“A STUDY TO DETERMINE DIAGNOSTIC ACCURACY OF MAMMOGRAPHY IN PATIENTS WITH PALPABLE BREAST LUMPS AT KLES DR. PRABHAKAR KORE HOSPITAL AND MEDICAL RESEARCH CENTRE, BELGAUM”

REG NO. BH0111003

Dissertation

Submitted to the
KLE University, Belgaum, Karnataka

In Partial Fulfillment
of the requirements for the degree of

MASTER OF SURGERY (M.S.)
in
GENERAL SURGERY

DEPARTMENT OF SURGERY,
JAWAHARLAL NEHRU MEDICAL COLLEGE,
BELGAUM, KARNATAKA

APRIL - 2014

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ENDORSEMENT

This is to certify that the dissertation entitled **"A STUDY TO DETERMINE DIAGNOSTIC ACCURACY OF MAMMOGRAPHY IN PATIENTS WITH PALPABLE BREAST LUMPS AT KLES DR. PRABHAKAR KORE HOSPITAL AND MEDICAL RESEARCH CENTRE, BELGAUM"** is a bonafide research work done by **THE CANDIDATE REG NO. BH0111003.**

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LIST OF ABBREVIATIONS USED

2-D	-	2-dimensional
3-D	-	3- dimensional
^{99m} Tc	-	Technetium-99m
ABUS	-	Automated Breast Ultrasound System
ACS	-	American cancer Society
AJCC	-	American joint committee on cancer
ASRs	-	Age standardized incidence rates
B.C.	-	Before Christ
B-cell	-	Beta cell
BCRAT	-	Breast Cancer Risk Assessment Tool
BSE	-	Breast self-examination
cm	-	Centimeter
CT	-	Computed tomography
DBT	-	Digital breast tomosynthesis
eg	-	For example
FDA	-	Food and drug administration
FDG	-	Fluorinated glucose
FFDM	-	Full-field digital mammography
FNAC	-	Fine needle aspiration cytology
hpL	-	Human placental lactogen
HPR	-	Histopathological report
ie	-	That is
MECC	-	Middle East Cancer Consortium
mm	-	Millimeter

mm	-	Millimeter
MRI	-	Magnetic resonance imaging
MT	-	Mammography test
n	-	Total number
NHBCSP	-	National Health Breast Cancer Screening Programme
NHIS	-	National Health Interview Survey
p	-	Probability
PET	-	Positron emission tomography
SEER	-	Surveillance, Epidemiology, and End Results
Tc-MDP	-	Tc-methylene diphosphonate
TGFB	-	Transforming growth factor beta
U.S.	-	United States
UK	-	United Kingdom
US	-	Ultrasonography
USA	-	United States of America
USPSTF	-	Preventive Services Task Force
VACNB	-	Vacuum-assisted large-gauge core biopsy
viz.	-	namely
WHO	-	World health organization
y	-	Years
β	-	Beta

ABSTRACT

Background and objectives

Various radiographic modalities are readily available to identify lesions that are suspicious for breast cancer. Mammography remains the mainstay of breast cancer screening. This study was aimed to determine the diagnostic accuracy of mammography in evaluating breast lumps.

Methodology

The present one year cross-sectional study was conducted from January 2012 to December 2012 on a total of 65 eligible women presenting with palpable breast lump in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospitals and Medical Research Centre, and Charitable Hospital, Belgaum.

Results

In the present study commonest age group was between 31 to 45 years with 43.08% of the patients and the mean age of the study population was 41.71 ± 13.76 years. The nipple discharge was present in 15.38% of the cases. The shape of the lesion was found to be globular in 44.62% and tenderness was present in 44.62% of the patients. The nipple examination revealed retracted nipples in 23.08% of the patients. The consistency of the breast lump was firm in 75.38% of the patients. Axillary lymph node was present in 13.85% of the women. Mammography findings revealed grade 3 breast lump in 46.15% of the patients. Malignant lesions were diagnosed in 46.15% of the patients while 53.85% of the women were diagnosed as having benign lesions.

Conclusion and interpretation

Of the 30 patients who had malignant lesions on histopathology/cytology, 26 had malignant lesions on mammography and 4 women had benign lesions. The sensitivity of mammography compared to histopathology/cytology in predicting malignant lesions was 86.67% with specificity of 97.14% and the diagnostic accuracy was 92.3%

Keywords

Breast cancer; Cytology; Histopathology; Mammography; Palpable breast lump;

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Chapter 1

Introduction

INTRODUCTION

A benign breast condition often causes a lump. It may or may not feel tender. One might find it during daily activities. The younger the age, the more likely it is that a single breast lump will be benign. The most common benign breast lumps are fibroadenomas and a combination of fibrosis and cysts that is sometimes called *fibrocystic changes*. It commonly encountered in surgical practice.[1]

No matter what age a woman is, lumps and other changes must be checked to be sure they are not breast cancer. Although most lumps aren't breast cancer, there is always a chance that a single lump may be breast cancer, even in a younger woman. Breast cancer is the most frequently diagnosed female cancer in the world and is the leading cause of cancer-related mortality in women.[2]

In the United States, it is the second most common cause of cancer death in women across all age groups and is the main cause of death in women aged 40-59. The lifetime probability of developing breast cancer is 1 in 6 overall (1 in 8 for invasive disease).[3] Due to the magnitude of the disease, its psychosocial impact, and associated morbidity and mortality, screening for early diagnosis forms a pivotal part of the struggle against this cancer.

Breast cancer mortality has shown a decline since 1975,[4] which may be attributable to both early diagnosis by virtue of screening mammograms and improvements in adjuvant therapies.[5]

Breast lumps, like other symptoms, have to be considered along with other symptoms a woman may be having. Most of them require triple assessment namely clinical assessment, radiological imaging and histopathological examination. Early detection through mass screening with mammography has the potential to reduce mortality.

Although various radiographic modalities are readily available to identify lesions that are suspicious for breast cancer, mammography remains the mainstay of breast cancer screening. Role of breast sonogram is confined mainly to the diagnostic follow-up of a mammographic abnormality because it may help clarify features of a potential lesion. The role of magnetic resonance imaging (MRI) for breast cancer screening is still evolving; currently MRI screening, in combination with mammography, is reserved to the screening of high-risk patients only.

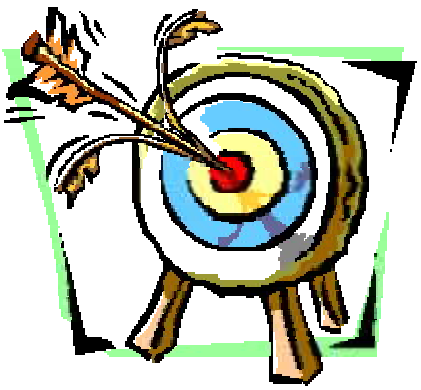
Mammography is the preferred examination for breast cancer. It has been used for investigating breast lumps since 1960. The earliest sign of breast cancer is an abnormality depicted on a mammogram, before it can be felt by the woman or her physician. When breast cancer has grown to the point where physical signs and symptoms appear, the patient feels a breast lump (usually painless). Various investigators have evaluated the diagnostic accuracy of mammography. The reported diagnostic accuracy varies from 60% to 90%. Mammographic sensitivity for breast cancer declines significantly with increasing breast density and is independently higher in older women with dense breasts. Hormonal status has no significant effect on the effectiveness of screening independent of breast density.[6]

However, there are reports stating that, mammograms also lead to overdiagnosis and overtreatment. Since screening preferentially identifies slow-growing tumours (length bias), the harms of unnecessary treatment could reduce or even neutralise any potential benefits. The large number of reviews reflects the controversies surrounding mammography screening and the uncertainties of its effects in women of various ages. There is wide variation in screening policies between different countries, with some countries abstaining from introducing screening partly because of the lack of a documented reduction in all-cause mortality. One area of concern is the potential for radiotherapy treatment of low-risk women, such as those who have their cancers identified at screening, to increase all-cause mortality because of adverse cardiovascular effects. In addition, there is concern that cause of death has not been ascribed in an unbiased fashion in the trials. Finally, carcinoma in situ is much more likely to be detected with mammography and although less than half of the cases will progress to be invasive these women will nevertheless be treated with surgery, drugs and radiotherapy. Also, the diagnostic accuracy of mammography in our hospital setup has not been assessed so far.

Considering the conflicts regarding the diagnostic accuracy and recommendations and the scarcity of data regarding the accuracy of mammography in our hospital set up this study was planned to determine the diagnostic accuracy of mammography in evaluating breast lumps.

Chapter 2

Objectives



OBJECTIVES

The objective of the present study was to determine the sensitivity, specificity, positive predictive value and negative predictive value of mammography in palpable breast lumps.

Chapter 3

Review of Literature

REVIEW OF LITERATURE

Lump in the breast is a source of anxiety to the patient. Now a days people have become more aware and their fear for cancer brings them to doctor without any delay for any type of breast lesion. Cancer breast is the most important malignant disease affecting women in the industrialized world. It is the principal cause of cancer morbidity and mortality in U.S.[1]

ANATOMY AND PHYSIOLOGY

Development[7]

In the 5-week-old human fetus, an ectodermal 'milk streak' the mammary ridge develops along the trunk on either side from the axilla to the groin. In many mammals, a series of paired mammary glands develop along this ridge, but in the human it regresses to the definitive site of the adult nipple. Here, this specialized epithelium buds into 15–20 branches. They first consist of solid epithelial columns, but then canalize before birth to form the lactiferous ducts.

Accessory nipples are not uncommon along the milk line; diagnosis is made readily if this condition is borne in mind, and by the characteristic appearance of the lesion and by the fact that it is present from birth.

At the point of invagination of epithelium from the skin, there is initially a small mammary pit, but at about the time of birth it evaginates to form the definitive nipple. Failure to do so results in a congenitally inverted nipple, which may be unilateral or bilateral, and is not uncommon.

The epithelial system becomes surrounded by invading mesenchyme, which develops into the supporting connective tissue and fat of the breast.

Stages of development[7]

From birth until puberty: the breast consists of lactiferous ducts, with no alveoli. At puberty, the ducts start to proliferate, and their terminations form solid masses of cells—the future breast lobules.

During pregnancy: secreting alveoli appear. During the early weeks, ductal sprouting and lobular proliferation occur, with increased nipple and areolar pigmentation. The alveoli now display a lumen surrounded by the secretory cells.

In the last days of pregnancy, the breasts secrete colostrum, a yellow, sticky, serous fluid, which is then replaced by true secretion of milk. When lactation ceases, the glandular tissue returns to its resting state.

After the menopause: the glandular tissue of the breast atrophies, the connective tissue becomes less cellular, and the amount of collagen decreases. In some women, marked fatty infiltration of the breast occurs at this stage; in others, the breasts shrink considerably.

Topography[7]

The breast mound

The mound of the adult female breast extends from the second rib above to the sixth rib below. Medially, it borders the lateral edge of the body of the sternum, and laterally it reaches the mid-axillary line, but the breast tissue

extends upto clavicle above midline medially, latissmer dense laterally and 8th rib below.

At its superolateral extremity, the breast tissue projects as a tongue into the axilla along the lower border of the pectoralis major-the axillary tail of Spence.

The main bulk of the breast tissue is usually localized to its upper outer quadrant. This quadrant is more often implicated in breast cancer and in most benign lesions of breast tissue.

The nipple

The nipple is usually situated at the level of the fourth intercostal space in nulliparous women, but its position is inconstant in relation to the intercostal space when the breasts are pendulous. The 15–20 lactiferous ducts open on to the nipple. The nipple itself is surrounded by the areola, which contains large sebaceous glands that are often visible to the naked eye—the glands of Montgomery.

Beneath the breast

On its deep aspect, about two-thirds of the breast lies on the pectoralis major. Laterally, the breast overlaps on to the serratus anterior, and inferiorly it abuts on to the upper part of the rectus sheath.

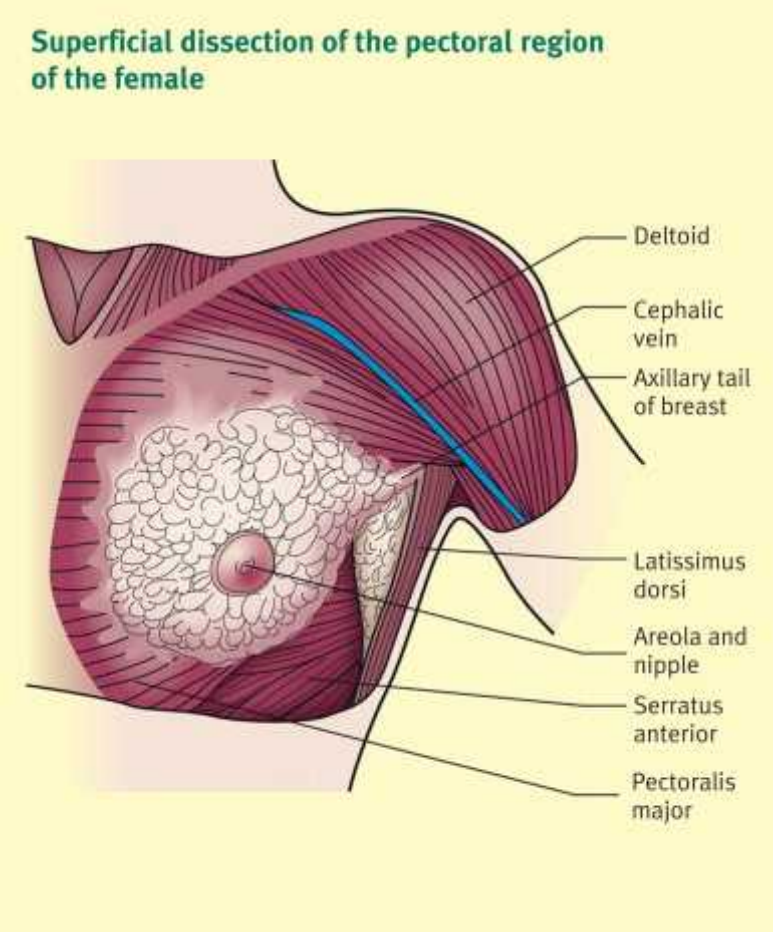


Figure 1. Superficial dissection of the pectoral region of the female[7]

The fascial relationships of the breast are of practical importance. As an ectodermal derivative, the gland lies in a pocket of superficial fascia. The superficial layer lies immediately beneath the dermis and enables superficial flaps to be dissected from the glandular mass of the breast quickly, neatly, and in a relatively avascular plane. Moreover, dissection in this layer also ensures that breast tissue is not left attached to the skin flaps.

Fibrous processes of this layer of fascia extend to the skin and to the nipple and are more developed over the upper part of the breast, where they form the suspensory ligament of Cooper. Contraction of this tissue by malignant

infiltration results in the characteristic skin dimpling over a carcinoma of the breast.

The deep layer of the superficial fascia is thicker than the subcutaneous component and covers the deep aspect of the breastplate.

Beneath this sheath is a layer of areolar tissue that allows the breast to move freely on the underlying fascial covering of the pectoralis major and the serratus anterior. This areolar layer forms the retromammary space. Deep infiltration of a cancer through this space into the underlying pectoralis fascia produces the physical sign of deep tethering of a malignant breast mass. Precise establishment of the plane of the retromammary space enables rapid and relatively bloodless dissection of the deep aspect of the breast in simple mastectomy.

Blood supply[7]

The blood supply of the breast is a rich anastomotic network derived from the axillary, internal thoracic (or internal mammary in the old nomenclature) and intercostal arteries.

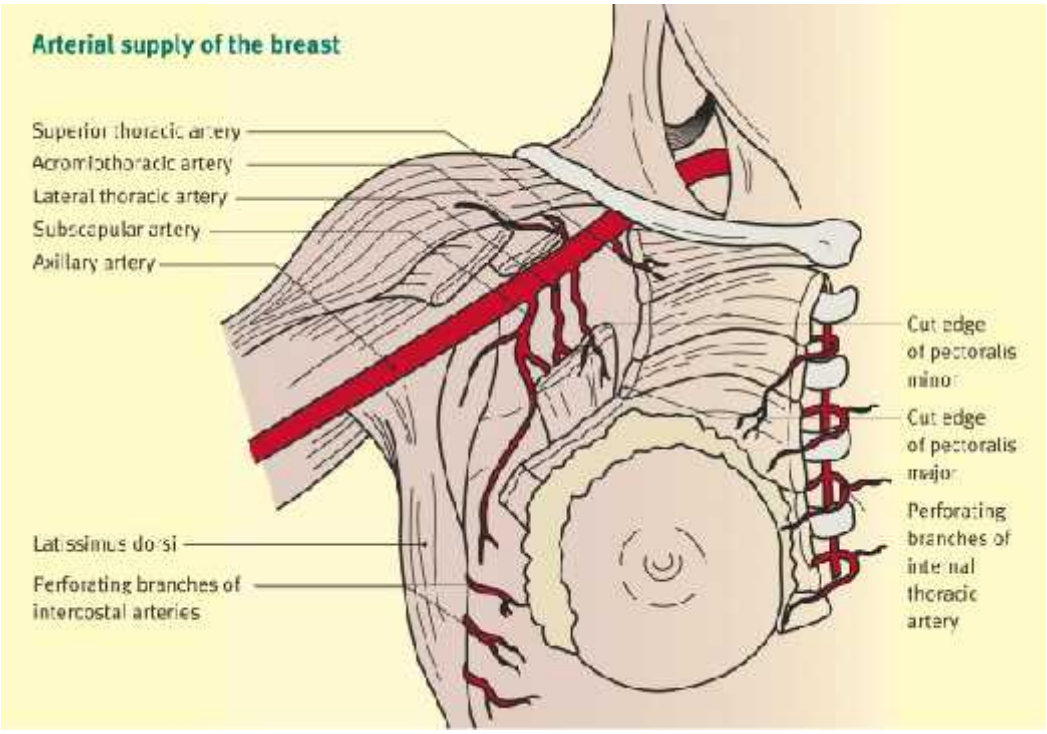


Figure 2. Arterial supply of the breast[7]

The largest vessels arise from the internal thoracic artery, the perforating branches of which pierce the chest wall adjacent to the sternal edge in the first to fourth intercostal spaces. The vessel in the second space is usually the largest of these. The four branches from the axillary artery are the:

- Superior thoracic
- Pectoral branch of the acromiothoracic
- Lateral thoracic
- Subscapular.

They are accompanied by the corresponding veins.

Lymphatic drainage[7]

The importance of lymphatic drainage of the breast and of the anatomy of the axillary and internal thoracic lymph nodes is self-evident.

The axillary lymph nodes vary in number from 20 to 30 and are divided into five not wholly distinctive anatomical groups.

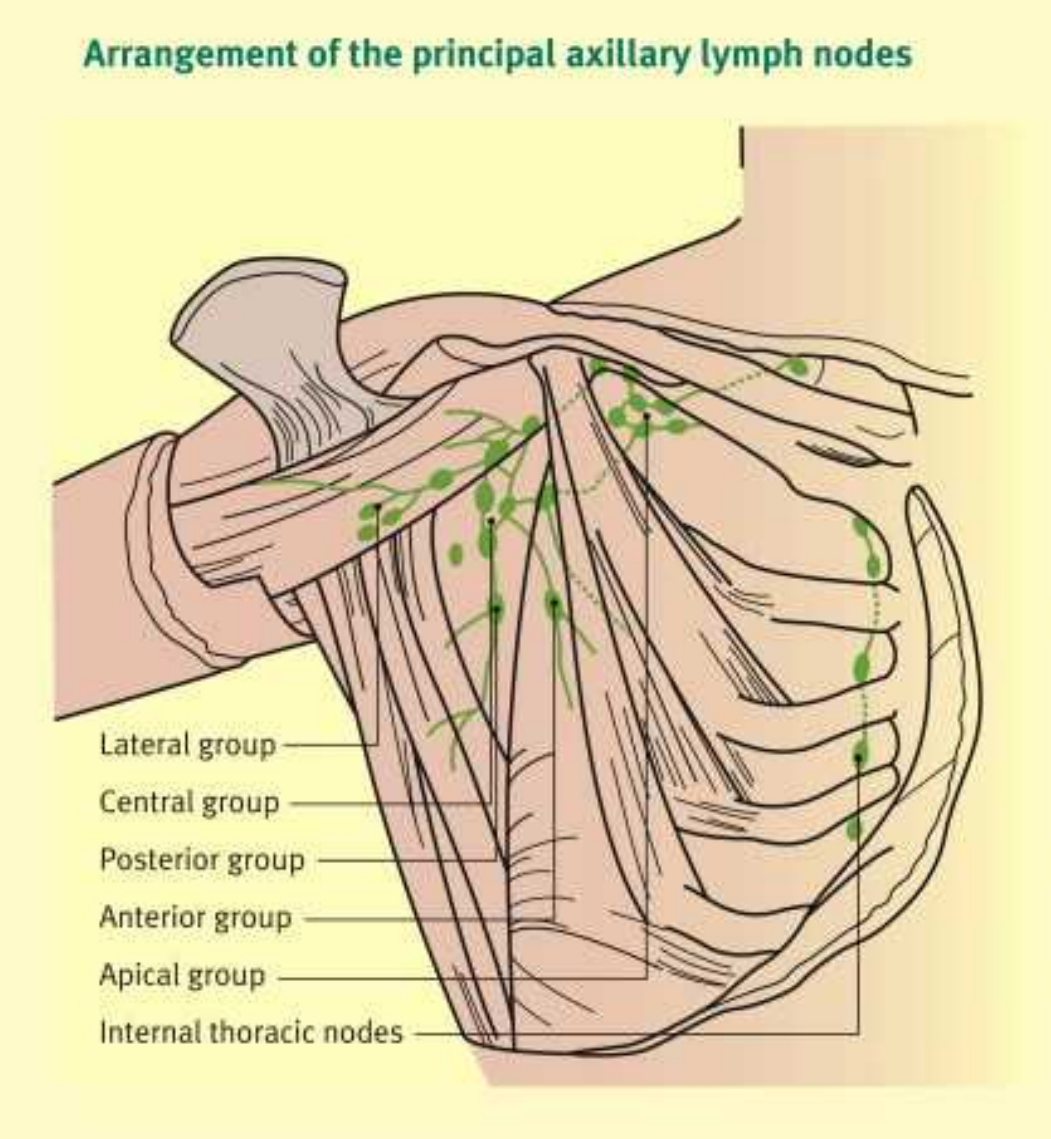


Figure 3. Arrangement of the principal axillary lymph nodes[7]

Efferents from the apical nodes unite into the subclavian trunk. On the left side, this trunk usually drains directly into the thoracic duct. On the right side, the subclavian trunk may empty directly into the jugulosubclavian junction or into a common right lymphatic duct. A few efferent channels usually reach the inferior deep cervical nodes directly.

Clinicians and pathologists often define metastatic axillary node spread simply into:

- Level I: nodes inferior to pectoralis minor
- Level II: nodes behind pectoralis minor
- Level III: nodes above pectoralis minor

The internal thoracic (internal mammary) lymph nodes are small, often only 2–3 mm in diameter, and lie along the internal thoracic vessels 2–3 cm from the sternal edge. Usually three to five of these nodes are found on either side. These nodes drain the anterior chest wall, anterior portion of the diaphragm, upper portion of the rectus sheath and muscle, and the superior portion of the liver, as well as the inner aspect of the mammary gland.

The intercostal nodes lie near the rib heads. They receive deep lymph vessels from the posteromedial aspect of the chest and some drainage from the lateral extremity of the mammary gland.

About 75% of all lymphatic drainage of the breast passes to the axillary nodes. The remainder principally drains to the internal thoracic nodes. Any part

of the breast may drain to either group, though there is a greater tendency for tumours situated in the medial part of the breast to disseminate to the internal thoracic nodes than for tumours in the lateral part of the breast to do so.

Involvement of the supraclavicular nodes in breast cancer usually represents retrograde spread along blocked lymphatic channels when the apical axillary nodes are heavily involved. Efferent channels pass directly from these nodes to the inferior deep cervical chain so that involvement of cervical nodes may occur via this route.

Lymphatics do not normally drain to lymphatics across the opposite side of the body; early lymphatic spread of a tumour from one breast to another does not occur. Such bilateral cases represent synchronous or early metachronous double primary tumours. In very advanced cases, extensive blockage of lymphatic channels allows subcutaneous lymphatic permeation to occur to the opposite side.

Physiology of the breast[7]

Prior to puberty there are no discernible differences, functional or structural, between the male and female breast. At the histological level, the prepubertal breast both in males and in females, consists of multiple rudimentary ducts arranged circumferentially, and converging towards the nipple. At the blind end of each rudimentary duct are poorly-developed but potentially secretory acini.

With the onset of puberty, a striking sexual dimorphism becomes manifest as dramatic changes ensue in the morphology and function of the female breast. These changes are the result of the unique response of the breast to various normal hormonal influences. The following account of breast physiology pertains exclusively to the female breast.

The prime function of the female breast is lactation: a term that encompasses synthesis, secretion and ejection of milk. Additionally the female breast is a prominent secondary sexual feature.

The initial growth of the female breast at puberty is affected primarily by oestrogen (oestradiol) which induces proliferation and branching of the duct system and also maturation and prominence of the nipples. However, the development and proliferation of acini (alveoli) at the *ab-areolar* ends of the ducts is the result of the combined and synergistic actions of oestrogen and progesterone.

Within the breast tissue there are a number of paracrine factors, some stimulatory and some inhibitory, which influence cell division and differentiation. These paracrine regulators include insulin-like growth factors, epidermal growth factor and transforming growth factor β.

Lactation[7]

The endocrine regulation of milk synthesis is complex. After initial conditioning of the mammary secretory tissue by oestrogen and progesterone,

there is a specific need for lactogenic hormone alongside the permissive actions of glucocorticoids, insulin and thyroxine for successful milk production.

There are two lactogenic hormones: (i) prolactin which is secreted by the lactotrophs in the anterior pituitary and (ii) human placental lactogen (hpL) which is produced by the maternal placenta. The secretion of the latter reaches a peak during the final weeks of gestation and this prepares the breast for milk production. At this stage there is no significant secretion of milk because the high levels of oestrogen and progesterone in maternal blood have an inhibitory effect on milk production. Soon after childbirth, hpL disappears from the maternal circulation, the levels of oestrogen and progesterone in maternal blood plummet and prolactin functions as the sole lactogenic hormone. Another hormone which plays an important role in lactation is oxytocin, a polypeptide which is synthesized in the hypothalamus and stored in the posterior pituitary (neurohypophysis). The act of nursing (the *sucking reflex*) stimulates the release of oxytocin which in turn mediates the secretion of prolactin.

The normal, healthy, well-nourished lactating woman forms about 1 litre of milk a day. Lactation can be artificially suppressed by the administration of oestrogen or by administering dopaminergic agents such as bromocriptine which have an inhibitory effect on the synthesis and release of prolactin.

Menopausal changes

The onset of menopause is associated with a natural and steep decline in the body's production of oestrogen and progesterone. This lack of hormonal stimulation results in a progressive decrease in the amount of glandular tissue in

the breast, and a concomitant increase in fatty tissue. The consequent reduction in tissue density renders the breast tissue more amenable to mammographic examination. It is for this reason that detection of neoplasms by mammography is easier in a menopausal or perimenopausal woman than in a young, premenopausal woman.

HISTORICAL ASPECTS

Breast cancer is an ancient disease, and it has been mentioned in almost every period of recorded history. In 460 B.C., Hippocrates, the father of Western Medicine, described breast cancer as a humoral disease. Galen and physicians succeeding him over the next 2,000 years, considered breast cancer a systemic disease.[8]

Johanes de Gorter in the 1750s claimed that tumors came from pus-filled inflammations in the breast that mixed with blood, lodged in the milk gland, and dried into a tumor. Lorenz Heister placed childless women at high risk, while others blamed a sedentary lifestyle which slackened bodily fluids. In 1757, Henri Le Dran, a leading French physician, argued that surgery could actually cure breast cancer as long as the infected axillary lymph nodes were removed. Le Cat would amputate the breast, cut out the lymph nodes as well as the pectoralis major muscle. This theory in the twentieth century led to the creation of the radical mastectomy.[9]

By the mid-nineteenth century, William Halstead of New York had made radical breast surgery the gold standard for the next 100 years. During the first four decades of the twentieth century, the radical mastectomy dominated breast

cancer treatment. In 1895, Scottish surgeon George Beatson discovered that removing the ovaries from one of his patients shrank her breast tumor. By 1920 most surgeons employed an oopherectomy only as a last resort. In 1976, Fisher published results indicating that simpler breast-conserving surgery followed by radiation or chemotherapy was just as effective as the radical mastectomy, and usually more so.[9]

With the decline of the Halstead radical mastectomy and a revised theory of metastasis, physicians hypothesized about the origins of breast cancer and, during the 1990s, everything ranging from diet, chemical pollution, race, delay in having children, and breastfeeding was up for debate. After an initial increase in breast cancer rates, the number of deaths plateaued in 1995 and then started to decline.[10]

EPIDEMIOLOGY

Global scenario

Breast cancer is the most common cancer in women worldwide, comprising 16% of all female cancers. Although breast cancer is thought to be a disease of the developed world, a majority (69%) of all breast cancer deaths occurs in developing countries.[11]

The incidence rate varies greatly worldwide, with age standardized rates as high as 99.4 per 100,000 in North America. Eastern Europe, South America, Southern Africa, and Western Asia have moderate incidence rates, but these are increasing. The lowest incidence rates are found in African countries but breast cancer incidence rates are increasing there too.[11]

Breast cancer survival rates vary greatly worldwide, ranging from 80% or more in North America, Sweden and Japan to around 60% in middle-income countries and below 40% in low-income countries.[12]

The low survival rates in less developed countries can be explained mainly by the lack of early detection programmes, resulting in a high proportion of women presenting with late-stage disease, as well as by the lack of adequate diagnosis and treatment facilities.[11]

Indian statistics

In India, breast cancer is the second most common cancer (after cervical cancer) with an estimated 115,251 new diagnoses and the second most common cause of cancer-related deaths with 53,592 breast cancer deaths in 2008.[13] The age-standardized incidence rate for breast cancer in India is 22.9 per 100,000 which is one-third of the Western countries, but the mortality rates are disproportionately higher.[14,15] Like other cancers such as those of the lung and colon, the rates of breast cancer in people of Indian origin living in Western countries are intermediate to their Western counterparts, who have much higher rates.[16] Breast cancer accounts for 22.2% of all new cancer diagnoses and 17.2% of all cancer deaths among women in India. Breast cancer in urban areas of India is three times higher than in rural parts of the country.[13]

Although breast cancer is the second most common cancer in all Indian women, recent data suggest that, breast cancer is the most common cancer in metropolitan cities and is predicted to be the most common type of cancer in the coming decade.[17]

In the metropolitan cities, breast cancer is the leading cancer diagnosis in women, with rates nearly twice as common as cervical cancer. In Bangalore, Chennai, Delhi, Mumbai and Kolkata, the age-adjusted incidence rates are 30.9, 33.0, 31.4, 29.3 and 20.6 per 100,000 respectively.[18] The rates in Northeastern states are generally lower; Imphal West District, Mizoram and Sikkim have breast cancer age-standardized rates of 14.6, 14.1 and 6.8 per 100,000 respectively.[18] A recent report by the Indian Council of Medical Research predicted that the number of breast cancer cases in India will rise to 106,124 in 2015 and to 123,634 in 2020.[17]

Mortality data on breast cancer is inconsistent, inadequate and there are no good nationwide data to provide reliable estimates.[19]

Age incidence rates in India suggest that the disease peaks at a younger age (40-50 years) than in Western countries[20] and as a result, the majority of new diagnoses occur in pre-menopausal women. Studies[18,21-23] have shown a rising trend with steadily increasing rates since the mid-1980's with the largest increases observed in Mumbai. The majority of new cases are advanced stage at the time of diagnosis.[24,25]

The increasing burden of disease may be associated with lifestyle factors such as later age at marriage, age at first birth, reduced breastfeeding and westernization of diet and physical activity patterns. Breast cancer rates tend to be higher in women of higher education and in specific communities that have adopted a more westernized lifestyle, such as Christians and Parsis, and are lowest in the Muslim communities.[13]

Differences in the prevalence of transforming growth factor beta signaling pathway associated gene polymorphisms (TGFB1 & TGFBR1) may also be linked to the lower rates observed in certain sub-populations such as those from western India compared to the Parsis.[13]

RISK FACTORS

The etiologies of breast cancer are multifactorial. The Breast Cancer Risk Assessment Tool (BCRAT) incorporates the following risk factors.[26]

A. Non-modifiable risk factors

1. Age

Older age increases the risk of breast cancer and most women are over the age of 60 when they are diagnosed although there is evidence that Indian women are more likely to develop breast cancer at earlier ages than their Western counterparts[27] and that breast cancer peaks from ages 45-50 years in India.[28] Recent data comparing Indians and Caucasians in the US show that 29.9% of Indians/Pakistanis living in the US had pre-menopausal breast cancer compared to 18.9% of Caucasians.[27]

2. Height

Adult height is positively associated with the risk of breast cancer.[29]

3. Personal history of benign breast or other breast disease

A history of atypical hyperplasia, lobular carcinoma in situ or ductal carcinoma in situ increases the risk of developing invasive breast cancer.[13]

4. Family history

Breast cancer in a first-degree family member is associated with 60-80% increase in breast cancer risk.[36] Risk is even stronger if the family member was diagnosed before the age of 50 years old and/or with pre-menopausal breast cancer.[35] The risks increase for a higher number of first- and second-degree relatives diagnosed with breast cancer. A history of ovarian cancer in other relatives also increases the risk of breast cancer.[31]

5. **BRCA1/BRCA2**

Having mutations in BRCA1, a gene on chromosome 17 that controls cell growth or BRCA2, a gene on chromosome 13 that suppresses cell growth, are associated with a 40-80% increased risk of breast cancer.[32]

6. Menstrual history

Women who have an early age at menarche (<12 years) have a 30% increased risk of breast cancer while those who have a late age at menopause (>60 years) will have a 20-50% increased risk of disease.[32]

7. Breast density on mammogram

Women with higher breast density have a higher risk of being diagnosed with breast cancer.[31]

8. Medical history of Hodgkin's lymphoma

Women diagnosed with Hodgkin's lymphoma who received a chest irradiation dose > 40 Gray between 25-55 years, have a 29% increased risk of developing breast cancer.[33]

B. Modifiable risk factors

1. Age at first child

Women who have never had children or those who are more than 30 years at the time of their first child's birth are twice as likely to develop breast cancer as women who had their first child before the age of 20 years.[32]

2. Hormone replacement therapy

Women who have taken menopausal hormone therapy (estrogen and progestin for at least 5 years) have a 20% higher risk of breast cancer.[32]

3. Breastfeeding

Women who do not breastfeed or breastfeed for shorter durations are at a higher risk of developing breast cancer. Specifically, a 4.3% reduction in risk has been observed for each additional year of breastfeeding.[34]

4. Alcohol consumption

Longnecker in 1994 suggested an association of even modest alcohol consumption (one drink per day) with increased risk of breast cancer. A study[35] observed an increased risk of ER-positive/PR-positive breast cancer among postmenopausal women who reported consumption of high levels of alcohol.

WORLD HEALTH ORGANIZATION (WHO) CLASSIFICATION OF BREAST TUMORS (2003)[36]

1. Epithelial tumors

- Invasive duct carcinoma, not otherwise specified
- Invasive lobular carcinoma
- Tubular carcinoma
- Invasive cribriform carcinoma
- Medullary carcinoma
- Mucinous carcinoma and other tumors with abundant mucin

- ❖ Mucinous carcinoma
- ❖ Cystadenocarcinoma and columnar cell mucinous carcinoma
- ❖ Signet ring cell carcinoma

- Neuroendocrine tuomurs
  - ❖ Solid neuroendocrine carcinoma
  - ❖ Atypical carcionid tumour
  - ❖ Small cell / oat cell carcinoma
  - ❖ Large cell neuroendocrine carcinoma
- Invasive papillary carcinoma
- Invasive micropapillary carcinoma
- Apocrine carcinoma
- Metaplastic carcinoma
  - ❖ Pure epithelial metaplastic carcinoma
    - o Squamous cell carcinoma
    - o Adenocarcinoma with spindle cell metaplasia
    - o Adenosquamous carcinoma
    - o Mucoepidermoid carcinoma
  - ❖ Mixed epithlial/ mesenchymal metaplastic carcinoma
- Lipid-rich carcinoma
- Secretory carcinoma
- Oncocytic carcinoma
- Adenoid cystic carcinoma
- Acinic cell carcinoma
- Glycogen-rich clear cell carcinoma
- Sebaceous carcinoma
- Inflammatory carcinoma
- Lobular neoplasia
  - ❖ Lobular ca in situ
- Intraductal proliferative lesions
  - ❖ Usual ductal hyperplasia
  - ❖ Flat epithelial atypia
  - ❖ Atypical ductal hyperplasia
  - ❖ Ductal carcinoma in situ
- Microinvasive carcinoma
- Intraductal papillary neoplasms
  - ❖ Central papilloma
  - ❖ Peripheral papilloma
  - ❖ Atypical papilloma
  - ❖ Intraductal papillary carcinoma
  - ❖ Intracystic papillary carcinoma

- Benign epithelial proliferations
  - ❖ Adenosis including variants
    - o Sclerosing adenosis
    - o Apocrine adenosis
    - o Blunt duct adenosis
    - o Microglandular adenosis
    - o Adenomyoepithelial adenosis
  - ❖ Radial scar / complex sclerosing lesion
- Adenomas
  - ❖ Tubular adenoma
  - ❖ Lactating adenoma
  - ❖ Apocrine adenoma
  - ❖ Pleomorphic adenoma
  - ❖ Ductal adenoma

2. Myoepithelial lesions

- Myoepitheliosis
- Adenomyoeithelial adenosis
- Adenomyoepithelioma
- Malignant myoepithelioma

3. Mesenchymal lesions

- Hemangioma
- Angiomatosis
- Hemangiopericytoma
- Pseudoangiomatous stromal hyperplasia
- Myofibroblastoma
- Fibromatosis (aggressive)
- Inflammatory myofibroblastic tumour
- Lipoma
  - ❖ Angiolipoma
- Granular cell tumour
- Neurofibroma
- Schwannoma
- Angiosarcoma
- Liposarcoma
- Rhabdomyosarcoma
- Osteosarcoma
- Leiomyoma
- Leiomyosarcoma

4. Fibroepithelial tumours

- Fibroadenoma
- Phyllodes tumour
  - ❖ Benign
  - ❖ Broderline
  - ❖ Malignant
- Periductal stromal sarcoma, low grade
- Mammary hamartoma

5. Tumors of the nipple

- Nipple adenoma
- Syringomatous adenoma
- Paget disease of the nipple

6. Malignant lymphoma

- Diffuse large B-cell lymphoma
- Burkitt lymphoma
- Extranodal marginal-zone B-cell lymphoma of MALT type
- Follicular lymphoma

7. Metastatic tumors

8. Tumors of the male breast

- Gynecomastia
- Carcinoma
  - ❖ Invasive
  - ❖ In situ

AMERICAN JOINT COMMITTEE ON CANCER (AJCC) STAGING[36]

Primary tumor (T)

TX: Primary tumor cannot be assessed.

T0: No evidence of primary tumor.

Tis: Carcinoma in situ (ductal, lobular, and/or Paget disease of the nipple without invasive carcinoma)

T1: Tumor <2 cm in greatest diameter

T1mic: Microinvasion <0.1 cm in greatest dimension

T1a: Tumor >0.1 but ≤0.5 cm in greatest dimension

T1b: Tumor >0.5 but ≤1 cm in greatest dimension

T1c: Tumor >1 cm but ≤2 cm in greatest dimension

T2: Tumor >2 cm but ≤5 cm in greatest dimension

T3: Tumor >5 cm in greatest dimension

T4: Tumor of any size, with direct extension to chest wall or skin

T4a: Extension to the chest wall, not including pectoralis muscle

T4b: Edema (including *peau d'orange*) or ulceration of the skin of the breast or satellite skin nodules confined to the same breast

T4c: Both T4a and T4b

T4d: Inflammatory disease

Regional lymph nodes (pN) [36]

pNX: Regional lymph nodes cannot be assessed

pN0: No regional lymph node metastasis or lymph node metastasis <0.2 mm. pN0 can be further classified as

pNo(i+): Isolated tumor cells (<0.2 mm) detected by hematoxylin and eosin or immunohistochemistry

pN0(mol+): Tumor cells detected by positive molecular findings (reverse transcription-polymerase chain reaction)

pN1: Metastasis in 1 to 3 axillary lymph nodes, and/or in internal mammary nodes with microscopic disease detected by sentinel lymph node dissection but not clinically apparent

pN1mi: Micrometastasis (>0.2 mm, none >2.0 mm)

pN1a: Metastasis in 1 to 3 axillary lymph nodes

pN1b: Metastasis in internal mammary nodes

pN1c: Metastasis in 1 to 3 axillary nodes and in internal mammary nodes

pN2: Metastasis in 4 to 9 axillary nodes, or in clinically apparent internal mammary nodes in the absence of axillary node metastasis

pN2a: Metastasis in 4 to 9 axillary nodes (at least one deposit >2 mm)

pN2b: Metastasis in clinically apparent internal mammary nodes in the absence of axillary lymph node metastasis.

pN3: Metastasis in ≥10 axillary lymph nodes, or in infraclavicular lymph nodes, or in clinically apparent ipsilateral internal mammary lymph nodes in the presence of ≥1 positive axillary lymph nodes; or in >3 axillary lymph nodes with clinically negative microscopic metastasis in internal mammary lymph nodes; or in ipsilateral supraclavicular lymph nodes.

pN3a: Metastasis in ≥10 axillary lymph nodes (at least one deposit >2 mm), or metastasis to the infraclavicular lymph nodes

pN3b: Metastasis in clinically apparent ipsilateral internal mammary lymph nodes in the presence of ≥1 positive axillary lymph nodes; or in >3 axillary lymph nodes and in internal mammary lymph nodes with microscopic disease detected by sentinel lymph node dissection but not clinically apparent.

pN3c: Metastasis in ipsilateral supraclavicular lymph nodes

Distant metastasis (M) [36]

MX: Distant metastasis cannot be assessed

M0: No distant metastasis

M1: Distant metastasis

TNM Staging System for Breast Cancer[36]

Stage	Tumor	Node	Metastases
Stage 0	Tis	N0	M0
Stage I	T1	N0	M0
Stage IIA	T0 T1 T2	N1 N1 N0	M0 M0 M0
Stage IIB	T2 T3	N1 N0	M0 M0
Stage IIIA	T0 T1 T2 T3	N2 N2 N2 N1-2	M0 M0 M0 M0
Stage IIIB	T4 T4 T4	N0 N1 N2	M0 M0 M0
Stage IIIC	Any T	N3	M0
Stage IV	Any T	Any N	M1

Five-year survival rates are highly correlated with tumor stage, as follows:

- Stage 0: 99-100%
- Stage I: 95-100%
- Stage II: 86%
- Stage III: 57%
- Stage IV: 20%

Evaluation of lymph node involvement by sentinel lymph node biopsy or axillary lymph node dissection has been considered necessary for staging and

prognosis, as recommended in the 2009 edition of the National Comprehensive Cancer Network breast cancer guidelines, but the 2011 update modified this recommendation and states that lymph node evaluation is optional in the following cases:[37,38]

- Strongly favorable tumors.
- When no result would affect the choice of adjuvant systemic therapy.
- Elderly patients.
- Patients with co-morbid conditions.

DIAGNOSIS

Mammography

Mammography is a special type of low-dose x-ray imaging used to create detailed images of the breast. Mammography can demonstrate microcalcifications smaller than 100 µm; it often reveals a lesion before it is palpable by CBE and, on average, 1-2 years before noted by BSE.

There are 2 types of mammography examinations: screening and diagnostic. Screening mammography is done in asymptomatic women.

Diagnostic mammography is performed in symptomatic women (eg, when a breast lump or nipple discharge is found during self-examination or an abnormality is found during screening mammography). This examination is more involved, time-consuming, and expensive than screening mammography and is used to determine the exact size and location of breast abnormalities and to image the surrounding tissue and lymph nodes. Women with breast implants or a

personal history of breast cancer will usually require the additional views used in diagnostic mammography.[39]

In 2012, the FDA Radiological Devices Panel endorsed the Selenia Dimensions 3-D System with C-View Software Module (Hologic) as a new option for breast cancer screening. The new element recommended for approval is the addition of a software module that can generate synthetic 2-dimensional images from the digital breast tomosynthesis (DBT) data. As a result, standard full-field digital mammography (FFDM) may be unnecessary.[39]

Breast cancer screening with mammography plus tomosynthesis significantly increases the cancer detection rate and enables the detection of more invasive cancers. In a prospective screening study of 12,631 women, screening with 2-dimensional (2D) mammography plus 3D reconstruction using tomosynthesis significantly increased the detection of invasive breast cancers by 40% and reduced the rate of false-positive results by 15%. With mammography alone, the rate of detection of invasive and in situ cancers combined was 6.1 per 1000 examinations; with the addition of tomosynthesis, the detection rate increased by 27% to a rate of 8.0 per 1000 examinations. This increase was observed in women with all breast tissue densities, from dense to fatty. Adding tomosynthesis to mammography increased mean interpretation time from 45 seconds to 91 seconds.[39]

Other uses of mammography in breast cancer

A ductogram, or galactogram, is sometimes helpful for determining the cause of nipple discharge. In this specialized examination, a fine plastic tube is

placed into the opening of the duct in the nipple. A small amount of contrast medium is injected, which outlines the shape of the duct on a mammogram and shows whether a mass is present inside the duct.

Ultrasonography

Ultrasonography has become a widely available and useful adjunct to mammography in the clinical setting. Ultrasound is generally used to assist the clinical examination of a suspicious lesion detected on mammography or physical examination. As a screening device, ultrasound is limited by a number of factors, most notably by the failure to detect microcalcifications and by poor specificity (34%).[40]

Originally, ultrasonography was used primarily as a relatively inexpensive and effective method of differentiating cystic breast masses, which did not require sampling, from solid breast masses that were usually examined with biopsy; in many cases, the results of these biopsies were benign. However, it is now well established that ultrasonography also provides valuable information about the nature and extent of solid masses and other breast lesions.[40]

This imaging technique is also useful in the guidance of biopsies and therapeutic procedures; research is currently under way to evaluate its role in cancer screening. In September 2012, the U.S. Food and Drug Administration approved the first ultrasound system, the somo-v Automated Breast Ultrasound System (ABUS), for breast cancer screening specifically in women with dense breast tissue.[41] ABUS is indicated as an adjunct to standard mammography for

women with a negative mammogram, no breast cancer symptoms and no previous breast intervention such as surgery or biopsy.

Magnetic Resonance Imaging

In an effort to overcome the limitations of mammography and ultrasonography, MRI has been explored as a modality for detecting breast cancer in women at high risk and in younger women. A combination of T1, T2, and 3-D contrast-enhanced MRI techniques has been found to be highly sensitive (approximating 99% when combined with mammogram and CBE) to malignant changes in the breast.[40]

Indications for MRI

The high cost and limited availability of MRI, as well as the difficulties inherent in performing and interpreting the studies, require careful recommendations for its use. The following are common agreed-upon and useful indications for MRI:

- Characterization of an indeterminate lesion after a full assessment with physical examination, mammography, and ultrasonography
- Detection of occult breast carcinoma in a patient with carcinoma in an axillary lymph node
- Evaluation of suspected multifocal or bilateral tumor
- Evaluation of invasive lobular carcinoma, which has a high incidence of multifocality
- Evaluation of suspected, extensive, high-grade intraductal carcinoma
- Detection of occult primary breast carcinoma in the presence of metastatic adenocarcinoma of unknown origin
- Monitoring of the response to neoadjuvant chemotherapy

- Detection of recurrent breast cancer

Contraindications to MRI

Conversely, in a number of situations, MRI is essentially contraindicated, usually because of physical constraints that prevent adequate patient positioning. These constraints include the following:

- Contraindication to gadolinium-based contrast media (eg, allergy, pregnancy)
- Patient's inability to lie prone
- Marked kyphosis or kyphoscoliosis
- Marked obesity
- Extremely large breasts
- Severe claustrophobia

Relative contraindications also exist. These are essentially based on the high sensitivity but limited specificity of the technique. MRI may not be useful for the following:

- Cancer-phobic patients
- Assessment of mammographically detected microcalcifications

Nuclear Imaging

Three radiotracers are commonly used for breast imaging or scintimammography in either clinical practice or research: technetium-99m (^{99m}Tc)-sestamibi and ^{99m}Tc-tetrofosmin (both used for myocardial perfusion imaging), as well as ^{99m}Tc-methylene diphosphonate (MDP) (used for bone scintigraphy). ^{99m}Tc-sestamibi was the first radiopharmaceutical agent to be approved by the FDA for use in scintimammography.[42]

Although not indicated as a screening procedure for the detection of breast cancer, scintimammography may play a useful and significant role in various specific clinical indications, as in cases of nondiagnostic or difficult mammography and in the evaluation of high-risk patients, tumor response to chemotherapy, and metastatic involvement of axillary lymph nodes.

In several prospective studies, overall sensitivity of ^{99m} Tc-sestamibi scintimammography in the detection of breast cancer was 85%, specificity was 89%, and positive and negative predictive values were 89% and 84%, respectively. Similar numbers have been demonstrated for ^{99m} Tc-tetrofosmin and ^{99m} Tc-MDP scintimammography.[42]

In March 2013, based on data from clinical trials of 332 patients with melanoma or breast cancer, the FDA approved Lymphoseek (technetium Tc 99m tilmanocept) Injection, a radioactive diagnostic imaging agent that helps doctors locate lymph nodes in patients with breast cancer or melanoma who are undergoing surgery to remove tumor-draining lymph nodes. All participants were injected with Lymphoseek and blue dye. Suspected lymph nodes were then removed by surgeons for pathologic examination. Results showed that both Lymphoseek and blue dye had localized most lymph nodes, although a notable number of nodes were localized only by Lymphoseek.

Positron Emission Tomography Scanning

PET scanning is the most sensitive and specific of all the imaging modalities for breast disease, but it is also one of the most expensive and least widely available. Using a wide range of labeled metabolites (eg, fluorinated glucose [^{18} FDG]), changes in metabolic activity, vascularization, oxygen

consumption, and tumor receptor status can be detected. At present, its main use may be to help detect recurrences in scarred breasts, but it is also useful in multifocal disease, in detecting axillary involvement, and in equivocal cases of systemic metastases.[40]

PET/computed tomography (CT) scans may be appropriate to assist in identification of nonaxillary lymph node metastasis (ie, internal mammary or supraclavicular lymph nodes) for staging locally advanced and inflammatory breast cancer before starting neoadjuvant therapy.[40]

Accuracy of Breast Imaging Modalities

In nonfatty breasts, ultrasonography and MRI are more sensitive than mammography for invasive cancer but may overestimate tumor extent. Combined mammography, clinical examination, and MRI are more sensitive than any other individual test or combination of tests.

Accuracy of Breast Imaging Modalities

Modality	Sensitivity	Specificity	Positive predictive value	Indications
Mammography	63-95% (>95% palpable, 50% impalpable, 83-92% in women older than 50 y) (decreases to 35% in dense breasts)	14-90% (90% palpable)	10-50% (94% palpable)	Initial investigation for symptomatic breast in women older than 35 years and for screening; investigation of choice for microcalcification
Ultrasonography	68-97% (palpable)	74-94% (palpable)	92% (palpable)	Initial investigation for palpable lesions in women younger than 35 years
MRI	86-100%	21-97% (< 40% primary cancer)	52%	Scarred breast, implants, multifocal lesions, and borderline lesions for breast conservation; may be useful in screening high-risk women
Scintigraphy	76-95% (palpable) 52-91% (impalpable)	62-94% (94% impalpable)	70-83% (83% palpable, 79% impalpable)	Lesions larger than 1 cm and axilla assessment; may help predict drug resistance
PET scanning	96% (90% axillary metastases)	100%		Axilla assessment, scarred breast, and multifocal lesions

Breast Biopsy

Percutaneous vacuum-assisted large-gauge core biopsy (VACNB) with image guidance is the recommended diagnostic approach for newly diagnosed breast cancers. Core biopsies spare the need for operative intervention (and subsequent scarring), often providing pathologic results more quickly than surgical excisions.

Additionally, excisional biopsy, as the initial operative approach, has been shown to increase the rate of positive margins. Thus, core biopsies for diagnosing breast cancer can eliminate the need for additional surgeries for definitive margin control and assessment of nodal status.

1. *Excisional biopsy:* The ultimate diagnostic biopsy is open excisional biopsy of a lesion, normally performed under general anesthesia. Open excisional biopsy should be reserved for lesions where the diagnosis remains equivocal despite imaging and less invasive assessment, or the procedure should be used for benign lesions that the patient chooses to have removed. A wide clearance of the lesion is usually not the goal in diagnostic biopsies, thus avoiding unnecessary distortion of the breast. Ongoing audit is essential to help reduce an excessive benign-to-malignant biopsy ratio.[43]

2. *Fine needle aspiration cytology (FNAC):* A very thin needle attached to a syringe is inserted into the suspicious area and a small amount of tissue is withdrawn. If the area cannot be felt, ultrasound can be used to guide the placement of the needle. Sometimes not enough tissue can be obtained to make a diagnosis using this method.

Early detection of Breast cancer

Each year, the American cancer Society (ACS) publishes a report that summarizes its recommendations for early cancer detection. ACS guidelines for Breast cancer screening in average risk were updated in 2003, and screening guidelines for women at very high risk were updated in 2007. Several risk assessment tools, such as the Gail model, the Claus model, help health professionals estimate a woman's breast cancer risk.

These tools give approximate, rather than precise, estimates of breast cancer risk based on different combinations of risk factors and different data sets.

American Cancer Society guidelines for Breast Cancer screening with average risk

The ACS (after updating guidelines in 2003), recommends that average-risk women should begin annual mammography at age 40 years. For women in their 20s and 30s, it is recommended that clinical breast examination be part of a periodic health examination, preferably at least every three years. Asymptomatic women aged 40 and over should continue to receive a clinical breast examination as part of a periodic health examination, preferably annually.[1]

Beginning in their 20s, women should be told about the benefits and limitations of breast self-examination (BSE). The importance of prompt reporting of any new breast symptoms to a health professional should be emphasized. Women who choose to do BSE should receive instructions and have their technique reviewed on the occasion of a periodic health examination. It is

acceptable for women to choose not to do BSE or to do BSE irregularly. Screening decisions in older women should be individualized by considering the potential benefits and risks of mammography in the context of current health status and estimated life expectancy. As long as a woman is in reasonably good health and would be a candidate for treatment, she should continue to be screened with mammography.[44]

American Cancer Society guidelines for breast screening with MRI for women with increased risk, (2007-2009)[44]

Women at increased risk of breast cancer might benefit from additional screening strategies beyond those offered to women of average risk, such as earlier initiation of screening, shorter screening intervals, or the addition of screening modalities other than mammography and physical examination, such as ultrasound or magnetic resonance imaging (MRI). Annual MRI screening is recommended for BRCA carrier, like those with BRCA mutation; first degree relative with life time risk ~ 20- 25% or greater, also patients who are exposed to radiation of the chest between age 10 and 30 years, and those with Li-Fraumeni syndrome (a familial cancer syndrome in which affected relatives develop a diverse set of early-onset malignancies including breast carcinoma, sarcomas, and brain tumors).

MAMMOGRAPHY:

Mammography is the single most important method in diagnosing breast disease. Its areas of application include:

(i) **Screening:** mammography is the only imaging method to date that is suitable for screening

(ii) **Problem solving / Diagnostic**: apart from few exceptions mammography is always indicated as a diagnostic method in symptomatic patients. This not only helps physicians in determining whether a lesion is potentially malignant or benign but also screens for occult disease in surrounding tissue.

EARLY DETECTION OF BREAST CANCER WITH MAMMOGRAPHY TEST (MT).

Mammography is a special type of x-ray imaging used to create detailed images of the breast. Low x-ray; high contrast, high-resolution film; and an x-ray system designed specifically for imaging the breasts18. Mammography is an x-ray which detects 85% of BC. A distinction should be made between diagnostic mammography and screening mammography.[44]

Screening mammography is an x-ray study of the breast to detect breast changes in women who have no signs or symptoms of BC. Diagnostic Mammography is an x-ray study of the Breast that is used to detect breast cancer after a lump or other signs or symptoms of BC has been found; 45% of BC can be seen by mammography before they are palpable.[44] Digital mammography takes an electron image of the breast and uses less radiation than film mammography; it allows image storage and transmission in addition software may be used to interpret digital mammograms. It gradually replaces film mammography and it is more expensive than film system.[44]

The technique

Mammography is done by compressing the breast between two plates. Single view mammography involves taking a mediolateral view of the breast or craniocaudal view. Both views are used in screening. For many women, mammography is found to be uncomfortable, so it is wise to explain, discuses, and warn every woman before the exam is done. After the films are completed, the woman is told that she will be informed of the results within a specified period. Results are interpreted by a radiologist who should have high skills for identifying malignant and benign abnormalities.If there is any abnormality, further investigations will take place including ultrasound, fine needle aspiration, and trucut needle biobsy.

Compared to radiographic studies of other parts of the body, mammography places particularly stringent demands on equipment and image quality. The stringent demands of the technique and positioning make mammography one of the most difficult examinations in conventional radiology. To meet the requirements, mammography requires special tubes that produce particularly low energy radiation.

Over the last 70+ years the technique has been developed and refined through the use of dedicated units, compression, Molybdenum targets, standardized techniques, moveable grids, automatic exposure control, high resolution films , rare earth screens, automatic film processing and even greater attention to quality control.

Benefits

Benefits of mammography were studied over the twenty past years. The largest study was the health insurance plan of New York, in which a group of women aged between 40 and 60 was offered a mammographic screening and physical examination annually for four years. Mortality rate was reduced by 30% for up to ten years in women invited for breast cancer screening.[45,46] A Swedish trial studied single view mammography every two years for women aged 40 years, and every three years for older women. At seven years follow up there was a reduction of mortality rate of 40% for women aged over 50 years old.[47]

The UK government established a working group to examine the benefits of breast screening. Professor Sir Patrick Forrest chaired with establishing the National Health Breast Cancer Screening Programme (NHBCSP). The committee published its findings in 1986 which showed that screening with mammography can lead to prolongation of life for women aged 50 years or over with breast cancer.[48] In 1991 the NHBCSP, Forrest et al published the latest research findings which concluded that if 70 % of the population accepts the invitation to screening with mammography, the reduction in mortality will be 25%.[49] Taken together, all the results confirm the conclusion from the Swedish randomized trials, that mammographic screening is an effective means of reducing breast cancer mortality[50].

Another benefit of mammography screening was studied by the National Cancer Institutes Surveillance, Epidemiology, and End Results (SEER); it showed that since the use of screening mammography has become widespread,

the proportion of patients who have locally advanced disease at diagnosis has decreased. Data which encompasses approximately 14% of the U.S. population indicate that 7% of patients have stage III disease at diagnosis. In populations that receive regular screening mammography, the percentage of patients with locally advanced disease is less than 5%. However, since only 50% 60% of women of the study data have had a recent mammogram, the national rates are higher. According to the SEER data, the 3- and 5-year relative survival rates for women with stage III breast cancer are 70% and 55%, respectively.[51]

Radiographic views

Both screening and diagnostic mammograms routinely start with the standard mediolateraloblique and craniocaudal projections. For further evaluation of suspected abnormalities supplemental views including exaggerated craniocaudal, spot compression, magnification, vertical lateral, tangential and push-back views may be obtained.

Definition of mammographic lesions

The sensitivity of mammography is initially determined by the relative background composition of the breast parenchyma. The denser the breast the less sensitive it is to the detection of small masses, although small calcifications can generally still be detected. The mammograms are initially evaluated for the presence of masses, architectural distortion, asymmetric parenchyma, calcifications and skin changes. Mammographically a *mass* is defined as a space occupying lesion seen in two different projections, with *density* defined as a

collection seen in only one view. A mass is then further characterized by its shape, margins, density, size, orientation and presence of associated calcifications.

Shape

An irregular shape is more concerning as it suggests indistinct or irregular margins. Some skins lesions, warts and seborreic keratoses have typical appearances due to the variegated surfaces and occasionally radiolucent/air halo. Some intramammary nodes have a typical reniform configuration with a fatty notch.

Margin or contour analysis

Characterizes the transition zone from mass to surrounding parenchyma or fatty tissue. The significance arises from the tendency of invasive carcinoma to infiltrate adjacent tissue and have indistinct, microlobulated or frankly spiculated margins. Well circumscribed or sharply marginated masses, either with or without a radiolucent halo, are probably benign. Circumscribed masses with irregular or microlobulated margins on magnification views should be considered suspicious and biopsy suggested.

Masses with spiculated margins are suggestive of malignancy. Other spiculated densities may represent radial scar or Sclerosing adenosis but are still suspicious and can be associated with tubular carcinoma. A spiculated density may also be secondary to a post operative scar, although the clinical history should provide the clue and subsequent serial follow up should demonstrate maturation and involution or at least stability of the scar. Density describes the relative

attenuation of a breast lesion compared to the normal fibroglandular tissue of the breast. Cancer is frequently, but not always higher in density than surrounding parenchyma, and can be isodense or rarely lower in density. Fat containing/radiolucent masses most frequently represent oil cysts, lipoma, galactocele, hamartoma or fibrolipoma and are considered benign unless other characteristics are suspicious. Calcifications can occur in the breast from many causes and be associated with both benign and malignant conditions.

TYPICALLY BENIGN CALCIFICATIONS

Skin calcifications: are typically small, round to oval with lucent centers.

Vascular calcification: is similar to elsewhere in the body and forms contiguous or interrupted dense paired tubular lines.

Coarse or popcorn like calcification: can be seen in an involuting fibroadenoma.

The large rod shaped calcification of secretory disease/plasma cell mastitis is usually over 1mm in diameter, may have lucent centers and occasionally branch.

Small, dense rounded calcifications are usually considered benign and related to involution.

Milk of calcium is benign and represents calcium precipitate in small cysts.

Eggshell calcifications are benign Small amorphous, indistinct, hazy rounded and flake like calcifications may be associated with both benign and malignant processes and are of intermediate concern

CALCIFICATIONS HIGHLY PROBABLE OF MALIGNANCY

- Pleomorphic or heterogeneous (granular) fine linear and/or branching calcifications

BI RADS CLASSIFICATION:

Radiologists are encouraged to use in their reporting, the terms recommended in the BIRADS published by the AMERICAN COLLEGE OF RADIOLOGY. Diagnosis should be categorized as[8]:

- CATEGORY I: Normal mammogram.
- CATEGORYII: Focal benign findings for which nothing further is required.
- CATEGORY III: Probably benign finding, short interval follow up suggested.
- CATEGORY IV: Indeterminate lesion, biopsy recommended.
- CATEGORY V: highly suggestive of malignancy and requires biopsy

Literature review

In a study to ascertain whether recent use of mammography has dropped nationally in the U.S.A, Breen N et al used the 2000 and 2005 National Health Interview Survey (NHIS) to characterize trends and current patterns in mammography use. They found that the use of mammography may be falling and the difference was significant. Changes in screening rates have an immediate impact on the reported incidence of breast cancer and, ultimately, mortality.[52]

Another survey was done in 1997 aiming to determine mammography rate and screening practice patterns throughout the state of Arkansas in the USA .The study revealed that a small fraction of women ages 40 years and older obtained annual mammograms in 1997, thus highlighting the need for intensifying efforts to increase the utilization of this lifesaving test.[53]

In Spain a cross sectional study revealed the dissemination of periodic mammography and repeat mammography behavior in Catalonia (Spain), from 1975 to 2006. A higher proportion of women of all age groups have annual mammograms rather than biennial or irregular ones. The Montserrat et al limited their analysis to a description of mammography usage patterns (non-user, annual, biennial, irregular) based on health surveys from 1994, 2002, and 2006 concluded that in Catalonia, periodic screening is associated with higher socioeconomic status and nonparticipation in the screening program were in higher level of education, higher occupational skills or working at home, self- or gynecological examination of breasts, and having received hormone replacement therapy.[54]

In Sweden, Lagerlund M et al examined attitudes, beliefs, and knowledge in relation to nonattendance in a population-based mammography screening program, in order to find out if the effectiveness of mammography screening could be improved by understanding better factors that influence nonattendance. Their findings suggest that nonattendance was most common among women within the highest quartile of perceived emotional barriers; other factors associated with nonattendance were less knowledge about mammography and breast cancer, lack of advice from a health professional to participate, and very poor trust in health care.[55]

According to the Middle East Cancer Consortium (MECC), Breast cancer was the leading tumor in females in all cancer registries, accounting for as high as 37.6% of all reported tumors in Egyptian females to as low as 27.7% of all reported tumors in Israeli Arab females. Age standardized incidence rates (ASRs) per 100,000 females were highest among Israeli Jews (93.1), similar to the rates

reported in US SEER females (97.2). These rates were significantly higher than those reported in Cypriot (57.7), Egyptian (49.6), Jordanian (38.0), and Israeli Arab (36.7) females. The high incidence rates described in Israeli Jews were similar to those described in North American and West European countries, while the lower rates is among the neighboring Arab.[56]

A study of Muslim Arab women in Israel was performed in Hadassah Medical Center in 2001 by female Arab interviewers aimed to study factors related to screening mammography behavior among Arab women by employing components from the Health Belief Model. Mammography screening rates by Muslim Arab women in Israel are lower compared with the general population. The women had limited knowledge about breast cancer and mammography, the rate was alarming (only 20%) ,since access to screening services is universal and free for this age group also the findings indicated that professional recommendation and beliefs sets are essential factors for developing effective mammography screening interventions in this unique population.[57]

More women are becoming aware of the dangers of breast cancer in the UAE, according to figures released by a specialist cancer detection and treatment centre. Over 1,100 women have been screened for breast cancer in mobile units so far in AL AIN this year (2009). In 2008, the nine month figure was less than 2000. Dr Ghowaya Mohammed Al Neyadi, Family and Community Medicine Specialist and Coordinator for the mobile unit at Taw'am Hospital said statistics indicated a momentous step forward on the road to breast cancer education and awareness.[58]

Chapter 4

Methodology

METHODOLOGY

This study was conducted in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospitals and Medical Research Centre, and Charitable Hospitals Belgaum over a period of one year from January 2012 to December 2012.

Study design

The study design was cross-sectional study.

Study period and duration

The present study was conducted for the period of one year from January 2012 to December 2013.

Place

The present study was carried done in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospitals, Belgaum tertiary care teaching hospitals attached to KLE University's Jawaharlal Nehru Medical College, Belgaum.

Source of Data

All women patients with palpable breast lump attending surgical OPD/admitted at Department of General Surgery, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum were studied.

Sample size

A total of 65 patients with palpable breast lump were studied.

Sampling procedure

The sample size was calculated based on the formula as below.

$n = 4Z^2 \times p \times q / d^2$

Where, n: Sample size

Z: 1.96 ~ 2 (taking confidence as 95%)

p: Sensitivity

q: 100 – p

d: Relative error that is 10%

Based on the above formula the sample size was calculated as 64 women with palpable breast lump. However, 65 women fulfilled the selection criteria during the study period and hence were enrolled in the study.

Selection criteria

Inclusion

- Patients aged between 15 to 75 years.
- Palpable breast lump of variable duration.

Exclusion

- Patients not willing for mammography / biopsy.
- Patients with infective breast masses.
- Patient not willing to participate in the study.

Ethical clearance

Prior to the commencement, the study was approved from the Ethical and Research Committee, Jawaharlal Nehru Medical College, Belgaum.

Informed Consent

The patients fulfilling selection criteria were informed about the nature of the study and a written informed consent was obtained before enrollment (Annexure I).

Method of collection of data

Patients were interviewed and demographic data such as age and presenting symptoms were noted. Further these patients were subjected to thorough clinical examination. Brest examination was done and variables like discharge, size, shape, tenderness, consistency and axillary lymphnode were assessed. These findings were recorded on a predesigned and pretested proforma (Annexure II).

Investigations

Patients underwent the following investigations.

- Mammography
- Biopsy

Procedure

Mammography

- Patients were asked to remove any clothing, jewelry, or other objects that might interfere with the procedure.
- The technologist confirmed the lumps or other changes in either breast. an adhesive marker was placed on the spot(s) prior to the procedure.
- An adhesive marker was also applied to moles, scars, or other spots that might interfere with the breast image.
- Patients was made to stand in front of a mammography machine and one breast was placed on the X-ray plate.
- A separate flat plate, made of plastic, was brought down on top of the breast to compress it gently against the X-ray plate.
- Compression of the breast was required in order to minimize the amount of radiation used and to ensure optimal visualization of the breast tissue.
- Patient was asked to hold her breath while the image was being taken.
- The radiologic technologist stepped behind a protective window while the image was taken.
- Two pictures cephalocaudal and lateral views were taken of each breast, requiring the breasts to be repositioned between pictures.

- After the X-rays have been taken, the films were examined by radiologist to ensure that the films are clear and that no additional films are needed. All the mammograms were evaluated by a single expert radiologist to rule out the interobserver variability.

- If there was any question about any of the films, additional films were taken.

- The examination process took approximately 20 to 30 minutes.

Grading of mammographic findings

- Category 0 – Incomplete requires additional imaging evaluation.
- Category 1 – Negative
- Category 2 – Benign
- Category 3 – Probably benign
- Category 4 – Suspicious probably malignant
- Category 5 – Highly suggestive of malignancy
- Category 6 – Histologically confirmed malignancy

Above 4 mammography grades were considered as malignant.

Histopathology / Cytology report

Depending upon the triple assessment viz. clinical examination, mammography and FNAC/core biopsy patients received treatment.

When the triple assessment indicated benign lesion, the lump was excised, the malignant lesions were treated according to the stage of the disease. HPR was

available in both these groups of patients, when there was no indication for surgical excision, FNAC or core biopsy findings were taken for calculation of sensitivity and specificity.

Statistical analysis

The data obtained was coded and entered in Microsoft Excel Spreadsheet. The categorical data was expressed as rates, ratios and percentages and comparison was done using chi-square test. Continuous data was expressed as mean ± standard deviation. The diagnostic accuracy of mammography in predicting breast lumps was determined by sensitivity, specificity, positive predictive value and negative predictive value. Kappa agreement was used to correlate the agreements between diagnosis. A ‘p’ value of less than or equal to 0.05 was considered as statistically significant.

Chapter 5

Results

RESULTS

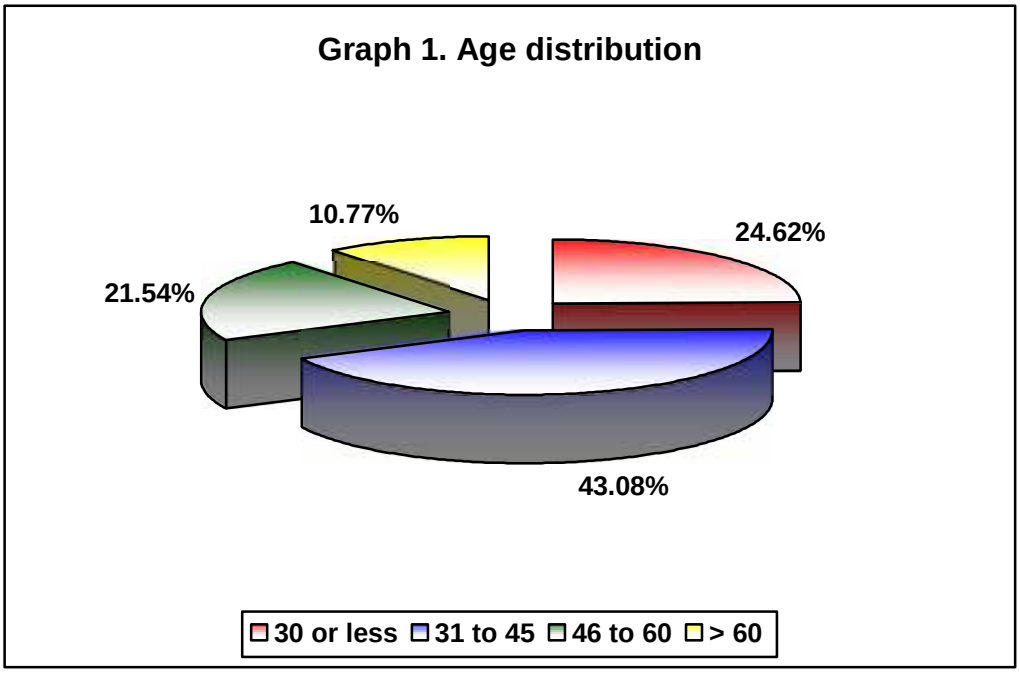
This one year cross-sectional study was conducted from January 2012 to December 2012.

A total of 65 eligible women presenting with palpable breast lump in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum were studied.

The data obtained was tabulated on excel spreadsheet (Annexure IV). The data was analysed and the final results were tabulated as below.

Table 1. Age distribution

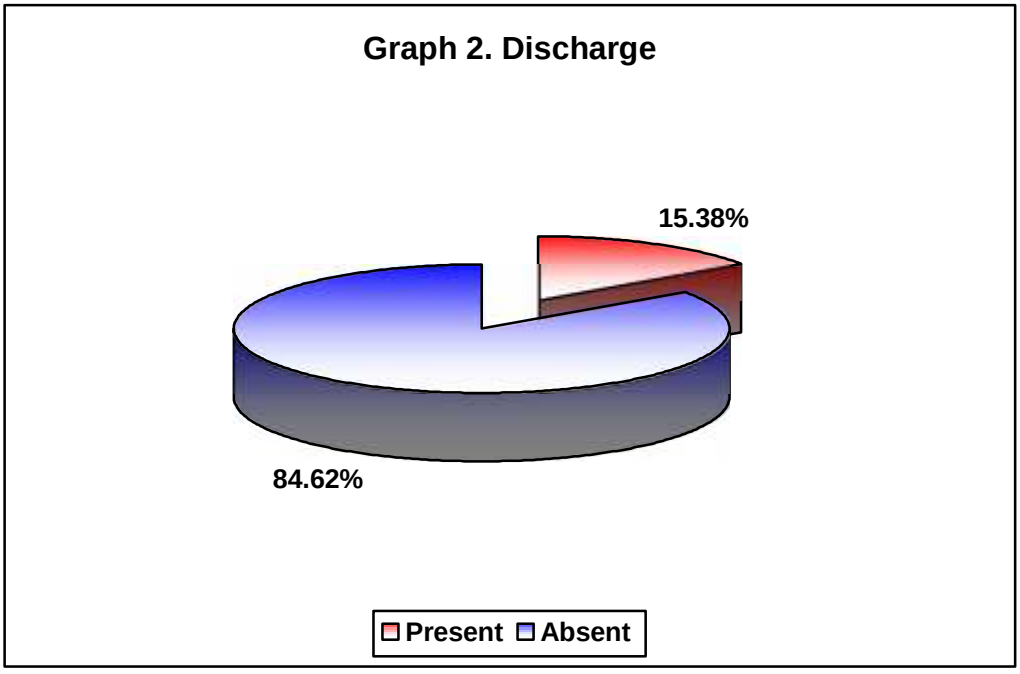
Age group (Years)	Distribution (n=65)	
	Number	**Percent**
30 or less	16	24.62
31 to 45	28	43.08
46 to 60	14	21.54
> 60	7	10.77
Total	**65**	**100.00**



In the present study most of the women (43.08%) presented with age between 31 to 45 years followed by 30 or less (24.62%), 46 to 60 (21.54%) and > 60 years (10.77%). The mean age of the study population was 41.71 ± 13.76 years.

Table 2. Discharge

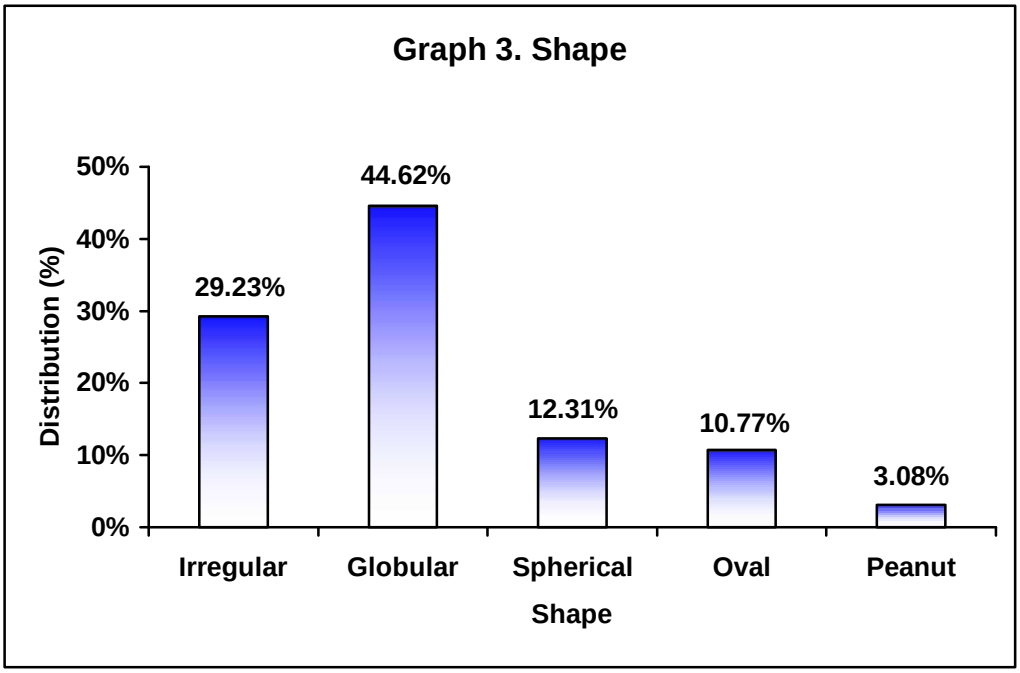
Discharge	Distribution (n=65)	
	Number	**Percent**
Present	10	15.38
Absent	55	84.62
Total	**65**	**100.00**



In this study, at presentation the discharge was present in 15.38% of the cases.

Table 3. Shape

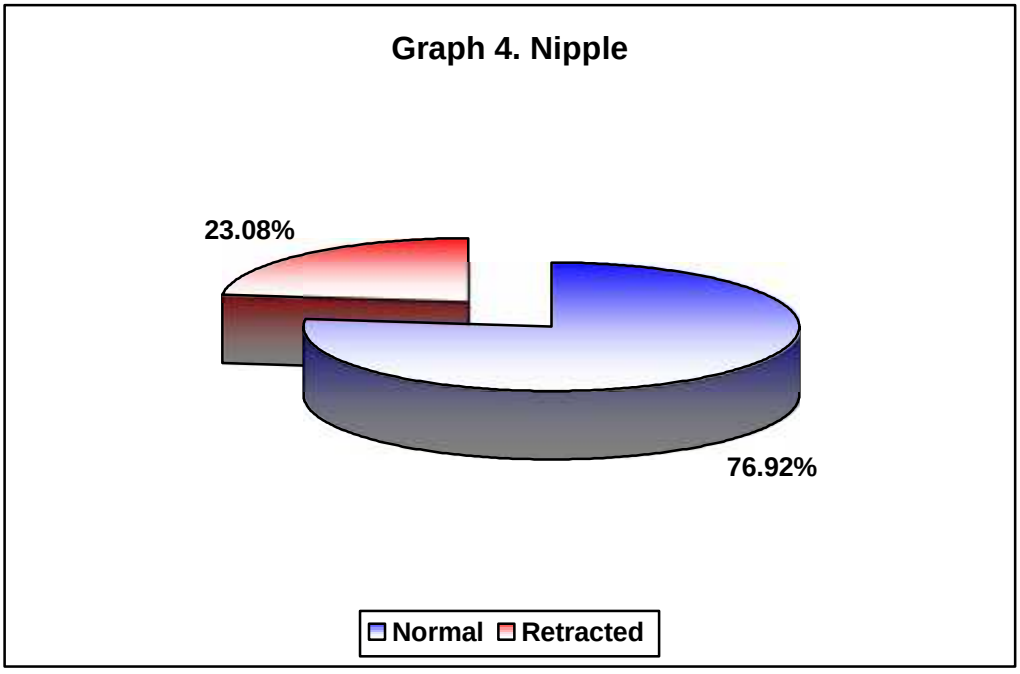
Shape	Distribution (n=65)	
	Number	**Percent**
Irregular	19	29.23
Globular	29	44.62
Spherical	8	12.31
Oval	7	10.77
Peanut	2	3.08
Total	**65**	**100.00**



In the present study shape of the lesion was found to be globular in 44.62%, irregular in 29.23%, spherical in 12.31% and oval in 10.77% of the patients. However, 3.08% of the patients had peanut shape.

Table 4. Nipple

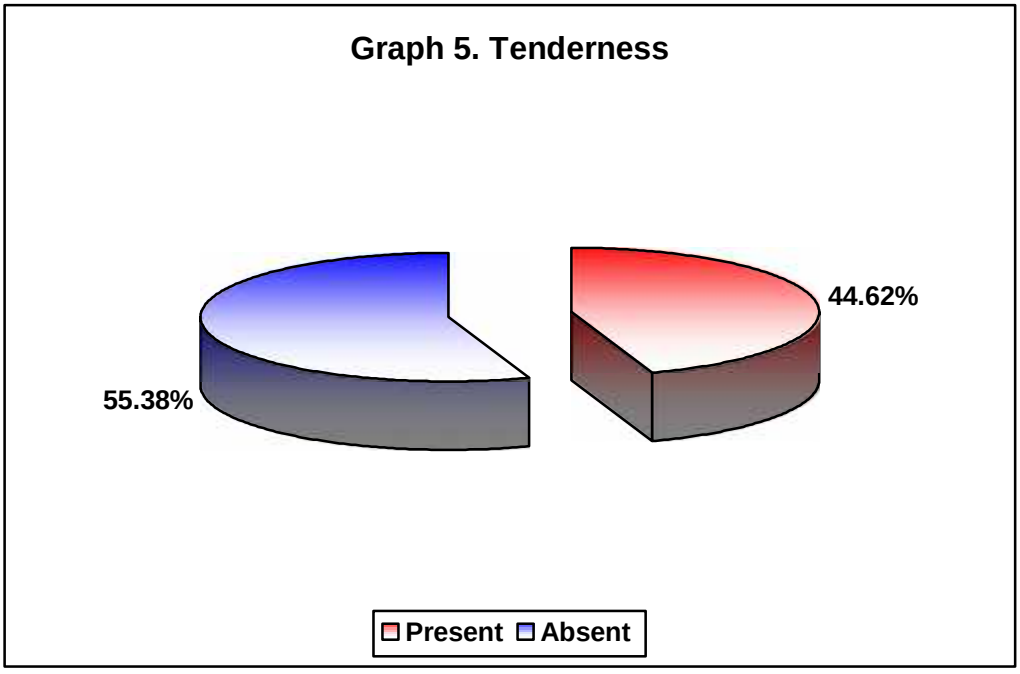
Findings	Distribution (n=65)	
	Number	**Percent**
Normal	50	76.92
Retracted	15	23.08
Total	**65**	**100.00**



In this study the nipple examination revealed retracted nipples in 23.08% of the patients.

Table 5. Tenderness

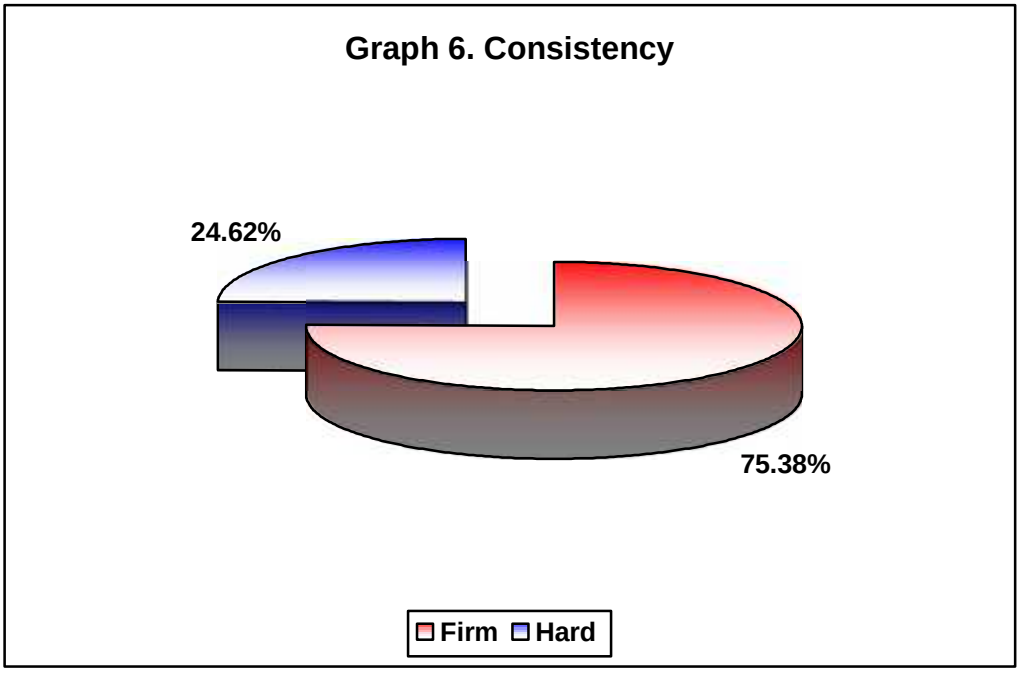
Findings	Distribution (n=65)	
	Number	**Percent**
Present	29	44.62
Absent	36	55.38
Total	**65**	**100.00**



In the present study tenderness was present in 44.62% of the patients.

Table 6. Consistency

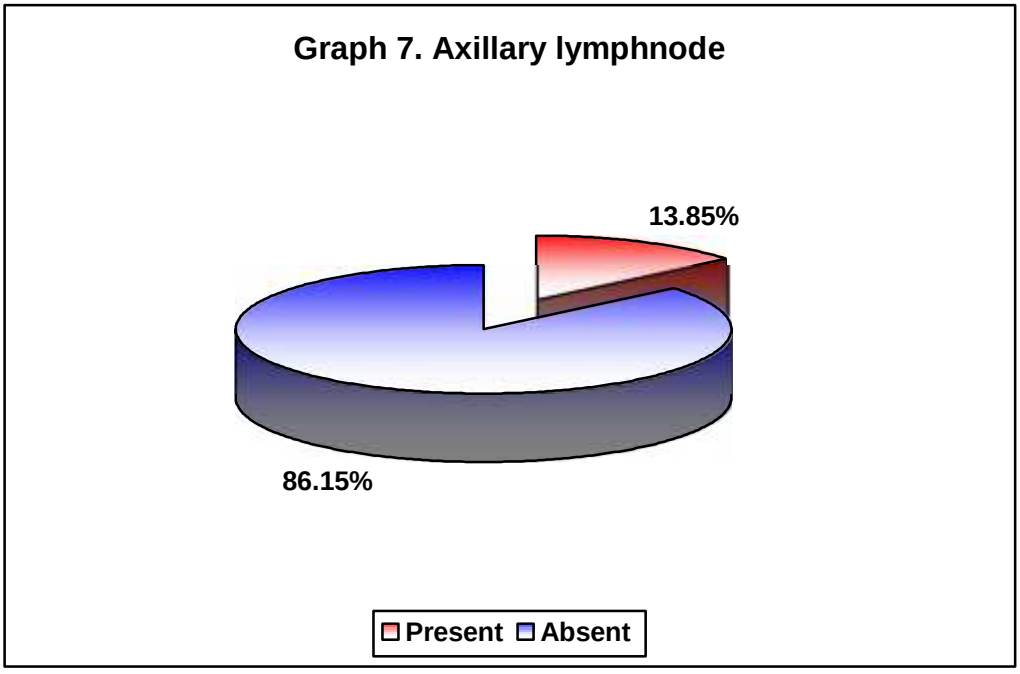
Findings	Distribution (n=65)	
	Number	**Percent**
Firm	49	75.38
Hard	16	24.62
Total	**65**	**100.00**



In this study the consistency of the breast was firm in 75.38% of the patients while hard in 24.62%.

Table 7. Axillary lymphnode

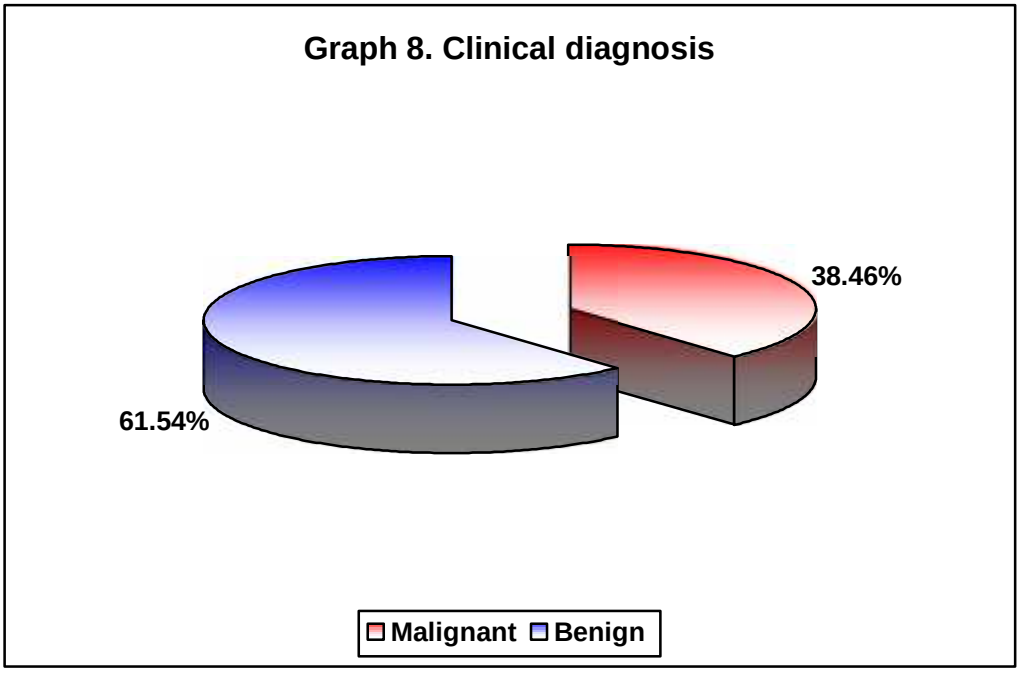
Findings	Distribution (n=65)	
	Number	**Percent**
Present	9	13.85
Absent	56	86.15
Total	**65**	**100.00**



In the present study axillary lymph node was present in 13.85% of the women.

Table 8. Clinical diagnosis

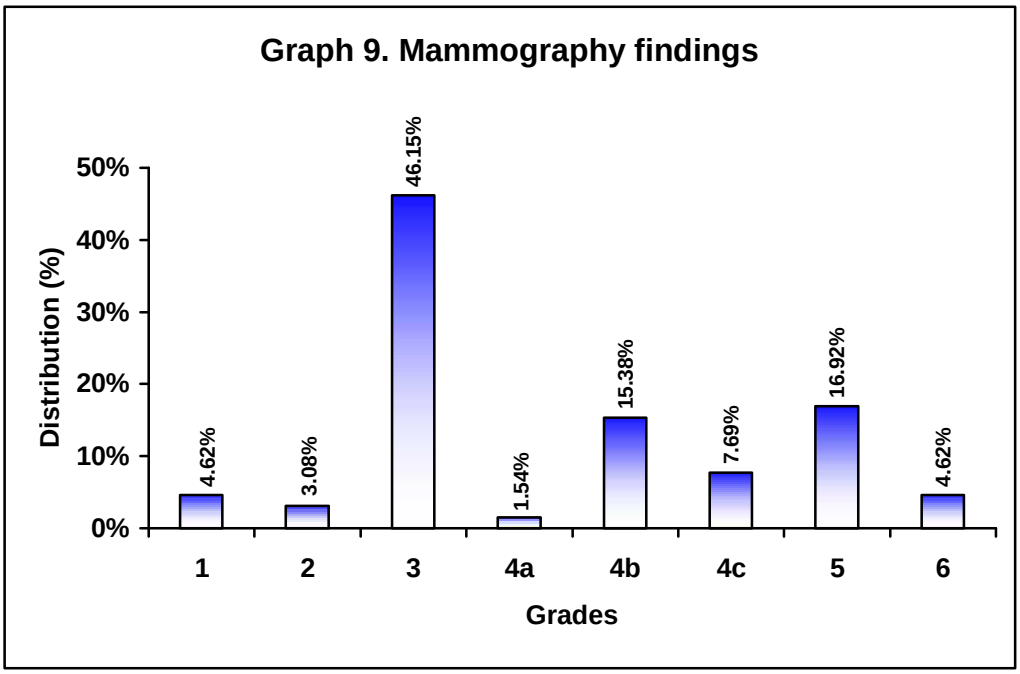
Diagnosis	Distribution (n=65)	
	Number	**Percent**
Malignant	25	38.46
Benign	40	61.54
Total	**65**	**100.00**



In this study based on the breast examination the clinical diagnosis was made as malignant in 38.46% and benign in 61.54% of the patients.

Table 9. Mammography findings

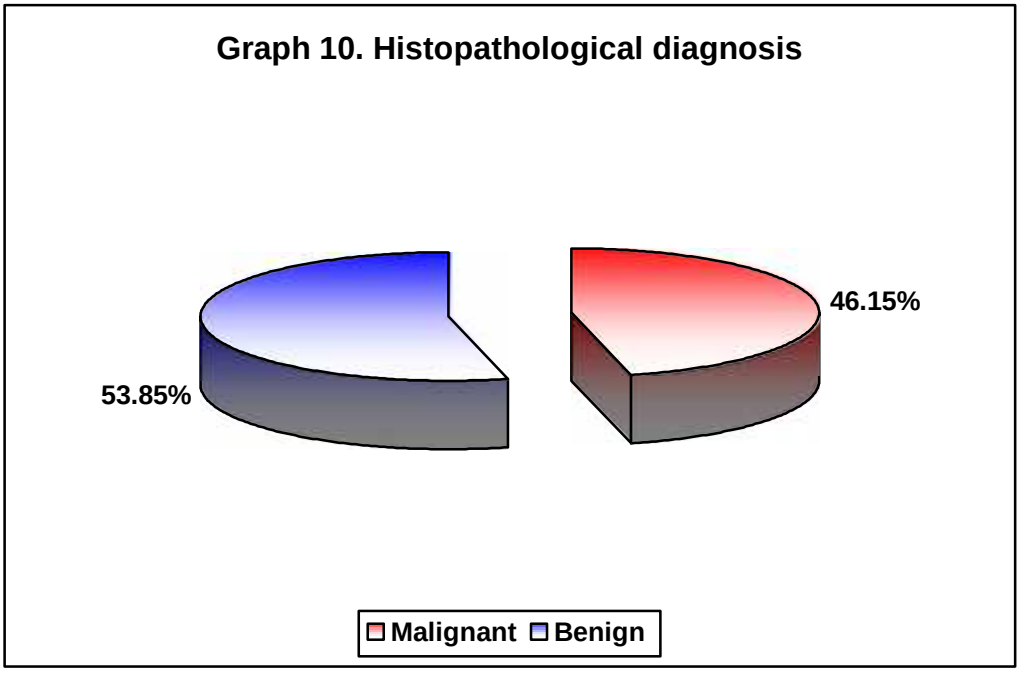
Grades	Distribution (n=65)	
	Number	Percent
1	3	4.62
2	2	3.08
3	30	46.15
4a	1	1.54
4b	10	15.38
4c	5	7.69
5	11	16.92
6	3	4.62
Total	**65**	**100.00**



In the present study mammography findings revealed grade 3 breast lump in 46.15% of the patients. The other grades are as shown in table 9 and graph 9.

Table 10. Histopathological diagnosis

Diagnosis	Distribution (n=65)	
	Number	Percent
Malignant	30	46.15
Benign	35	53.85
Total	**65**	**100.00**



In the present study 46.15% of the patients were diagnosed to have malignant lesions while 53.85% of the women were diagnosed as having benign lesions.

Table 11. Accuracy of mammography in comparison to histopathology

Mammography findings	Histopathology / Cytology		Total
	Malignant	**Benign**	
Malignant	26	1	27
Benign	4	34	38
Total	30	35	65

Sensitivity = (26/30) x 100 = 86.6%

Specificity = (34/35) x 100 = 97.1%

Positive predictive value = (26/27) x 100 = 96.3%

Negative predictive value = (34/38) x 100 = 89.5%

Diagnostic accuracy = [(26+34)/65] x 100 = (60/65) x 100 = 92.3%

In the present study of the 30 patients who had malignant lesions on histopathology, 26 had malignant lesions on mammography and 4 women had benign lesions. The sensitivity of mammography compared to histopathology in predicting malignant lesions was 86.67% with specificity of 97.14%. The diagnostic accuracy of the mammography was 92.3%

Chapter 6

Discussion

DISCUSSION

Breast cancer mortality has shown a decline since 1975,[59] which may be attributable to both early diagnosis by virtue of screening mammograms and improvements in adjuvant therapies.[60]

Although various radiographic modalities are readily available to identify lesions that are suspicious for breast cancer, mammography remains the mainstay of breast cancer screening.

Mammography has been used for investigating breast lumps since 1960. The earliest sign of breast cancer is an abnormality depicted on a mammogram, before it can be felt by the woman or her physician. When breast cancer has grown to the point where physical signs and symptoms appear, the patient feels a breast lump (usually painless).

However, there are reports stating that, mammograms also lead to overdiagnosis and over treatment. This study was aimed to determine the diagnostic accuracy of mammography in evaluating palpable breast lumps.

This cross-sectional study was conducted for one year from January 2012 to December 2012. A total of 65 eligible women presenting with palpable breast lump in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospitals and Medical Research Centre and Charitable Hospital, Belgaum were studied.

In the present study most of the women (43.08%) presented with age between 31 to 45 years. Women with age 30 or less constituted 24.62% while,

21.54% were aged between 46 to 60 years. The mean age of the study population was 41.71 ± 13.76 years.

Nipple discharge was seen in 15.38% of the cases. The shape of the lesion was found to be globular in 44.62% and irregular in 29.23%. Tenderness was present in 44.62% of the patients. Retracted nipples were found in 23.08% of the patients. The consistency of the breast lump was firm in 75.38% of the patients and hard in 24.62%. The axillary lymph node was present in 13.85% of the women.

In the present study mammography findings revealed grade 3 breast lump in 46.15% of the patients. based on histopathological/cytological reports, 46.15% of the patients were diagnosed to have malignant lesions while 53.85% of the women were diagnosed as having benign lesions. Of the 30 patients who had malignant lesions on histopathology, 26 had malignant lesions on mammography and 4 women had benign lesions. The sensitivity of mammography compared to histopathology in predicting malignant lesions was 86.67% with specificity of 97.14%. The diagnostic accuracy of the mammography was 92.3%

The sensitivity of mammography to the index cancer ranges from 63% to 98% and has been reported to be as low as 30%– 48% in dense breasts.[61] Several groups have evaluated the preoperative use of supplemental magnetic resonance (MR) imaging,[62-64] ultrasonography,[65,66] or both[67,68] after mammography and clinical breast examination to assess the extent of disease within the breast(s). Across these series, a change in management in 11%–15% of patients resulted

from additional imaging after mammography; 27%–34% of breasts had additional malignant foci not seen mammographically.[61]

As breast cancer rarely causes pain, a painless mass is much more worrisome for malignancy than the one causing symptoms. Mammography done yearly beginning at age 40 is the current recommendation for women with no risk factors. Although mammograms may detect malignancy as small as 0.5 cm, 10% to 20% of malignancies elude detection by mammography, even when they occur at a much larger size. In a patient with a solid, dominant mass (suspicious mass) the primary purpose of the mammogram is to screen the normal surrounding breast tissue and the opposite breast for nonpalpable cancers, not to make a diagnosis of the palpable mass. Thus, a negative mammogram is no guarantee of absence of malignancy, and a mass that does not disappear or collapse with aspiration must be assumed to be a malignancy and biopsied.[69]

Chapter 7

Conclusion

CONCLUSION

In this study of 65 patients, 46.15% of the patients were diagnosed to have malignant lesions while 53.85% of the women were diagnosed as having benign lesions. Of the 30 patients who had malignant lesions on histopathology, 26 had malignant lesions on mammography and 4 women had benign lesions. The sensitivity of mammography compared to histopathology in predicting malignant lesions was 86.67% with specificity of 97.14% and diagnostic accuracy was 92.3%

Based on these results it may be concluded that, mammography remains the mainstay of breast cancer screening and is readily available to identify lesions that are suspicious for breast cancer.

Chapter 8

Summary

SUMMARY

Although various radiographic modalities are readily available to identify lesions that are suspicious for breast cancer, mammography remains the mainstay of breast cancer screening. This study was aimed to determine the diagnostic accuracy of mammography in evaluating breast lumps.

The present one year cross-sectional study was conducted from January 2012 to December 2012. A total of 65 eligible women presenting with palpable breast lump in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospitals and Medical Research Centre, and Charitable Hospital, Belgaum were studied.

In the present study commonest age group was between 31 to 45 years with 43.08% of the patients and the mean age of the study population was 41.71 ± 13.76 years. The nipple discharge was present in 15.38% of the cases. The shape of the lesion was found to be globular in 44.62% and tenderness was present in 44.62% of the patients. The nipple examination revealed retracted nipples in 23.08% of the patients. The consistency of the breast lump was firm in 75.38% of the patients. Axillary lymph node was present in 13.85% of the women. Mammography findings revealed grade 3 breast lump in 46.15% of the patients. Malignant lesions were diagnosed in 46.15% of the patients while 53.85% of the women were diagnosed as having benign lesions. Of the 30 patients who had malignant lesions on histopathology, 26 had malignant lesions on mammography and 4 women had benign lesions. The sensitivity of mammography compared to histopathology in predicting malignant lesions was

86.67% with specificity of 97.14%. The diagnostic accuracy of the mammography was found to be 92.3%

Based on the results of this study it may be concluded that, mammography is a valuable tool for the breast cancer screening and is easily available to identify lesions that are suspicious for breast cancer.

Chapter 9

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Annexures

Annexure I

ANNEXURE I – CONSENT FORM

Title Of Research Study : A study to determine diagnostic accuracy of mammography in patients with palpable breast lumps at KLES Dr.Prabhakar Kore hospital and medical research Centre, Belgaum.

Principal Investigator:-
Dr. **********
Vice principal & Professor,
Department of General Surgery,
J. N. Medical college,
K. L. E. University, Belgaum -10.

Co-investigator:-
Dr. **********
Post graduate student,
Department of General Surgery,
J. N. Medical College,
K. L. E. University, Belgaum -10.

INTRODUCTION AND PURPOSE:-

- **With growing awareness in general population about breast diseases , a lady with breast lump is frequently seen in surgical practice.**
- **Breast cancer is a common malignancy in women; it is the second leading cause of cancer related deaths and the third most common cancer throughout the world .**
- **Its incidence is rising in the world due to increasing awareness and better diagnostic aids to detect the lesion at an early stage.**

PROCEDURE:-

- **To subject all patients presenting with a palpable breast lump for mammography.**
- **Biopsy – FNAC, Truecut biopsy or excision is done.**

BENEFITS:-

1) **Early detection of Malignancy of Breast.**
2) **Quick implement of plan of treatment.**

3) Diagnostic accuracy of mammography can be determined.

Risk involved: - Radiation exposure

VOLUNTARY PARTICIPATION / WITHDRAWAL:-

I Mr./Ms._____ have been explained about the research study, the need of the study, the diagnostic intervention, their risks, benefits and alternatives available in my own vernacular language.

Taking part in this study is voluntary. I may choose not to take part in the study, or withdraw from the study anytime later. My decisions will not change the present or future health care or any service I receive. The study doctor or sponsor may stop my participation in the study without any consent. While taking part in the study I will be told of any important new findings that may change my willingness to continue or take part. If I choose not to take part in the study I will receive the standard treatment for patients with my conditions.

COST:- - Mammography examination – 1000 Rs. (Bilateral)

Procedure and drugs cost – 2000 Rs. To 4000 Rs.

Biopsy examination – 300 Rs. To 500 Rs.

COMPENSATION:-

In the event that I become injured as a result of taking part in this study, treatment will be offered to me or I will be given information about where to receive medical care: but my insurance company or I will

be responsible for the costs. No reimbursement, compensation or free medical care will be given.

CONFIDENTIALITY

All information collected about me during the course of the study will be kept confidential to the extent, permitted by law. I will be identified in research records by a code number. Information of the study may be published but my identity will be kept confidential in any publication.

CONSENT TO PARTICIPATE IN THE STUDY

You are voluntarily agree to participate in this study by signing up this form below. You may withdraw at any time from this study. You are not giving any of your legal rights by signing up this form. Your signature / thumb impression below indicates that you have read or information in the consent been read to you including the risks and benefits and have cleared your doubts. You will be given a copy of this consent form.

In case of any queries, you can contact the following:

Dr. **********
Chairman, College Ethical Dissertation
And Research Committee,
J. N. Medical College,
KLE University, Belgaum – 10.

Dr. **********
Vice Principal and Professor,
Department of Surgery
J. N. Medical College,
KLE University, Belgaum-10

Dr.***********
Post graduate student,
Department of General Surgery
J. N. Medical College,
KLE University, Belgaum – 10.

Dr. **** **********
Associate Professor,
Department of Radiology
J. N. Medical College,
KLE University,Belgaum-10

Signature of the study participant:

Name of the study participant :

Signature of the witness:

Relationship to the patient:

Signature of the investigator:

Date:

Place:

Annexures

Annexure II

ANNEXURE II – PROFORMA

Title: A study to determine diagnostic accuracy of mammography in patients with palpable breast lumps at KLES Dr.Prabhakar Kore hospital and medical research Centre, Belgaum.

I.D No:-

Name & Address: Age:

Sex : IP No.:

Education : Religion:

Marital Status : Occupation:

Parity : Socio-Economic Status:

HISTORY :

When did the patient notice the lump:

Initial size of the lump :

Present size of the lump :

Associated features : Pain

Pigmentation

Discharge

Past History :

Family History :

GENERAL PHYSICAL EXAMINATION:

Built and Nourishment :

Weight : kg

Pallor: Icterus: Yes / No

Cyanosis: Clubbing: Yes / No

Edema: Lymphadenopathy: Yes / No

Vital Signs : PR: /min

BP: / mmHg

RR: /min

Temp:

SYSTEMIC EXAMINATION:

Per Abdomen:

Respiratory System:

Central Nervous System:

Cardio-Vascular System:

LOCAL EXAMINATION:

(1) **INSPECTION**:

Situation:

Color: Shape:

Size:

Number:

Movement with shoulder movement:

Nipple: Areola:

(2) PALPATION:

Temperature:

Tenderness: Size:

Shape: Extent:

Surface: Margin :

Consistency:

Axillary lymph node:

(3) Clinical Diagnosis : Benign :

Malignant:

INVESTIGATION:

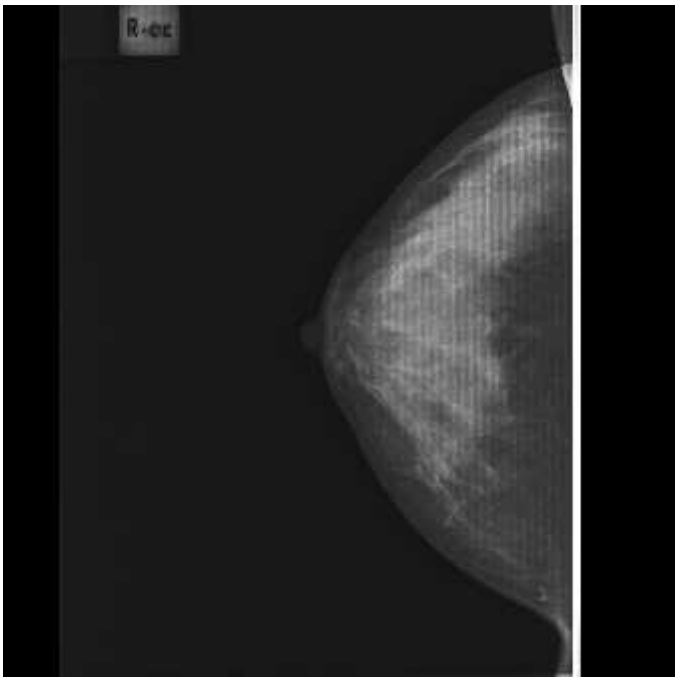
Mammography report:-

Histopathology report:-

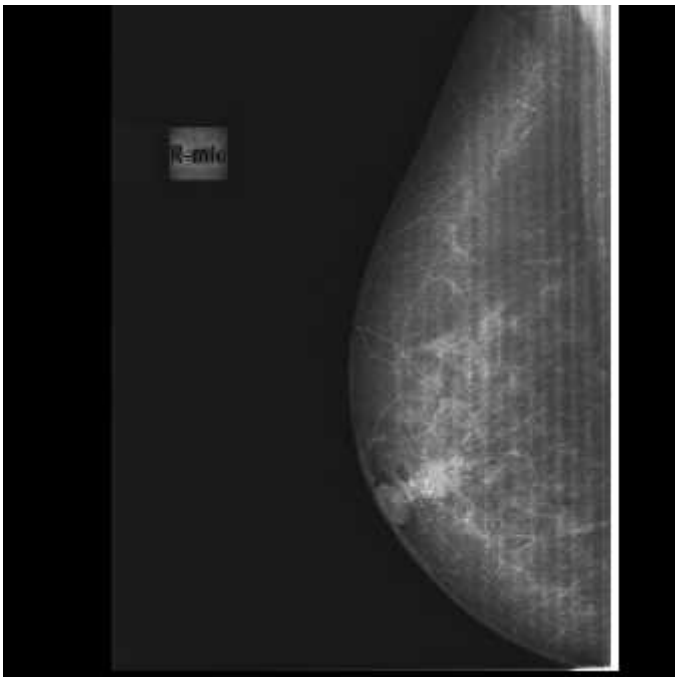
Annexures

Annexure III

ANNEXURE III – PHOTOGRAPHS



Photograph 1. Benign breast fibroadenoma



Photograph 2. Carcinoma breast

ANNEXURE IV - MASTER CHART

Serial Number	In patient Number	Sex	Age (Years)	History				General physical examination			Local examination								Palpation								Diagnosis		
									BP (mm Hg)																				
				Size of the lump	Pain	Pigmentation	Discharge	Pulse rate (bpm)	Systolic	Diastolic	Situation	Colour	Shape	Size	Number	Movement with should	Nipple	Aerola	Temperature	Tenderness	Size	Shape	Surface	Margin	Consistency	Axillary lymph node	Clinical	Mammography	Histopathology
1	492238	F	35	7*6	+	-	-	76	140	90	LT	N	IR	7*6	1	+	RTC	N	N	+	7*6	IR	ND	ID	HD	-	M	5	M
2	504126	F	34	2*2	-	-	-	64	130	80	LT	N	SP	2*2	1	-	N	N	N	-	2*2	SP	SM	WD	FM	-	B	1	B
3	492688	F	43	6*5	-	-	-	70	120	60	LT	N	GL	6*5	1	-	N	N	N	-	6*5	GL	SM	ID	FM	-	B	3	M
4	491558	F	30	2*2	-	-	-	68	130	80	RT	N	PN	2*1	1	-	N	N	N	-	2*1	SP	SM	WD	FM	-	B	1	B
5	496019	F	27	4*3	-	-	-	72	110	60	RT	N	GL	4*3	1	-	N	N	N	-	4*3	GL	SM	WD	FM	-	B	3	B
6	495301	F	39	5*4	+	-	-	76	140	80	RT	N	GL	5*4	1	-	N	N	N	-	5*4	GL	SM	WD	FM	-	B	3	M
7	501820	F	30	3*3	-	-	-	66	110	70	RT	N	PN	3*3	1	-	N	N	N	-	3*3	SP	SM	WD	FM	-	B	3	B
8	502356	F	35	8*6	-	-	-	70	130	80	RT	N	GL	8*6	1	-	N	N	N	-	8*6	GL	SM	WD	FM	-	B	3	B
9	492385	F	39	3*3	-	-	-	74	120	60	RT	N	SP	3*3	1	-	N	N	N	-	3*3	SP	SM	WD	FM	-	B	3	B
10	493090	F	29	2*2	-	-	-	62	140	90	LT	N	SP	2*2	1	-	N	N	N	-	2*2	SP	SM	WD	FM	-	B	3	B
11	489887	F	46	5*4	+	-	-	78	130	80	LT	N	IR	5*4	1	+	RTC	N	N	+	5*4	IR	ND	ID	HD	+	M	4b	M
12	488175	F	39	3*3	-	-	-	80	110	70	RT	N	SP	3*3	1	-	N	N	N	-	3*3	SP	SM	WD	FM	-	B	3	B
13	479010	F	45	5*4	+	-	+	78	130	70	RT	N	IR	5*4	1	+	RTC	N	ICR	+	5*4	IR	ND	ID	HD	+	M	5	M
14	478849	F	30	3*2	-	-	-	64	134	66	RT	N	SP	3*2	1	-	N	N	N	-	3*2	SP	SM	WD	FM	-	B	3	B
15	493081	F	44	5*4	-	-	-	72	126	80	RT	N	GL	5*4	1	-	N	N	N	-	5*4	GL	SM	WD	FM	-	B	4b	M
16	487754	F	75	4*4	+	-	-	68	136	76	LT	N	GL	4*4	1	-	RTC	N	N	+	4*4	GL	ND	WD	FM	+	M	5	M
17	486829	F	48	7*6	-	-	-	74	126	64	LT	N	GL	7*6	1	-	N	N	N	-	7*6	GL	SM	WD	FM	-	M	3	B
18	455082	F	67	3*3	-	-	-	64	146	94	LT	N	SP	3*3	1	-	RTC	N	-	+	3*3	SP	SM	WD	FM	-	M	5	M

ANNEXURE IV - MASTER CHART

Serial Number	In patient Number	Sex	Age (Years)	History				General physical examination			Local examination								Palpation								Diagnosis		
									BP (mm Hg)																				
				Size of the lump	Pain	Pigmentation	Discharge	Pulse rate (bpm)	Systolic	Diastolic	Situation	Colour	Shape	Size	Number	Movement with should	Nipple	Aerola	Temperature	Tenderness	Size	Shape	Surface	Margin	Consistency	Axillary lymph node	Clinical	Mammography	Histopathology
19	477793	F	42	6*4	+	-	+	78	136	86	LT	RED	IR	6*4	1	+	N	N	ICR	+	6*4	IR	ND	ID	HD	+	M	6	M
20	481178	F	54	10*8	+	+	+	82	146	90	RT	REDNESS	IR	10*8	1	+	RTC	N	ICR	+	10*8	IR	ND	ID	HD	-	M	5	M
21	479758	F	44	6*6	+	-	-	74	130	70	RT	N	IR	6*6	1	+	RTC	N	ICR	+	6*6	IR	ND	ID	HD	-	M	6	M
22	466228	F	47	5*5	-	+	+	80	136	76	RT	RED	GL	5*5	1	-	RTC		N	+	5*5	GL	SM	ID	FM	-	M	6	M
23	465941	F	35	7*6	+	-	-	76	126	76	LT	N	IR	7*6	1	-	N	N	N	+	7*6	IR	ND	WD	FM	-	B	4b	M
24	472995	F	55	5*5	+	-	+	66	130	60	RT	N	IR	5*5	1	-	RTC	N	ICR	+	5*5	IR	SM	ID	HD	-	M	4c	M
25	473435	F	69	6*4	+	-	-	64	144	74	RT	N	GL	6*4	1	+	RTC	N	N	+	6*4	IR	ND	ID	HD	+	M	5	M
26	452505	F	56	6*6	+	+	+	78	134	74	RT	RED	IR	6*6	1	-	RTC	N	ICR	+	6*6	IR	ND	ID	FM	+	M	5	M
27	453258	F	30	4*3	-	-	-	64	130	84	RT	N	GL	4*3	1	-	N	N	N	-	4*3	GL	SM	WD	FM	-	B	3	B
28	452714	F	65	10*8	+	-	-	70	126	80	LT	N	IR	10*8	1	-	N	N	N	+	10*8	IR	SM	WD	FM	-	M	3	B
29	453096	F	55	7*5	+	+	+	76	144	86	RT	RED	IR	7*5	1	+	RTC	OLAR	ICR	+	7*5	IR	ND	ID	HD	-	M	5	M
30	457673	F	30	3*2	-	-	-	72	130	70	LT	N	SP	3*2	1	-	N	N	N	-	3*2	SP	SM	WD	FM	-	B	3	B
31	461006	F	28	6*5	+	-	-	64	136	86	LT	N	GL	6*5	1	-	N	N	N	+	6*5	GL	SM	WD	FM	-	B	3	B
32	465481	F	38	3*3	-	-	-	78	126	80	LT	N	GL	3*3	1	-	N	N	N	-	3*3	GL	SM	WD	FM	-	B	3	B
33	467595	F	25	6*6	-	-	-	66	130	70	LT	N	GL	6*6	1	-	N	N	N	-	6*6	GL	SM	ID	FM	-	B	3	B
34	469424	F	23	3*2	-	-	-	70	120	60	RT	N	GL	3*2	1	-	N	N	N	-	3*2	GL	ND	WD	FM	-	B	3	B
35	469856	F	37	3*3	-	-	-	74	126	70	LT	N	GL	3*3	1	-	N	N	N	-	3*3	GL	SM	WD	FM	-	B	3	M
36	469305	F	65	3*3	-	-	-	68	140	84	LT	N	GL	3*3	1	-	N	N	N	+	3*3	GL	SM	ID	FM	-	M	3	B
37	470694	F	35	4*4	-	-	-	74	130	76	LT	N	GL	4*4	2	-	N	N	N	+	4*4	GL	SM	WD	FM	-	B	3	B

ANNEXURE IV - MASTER CHART

Serial Number	In patient Number	Sex	Age (Years)	History				General physical examination			Local examination								Palpation									Diagnosis		
									BP (mm Hg)																					
				Size of the lump	Pain	Pigmentation	Discharge	Pulse rate (bpm)	Systolic	Diastolic	Situation	Colour	Shape	Size	Number	Movement with should	Nipple	Aerola	Temperature	Tenderness	Size	Shape	Surface	Margin	Consistency	Axillary lymph node	Clinical	Mammography	Histopathology
38	471994	F	33	4*3	-	-	-	64	126	80	LT	N	GL	4*3	1	-	N	N	N	-	4*3	GL	SM	WD	FM	-	B	3	B
39	476650	F	38	5*4	+	-	-	no	120	70	RT	N	IR	5*4	1	-	N	N	N	-	5*4	IR	SM	ID	FM	-	B	3	B
40	478088	F	50	10*5	+	+	+	84	146	94	RT	REDNESS	IR	10*5	1	+	N	N	ICR	+	10*5	IR	ND	ID	HD	+	M	5	M
41	479255	F	26	3*3	-	-	-	72	110	70	LT	N	GL	3*3	1	-	N	N	N	-	3*3	GL	SM	WD	FM	-	B	2	B
42	480054	F	23	3*2	-	-	-	64	114	76	LT	N	GL	3*2	1	-	N	N	N	-	3*2	GL	SM	WD	FM	-	B	3	B
43	480485	F	33	3*4	-	-	-	66	126	80	LT	N	GL	3*4	4	-	N	N	N	-	3*4	GL	ND	SM	FM	-	B	3	B
44	482545	F	52	5*4	-	-	-	74	130	70	RT	N	IR	5*4	1	-	N	N	N	-	5*4	IR	GL	ID	FM	-	B	4b	M
45	487506	F	23	4*4	-	-	-	70	120	64	BL	N	OVAL	4*4	2	-	N	N	N	-	4*4	OVAL	IR	WD	FM	-	B	3	B
46	488083	F	60	3*3	-	-	-	78	144	80	LT	N	IR	3*3	1	-	N	N	N	+	3*3	IR	SM	ID	FM	-	B	4c	M
47	489451	F	25	2*1	-	-	-	64	130	64	RT	N	SP	2*1	1	-	N	N	N	-	2*1	SP	SM	WD	FM	-	B	1	B
48	491642	F	32	4*3	+	-	-	76	124	70	LT	N	OVAL	4*3	1	-	N	N	N	+	4*3	OVAL	SM	WD	FM	-	B	3	B
49	491683	F	60	6*5	+	-	+	74	130	70	LT	N	GL	6*5	1	-	N	N	N	+	6*5	GL	ND	ID	HD	-	M	4b	M
50	488608	F	51	2*2	-	-	-	70	120	64	LT	N	OVAL	2*2	1	-	N	N	N	-	2*2	OVAL	SM	WD	FM	-	B	3	M
51	484945	F	44	4*3	+	-	-	64	126	74	LT	N	IR	4*3	1	-	N	N	N	+	4*3	IR	ND	ID	FM	-	M	4c	M
52	473409	F	35	2*2	-	-	-	70	136	74	RT	N	GL	2*2	1	-	N	N	N	-	2*2	GL	SM	WD	FM	-	B	2	B
53	466730	F	74	5*5	+	-	-	76	130	60	LT	N	GL	5*5	1	+	RTC	N	N	+	5*5	GL	ND	WD	HD	-	M	5	M
54	512323	F	23	4*3	-	-	-	74	120	70	LT	N	GL	4*3	1	-	N	N	N	-	5*4	GL	SM	WD	FM	-	B	3	B
55	511475	F	31	4*3	-	-	-	66	124	66	LT	N	OVAL	4*3	1	-	N	N	N	-	4*3	OVAL	SM	WD	FM	-	B	3	B
56	509081	F	35	6*4	-	-	-	72	120	70	RT	N	OVAL	6*4	1	-	N	N	N	+	6*4	OVAL	SM	WD	FM	-	B	4b	B
57	509293	F	43	3*3	-	-	-	74	126	76	BL	N	GL	3*3	1	-	N	N	N	-	3*3	GL	SM	WD	FM	-	B	3	B
58	521579	F	42	3*3	-	-	-	68	134	74	LT	N	GL	3*3	1	-	N	N	N	-	3*3	GL	SM	WD	FM	-	B	3	B

ANNEXURE IV - MASTER CHART

Serial Number	In patient Number	Sex	Age (Years)	History				General physical examination			Local examination								Palpation								Diagnosis		
									BP (mm Hg)																				
				Size of the lump	Pain	Pigmentation	Discharge	Pulse rate (bpm)	Systolic	Diastolic	Situation	Colour	Shape	Size	Number	Movement with should	Nipple	Aerola	Temperature	Tenderness	Size	Shape	Surface	Margin	Consistency	Axillary lymph node	Clinical	Mammography	Histopathology
59	516565	F	18	3*2	-	-	-	64	110	66	RT	N	OVAL	3*2	1	-	N	N	N	-	3*2	OVAL	SM	WD	FM	-	B	3	B
60	520699	F	44	6*3	-	-	-	72	136	80	RT	N	OVAL	6*3	1	+	N	N	N	-	6*3	OVAL	ND	WD	HD	-	M	4c	M
61	513748	F	60	3*3	-	-	-	68	154	90	LT	N	GL	3*3	1	-	N	N	N	+	3*3	GL	SM	WD	FM	-	B	4a	M
62	509288	F	50	7*6	+	+	-	76	136	80	LT	N	IR	7*6	1	+	RTC	N	ICR	+	7*6	IR	ND	ID	HD	+	M	4b	M
63	510873	F	40	6*5	+	-	+	82	140	70	LT	N	IR	6*5	1	+	RTC	N	ICR	+	6*5	IR	ND	ID	HD	+	M	5	M
64	491511	F	34	11*10	+	-	-	74	136	78	RT	N	GL	11*10	1	-	N	N	N	-	11*10	GL	SM	WD	FM	-	M	3	B
65	456012	F	64	5*4	+	-	-	72	130	70	RT	N	IR	5*4	1	+	N	N	N	+	5*4	IR	ND	ID	HD	-	M	4b	M

Annexures

Annexure IV

ANNEXURE IV – KEY TO MASTER CHART

-	-	Absent
+	-	Present
B	-	Benign
BP	-	Blood pressure
F	-	Female
FM	-	Firm
GL	-	Globular
HD	-	Hard
ICR	-	Increased
ID	-	Ill defined
IR	-	Irregular
LT	-	Left
M	-	Malignant
mm Hg	-	Millimeters of mercury
N	-	Normal
ND	-	Nodular
PN	-	Peanut
RT	-	Right
RTC	-	Retracted
SM	-	Smooth
SP	-	Spherical
WD	-	Well defined