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Review Article

Enhancing Breast Cancer Awareness to Foster Understanding and Support: A Review

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Abstract

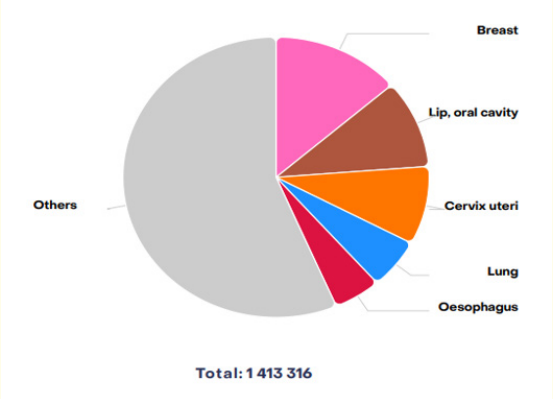
Public awareness of breast cancer diagnoses and screening rates is heightened each October during Breast Cancer Awareness Month. A recent review examined the impact of artificial light on breast cancer and its implications for early detection. Breast cancer is widely recognized as one of the most prevalent forms of cancer, affecting people across diverse races and cultures and posing a significant risk of mortality. The role of breast density in cancer detection and its association with risk factors, however, remains incompletely understood. Breast cancer stands as a leading cause of death among women, and despite notable advancements in treatment over the past two decades, it remains a potentially fatal disease. Among postmenopausal women, breast cancer accounts for 23% of cancer-related deaths, ranking as one of the most common causes of cancer mortality. While breast cancer is now recognized globally, it often goes undetected until advanced stages, partly due to women's lack of physical and self-examination practices. This review covers the anatomy, risk factors, epidemiology, pathogenesis, staging, diagnosis, surgical interventions, and available treatments for breast carcinoma, including hormone replacement therapy, radiation therapy, gene therapy, complementary medicine, chemotherapy, targeted therapies, and stem cell therapy.

Keywords: Stem Cell Therapy; Hormone Replacement Therapy; Gene Therapy; Radiation Therapy; Chemotherapy

Introduction

Breast cancer is the leading cause of cancer-related death among women worldwide. In 2008, 1.36 million new cases of breast cancer were reported, with nearly half of all cases and 60% of deaths occurring in emerging economies. Wealthier nations have an estimated five-year survival rate of 80% for breast cancer, whereas less developed countries have a survival rate of under 40% after five years [1]. By 2030, it is projected that more than 2 million women globally will be diagnosed with breast cancer, with a growing proportion of cases in developing countries [3]. Routine mammography screening is not universally provided for older women, as the National Health Service Breast Screening Program has an upper age limit [2]. Surveys have shown no significant differences in risk factors, with stress and smoking being more frequently cited than well-established risk factors. In a few countries, over 90% of respondents identified "family history" as the most significant risk factor. Other studies reveal a lack of awareness regarding non-genetic factors contributing to breast cancer. Breast Cancer Awareness Month (BCAM) is observed in October to raise public awareness about breast cancer. BCAM's primary goal is to encourage women to perform regular self-examinations and seek medical attention if they detect any lumps or unusual rashes on or near their breasts. The third Friday in October is recognized as "National Mammography Day" [1]. Lifetime exposure to environmental and lifestyle factors, in conjunction with low-penetrance susceptibility genes, is believed to be a primary contributor to breast cancer risk. Factors such as parity, age at menarche, and age at menopause are linked to breast cancer risk, with emerging evidence suggesting that exogenous hormones may also play a role.

Key lifestyle factors include alcohol consumption, weight, and physical activity. An Irish survey found that while respondents considered smoking and stress important, these factors do not play a substantial role in breast cancer etiology [4]. Breast cancer mortality rates among women are high due to a lack of awareness, complex referral pathways, limited access to effective treatment, and incomplete treatment regimens. In the absence of widespread screening programs and sufficient awareness, approximately 192,000 new cases and 98,000 deaths occur annually, with 70% of cases detected at advanced or metastatic stages.



Rank	Cancer site	Number of cases	Percent
1st	Breast	192 020	13.6%
2nd	Lip, oral cavity	143 759	10.2%
3rd	Cervix uteri	127 526	9.0%
4th	Lung	81 748	5.8%
5th	Oesophagus	70 637	5.0%

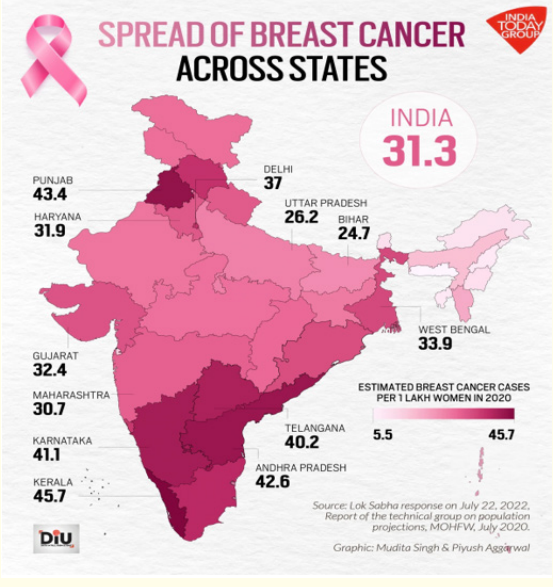


Figure 1: Cancers that are prevalent in India. Source: India Today Group.

Management options for patients with distant metastases focus on enhancing quality of life and survival rates. 1. Delay in Treatment Seeking: Delayed identification and treatment of symptomatic breast cancer can lead to larger tumors and reduce long-term survival rates. Research indicates that approximately 20-30% of white women may wait over three months before seeking treatment for symptoms. 2. Influence of Sociocultural Factors: In developing countries, strong religious beliefs, preference for traditional treatments, and negative sociocultural attitudes towards breast cancer contribute to delayed presentation. 3. Treatment and Prevention: Modern medications, including anti-estrogen drugs like tamoxifen, are used to treat breast cancer and may also provide preventive benefits for high-risk individuals [11]. Prophylactic surgery on both breasts can reduce the risk of developing cancer. In cases of distant metastases, management focuses on enhancing the quality of life and improving survival rates.

Variables	N (number)	%
Age mean		
15-25	87	43.1
26-35	95	47.5
36-45	17.5	8.75
Ethnicity		
Chinese	84	42
Indian	33	16.5
Malaysia	73	36.5
Others	12	6
Education level		
Post graduate	20	10
Under graduate	180	90

Table 1: Socio demographic variables of students/participants of literates (Muhammad A. Hadi., *et al.* 2010) [49].

The overall mean score for awareness on breast cancer is 14.97 (SD is about 4.7).

Breast anatomy

Breasts are made up of adipose tissue and are present in both males and females [6]. Ten to fifteen lobes make up a woman's breasts, and each lobe is further fragmented into smaller lobules. In accordance with the menstrual cycle, they go through periodic changes. They are closely related to the genitalia of females. Pituitary gland prolactin secretion is increased by breast stimulation. This hormone affects the uterus, potentially causing contractions. The nipple is encircled by a round, 15–60 mm spherical areola. Sebaceous, lanugo, and sweat hairs are found on the skin. In the areola epidermis, Montgomery's glands' tiny milk ducts—which are modified sebaceous glands—enter Morgagni's tubercles [7]. Areolar contractions, nipple erections, and milk sinus drainage are all caused by these muscles. The breast parenchyma extends inferiorly from the 2nd or 3rd rib to the infra mammary fold, which extends around the sixth or seventh rib. It crosses the sternum boundary as well as the frontal axillary line.

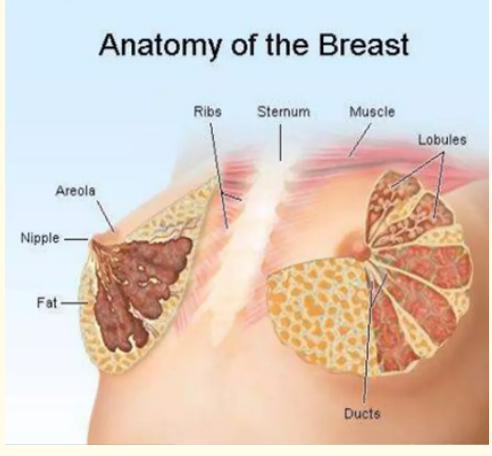


Figure 2: Anatomy of Breast.

A global prospective

Globalisation has historically been associated with business activities, environmental issues, and, more recently, terrorism. For decades, the "globalisation" of various human activities, including healthcare, has progressed with advancements in technology. Unfortunately, a lack of community wellbeing programs for breast cancer has hindered women's knowledge of their rights. Breast cancer therapies are impractical, lethal, and incredibly costly, making them inaccessible to the vast majority of females worldwide.

Breast cancer types

Cancers can be classified as either invasive or non-invasive.

Non-invasive neoplasm

The ducts or lobules are the only places where this kind of malignancy spreads [8]. One type of breast cancer that is not invasive is called ductal carcinoma *in situ*. When malignant cells develop inside the milk ducts without spreading to other tissues

or the exterior, it is known as carcinoma of the duct *in situ*. "*In situ*" translates to "in place." When treating ductal carcinoma *in-situ*, breast preservation should be taken into consideration because it is the most effective treatment for breast cancer, which is what we want to prevent. The necessity of doing clinical research and the drawbacks of depending exclusively on historical data have been taken into account. It is confirmed to choose the optimal treatment plan for non-invasive breast cancer [9].

In-situ lobular neoplasm

This indicates that the neoplasm originates in the lobular glands of the breast [10]. The tumor has not migrated to the surrounding breast tissue beyond its lobules [11]. Lobular carcinoma *in situ* is a common type of breast cancer that is non-invasive.

In-situ ductal neoplasm

Most often, the Bust ducts are affected by this specific form of non-intrusive breast cancer. Ductal carcinoma is a type of neoplasm of the ducts *in situ* [11].

Invasive neoplasms

When abnormal milk duct or lobule cells proliferate close to breast tissue, this happens. Via the immunological system or defence circulation system, cancer cells can travel from the breast to other parts of the body. At any point throughout their development, tumors of any size have the potential to migrate. The most prevalent type of general carcinoma in females is invasive breast cancer. When invasive breast cancer spreads to other body organs, it is referred to be metastatic breast cancer [12].

Infiltrating ductal neoplasm

Other name for infiltrated ductal neoplasm is "ductal invasive carcinoma." IDC starts in the women's bust milk ducts and moves in to the duct wall, where it infects fatty tissues and maybe other body parts [11].

Infiltrating lobular Neoplasm

Invasive lobular cancer is another term for infiltrating lobular cancer. ILC typically starts in the breast milk glands' lobules, although it can also spread to other body areas [9].

Tubule neoplasm

One type of invasive breast cancer is tubular malignancy. Compared to women with other forms of invasive carcinomas, those with tubular carcinoma frequently had better results [13].

Medullary neoplasm

The invasive kind of breast cancer known as medullary carcinoma (MC) has a clear separation between normal and medullary tissue [28].

Acute inflammatory breast condition

Acute Inflammatory breast carcinoma is defined by red, swollen breasts with dimples and/or broad ridges where cancer cells obstruct lymphatic arteries or channels in the skin around the breast. Coordination of multidisciplinary treatments including chemotherapy, surgery, radiation therapy and imaging is necessary for an effective course of treatment. Neoadjuvant chemotherapy, along with local treatments like radiation and surgery, has significantly improved overall survival rates since the first reports of this disease.

Mutinous carcinoma

Colloid carcinoma is the other name for Mutinous Carcinoma, is an unusual form of breast carcinoma caused by mucus-producing cell. Females diagnosed with mutinous malignancy seem to have a improved prognosis than compared with some-other kinds of invasive cancers [15].

TNBC (Triple Negative Breast Carcinoma)

Breast cancer exhibits a variety of clinical and pathological traits, treatment modalities, and outcomes, making it a complex disease. A hallmark of triple-negative breast cancer is the absence of expression of the progesterone receptor, the estrogen receptor, and the receptor for human epidermal growth factor 2 [16]. Destructive type is more common in white females, accounting for 10-15% of cases, and is typically observed in premenopausal females [17].

Paget's disorder

Paget's disease is one of the rarest form of breast carcinoma results in observable changes to the nipple and skin of the breast. The symptoms include swelling, and irritation of the nipple and areola, redness, sometimes accompanied by discharge which can occasionally spread to other areas of the body [18]. Unlike psoriasis and eczema, Paget's illness of the breast usually affects only one breast and starts at the nipple instead of the areola. Breast tumors, nipple inversion or flatness, and nipple discharge and bleeding are all warning signs. Punch biopsies can corroborate this. If the tumor remains in the nipple or breast ducts, the prognosis is quite good [19].

Phyllode tumor

Tumors from Phyllodes can be either benign or malignant. The connective tissues of the breast are host to phyllodes tumors, which can be surgically removed [20].

Breast tumor pathogenesis

The breast, a complicated tubulo-alveolar organ with asymmetric connective tissue, changes from reproductive age till senility. We hypothesized that precursor cells in mature tissue could generate additional duct-lobular units based on alterations seen during pregnancy and menstruation [36]. The normal breast architecture consists of a basement membrane, a network of lymphatics, stromal cells, and blood arteries, as well as a stratified epithelium. The two cell types that comprise the breast epithelium, myoepithelial and epithelial, can be distinguished from one another by immunohistochemical labeling with myosin and CK antibodies, respectively. Cancer cells are able to override growth inhibitory genes. Breast carcinoma is a malignant disease that starts in the cells that comprise the breast. Breast cancer can be brought on by a variety of factors, just like other malignant tumors. Since genetic changes and DNA damage can cause breast cancer, estrogen exposure has been linked to the disease. Patients may inherit mutations in other DNA, including the P53, BRCA1, and BRCA2 genes. A family history of breast or ovarian cancer increases the risk of developing breast cancer. Neoplastic cells must have a high degree of growth capacity in order to mature into a big tumor. A healthy immune system searches for and eliminates malignant cells as well as cells with damaged DNA. An immunological surveillance and defense system that is impaired is one potential cause of breast cancer. Cell suicide can be prevented by normal cells through the RAS/MEK/ERK and PI3K/AKT pathways. Cancer develops as a result of mutations in genes that produce defense systems, which stop cells from killing themselves.

Causative factors

Women who are unmarried are more likely than married women to develop breast cancer [22,41]. Women's breasts are sensitive to estrogen. Many women who have used estrogen replacement treatment or birth control pills report that the drugs make their breasts swell and hurt. The risk of breast cancer may rise if this medication is used with a diet heavy in fat and deficient in fiber that promotes breast tissue. With two cases reported for every 1000 women over 50, breast cancer is more common in this demographic. Studies have shown that women with more children have a lower risk of breast cancer than those with fewer. Before menopause, the risk increases rapidly, and after menopause, the risk increases gradually [23]. Breastfeeding reduces the chance of developing breast cancer. By inducing menopause, oophorectomy, or surgical removal of the ovaries, reduces the risk [24]. Breast cancer is 2-4 times more likely to strike women with a family history of the disease, especially those with the BRCA1 or BRCA2 genes [25]. Breast cancer is a disease that can affect both men and women, but it is more common in women. Women have a 100-fold higher risk of developing breast cancer than men.

BRCA 1&2

There is a strong correlation between two genes and breast cancer. Despite having similar fundamental functions, such DNA repair, their differences increase the risk of breast and ovarian cancer. Women over 70 who have the BRCA1 gene are 65% more likely to develop breast cancer than those who have the BRCA2 gene [10]. They are responsible for only one out of every 1000 females getting breast cancer, or about 5% of all cases. Certain tribal subgroups have a higher likelihood of inheriting the BRCA2 and BRCA1 genes. For instance, around 1% of Ashkenazi Jewish women are at a higher risk of possessing both the BRCA1 and BRCA2 genes. Women from Iceland and other Scandinavian nations also exhibit similar variations.

Mortality and five-year survival rate

In Poland, 14% of deaths and 17% of illness cases are related to cancer. 517,000 people worldwide lost their lives to breast cancer in 2004. Breast carcinoma is the 6th most frequently caused to death because of cancer. Compared to other countries, the United States has a higher age-standardized prevalence and death rate from breast carcinoma [26]. A five-year survival rates can tell you how many patients with the same kind and level of tumour are still alive five years after being diagnosed. They cannot tell you how long people will survive, but they can help you assess the likelihood of your treatment's effectiveness.

Breast cancer and its stages

According to the study from breast cancer.org Breast cancer stages vary based on tumour size, kind, and tissue penetration [26]. Stages 0 and 4 correspond to non-invasive and invasive tumours, respectively. Descriptions of the tumour phases are.

0th stage

If both the non cancerous and cancerous cells are seen in developing breast's and there is no sign of invasion into the surrounding tissues, the tumor is considered to be in its non-invasive stage. This stage can be illustrated by DCIS (ductal cell cancers *in situ*) [27].

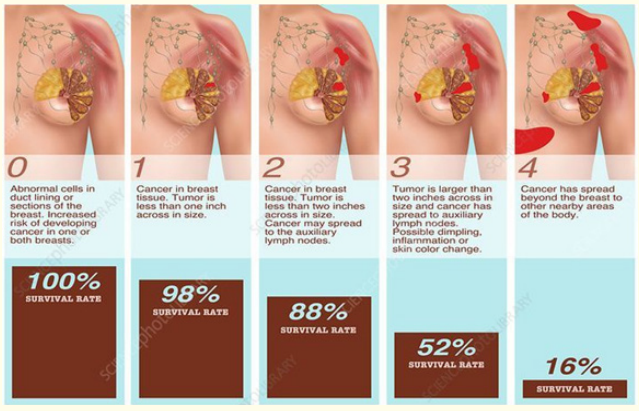


Figure 3: Survival rate of breast cancer.

1st stage

One of the traits that distinguish this stage of invasive breast cancer is microscopic invasion. Phases 1A and 1B comprise its two groupings. On the other hand, tumors with 2.0 cm in size without any lymph nodes are classified as group 1A, but cancer cells larger than 0.2 mm that are discovered in a lymph node are classified as category 1B [28].

2nd stage

2nd phase is divided in to two categories, 2A and 2B. In this 2A phase, tumors are not identified in bust but rather in the sentinel lymph nodes or axillary. The tumor size may vary from 2.0 to 5.0 cm. Stage 2B refers to a tumor which is more than 4.5cm in size but still doesn't reach the axillary part of lymph nodes.

3rd stage

There are three distinct sub-categories: 3A, 3B, and 3C. In phase 3A, there are four to nine Primary lymph node or axillary lymph nodes but no breast tumor. Stage 3B breast cancer is characterized by breast surface swelling or ulceration and the dissemination to up to nine sentinel lymph nodes or axillary lymphatic nodes. The symptoms include red, hot, and swollen skin. The tumours has spread to ten or higher number of axillary lymph nodes, including those above and below the collarbone, according to stage 3C [32].

4th phase

The development of cancer to other organs, including the brain, liver, lungs, and bones, is referred to as the advanced and metastatic stage.

Table 2: Illustrating the stages of cancer.

Stage	Extent	Five-year Survival percentage	Distribution	
			USA percentage	India percentage
0th	Non invasive	100	16.0	---
1st	Preliminary stage	100	40.0	1.0
2nd	Early phase	86.0	34.0	23.0
3rd	Locally progressed	57.0	6.0	52.0
4th	Metastatic disease	20.0	4.0	24.0

Diagnosis

Self-examination of breast

Monthly BSE is usually taught by doctors to women in order to accommodate their regular schedules and provide them permission to take care of themselves [3]. Advice is given to women on how to check for breast cancer on their own. Women are able to identify abnormalities in breast size and shape through self-examination.

- Start at age of 18 and continue lifetime
- Menstruating women-5-7 days after beginning of period
- Menopausal and pregnant women - same date each month
- Perform at least once a month

Physical examination and Family histories:

In order to determine the cancer risk and spot any signs of breast illness, individuals with breast cancer are asked about their medical history [34]. The evaluation should be taken into account based on patient's age at first menstruation, menopause stage, past pregnancy histories, and random usage of oral contraceptives or

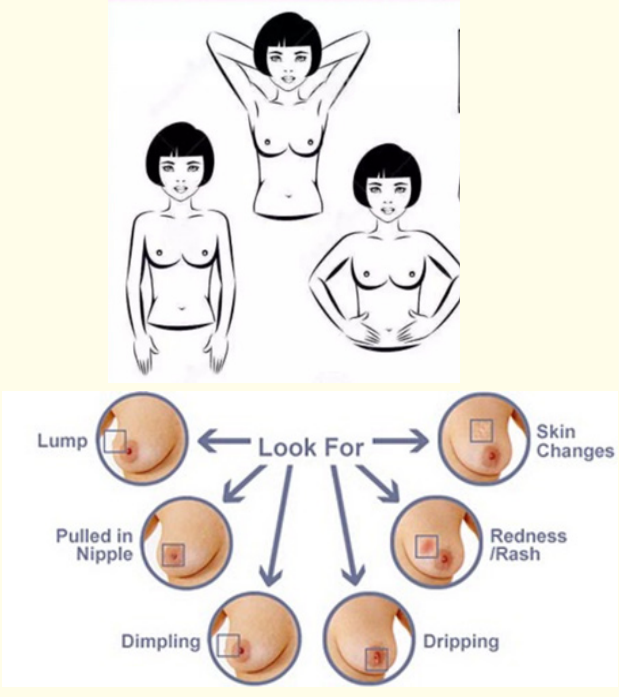


Figure 4: Self examination.

hormone replacement therapy (HRT). Compile a thorough personal and family history. Patients should observe their own specific symptoms, including fatigue, discharge from nipples , bone sprain, breast discomfort, and weight loss [35].

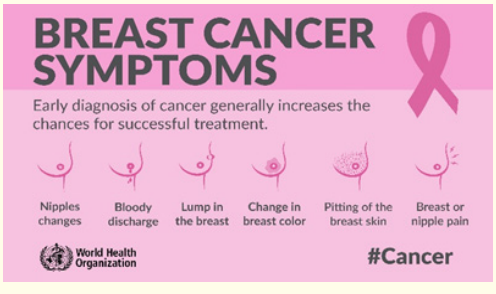


Figure 5: Breast cancer symptoms.

Tumor markers

Tumor markers should be evaluated during every stage of breast cancer, including diagnosis, screening, treatment, and prediction of metastases, according to Porika., *et al.* The guideline is unique in that it evaluates six out of thirteen breast cancer tumor indications. It is advised to employ the different versions in practice because they have shown clinical benefit [37].

Ultra sound imaging

Additional screening with ultrasonography is beneficial for women with thick breast tissue, according to several studies; However, there are a significant proportion of false positives [38,39]. Ultrasound breast imaging can determine the location and size of a tumor, regardless of whether it is solid or filled with fluid. Biopsies are necessary to rule out cancer. In order to detect lumps in young women, this examination is increasingly becoming the norm.

Biopsy

Many types of breast biopsies are performed. This triple test minimizes false negative findings by performing breast imaging, biopsy and clinical examination all these at a single point of time.

Breast cancer and MRI scan

Although mammography has been used for years to screen for breast cancer [40], it may miss 10-15% of cases and is unable to differentiate between solid and cystic tumors. For women with axillary lymph adenopathy and hereditary abnormalities in BRCA2 and BRAC1, MRI is more precise and advantageous.

Digital mammography

It makes it easier to locate bumps in thick tissue. The picture may be simply preserved and shared with another radiologist for a second opinion [41].

Figure 6: Digital mammograph.

Surgical biopsy

If the aberrant area cannot be biopsied using conventional methods or the results are unclear, a surgical biopsy is performed. Before the Incisional biopsy, a guide wire will be inserted into the

female breast to assist the physician in identifying suspicious tissue. The wire may be guided through position by medical professionals using mammography, MRI and ultrasound and a local anesthetic may be given. After that, general anaesthesia is used to perform the biopsy. A tiny portion that encircles the breast tissues and lump is detached along with the wire.

Surgery

This is the primary Intervention for breast tumor was not to spread through other parts of the body as well as for more advanced stages of the disease [43]. The characteristics, extent, and patient preference of breast cancer influence how much tissue is removed by following with surgery. Among the frequent surgical techniques are

Mastectomy

Mastectomy is a surgical protocol which is used to dissect one or both the bust. It reduces the risk of the breast tumors. Prophylactic bilateral mastectomy is a preventive surgical procedure that involves removing both breasts in people with severe breast cancer. This option is often considered by people with a strong family history of breast cancer, genetic mutations such as BRCA1 or BRCA2, or other risk factors [44].

Antiestrogen therapy

Hormone-related tumors that include hormone receptors, such as oestrogen receptors, respond well to this treatment. Tamoxifen prevents estrogen from entering the cells that cause breast cancer. This technique prevents breast cancer cells from multiplying. Tamoxifen is suitable for females of any age. The best treatment for female with breast tumors who have a positive estrogenic receptor which is tamoxifen.

Radiation therapy

It is beneficial in minimising the need for mastectomies. In early breast cancer phases, a lumpectomy combined with radiation therapy is becoming more common than a mastectomy alone.

Chemotherapy

The procedure of using particular drugs to kill cancer cells is known as chemotherapy [47]. Among the chemotherapy treatments, the American Cancer Society recommendations are platinum medicines like carboplatin and cisplatin, Paclitaxel, Docetaxel, Carboplatin (Paraplatin) Liposomal doxorubicin (Doxil), Cyclophosphamide (Cytoxan) Vinorelbine (Navelbine), Capecitabine (Xeloda) [46].

Immunotherapy

The therapy fights cancer cells by utilizing the body's immune system. Vaccination against cancer is one example. Whole or partial cancer cells are used to make vaccines. In order to combat and eradicate cancer cells, these cells stimulate the immune [48].

Conclusion

As understanding of the pathophysiology of breast carcinoma has advanced, biomolecular markers have become increasingly significant. The design of targeted therapies has grown more complex, with multiple compounds available for in vivo and clinical research focusing on specific markers. Although scientists and clinicians are encouraged by the potential of these new therapies, there is concern regarding the adequacy of funding to support their progression into clinical trials. Challenges include selecting the most promising drugs and conducting rigorous clinical investigations for proper evaluation. To mitigate the risk of breast cancer, Indian women must understand both modifiable and non-modifiable risk factors. There is a pressing need for enhanced cancer literacy programs at national and state levels, in addition to partnerships with community organizations and the healthcare system. A robust breast cancer awareness campaign is necessary, emphasizing the importance of early detection and timely reporting based on current knowledge. Young adults may find it challenging to grasp disease-specific risk factors; therefore, straightforward, universal health messages could prove more effective. Many diseases can be prevented by avoiding smoking, limiting alcohol consumption, engaging in regular physical activity, and maintaining a healthy weight.

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