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(RESEARCH ARTICLE)

Age-related prevalence of breast cancer in Benghazi, Libya

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Abstract

Breast cancer is the leading cause of cancer-related death among women. While incidence and mortality rates have been declining in high-resource countries, they continue to rise in low-resource settings. This trend is largely attributed to differences in risk factors, early detection, and access to treatment. Risk factors for breast cancer include increasing age, genetic and reproductive history, hormone usage, lifestyle factors, and body weight. This study identifies that women aged 45 to 54 are most at risk of breast cancer diagnosis.

Materials and Methods: This retrospective, cross-sectional study was conducted at the National Center for Tumors in Benghazi, Libya, covering cases from January 2022 to August 2024. Data analysis, including graphical representation and pie charts, was performed using Microsoft Excel 2016.

Results: A total of 535 cases were collected, with 99% involving female patients and 1% male patients. The majority of records were collected in 2023. The average age of patients in 2024 was 58 years (SD = 18.6), with an age range of 18 to 94 years. The highest incidence was observed in the 45-54 age group, with 161 cases reported.

Conclusion: The study investigates breast cancer trends in Libya, revealing a significant incidence among women aged 45 and older, it highlights challenges such as advanced-stage diagnoses due to socio-cultural barriers, lack of awareness, and limited screening access. The study advocates for targeted public health interventions, effective screening programs, and increased awareness to improve early detection and outcomes.

Keywords: Breast cancer; Libya; Age-related; National Center for Tumors

1. Introduction

Breast cancer is a major **global health** challenge and the leading cause of cancer-related mortality among women worldwide. According to the World Health Organization (WHO). 2.3 million women had a breast cancer diagnosis in 2022, and 670,000 people died from the disease worldwide. In any nation on earth, breast cancer can strike women at any age after puberty, though its incidence rises with age [1]. In Africa and many low- and middle-income countries (LMICs) a number of issues, such as inadequate health infrastructure, incomplete vital registrations, a lack of population awareness, delayed health seeking behavior, and low levels of female empowerment and education, have contributed to a high breast cancer mortality rate [2]. Studies indicate that breast cancer in Libya is typically diagnosed at advanced stages, which may be due to limited access to screening facilities and low levels of public awareness. Diagnosis delays in Libya significantly contribute to advanced-stage breast cancer cases. These delays stem from multiple factors and highlight the need for increased breast cancer awareness, better training for general practitioners, and treatment

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guidelines focused on early detection and management. Enhanced guidelines for best practices in tumor detection could help reduce breast cancer mortality [3]. Breast cancer rates in in the Middle East and North Africa (MENA) have risen significantly over the past 30 years, though death rates and years lost have stayed about the same. Preventive programs focusing on major risk factors are needed in the region [4]. Age is one of the most significant risk factors in the development of breast cancer, with the incidence rising notably in women aged 50 and above. Breast cancer is a common diagnosis in women under 40, with poorer survival outcomes. As the incidence of young onset BC increases globally, it's crucial to address modifiable risk factors, such as physical activity and alcohol habits. Healthcare professionals should assess BC inherent and familial risk, discuss modifiable factors, and provide personalized advice to young women to minimize their personal BC risk [5]. As people age, their breast cancer biology changes in a number of ways [6]. Older age is linked to less high-grade cancers in terms of histological characteristics [7]. Additionally, invasive ductal carcinoma (IDC), which makes up 70% of breast cancers, is linked to lower proportions than invasive lobular carcinomas (ILC), which make up 15%, and mucinous carcinomas, which make up 1% [7]. Because hormonally focused treatments have been used to improve prognostic variables, aging is also linked to increased expression of the estrogen receptor (ER) and progesterone receptor (PR) [8]. On the other hand, HER2 positive declines with age [9]. HER2+ cancers react to anti-HER2 treatments like transtuzumab, despite being linked to aggressive behavior [10]. Regarding tumor driver mutations, mutant TP53, AKT1, GATA3, and MAP2K4 were less common as people aged [11]. However, other driver mutations, including those for PIK3CA, MLL3, CDH1, and MAP3K1, were more common in older people [11]. According to molecular markers used to identify subtypes of breast cancer, women 70 years of age or older are more likely than younger women to have luminal A and B tumors (both ER positive, but with a low differentiation grade for luminal A and a high grade for luminal B [12].

Age causes a modest decrease in the HER2-erniched subtype (regardless of ER status) [13]. There is evidence of an age-related decline in the basal-like signature (ER-negative, PR-negative, HER2-negative) [13]. Regarding immune-related alterations, age-dependent modifications in local and systemic tumor immunity have been documented; however, more investigation is necessary in various subtypes of breast cancer [6].

Increases in stromal tumor-infiltrating lymphocytes have been linked to improved overall survival for both HER2-positive and triple-negative breast cancers, as well as a response to neoadjuvant treatment in both molecular subtypes [14]. The percentage of tumor-infiltrating lymphocytes decline with age in both breast cancer patients and the general population [14]. Age-related declines in the number of lymphocytes infiltrating luminal B malignancies have been shown, together with changes in the immune system (decreased densities of CD3+, CD5+, and particularly the cytotoxic CD8+ cells) [15]. While it is known that younger women in Libya often present with aggressive tumor types such as triple-negative breast cancer, the biological underpinnings specific to this demographic in Libya are not well-explored in the literature [16]. Understanding these mechanisms could lead to improved diagnostic and therapeutic strategies [17]. There are significant delays in diagnosis linked to socio-cultural and healthcare barriers, contributing to the late-stage detection of breast cancer. Specific studies point out a need for better awareness and screening practices [18].

1.1. Aim of the study

This study aims to investigate age-specific patterns of breast cancer incidence and characteristics in Libya, highlighting the role of socioeconomic and healthcare disparities in diagnosis and treatment. By examining these trends, it seeks to provide critical insights for developing targeted, age-specific screening and prevention strategies. The findings aim to inform healthcare policies that improve early detection and reduce the breast cancer burden in the country.

2. Materials and Method

2.1. Study Design

This retrospective cross-sectional study was conducted in the Oncology Department at the National Center for Tumors, Benghazi, Libya, spanning from January 2022 to August 2024.

2.1.1. Statistical Analysis

Data were analyzed using Microsoft Excel 2016. Descriptive statistics, including graphical representations such as pie charts and bar graphs, were employed to summarize and visualize the findings.

2.2. Ethical Approval

The study protocol was reviewed and approved by the Biomedical Regional Ethics Committee. All procedures were conducted in adherence to ethical guidelines, and written informed consent was obtained from all participants prior to their inclusion in the study.

3. Results

A total of 535 patient samples were analyzed, with 99% of the cohort comprising females and 1% males (Figure 1). The distribution of patients by year of diagnosis is illustrated in Figure 2, covering the period from January 2022 to August 2024. The majority of cases were recorded in 2023, while data for 2024 included only the first six months.
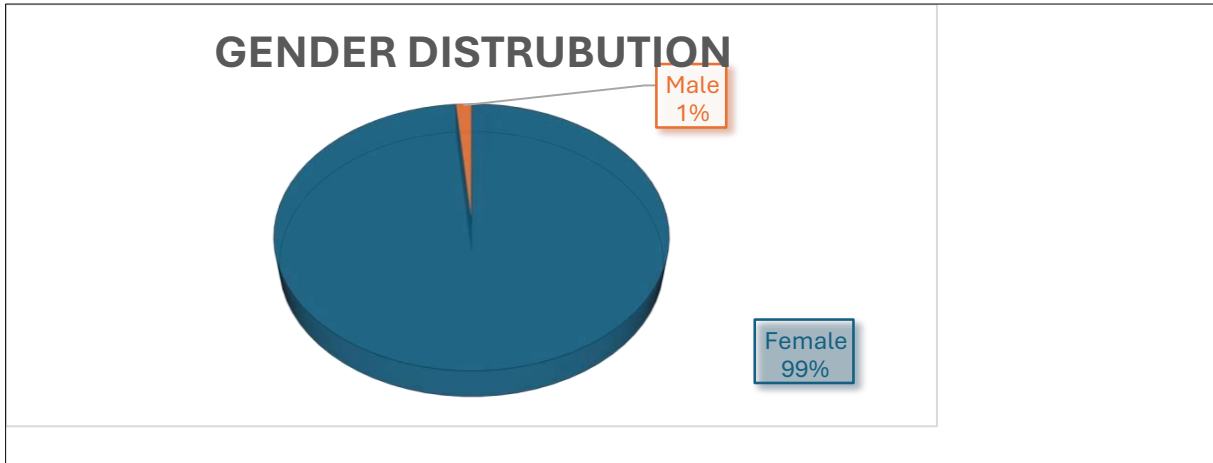

Figure 1 Distribution of patients according to Gender
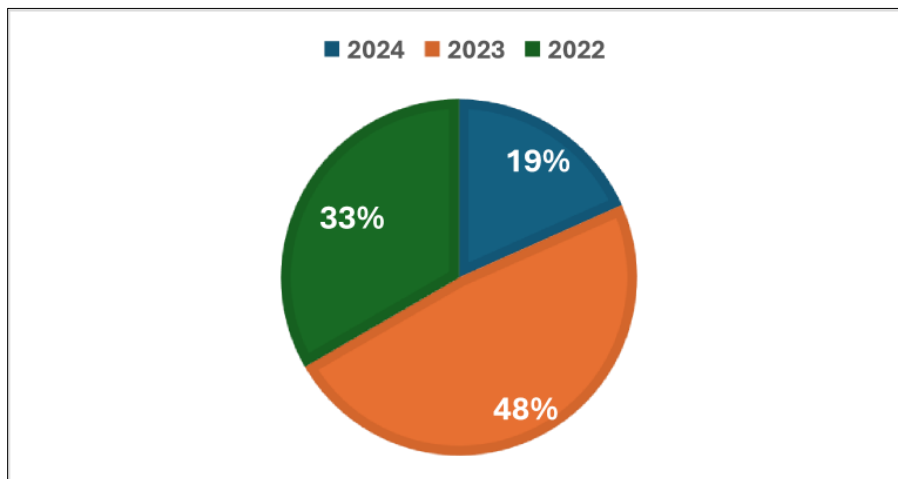

Figure 2 The distribution of the patients by year of diagnosis

The average age of cases recorded in the archive was 58 years, with a standard deviation of 18.6 years. The age range spanned from 18 to 94 years. The highest frequency of cases (161) was observed in the 45–54 age group. The age distribution is illustrated in Figure 3.
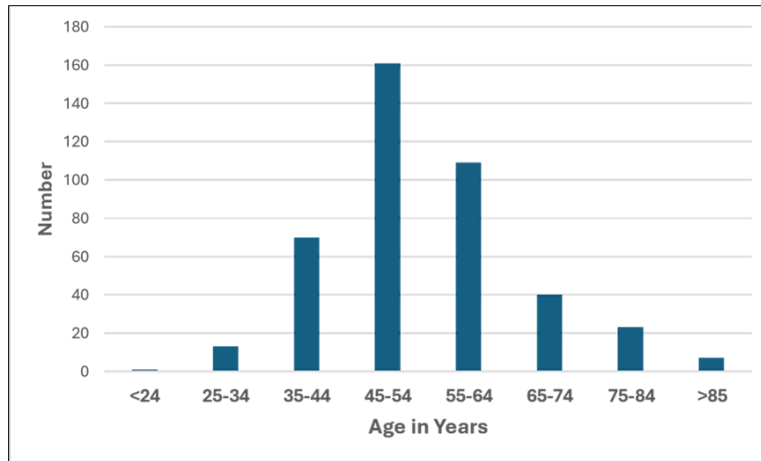
Figure 3 Distribution of patients according to age groups in years

The majority of patients (approximately 350 cases) originated from Benghazi, followed by over 40 cases from Baida City, located east of Benghazi. Ejdabya and Tobruk each contributed 34 cases, while Derna and El Marj accounted for 28 and 27 cases, respectively. Sirt reported 10 cases, Elkofra 9 cases, and Tripoli 8 cases. Other cities collectively accounted for only 1 case (Figure 4). Figure 5 highlights the patients' nationalities, with the vast majority being Libyan (97%). Other nationalities included individuals from Egypt, Palestine, Sudan, Ukraine, and Syria.
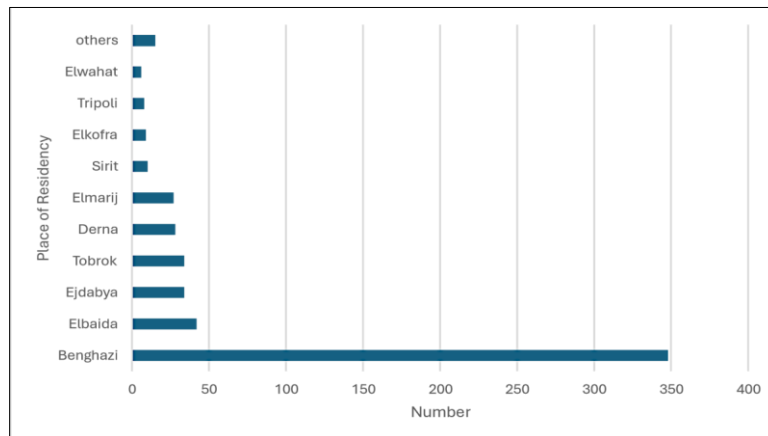
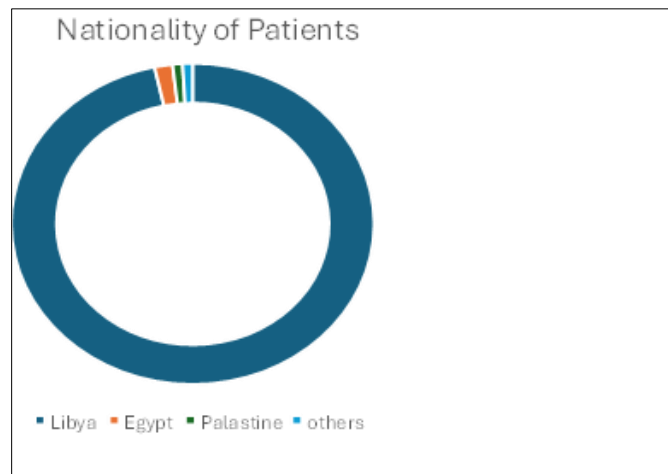

Figure 4 Geographical distribution of patients per city

Figure 5 Distribution of patients according to Nationality

4. Discussion

This study revealed a significant correlation between breast cancer incidence and age, with the highest prevalence observed in the 45–54 age group, accounting for approximately 161 out of 535 cases reported between 2022 and 2024 in Benghazi. Notably, only 1% of cases were male, underscoring the importance of early screening and targeted interventions for high-risk populations. These findings align with the global trends outlined by the World Health Organization, which highlight age as a pivotal determinant in breast cancer incidence. Breast cancer remains a multifaceted public health challenge, characterized by significant variability in its epidemiology, clinical presentation, and outcomes across different populations and age groups. The global burden of breast cancer, as indicated by WHO's 2022 statistics of 2.3 million cases and 670,000 deaths, underscores its prominence as a leading cause of cancer-related mortality among women. This universal burden reflects both shared and region-specific risk factors, with age being a central influence. While breast cancer can affect women of all ages, its incidence increases notably post-puberty and peaks in women over 50 years old, aligning with the biological and hormonal changes associated with aging [1]. In low- and middle-income countries (LMICs), particularly in Africa, the high mortality rates from breast cancer are exacerbated by inadequate healthcare infrastructure, limited access to screening, and socio-cultural barriers. In Libya, delayed diagnosis due to factors such as insufficient awareness, limited health resources, and cultural stigma often leads to advanced-stage detection. These delays highlight the critical need for targeted public health interventions, including awareness campaigns, training programs for healthcare providers, and the establishment of robust screening and treatment protocols [2][3]. The Middle East and North Africa (MENA) region has seen a significant increase in breast cancer incidence over the past three decades, although mortality rates have remained relatively stable. This trend underscores the need for preventive programs targeting modifiable risk factors such as physical inactivity and alcohol consumption. Young-onset breast cancer (under 40 years) is particularly concerning due to its association with aggressive tumor behavior and poorer survival outcomes. As the prevalence of breast cancer rises among younger women, a focused approach involving risk assessment, lifestyle modification, and familial predisposition evaluation is imperative [4][5].

Age-related biological changes in breast cancer further complicate its clinical management. Older women are more likely to have hormonally driven tumors, with increased expression of estrogen (ER) and progesterone receptors (PR), which generally confer a favorable prognosis. Conversely, younger patients often present with triple-negative breast cancer (TNBC), a more aggressive subtype with limited targeted treatment options. Additionally, the decline in HER2-positive tumors with age affects therapeutic approaches, as HER2-directed therapies such as trastuzumab play a vital role in managing this subtype [6][7][8][9].

Tumor biology also evolves with aging, marked by variations in histological subtypes and genetic mutations. Older women demonstrate higher prevalence rates of luminal A and B subtypes, characterized by hormonal receptor positivity, while younger patients more frequently present with basal-like and HER2-enriched subtypes. Molecular markers such as PIK3CA and MAP3K1 mutations are more common in older patients, whereas TP53 mutations are predominant in younger cohorts. These distinctions emphasize the necessity for age-specific molecular and genetic profiling to optimize treatment strategies [11][12].

Immune-related changes also play a significant role in age-related variations in breast cancer. Tumor-infiltrating lymphocytes (TILs), crucial for tumor immunity, show a decline with age, potentially impacting response to immunotherapy and overall prognosis. In particular, reduced cytotoxic CD8+ T-cell densities and stromal lymphocyte infiltration in older patients suggest age-specific immune modulation, necessitating further research into tailored immunotherapeutic approaches [16][17].

In Libya, the younger demographic's tendency to present with aggressive tumor types like TNBC remains poorly understood, necessitating further studies to unravel the underlying biological mechanisms. Addressing socio-cultural and healthcare barriers, including enhancing early detection and awareness initiatives, is crucial to mitigating late-stage diagnoses. A comprehensive strategy involving community education, improved healthcare infrastructure, and personalized therapeutic approaches could significantly reduce breast cancer mortality in Libya [16][17][18].

Future research should focus on understanding age- and region-specific variations in breast cancer biology to develop tailored interventions that address the unique challenges faced by populations in LMICs, including Libya. Collaborative efforts between global and regional stakeholders are essential to bridge gaps in awareness, screening, and treatment access.

5. Conclusion

This study highlights the significant age-related trends in breast cancer incidence and characteristics in Libya, underscoring the disproportionate burden among women aged 45 and older. The findings reaffirm the critical need for tailored public health interventions to address age-specific risks and barriers to early detection. While younger women in Libya often present with more aggressive tumor subtypes, the lack of biological research specific to this demographic warrant's further investigation. The advanced-stage diagnoses commonly seen in Libya reflect systemic challenges, including socio-cultural barriers, inadequate awareness, and limited access to screening facilities.

Recommendations

These findings emphasize the urgency of implementing effective screening programs and promoting breast cancer awareness, especially among high-risk age groups. Additionally, healthcare practitioners must prioritize personalized risk assessments and integrate advanced diagnostic tools to improve outcomes. Addressing the disparities in healthcare access and enhancing education about breast cancer prevention could lead to earlier diagnoses and reduced mortality rates. This study contributes valuable insights to inform policies and interventions, offering a pathway to reduce the breast cancer burden in Libya and comparable regions.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The study received approval from the Biomedical Regional Ethics Committee and was conducted according to their guidelines.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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