

# Development of an Outpatient Cardio-oncology Program



## *Bringing service lines together in a community cancer center*

**W**ithin the oncology community, there is increasing concern for the cardiovascular health of patients with cancer. There is a well-known increase in the number of patients diagnosed with cancer and those who have survived cancer who are now living with cardiovascular disease because of their treatment.<sup>1</sup> In fact, cardiovascular disease that develops as a result of cancer treatment is the second leading cause of death among cancer survivors.<sup>2</sup> Many existing and emerging cancer therapies have the potential to have significant impact and adverse effects on the cardiovascular health of patients being treated for cancer and those survivors of cancer.<sup>3</sup> For example, cardiotoxicity related to chemotherapy can lead to signs and symptoms of congestive heart failure and potentially cardiac death. Immunotherapies are also a concern that warrant close monitoring.

Though evidence demonstrates a growing clinical demand for dedicated cardio-oncology programs, most of these programs are found only within academic cancer centers. Yet the majority of cancer patients and survivors are cared for within a community cancer center, so the need for these programs to provide early detection of cardiac toxicity and assist in decreasing the adverse effects of cancer treatment to cardiovascular health is vital.

At University of Maryland Upper Chesapeake Health, the Heart and Vascular Institute and the Kaufman Cancer Center have come together to create a cardio-oncology program that provides a patient-centered, multidisciplinary clinic for cancer patients during diagnosis, treatment, and survivorship.

With this combined cardiology and oncology program, Kaufman Cancer Center looked to provide early recognition of those at risk, monitor minute changes of cardiac toxicity, and track possible changes into survivorship.

### **Why Cardio-oncology?**

Early recognition of toxicity related to cancer therapy is a clinical concern for hematologists, oncologists, and cardiologists.<sup>4</sup> The scope of cardio-oncology includes the prevention, detection, monitoring, and treatment of cardiovascular toxicity related to cancer therapy, an approach that improves the overall care of patients with cancer and cardiovascular disease. Gomes-Barros and colleagues discussed the importance of key points in treatment of cardiovascular evaluation, including before, during, and at the end of anticancer treatment.<sup>4</sup> These pivotal points are secondary to the different forms of cardiovascular manifestations related to chemotherapy.<sup>4</sup> There are specific chemotherapy agents that



Cardio-oncology planning team.

primarily affect cardiac function. Additionally, there are chemotherapy agents that indirectly affect cardiac decompensation (worsening of symptoms of heart failure) by altering preload (fluid retention), afterload (hypertension), and heart rate (arrhythmias), as well as chemotherapy agents that cause cardiovascular disease.<sup>4</sup>

### Getting Started

In April 2016 after a comprehensive review of its cancer service line, Kaufman Cancer Center, Bel Air, Md., recognized the need for collaboration between its cardiology practice and its hematology and oncology practice. As a first step, the cancer center brought together two physician champions, Dipan Desai, DO, from Upper Chesapeake Cardiology, and Philip Nivatpumin, MD, from Upper Chesapeake Hematology Oncology, to create a formal outpatient cardio-oncology program and:

1. Establish baseline monitoring guidelines for the at-risk patient.
2. Decrease current gaps in cardio-oncology care.
3. Reduce and prevent cardiotoxic events in at-risk patients to improve quality of life and survivorship.

With this combined cardiology and oncology program, Kaufman Cancer Center looked to provide early recognition of those at risk, monitor minute changes of cardiac toxicity, and track possible changes into survivorship. The goal of the cardio-oncology program was twofold: to (1) provide optimal overall care of cancer patients with or without cardiac disease and (2) understand and manage their risk for cardiovascular manifestation related to chemotherapy agents. The cardio-oncology program would also help:

- Reduce cancer treatment–related cardiovascular adverse effects
- Provide quality outcomes
- Improve patients' quality of life.

### Our Planning Team

The cardio-oncology planning team included oncologists, cardiologists, the director of the Heart & Vascular Institute, the clinical manager of Cardiovascular Ultrasound, the executive director of Kaufman Cancer Center, the director of Clinical Oncology Programs, the manager of Infusion Services, the Infusion Center office coordinator, and managers at the partnering physician practices. Development of the cardio-oncology program began with reviewing current gaps, prioritizing services, and identifying opportunities to meet the needs of this high-risk population, specifically:

- *Reviewing current gaps within cardio-oncology practice and prioritizing services.* The planning team conducted a needs assessment and provided education sessions to clinical staff within all areas of the cancer center. The planning team also looked to improve the overall patient experience through timely and efficient scheduling of cardiology consultations and echocardiograms, centering care around patients so that they could even be seen in the cardiology office. The planning team reviewed the hospital's echo machines and newer strain technology, an advanced visualization software that allows simultaneous assessment of three different views of the myocardium. Strain imaging can show microscopic changes in movement of the myocardium prior to symptoms, allowing the cardiologist to use monitoring equipment at the physician workstation to view results.

- **Identifying the at-risk population for cardiotoxicity from cancer treatment.** The planning team developed referral and follow-up criteria and put in place a process to ensure that appropriate patients are connected to a cardiologist.
- **A detailed review of chemotherapeutic agents and cardiotoxicity indications.** The planning team identified these agents as having the highest risk for cardiotoxicity: chemotherapeutics, biologics, and immunotherapies. During this review, the planning team found limited manufacturing guidelines and National Comprehensive Cancer Network guidelines.
- **Baseline monitoring and prediction of those at risk for developing cardiotoxicity.** The planning team developed monitoring guidelines and a patient assessment form.
- **Developing risk stratification models of clinical pathways—before, during, and after treatment.** The planning team developed cardio-oncology guidelines (Figure 1, page 48).
- **Establishing general practice guidelines for the community cancer center.** The planning team established processes to streamline the scheduling and referral process (Figure 2, page 49). The planning team also educated clinical staff on the appropriate use of these guidelines.

### Next Steps in Program Development

The cardio-oncology planning team then reviewed treatment regimens and narrowed the focus to the top cardiotoxic agents administered in Kaufman Cancer Center. These agents were identified as Adriamycin (doxorubicin), Cytosan (cyclophosphamide), 5-FU, Herceptin (trastuzumab), Velcade (bortezomib), and Kyprolis (carfilzomib; Table 1, page 49). In March 2017, the planning team added Emluciti (elotuzumab) and Darzalex (daratumumab) to this list and the monitoring process. Patients receiving these regimens are considered “high risk.”

An assessment tool for these high-risk patients was developed to help providers predict and monitor cardiotoxicity, plan for individualized treatment plans, and conduct interval cardiac follow-up and management (Table 2, page 50). Those who meet high-risk criteria are recommended for consultation in the cardio-oncology program, with the oncologist making the final decision. The referral decision also takes into consideration patient history, lifestyle, risk factors, and previous cardiac evaluations. Patients who are identified as high risk are given a “STOP” card that indicates their oncologist has prescribed a treatment plan that may affect their heart health. This card briefly explains the cardio-oncology program, introduces them to the cardiologists and what they may expect at the cardiac visit. Additional education is provided during chemo-education class by the oncology nurse navigator. Patients are educated and provided with assistance to schedule appointment prior to the start of their chemotherapy regimen.

In addition to adding an interventional radiologist and educators to the cardio-oncology program, we included team members to verify insurance, handle billing, and manage scheduling. We have found that a formalized approach of care coordination and communication within cardio-oncology has optimized care delivery and had the greatest overall impact on the program and patients. Next, an advisory board was established to review:

All cardio-oncology services are provided at established intervals within the multidisciplinary clinic, allowing the patient access to diagnostic testing and physician visits at the same location.

- All processes proposed by the planning team
- Standardization of order sets
- The care delivery model
- Integration of services
- Staff and patient education plans.

Further review of National Comprehensive Cancer Network Guidelines Version 1.2016 assisted with process algorithm development and education. See Table 3, pages 50–51, for a brief timeline of the development of our cardio-oncology program.

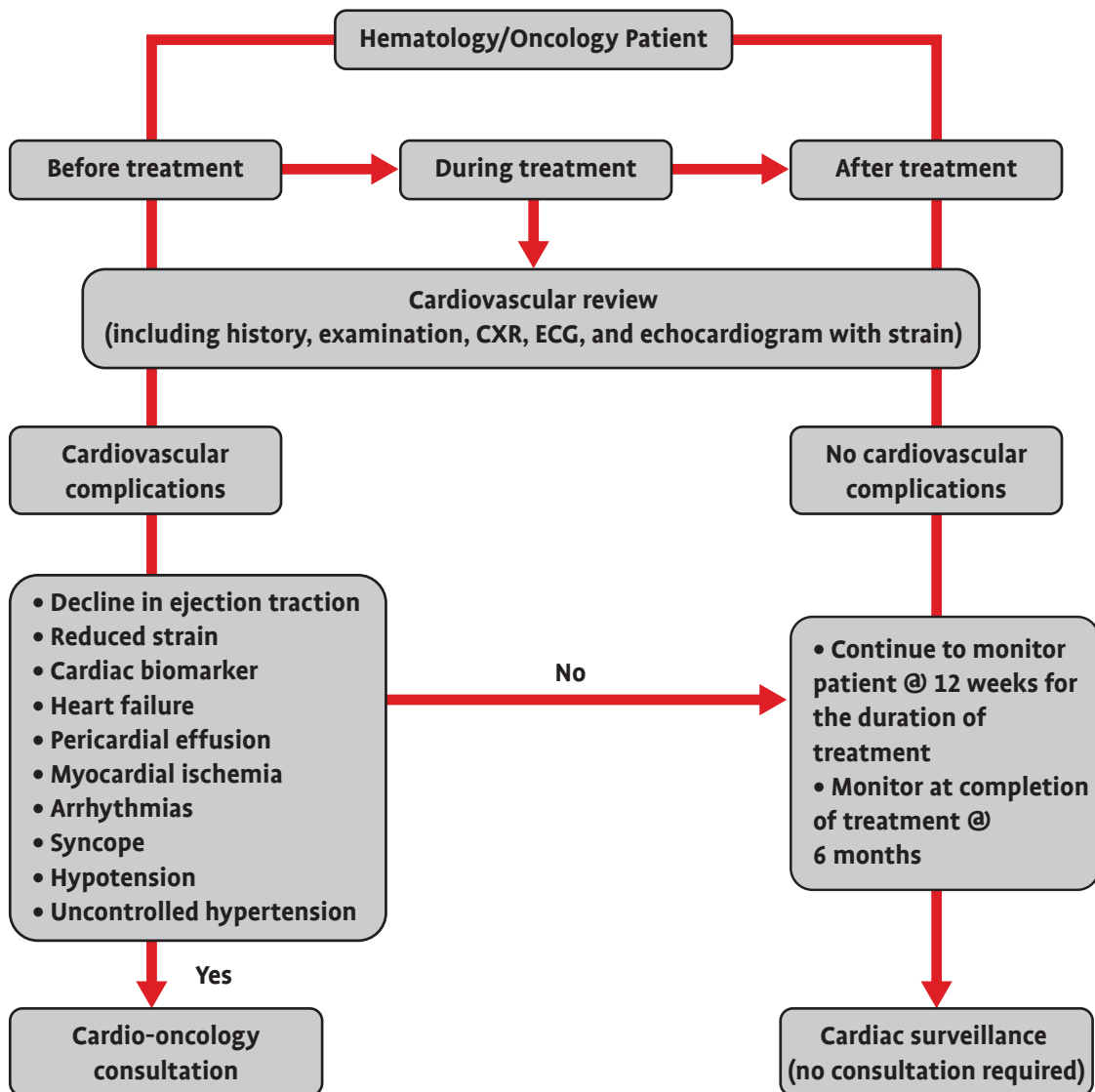
### Getting the Program Up and Running

Patients who have—or who are at risk for—cardiac toxicity are referred for a cardiac consultation by the cardio-oncology program located within the cancer center’s Multidisciplinary Clinic. During the consultation, clinical pathways are determined. The Cardio-oncology Clinic offers appointments every other week during a four-hour time block, and cardiologist appointments are available every 30 minutes. Patients need to have had an echocardiogram (echo) within the 12 weeks prior to the consultation. Same-day echo and cardio-oncology appointments are available. Prior to a patient’s appointment, the cardiologist reviews and evaluates the echo from the Kaufman Cancer Center physician reading room located within the clinic. Once patients are established in the clinic, they are seen a minimum of once every 12 weeks or as clinically indicated. Continued collaboration between cardiology and oncology provides the patient with disease management, prevention, dose adjustment, and quality outcomes. At completion of treatment, individualized survivorship care plans are developed for each patient. The oncology nurse navigator provides the patient with the care plan, emphasizing recommendations made by the cardiologist and oncologist.

A November 2017 review of our data showed that an average of 100 patients each month are treated using the defined “at-risk” cardiac agents. Oncology patients who met the inclusion criteria for the cardio-oncology program were given appointments at the Kaufman Cancer Center Multidisciplinary Clinic. Additionally, patients with known cardiac disease who were receiving chemotherapeutic agents were included in the program. All cardio-oncology services are provided at established intervals within the multidisciplinary clinic, allowing the patient access to diagnostic

(continued on page 52)

Figure 1. Cardio-Oncology Guidelines



Development and implementation of a cardio-oncology program within a community cancer center provides patients the best possible cancer therapy with the least amount of risk for cardiovascular toxicity or worsening cardiovascular health. At our cancer center, the cardio-oncology program helped us improve care coordination, collaboration, quality of care, education, cost effectiveness, and communication between oncology and cardiology, as well as decrease cardiac clinical outcomes.



Figure 2. Cardio-Oncology Program Scheduling and Referral Process

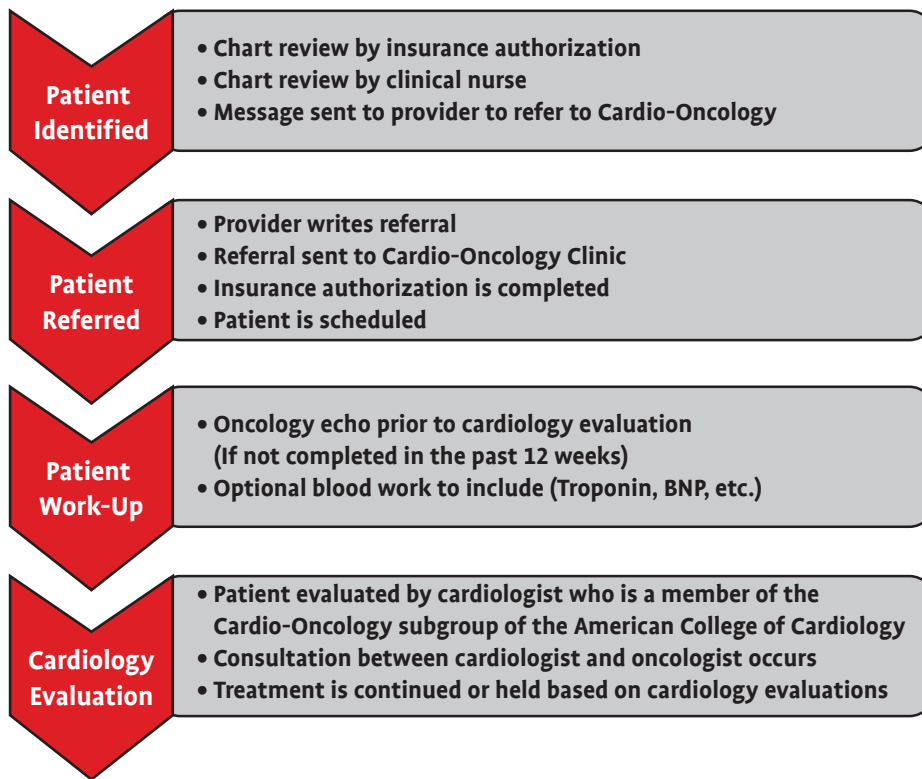


Table 1. Top Cardiotoxic Agents Administered in Kaufman Cancer Center

<b>Anthracycline:</b> adriamycin (Doxorubicin)	- Myopericarditis, cardiac arrhythmias, ECG abnormalities
<b>Alkylating Agent:</b> cytoxan (Cyclophosphamide)	- Peri/myocarditis, cardiac tamponade, arrhythmias
<b>Antimetabolite:</b> fluorouracil (5-FU)	- Coronary vasospasm, myocardial ischemia and infarction, arrhythmias, ECG changes including ventricular ectopy, hypotension
<b>Monoclonal/TKI:</b> trastuzumab (Herceptin), daratumumab (Darzalex)	- Hyper/hypotension, arrhythmia, vascular thrombosis, swelling in hands and feet, shortness of breath
<b>Proteasome inhibitor:</b> bortezomab (Velcade), darfilzomib (Kyprolis)	- Ischemia, bradycardia
<b>Immunotherapy:</b> elotuzumab (Empliciti)	- Hypertension, bradycardia

**Table 2. Cardio-Oncology Risk-Assessment Tool**

<b>Patient-Related Risk Factors</b>	<b>Medication-Related Risk Factors</b>
<b>Risk Factor Present</b>	<b>High Risk</b>
Age (<15 or >65)	Anthracyclines (adriamycin, doxorubicin)
Female	Trastuzumab (Herceptin)
Hypertension	Cyclophosphamide (Cytoxan)
Diabetes mellitus	<b>Intermediate Risk</b>
Coronary artery disease	Velcade (bortezomib)
Cardiomyopathy	Kyprolis (carfilzomib)
Previous congestive heart failure	5-FU (fluorouracil)
Prior anthracycline	Darzalex (daratumumab)
Prior radiation therapy to the chest	Empliciti (elotuzumab)
Prior Herceptin	
<b>Symptoms</b>	<b>Functional Status</b>
Dyspnea	Use METS chart
Chest pain	Complete questionnaire located in EMR Medical Oncology ARIA
Palpitations	
Edema	

**Table 3. Development of the Cardio-oncology Department 2016–2017**

Jan. 2016	Discussion with senior leadership about need for program
Feb. 2016	Kickoff meeting with core members Identified physician champions Identified key stakeholders Identified program capital needs
Mar. 2016	Evidence-based literature review Defining program Review of community cancer programs and established cardio-oncology Next steps developed Review of technology and reassessment of needs
Apr. 2016	Capital request submitted
May 2016	Review of goal and components of cardio-oncology collaboration IV diuresis Clinical protocols for screening Cardio-oncology Advisory Board
June 2016	Development of monitoring guidelines Goal of monitoring and prevention of future problems IT reviewed needs for PAC's network

**Table 3 (continued). Development of the Cardio-oncology Department 2016–2017**

July 2016	Development of billing and referral forms
Aug. 2016	Training of key stakeholders (cardiology staff, oncology staff, multidisciplinary staff)
Sept. 2016	Needs assessment Nursing pre-assessment
Oct. 2016	Program phone line established Business/appointment cards designed STOP card designed Schedules built for clinic Educational program (physicians, nurses, all staff)
Nov. 2016	Cardiologist training within EMR Developed templates for physician documentation Scheduling training with multidisciplinary and cardiology staff
Dec. 2016	Clinic open Patients evaluated
Jan. 2017	Started discussion of cardio-oncology echos within infusion center Process improvement goal
Feb. 2017	Red Dress Pink Ribbon Event Community education of new program
Mar. 2017	Re-education of clinical nursing staff Re-evaluated high-risk medication 5-FU removed
Apr. 2017	Capital request submitted
May 2017	Review of potential vendors for capital equipment
June 2017	Capital purchase of echo with strain technology IT reviewed needs for echo strain support within the Kaufman Cancer Center Re-education to providers on ordering process and consult criteria
July 2017	Development of billing and referral forms Training of echo sonographers
Aug. 2017	Training of key stakeholders on strain technology Establish workflow of new process Completed process within test environment
Sept. 2017	EMR changes to support change in echo scheduling and process
Oct. 2017	First echo with strain seen within the Kaufman Cancer Center Data review
Nov. 2017	ACCC presentation Patients seen within Kaufman Cancer Center for echo studies with strain
Dec. 2017	Evaluating clinic schedule to support patient and physician needs



**Table 4. Cardio-oncology Patient Population by Diagnosis\***

Lymphoma	5
Colon	2
Head and neck	1
Rectal	1
Multiple myeloma	5
Non-oncology	2
Breast	56
Pancreatic	1
Lung	16
Ovarian	1
Neuro	3
Bladder	1

\*86 Patient visits in the cardio-oncology clinic.  
 83 Percent were referred by hematology/oncology.  
 17 Percent were referred by an external provider

(continued from page 47)

testing and physician visits at the same location. The cardio-oncology program improved overall patient experience through timely and efficient scheduling of cardiology consultation and echocardiograms. For example, to improve patient satisfaction, echocardiograms at Kaufman Cancer Center are scheduled within one week.

As of Nov. 30, 2017, there have been 86 patient visits to the cardio-oncology clinic (see Table 4, left). Of these, 83 percent were referred by our hematologists and oncologists and 17 percent were referred by providers outside the cancer center.

**Key Takeaways and Future Goals**

Development and implementation of a cardio-oncology program within a community cancer center provides patients the best possible cancer therapy with the least amount of risk for cardiovascular toxicity or worsening cardiovascular health. At the Kaufman Cancer Center, the cardio-oncology program helped us improve care coordination, collaboration, quality of care, education, cost effectiveness, and communication between oncology and cardiology. Most importantly, there has been an increase in the early management of those patients experiencing cardiac side effects from their treatment. The collaborative program supports our goal to promote quality of life, heart health, and survivorship through the patient’s entire journey. At the end of their cancer treatment patients will continue to be followed by cardiology to ensure that any long-term effects from their cancer care will be identified early and have the least impact on their cardiac health.

**Our Program At-a-Glance**

Located in north central Maryland, The Kaufman Cancer Center is a state-of-the-art community cancer center and a member of the University of Maryland Cancer Network. Our Harford County community of approximately 250,000 people has a higher than average rate of cancer incidence: 480.6 per 100,000 compared to 440.7 and 450.6 for Maryland and the entire United States, respectively. With the increased cancer incidence rate in Harford County, Kaufman Cancer Center has been able to develop and implement several multidisciplinary clinics that reduce the number of appointments before, during, and after cancer care.

Multidisciplinary cancer clinics allow a team of specialists to coordinate not only with each other but with patients and their families to create a comprehensive treatment plan in a timely fashion. These clinics provide a wealth of information that enhances the patient’s and family’s ability to make care decisions.

Multidisciplinary clinics provide not only an excellent forum to receive information but also access to clinical follow-up and surveillance. Kaufman Cancer Center currently offers full multidisciplinary clinics for lung and breast cancers. We also provide a supportive care clinic for patients with head and neck cancer that includes a nurse navigator, dietitian, social worker, speech pathologist, and chaplain. This population has indicated to us that they need more intensive supportive care and follow-up with dietary recommendations, speech and swallowing oversight, and overall coping. Therefore, our clinic has been designed to meet these specific needs.

Gynecologic oncology, palliative care, and survivorship clinics are also provided in a modified format. In addition, and through our agreement with the University of Maryland, Kaufman Cancer Center can offer onsite genetic counseling.

During development and implementation of the cardio-oncology program, we have had to evaluate and re-evaluate several processes that have improved cardio-oncology care and outcomes. For cancer programs looking to develop and implement a similar program, our cardio-oncology team shares these three takeaways:

1. Cardio-oncology collaborative services can be achieved within a community cancer center. Integrating these services within a multidisciplinary clinic helps to improve care coordination, quality of care, and cost effectiveness and result in better clinical outcomes.
2. Enhanced collaboration from all healthcare providers ensures a level of quality care that decreases the incidence of cardiotoxicity and improves patient outcomes and satisfaction.
3. Overall care of cancer patients—with or without cardiac disease—improves by decreasing adverse cardiovascular effects from cancer treatment.

Future goals of the cardio-oncology program are to:

1. Implement serial tracking echo findings to include trending and review of discontinued, dose reduction, and potential medication management and transfer echo results from previous technology to the strain technology to determine whether any minute changes have occurred as well as to compare the results.
2. Incorporate radiation pacemaker interrogation and expand services to certain radiation treatments that may be considered cardiotoxic.
3. Develop a presurgical evaluation and tool for patients who are diagnosed with lung cancer and have a potential cardiac risk, to include adjuvant and neo-adjuvant chemotherapy patients.
4. Expand services within the cardio-oncology clinic to include full clinic days and incorporate a second cardiologist who has specialized training in the cardio-oncology population.

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*Cardiology and oncology have become intertwined as we strive to assess patients for changes in their cardiac status and address these specific issues before they have a significant effect on the patient's heart health. Echocardiographic strain imaging, also known as deformation imaging, has provided a means to objectively quantify myocardial mechanical function. When significant changes in strain rates are noted, interventions can be used to support cardiac function as chemotherapy treatment continues, either by changing the chemotherapy regimen or with supportive cardiac medications.*

Mark S. Lewis, MD, RRT  
Director, Heart and Vascular Institute  
University of Maryland Upper Chesapeake Health

*As cancer treatment has become more effective, patients are living longer than ever. Minimizing long-term side effects of treatment and maintaining a high quality of life are critical goals of the Kaufman Cancer Center. Our cardio-oncology program brings state-of-the-art heart and cancer specialists together in real-time to provide a personalized approach to our patients in the hopes of not only curing more people than ever but also allowing them to do the things they love as strong and fit as before.*

Phil Nivaputmin, MD  
Medical Oncologist  
Upper Chesapeake Hematology Oncology

*I have a rare rapid growing tumor and my oncologist wanted me followed by a cardiologist to ensure no changes occurred to my heart because the medication I receive [Perjeta and Herceptin] can cause heart damage. I love Dr. Desai; he took excellent care of me and consistently monitored my ECHO for changes, which there weren't any. I was able to complete my Herceptin infusions and will continue to see Dr. Desai after my treatment is completed.*

Ellen Larrimore  
Patient