

Cardiovascular causes of death in breast cancer patients: analysis of the Georgia Cancer Registry (2020–2021)

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Abstract

Background: Cardiovascular disease (CVD) has emerged as a major non-cancer cause of mortality among breast cancer (BC) patients, driven by shared risk factors and cardiotoxic effects of anticancer therapies.

Aim: To evaluate cardiovascular causes of death among breast cancer patients who underwent anticancer treatment using data from the Georgia Cancer Registry

Methods: A retrospective analysis was conducted on 522 deceased BC patients recorded between January 1, 2020, and January 1, 2021. Among them, 344 (65.9%) had received anticancer therapy. Cardiovascular causes of death and contributing conditions were analyzed by age group. Proportions were compared using Pearson's chi-square test.

Results: Cardiovascular causes accounted for 15.1% of deaths among treated patients. Ischemic heart disease was the leading cause (36.5%), followed by cerebrovascular events (19.2%) and pulmonary embolism (11.5%). Heart failure (HF) was identified in 6.7% of patients, including unspecified HF (1.5%). Additional contributing conditions included, hypertension (9 cases, 2.6%), valvular disease (3 cases, 0.9%), and atrial fibrillation (2 cases, 0.6%). The highest proportion of cardiovascular deaths occurred in patients aged 25–49 years (24.3%), although differences were not statistically significant ($p > 0.05$). Cardio-toxicity-related cardiomyopathy (ICD-10 I42.7) was not reported.

Conclusions: CVD constitutes a significant cause of mortality among breast cancer patients in Georgia. The absence of documented cardiotoxic cardiomyopathy suggests underdiagnosis, emphasizing the need for improved cardio-oncology integration.

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Keywords: Cardiovascular Causes of Death, Breast Cancer, Anti-Cancer Therapy-related Cardiotoxicity.

Introduction

Breast cancer (BC) remains the most frequently diagnosed malignancy among women worldwide and a leading cause of cancer-related mortality [1]. Advances in early detection and treatment have substantially improved survival outcomes; however, long-term complications, particularly cardiovascular disease (CVD), have emerged as major determinants of prognosis in survivorship.

Cardiovascular disease is increasingly recognized as a competing cause of death in breast cancer patients [2]. This relationship is multifactorial, involving shared risk factors and treatment-related cardiotoxicity [3]. Recent evidence highlights a bidirectional interaction between cancer and cardiovascular disease, further complicating patient outcomes and long-term management [10].

Anticancer therapies—including anthracyclines, HER2-targeted agents, endocrine therapies, and thoracic radiotherapy—are associated with a spectrum of cardiovascular complications such as cardiomyopathy, heart failure, ischemic heart disease, arrhythmias, and thromboembolic events [4,5]. These effects may manifest both acutely and years after treatment completion.

Despite the growing importance of cardio-oncology, data from low- and middle-income settings remain limited. Furthermore, global reports emphasize the need for improved prevention and early detection strategies to mitigate cardiovascular risk in breast cancer populations [12].

This study aimed to evaluate cardiovascular causes of death among breast cancer patients undergoing anticancer treatment using data from the Georgia Cancer Registry.

Methods

A retrospective population-based study was conducted using data from the Georgia Cancer Registry. The registry includes nationwide data on cancer incidence and mortality.

A total of 522 deceased breast cancer patients recorded between January 1, 2020, and January 1, 2021 were identified. Among them, 344 (65.9%) patients who received anticancer treatment (Chemotherapy, Hormone therapy, Radiotherapy, Combined treatment) were included in the primary analysis.

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The primary outcome was cardiovascular disease as the underlying cause of death. Secondary outcomes included: Specific cardiovascular diagnoses, contributing cardiovascular conditions, and age-stratified mortality patterns. Classification was based on ICD-10 codes. Statistical Analysis: Descriptive statistics were used. Pearson's chi-square test assessed differences between age groups. Statistical significance was set at $p < 0.05$.

Results and discussion

Among treated patients, 52 deaths (15.1%) were attributed to cardiovascular causes. Ischemic heart disease was the leading cardiovascular cause of death (19 cases, 36.5%) in treated patients, followed by cerebrovascular events (10 cases, 19.2%) and pulmonary embolism (6 cases, 11.5%), dilated cardiomyopathy (2 cases, 3.8%), Heart failure (HF) was diagnosed in 23 patients (6.7%), including: unspecified heart failure: 5 cases (1.5%). (Figure 1). Additional contributing conditions included hypertension (9 cases, 2.6%), valvular disease (3 cases, 0.9%), and atrial fibrillation (2 cases, 0.6%).

The highest proportion of CVD deaths occurred in patients aged 25–49 years (24.3%), followed by older age groups (50–70 years: 14.1%; >70 years: 13.9%). Differences were not statistically significant ($p > 0.05$) (Figure 2). Notable observation: Cardiotoxicity-related cardiomyopathy (ICD-

This population-based study provides important real-world evidence on cardiovascular mortality among breast cancer patients in Georgia, demonstrating that cardiovascular disease accounts for a substantial proportion (15.1%) of deaths among patients who received anticancer treatment. These findings are consistent with global evidence indicating that CVD is a leading non-cancer cause of death among breast cancer survivors [2,6,9,11].

Ischemic heart disease was identified as the predominant cardiovascular cause of death, consistent with previous studies linking radiotherapy and systemic therapy to accelerated atherosclerosis and coronary artery disease [5]. The presence of cerebrovascular events and pulmonary embolism further underscores the complex interplay between cancer-associated hypercoagulability and treatment-related vascular toxicity.

Heart failure was frequently observed, supporting existing evidence that cardiotoxicity is a major complication of breast cancer therapy. Contemporary literature confirms that treatment-related cardiotoxicity significantly contributes to heart failure burden in this population [8]. However, the absence of reported cardiotoxicity-related cardiomyopathy is a critical finding. Given the established association between anticancer therapies and cardiomyopathy, this likely reflects underdiagnosis or mis-

classification rather than a true absence of disease [4,7].

Potential explanations include limited access to advanced cardiac diagnostics, insufficient integration of cardiology and oncology services, and inaccuracies in cause-of-death coding. This gap has important clinical implications, as failure to recognize cardiotoxicity may lead to delayed intervention and suboptimal management.

The observed higher proportion of cardiovascular mortality among younger patients, although not statistically significant, raises additional concerns. Younger patients may be exposed to more intensive treatment regimens, increasing their risk of treatment-related cardiotoxicity. This finding highlights the need for cardiovascular risk assessment and surveillance across all age groups, including younger populations traditionally considered low risk.

From a healthcare systems perspective, these findings emphasize the need to strengthen cardio-oncology services in Georgia. Implementation of standardized screening protocols, improved diagnostic capabilities, regular monitoring during therapy, and long-term follow-up after treatment completion. The implementation of standardized protocols for cardiotoxicity surveillance, including the use of biomarkers and imaging, could significantly improve early detection and outcomes.

Furthermore, improving the accuracy of registry data is critical. Enhanced training in ICD coding, incorporation of more detailed clinical data, and linkage between oncology and cardiology records could help address the apparent underreporting of cardiotoxicity-related conditions. Reliable data are essential not only for epidemiological surveillance but also for informing health policy and resource allocation.

Limitations

This study has several limitations. As a retrospective registry-based analysis, it is subject to potential misclassification and incomplete data. Information on specific chemotherapy agents, radiation doses, and duration of treatment was not available, limiting the ability to assess treatment-specific risks. Additionally, comorbidities and lifestyle factors were not comprehensively captured, which may confound the observed associations.

Conclusion

Cardiovascular disease is a significant cause of death among breast cancer patients undergoing anticancer treatment in Georgia. The findings highlight ischemic heart disease and heart failure as key contributors to mortality. The absence of reported cardiotoxic cardiomyopathy suggests underrecognition, emphasizing the need for improved diagnostic accuracy and integration of cardio-oncology care.

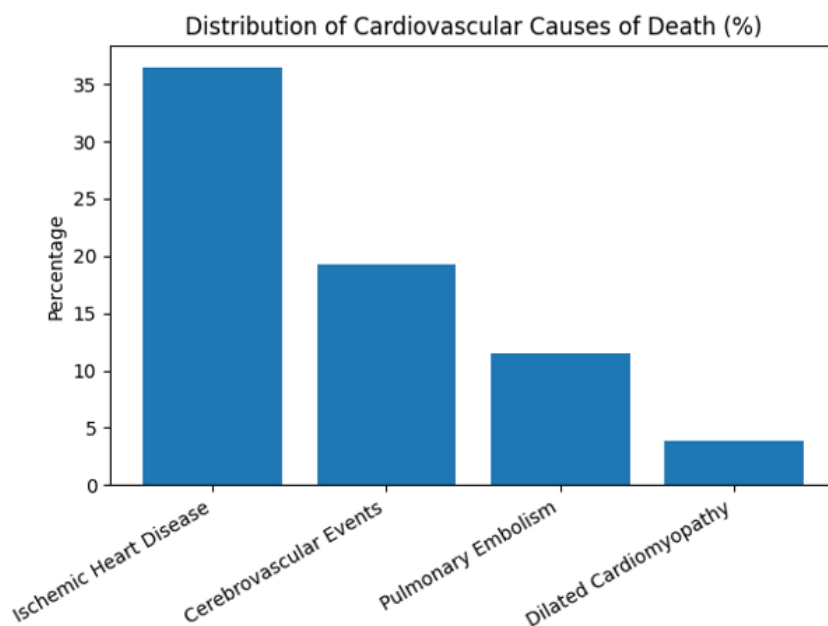


Figure 1. Distribution of cardiovascular causes of death among treated breast cancer patients

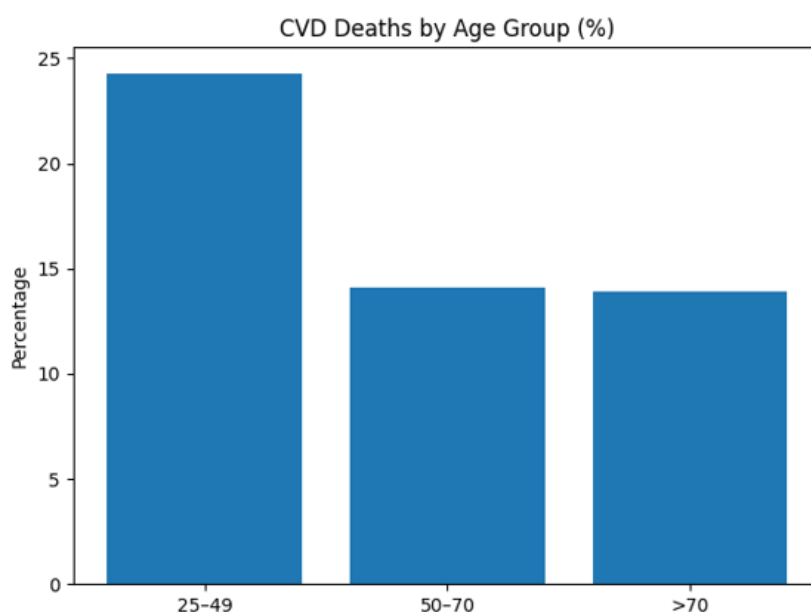


Figure 2. Proportion of cardiovascular deaths stratified by age group

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