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Advancement in Breast Cancer Treatment: An Overview

Suchita Kujur, Satendra Pradhan, Rajendra Kumar, Jyoti prakash, Gyanesh Kumar Sahu, Rajesh Kumar Nema, Chandraprabha Dewangan*

Rungta Pharmaceutical Sciences Institute, Kohka, kurud, Bhilai , Chhattisgarh, India

Rungta Pharmaceutical Sciences & Research Institute, Kohka, kurud, Bhilai , Chhattisgarh

The Corresponding Author: Chandraprabha Dewangan*, Assistant Professor, Rungta institute Pharamaceutical sciences and Research Kohka, Kurud, Bhilai, Chhattisgarh 490024, India .

Abstract

Cancer of the breast is still among the most prevalent diseases in females worldwide, along with it poses a serious threat to public health. Many patients' outcomes have improved dramatically as a result of developments in molecular biology, early identification, and personalised therapy. Mammography and other advanced imaging techniques are examples of screening procedures that help with earliest diagnosis, which Is vital to achieving therapy. Monoclonal antibodies along with tyrosine kinase inhibitors are examples of targeted therapy that have demonstrated effectiveness in raising survival rates, especially in HER2-positive cases. Additionally, immunotherapy is showing promise, particularly for Triple-negative breast cancer, for which there are not specific treatment alternatives.

Keywords: Breast cancer, Modulator Chemotherapy, Docetaxel, Anastrozole

Introduction

One type of cancer that arises from breast tissue is called breast cancer. A breast lump, a change in the breast's form, or skin dimpling are all possible indicators of breast cancer, milk rejection, fluid originating from the nipple, a red or scaly area of skin, or a recently inverted nipple. Bone discomfort, enlarged lymph nodes, dyspnea, or yellow skin are possible symptoms in patients with distant illness dissemination. The most typical neoplasm within the world as well as one of the main reasons for death for women is Breast cancer.

(BC) [1]. HER2, a transmembrane receptor The overexpression of tyrosine kinase in 15-20% of Cancer of the breast cases, Using 50% expressing estrogen and/or progesterone receptors [2].The BACCAN-RAY project is reviewing a thorough risk assessment for breast cancer. approach for females between the ages of 30 and 39, including A survey, low-dose mammography, and polygenic risk measurement [3] .By 2050, 3.2 million new breast cancer cases worldwide will occur annually due to population growth, with benign,

normal, in situ, and aggressive types. Early detection and treatment are crucial [4,5]. Each year, about 6,000 new non-invasive BCs as well as 70,550 There are new invasive BCs identified. in Germany. The one that prevalence Of late-stage breast cancer decreased among age categories for screening (ages 50–69) after coordinated mammography screening was implemented in Germany from 2005 to 20E09. [6] These top-notch, cutting-edge, and instructive lectures covering imaging, biomarkers, survivorship, local and systemic therapy issues, and even COVID-19-related topics took place over three days. They were followed by excellent live discussion sessions that allowed for expert discussions of specific topics and, for the first time, audience questions [7] Breast cancer, a prevalent and deadly illness, is present in milk-delivering glands and ducts, often spreading through the bloodstream. Age-specific clinical features and outcomes are limited, and younger women are underrepresented in traditional medicine [8,9,10]

Epidemiology

The platform of the Global Cancer Observatory provides access to the WHO, the World Health Organization. [11] The one that disease known as breast cancer sixth most frequent reason for cancer-related deaths worldwide, accounts for one-sixth of cancer fatalities and one-fourth of women's cancer cases, with Every year, There are 2.3 million new cases recorded.

surpassing lung cancer the year 2020 [12] But the state is According to the most current forecast, the global burden of 626,679 deaths in 2018 is expected to increase to almost 3 million new cases annually by 2040 [13,14.15]. Dealing with the growing challenges brought on by the younger generation's aging and longer lifespans. Breast cancer is becoming more common worldwide, with industrialised countries having the highest prevalence. Stress and poor eating habits are two aspects of Western lifestyles that fuel this tendency. Postmenopausal women have a lower widespread mammographic density, indicating that menopause can also reduce mammographic density [16,17,18,19,20].

Statistical Analysis

Breast Cancer was The most prevalent kind of common type of widespread Cancer diagnosed globally over A total of 685,00 fatalities and 2.3 million new cases. Despite having an imbalance of breast cancer mortality transitioning nations account for the majority instances. It is anticipated instances of breast cancer and a million deaths [21] Rates of occurrence and death per 100,000 population, Age-standardized, were computed using The world-standard population of Segi [22] Even while The idea behind the burden of an illness like cancer on a community appears to be quite simple, there are several ways it can be stated [23] The World Health Organisation (WHO) introduced in 2021In 2021, an organisation launched The Global Breast Cancer action (GBCI) to address The actual rising Initiative prevalence of breast cancer particularly In emerging nations The program aims To increase the percentage of Cancer in stages II and II cases to 60% by early diagnosis. [24,25]

Cancer of the breast is relatively uncommon in women under Age 40.

- The American Cancer Society claims that the typical risk of breast cancer development by age 40 is about 1.5 % (1 in 67 women)
- However, breast cancer can occur, among younger females particularly individuals with a family background of the disease Or certain genetic mutations.

Middle -Aged Women (40-60)

- As women age, the likelihood of having breast cancer increases.
- At 50 years old, the average lifelong danger of breast What cancer is about 2.3% (1 in 38 women)
- The majority of Breast Cancer cases occur among ladies who are older than fifty.
- **Older Women (60 and above**
- As people age, their risk of developing breast cancer keeps rising.
- About 3.5% of women will develop breast cancer by the age of 70 (1 in 28).
- Postmenopausal women account for the majority of breast cancer cases.

The proportion of deaths By age group: The highest percentage of aged 65 to 74.

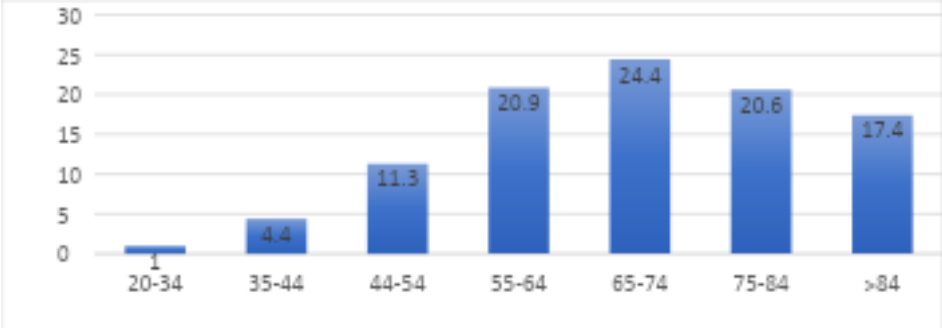


Fig No: 1.1 Women's Age-Related Death Rate

The study ranked the top 14 kinds of cancer globally by New Cases and fatalities from 2018 to 2020, analyzing mortality and incidence across six continents, as well as particular nations. It also provided estimates of deaths and new cases in China [26] The study examined the impact of age and HR on breast cancer incidence rates among ER+/PR+, non-Hispanic White, and stage I groupings using The ARIMA model [27] ARIMA The autoregressive integrated moving average model was used in time-series analysis to forecast the number of female breast cancer cases in 2022–2026. [28] The research investigated the effects of HR and age at diagnosis on variability In ASIRs and compared incidence rates among stage I, ER+/PR+, and non-Hispanic White groups. Age-specific percentages of observed DCIS cases were computed, and age-specific proportions of invasive breast cancer cases and fatalities were approximated. Age-standardized to the US standard population in 2000, the The rates of incidence and death were reported Per 100,000 women [29,30] One of the leading causes of death for women with breast cancer (BC) and the most common neoplasm worldwide[31] Estrogen and/or progesterone receptors (ER/PR) are expressed in approximately 50% of cases of this clinically and physiologically heterogeneous BC subgroup. [32] The BACCAN-RAY project Is conducting a thorough risk assessment for breast cancer approach for females between the ages of 30 and 39, including A survey, low-dose mammography, and polygenic risk measurement.[33] Experts estimate estimated over 3.2 million additional BC cases would occur each year by 2050. worldwide, taking population increase into account [34]. Breast cancer is classified into four main types: benign, normal, in situ, and invasive carcinoma. Benign tumors are not severe and do not cause significant harm. In situ cancer affects the mammary duct lobule system and is curable if caught early. Invasive carcinoma is the most severe and can spread to other organs. Various techniques, including mammography, X-rays, ultrasound,

PET, and MRI, are used to detect breast cancer [35,36,37] Cancer cells have DNA and RNA that are similar, but not identical, to those of the organism from whom they developed. This explains why the immune system, especially when it is compromised, does not frequently identify them [38]. Breast cancer, the most common and dangerous disease globally, develops when abnormal cells divide and contact healthy ones, forming carcinoma. It can be invasive or non-invasive, and can spread to other organs or the bloodstream. Younger women are often underrepresented in traditional medicine, with limited evidence on age-specific clinical features or outcomes. This study covers epidemiology, clinicopathologic features, aprognosis, treatment, and unique considerations [39,40].

Breast Cancer Types

1. In situ Carcinoma of Ductal
2. Invading Ductal Carcinoma (IDC)
3. Lobular Cancer in Situ (LCIS)
4. Lobular Invasive Carcinoma (ILC)
5. Medullary Carcinoma
6. Muc-based Carcinoma (Carcinoma Colloid)
7. Tubular Cancer
8. Metaplastic Carcinoma

1. SITU DUCTAL CARCINOMA

The ungreeted cell in situ ductal carcinoma (DCIS), a hallmark Of stage 0 Breast Cancer, accounts for 20% of new cases. Imaging modalities like mammography, ultrasound, and MRI aid in risk stratification [41,42] It is distinguished by its clear heterogeneity and propensity to progress to aggressive cancer. [43]. Overdiagnosis and overtreatment in DCIS patients have not been effectively reduced through screening programs or multimodal treatments.[44] In addition to these worries, [45]. DCIS if treatment is not received therefore, most of DCIS Patients are Treated in accordance with guidelines, which usually entail surgery, either mastectomy or Surgery for breast conservation (BCS) [46]. Active monitoring Is a nonsurgical approach to managing DCIS that offers more treatment alternatives and chooses close imaging follow-up over surgery in order to de-escalate treatment.[47]. The comparable Copy number changes Considering the differences in patterns of gene expression in invasive ductal carcinoma (IDC) and DCIS [48]. DCIS may be linked to microinvasion, which is characterized by ≥1 mm-sized foci of stromal invasion, about 1% of Breast tumors About 5–10% of cases of DCIS exhibit microinvasion [49]. DCIS has no potential for metastasis because of its histologic features. [50].

In situ Lobular Carcinoma (LCIS)

The one that second most prevalent kind of breast cancer is intrusive. lobular Carcinoma (ILC), which explains about 15% Of all situations. Hormone replacement therapy and diagnostic advancements have increased the incidence of this subtype. LCIS patients are eligible for high-risk screening, including annual mammograms and MRIs or ultrasounds. Chemoprevention may be suitable in some cases. LCIS is a sign of a breast microenvironment conducive to invasive breast cancer development and a non-obligatory precursor of invasive lobular carcinoma. Surgery is not used to treat LCIS, as the ensuing malignancies may arise in other quadrants or opposite breasts and are often multifocal/ multicentric. [51,52,53,54] We examined ILCs'

pathological and mammographic appearances, the repeatability of the classification of these appearances, and any potential associations between them in the current investigation [55].

Medullary Carcinoma

Invasive breast cancer are medullary breast carcinoma (MBC), a unique form of the disease [56] The WHO, or World Health Organization has Classified medullary carcinoma As a distinct morphological subtype, previously known as BCNST-MP cancers [57] MedBCs, with unique histological and genetic characteristics, have a better prognosis than other breast cancer subtypes, especially TNBC, and are categorized as a pattern within invasive ductal carcinoma[58,59] MedBCs, make up 1-7% of the total breast tumors, which are distinguished by soft, mushy mass, Large cells, lymphocytic infiltration, and well-defined boundaries[60]The study explores the prognostic implications of medullary breast carcinomas in Asian women, examining the correlation between immunohistochemistry results, clinicopathologic features, and follow-up outcomes of common markers [61] MBC usually exhibits a P53 mutation, is usually negative for typically negative for the ER, or estrogen receptor and is often negative for ERBB2. BRCA1 mutations are found in a significant percentage of MBCs [62]. A study of 15 patients with DCIS found that 24.2%) were classified as atypical MBC, with three exhibiting comedonecrosis. The remaining nine cases were low to intermediate grade, free of necrosis. The presence of DCIS did not significantly correlate with diagnosis, leading to overtreatment and chemotherapy side effects [63,64].

(Colloid Carcinoma) Mucinous Carcinoma)

Pure malignant mucinous cells, which make Up 1% to 6% Breast cancers, which are more prevalent in individuals over 60 And have an improved outlook compared to invasive ductal carcinoma [65] Mucinous carcinoma Is a rare, moderately well-confined breast tumor, causing 1%-7% of all breast cancers, with 2% of primary breast cancers being pure mucinous carcinomas[66]Breast carcinoma, unlike colloid carcinoma, is characterized by intracellular mucin-containing cells, which are rare but present in many breast carcinomas [67] MUC1 is a membrane-bound mucin present in all forms of neoplastic breast epithelium, apically localized in benign lesions but abnormal in malignant ones. It is not linked to specific tumor forms like MUC2 and MUC6. MUC1 differs biochemically from mucin using antibodies against oestrogen and progesterone receptors [68] MUC1 is a membrane-bound mucin present in all forms of neoplastic breast epithelium, apically localized in benign lesions but abnormal in malignant ones. It is not linked to specific tumor forms like MUC2 and MUC6. MUC1 differs biochemically from mucin using antibodies against oestrogen and progesterone receptors [69] Only 2% of breast cancers are pure mucinous carcinomas, found in postmenopausal women. These tumors produce mucin, with a 50% or higher mucinous component. Mixed types combine mucinous and infiltrating epithelial components. Fine needle aspiration produces large volumes of mucinous material [70]

Carcinoma Tubular

One kind of invasive ductal carcinoma is tubular carcinoma, is characterized by small, tube-shaped tumors in milk ducts, spreading to surrounding healthy tissue, with similar ultrasonographic characteristics and prognoses [71] Pure Breast TC, characterized by glands that are angulated and In the desmoplastic stroma,

low-grade nuclei are a favorable histology with a low malignancy probability and positive prognosis, distinguishing it from IDC due to its smaller size and increased estrogen and progesterone expression [72]

Metaplastic Cancer

A rare and severe kind of breast cancer, distinguished by a combination of glandular and non-glandular patterns, Mesenchymal and epithelial constituents, and A increased likelihood Of local recurrence, with 63 as the median age. [73] The Medical Oncology Society of Europe (ESMO) has recommended the use of ctDNA assays for routine tumor genotyping in clinical practice to guide molecularly targeted therapy in metastatic cancer patients [74] Eligible individuals who have breast cancer that has spread (mBC) accessible non-bone locations and undergone chemotherapy. HER2-overexpressing patients must be resistant to trastuzumab and TDM-1, have taxanes pretreatment, and have hormo -receptor receptor-positive malignancies. A tumor biopsy is optional during treatment. [75]

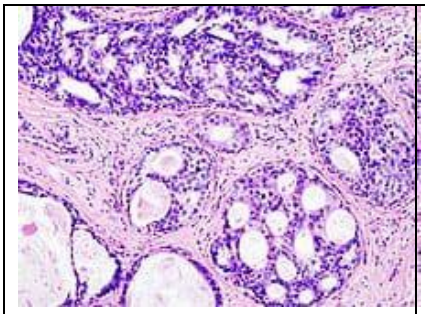
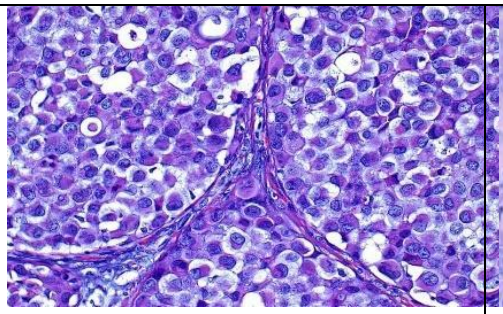
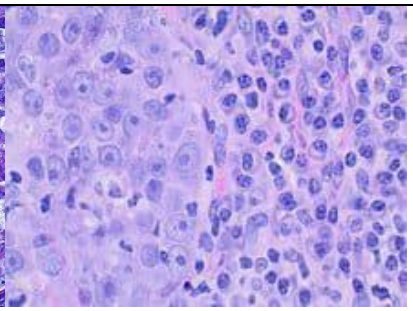
		

Fig No 1.2 In Situ Ductal Carcinoma	Fig no. 1.3 Lobular In situ carcinoma	Fig no:1.4 Medullary Carcinoma

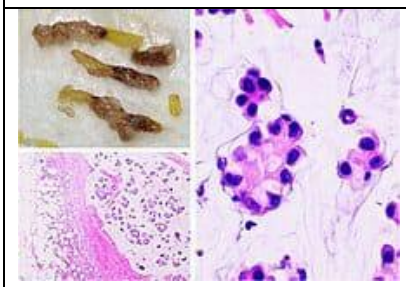
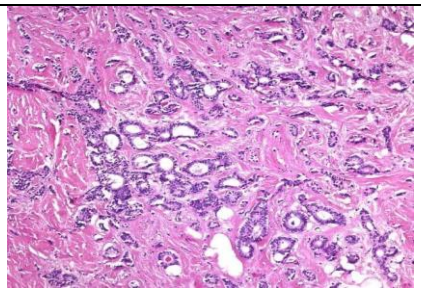
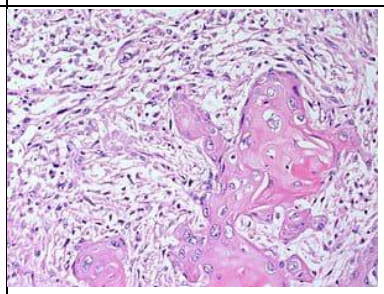
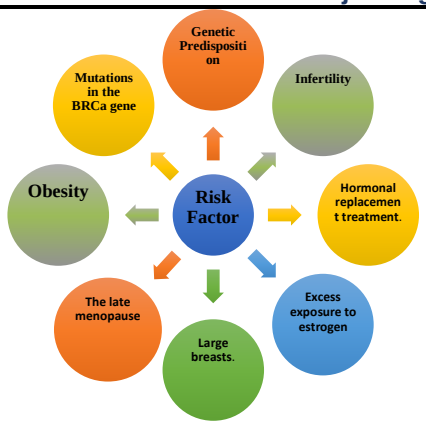

		

Fig No:1.5 Mucinous Carcinoma (Colloid Carcinoma)	Fig No:1.5 Tubular Carcinoma	Fig No: 1.6 Metaplastic Carcinoma

Fig.: Different types of Carcinoma

Risk factors

Breast cancers are influenced by social-psychological factors, environmental conditions, and poor lifestyle choices, with accounting for 5-10% of cases and potentially modifiable factors accounting for 20%-30%. [76] High financial load, poor body image, lower self-efficacy, and older age are risk factors for the "high burden of all symptom group" and individuals with high psychological symptoms [77]



Symptoms

1.Lump or mass in the breast.

2.Swelling of part or all of the breast.

3.Skin dimpling or texture changes.

4.Redness or flakiness of breast skin.

5.Nipple inversion.

6.Nipple discharge (clear, bloody, or other).

7.Pain in the breast or nipple.

8.Changes in the breast size or shape.

9.Lump or swelling in the underarm or collarbone area.

10.Thickening or hardening of breast tissue.

11.Skin uclers or sores on the breast.

12.Unexplained fatigue, bone, pain, or weight loss (in advanced stages).

Treatment

Treatment depends on the stage and general condition of the patient.

Its treatment depends on the stage of cancer.it may consist of chemotherapy, radiation, hormone therapy, and surgery in a combined multimodality form.

Surgery

Mammoplasty, Tissue expansion, Lymph node dissection, Lumpectomy and Mastectomy.

Medical procedure

Teletherapy and Radiation therapy

Medications

Estrogen modulator, Chemotherapy, Hormone based chemotherapy and Bone health. Patients should be informed about chemoprevention using SERMs, or selective estrogen receptor modulators, including tamoxifen, For invasive Breast Cancer. DCIS treatment typically involves radiation therapy, but mastectomy may be suggested due to the rarity of nodal metastases. Regular usage of tamoxifen is not advised is not advised for frequent use due to its risks [78]

In clinical terms, making up 15% to 20% of all Breast Cancers [79]. BCRP's role in medication dispersion is growing, necessitating understanding of physiological, xenobiotic, conditions, and pathological circumstances to forecast how it would affect medication pharmacokinetics and interactions. [80]TNBC

responds to ICI despite lacking traditional targets due to its high tumor mutational burden. ICIs are more effective in treating TNBC when given early in the disease, as they do not damage the immune system or develop immune escape mechanisms. Olaparib, a neoadjuvant or adjuvant, has been investigated in clinical trials with other chemotherapy medications. [81,82] Chemotherapeutic medications are administered before or after surgery to selectively stop cancer cell growth and trigger apoptosis. However, long-term treatment can lead to moderate to severe adverse effects and acquired resistance to the drug, a more adaptive response to its presence. Patients often experience moderate to severe side effects due to long-term treatment [83,84].

SURGERY

Mammoplasty

These problems affected 92.2% of irradiated breasts and 7.8% of non-irradiated breasts. [85] The number of mastectomy procedures worldwide is decreasing due to neoadjuvant therapy, and targeted surgeon training. In 2020, only 16% of UK women had invasive procedures [86]A retrospective observational study examined 15 patients with matrix rotation mammaplasty and breast-conserving surgery. The most common pedicle-based approach was superomedial [87,88] The Sloan Kettering Memorial Cancer Center developed the BREAST-QTM in 2009 to assess patient satisfaction after cosmetic and reconstructive breast surgery. The seven dimensions of the BREAST-QTM breast reduction module include physical, sexual, psychosocial, information, contentment, breasts, outcome, and radiation satisfaction. The tool recommends using the module for breast reduction in patients having this kind of surgery [89,90]

Tissue expansion Lymph node dissection

In 2020, US breast reconstruction procedures saw over 80,000 tissue expander procedures, a popular two-stage technique due to its safety and efficacy [91] Prepectoral implants are increasingly used for breast reconstruction after mastectomy, offering benefits like reduced pain and absence of animation abnormalities. However, sentinel lymph node biopsy has high false-negative rates, leading to the consideration of less intrusive surgical methods [92,93]

Lumpectomy and Mastectomy

Breast lumpectomy and mastectomy are two surgical procedures affecting patients' physical and mental health, with patient awareness, medical advice, and personal preferences influencing treatment decisions [94]A study involving 36,028 women found that those who underwent lumpectomy had a 20-year incidence of 6.9% contralateral breast cancer. [95] Breast-conserving surgery, also known as lumpectomy, is a surgical option for individuals with tumors under 2 cm. It reduces breast appearance and complications while maintaining the same long-term survival rate as mastectomy, making it essential for breast cancer treatment [96,97]

MEDICAL PROCEDURE

Teletherapy and Radiation therapy

Adjuvant radiation therapy, hormonal therapy drugs like tamoxifen and HER-2 targeted therapy are the typical Most patients with breast cancer receive treatment. post-mastectomy or BCS [98] Less than 15% of Africa's 800,000 new cancer cases require radiotherapy services. Nigeria's four most prevalent cancers are breast, prostate, colorectal, non-Hodgkin lymphoma, and other. In 2020, 125,000 new cases and 79,000

deaths occurred, with prostate, head, neck, uterine cervix, and breast being most frequently treated [99] Brachytherapy is a close-range radiation technique, while teletherapy uses specific distance sources. External therapy uses devices like Cs-137, Co-60, and LINAC [100] Breast-conserving strategy of restricted surgery followed by radiation is effective, with cosmetic outcome influenced by adjuvant radiotherapy modality, making it an option for many women [101]

MEDICATIONS

Estrogen, Modulator Chemotherapy, Hormone, based Chemotherapy and Bone health.

- **Estrogen**

Women with benign breast tissue are at risk for breast cancer. illness is 1.16, while those using 1.25 mg/d or more conjugated estrogens have a risk of 2.0 or less [102]Tamoxifen, a well-known SERM, has positive effects on bone metabolism and BC regulation, but also has negative effects in other tissues due to its estrogen inactivity [103] When compared to raloxifene and a placebo, tamoxifen doubled the incidence of cataracts and endometrial cancer. Tamoxifen side effects prevent many women from taking it. Breast cancer was modestly predicted by 13 risk-stratification models [104]. Research shows vaginal oestrogen therapy can effectively treat menopausal genitourinary conditions, and systemic hormone replacement treatment (HRT) may increase Breast cancer patients' likelihood of recurrence [105,106] The two drugs most frequently are tamoxifen (TAM) and fulvestrant [107].

tamoxifen

IUPAC name - **2-[4-[(1Z)-1,2-diphenylbut-1-enyl]phenoxy]-N,N-dimethylethanamine**

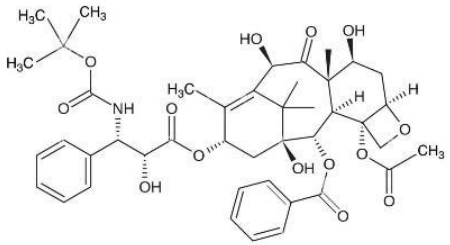
Molecular formula - **$C_{26}H_{29}NO$**

Molecular weight - **371.51g/mol**

- **Modulator Chemotherapy**

PTX, a natural plant-derived chemotherapeutic medication, was extracted from the Pacific Yew tree bark in 1971. It's an antimitotic anticancer drug that binds to microtubule β-tubulin, induces mitotic arrest, controls microRNA production, triggers apoptosis, and alters immune response [108] Therapeutic resistance in Chemotherapy For breast cancer that is hormone receptor positive (BC) Is linked to tumour metabolism. Targeting enzymes controlling energy metabolism can supplement traditional BC treatment, with prognostic biomarkers like HK2 and LDHA more valuable [109] Patients with recurrent illness may benefit from first-line treatment with capecitabine or vinorelbine [110] Pembrolizumab combined with chemotherapy is recommended for recurrent or metastatic TNBC. Endogenous vaccines made from dying cancer cells can strengthen immune responses and have long-lasting anticancer effects. [111]

Docetaxel

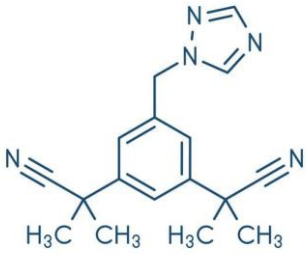


IUPAC Name - **(2R,3S)-N-tert-Butoxycarbonyl-3-phenylisoserine N-carboxyanhydride 13-ester with (2R,3S)-3-(benzoyloxy)-2-hydroxy-5,12-dioxo-9,10-dehydro-tax-11-en-2-yl-13-yl acetate.**

Molecular formula - **$C_{43}H_{53}NO_{41}$**
Molecular weight **- 807.88g/mol**

- **Hormone based Chemotherapy**

Neoadjuvant endocrine therapy (NET) may benefit HR-positive HER2-negative early breast cancer, but its exact use over NACT is not proven, and prognostic biomarkers are being proposed for clinical trial guidance [112]Tissue infiltrate lymphocytes (TILs) play an important part of understanding. The immune system's interactions with HR+ breast cancer tumours and their intrinsic features. A significant number of TILs, around 60%, was linked to increased pCR rate post-nasal amputation, but had poor predictive function in overall survival [113] Since they significantly improve Inhibitors of, including abemaciclib, palbociclib, and ribociclib) in addition to ET are now the advised primary therapy for those with HR+/HER2–ABC due to the enhanced progression-free survival (PFS) when compared to ET alone. [114].



anastrozole

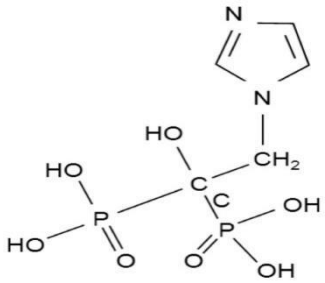
IUPAC Name - **1,3-benzodioxole-5-carbaldehyde, 2,3-dihydro-2-(4-methylphenyl)-1H-1,2,4-triazole.**

Molecular formula - **$C_{17}H_{19}N_5$**
Molecular weight - **293.37g/mol**

- **Bone health medications**

Adjuvant tamoxifen treatment reduces bone loss in postmenopausal breast cancer women, but its impact on premenopausal bone mineral density remains unknown. [115] Most respondents require bone health diagnostic tests before hormonal medication, like dual-energy X-ray absorptiometry, for prognosis, densitometry values, and reducing fracture risk, with varied responses on antiresorptive treatment management [116] Denosumab (Dmab) is an alternate treatment for women undergoing aromatase inhibitor (AI) treatment for early-stage breast cancer and metastatic illness. There are

benefits for overall survival, disease-free survival, and bone-metastasis-free living, and it lowers fractures. Osteoporosis patients may experience a "rebound" increase in bone resorption after Dmab removal. [117] Ovarian function suppression combined with tamoxifen or AI reduces death and recurrence in premenopausal women. Zoledronate decreases bone pain and skeletal problems by 36%. Denosumab reduces cumulative SREs by 18%. However, zoledronate does not increase survival in endocrine-sensitive prostate cancer (ESPC) and does not significantly lower SRE frequency in early treatment [118,119]



Denosumab

Molecular formula - **C6404H9912N17242O2004S50**

Molecular weight - **147 kDa**

TABLE 1: Detailed Overview of Commercial Formulations of Drugs Authorized by the USFDA for Adjuvant, Neoadjuvant, and First Line Treatment of Different Breast Cancer Types [Approval Year via General Approval of Information 1953–2023.

S. No	Drug name	Dosage forms in market	Recommended dose	Condition of breast cancer	Drug delivery type	Reference
1.	Methotrexate	i.Injection	i. 15 mg/mL)	Primary metastatic breast cancer	Combination	Accessdata, (2019)
		ii. Tablet	ii. 2.5 mg			
		iii. Topical gel	ii. 1%w/w *20g			
2.	Fluoxymesterone	i. Tablet	i.10–40 mg daily	Androgen-responsive, advanced, metastatic (skeletal) breast cancer	Single	FDA, (1959)
		ii. Tablet				
3.	Tepadina	i. Injection (iv)	0.3-0.4 mg/kg	First line andsecond line breast cancer	Combination	USP, (2012)
4.	Cyclophosphamide	i. Injection (iv)	i. 200mg	Retinoblastoma breast carcinoma	Single and combination both	FDA (2012c); FDA (2013)
		ii. Tablet	ii. 50 mg tablet.			
5.	Vinblasti	i. Injection	i. 10	Neoadjuvant, adjuvant or in	Combination	FDA (2010a); Lam

	n Sulfate	(iv) ii. Injection (iv)	mg/mL ii. 10 mg/mL	first line metastatic breast cancer		
6.	5-Fuluroura cil	i. capsule ii. Tablet iii. Injection (iv)	i. 10mg ii. 14mg iii. 600 mg/m2 intraveno usly	Adenocarcinoma of the breast cancer	Single	Rahool et al. (2021); Al-Batran et al. (2016)
7.	Methyl testostero ne	i. Injection ii. capsule	i. 1mL ii. 10–50 mg	Breast Carcinoma and Postpartum Breast Pain and Engorgement in females	Singe and combination both	Ixabepilone, (2006)
8.	Doxorubi cin	i. Injection (iv) ii. Injection (iv)	i. 10mg/5 mL ii. 2 mg/mL	Metastatic breast cancer	Single	FDA (2012a); Pearce et al. (2012)
9	Tamoxife n	i. Tablet ii. Tablet	i. 10mg per day	Estrogen receptor-positive metastatic breast cancer	Single	USP (2012); Wanget et al. (2018)
10.	Goserelin Acetate	i. Injection (iv) ii. Injection (iv)	i. 3.6 mg ii. 6.8 mg	Perimenopausal and premenopausal	Single and combination both	FDA, (2011)
11.	Paclitaxel	i. Injection (iv) ii. Injection (iv)	i. 20 mL ii. 30mL	Initial treatment for breast cancer that is triple negative	Single and combination both	FDA (1995); FDA (2011)
12.	Anastroz ole	i. soft capsule	i. 1 mg capsule once daily	Used for first line breast cancer treatment	Single	Iirola et al. (2011)

TABLE 2 List of innovative formulations being tested in clinical trials for different breast cancer situations.

S. No.	Drug	Type of novel formulation	Condition of breast cancer	NCT number	Clinical trial phase	References
1.	Cyclophosphamide (Cytoxon)	Nanoparticles	Retinoblastoma breast carcinoma	NCT00629499P	Phase II	Cho and Moniri (2016); Banu et al. (2014)., ClinicalTrial.gov
2.	Doxorubicin Hydrochloride (Rubex)	Liposome	Triple negative breast cancer	NCT03164993	Phase II	Wissner and Mansour (2008); Wong (2006);O'Brien (2004)., Clinical Trial.gov
		Nanoparticles		NCT03606967	Phase II	
3.	Tamoxifen (Soltamox)	Nanoparticles	Metastatic Breast Cancer	NCT04997941	Phase II	Dreaden (2009); (2014); Zhang (2019)., Clinical Trial.gov
4.	Gemcitabine Hydrochloride (Gemzar)	Nanoparticles	First line breast cancer treatment	NCT00662129	Phase Two	De Angel et al. (2013); Devi et al. (2020); Sung et al.(2021)., Clinical Trial.gov
5.	Docetaxel (Taxotere)	Nanosomal lipid suspension	First-line therapy for breast cancer that has spread	NCT03671044	Phase III	Sahu et al. (2016); Falvo et al. (2021)., ClinicalTrial.gov
6.	Transtuzumab (Herceptin)	Injectable solution	First line& Second line or Advance treatment of breast cancer	NCT01875367	Phase III	Lo et al. (2019); Yassemi et al. (2020)., ClinicalTrial.gov
7.	Ellence (Epirubin)	Nanoparticles	HR positive Metastatic breast cancer	NCT00110695	Phase II	Chang et al. (2009); Lan et al. (2018)., ClinicalTrial.gov
8.	Abraxane (Nab-Paclitaxel)	Nanoparticles for injectable suspension	First line treatment for triple negative breast cancer	NCT00251472	Phase II	Lan et al. (2018)., Clinical Trial.gov
9.	Paclitaxel (Taxol)	Nanoparticles	Locally advanced or MSBC	NCT00629499	Phase II	FDA (1995); Yang et al. (2009); Rasaneh and Zahabi (2016)., Clinical Trial.gov [120]
			Advanced or MBC			
			Advance HER-2negativeBreast cancer			

Conclusion

Given the evaluation of recent advancements under the supervision of individuals with carcinoma of the breast and the concurrent absence Of entirely satisfactory outcomes and solutions, significant progress was created to treat breast cancer. through immunotherapy, personalised therapeutics, early detection, and minimally invasive procedures. it appears that more advancements in the creation of novel cancer-fighting strategies will usher in a new era in this area. while novel medications like checkpoint inhibitors and antibody-drug conjugates increased treatment options for aggressive malignancies, improved genomic screening and targeted medicines improved therapeutic precision. improvements in radiation, chemotherapy, and hormone therapy increased survival and quality of life. additionally, survivability, long-term adverse effects, and mental health were given more attention. overall, the effectiveness, individualisation, and patient-centeredness of the treatment improved.

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