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An review on Breast Cancer

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ABSTRACT:
Breast cancer is the most frequent malignancy in women worldwide and is curable in ~70-80% of patients with early-stage, non-metastatic disease. Advanced breast cancer with distant organ metastases is considered incurable with currently available therapies. On the molecular level, breast cancer is a heterogeneous disease; molecular features include activation of human epidermal growth factor receptor 2 (HER2, encoded by ERBB2), activation of hormone receptors (oestrogen receptor and progesterone receptor) and/or BRCA mutations. Treatment strategies differ according to molecular subtype. Management of breast cancer is multidisciplinary; it includes locoregional(surgery and radiation therapy) and systemic therapy approaches. Systemic therapies include endocrine therapy for hormone receptor-positive disease, chemotherapy, anti-HER2 therapy for HER2-positive disease, bone stabilizing agents, poly (ADP-ribose) polymerase inhibitors for BRCA mutation carriers and, quite recently, immunotherapy. Future therapeutic concepts in breast cancer aim at individualization of therapy as well as at treatment de-escalation and escalation based on tumor biology and early therapy response. Next to further treatment innovations, equal worldwide access to therapeutic advances remains the global challenge in breast cancer care for the future.

Keyword: cancer, breast cancer, breast cancer screening techniques,artificial intelligences techniques women, medical images processing ,prevalence, gene

I. INTRODUCTION:

Breast cancer (BC) is the commonest malignancy among women globally. It has now increasedto the lung cancer as the leading cause of global cancer incidence in 2020, with an estimated 2.3million new cases, representing 11.7% of all cancer cases. Epidemiological studies have shownthat the global burden of BC is expected to cross almost 2 million by the year 2030. In India, the incidence has increased significantly, almost by 50%, between 1965 and 1985[1].Epidemiological studies have shown that the global burden of BC is expected to cross almost 2million by the year 2030.In India, the incidence has increased significantly, almost by 50%,between 1965 and 1985. The estimated number of incident cases in India in 2016 was 118000(95% uncertainty interval, 107000 to 130000), 98.1% of which were females, and the prevalent cases were 526000 (474000 to 574000). Over the last 26 years, the age-standardizedincidence rate of BC in females increased by 39.1% (95% uncertainty interval, 5.1 to 85.5) from 1990 to2016, with the increase observed in every state of the country[1].Breast cancers were categorized into 4 tumor shapes: 34% of tumors were discoidal, 29%segmental, 19% spherical and 18% irregular[4].The structure of female breast is complex –Including fat, glandular and connective tissue, as well as lobes, lobules, ducts, lymph nodes,blood vessels and ligaments. Non-cancer breast tumors are abnormal growths, but they do notspread outside of the breast.They are not life threatening, but some types of benign breast lumps can increase a woman's risk of getting breast cancer. Any breast lump or change needs to be checked by a health care professional to find out if it is benign or malignant (cancer) and if it might affect your future cancer risk. Breast cancer is the abnormal growth of cells or the tumor. Thein of cancer cells may form mass malignant tumor . Non cancer cells that form a mass are termed benign tumor [5]. Just like any cancer, breast cancer results from DNA mutations that instruct your cells to grow out of control. IN this in, it targets cells in the breast tissue, and there's no single thing that causes these DNA mutations. Breast cancer is the most frequent malignancy in women and is heterogeneous disease on themolecular level. The breast is made up of different tissues, ranging from very fatty tissue to very dense tissue. Within this tissue is a network of lobes. Each lobe is made up

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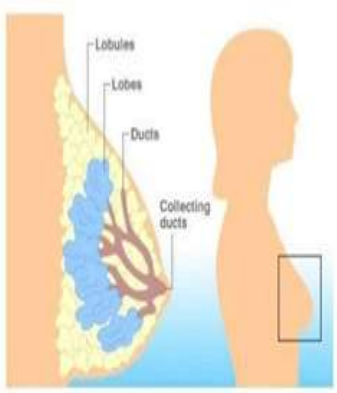
of small, tube-like structures called lobules that contain milk glands. Small ducts connect the glands, lobules, and lobes, carrying milk from the lobes to the nipple. The nipple is located in the middle of the areola, which is the darker area that surrounds the nipple. Blood and lymph vessels also run throughout the breast. Blood vessels nourish the cells by delivering oxygen and nutrients and also removing waste and carbon dioxide. Lymph vessels, unlike blood vessels, only carry fluid away from tissues. They connect to lymph nodes and the lymphatic system, which drains bodily waste products. Lymph nodes are the small, bean-shaped organs that help fight infection. Groups of lymph nodes are located in different areas throughout the body, such as in the neck, groin, and abdomen. Regional lymph nodes of the breast are those nearby the breast, such as the lymph nodes under the arm, which are called axillary lymph nodes[6].

Types of cancer in female:

1) Gestational Trophoblastic disease (GTD)
2) Ovarian cancer
3) Uterine cancer
4) Vaginal cancer
5) Breast cancer

Figure:

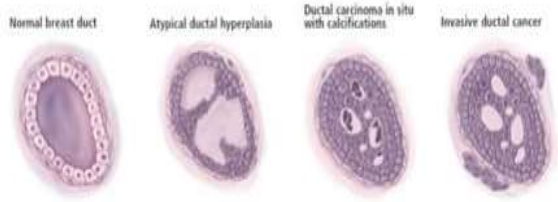


SPREADING OF CANCER :

The genomic evolution of breast cancer metastasis-Cancer is primarily caused by DNA damage. The transformation from a normal to cancerous phenotype and from primary to metastatic BC is marked by the accumulation of genetic changes known as somatic mutations. Breast cancer most often spreads to the bones, liver, lungs, and brain. Even after cancer spreads, it is still named for the area where it began. This is called the “primary site” or “primary tumor.” For example, if breast cancer spreads to the lungs, it is metastatic breast cancer, not lung cancer.

• Tissue – The cancer spreads form where it began by growing into nearby areas.
• Blood – The cancer gets into the blood ,travel through blood vessels and forms a tumor into other parts of the body.
• Lymph system – The cancer gets into the lymph system ,travels through the lymph ,vessels, and forms a tumor In other parts of body [8,9].

Breast cancer classification and staging pathologic classification: Breast cancer is adenocarcinoma that occurs in primarily in two forms ductal or lobular carcinoma , in which malignancy develops in breastducts or lobules respectively. The majority of breast cancers are ductal in origin. Another key pathologic distinction is between in situ verses carcinoma which depends on whether the cancer cell remains within the duct or lobule or has spread on a microscopic level to the adjacent breast parenchyma(invasive or in filtrating)[10].



BREAST CANCER CLASSIFICATION AND STAGING

Pathoassification

Stages of cancer:

Stage 1 : The Growth is confined to the breast .The cancer is small and only in the breast tissue or it might be found in lymph nodes close to the breast Tumors is less than 1 inches across. Cancer cell remains inside the breast duct ,without invasion into normal adjacent breast tissue [27].

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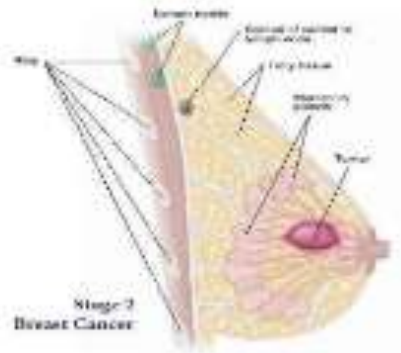
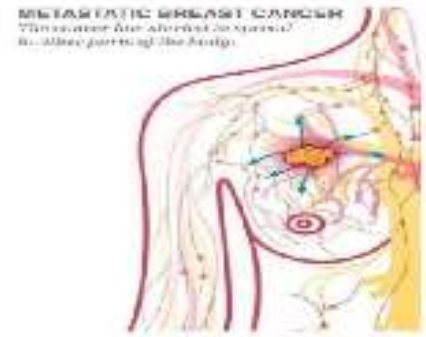
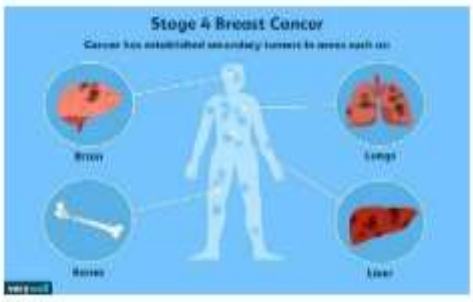
Stage 2: The Growth is confined to the breast, palpable, mobile lymph nodes are present in the axilla. Cancer in the breast tissue tumor less than 2 inches and cancer may spread to auxiliary lymph nodes .



Stage 3: The Growth extends beyond the mammary parenchyma . the cancer has spread from the breast to lymph nodes close to the breast or to the skin of the breast or chest cell.



Stage 4 : The Growth extends beyond the breast area. Between 20 and 30 percent of women with early stage of breast cancer go on to develop breast cancer[11].



Cancer staging:

Breast cancer staging is depend on the staging is based on TNM system, defined by the American joint committee on cancer which takes into account tumor (t)size, the extent of regional lymphnode(N)involvement and the presence or absence of metastasis (M) beyond the regional lymph node[12]Breast cancer is staged from 0 to 4 Stage 0 implies in situ cancer, while stages I to IV indicate invasive cancer, with IV implying metastatic spread to distant organs. patients cannot be told their stage until after surgery, when a final pathologic report detailing tumor size and nodal status is available

Early Breast Cancer –

Breast cancer that has not spread beyond the breast or axillary lymph nodes. This includes in situ breast cancer (stage 0) and stage 1 and stage .A breast cancers. The therapy involved in early breast cancer to remove the tumor and to either stage the axillary tumor burden or excise the affected axillary lymph nodes. Breast conserving surgery has been made to downsize tumors and development of advanced oncoplastic techniques. IN this V-mammoplasty a v shaped wedge is cut around the tumor up to the point of the nipple and the breast is 'closed' together[14].

Advanced breast cancer:

Advanced breast cancer comprises inoperable locally advanced abreast cancer, which has not spread to distant organs and metastatic (stage 4) breast cancer .The common sites of spread are bone ,the lungs and the liver [8,14].Currently, it is a treatable but virtually incurable disease, with metastases being the cause of death in almost all patients and a median overall survival 2'3 year. Patients with metastatic breast cancer relieves treatments that aim to relieve their symptoms and to prolong quality.[14,16]17

Radiation therapy: Radiation therapy, which has a vital role in alleviating symptoms from bone ,brain and soft tissues metastases among others ,should be prescribed in a multidisciplinary and individualized approach with dose and fractionation schedules depending on the severity of the lesions and the remaining life For most patients with Bo metastases, a single dose of 8 by is sufficient, as demonstrated in a large prospective randomized trial.

Overview of surgical options:

1) Breast conservation therapy: For breast conservation therapy, the ratio of tumor size to breast size must be small enough to ensure complete tumor removal with an acceptable cosmetic outcome. In general, it is estimated that up to25%of the breast can be removed while still ensuring a "good" cosmetic outcome. Advances in

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closure techniques allowing for more tissue to be removed with even better cosmetic outcomes are known as oncoplastic closure.

2) Mastectomy: A second surgical option for patients is mastectomy. Today "mastectomy" can refer to any of severalsub- types of surgical procedures. Modified radical mastectomy (Figure 3,) involves complete removal of the breast with preservation of the pectoralis major and minor muscles (unlike radical mastectomy) and dissection of level I and II axillary lymph nodes. Simple mastectomy involves removal of the breast only, without removal of lymph nodes. Either of the incisions depicted in the left and center panels of Figure 3 can be used. Both modified radical mastectomy and simple mastectomy involve removal of the nipple and areola (nipple-areola complex

Types of Breast Cancer:

•**Ductal Carcinoma In Situ (DCIS) :** Ductal carcinoma in situ (DCIS) is a non-invasive cancer in which abnormal cells have been found in the lining of the breast milk duct. The atypical cells have not spread outside of the ducts into the surrounding breast tissue.

•**Invasive Ductal Carcinoma (IDC):**Invasive Ductal Carcinoma (IDC) is an invasive cancer where abnormal cancer cells that began forming in the milk ducts have spread beyond the ducts into other parts of the breast tissue

•**Lobular Carcinoma In Situ (LCIS) :** Lobular Carcinoma In Situ (LCIS) is a condition where abnormal cells are found in the lobules of the breast. The atypical cells have not spread outside of the lobules into the surrounding breast tissue.

•**Invasive Lobular Cancer (ILC):** Invasive breast cancer that begins in the lobules (milk glands) of the breast and spreads to surrounding normal tissue. It can also spread through the blood and lymph systems to other parts of the body.

•**Inflammatory Breast Cancer (IBC):** Inflammatory breast cancer is aggressive and fast-growing breast cancer in which cancer cells infiltrate the skin and lymph vessels of the breast

•**Breast Cancer During Pregnancy :**It is possible to be diagnosed with breast cancer during pregnancy, although it is rare and the breast cancer is not caused by the pregnancy

Risk factors of breast cancer –A Risk factor is anything that increases a person's chance of developing cancer. Although Risk factor often influence the development of cancer,most do not directly cause cancer .some people with several Risk factors never develop cancer ,while others with no known Risk factors doknowing your risk factors and talking about them with your doctor may help you make more informed lifestyle and health care choices.

***Personal history of breast cancer.**

A woman who has had breast cancer in 1 breast has a higher risk of developing a new cancer in the other breast. [27].

Inherited risk/genetic predisposition. There are several inherited genetic mutations linked with an increased risk of breast cancer, as well as other types of cancer. BRCA1 or BRCA2 are the most common known genes linked to breast cancer

Early menstruation and late menopause. If menstruation began before ages 11 or 12 or menopause began after age 55, there is a somewhat higher risk of breast cancer

Timing of pregnancy. Having a first pregnancy after age 35 or if you've never had a full-term pregnancy brings a higher risk of breast cancer.

Weight-.Recent studies have shown that being post-menopausal and being overweight or obese brings an increased risk of breast cancer.

Alcohol-Current research suggests that having more than 1 to 2 servings of alcohol including beer, wine, and spirits, per day raises the risk of breast cancer

Radiation exposure at a young age-Exposure to ionizing radiation at a young age may increase a woman's risk of breast cancer. For example, therapeutic radiation to the chest for Hodgkin lymphoma may increase breast cancer risk in both breasts.

Physical activity-A lower amount of physical activity is associated with an increased risk of developing breast cancer and a higher risk of having the cancer come back after treatment.

Socioeconomic factors-More affluent women in all racial and ethnic groups have a higher risk of developing breast cancer than less affluent women in the same groups.

Breast density-Dense breast tissue may make it more difficult to detect a tumor on standard imaging tests, such as mammography (see Diagnosis).

Signs and symptoms of Breast Cancer –

• Thickening or swelling of part of the breast.
• Irritation or dimpling of breast skin.
• Redness or flaky skin in the nipple area or the breast.
• Pulling in of the nipple or pain in the nipple area.

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• Any change in the size or the shape of the breast.
sign of breast cancer spread even before the original tumor in the breast is large enough to be felt.) [27].

Treatment of breast cancer –
The choice of treatment depends largely on the type of cancer and the stage of the disease. The exact stage for surgery may not be known. In that cases, treatment is based on what is known Other factors that could play a part in choosing the best might include your general state of health and other things that are important to you.
The main treatment of breast cancer are:
• Surgery
• Radiation Therapy
• Hormonal therapy
• Targeted Therapy

•**Surgery:** Surgery is the removal of the tumor and some surrounding healthy tissue during an operation. Surgery s also used to examine the nearby axillary lymph nodes, which are under the arm. For DCIS, radiation therapy after surgery is usually given.This is the surgical removal of the entire breast.
•**Radiation therapy:**Radiation therapy is the use of high-energy x-rays or other particles to destroy cancer capercailzies' in giving radiation therapy to treat cancer is called a radiation oncologist
• **Chemotherapy:** Chemotherapy is the use of drugs to destroy cancer cells, usually by keeping the cancer cells from growing, dividing, and making more cells. It may be given before surgery to shrink a large tumor, make surgery easier, and/or reduce the risk of recurrence.
• **Hormonal therapy :**Hormonal therapy, also called endocrine therapy, is an effective treatment for most tumors that test positive for either estrogen or progesterone receptors (called ER positive or PR positive). Hormonal therapy for breast cancer treatment is different than menopausal hormone therapy (MHT). MHT may also be called postmenopausal hormone therapy or hormone replacement therapy (HRT). Hormonal therapies used in breast cancer treatment act as "anti-hormone" or "anti-estrogen" therapies.
• **Targeted Therapy :** Targeted therapy is a treatment that targets the cancer's specific genes, proteins, or the tissue environment that contributes to cancer growth and survival. These treatments are very focused and work differently than chemotherapy.

•**Prevention of Breast cancer –**Different factors contribute to different types of cancer .Research continue to investigate what factors increase the risk for this type of cancer. Although there is no proven way to completely prevent this disease, you may be able to lower your risk
• **Limit alcohol-** The more alcohol you drink, the greater your risk of developing breast cancer. The general recommendationbased on research on the effect of alcohol on breast cancer risk is to limit yourself to no more than one drink a day, as even small amounts increase risk.
• **Maintain a healthy weight.** If your weight is healthy, work to maintain that weight. If you need to lose weight, ask your doctor about healthy strategies to accomplish this
• **Be physically active**. Physical activity can help you maintain a healthy weight, which helps prevent breast cancer
• **Breast-feed.** Breast-feeding might play a role in breast cancer prevention. The longer you breast-feed, the greater the protective effect.

***Medication**
Drugs used in breast cancer – For breast cancer, this is the use of hormone-blocking drugs to reduce cancer risk.
Tamoxifen (available as a generic drug). Tamoxifen is a type of drug called a selective estrogen receptor modulator (SERM). It is often used as a treatment for breast cancer for people who already have the disease.
Raloxifene (available as a generic drug). Raloxifene is also a SERM. It is often used to prevent osteoporosis (thinning of the bones) after menopause.
Aromatase inhibitors (AIs). AIs reduce the amount of estrogen in the body by blocking estrogen production. There are 3 AIs that may be options for lowering breast cancer risk after menopause when there is a higher risk of developing breast cancer. [27].

II. CONCLUSIONS:

Attention to the psychological costs of screening has lagged far behind the technical and organizational aspects of screening services.There are signs of greatest interest ,but particularly from those who are most clinical of the whole ethos of screening and consequently consideration of psychological impact has been linked with doubts about the value of screening programmes[27]. Decisions surrounding the choice of breast surgery procedure must be individualized to the patient and

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her desires and based on comprehensive patient evaluation and thorough patient counseling. Optimal results for the patient oncologically, psychologically, and in terms of cosmetic outcomes require consultation and collaboration among general surgeons, medical oncologists, genetic counselors, radiation oncologists, radiologists, and plastic surgeons to clarify the risks and benefits of various intervention options. Striving for this multidisciplinary collaboration will promote optimal patient management and the most favorable clinical outcomes[10].

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