any ulceration, enlargement, or deformity of the nipple and areola should suggest Paget’s disease (Sandra 2012).

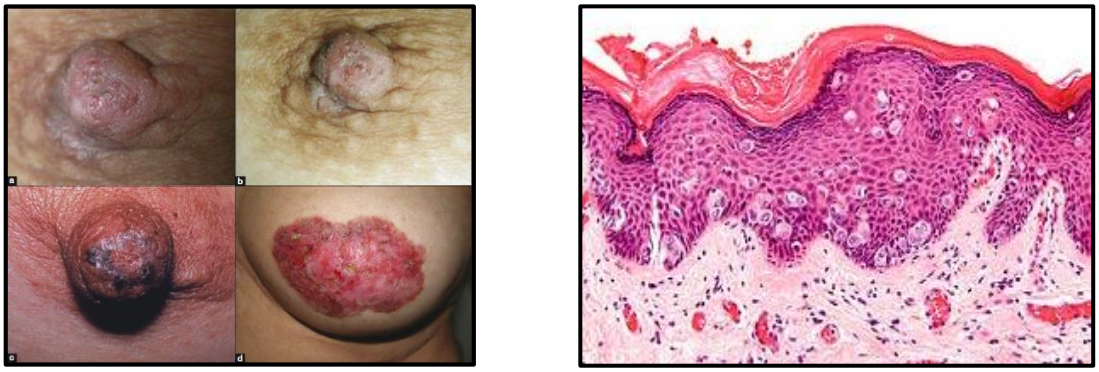


Figure 2.15 shows Paget's disease (Prasad et al 2013).

2.2 Specific breast pathology: Fibroadenoma:

Fibroadenoma is a well-demarcated benign fibroepithelial tumor with a relative balance between stromal and epithelial components. It contains elongated ducts surrounded by stroma (Werner 2006).

2.3.1 Epidemiology:

The age distribution ranges from the early teens to over 70 years, with a mean age of about 30 years. Less than 5% of women with a fibroadenoma are post-menopausal (Prasad et al 2013).

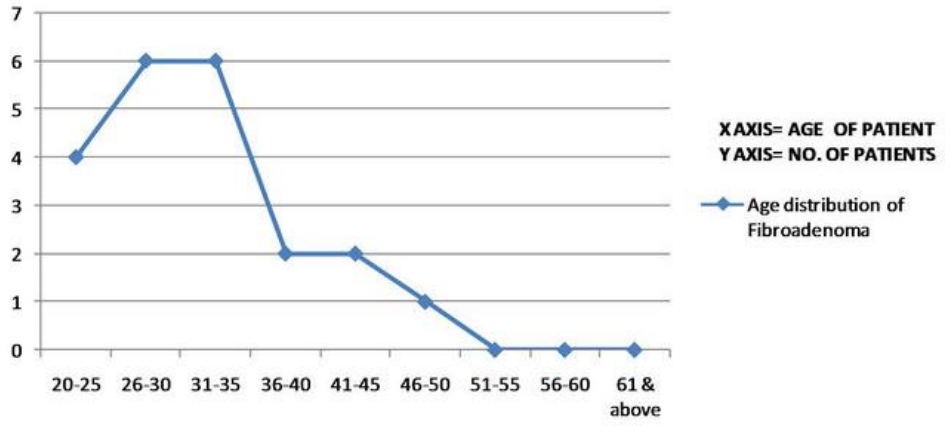


Figure 2.16 Shows number of FA patients in specific age group according to a study done on 2013

2.3.2 Clinical presentation:

The typical presentation is in a woman of reproductive age with a mobile palpable breast lump. Due to their hormonal sensitivity, the fibroadenoma commonly enlarges during pregnancy and involute at menopause. The lesions are well defined and well circumscribed clinically and the overlying skin is normal. The lesions are not fixed to the surrounding parenchyma and slip around under the palpating hand, hence the colloquial term a breast "mouse" (Owen et al 2016).

2.3.3 Causes:

Fibroadenomas are partially hormone-related and frequently regress after menopause. Higher intake of fruits and vegetables, higher number of live births, use of oral contraceptives and moderate exercise are associated with lower frequency of fibroadenomas (Nelson et al 2010).

2.3.4 Types:

2.3.4.1 A juvenile fibroadenoma: is a term given to a fibroadenoma presenting in children or adolescents. These may account for ~0.5-2% of all fibroadenomas, and are rapidly growing masses that cause asymmetry of the breast, distortion of the overlying skin, and stretching of the nipple. 10-25% of patients with juvenile fibroadenomas have multiple or bilateral lesions at presentation (Chung et al 2009).

A study done on 2013 in Inje University College of Medicine, Busan, Korea revealed that the most common sonographic presentation of juvenile fibroadenoma is a circumscribed oval hypoechoic or isoechoic mass, which resembles that of simple fibroadenoma. Juvenile fibroadenoma frequently shows posterior acoustic enhancement and hypervascularity on color Doppler sonography (Suk et al 2014).

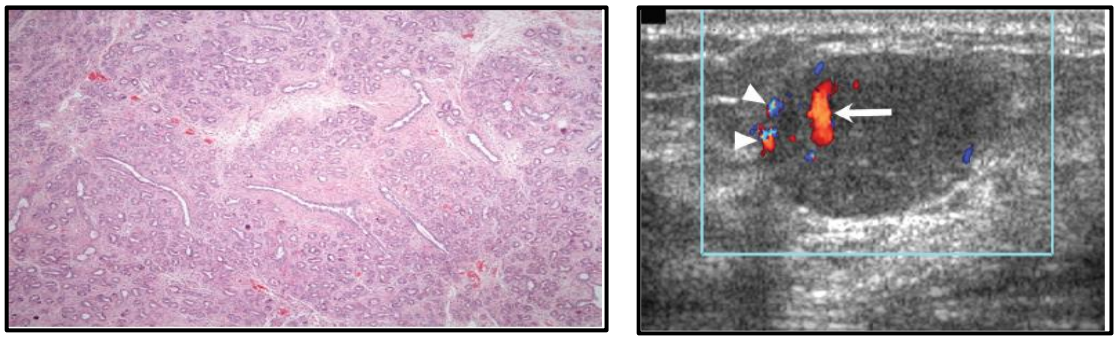


Figure 2.17: juvenile fibroadenoma in a 19-year-old woman (Suk et al 2014).

2.3.4.2 Complex fibroadenoma: is a sub type of fibroadenoma harboring one or more of these features: Epithelial calcifications, papillary apocrine metaplasia, sclerosing adenosis or cysts larger than 3 mm (Durak et al 2011).

2.3.4.1 Simple FA: most FAs are about 1-3cm in size. No sonographic features have been clearly defined for the distinction of simple FAs from complex FAs (Cyrlak et al 1998).

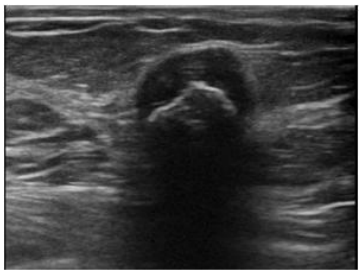
(A)  (B) 

Figure 2.18: FA (popcorn appearance) (Durak et al 2011).

2.3.4.3 Giant FA: Fibroadenomas more than 5 cm in diameter or weighing more than 500 grams are known as giant fibroadenomas. Giant fibroadenomas are the most common cause of massive breast enlargement in young females (Waqar et al 2009).

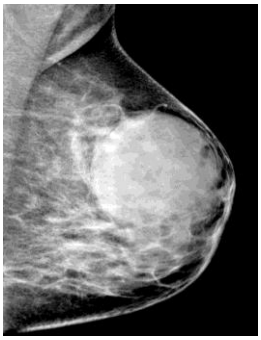
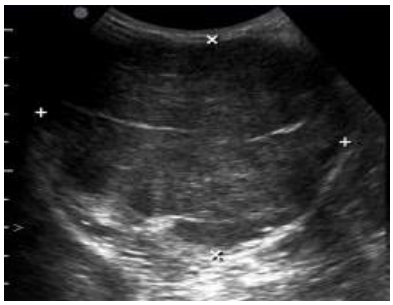
(A)  (B) 

Figure 2.19: Giant FA (A) mammogram (B) U/S (Waqar et al 2009).

2.3.5 Diagnosis:

Commonly, a large number of patients with palpable breast lesions are referred to diagnostic breast centers for mammography, sonography and biopsy (FNAC, excisional/incisional) to guide the treatment of breast mass and to screen the rest of the breast. Breast lump should be evaluated by "triple assessment", which includes palpation, imaging and percutaneous core needle biopsy or fine-needle aspiration cytology. The accurate diagnosis of breast lumps without formal biopsy is highly desirable.

2.3.5.1 Ultrasound:

In close to 2/3 of patients fibroadenomas present with typical benign sonographic characteristics such as: round, oval, rarely lobulated contour; sharp borders with strong capsule echoes; homogenous hypoechoic internal pattern; bilateral refractive shadowing; posterior enhancement and horizontal orientation. In older patients with increasing fibrosis within the fibroadenoma, contour irregularities, heterogeneous internal echoes, retrograde acoustic shadowing due to the calcifications, and impaired compressibility may develop. Such lesions are difficult to differentiate from malignancies (Asim & Frank 2003).

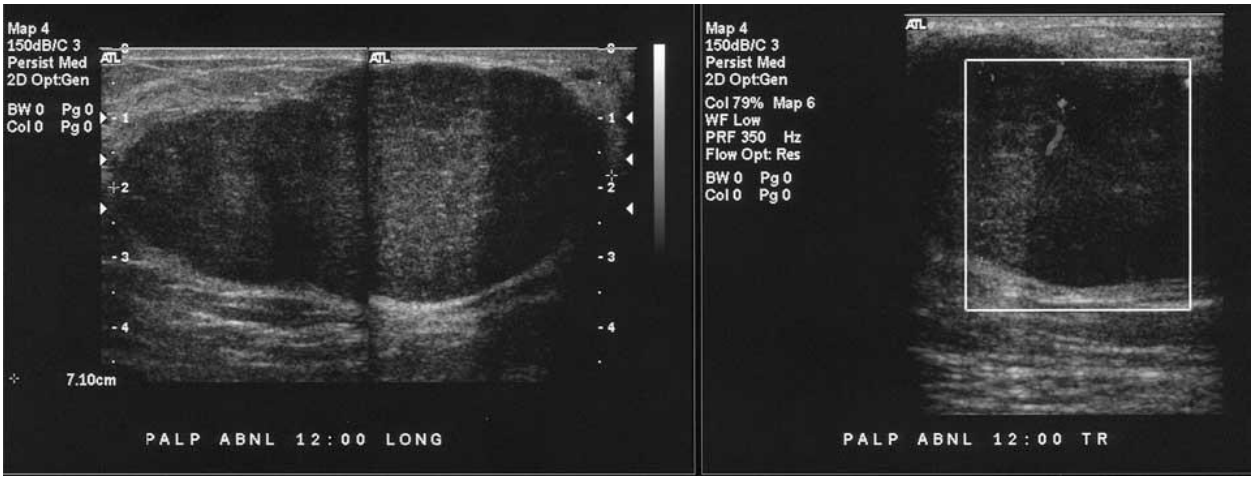
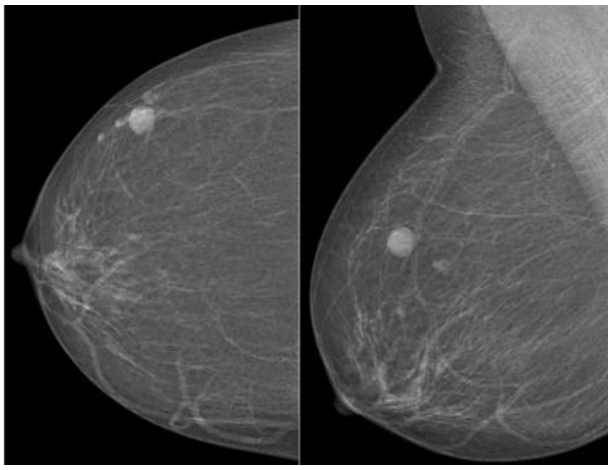


Figure 2.20: Typical ultrasound features of FA (Asim & Frank 2003).

2.3.5.2 Mammography:

Fibroadenomas have a spectrum of features from the well circumscribed discrete oval mass hypo- or isodense to the breast glandular tissue, to a mass with macrolobulation or partially obscured margin. Involuting fibroadenomas in older, typically postmenopausal patients may contain calcification, often producing the classic, coarse popcorn calcification appearance. In some cases the whole lesion is calcified. Calcification may also present as crushed stone-like microcalcification which makes differentiation from malignancy difficult (Owen 2016).

(A)



(B)

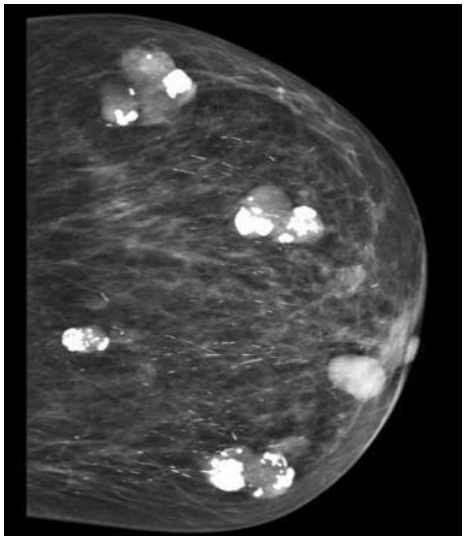


Figure 2.21: (A) FA. (B) calcified FA (Owen 2016).

2.3.6.3 Histopathology:

The basic characteristic feature of all fibroadenomas is proliferation of glandular as well as stromal elements with a sharply defined border and the pericanalicular or intracanalicular or mixed growth pattern (Brijesh 2014).

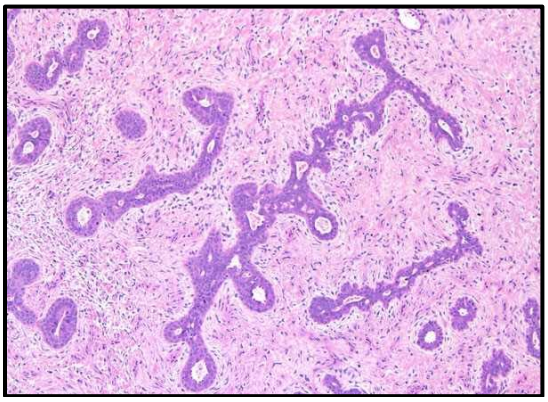


Figure 2.22: FA histopathology shows ducts with both tubular and compressed architecture. Note the hypocellular stroma around ducts.

2.3.6 Differential diagnosis:

The differential diagnosis comprises Hamrtoma, tubular adenoma, sclerosing lobular hyperplasia, and especially phyllodes tumor (Werner 2006).

A study done on 2012 revealed that if a lesion appears on US as an oval or lobular mass with smooth contours, hyperechogenicity relative to the surrounding glandular tissue and homogeneous echotexture, it is likely to be a fibroadenoma. Moreover, if a lesion with these features has a diameter >5 cm, it is likely to be a giant fibroadenoma. If a lesion appears rounded or multilobular, with irregular contours, marked hypoechogenicity (relative to the surrounding fat), heterogeneous echostructure and cystic areas, it is likely to be a benign lesion (but not fibroadenoma). There is nonetheless a substantial overlap between the mammographic and US parameters of fibroadenomas and phyllodes tumors, and no pathognomonic signs exist that allow discrimination between the two histological types. US-guided CNB represents a valuable tool in the differential diagnosis between fibroadenoma and phyllodes tumor (Brijesh & Vatsala 2014)

In histopathology Hamartomas show a normal lobular arrangement, and lack elongated ducts and cellular/edematous/myxoid stroma. Furthermore fibrocystic changes and epithelial hyperplasia are rare. Sclerosing lobular hyperplasia is less well demarcated than fibroadenoma, shows more vague and often enlarged lobular architecture, and the stromal component is more sclerotic. Tubular adenoma contains tubular/acinar structures with scant stroma tissue and is thus easily distinguished from fibroadenoma. Phyllodes tumor and fibroadenoma of intra-canalicular type may be difficult to discriminate. Compared to fibroadenoma, phyllodes tumors show overgrowth of the stromal compartment with increased cellularity, especially in the periductal stromal areas (Werner 2006).

2.3.7 Management:

The management of fibroadenomas is still debatable and dependent on patient age and clinical findings. For non-palpable lesions, the recommended approach is a follow up period of 1 and 3 years after the fibroadenoma is diagnosed by the triple assessment. For palpable lesions, some advocate complete surgical; excision of all lesions that are clinically suspected of being fibroadenomas, as it provides a definitive diagnosis while removing the lesion as a source of patient concern (Fani et al 2003).

2.4 diagnostic ultrasound of the breast:

Ultrasound is a non-invasive, non-painful technique performed with high frequency sound waves, unable to be heard by the human ear.

The use of ultrasound in addition to clinical examination and mammography may result in an increased rate of breast cancer detection. USG is useful to differentiate cystic from solid abnormalities of the breast.

2.4.1 Equipment:

Breast ultrasound requires the use of high-resolution ultrasound equipment. The sonographer must select the appropriate transducer for the area to be examined. Lower frequency transducers may be required for a large breast masses.

The image first must be optimized using electronic focusing, overall gain, and time gain compensation (TGC) adjustment. The goal is to balance the image from the low-level echoes of the subcutaneous fat to the low-level echoes of the retromammary fat. This should result in an image that clearly shows all levels of the breast from the skin level through the echogenic breast core and the deeper echogenic chest wall layers. Moderate compression applied with the transducer during scanning will improve detail and decrease the depth of tissue (Carol et al 2011).

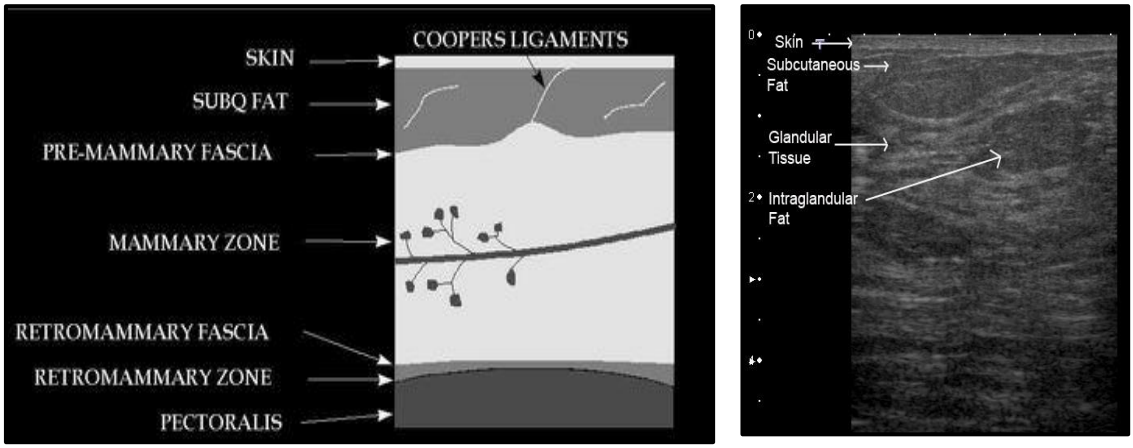


Figure 2.23: Normal breast U/S (Carol et al 2011).

2.4.2 Positioning:

Patients are usually scanned in the supine position with the use of a hand-held, high-resolution transducer. The patient is positioned with her arm behind her head on the side of the breast to be examined. This spreads the breast tissue more evenly over the surface of the chest and provides a more stable scanning surface and easier access to the axilla. When the medial portion of the breast is scanned, a supine position works well. For the lateral margin of the breast, the patient can be rolled slightly toward the opposite side (approximately 30 to 45 degrees) and stabilized with a cushion under her shoulder and hips (Sandra 2012).

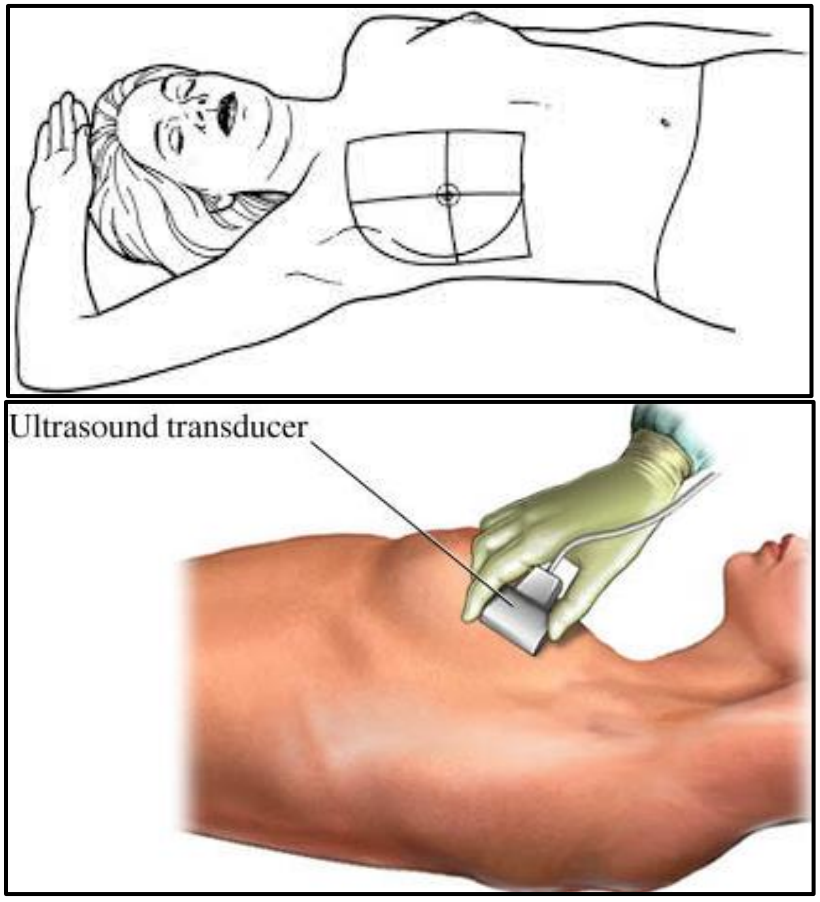


Figure 24: Patient position for breast U/S (Sandra 2012).

2.4.3 Technique:

The most common scanning technique is to initially scan using the grid scanning pattern, followed by a radial (clock face) technique for the hard copy imaging.

2.4.3.1 Grid scanning pattern:

- Scan up and down the breast in rows, making sure you overlap each row slightly to ensure no breast tissue is overlooked.
- Begin in the upper outer quadrant, scanning in transverse. Slide inferiorly from top to bottom.
- Move across and repeat the sweep inferior to superior.
- Repeat this across the breast.
- Rotate into a sagittal plane and repeat the pattern.

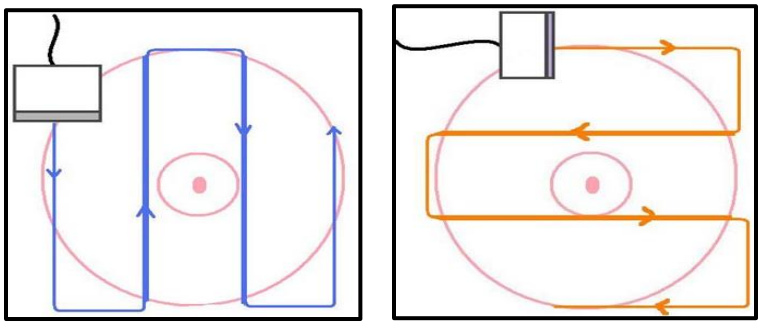


Figure 2.25: Grid scanning pattern for breast U/S

2.4.3.2 Radial scanning pattern (Clock-face):

- The breast is scanned and described as a clock-face.
- Begin at 12 o'clock in a sagittal plane with the toe of the probe at the nipple.
- Scan by rotating the probe around the nipple.
- Depending on breast size, a second pass further from the nipple may be required.

- If pathology is identified, rotate the probe 90degrees in the 'anti-radial' plane (Ultrasoundpaedia 2016).

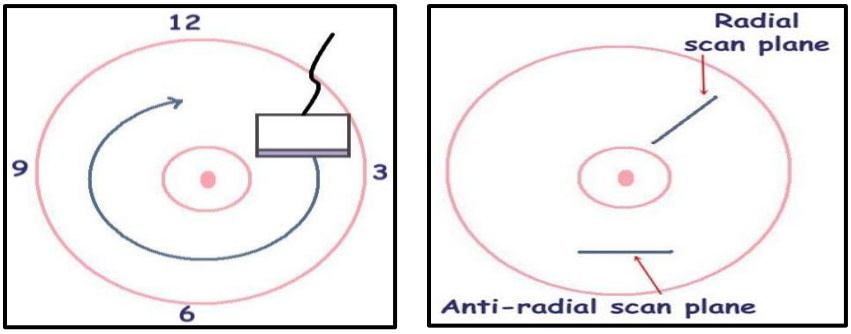


Figure 2.26: Radial scanning pattern for breast U/S (Ultrasoundpaedia 2016).

2.4.4 Documentation:

Labeling sonographic images of the breast is extremely important in the identification and correlation of breast images with images from other modalities.

2.4.4.1 Quasi-grid pattern:

Most imaging centers have traditionally used the quasi-grid pattern. This views the breast as a clock face. Directly above the nipple on either breast is 12 o'clock.

Right medial breast and left lateral breast are 3 o'clock. Directly below the nipple bilaterally is 6 o'clock, and right lateral breast and left medial breast are 9 o'clock, respectively.

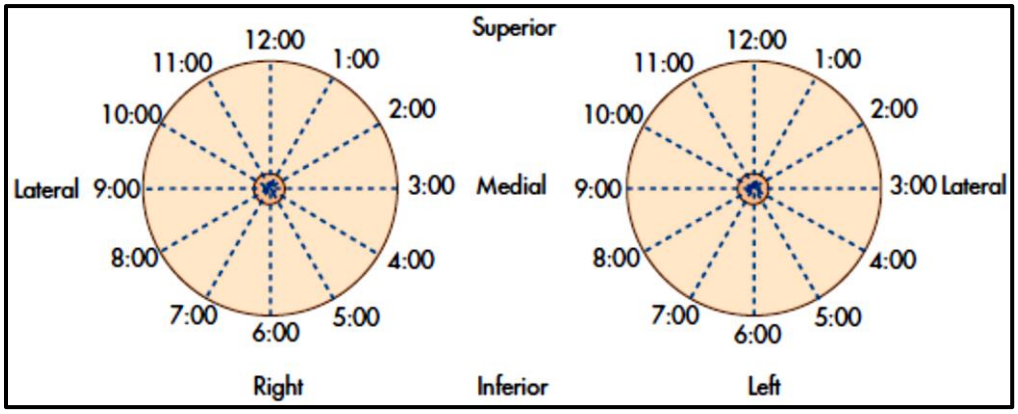


Figure 2.27: Quasi-grid pattern (Sandra 2012).

2.4.4.2 Clock method:

Many imaging centers will further subdivide the breast with three concentric circles, with the center being the nipple. The first ring circles one third of the breast tissue, encompassing the area just outside the nipple, or zone 1. The second ring is about two thirds of the breast surface from the nipple, or zone 2. The final ring is to the breast periphery, or zone 3. Lesions located close to the nipple are labeled "A," lesions in the middle of the breast are labeled "B," and lesions located at the outer margin of the breast are labeled "C" (Sandra 2012).

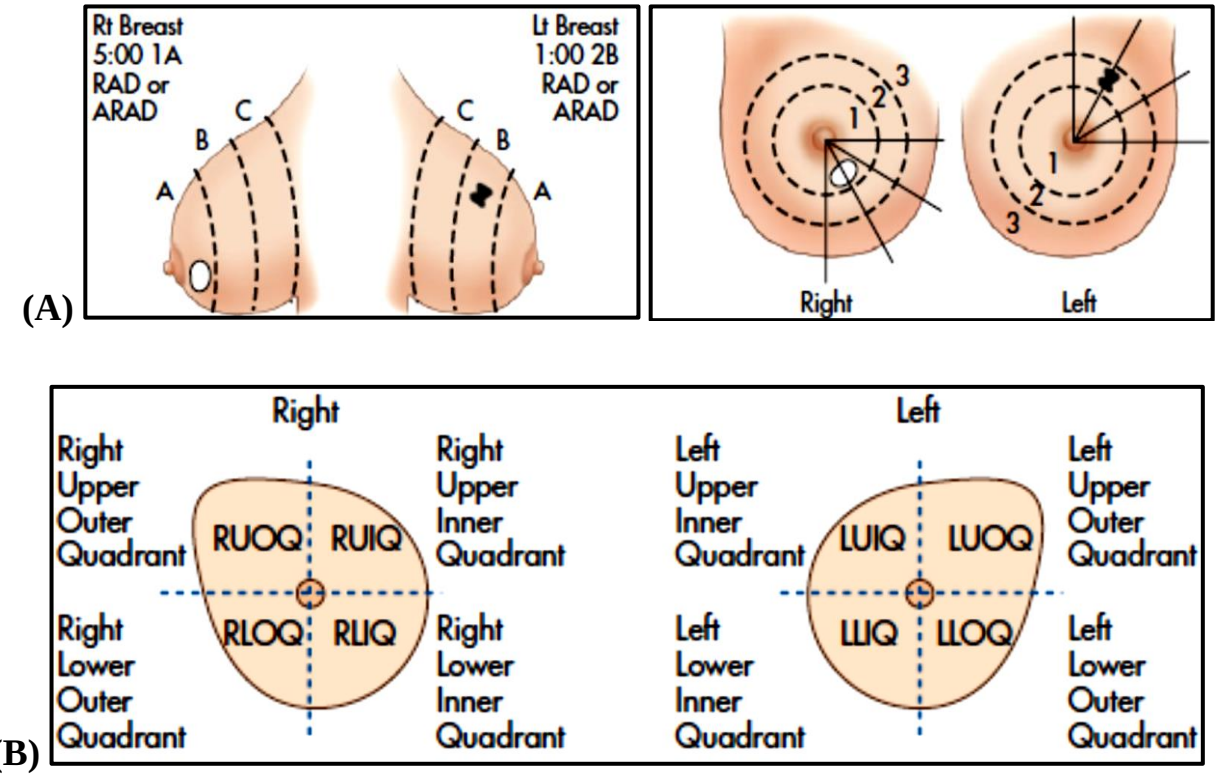


Figure 2.28: Breast anatomy is described by two methods: the quadrant method (right/left, upper/lower, and inner/outer quadrants) and the clock face method (Sandra 2012).

2.4.4.3 Depth labeling:

Finally, the depth of any pathologic condition is documented. The breast again is divided into thirds from the skin to the pectoralis major. Depth A is the most superficial third of the breast, depth B is the middle layer, and depth C is the deepest third of the breast. Superficial lesions located close to the skin surface are labeled “1,” lesions in the middle of the breast are labeled “2,” and deeper lesions located toward the chest wall are labeled “3” (Sandra 2012).

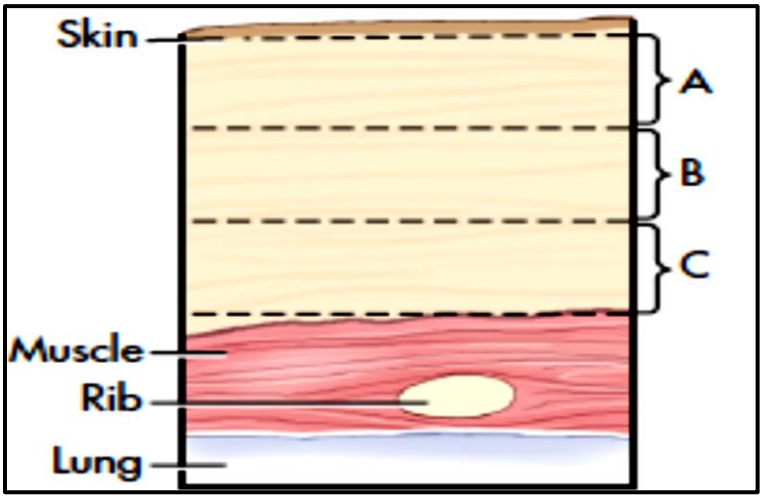


Figure 2.29: Labeling of breast lesion depth (Sandra 2012).

2.5 Previous studies:

A study done by **Jackson VP** in 1986 to evaluate the sonographic findings of breast fibroadenoma in 59 biopsy-proven fibroadenomas and additional 26 biopsy-proven fibroadenomas that were not diagnosed as such with ultrasound had showed that only 12 of the 76 fibroadenomas had the classic sonographic appearance of a smooth round or oval mass with homogeneous internal echoes. 50 fibroadenomas demonstrated one or more "atypical" signs of border irregularity, tabulation, inhomogeneous internal echo texture, or posterior shadowing. There were nine sonographic false positives: five patients had other benign lesions on histology, and four masses believed to be sonographically compatible with fibroadenoma were found to be carcinomas. The study has recommended that the histologic evaluation of all solid masses essential to differentiate between malignant and benign mass (Jackson 1986).

A sonomammography correlation for breast fibroadenoma assessment in 122 patients with 140 biopsy-confirmed fibroadenomas was done by **Cole** has reported that the most significant fibroadenoma sonographic features were a round (48%) or oval (37%) shape, a smooth contour (75%), weak internal echoes (80%) in a uniform distribution (88%), and intermediate acoustic attenuation (71%) (Cole et al 1983).

A study included the sonographic evaluation of 34 juvenile fibroadenomas confirmed by histopathology by **Suk et al** was found that the mean size was 30 mm, The dominant sonographic presentation of juvenile fibroadenoma is a circumscribed oval hypoechoic or isoechoic mass, which resembles that of simple fibroadenoma. Juvenile fibroadenomas frequently show posterior acoustic enhancement and hypervascularity on color Doppler sonography (Suk et al 2014).

The results obtained by **Houssami et al** suggest that the diagnosis is based on the combination of clinical examination, imaging and non-surgical tissue biopsy (the triple test). A clinical diagnosis of fibroadenoma alone is unreliable and does not exclude malignancy even in younger women. The choice of imaging is mammography, combined with ultrasound in older women, and ultrasound alone in younger women. Tissue biopsy, by either fine-needle aspiration or core biopsy, is the most accurate means of establishing the diagnosis (Houssami et al 2001).

.

Chapter Three

3. Material and methods

3.1 Materials:

The study intended to evaluate the sonographic findings in patients with breast fibroadenoma. The data used in this study was collected from Khartoum breast center in Khartoum state. The data has been collected from April 2016 to August 2016.

3.1.1 Subjects:

Study cases were 50 pathological confirmed fibroadenoma that underwent US examinations. They were all female, age 17-35 years. There were no women in pregnancy or lactation. All cases had single breast lesion.

3.1.2 Machine used:

All patients where scanned on GE Logiq P5 ultrasound machine using linear high frequency transducer (7.5-12 MHz) and curve linear transducer (5MHZ) for large massess assessment.

Figure 3.1GE U/S machine

3.2 Method

USG examination of 50 cases of pathological confirmed (FNA, Core biopsy & excisional biopsy), breast fibroadenomas was done by an expert Sonologist in

the department of radiology and the sonographic findings of the lesions were analyzed.

3.2.1 Technique used:

The area for evaluation was fixed and skin adequately lubricated to facilitate ultrasound transmission. The transducer was gently applied and both longitudinal and transverse scans were taken.

3.2.2 Image interpretation:

The scans included sonographic information regarding the shape, margins, width antero-posterior, echogenicity, internal echo texture, posterior acoustic phenomena, lateral edge shadowing and vascularity of the breast fibroadenomas.

3.2.3 Data analysis

It has been carried out by statically package for social sciences AXEL.

Chapter Four

4. Results

4.1 Results:

This study includes 50 patients aged between 17-35years all were complaining of breast lump, the results of ultrasonic examination were as follows:

Table 4.1:

Shows age frequency:

Age (yrs.)	Frequency	Percent
17-21	14	28.0
22-26	22	44.0
27-31	7	14.0
32-36	7	14.0
Total	50	100.0

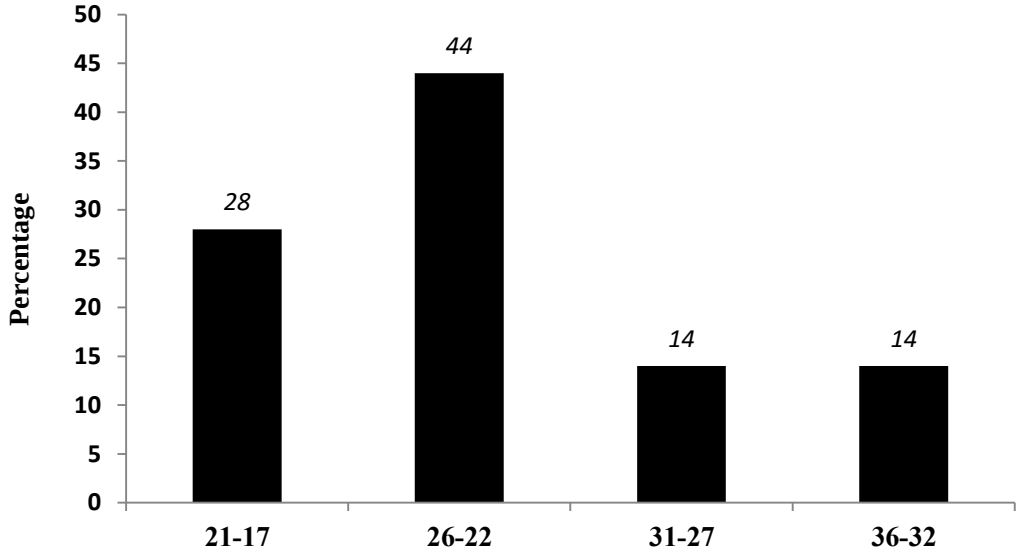


Figure 4.1 Age distribution

Table 4.2:

Shows tumor side frequency:

Side	Frequency	Percent
Right	**20**	**40.0**
Left	**30**	**60.0**
Total	**50**	**100.0**

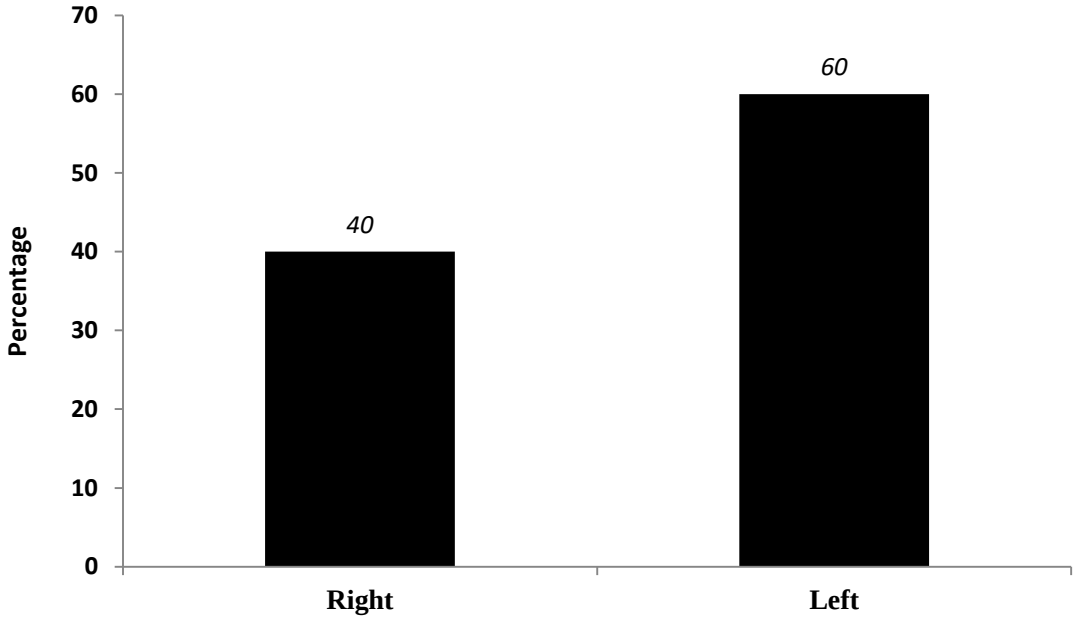


Figure 4.2 Tumor side distribution

Table 4.3:

Shows mobility frequency:

Mobility	Frequency	Percent
Mobile	**28**	**56.0**
Not mobile	**22**	**44.0**
Total	**50**	**100.0**

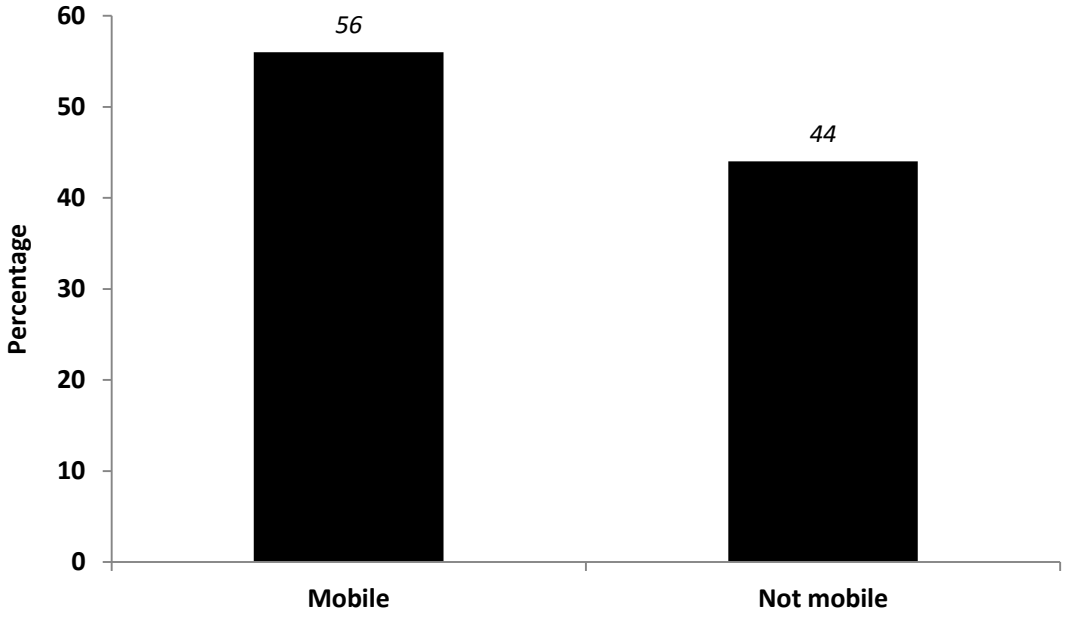


Figure 4.3 Mobility distribution

Table 4.4:

Shows width to height ratio frequency:

Width to height ratio	Frequency	Percent
≥ 1.4	40	80.0
< 1.4	10	20.0
Total	43	100.0

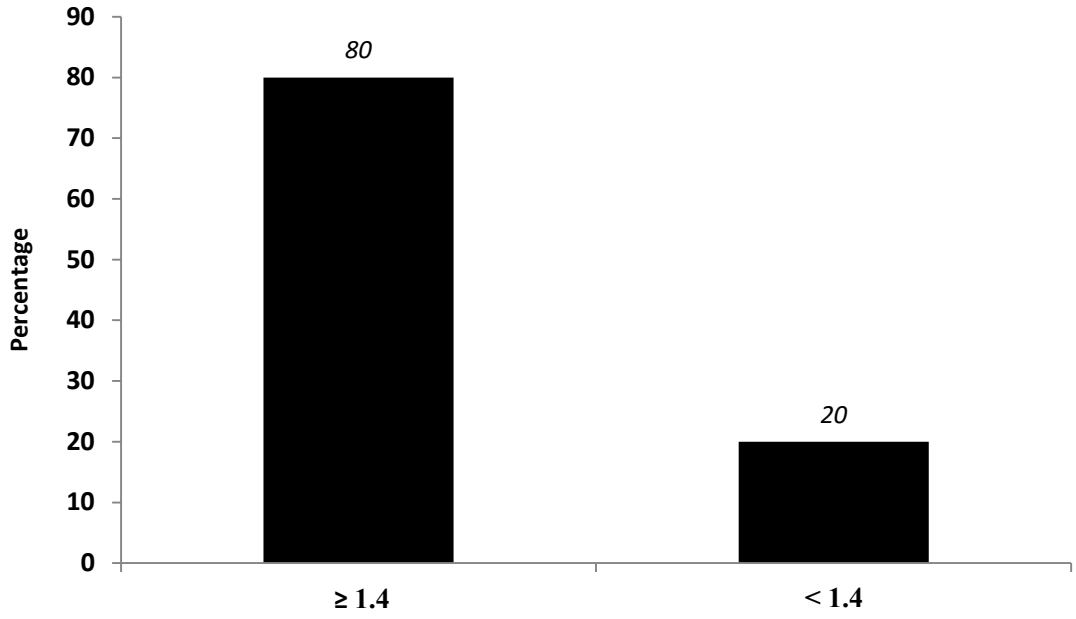


Figure 4.4 Width to height ratio distribution

Table 4.5:

Shows shape frequency:

Shape	Frequency	Percent
Round	**17**	**34.0**
Oval	**26**	**52.0**
Irregular shape	**7**	**14.0**
Total	**50**	**100.0**

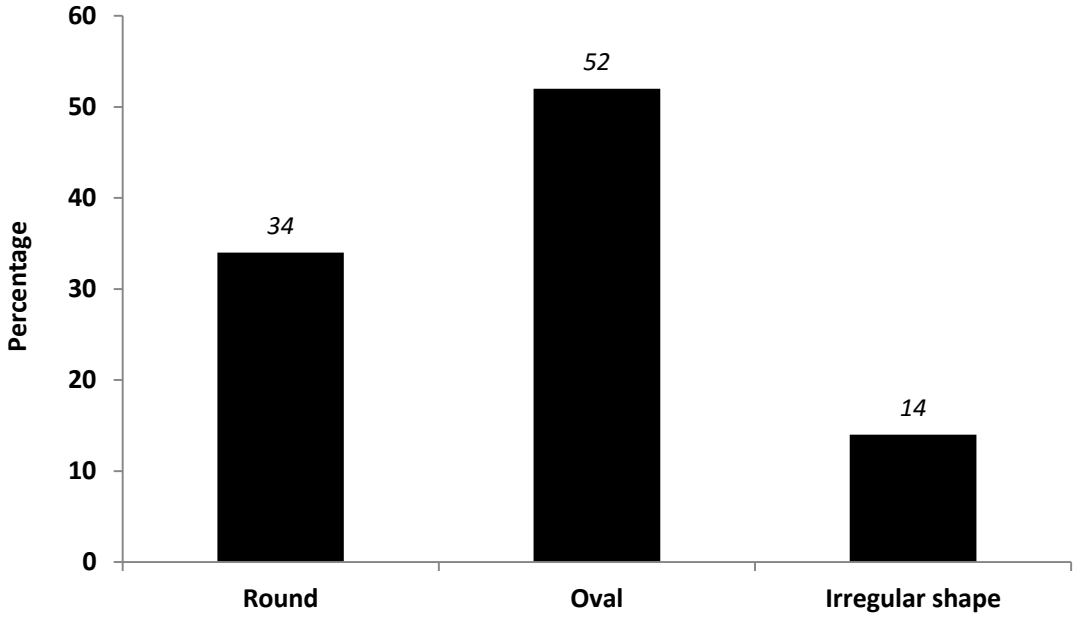


Figure 4.5 Shape distribution

Table 4.6:

Shows margins frequency:

Margins	Frequency	Percent
Well defined	**48**	**96.0**
Ill defined	**2**	**4.00**
Total	**50**	**100.0**

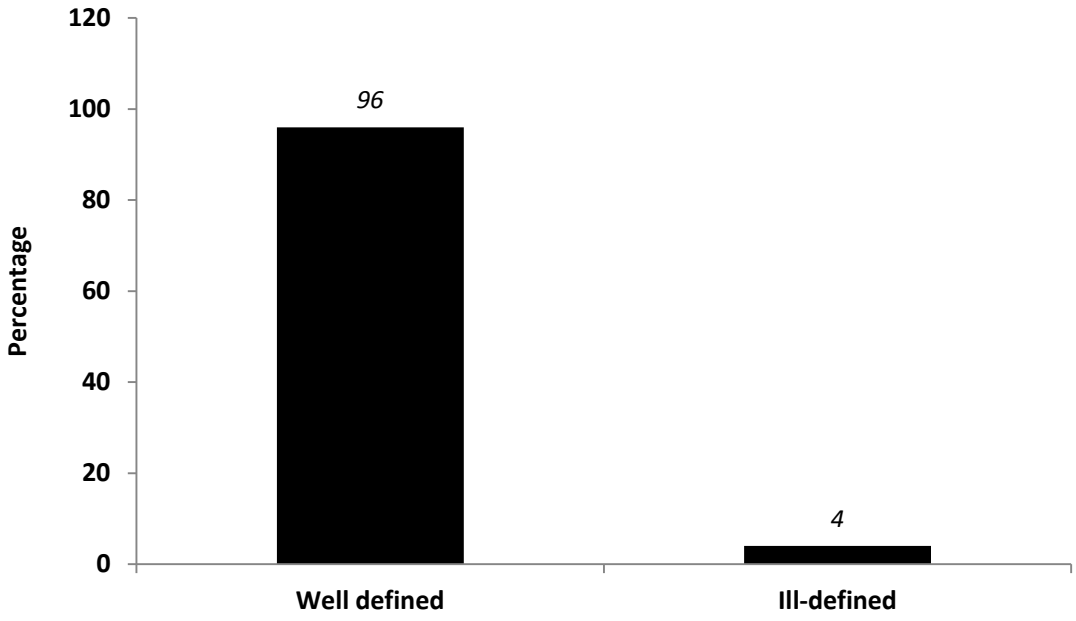


Figure 4.6 Margins distribution

Table 4.7:

Shows macrolobulation frequency:

Macrolobulation	Frequency	Percent
Present	**16**	**32.0**
Absent	**34**	**68.0**
Total	**50**	**100.0**

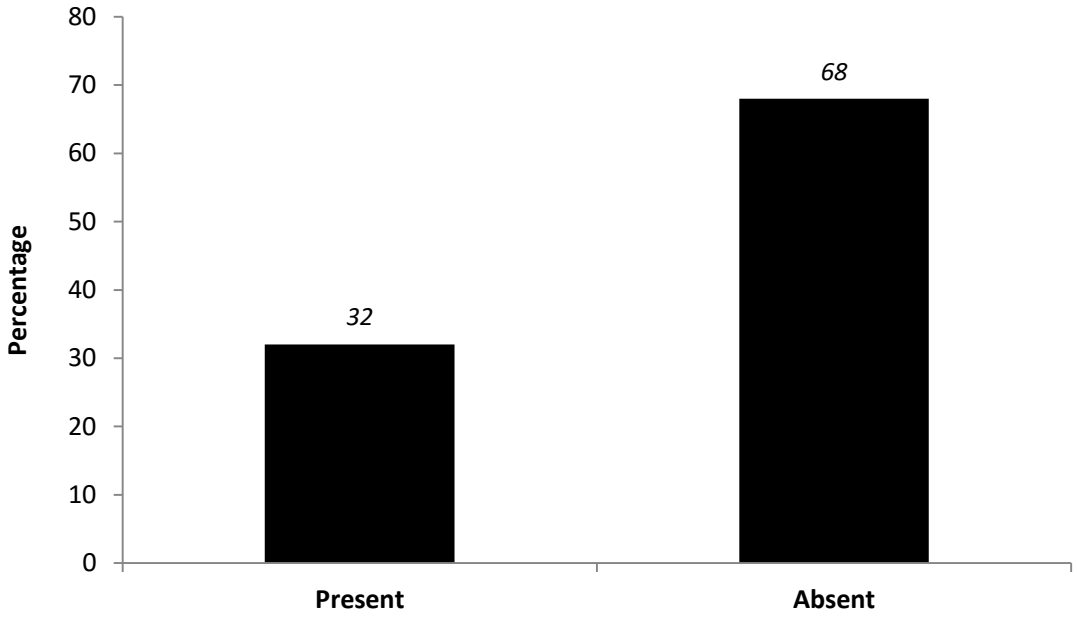


Figure 4.7 Macrolobulation distribution

Table 4.8:

Shows echogenicity frequency:

Echogenicity	Frequency	Absent
Hypoechoic	**50**	**100.0**
Total	**50**	**100.0**

Table 4.9:

Shows internal echo pattern frequency:

Internal echo pattern	Frequency	Percent
Homogenous	42	84.0
Cystic areas	5	10.0
Calcification	3	6.0
Total	50	100.0

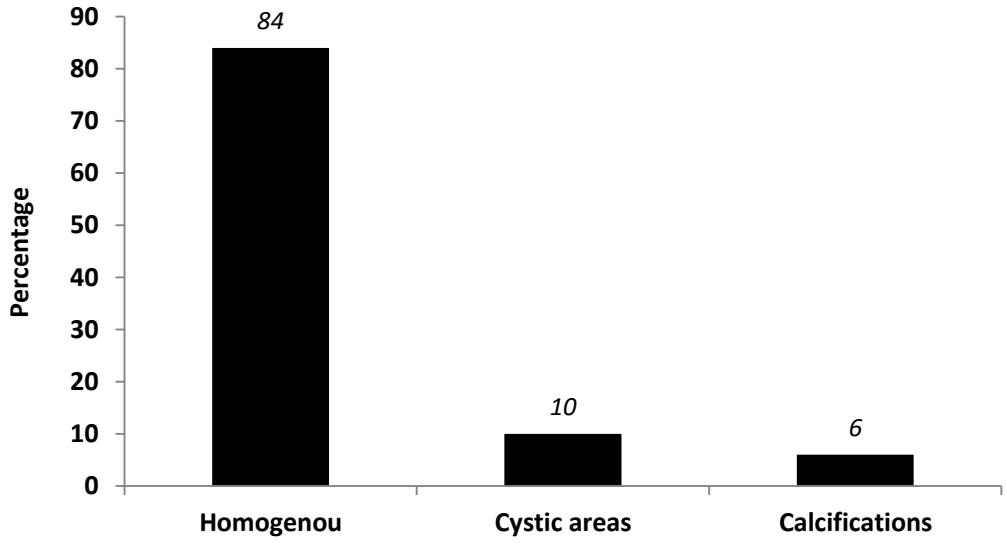


Figure 4.8 Internal echo pattern distribution

Table 4.10:

Shows lateral acoustic shadow frequency:

Lateral acoustic shadow	Frequency	Percent
Present	**17**	**34.0**
Absent	**33**	**66.0**
Total	**50**	**100.0**

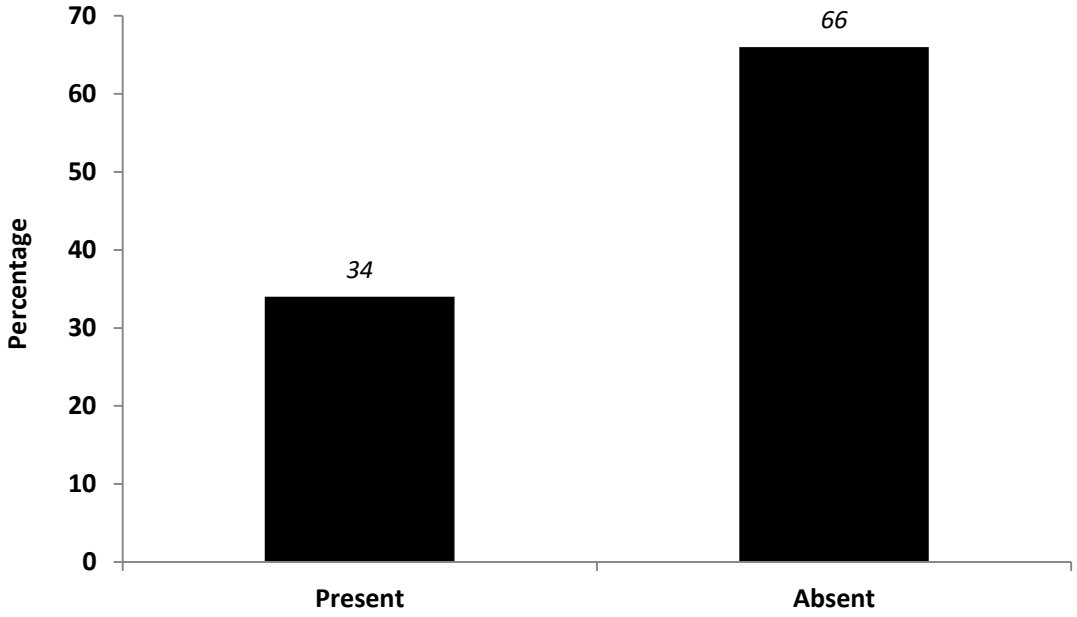


Figure 4.9 Lateral acoustic shadow distribution

Table 4.11:

Shows posterior acoustic phenomena frequency:

Posterior acoustic phenomena	Frequency	Percent
Enhancement	**28**	**56.0**
Shadowing	**2**	**4.0**
None	**20**	**44.0**
Total	**50**	**100.0**

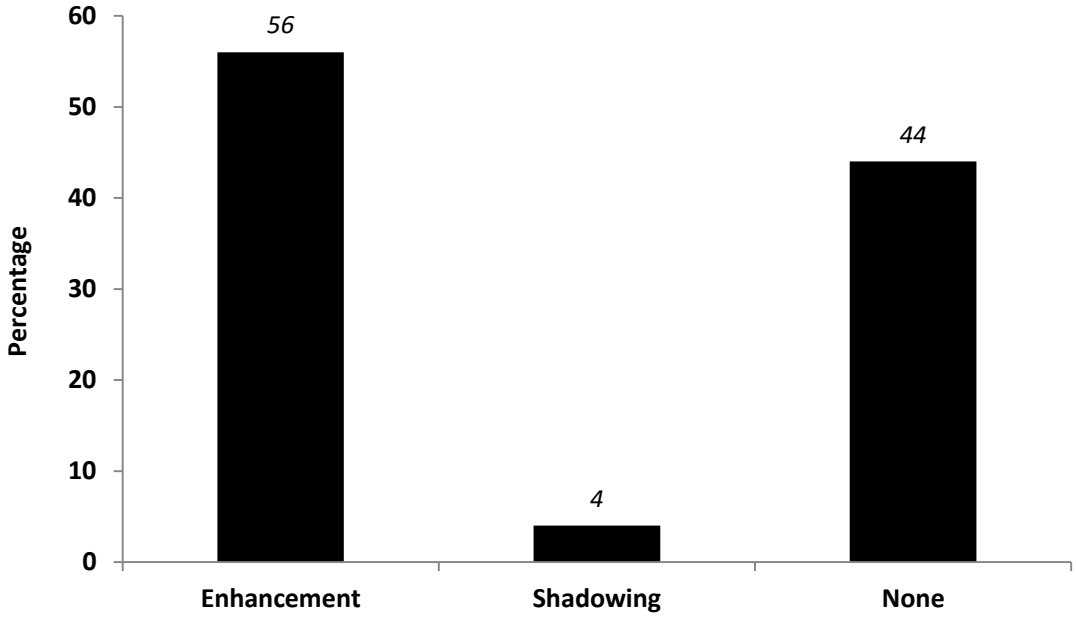


Figure 4.10 Posterior acoustic phenomena distribution

Table 4.12:

Shows vascularity frequency:

Vascularity	Frequency	Percent
Avascular	**50**	**100.0**
Total	**50**	**100.0**

Table 4.13:

Shows histopathology results frequency:

Histopathology results	Frequency	Percent
Simple FA	**30**	**60.0**
Complex FA	**6**	**12.0**
Giant FA	**12**	**24.0**
Juvenile FA	**2**	**4.0**
Total	**50**	**100.0**

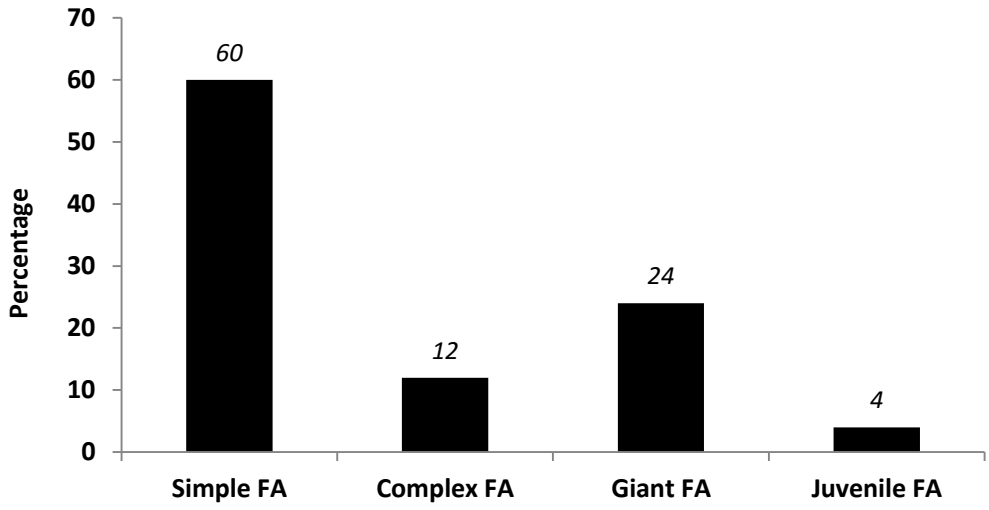


Figure 4.12 Types of FA distribution

Table 4.15:

Sonographic appearances of different types of fibroadenoma

Ultrasound features		FA U/S criteria			
		Simple FA *Total No. (30)*	**Complex FA** *Total No. (6)*	**Giant FA** *Total No. (12)*	**Juvenile FA** *Total No. (2)*
Macrolobulation	*Present*	8 (26.7%)	2 (33.3%)	5 (41.7%)	-
	Absent	22 (73.3%)	4 (66.7%)	7 (58.3%)	2 (100%)
Margins	*Well defined*	30 (100%)	2 (33.3%)	10 (83.3%)	2 (100%)
	Ill defined	-	4 (66.7%)	2 (16.7%)	-
Lateral acoustic shadow	*Present*	13 (43.3%)	2 (33.3%)	1 (8.3%)	1 (50%)
	Absent	17 (56.7%)	4 (66.7%)	11 (91.7%)	1 (50%)
Internal echo pattern	*Homogenous*	29 (96.7%)	-	10 (83.3%)	2 (100%)
	Cystic areas	1 (3.3%)	3 (50%)	2 (16.7%)	-
	Calcifications	-	3 (50%)	-	-
Posterior acoustic phenomena	*Enhancement*	16 (53.3%)	3 (50%)	8 (66.7%)	1 (50%)
	Shadowing	1 (3.3%)	-	1 (8.3%)	-
	None	13 (43.3%)	3 (50%)	3 (25%)	1 (50%)
Shape	*Round*	8 (26.7%)	2 (33.3%)	6 (50%)	1 (50%)
	Oval	19 (63.3%)	3 (50%)	3 (25%)	1 (50%)
	Irregular	3 (10%)	1 (16.7%)	3 (25%)	-
Width to height ratio	*≥ 1.4*	25 (83.3)	5 (83.3%)	9 (75%)	1 (50%)
	< 1.4	5 (16.7)	1 (16.7)	3 (25%)	1 (50%)
Mean Size (cm)		0.8	2	11.5	0.5

Chapter Five

5. Discussion, conclusion and recommendations

5.1 Discussion:

Breast fibroadenomas are common benign breast tumors and detailed descriptions of their sonographic appearances are necessary for differential diagnosis from other benign lesions or breast cancers.

This study investigated 50 cases of fibroadenomas confirmed by histopathology examination (FNA, Core biopsy & excisional biopsy), the lumps underwent ultrasound scann done by a Sonologist in the department of radiology and the sonographic findings of the lesions were analyzed.

In accordance with previous results which showed that the mean age affected by FA is (25 years) (Rosen 1996), the mean age in 50 patients with fibroadenoma in our study was (24.6) years. 22 patients (44%) were in the age range (22-26), 14 patients (28%) were in the age range (17-21), 7 patients (14%) were in the age range (27-31) and 7 patients (14%) were in the age range (32-36).

All fibroadenomas were solitary and mobility of the lump were detected in 28 patients (56%), a primary advantage of this finding is the ability to directly correlate the physical exam findings with imaging results.

30 out of 50 fibroadenomas (60.%) are located mostly in left breast, so far the significance of this finding is not clear.

The size of the tumors ranged from 1.5 to 148.3 cm (mean size, 2.94 cm) with width to height ratio ≥1.4 in 40 fibroadenomas (80%), these results are consistent with the findings of a study showed that the antero-posterior ratio of all benign tumors including fibroadenoma is ≥ 1.4 (Kailash et al 2008).

The imaging features of fibroadenoma have been broadly stated in the literature. In contrast, sonographic features of individual subtypes of fibroadenoma have not been widely reported. Sanchez et al analyzed sonographic findings of 44 breast fibroadenomas in the pediatric population. These 44 fibroadenomas included 34 conventional fibroadenomas, 7 juvenile fibroadenomas, and 3 complex fibroadenomas. Characteristically, 5 (71%) of 7 juvenile fibroadenomas showed internal linear hyperechoic septa. No other differences in gray scale sonographic features were observed between conventional and juvenile fibroadenomas. (Sanchez 2010). In our study simple fibroadenoma (frequency 30, percentage 60%) is the most common type of breast fibroadenoma followed by Giant fibroadenoma (frequency 12, percentage 24%), complex fibroadenoma (frequency 6, percentage 12%) and the least common type is juvenile fibroadenoma (frequency 2, percentage 4%).

The most significant fibroadenoma sonographic features are a round or oval shape, a smooth contour, weak internal echoes in a uniform distribution and intermediate acoustic attenuation (Cole et al 1983). The present study confirmed this observation; The shape of the lesions was oval in 26 fibroadenomas (52%) round in 17 fibroadenomas (34%) and irregular shape in 7 fibroadenomas (14%). The margins were well defined in 48 masses (96%) and ill-defined in 2 fibroadenoma (4%), while 16 out of 50 fibroadenomas (32%) showed macrolobulations. Lateral acoustic shadowing was found in 17 masses (34%) and not seen in 33 out of 50 masses (66%). Posterior acoustic characteristics included posterior acoustic enhancement in 28 masses (56%), posterior shadowing in 2 cases (4%), and no posterior acoustic phenomena in 20 (44%).

Although Ying et al. reported that 26 out of 48 (54.2%) lesions in fibroadenoma group were avascular, none of the 50 fibroadenomas in our study showed vascular

or Doppler signals this could be due to the lack of experience in using Doppler by the radiologists and technicians.

Echogenicity has often been of less importance for the differentiation of solid masses, partly because no standardized definition of this parameter exists. In this study all fibroadenomas were hypoechoic in contrast to some reports in the literature which showed that fibroadenoma could be hypoechoic, isoechoic or hyperechoic (Suk et 2014). More useful information can be gained by comparing tumor echogenicity with that of the fatty tissue of the breast rather than with that of adjacent echogenic fibroglandular tissue surrounding the tumor.

Echotexture commonly divided into homogenous and heterogeneous echo pattern, the heterogeneous texture may contain cystic areas or calcifications. In this study 42 masses (84%) showed homogenous texture and 5 masses (10%) showed areas of cystic contents and 3 masses (6%) showed internal calcification.

There is no significant difference between types of fibroadenoma, however complex fibroadenoma may shows some outlines irregularity and heterogeneous texture and giant fibroadenoma has a large size >5cm with irregular shape.

5.2 Conculsion:

Fibroadenomas are more common in the age between (22-26) years. The dominant sonographic presentation of fibroadenoma is a circumscribed oval hypoechoic homogenous mass, macro-calcficiation and cystic contents may be found in some types of fibroadenoma. Fibroadenomas frequently show posterior acoustic enhancement and avascular on color Doppler sonography.

Ultrasound is unable to differentiate between different types of fibroadenoma but according to histopathology results simple fibroadenoma is the most common type.

5.3 Recommendation:

1- Ultrasound is a simple, time saving tool for evaluation of breast masses. It should be the first investigation to be done in young females or pregnant women when mammography is not advisable.
2- The sonographic evaluation of a simple breast fibroadenoma with the typical sonographic features should eliminate the need for further invasive procedures including biopsy.
3- The role of ultrasound in the diagnosis of large breast masses needs further assessment.
4- Educating and training technologist sonographers and radiologists to perform optimum examination and correct interpreting are of prime importance.
5- The most profound limitation of the study was the small sample size. So we recommend that study with larger sample be considered.

References:

Brijesh Thakur & Vatsala Misra 2014, Clinicohistopathological features of Fibroadenoma Breast in patients less than 20 years of age and its comparison with elder patients, Journal of Nursing and Health Science Volume 3, Issue 5 PP 67-7.

Asim Kurjak, Frank A Chervenak 2004. Donald School Textbook of Ultrasound in Obstetrics and Gynecology. 2nd ed. London, Parthenon Publishing Group.

Bartow SA, Pathak DR, et al. December 1987 Prevalence of benign, atypical, and malignant breast lesions in populations at different risk for breast cancer. A forensic autopsy study. Volume 60, Issue 11, pages 2751–2760.

Betty Bates Tempkin 2007. Pocket Protocols For Ultrasound Scanning, 2nd ed. Missouri, Elsevier Inc.

C Cole-Beuglet, RZ Soriano, et al. Feb 1983. Fibroadenoma of the breast: Sonomammography correlated with pathology in 122 patients. AJR Volume 140, Number 2.

Carol M. Rumack, et al2005. Diagnostic Ultrasound. 4th ed. Philadelphia,, Mosby, Inc.

Chung EM, Cube R, Hall GJ et-al 2009. From the archives of the AFIP: breast masses in children and adolescents: radiologic-pathologic correlation. Radiographics. Vol 29, issue 3: 907-31. doi:10.1148/rg.293095010 .

Cyrlak D, et al 1998, Breast Imaging Case of the Day, radiograhics vol 19, Issue 2.

Durak MG, et al 2011, Cystic fibroadenoma of the breast: a case report. Turk Patoloji Derg. Vol 27(3).

Elisabetta Buscarini, et al 2013, Manual of diagnostic ultrasound. Vol. 2. 2nd ed. Slovenia, World Health Organization.

Fani Sperber, et al 2003 Diagnosis and Treatment of Breast Fibroadenomas by Ultrasound-Guided Vacuum-Assisted Biopsy, JAMA, Vol 138, No. 7, 796-800

Gatta G, Iaselli F, et al. 2011 Sep. Differential diagnosis between fibroadenoma, giant fibroadenoma and phyllodes tumor: sonographic features and core needle biopsy. Radiol Med. 116(6):905-18.

Greenberg R, Skornick Y, Kaplan O1998. Management of fibroadenoma. J Gen Intern Med.;13:640-643

Houssami N1, Cheung MN, et al. 2001 Feb. Fibroadenoma of the breast. Med J 19;174(4):185-8.

Ismail Jatoi Manfred Kaufmann 2010, Management of Breast Diseases, 1st ed. New York, Springer.

Jackson VP, Rothschild PA, et al. 1986 Jan. The spectrum of sonographic findings of fibroadenoma of the breast. Invest Radiol. 21(1):34-40.

Kim SJ, Park YM, et al. 2014 Nov. Sonographic appearances of juvenile fibroadenoma of the breast. J Ultrasound Med 33(11):1879-84.

Nelson, Z. C.; Ray, et al 2010, "Fruit and Vegetable Intakes Are Associated with Lower Risk of Breast Fibroadenomas in Chinese Women". Journal of Nutrition. 140 (7): 1294–1301.

Owen Kang, et al (access 08/18/2016) http://radiopaedia.org/articles/fibroadenoma-of-the-breast-1

Pinto J1, Aguiar AT, et al. March 2014. Summary of "Simple and complex fibroadenomas: are there any distinguishing sonographic features?. J Ultrasound Med. 33(3):415-9.

Prasad Wavare et al FEB 2013 Evaluation of Breast Masses Using Mammography and Sonography as First Line Investigations, Open Journal of Medical Imaging, Vol. 3 No. 1 , Article ID: 28895 , 10 pages

Richard Lee Drake. Et al 2012, Gray's Basic Anatomy, international ed. Philadelphia, chruchill Livingstone.

Sanchez R etal fibroadenomas in the pediatric population: common and uncommon sonographic findings. Pediatr Radiol 2010; 40:1681–1689.

Rosen PP. Fibroepithelial neoplasms. In: Rosen PP, ed.Rosen's Breast Pathology.1st ed. New York, NY: Lippincott-Raven Press; 1996:143-155

S H Waqar, et al 2009 (access: 16/08/2016) www.ncbi.nlm.gov/pubmed/24567452

Sanchez R, Ladino-Torres MF, Bernat JA, Joe A, DiPietro MA. Breast

Sandra L. Hagen-Ansert, Textbook Of Diagnostic Sonography vol 1. 7th ed. Missouri. Elsevier Inc. 2012

Suk Jung Kim, et al 2014 Sonographic Appearances of Juvenile Fibroadenoma of the Breast, Journal of ultrasound in medicine, vol 33 (11).

Susan Standrig, Gray's Anatomy the anatomical basis of clinical practice, 40th ed. Elsevier 2008

Tavassoli, F.A., Devilee, P., ed. (2003). World Health Organization Classification of Tumors: Pathology & Genetics: Tumors of the breast and female genital organs. Lyon: IARC Press. ISBN 92-832-2412-4.

Werner Boecker, Preneoplasia of the Breast, 1st Ed. 2006

Wild JJ, Neal D.Further pilot echographic studies of the histologic structures of tumors of living intact human breast. American J Pathol 1952; 28: 839-61.

- **Data collection:**

Master data sheet

NO.	Age	Size (cm)	Width To Height Ratio	Side	Mobility	Macro lobulation	Margin	Echogenicity	Lateral acoustic shadow	Internal echo pattern	Posterior Acoustic phenomena	Shape	Vascularity	Histo. result
1	20	1.5	1.52	Rt	Not mobile	Present	Well defined	Hypoechoic	Absent	Cystic areas	Enhancement	Irregular	Avascular	Complex FA
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														

36													
37													
38													
39													
40													
41													
42													
43													
44													
45													
46													
47													
48													
49													
50													

Data sheath analysis

Case NO.	Age	Side	Size (cm)	Width To Height Ratio	Mobility	Macro-lobulation	Margins	Echogenicity	Lateral acoustic shadow	internal echo pattern	Posterior Acoustic phenomena	Shape	Vascularity	Histo. result
1	1	1	1.5	1	2	1	1	1	2	2	1	3	1	2
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
32														
33														
34														
35														
36														
37														
38														
39														
40														
41														

42													
43													
44													
45													
46													
47													
48													
49													
50													

Ultrasound images:

Image (1) 25 yrs old female came to the department with Lt breast palpable lump diagnosed as Giant FA .

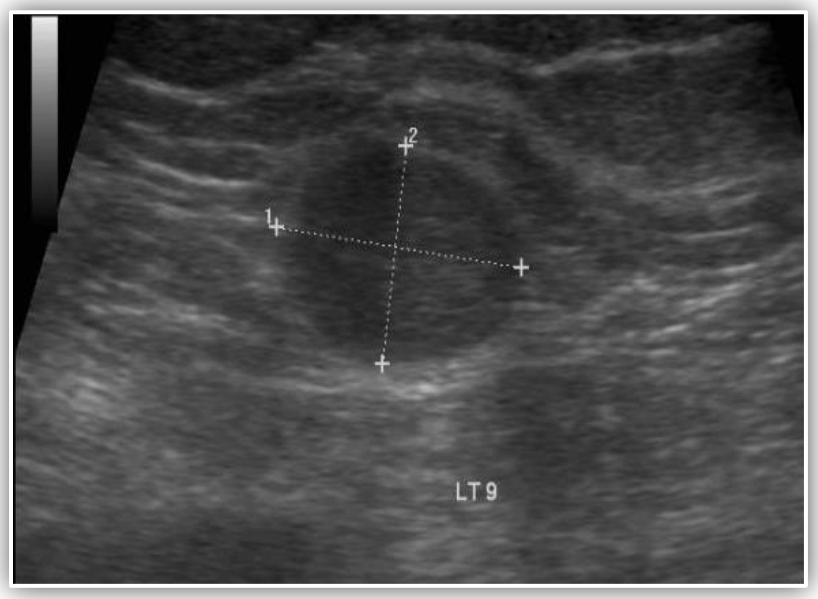


Image (2) 18 years female complaining of Lt breast lump diagnosed as juvenile FA which appears as homogenous rounded hypoechoic mass.

Image (3) Rt breast (3.5x2.2 cm) well defined FA showing macrolobulation

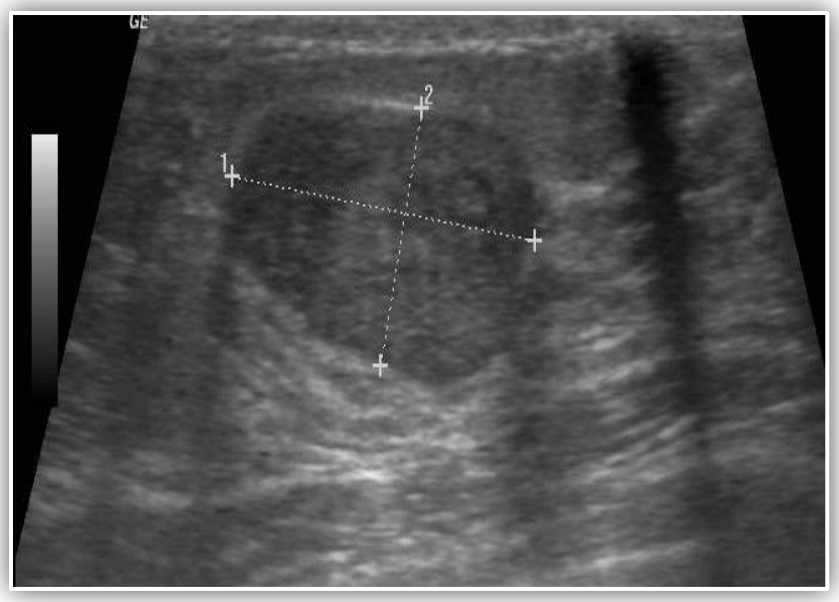


Image (4) Lt breast (1.9x1.1 cm) well defined FA showing lateral shadowing

Image (5) Lt breast (3.6x2.2cm) homogenous FA

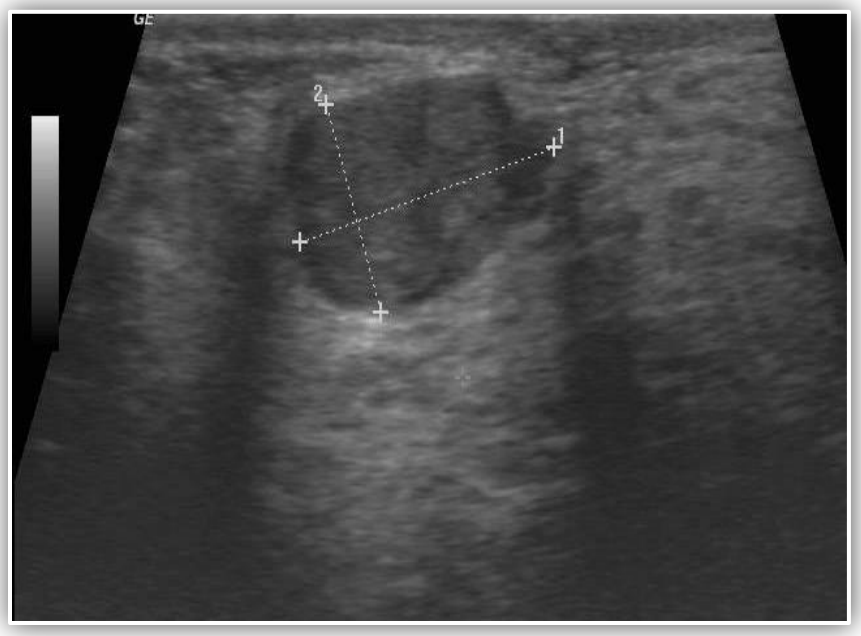


Image (6) Lt breast (1.6x1cm) well defined FA with posterior enhancement

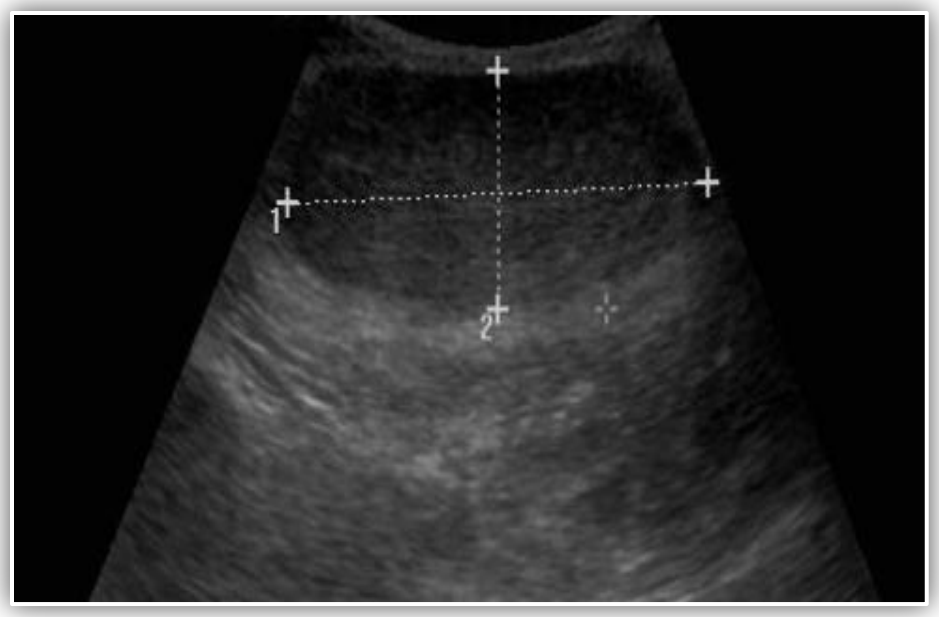
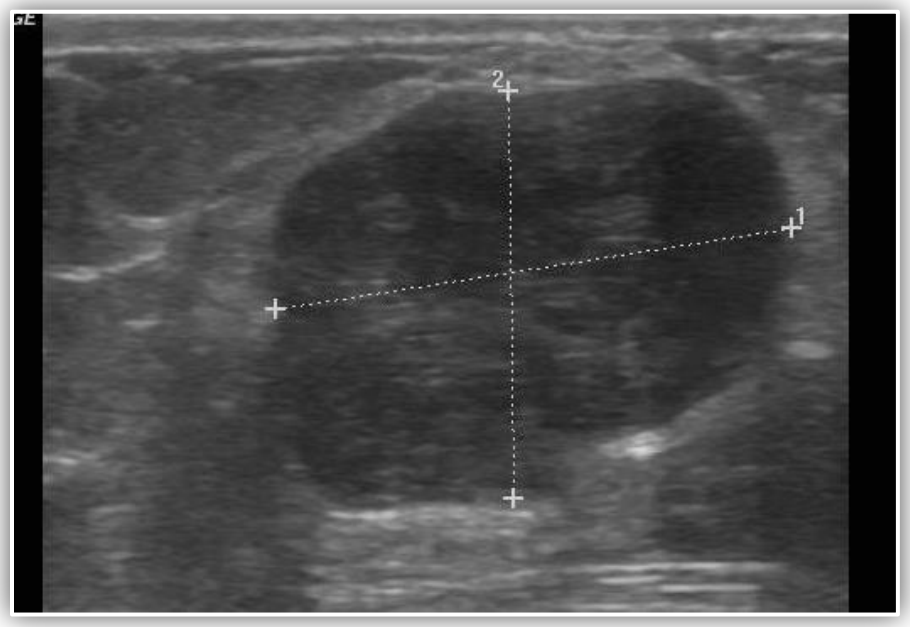


Image (7) Lt breast (7.7x3.2cm) oval hypoechoic FA



Appendix (8) Lt breast (2.5x2cm) well defined hypoechoic FA

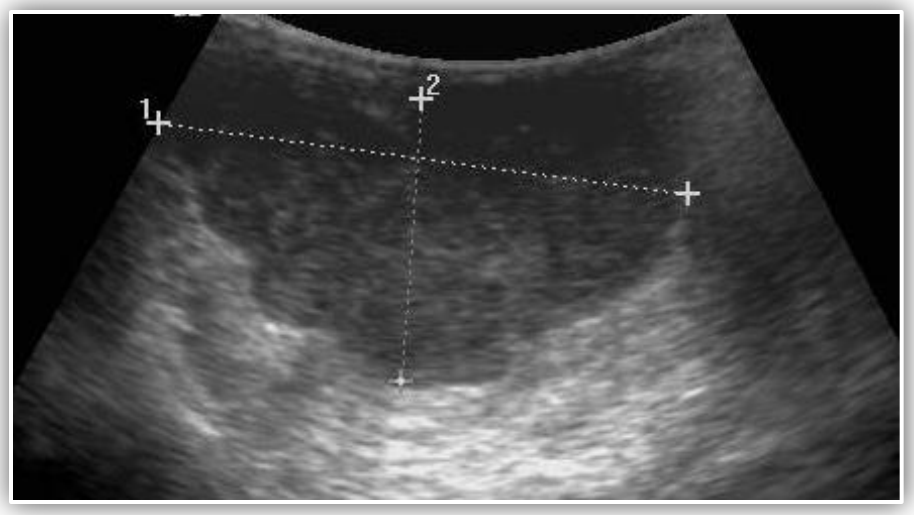


Image (9) Lt breast (3.2x3.3cm) lobulated hypoechoic mass approved as giant FA.

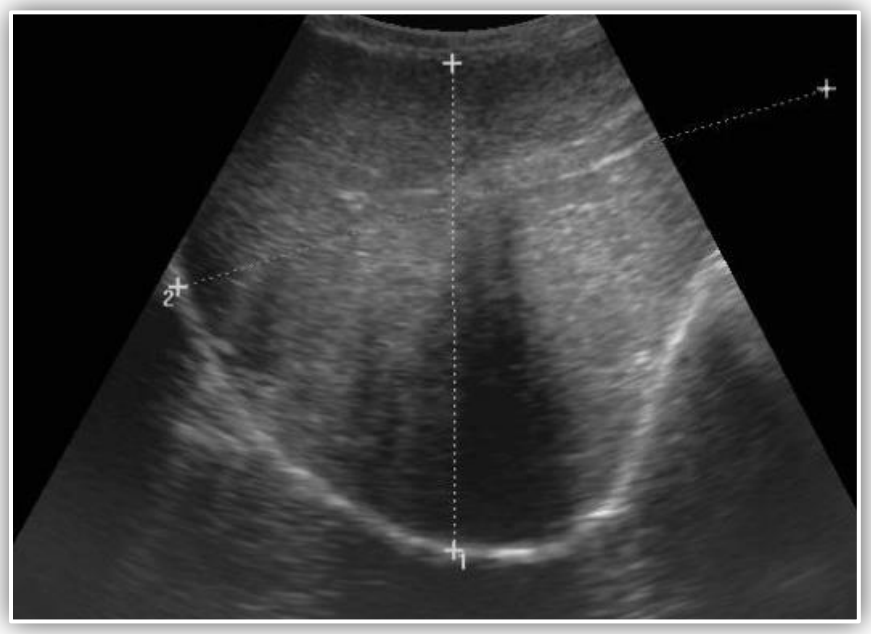


Image (10) Lt breast (14.4x10.3cm) mass approved by histopathology to be giant FA.