Clinical Patterns, Risk Factors, and Treatment Outcomes of Breast Cancer: A Case Study at Atal Bihari Vajpayee Regional Cancer Centre, Agartala Tripura

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Abstract

Background:
Breast cancer (BC) is the most commonly diagnosed malignancy in women worldwide, with over 2 million new cases reported in 2020. Its incidence and mortality have risen over recent decades, largely due to shifts in risk factor profiles, improved cancer registration, and advances in early detection. Risk factors are multifactorial, encompassing both modifiable and non-modifiable elements, with nearly 80% of cases occurring in women aged over 50 years. Prognosis is strongly influenced by disease stage and molecular subtype. Invasive BC represents a heterogeneous group of tumors with distinct clinical, morphological, and biological characteristics. Molecular classification, based on mRNA expression, defines subtypes such as Luminal A, Luminal B, HER2-enriched, and Basal-like, which guide therapeutic decisions and patient stratification. The eighth edition of the TNM classification integrates biological markers with anatomical staging, offering a more precise prognostic model. Management of BC is multidisciplinary, combining surgery, radiotherapy, chemotherapy, hormonal therapy, and targeted biological agents, tailored to individual patient profiles for optimal outcomes.

Objective:
To evaluate the clinical presentation, risk factors, and treatment outcomes of breast cancer patients at Atal Bihari Vajpayee Regional Cancer Centre (ABVRCC), Agartala.

Methods:
A cross-sectional, observational study was conducted over 45 days involving 100 confirmed breast cancer patients. Patient data were collected from hospital records and analyzed based on demographic profile, clinical staging, risk factors, diagnostics, and treatment modalities.

Results:
Most patients were diagnosed at Stage II (40%) and Stage III (35%). The majority were females aged 41–50 years. Major risk factors included age, obesity, family history, and betel leaf chewing. Diagnostic methods used were mammography, MRI, and biopsy. Treatments provided included surgery, chemotherapy, radiotherapy, and hormone therapy.

Conclusion:
Late-stage diagnosis remains a significant barrier to successful outcomes. Region-specific awareness and early detection programs are urgently required in line with WHO Global Breast Cancer Initiative (GBCI).

Keywords: Breast cancer, risk factors, staging, treatment, Tripura, ABVRCC, WHO GBCI

Introduction

Cancer represents a diverse group of diseases characterized by uncontrolled cell proliferation, evasion of apoptosis, tissue invasion, and metastasis to distant organs. Globally, it is one of the leading public health challenges, with rising incidence and mortality despite advances in prevention and treatment. According to the GLOBOCAN 2020 estimates, approximately 19.3 million new cancer cases and nearly 10 million cancer-related deaths occurred worldwide in that year alone, reflecting the magnitude of this disease burden [1]. Among the various malignancies, female breast cancer emerged as the most frequently diagnosed cancer in 2020, surpassing lung cancer for the first time, with an estimated 2.3 million new cases contributing 11.7% of the global cancer incidence [1].

Breast cancer is not only the most common malignancy among women but also a leading cause of cancer-related mortality, accounting for approximately 6.9% of all cancer deaths globally [1,2]. This dual burden reflects the complex nature of breast cancer, which encompasses heterogeneous tumor biology, variable clinical behavior, and diverse responses to treatment. While advances in early detection through mammographic screening and improvements in systemic therapy have markedly improved outcomes in high-income countries, disparities persist across regions [3]. For instance, survival rates exceed 80–85% in North America, Western Europe, and parts of East Asia, while they remain below 50% in many low- and middle-income countries, including India [4]. These inequalities are driven by a combination of delayed diagnosis, limited access to quality care, sociocultural barriers, and economic constraints.

Advances and evolving challenges in breast cancer management

The past two decades have witnessed significant progress in understanding the molecular basis of breast cancer. Classification based on hormone receptor (estrogen and progesterone) and HER2 status, and more recently, intrinsic molecular subtypes (luminal A, luminal B, HER2-enriched, triple-negative), has revolutionized both prognosis and treatment [5]. Targeted therapies such as trastuzumab for HER2-positive disease and CDK4/6 inhibitors for hormone receptor–positive breast cancer have improved survival outcomes. Immunotherapy has also shown promising results in subsets of triple-negative breast cancer [6].

Despite these advances, challenges remain, particularly in low-resource settings. Limited availability of advanced diagnostics, high treatment costs, and inadequate healthcare infrastructure contribute to suboptimal implementation of modern therapies [7]. Moreover, in

countries like India, patients often present at advanced stages due to lack of awareness, absence of organized screening programs, and sociocultural factors including stigma and fear [8].

Breast cancer in India

India is undergoing an epidemiological transition, with non-communicable diseases, including cancer, emerging as major health priorities. Breast cancer has now overtaken cervical cancer as the most common cancer among Indian women [9]. According to the National Cancer Registry Programme (NCRP) report, the age-standardized incidence rate of female breast cancer in India was estimated at 32.0 per 100,000 women, while the mortality rate was 15.1 per 100,000 [10].

Projections suggest that the number of breast cancer cases in India will continue to rise due to population growth, increasing life expectancy, urbanization, and lifestyle changes such as delayed childbirth, reduced breastfeeding duration, obesity, and physical inactivity [11]. The Indian Council of Medical Research (ICMR) estimated that by 2025, India would witness over 200,000 new cases of breast cancer annually, further straining oncology services [10].

Another critical concern is the late stage at which patients present for treatment. Studies indicate that nearly 50–60% of breast cancer cases in India are diagnosed at stage III or IV, significantly reducing the likelihood of long-term survival [12]. This contrasts with Western countries where early detection strategies have shifted most diagnoses to stage I or II. The 5-year survival rate for breast cancer in India is estimated at around 60%, compared to 80–90% in developed nations [13]. This survival gap underscores the urgent need for region-specific interventions in awareness, screening, and timely management.

Breast cancer in Northeast India

The epidemiology of breast cancer in Northeast India presents unique characteristics. Data from Population-Based Cancer Registries (PBCRs) under the NCRP reveal significant geographic variations. While states like Mizoram and Meghalaya have relatively higher incidence rates for certain cancers such as stomach, esophagus, and nasopharynx, the burden of breast cancer, though lower compared to metropolitan cities, is steadily increasing [14]. In Tripura, the age-adjusted incidence rate for female breast cancer has been reported at approximately 8.5 per 100,000, which is lower than the national average but still represents a major concern given the healthcare limitations in the region [15].

The Northeast region faces additional challenges including geographical isolation, inadequate healthcare infrastructure, shortage of trained oncology professionals, and socioeconomic disparities. These factors often lead to delayed diagnosis and suboptimal treatment adherence. Furthermore, cultural beliefs, stigma, and reliance on traditional healing practices may hinder timely access to modern cancer care [16].

The role of ABVRCC, Agartala

The Atal Bihari Vajpayee Regional Cancer Centre (ABVRCC), located in Agartala, Tripura, serves as a major referral center for cancer diagnosis and treatment in the region. It caters not

only to patients from Tripura but also to neighboring states and cross-border populations from Bangladesh. Despite its central role, there is limited published literature documenting the clinical characteristics, risk factors, and treatment outcomes of breast cancer patients managed at ABVRCC. Such data are critical for designing region-specific cancer control strategies, optimizing resource allocation, and improving patient care outcomes.

Rationale for the present study

While national-level data on breast cancer incidence and mortality are available through ICMR-NCDIR, there is a paucity of studies focusing specifically on the Northeast and, in particular, Tripura. Given the distinct demographic, socioeconomic, and cultural context of this region, extrapolating findings from metropolitan or pan-Indian studies may not fully capture local realities. Therefore, this study aims to systematically evaluate the clinical presentation, associated risk factors, and treatment outcomes of breast cancer patients treated at ABVRCC, Agartala.

By bridging this knowledge gap, the findings will provide evidence to inform awareness campaigns, early detection initiatives, and region-appropriate management strategies. Ultimately, this research seeks to contribute toward reducing disparities in breast cancer outcomes and strengthening cancer control efforts in Northeast India.

Methodology

Study Design

This was a **cross-sectional observational study** conducted to evaluate the demographic characteristics, risk factors, diagnostic approaches, and treatment patterns among breast cancer patients.

Study Setting and Duration

The study was carried out at the **Atal Bihari Vajpayee Regional Cancer Centre (ABVRCC), Agartala, West Tripura**, over a period of **45 days (December 2024 – January 2025)**.

Study Population and Sample Size

A total of **100 patients** with confirmed breast cancer were included in the study. The sample was selected based on predefined inclusion and exclusion criteria to ensure reliability and representativeness.

Inclusion Criteria

- Female patients with a histopathologically confirmed diagnosis of breast cancer.
- Patients undergoing treatment or follow-up at ABVRCC during the study period.
- Availability of complete medical records.

Exclusion Criteria

- Patients with incomplete or missing medical records.
- Patients unwilling to provide informed consent.
- Male patients were excluded due to very low representation.

Data Collection

Data were obtained retrospectively from patient case files and medical records. A structured proforma was used to capture relevant details including:

- **Demographic characteristics:** Age, gender, body weight.
- **Clinical data:** Stage at diagnosis, tumor receptor status (ER, PR, HER2), comorbidities.
- **Family history:** Presence of breast cancer or other malignancies in first-degree relatives.
- **Lifestyle and social history:** Betel leaf chewing, smoking, alcohol consumption, and other relevant habits.
- **Diagnostic methods:** Mammography, ultrasound, MRI, and histopathological biopsy.
- **Treatment modalities:** Surgical procedures (mastectomy, breast-conserving surgery), chemotherapy (adjuvant/neoadjuvant), radiotherapy, hormone therapy, and targeted therapy (e.g., trastuzumab).

Data Analysis

The collected data were compiled and analyzed using **descriptive statistical methods**. Frequencies and percentages were calculated for categorical variables, while graphical representation (pie charts and bar diagrams) was used to illustrate the distribution of age groups, stage of diagnosis, and lifestyle risk factors.

Ethical Considerations

Ethical clearance was obtained from the **Institutional Ethics Committee of ABVRCC, Agartala** prior to initiation of the study. Confidentiality of patient records was strictly maintained, and data were anonymized to protect patient identity. Informed consent was obtained from all participants included in the study.

Results

Weight-wise Distribution

A total of 100 breast cancer patients enrolled at ABVR Cancer Centre, Agartala, were analyzed for weight-wise distribution. The patients were divided into five categories based on body weight. The distribution was as follows: 31–40 kg (15%), 41–50 kg (35%), 51–60 kg (25%), 61–70 kg (14%), and 71–80 kg (11%). The majority of patients belonged to the **41–50 kg group (35%)**, followed by the 51–60 kg group (25%). These findings indicate that a significant

proportion of patients were within the middle weight categories, suggesting a possible association between body weight and breast cancer prevalence. The findings are depicted by a pie chart in Figure 1.

Table no. 1: Showing Weight-wise Distribution

Weight Range	Number of patients	% of patients
31-40	15	15
41-50	35	35
51-60	25	25
61-70	14	14
71-80	11	11

Gender-wise Distribution

A total of 100 breast cancer patients enrolled at ABVR Cancer Centre, Agartala, were analyzed for gender-wise distribution. The study population was divided into two groups: **female patients (96%)** and **male patients (4%)**. As expected, the majority of cases were observed in females, reaffirming the well-established fact that breast cancer predominantly affects women, while male breast cancer remains relatively rare but clinically significant. The findings are depicted by a pie chart in Figure 2.

Table no. 2: Showing Gender-wise Distribution

Gender	Number of patients	% of patients
Male	4	4
Female	96	96

Age-wise Distribution

A total of 100 breast cancer patients enrolled at ABVR Cancer Centre, Agartala, were analyzed for age-wise distribution. The patients were categorized into seven age groups. The distribution was as follows: **21–30 years (2%), 31–40 years (24%), 41–50 years (47%), 51–60 years (12%), 61–70 years (9%), 71–80 years (5%), and 81–90 years (1%)**. The **41–50 years group (47%)** constituted the largest proportion, indicating that middle-aged women represented the highest risk category in this study population. The findings are depicted by a pie chart in Figure 3.

Table no. 3: Showing Age-wise Distribution

Age Range	Number of patients	% of patients
21-30	2	2
31-40	24	24
41-50	47	47
51-60	12	12
61-70	9	9
71-80	5	5
81-90	1	1

Social History Distribution

A total of 100 breast cancer patients at ABVR Cancer Centre, Agartala, were analyzed for social history. The study population was categorized into four groups based on lifestyle habits. The distribution was as follows: betel leaf (paan) chewing (67%), alcohol consumption (13%), smoking (7%), and others (13%). The majority of participants reported betel leaf consumption (67%), highlighting it as the most prevalent lifestyle factor among the study cohort. The findings are depicted by a pie chart in Figure 4.

Table no. 4: Showing Social History Distribution

Social History	Number of patients	% of patients
Betel leaf	67	67
Alcohol	13	13
Smoking	7	7
Others	13	13

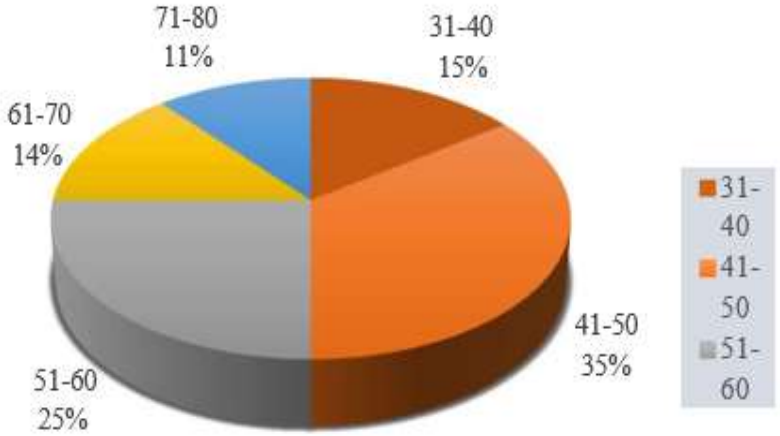

Figure 1: Pie Chart Representing Weight Wise Distribution of Patients

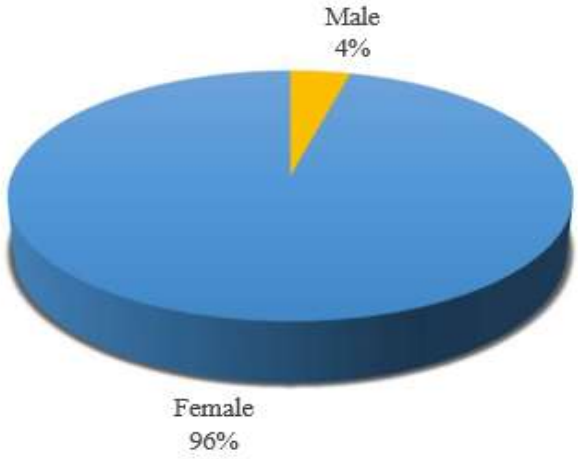

Figure 2: Pie Chart Representing Gender-wise Distribution of Patients

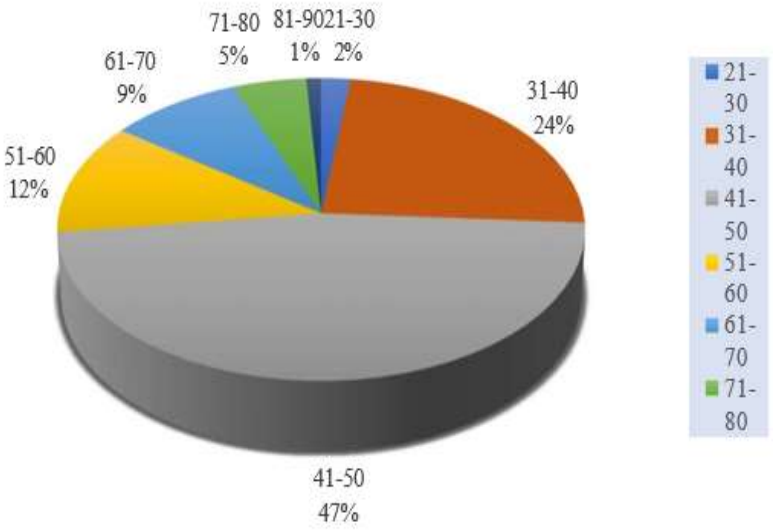

Figure 3: Pie Chart Representing Age-wise Distribution of Patients

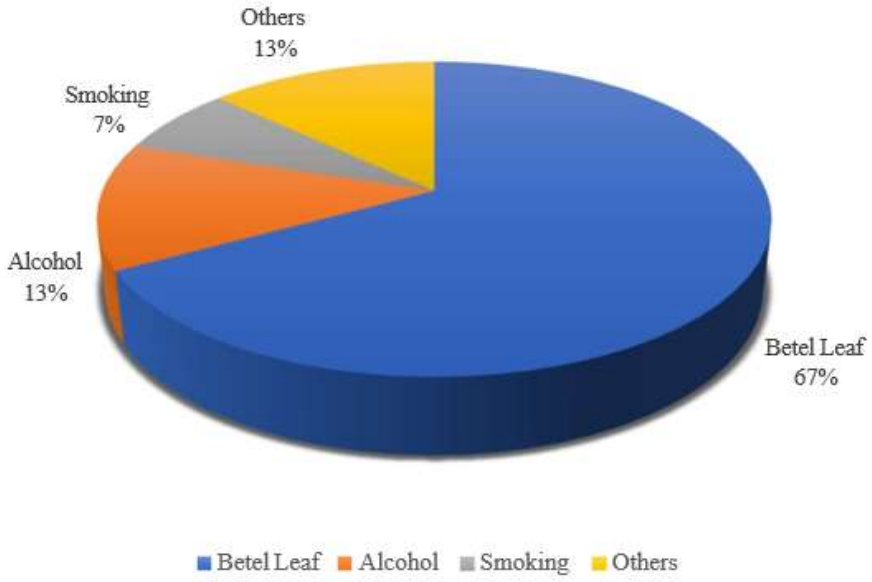

Figure 4: Pie Chart Representing Social History of Patients

Discussion

The present study conducted at Atal Bihari Vajpayee Regional Cancer Centre (ABVRCC), Agartala, aimed to assess the impact of clinical pharmacist involvement in the management of breast cancer patients, while also exploring the association of demographic, lifestyle, and clinical factors with disease progression and treatment outcomes. The findings highlight several critical observations that are consistent with national and global trends but also reflect region-specific challenges in cancer care.

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Social habits such as betel leaf chewing, smoking, and alcohol consumption were identified as contributory risk factors in this population. While these habits are more commonly associated with oral and gastrointestinal cancers, their role in systemic inflammation,

immunosuppression, and delay in timely medical intervention cannot be overlooked. Notably, 67% of patients reported betel leaf chewing, highlighting a culturally rooted behavior in the region that may indirectly influence cancer outcomes. This emphasizes the need for culturally sensitive public health campaigns that target modifiable lifestyle factors(18)

The study also demonstrated that the majority of patients presented at stage II or III, with only a small proportion diagnosed at an early stage. This delayed presentation is attributable to lack of awareness, absence of organized screening programs, and reliance on incidental findings during routine health camps(19). Such delays have been documented in other low- and middle-income regions, where limited access to diagnostic facilities and sociocultural barriers hinder early detection. Implementation of community-based screening strategies, mobile mammography units, and training in breast self-examination could address this gap (20).

Treatment approaches in this study were broadly consistent with global standards, including surgery, chemotherapy, radiotherapy, and targeted therapy. However, financial constraints limited access to advanced therapies such as trastuzumab in HER2-positive patients, reflecting disparities in healthcare access. This economic limitation remains a major challenge in resource-constrained settings and warrants government-supported cancer care financing to ensure equitable access to life-saving therapies. The role of the clinical pharmacist was particularly valuable in optimizing chemotherapy regimens, monitoring adverse drug reactions, counseling patients, and ensuring adherence to long-term endocrine therapy, thereby enhancing the overall quality of care(21).

The results also parallel ongoing global research efforts. For example, studies under the NCI-supported Breast SPOREs and TMIST trials emphasize the importance of advancing diagnostic technologies and personalized therapy, while novel agents such as PI3K and AKT inhibitors show promise in overcoming drug resistance in advanced breast cancer. Although such therapies remain largely inaccessible in developing countries, our findings highlight the need to strengthen local healthcare systems, integrate clinical pharmacists in multidisciplinary teams, and develop breast cancer registries for data-driven decision-making (22).

The public perception survey further reinforced gaps in awareness, with 50% of respondents unfamiliar with breast self-examination and 70% identifying lack of awareness as the primary barrier to screening. These results indicate that community-based awareness drives, integration of breast health education into school curricula, and leveraging social media platforms could play a pivotal role in improving health-seeking behavior.

Overall, this study contributes valuable insights into the interplay of clinical, social, and economic factors influencing breast cancer outcomes in Tripura. The findings advocate for a multi-pronged approach—comprising early detection, lifestyle modification, genetic risk assessment, improved access to advanced therapies, and pharmacist-led interventions—to reduce breast cancer burden and improve survival outcomes (23).

Conclusion

In this review, we aimed to summarize and update the current knowledge on breast cancer, with emphasis on its epidemiology, risk factors, classification, prognostic biomarkers, and available treatment strategies. As both morbidity and mortality rates have significantly increased over recent decades, it is crucial to strengthen prevention strategies, particularly by

addressing modifiable risk factors that may reduce the incidence of breast cancer. Currently, mammography and sonography remain the most widely used screening tools, enabling relatively early detection. Meanwhile, the ongoing identification of prognostic biomarkers and therapeutic targets has substantially improved patient management and clinical outcomes.

In advanced breast cancer, determining the best endpoints to evaluate therapies remains a matter of debate. Incorporating patient-reported outcome measures and dedicated quality-of-life tools for metastatic disease is urgently required. Tumor resistance continues to be a major challenge, underscoring the need for ongoing disease monitoring and adaptation of treatment strategies. While repeated tissue biopsies are often impractical, emerging technologies such as liquid biopsies, functional imaging, and nanotechnology hold promise for real-time monitoring of tumor biology. Advances in next-generation sequencing and research into metastatic tropism may further enhance personalized treatment approaches in the future.

Despite scientific progress, improving outcomes for patients with advanced breast cancer requires not only novel therapeutic targets but also a deeper understanding of patient needs and stronger advocacy. The establishment of initiatives such as the ABC Global Alliance reflects a growing commitment to improving survival, quality of life, access to multidisciplinary care, supportive measures, and financial and social support. The ABC Charter underscores that collaborative efforts among all stakeholders are essential to extend survival, enhance quality of life, and ultimately strive toward the possibility of cure.

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