



# Cardiotoxic effects of cancer therapy

Treatment risks and how to manage them

By Bernadette Shields, MSN, RN, MHA

**AS PATIENTS** with cancer live longer, they face increased risk of developing secondary cardiac events linked to the treatments they received. All nurses who care for patients receiving cancer treatment should be familiar with potentially cardiotoxic cancer medications and treatments, recognize the signs and symptoms of cardiotoxicity, and know when to refer patients to cardio-oncology for further assessment and treatment. (See *What's cardio-oncology?*)

## Cardiotoxicity

Cancer treatments such as radiation and chemotherapy can be toxic to the heart, resulting in cardiovascular abnormalities in conduction pathways (arrhythmias), vasculature (hypotension, hypertension, and Raynaud phenomenon), and coronary arteries (unstable angina, acute myocardial infarction), as well as cardiomyopathy and pericardial fluid accumulation. Symptoms of cardiotoxicity can include dyspnea, arrhythmias, cardiac dysfunction, fatigue, edema, chest pain, and ECG changes.

## Potentially cardiotoxic medications

Some chemotherapy medications can cause short-term side effects that occur during treatment but stop when treatment ends, while other medications can lead to long-term effects that need ongoing management. The symptoms of short- and long-term side effects may be similar; the medication itself determines whether the side effects are

reversible and how to proceed with treatment. (See *Chemotherapy agents and potential cardiotoxicities.*)

The following categories of medications contain examples of cardiac side effects from specific drugs. Not all drugs in each category will have the same effect.

**Alkylating agents.** Cyclophosphamide is used to treat cancers of the GI tract, bone marrow, testicles, and ovaries. It can cause cardiomyopathy, pleural effusions, and myocarditis. Treatment includes relieving dyspnea and fatigue.

**Angiogenesis inhibitors.** Bevacizumab is used to treat kidney, colorectal, and lung cancers; sunitinib is used for kidney cancer. Other angiogenesis inhibitors are prescribed for kidney, lung, colorectal, thyroid, and stomach cancers, as well as multiple myeloma. Cardiac dysfunction has been reported with bevacizumab and sunitinib. Vascular endothelial growth factor receptor inhibitors (which are a type of angiogenesis inhibitor), such as sunitinib and sorafenib, block several tyrosine kinase receptors, making it difficult to identify which targets

## What's cardio-oncology?

Cardio-oncology is a new field that focuses on providing collaborative, supportive care to patients who experience cardiac symptoms related to their cancer treatments.

**Cardio-oncologists** have advanced training in the effects of cancer treatments on the heart and **cardio-oncology nurses** have knowledge in both cardiology and oncology. Together, they provide education about cardiac symptoms, medications, and cardiac testing.

# Chemotherapy agents and potential cardiotoxicities

Complications of cardiotoxic cancer treatments can be short- or long-term. Here are examples of possible complications for the various types of chemotherapy. Not all agents in each category will have the same effects.

Chemotherapy category	Cardiotoxic complications								
	Angina	Palpitations	Left ventricular dysfunction	Heart failure	Hypertension	Myocarditis	Pericarditis	Arrhythmias	Cardiomyopathy
Alkylating agents									X
Angiogenesis inhibitors					X				
Anthracyclines			X	X					X
Antimetabolites	X	X						X	
Immune-checkpoint blocking antibodies						X	X		
Monoclonal antibodies			X	X					
Taxanes					X			X	

mediate cardiotoxicity. Tyrosine kinase inhibitors (which also are a type of angiogenesis inhibitor) have been associated with hypertension, and nilotinib and ponatinib specifically have been associated with thrombotic events.

**Antimetabolites.** Fluorouracil (5-FU), used to treat solid tumors, can cause angina and palpitations. Stopping the medicine frequently relieves symptoms.

**Anthracyclines.** Doxorubicin, which is used to treat breast cancer, solid tumors, sarcomas, lymphoma, and lung cancer, may cause cardiomyopathy and decreased heart function. Monitor heart function before and during treatment and manage symptoms as needed. Teach patients and families how to recognize the signs and symptoms of these conditions.

**Immune-checkpoint blocking antibodies.** Ipilimumab, nivolumab, and pembrolizumab, which are used to treat melanoma, non-small cell lung cancer, and renal cell cancer, can cause myocarditis and pericarditis. Treatment and management of the symptoms of these conditions (hypertension and peripheral vascular disease) include beta blockers,

angiotensin-converting enzyme (ACE) inhibitors, and statins. Patients with known cardiac conditions prior to treatment should be closely monitored and treated quickly for declining heart function when taking these medications.

**Monoclonal antibody.** Trastuzumab is used to treat breast, lung, head and neck, stomach, colorec-

tal, and prostate cancer, as well as Hodgkin's lymphoma and melanoma. It can cause left ventricular dysfunction and congestive heart failure. Discontinuing the medication will reverse the symptoms, but it may take weeks for them to subside.

**Taxanes.** Paclitaxel and docetaxel, which are used to treat breast, lung, and ovarian cancers, may

## Other considerations

Other considerations for cardiotoxicity include childhood cancer, radiation, and pericardial effusion.

### Childhood cancer

The increased risk of cardiomyopathy among survivors of childhood cancer underscores the importance of surveillance for subclinical myocardial dysfunction in this patient population. Childhood cancer survivors who receive treatment with anthracyclines are at an increased risk for developing long-term negative cardiac effects of treatment. These patients should be monitored by a cardiologist.

### Radiation

Radiation may cause cardiovascular disease months to years after treatment has ended. Radiation treatment to the chest can lead to atherosclerosis and higher risk for myocardial infarction, heart valve damage, and arrhythmias such as tachycardia and heart block.

### Pericardial effusion

Pericardial effusion, which can lead to cardiac tamponade if untreated, may occur in up to 20% of cancer patients. Fluid accumulation in the pericardial sac increases pressure and reduces stroke volume and output. Pericardial effusion can result from mediastinal radiation therapy or chemotherapy with agents such as doxorubicin, busulfan, and cytarabine.

## Lifestyle changes and follow-up

Comprehensive patient education about cardiotoxic side effects of cancer treatment should include discussions about lifestyle changes and follow-up.

### Lifestyle changes

Lifestyle changes to help manage symptoms include:

- **Diet:** Low-salt, low-fat diets can help manage blood pressure and cardiovascular disease.
- **Exercise:** Patients should participate in as much physical activity as possible.
- **Smoking and alcohol:** Advise patients to eliminate smoking and alcohol. If necessary, refer them to a smoking-cessation specialist.



### Follow-up

Talk to patients about survivorship clinics where providers experienced in the potential long-term effects of cancer treatment will monitor for changes in cardiac function with applicable surveillance labs (baseline cardiac biomarkers, such as brain natriuretic peptide, troponin, and lipid panels) and routine cardiac imaging with echocardiogram or multigated acquisition scans.

Encourage patients to keep records of all treatments—including chemotherapy and radiation doses, surgeries, and pathology reports—to help with surveillance and monitoring of long-term cardiotoxic effects of cancer treatment.

cause hypertension and arrhythmias, such as supraventricular tachycardia. Symptoms may resolve with cessation of the treatment.

Be aware that 5-FU, sunitinib, and some taxanes may cause QT prolongation. Treatment includes stopping cancer therapy and ECG monitoring until QT returns to baseline.

### Assessing for cardiotoxicity

Patients receiving cancer treatment should be monitored for dyspnea, peripheral edema, and decreased heart function. The provider may order an echocardiogram or multigated acquisition (MUGA) scan to evaluate the patient's baseline ejection fraction and to detect early signs of cardiotoxicity. If the ejection fraction is less than 40%, chemotherapy may be discontinued or reduced. Some patients may develop decreased ejection fraction during treatment, while others may not experience it until months or years after treatment. Echocardiography and MUGA scans also may be ordered to evaluate patients with complaints of increased dyspnea and peripheral edema.

ECG can be used to monitor

heart function during and after cancer treatment. And advances in echocardiography and strain imaging allow for early identification of decreased cardiac function so that the provider can make necessary treatment changes.

Any patient experiencing cardiac symptoms should be referred to cardio-oncology. The cardio-oncologist can prescribe medications to help control symptoms and continue to manage and monitor the patient. If a cardio-oncologist is not available, refer to a cardiologist experienced in managing oncology patients. (See *Other considerations*.)

### Patient education

Educating patients about the potential cardiotoxic effects of cancer therapy is essential to successful treatment. Explain to patients and their families that potential side effects can occur during treatment or may not occur for years after. Emphasize the importance of following up with providers after treatment is completed and that all providers should be told about the cancer treatment so they can monitor for cardiotoxicity. (See *Lifestyle changes and follow-up*.)

### Good outcomes

Caring for patients with cancer includes monitoring for and managing the effects of treatment. Cardiotoxicity symptoms can emerge well after treatment has ended, so thorough assessment and patient education is essential to good quality of life. And if your organization has a cardio-oncology team, use their expertise to improve your patients' chances of a good outcome. ★

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