CHAPTER 2

BREAST CANCER

2.1 INTRODUCTION

Cancer is a process in which normal cells go through stages that eventually change them to abnormal cells which multiply out of control. Many breast cancers arise from a sequence which begins with an increase in the number of breast cells (hyperplasia) to the emergence of atypical breast cells (atypical hyperplasia) followed by carcinoma in situ (noninvasive cancer) and finally, invasive cancer. However, not all breast cancers necessarily follow this progressive pattern and the speed of progression for those that do is highly variable. Some cancers may never progress beyond in situ disease (California Department of Public Health, 2010). Figure 2.1 shows the photograph of breast cancer cell.

Figure 2.1 Breast cancer cell, photographed by a scanning electron microscope (California Department of Public Health)
The following are the definitions given by American Cancer Society to describe the breast cancer terms used by doctors:

**Carcinoma**

This is a term used to describe a cancer that begins in the lining layer of organs such as the breast. Nearly all breast cancers are carcinomas (either ductal carcinomas or lobular carcinomas).

**Adenocarcinoma**

An adenocarcinoma is a type of cancer that starts in gland tissue (tissue that makes and secretes a substance). The ducts and lobules of the breast are gland tissues because they make breast milk, so cancers starting in these areas are often called adenocarcinomas.

**Carcinoma in situ**

This term is used for the early stage of cancer, when it is still only in the layer of cells where it began. In breast cancer, in situ means that the cancer cells are only in the ducts (ductal carcinoma in situ) or lobules (lobular carcinoma in situ) and they have not spread into deeper tissues in the breast or to other organs in the body. They are sometimes called non-invasive or pre-invasive breast cancers.

**Invasive (infiltrating) carcinoma**

An invasive cancer is one that has already grown beyond the layer of cells where it started (unlike carcinoma in situ). Most breast cancers are invasive carcinomas - either invasive ductal carcinoma or invasive lobular carcinoma.
Sarcoma

Sarcomas are cancers that start from connective tissues such as muscle, fat tissue or blood vessels (American Cancer Society, 2011).

Benign breast lumps

Most breast lumps are benign. Benign breast tumors are just abnormal growths which do not spread outside of the breast. Though these are not life threatening, some benign breast lumps can increase a woman's risk of developing breast cancer (American Cancer Society, 2010).

2.2 ANATOMY OF BREAST

The mammary gland is a milk-producing structure that is composed largely of fat cells (cells capable of storing fat) and the breast medically refers to the mammary gland. Under the influence of the female hormone estrogen, the fat deposits are laid down in the breast. The surge of estrogens at adolescence encourages this process while androgens, such as testosterone, discourage it (Medicine Net.com 2011).

2.2.1 Anatomical Description

The breasts are located one on each side, within the subcutaneous layer of the thoracic wall, anteriorly to the pectoralis major muscle. Breast extend superiorly as far as the level of the second rib, inferiorly as far as the level of the sixth or seventh ribs, laterally as far as the anterior axillary line (sometimes as far as the middle axillary line) and medially they reach the lateral margin of the sternum. The base is circular and measures around 10 to 12 cm, but its volume is very variable. Though a lactating breast may exceed 500g in weight, the weight of a non-lactating breast ranges from 150 to 225g only. Three portions of the breast that are distinguished anatomically are: the
gland itself, the mammary papilla and the areola. The mammary gland consists of fifteen to twenty lobes that are arranged radially and delimited by septa of conjunctive tissue and adipose tissue in the subcutaneous layer. The mammary parenchyma is more abundant in the upper half of the gland, especially in the superolateral quadrant and the mammary tissue frequently extends beyond the apparent outline of the breast, projecting towards the axilla as an axillary process.

The mammary papilla represents the apex of the cone and contains the opening for all the lactiferous ducts from the lobes and close to the apex of the papilla, each duct presents a distal saclike dilatation known as the lactiferous sinu. Although the term nipple is habitually used in clinical practice, it is recommended that the expression mammary papilla should be utilized in the anatomical terminology. The areola is a slightly raised disc-shaped area of variable size surrounding the papilla.

2.2.2 Vascularization and Lymphatic Drainage

The mammary blood is supplied by the medial and lateral mammary branches of vessels. The venous drainage from the mammary gland is done by veins that generally accompany the arteries. Four intercommunicating lymphatic plexuses in the breast are described as one located in the dermis (cutaneous plexus), one in the superficial subcutaneous region (subcutaneous plexus), one in the fascia of the pectoralis major muscle (fascial plexus) and the last in the mammary gland, involving the lobes and ducts (glandular plexus). This last one communicates by means of lymphatic vessels which accompany the lactiferous ducts with a region of the subcutaneous plexus located immediately below the areola that is known as the subareolar plexus (or Sappey’s plexus).
The fascial plexus establishes communication with the subcutaneous plexus through the lymphatic vessels along the fibrous fascicles of the stroma. The deep and superficial (cutaneous) lymphatic drainage is carried out by the lateral and medial efferent lymphatic vessels, to lymph nodes respectively in the axilla and along the thoracicae internae vessels. The medial efferent vessels of one breast may anastomose with those of the contralateral breast, thus establishing intermammary lymphatic anastomoses (intermammary communication) and this explains the occasional metastatic involvement of contralateral axillares lymph nodes in relation to neoplasm in the other breast.

Though the fascial lymphatic plexus does not have significant participation in the drainage of the breast, it serves as an alternative route in the event of obstruction of the principal route. The lymph from the breasts may occasionally drain via lymphatic vessels that accompany the lateral cutaneous branches of the intercostales vessels and drain to the intercostales posteriores lymph nodes, which are located close to the heads of the ribs and the lymphatic vessels from the breasts may also occasionally drain to the liver and subdiaphragmatic plexus, by means of the abdominal lymphatic vessels (Macea and Fregnani 2006)
Figure 2.2 shows the anatomy of the breast. The breast is made up of both fatty tissue and glandular milk-producing tissues. The ratio of fatty tissue to glandular tissue varies among individuals. In addition, with the onset of menopause (i.e., decrease in estrogen levels), the relative amount of fatty tissue increases as the glandular tissue diminishes.

The base of the breast overlies the pectoralis major muscle between the second and sixth ribs in the nonptotic state. The gland is anchored to the pectoralis major fascia by the suspensory ligaments first described by Astley Cooper. These ligaments run throughout the breast tissue parenchyma from the deep fascia beneath the breast and attach to the dermis of the skin. Since they are not taut, they allow for the natural motion of the breast. These ligaments relax with age and time, eventually resulting in breast ptosis. The lower pole of the breast is fuller than the upper pole. The tail of Spence extends obliquely up into the medial wall of the axilla.

The breast overlies the pectoralis major muscle as well as the uppermost portion of the rectus abdominis muscle inferomedially. The nipple should lie above the inframammary crease and is usually level with the fourth rib and just lateral to the midclavicular line. The average nipple - to - sternal notch measurement in a youthful, well-developed breast is 21-22 cm; an equilateral triangle formed between the nipples and sternal notch measures an average of 21 cm per side (Allen Gabriel 2011).

2.3 BREAST CANCER CAUSES AND TYPES

A tumor can be benign (not cancer) or malignant (cancer). Malignant tumor is one which invades damages and destroys nearby tissues and spreads to other parts of the body. Though a benign tumor won't spread to other parts of the body, it damages the local tissue and the growth may need to be removed.
2.3.1 Spreading Mechanism of Cancer

Malignant tumor has the ability to invade surrounding tissue and destroy it. Cancer cells which break away from a malignant tumor enter the bloodstream or lymphatic system and this is how cancer spreads within the body. When breast cancer spreads outside the breast, cancer cells are usually found in the lymph nodes under the arm. Cancer cells may spread beyond the breast and affect other lymph nodes, the bones, liver or lungs. Some patients whose underarm lymph nodes are clear of breast cancer may still have cancer cells which have spread to other parts of the body, but it is not common.

Cancer that spreads to other parts of the body is the same disease and has the same name as the original cancer and when breast cancer spreads, it is called metastatic breast cancer even though it is found in another part of the body. For example, breast cancer which has spread to the bones is called metastatic breast cancer, not bone cancer.

2.3.2 Causes of Cancer

Changes in certain genes within breast cells can be linked to a higher risk for breast cancer. Breast cells contain a variety of genes that normally work in cooperation with a woman's natural hormones, diet, and environment to keep her breasts healthy. But certain genes routinely keep breast cells from dividing and growing out of control and forming tumors and when these genes become altered, changes occur and a cell no longer can grow correctly.

Genetic changes which may be inherited from a parent or grandparent may accumulate throughout a person's lifetime. Breast cancer generally begins in a single cell that cell changes from normal to malignant over a period of time. Presently, there is no possibility of predicting exactly
when cancer will occur or how it will progress. When breast cancer is diagnosed- even if detected at the earliest stage-no one can predict which cancer cells will be treated successfully and which will continue to grow and spread quickly to other parts of the body. A biopsy is the only way to find out for sure if a breast lump or abnormal tissue is cancer. The suspicious tissue that is removed by a surgeon or radiologist during a biopsy is examined under a microscope by a pathologist and a diagnosis is made (University of California San Francisco Medical Center, 2011).

2.3.3 Most Common Types of Breast Cancer

Adenocarcinomas are the most common types of breast cancers that originate in the ducts or lobules of the breast. Adenocarcinomas are classified into two main types as ductal carcinomas and lobular carcinomas. These are further divided into the following subtypes:

2.3.3.1 Ductal Carcinoma in Situ (DCIS)

Ductal carcinoma in situ (DCIS) of the breast is an early, localized cluster of cancer cells which start in the milk passages (ducts) but have not penetrated the duct walls into the surrounding tissue. The term "in situ" is used to describe a tumor that has not spread beyond the place where it originally developed.

DCIS is a non-invasive form of breast cancer in which the cancer cells are confined to the milk ducts of the breast. Ductal carcinoma in situ is also known as "pre-cancerous", "pre-invasive", "non-invasive", or "intraductal carcinoma". Although, DCIS is a non-invasive form of breast cancer, if left untreated, it may turn to 'true' breast cancer by spreading into and invading the surrounding healthy breast tissue. Since doctors cannot predict whether DCIS will develop into invasive breast cancer, early diagnosis and treatment
is crucial. The prognosis (outlook) for women with DCIS is excellent with appropriate treatment.

Fortunately, screening mammography DCIS can often detect DCIS before any symptoms develop. Ductal carcinoma in situ generally appears on mammography as an area of microcalcification (groups of small calcifications clustered together within the breast) and with the increased availability of mammography, breast cancers are being detected earlier.

DCIS may contain areas of necrotic (dead) cancer cells and pathologists use the term comedocarcinoma or comedo DCIS to describe DCIS if necrotic cancer cells are observed under a microscope. Comedo DCIS is considered as a more aggressive type of disease than non-comedo.

2.3.3.2 Lobular Carcinoma in Situ (LCIS)

LCIS is also a noninvasive form of breast cancer which starts in the milk-producing lobules of the breast but does not penetrate the walls of the lobules. The term "in situ" means that this is an early stage of breast cancer that is confined locally to area where the cancer started. Some doctors believe that LCIS is a risk factor for developing invasive breast cancer and women with LCIS should undergo a physical exam at least twice every year as well as a yearly mammogram.

2.3.3.3 Infiltrating (invasive) Ductal Carcinoma (IDC)

IDC is the most common type of breast cancer and about 80% of all invasive breast cancers are of this type. IDC starts in the ducts of the breast and spreads to invade the surrounding normal breast tissue.
2.3.3.4 Infiltrating (invasive) Lobular Carcinoma (ILC)

ILC is also an invasive form of breast cancer but is much less common than IDC. ILC starts in the lobules of the breast and can spread (metastasize) to other parts of the body. It may be more difficult to detect ILC with screening mammography than IDC (Medifocus Guidebook 2009).

2.4 RISK FACTORS

A risk factor is anything that affects the chance of getting a disease, such as cancer. Risk factors are different for different cancers. The mere presence of a risk factor, or even several, does not necessarily mean that one will suffer from cancer. Though many women with breast cancer have no apparent risk factors (other than being a woman and growing older), most women who have one or more breast cancer risk factors never develop the disease. Even when a woman with risk factors develops breast cancer, it is hard to judge that how much these factors may have contributed to her cancer (American Cancer Society, 2011). Risk factors help us to identify women who may benefit most from screening or other preventive measures (Suszanne Fletcher 2011).

There are many kinds of risk factors. Some factors, like a person's age or race, can't be changed while others are linked to cancer-causing factors in the environment. There are other risk factors that are related personal behaviors, such as smoking, drinking, and diet. Some factors have more influence over the risk factors than others; the risk for breast cancer can change over time, due to factors such as aging or lifestyle.
2.4.1 Unchangeable Risk Factors

Gender

Simply being a woman is the major risk factor for developing breast cancer. Although women have many more breast cells than men, the main reason they develop more breast cancer is because their breast cells are constantly subjected to the growth promoting effects of the female hormones estrogen and progesterone. Men can develop breast cancer, but this disease is about 100 times lesser in men than in women.

Aging

The risk of developing breast cancer increases with age. About 1 out of 8 invasive breast cancers are found in women younger than 45 while about 2 out of 3 invasive breast cancers are diagnosed in women age 55 or older.

Genetic risk factors

About 5% to 10% of breast cancer cases are thought to be hereditary, caused by gene defects (called mutations) inherited from a parent. BRCA1 and BRCA2: An inherited mutation in the BRCA1 and BRCA2 genes is the most common cause of hereditary breast cancer. In normal cells, these genes help prevent cancer by making proteins that help keep the cells from growing abnormally. If a mutated copy of either gene from a parent is inherited, there is a high risk of developing breast cancer during one's lifetime. For members of some families with BRCA mutations the risk may be as high as 80%. These cancers affect younger women and more often affect both breasts than cancers in women who are not born with one of these gene mutations. Women who have inherited these mutations also have an increased risk for developing other cancers, particularly ovarian cancer.

**Changes in other genes**

Other gene mutations can also result in inherited breast cancers. These gene mutations are much rarer and generally do not increase the risk of breast cancer as much as the BRCA genes.

**ATM**

The ATM gene usually helps repair damaged DNA. Inheriting 2 abnormal copies of this gene causes the disease ataxia-telangiectasia and inheriting one mutated copy of this gene has been linked to a high rate of breast cancer in some families.

**p53**

The Li-Fraumeni syndrome is caused by inherited mutations of the p53 tumor suppressor gene. People with this syndrome have an increased risk of developing breast cancer, as well as several other cancers such as leukemia, brain tumors, and sarcomas (cancer of bones or connective tissue) and this is a rare cause of breast cancer.

**CHEK2**

Inherited mutations in the CHEK2 gene can also cause the Li-Fraumeni syndrome. Even if it does not cause this syndrome, it can increase breast cancer risk about twofold when it is mutated.
PTEN

The PTEN gene normally helps regulate cell growth and inherited mutations in this gene cause Cowden syndrome; it is a rare disorder in which people are at increased risk for both benign and malignant breast tumors, as well as growths in the digestive tract, thyroid, uterus, and ovaries.

CDH1

Hereditary diffuse gastric cancer, a syndrome in which people develop a rare type of stomach cancer at an early age is caused by inherited mutations in this gene. Women with mutations in this gene face an increased risk of invasive lobular breast cancer.

STK11

Defects in this gene can cause Peutz-Jeghers syndrome. People affected by this disorder develop pigmented spots on their lips and in their mouths, polyps in the urinary and gastrointestinal tracts, and an increased risk of many types of cancer, including breast cancer.

Family history of breast cancer

Breast cancer risk is higher among women if their close blood relatives have this disease. Having one first-degree relative (mother, sister, or daughter) with breast cancer approximately doubles a woman's risk and having 2 first-degree relatives increases her risk about 3-fold. The exact risk is not known, but women with a family history of breast cancer in a father or brother also have an increased risk of breast cancer and less than 15% of women with breast cancer have a family member with this disease (American Cancer Society, 2011).
High familial risk is defined by the Consortium on Familial Breast and Ovarian Cancer of the German Cancer Aid, corresponding to a lifetime risk for breast cancer of at least 20% as individuals with the following family history: individuals from families with two or more cases of breast cancer on the same side of the family, including at least two cases with onset before age 50 years, or with breast and ovarian cancer, irrespective of age, families with three or more cases of breast cancer on the same side of the family, families with at least one case of breast cancer diagnosed before age 35 years, families with at least one case of male breast cancer (Meindl 2002).

**Personal history of breast cancer**

A woman with cancer in one breast is subjected to a 3- to 4-fold increased risk of developing a new cancer in the other breast or in another part of the same breast. This is not a recurrence (return) of the first cancer.

**Race and ethnicity**

White women are slightly more likely to develop breast cancer than are African-American women and African-American women are more likely to die of this cancer. The risk of developing and dying from breast cancer is lower in Asian, Hispanic, and Native-American women.

**Dense breast tissue**

Women with denser breast tissue have a higher risk of breast cancer, since they have more glandular tissue and less fatty tissue. Certain benign breast conditions Women diagnosed with certain benign breast conditions may have an increased risk of breast cancer and some of these conditions are more closely linked to breast cancer risk than others. Doctors usually divide benign breast conditions into 3 general groups, depending on
how they affect this risk. Non-proliferative lesions: These conditions are not related to overgrowth of breast tissue. They do not seem to affect breast cancer risk, even if they do; it is to a very small extent. They are:

- Fibrocystic disease (fibrosis and/or cysts)
- Mild hyperplasia
- Adenosis (non-sclerosing)
- Duct ectasia
- Phyllodes tumor (benign)
- A single papilloma
- Fat necrosis
- Mastitis (infection of the breast)
- Simple fibroadenoma and other benign tumors (lipoma, hamartoma, hemangioma, neurofibroma)

**Proliferative lesions without atypia**

These conditions show excessive growth of cells in the ducts or lobules of the breast tissue and they seem to raise a woman's risk of breast cancer slightly (1½ to 2 times normal). They are:

- Usual ductal hyperplasia (without atypia)
- Complex fibroadenoma
- Sclerosing adenosis
- Several papillomas (called papillomatosis)
- Radial scar
Proliferative lesions with atypia

There is excessive growth of cells in the ducts or lobules of the breast tissue in these conditions and the cells no longer appear normal. These conditions increase breast cancer risk that it is 4 to 5 times higher than normal.

They are:

- Atypical ductal hyperplasia
- Atypical lobular hyperplasia
- Women with a family history of breast cancer and either hyperplasia or atypical hyperplasia face an even higher risk of developing a breast cancer.
- Lobular carcinoma in situ-Lobular carcinoma in situ (LCIS) increases the risk of developing invasive cancer in either breast about 7 to 11 folds.

Menstrual periods

Women who have had more menstrual cycles because they started menstruating at an early age (before age 12) and/or went through menopause at a later age (after age 55) face a slightly higher risk of breast cancer. The longer lifetime exposure to the hormones estrogen and progesterone may be the cause for the increase in risk.

Previous chest radiation

Women who had radiation therapy to the chest area as treatment for another cancer (such as Hodgkin disease or non-Hodgkin lymphoma) are at significantly increased risk for breast cancer and this varies with the patient's age when they had radiation. If chemotherapy was also given, it may have
stopped ovarian hormone production for some time which lowers the risk. If the radiation was given during adolescence when the breasts were still developing, the risk of developing breast cancer from chest radiation is highest. However, radiation treatment after age 40 does not seem to increase breast cancer risk (American Cancer Society, 2011). An account about the other risk factors and the way of decreasing and estimating the risk factors is given by Suszanne Fletcher, Harvard Medical School (2011). The following section gives the details:

2.4.2 Other Risk Factors

Presence of other cancers

Women who have been diagnosed with cancer of the endometrium, ovary, or colon have more chance to develop breast cancer than women who do not have these cancers.

Miscellaneous factors

Several other factors are related to breast cancer risk for reasons that are unknown. Women of high socioeconomic status have more chances than women of low socioeconomic status to develop breast cancer and women who live in urban settings are more likely than women who live in rural settings to develop breast cancer. Some studies reveal an association between exposure to light at night (such as with night shift work) and the risk of breast cancer, but the strength of the association has been variable.

2.4.3 Decreasing the Risk

Several factors that decrease the risk of breast cancer are:
Removal of the ovaries

Women whose ovaries have been removed before age 35 have a lower risk of developing breast cancer later in life compared to women who have ovaries. But, removal of the ovaries places women at higher risk for more common diseases such as coronary heart disease and osteoporosis, and oophorectomy is not encouraged for breast cancer prevention in most women. Removal of ovaries may be recommended for women with the BRCA1 or BRCA2 gene mutation.

Lifestyle changes

Lifestyle changes that may reduce breast cancer risk are:

The use of postmenopausal hormones should be minimized. Non-estrogen alternatives may be considered (eg., bisphosphonates for treatment of osteoporosis rather than hormones). Breast feeding for a period of at least 12 months can decrease breast cancer risk. Limiting alcohol, regular physical activity, avoiding adult weight gain and having a first child at early age may also reduce the risk.

Medication

Women who are already at higher than average risk can reduce their risk of developing breast cancer by at least 50 percent or more by taking tamoxifen or raloxifene for five years.

Early detection

Though breast cancer incidence cannot be substantially reduced for some women who are at high risk for developing the disease, the risk of death from breast cancer can be reduced with regular mammography screening.
2.4.4 Estimating Risk

Many factors can affect a woman's risk for breast cancer and in most cases, a woman and her clinician can use the Breast Cancer Risk Assessment Tool which was developed by the National Cancer Institute to estimate personal risk. The score is obtained by multiplying a woman's baseline risk (based upon her age and race/ethnicity) and the risks associated with five key factors. The individual's risk is then compared with a woman of the same age who has an “average risk" of developing breast cancer (Suszanne Fletcher 2011).

Lifestyle-related factors and breast cancer risk

Having children

Women who have had no children or who had their first child after age 30 have a slightly higher breast cancer risk and having many pregnancies, becoming pregnant at a young age reduce breast cancer risk.

Recent oral contraceptive use

Studies have found that women using oral contraceptives (birth control pills) have a slightly greater risk of breast cancer than women who have never used them and this risk seems to decline back to normal over time, once the pills are stopped.

Alcohol

There is an increased risk of developing breast cancer by the use of alcohol and the risk increases with the amount of alcohol consumed. Compared with non-drinkers, women who consume 1 alcoholic drink a day have a very small increase in risk and those who have 2 to 5 drinks daily have about 1½ times the risk of women who drink no alcohol.
**Being overweight or obese**

Avoiding adult weight gain and maintaining a healthy weight may decrease postmenopausal breast cancer risk. Before menopause, ovaries produce most of the estrogen and fat tissue produces only a small amount of estrogen. But after menopause (when the ovaries stop making estrogen), most of a woman's estrogen is produced by fat tissue. Having more fat tissue after menopause can increase a woman's chance of getting breast cancer by raising estrogen levels. Also, women who are overweight tend to have higher blood insulin levels and higher insulin levels have also been linked to some cancers, including breast cancer.

**Physical activity**

Regular physical activity in the form of exercise reduces breast cancer risk and to reduce the risk of breast cancer, the American Cancer Society recommends 45 to 60 minutes of intentional physical activity 5 or more days a week (American Cancer Society, 2011).

**2.5 BREAST CANCER SYMPTOMS & STAGES**

Cancer at it's first stage is not painful, hence it does not even bother the victim. Signs generally appear in the second or the third stage. A breast lump, or a lump in the armpit or near the collar bone, even if not painful should be tested since it can be a sign of developing cancer (Suparna Chakraborty 2010).

Cancer Help UK delivers the following information about the symptoms of breast cancer:

Though many women have breast lumps 9 out of 10 (90%) are benign. Most benign breast lumps are nothing but the areas of breast cell
changes, causing lumpiness that is more obvious just before a period, particularly in women over 35 years of age.

**Cysts**

They are sacs of fluid in the breast tissue, which are quite common.

**Fibroadenoma**

It is a collection of fibrous glandular tissue (these are more common in younger women).

The Changes that don't necessarily mean cancer but should be looked out for a breast cancer are,

- A lump or thickening in an area of the breast
- A change in the size or shape of a breast

**Dimpling of the skin**

A change in the shape of your nipple, particularly if it turns in, sinks into the breast or becomes irregular in shape

- A blood stained discharge from the nipple
- A rash on a nipple or surrounding area
- A swelling or lump in your armpit

The whole breast can look red and inflamed and can be very sore in a rare type of breast cancer called inflammatory breast cancer.
Paget's disease, another rare type of breast cancer shows up as a rash on and around the nipple. This looks a bit like eczema and is sometimes mistaken for that at first and the red, scaly rash formed can be itchy (Cancer Help UK 2010). The following section describes about the Early, locally advanced and secondary breast cancers and about TNM staging system (Cancer Help UK 2011). Staging is about describing how big the cancer is and whether it has spread to lymph nodes or other parts of the body. The tests and scans that are done to diagnose cancer, give some information about the stage. Finding the stage is important since it helps the breast cancer specialist to decide on the best treatment for the patient.

Specialists generally make decisions about treatment for breast cancer according to the TNM stage and the grade of the cancer. Doctors also sometimes use the number system of staging and put the staging information into a formula called the Nottingham Prognostic Indicator (NPI) to get some idea of how well treatment may work for an individual person with breast cancer and how long the person may live.

**Early, locally advanced and secondary breast cancer**

Early breast cancer is the cancer which has not spread beyond the breast or the lymph nodes in the armpit on the same side of the body. So, the cancer has not spread to any other part of the body and cancer that has come back in the area of the breast after treatment is called local recurrence.

The term locally advanced breast cancer is used for the cancer which has not spread to another part of the body but may be

- Bigger than 5 cm across
- Growing into the skin or muscle of the chest
Present in the lymph nodes in the armpit, and these lymph nodes are either stuck to each other, or to other structures.

Secondary breast cancer is also termed metastatic breast cancer or stage 4 breast cancers. In this stage the cancer has spread to other parts of the body, such as the liver or bones.

### 2.5.1 TNM Staging System

TNM staging describes about the size of the tumour (T), whether the cancer has spread to the lymph glands (lymph nodes) (N), and whether the tumour has spread anywhere else in the body (M-Metastases).

TNM staging system for breast cancer is described as,

The T stages (tumour)

TX means that the tumour size cannot be assessed

T1- The tumour is no more than 2 centimetres (cm) across

T1 is further divided into 4 groups

- T1mic – under a microscope the cancer cells can be seen to spread less than 0.1 cm into surrounding tissue (microinvasion)
- T1a – the tumour is more than 0.1 cm but not more than 0.5 cm
- T1b – the tumour is more than 0.5 cm but not more than 1 cm
- T1c – the tumour is more than 1 cm but not more than 2 cm

T2 – The tumour is more than 2 centimetres, but no more than 5 centimetres across

T3 – The tumour is bigger than 5 centimetres across
T4 is divided into 4 groups

- T4a - The tumour has spread into the chest wall
- T4b - The tumour has spread into the skin
- T4c - The tumour is fixed to both the skin and the chest wall
- T4d - Inflammatory carcinoma - this is a cancer in which the overlying skin is red, swollen and painful to the touch

The N stages (nodes) are

- NX means that the lymph nodes cannot be assessed (for example, if they were previously removed)
- N0 - No cancer cells found in any nearby nodes
- N1 - Cancer cells are in the upper levels of lymph nodes in the armpit but the nodes are not stuck to surrounding tissues

N2 is divided into 2 groups

- N2a – there are cancer cells in the lymph nodes in the armpit, which are stuck to each other and to other structures
- N2b – there are cancer cells in the lymph nodes behind the breast bone (the internal mammary nodes, which have either been seen on a scan or felt by the doctor). There is no evidence of cancer in lymph nodes in the armpit

N3 is divided into 3 groups

- N3a – there are cancer cells in lymph nodes below the collarbone
- N3b – there are cancer cells in lymph nodes in the armpit and under the breast bone
- N3c – there are cancer cells in lymph nodes above the collarbone

The M stages (metastases)

- M0 - No sign of cancer spread
- M1 - Cancer has spread to another part of the body, apart from the breast and lymph nodes under the arm

TNM Results

The doctor will put the TNM results together to give the overall stage. So, for example, a tumour described as T2 N0 M0 would be

- A single tumour 2 to 5 cm across
- No evidence of spread to any lymph nodes
- No evidence of spread outside the breast

2.5.2 Number Staging System

Number staging system for breast cancer is described as,

Stage 1 breast cancer

- The tumour is no more than 2 centimetres (cm) across (T1)
- There are no cancer cells in the lymph nodes in the armpit
- The cancer has not spread anywhere else
**Stage 2 breast cancer**

This is divided into two groups. They are

**Stage 2A means**

- The tumour is less than 2 cm, the lymph nodes under the arm contain cancer but are not stuck to each other and the cancer has not spread or

- The tumour is less than 5 cm, there are no cancer cells in the lymph nodes in the armpit and the cancer has notspread or

- Although no tumour is seen in the breast, the lymph nodes under the arm contain cancer cells but are not stuck together or to other structures, and there is no sign of spread to other parts of the body.

**Stage 2B means**

- The tumour is less than 5 cm and the lymph nodes under the arm contain cancer cells but are not stuck to each other, and the cancer has not spread or

- The tumour is bigger than 5 cm across, there are no cancer cells in the lymph nodes in the armpit and the cancer has not spread.

**Stage 3 breast cancer**

Stage 3 breast cancer is divided into 3 groups. They are
Stage 3A means

- Although no tumour is seen in the breast, the lymph nodes under the arm contain cancer cells and are stuck together or to other structures, but there is no sign of cancer spread or
- The tumour is 5 cm or less, the lymph nodes in the armpit contain cancer cells and are stuck to each other, but the cancer has not spread elsewhere or
- The tumour is more than 5 cm, the lymph nodes in the armpit contain cancer cells and may be stuck together, but there is no further spread.

Stage 3B means

- The tumour is fixed to the skin or chest wall, the lymph nodes may or may not contain cancer cells, but there is no further spread.

Stage 3C means

- The tumour can be any size and has spread to lymph nodes in the armpit and under the breast bone, or to nodes above or below the collarbone, but there is no further spread.

Stage 4 breast cancer

In stage 4 breast cancer

- The tumour can be any size
- The lymph nodes may or may not contain cancer cells
The cancer has spread (metastasised) to other parts of the body such as the lungs, liver or bones.

If you have cancer cells in the breast and the lymph nodes in your armpit on the same side of the body, you do not have stage 4 breast cancers. Stage 4 only applies if the cancer has spread to other body organs.