Original Article

Prevalence and Risk Factors of Cardiotoxicity in Elderly Cancer Patients

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Abstract

Background: Cancer and heart disease are the leading causes of death in older adults. Cardiotoxicity of anticancer agents may lead to under-treatment of elderly patients, resulting in suboptimal outcomes.

Aim: To determine the prevalence and risk factors of cardiotoxicity in elderly patients with cancer.

Patients and Methods: The study sample included one hundred (100) elderly subjects, both males and females, aged sixty years and above. The study participants were subjected to the following: comprehensive geriatric assessment (CGA), laboratory work-up (fasting blood glucose, lipid profile, and C-reactive protein), electrocardiography (ECG), and echocardiography (ECHO).

Results: The prevalence of cardiotoxicity (any pattern) was 57%. Patients who experienced cardiotoxicity were older, had higher smoking index, lower body mass index, and longer cancer duration. They had higher prevalence of hypertension, diabetes, and dyslipidemia and had higher mean level of C-reactive protein. Participants who had received certain chemotherapeutic agents (e.g., Anthracycline), certain targeted therapy agents (e.g., Pertuzumab); and those who received radiotherapy (delivered to the chest) were more liable for cardiotoxicity. Cardiotoxicity was associated with malnutrition, depression and functional decline of the affected patients.

Conclusion: Cardiotoxicity is common in elderly patients with cancer. It is associated with certain risk factors; such as smoking, dyslipidemia, hyperglycemia, malnutrition and certain anticancer treatments. Comprehensive geriatric assessment is essential in the management of elderly cancer patients.

Keywords: Cancer, Cardiovascular, Anticancer agents, Cardiotoxicity, Elderly.

Introduction

According to United Nations' report, the proportion of elderly individuals (65 years or older) is projected to increase from 10% in 2022 to 16% in 2050 [1]. Aging is a major risk factor for many diseases, progressive loss of resilience and age-related multiple systems homeostatic derangements [2].

Cancer stands as the leading cause of the disease burden all over the world,

accounting for about 244 million disability-adjusted life years (DALYs). This holds true for both males (137 million DALYs) and females (107 million DALYs). Following closely are coronary heart disease with around 203 million DALYs and cerebrovascular stroke with 137 million DALYs [3].

Aging and cancer are closely related; both share many underlying mechanisms, risk factors and tightly interconnected biological processes [4]. The high incidence of cancer in elderly has more than one mechanism. These mechanisms include prolonged lifetime exposure to carcinogenic agents, DNA damage accumulation, derangements of cellular repair mechanisms, oncogenic activation, and defects in tumor suppressor genes. A progressive senescence of immune function occurs in elderly, while an effective immune response against developing tumors may fail [5,6].

Approximately 80% of adults aged 65 and above are affected by at least one cardiovascular disease (CVD) like hypertension (58%), coronary heart disease (29%), or diabetes mellitus (28%). The incidence of cardiovascular diseases among individuals aged 60 to 80 years hovers around 75–78% and surpasses 85% in those above 80 years of age [7,8].

Cardiovascular risk factors, aging, and comorbidities play pivotal roles in the onset of heart disease. Among these factors, age stands out as one of the most significant contributors. Both the incidence and prevalence of cardiovascular disease significantly rise with age [2].

Age-related changes in cardiovascular tissues often involve chamber hypertrophy, diminished left ventricular (LV) diastolic function leading to diastolic dysfunction, reduced LV reserve capacity, more arterial stiffness, and endothelial dysfunction. Additionally, risk factors for cardiovascular diseases are prevalent among the elderly population. Commonly observed risk factors include hypertension, diabetes mellitus, lipid disorders, obesity, and smoking. These conditions contribute significantly to the increased susceptibility of elderly individuals to cardiovascular diseases [9, 10].

An association between cardiovascular diseases and cancer exists, often attributed to shared risk factors. These common factors include advancing age, smoking, obesity, diabetes, high cholesterol levels, hypertension, and lack of physical activity [11].

Many cancer therapies have the potential for toxic effects on the cardiovascular system. Cardiotoxicity may cause frailty and under-treatment, resulting in suboptimal outcomes. A multi-disciplinary team based on collaboration between geriatricians, oncologists, and cardiologists is essential [12].

The cardio-oncology team concentrates on preventing and managing cardiovascular complications arising from cancer therapy through three main approaches. First, treatment-based approach, which involves assessing the specific cancer treatments used, including drugs, surgeries, or radiation therapy, and understanding their potential impact on the cardiovascular system. Second, symptom/complication-based approach, the team investigates clinical manifestations such as dyspnea, chest pain, or rhythm disturbances, which are indicative of cardiovascular issues during or after cancer therapy. Third, patient characteristic-based approach, by considering individual patient factors, such as existing cardiovascular risks or established heart diseases, the team tailors their approach to address the unique cardiovascular challenges faced by each patient [13].

Many unexplored areas in cardio-oncology still exist, which could open new perspectives for early detection, follow-up,

and treating cardiotoxicity caused by antitumor treatments [14]. Therefore, our aim was to evaluate the prevalence and risk factors associated with cardiotoxicity among elderly cancer patients who underwent various types of cancer-specific treatments.

Patients and methods

A cross sectional study comprised one hundred (100) elderly participants, men, and women, aged sixty years and above, who were diagnosed with cancer. The sample size was calculated using Power Analysis and Sample Size System (PASS) 11 program, setting alpha error at 5%, margin of error at 5%, and the power of the test 80%. The research protocol has been approved by the Ethics Board of Ain Shams University (Study Protocol Approval Code: FMASU MD 01/2018). Every participant provided their consent by signing an informed written permission form.

The study sample was collected from the inpatient wards and outpatient clinics of National Cancer Institute, Cairo, Egypt. Medical records were reviewed; and all patients enrolled in the study had normal cardiovascular assessment at baseline. Additionally, patients who had previous history of heart disease two years or more before diagnosis of cancer were excluded.

All the study participants were subjected to the following:

(1) Comprehensive Geriatric Assessment (CGA) including:
- Medical history and physical examination.
- Body mass index (BMI) calculation [15].
- Screening for dementia: using the Arabic version [16] of the Mini-mental state examination (MMSE) [17].
- Depression screening: using the Patient Health Questionnaire-2 (PHQ-2) [18].
- Nutritional screening: using the short form of Mini-Nutritional Assessment (MNA-SF) [19].
- Functional assessment: using activities of daily living (ADL) tool [20] and instrumental activities of daily living (IADL) tool [21].

(2) Laboratory Investigations: Lipid profile, fasting blood glucose, and C-reactive protein (CRP).

(3) Echocardiography (ECHO).

(4) Electrocardiogram (ECG).

Cardiotoxicity was diagnosed if there is one or more of the following patterns: systolic dysfunction/low ejection fraction (EF) (<55%), symptomatic diastolic dysfunction, myocardial ischemia, QTc interval prolongation and/or arrhythmia [22].

Statistical analysis

The gathered data underwent a thorough review, coding, and tabulation before being input into a computer using the Statistical Package for the Social Sciences (IBM SPSS 20.0). Quantitative parametric data were presented as mean and standard deviation (±SD), while quantitative nonparametric data were represented as median and interquartile range. To compare quantitative variables, t-tests were employed for comparing two groups, while ANOVA was used for comparing three groups. For qualitative variables, the Chi-square test was utilized. The significance level was determined based on P value (Probability) as follows: $P>0.05$ (insignificant), $P<0.05$ (significant), and $P<0.01$ (highly significant).

Results

The study sample comprised one hundred (100) elderly participants, men and women, sixty years and above, the mean age of the participants was 68.8 years, 50% of participants were smokers (mean smoking index=37), and 14% were obese. Most prevalent cancer type among our study participants was breast cancer (32%) and most of the participants had a cancer stage of 2 or 3. Hypertension, diabetes mellitus, and COPD were the most prevalent associated comorbidities among the studied population; as shown in table (1).

Various modalities of cancer treatment were received by the study participants. 70% of our study participants underwent surgical treatment, 92% received chemotherapy (with mean duration of 2.38 years), 58% received radiotherapy (most common site of radiotherapy was chest radiotherapy), 40% received hormonal therapy, and 30% received targeted therapy. Combined chemo/radiotherapy was used in 55% of participants, while combined chemo/targeted therapy was used in 30% of participants.

Most common types of anti-cancer agents used among the study population were Anthracycline (Doxorubicin) (67%), Paclitaxel (37%), Trastuzumab (26%), Cyclophosphamide (22%) and 5-Fluorouracil (18%).

Cardiotoxicity was found in 57% of study participants. The pattern of the observed cardiotoxicity included: low EF (59.65%), symptomatic diastolic dysfunction (57.89%), myocardial ischemia (45.61%), QTc interval prolongation (21.05%) and arrhythmias (14.04%). This is shown in table (2).

Study participants who experienced cardiotoxicity (any pattern) were older, had higher smoking index, lower body mass index, and longer cancer duration. They had higher prevalence of diabetes, hypertension and dyslipidemia and had higher mean value of fasting blood glucose and C-reactive protein. They also showed higher prevalence of depression, malnutrition, and functional impairment. This is illustrated in table (3).

With regards to treatment-related cardiotoxicity, as presented in table (4), participants who experienced cardiotoxicity were those patients who received certain chemotherapy agents (namely Anthracycline, 5-Fluorouracil, Capecitabine, Arsenic trioxide, and Lapatinib); patients who received certain targeted therapy agents (namely Pertuzumab and Trastuzumab); and patients who received radiotherapy (most commonly radiotherapy to the chest). Participants who experienced cardiotoxicity received longer duration of chemotherapy. Participants who were treated with hormonal therapy experienced less cardiotoxicity.

Regression analysis was done to determine the risk factors independently associated with cardiotoxicity, as shown in table (5). According to the results, the risk factors independently associated with cardiotoxicity, in the studied population, were high smoking index, dyslipidemia (low HDL), high fasting blood glucose, malnutrition and previous treatment with Pertuzumab.

Table (1): Demographic and clinical characteristics of the studied population:

Demographic and Clinical Characteristics			
Age (years)	**Range (Mean ±SD)**	60-84 (68.820±5.133)	
		N	**%**
Gender	**Male**	56	56.00
	Female	44	44.00
Smoking	**Smoker**	50	50.00
	Non-Smoker	50	50.00
Smoking index	**Range (Mean ±SD)**	10-64 (37.180±16.658)	
BMI (kg/m^2)	**Range (Mean ±SD)**	12-38 (23.920±6.038)	
Cancer type	**Breast**	32	32.00
	Prostate	7	7.00
	Colon	8	8.00
	Lung	9	9.00
	NHL	9	9.00
	Stomach	13	13.00
	AML	9	9.00
	Others	13	13.00
Cancer stage	**Stage II**	45	45.00
	Stage III	21	21.00
	Stage IV	14	14.00
	NA	20	20.00
Cancer duration (years)	**Range (Mean ±SD)**	1-10 (3.250±2.037)	
Co-morbidities	**Diabetes**	39	39%
	Hypertension	56	56%
	Stroke	1	1%
	COPD	39	39%
	CLD	15	15%
	CKD	2	2%

BMI: Body mass index; NHL: Non-Hodgkin lymphoma; AML: Acute myeloid leukemia; COPD: Chronic obstructive pulmonary disease; CLD: Chronic liver disease; CKD: Chronic kidney disease; NA: Non-applicable

Table (2): Cardiotoxicity and its patterns among the studied population:

Cardiotoxicity		**N**	**%**
		57	57.00
Pattern	**Low ejection fraction (<55%)**	34	59.65
	Diastolic dysfunction with symptoms	33	57.89
	Myocardial ischemia	26	45.61
	QT_c prolongation	12	21.05
	Arrhythmia	8	14.04

Table 3: Comparison between study participants with/without cardiotoxicity (any pattern) as regards cardiac risk factors, clinical and laboratory data:

		Cardiotoxicity				T-Test	
		Yes		No		T	P-value
Age	Range	63-84		60-75		8.111	<0.001*
	Mean ±SD	71.632±4.139		65.093±3.785			
Smoking index	Range	10-64		10-40		7.300	<0.001*
	Mean ±SD	44.270±12.511		17.000±8.206			
BMI (kg/m^2)	Range	12-38		17-38		-4.298	<0.001*
	Mean ±SD	21.842±5.784		26.674±5.263			
Cancer duration (years)	Range	1-10		1-8		4.530	<0.001*
	Mean ±SD	3.982±2.125		2.279±1.436			
Triglycerides (mg/dl)	Range	68-249		76-180		4.444	<0.001*
	Mean ±SD	147.895±42.376		112.535±35.017			
Total cholesterol (mg/dl)	Range	100-292		119-270		4.170	<0.001*
	Mean ±SD	208.947±45.603		174.442±33.806			
LDL (mg/dl)	Range	60-187		67-160		3.947	<0.001*
	Mean ±SD	117.684±30.196		95.209±25.272			
HDL (mg/dl)	Range	31-42		32-45		-6.353	<0.001*
	Mean ±SD	36.702±3.059		40.186±2.174			
Fasting blood glucose (mg/dl)	Range	89-320		87-259		5.641	<0.001*
	Mean ±SD	182.351±78.566		111.047±30.135			
CRP (mg/L)	Range	18-131		12-54		9.377	<0.001*
	Mean ±SD	74.281±34.054		24.070±9.672			
Chi-Square		N	%	N	%	X^2	P-value
Diabetes	Yes	31	54.39	8	18.60	13.191	<0.001*
	No	26	45.61	35	81.40		
Hypertension	Yes	38	66.67	18	41.86	6.121	0.013*
	No	19	33.33	25	58.14		
PHQ-2	Positive	50	87.72	11	25.58	39.780	<0.001*
	Negative	7	12.28	32	74.42		
MNA-SF	Malnourished/ At risk	39	68.42	4	9.30	34.950	<0.001*
	Negative	18	31.58	39	90.70		
ADL	Independent	17	29.82	43	100.00	50.292	<0.001*
	Assisted	24	42.11	0	0.00		
	Dependent	16	28.07	0	0.00		
IADL	Independent	6	10.53	32	74.42	56.074	<0.001*
	Assisted	9	15.79	10	23.26		
	Dependent	42	73.68	1	2.33		

BMI: Body mass index; LDL: Low-density lipoprotein; HDL: High density lipoprotein; CRP: C-reactive protein; PHQ-2: Patient Health Questionnaire-2; MNA-SF: Mini-nutritional assessment-short form, ADL: Activities of daily living; IADL: Instrumental activities of daily living

Table (4): Comparison between study participants with/without cardiotoxicity (any pattern) as regards anticancer therapy:

		Cardiotoxicity				T-Test	
		Yes		No		T	P-value
Chemotherapy duration (years)	Range	1-8		1-4		4.229	<0.001*
	Mean ±SD	2.912±1.883		1.514±0.658			
Chi-Square		N	%	N	%	X^2	P-value
Chemotherapy	Yes	57	100.00	35	81.40	11.527	0.001*
	No	0	0.00	8	18.60		
Anthracycline	Yes	42	73.68	21	48.84	6.492	0.011*
	No	15	26.32	22	51.16		
Cyclophosphamide	Yes	14	24.56	8	18.60	0.507	0.477
	No	43	75.44	35	81.40		
Methotrexate	Yes	5	8.77	3	6.98	0.107	0.743
	No	52	91.23	40	93.02		
Vincristine	Yes	7	12.28	3	6.98	0.766	0.381
	No	50	87.72	40	93.02		
5-Fluorouracil	Yes	17	29.82	1	2.33	12.557	<0.001*
	No	40	70.18	42	97.67		
Paclitaxel	Yes	22	38.60	15	34.88	0.145	0.703
	No	35	61.40	28	65.12		
Capecitabine	Yes	8	14.04	1	2.33	4.103	0.043*
	No	49	85.96	42	97.67		
Cisplatin	Yes	8	14.04	2	4.65	2.398	0.121
	No	49	85.96	41	95.35		
Arsenic trioxide	Yes	10	17.54	0	0.00	8.382	0.004*
	No	47	82.46	43	100.00		
Lapatinib	Yes	5	8.77	0	0.00	3.970	0.046*
	No	52	91.23	43	100.00		
Radiotherapy	Yes	46	80.70	12	27.91	28.045	<0.001*
	No	11	19.30	31	72.09		
Radiotherapy site	Chest	34	73.91	4	33.33	22.985	<0.001*
	Prostate	0	0.00	5	41.67		
	Colon	6	13.04	2	16.67		
	Stomach	4	8.70	0	0.00		
	Pelvis	2	4.35	1	8.33		
Targeted therapy	Yes	27	47.37	3	6.98	19.042	<0.001*
	No	30	52.63	40	93.02		
Pertuzumab	Yes	7	12.28	0	0.00	5.678	0.017*
	No	50	87.72	43	100.00		
Trastuzumab	Yes	26	45.61	0	0.00	26.505	<0.001*
	No	31	54.39	43	100.00		
Hormonal therapy	Yes	13	22.81	27	62.79	16.327	<0.001*
	No	44	77.19	16	37.21		

Table (5): Regression analysis of the risk factors associated with cardiotoxicity:

	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Std. Error	Beta		
Age	0.009	0.008	0.094	1.135	0.280
Smoking index	-0.011	0.003	-0.436	-4.360	0.001*
BMI	0.022	0.014	0.181	1.574	0.144
Cancer duration	0.019	0.031	0.073	0.632	0.540
Triglycerides	0.000	0.002	-0.013	-0.080	0.938
Total cholesterol	-0.001	0.001	-0.144	-0.980	0.348
LDL	0.000	0.002	0.003	0.023	0.982
HDL	0.027	0.009	0.227	2.969	0.013*
Fasting blood glucose	-0.003	0.001	-0.422	-3.726	0.003*
CRP	0.002	0.001	0.155	1.263	0.233
Diabetes	-0.007	0.095	-0.008	-0.069	0.946
Hypertension	0.101	0.097	0.111	1.046	0.318
PHQ-2	-0.149	0.150	-0.156	-0.994	0.342
MNA-SF	0.297	0.103	0.336	2.873	0.015*
ADL	0.078	0.051	0.159	1.535	0.153
IADL	-0.021	0.067	-0.043	-0.307	0.764
Chemotherapy duration	-0.025	0.032	-0.095	-0.773	0.456
Anthracycline	0.170	0.104	0.203	1.630	0.131
5-Fluorouracil	0.025	0.082	0.029	0.301	0.769
Capecitabine	0.111	0.061	0.105	1.834	0.094
Pertuzumab	0.337	0.142	0.240	2.377	0.037*
Trastuzumab	0.128	0.098	0.158	1.315	0.215
Hormonal therapy	-0.050	0.093	-0.040	-0.540	0.600
Radiotherapy site	-0.005	0.032	-0.014	-0.162	0.875
Dependent Variable: Cardiotoxicity					

BMI: Body mass index; LDL: Low-density lipoprotein; HDL: High density lipoprotein; CRP: C-reactive protein; PHQ-2: Patient Health Questionnaire-2; MNA-SF: Mini-nutritional assessment-short form, ADL: Activities of daily living; IADL: Instrumental activities of daily living

Discussion

Cancer and heart disease stand as the primary causes of mortality among individuals over 60 years of age. The involvement of geriatricians in these specialized fields holds particular importance. Geriatric cardiology and geriatric oncology have become crucial allies due to advancements in cancer and cardiovascular treatments, leading to an overall increase in life expectancy [23].

The aim of this work was to assess the prevalence and potential risk factors associated with cardiotoxicity among elderly cancer patients who underwent cancer-specific treatments. The study was carried out on 100 elderly participants, men and women, sixty years and above; diagnosed with cancer.

In the current study, the prevalence of cardiotoxicity was 57%. The pattern of the observed cardiotoxicity included depressed systolic function/ low EF (59.65%), symptomatic diastolic dysfunction with (57.89%), myocardial ischemia (45.61%), QTc interval prolongation (21.05%) and arrhythmia (14.04%).

Our study participants who experienced cardiotoxicity (any pattern) were older, had higher smoking index, lower body mass

index, and longer cancer duration. They had higher prevalence of diabetes, hypertension and dyslipidemia. Most of these are well known cardiac risk factors, as reported in the previous studies [24, 25].

It has been observed that the presence of several cardiovascular risk factors in cancer patients, including hypertension, diabetes, a history of smoking, and dyslipidemia, is associated with a significantly higher risk of cardiac adverse events [26]. Similarly, retrospective study suggested that cardiovascular disease risk factors, such as history of hypertension and diabetes, also increase the risk of developing medication-related cardiotoxicity (e.g., Anthracyclines use) [27].

A strong link between inflammation, heart disease and cancer has been reported in numerous previous studies. In our study, participants who experienced cardiotoxicity had higher mean value of C-reactive protein. Similarly, a study evaluated inflammatory factors such as high-sensitivity C-reactive protein and demonstrated that these markers were associated with an increased risk of developing heart failure and new-onset cancer [28].

Previous studies revealed a greater risk of cardiovascular disease in obese individuals. Among our study participants, and in contrast to these studies, lower body mass index was associated with more cardiotoxicity. This may have some explanations. First, lower BMI is associated with cancer cachexia, longer cancer duration, poorer health, and therefore more cardiovascular toxicity/complications. Second, looking at patients who didn't develop cardiotoxicity, their mean BMI was 26.67 (i.e., just overweight), and many studies reported better outcomes in these patients compared with underweight patients [29]. This was sometimes called "Obesity Paradox" [30].

With regards to treatment-related cardiotoxicity, participants who experienced cardiotoxicity were those patients who received certain chemotherapy agents (namely Anthracycline, 5-Fluorouracil, Capecitabine, Arsenic trioxide, and Lapatinib); patients who received certain targeted therapy agents (namely Pertuzumab and Trastuzumab); and patients who received radiotherapy (most commonly radiotherapy to the chest). Participants with cardiotoxicity received longer duration of chemotherapy.

The use of anticancer agents was extensively studied as a cardiovascular risk factor. A recent systematic review highlighted the development of heart failure, acute coronary syndrome, and arrhythmias in patients undergoing chemotherapy, providing evidence of the existing cardiovascular risk [26].

In a study conducted by Wittayanukorn and colleagues, which involved 937 cases and assessed reports of chemotherapy-related cardiotoxicity in breast cancer patients, Trastuzumab in combination with doxorubicin or cyclophosphamide were identified as the most associated medications [31]. An earlier study by Volkova and Russell indicated that cardiotoxicity occurred in 8.3% of cancer patients undergoing chemotherapy [32]. Specifically, Anthracycline was found to induce heart failure in up to 8.7% of cases. Additionally, Curigliano and colleagues reported that patients treated with Trastuzumab experienced cardiotoxicity in up to 3.8% of cases, while with cyclophosphamide, this ranged from 7% to 28% [33].

These findings align with a prior study conducted by Chen and colleagues, which indicated that the concurrent use of Anthracyclines and Trastuzumab raises the risk of heart failure [34].

In clinical trials involving Trastuzumab, cardiotoxicity was documented in 4.1-27.0% of patients receiving the drug. Slamon and colleagues reported a 27% incidence of cardiotoxicity in patients treated with Trastuzumab, in contrast to 8% of patients treated solely with chemotherapy [35]. In a systematic review of 8 randomized controlled trials, treatment with Pertuzumab was found to increase the risk of clinical cardiac failure in patients suffering from HER2-positive malignancy [36].

Another research on Fluoropyrimidine cardiotoxicity has revealed diverse clinical manifestations, ranging from silent cardiac ischemia to atypical presentations, acute coronary syndrome, impaired left ventricular function, or heart block. Interestingly, physical exertion served as the triggering factor for cardiotoxicity in nearly 50% of the studied cases [37]. For the individual agents, incidence of symptomatic cardiotoxicity reaches up to 20% with 5-Fluorouracil, and up to 35% with Capecitabine [38].

Finally, and most importantly, comprehensive geriatric assessment is essential in the evaluation and monitoring of elder cancer patients. Multiple assessment tools were administered in our study. Of our study participants, 88% had normal cognition, 61% were depressed, and 43% were malnourished or at risk of malnutrition. As regards the functional assessment; 16% were dependent in activities of daily living and 43% were dependent in instrumental activities of daily living. Cardiotoxicity was found to be associated with depression, malnutrition, and functional decline of the affected patients.

Depression and anxiety are now acknowledged as significant cardiovascular risk factors, with their impact comparable to traditional factors like hypertension. This recognition stems from consistent research findings indicating that these psychological factors not only contribute to inflammation but also elevate the risk of developing cardiovascular diseases [39].

For instance, in a study of 2165 breast cancer survivors, 466 developed cardiovascular disease over a mean follow-up of 5.7 years. Collected evidence indicated a higher prevalence of poor nutrition, physical inactivity, and functional decline in these patients [40].

Conclusion

Cardiotoxicity is common in elderly cancer patients, and it has different patterns. Smoking, dyslipidemia, and hyperglycemia are important risk factors for cardiotoxicity. Certain anticancer therapies increase the risk of cardiotoxicity. Cardiotoxicity is associated with depression, malnutrition, and functional decline of the geriatric patients, highlighting the importance of comprehensive geriatric assessment in elderly cancer patients.

Limitations of the study

We recognize that this study had certain limitations. One of the limitations was its small sample size. It could be better to measure other cardiac biomarkers (such as troponin and brain natriuretic peptide; BNP) to add intensity to cardiotoxicity diagnosis.

Conflicts of interest

No potential conflicts of interest.

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