

## VIEWPOINT

# Development of a Cardio-Oncology Program in a Community Hospital



Deborah W. Sundlöf, DO,<sup>a</sup> Brijesh D. Patel, DO,<sup>a</sup> Kelly C. Schadler, MSN, CRNP,<sup>a</sup> Ross G. Biggs, DO,<sup>a</sup> Cheri A. Silverstein Fadlon, MD, MSCR,<sup>b</sup> Paul S. Corotto, MD,<sup>b</sup> Sameer Tolay, MD,<sup>c</sup> Ahmed J. Nadeem, DO,<sup>c</sup> Ranju Gupta, MD,<sup>c</sup> Nadeem V. Ahmad, MD<sup>a</sup>

The intersection between cardiovascular disease and cancer care is relevant to patients with cancer across the health care system. Cancer and cardiovascular disease are the leading causes of death in the United States (1). In the United States, 48% of adults have cardiovascular disease (2), whereas nearly 5,000 patients are diagnosed with cancer each day, and >20 million cancer survivors are expected by 2026 (3). Cancer and cardiovascular disease share many common risk factors. Because of recent advances in oncological diagnostics and therapeutics, the number of cancer survivors continues to rise, but cardiovascular disease often negatively affects survivorship. For example, women >65 years of age with breast cancer are more likely to die of heart disease than of cancer (4). Thus, optimization of cardiovascular outcomes in these patients has become increasingly important.

As the oncology community continues to develop and use new therapies, cardiovascular care of cancer patients has become increasingly complex. Many cardiologists are aware of acute cardiotoxicity related to anthracyclines and trastuzumab, but there are many novel agents with potential cardiotoxicities that are less familiar to most cardiovascular specialists. As use of these novel agents becomes standard of care, there is a growing need for cardiovascular medicine specialists in the general community who have knowledge and expertise in

the management of patients treated with these therapies.

Specialized cancer research centers and other large academic medical centers have been at the forefront of cardio-oncology program development, but these centers cannot reach all patients who would benefit from multidisciplinary cardiovascular and oncological care. According to the American Hospital Association, there were 6,210 hospitals in the United States in 2017, and only about 400 of those are academic medical centers or major teaching hospitals (5). Therefore, significant numbers of cancer patients who develop or have pre-existing cardiovascular disease will seek care at smaller centers. Furthermore, the nature of cancer treatment requires access to expertise close to where patients live. Depending on the specific cancer and treatment regimen, patients may have frequent infusions or diagnostic testing. Long drives to specialized centers may not be practical in these situations. For these reasons, there is a growing need for physicians in the community who can serve as subspecialists in the field of cardio-oncology. There are currently few formal fellowships in this field, resulting in “on the job” learning among many established practitioners. We aim to provide a framework for the implementation of a multidisciplinary cardio-oncology program in a community-based hospital.

## PROGRAM INCEPTION

Our multidisciplinary program was started in 2015 at Lehigh Valley Health Network (LVHN)-Muhlenberg Hospital, a 223-bed full-service hospital that is a member of LVHN. LVHN is a network of 8 hospital campuses, physician practices, and other services in the Lehigh Valley and surrounding areas of eastern

From the <sup>a</sup>Lehigh Valley Health Network, Heart Institute, Bethlehem, Pennsylvania, USA; <sup>b</sup>Lehigh Valley Health Network, Heart Institute, Allentown, Pennsylvania, USA; and the <sup>c</sup>Lehigh Valley Health Network, Cancer Institute, Bethlehem, Pennsylvania, USA. Dr. Nadeem holds stock in Seattle Genetics. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

Pennsylvania. Located about 60 miles north of Philadelphia and 90 miles west of New York City, the Lehigh Valley has a population of >800,000 people. LVHN-Muhlenberg Hospital primarily serves the population of Northampton County in the eastern portion of the region. It also serves as a teaching affiliate of the residency and fellowship programs based at the flagship hospital, LVHN-Cedar Crest, as well as the Morsani College of Medicine of the University of South Florida. The Heart Institute at LVHN-Muhlenberg currently has 12 cardiologists and 5 cardiology advanced practice clinicians (APCs), whereas the Cancer Center at Muhlenberg has 5 oncologists and 3 APCs.

The cardio-oncology program began from the mutual desire of an oncologist and a cardiologist to educate each other on a rapidly evolving field and to improve multidisciplinary care for our patients. At the inception of our program, there were no well-established guidelines to direct us in developing a program with limited resources. Instead, we each attended national and local cardio-oncology meetings and summits while also following the guidance of a national thought leader, friend, and mentor, Joseph R. Carver, MD. Dr. Carver led a monthly video conference with other local cardiologists who were also interested in cardio-oncology. During these conferences, we discussed challenging patients and the best approaches to commonly encountered cardio-oncology management scenarios.

Our initial core team included 2 cardiologists, a nurse practitioner, an oncologist, and a clinical pharmacist. The purpose of our multidisciplinary team was to review challenging cases while ensuring that our patients were receiving guideline- or consensus-directed care. One of the advantages of practicing in a smaller hospital is the feasibility of frequent face-to-face discussion among members of the cardiology and oncology teams to address clinical issues in real time. Patients were advised that their case would be discussed with the full cardio-oncology team, and they were almost universally appreciative of the collaborative approach to their care.

The resources required to start the program were minimal. We acquired administrative support with a projection to see 2 new referrals a month with plans of growing our program by 25% annually. Physicians and their staff within both the cardiology and oncology departments were instructed to direct all cardio-oncology consultations to members of our program.

Our monthly multidisciplinary meetings were held during nonclinical hours to avoid affecting our

existent clinical workload. Our program was marketed as the first of its kind within a 60-mile radius. We anticipated that these patients would generate downstream revenue in the form of, but not limited to, cardiovascular testing and other subspecialty consultations such as electrophysiology and advanced heart failure.

Additionally, to enable quality improvement and future research, we obtained Institutional Review Board approval to establish a patient registry using the REDCap software platform (Vanderbilt University, Nashville, Tennessee).

### PROGRAM COMPONENTS AND ALGORITHM

---

Building a multidisciplinary cardio-oncology program at a community hospital is a feasible goal and should be considered a necessary resource. To develop a cardio-oncology program successfully, the components should include the following: a cardiologist(s) with a personal commitment to self-market to medical colleagues and the community at large; an oncological champion(s); and administrative support to assist in the implementation of guideline- or expert consensus-driven tools to improve patient care. Initially, our program grew by word of mouth (e.g., being visible and available at oncology business meetings, grand rounds, and morbidity and mortality conferences). The most beneficial part of our group's referral strategy has been our commitment to speak personally to each referral oncologist, to discuss the care of their patient specifically, and to include them in any decision making. Our presence at oncology meetings to facilitate the cardio-oncology portions of patient discussions also has been vital to strengthening relationships. We have used existing marketing tools in the health network to provide patient and physician testimonials about our multidisciplinary care in the community newsletter, *Healthy You*. It has also been important to reach out directly to our community by speaking at events such as the American Heart Association *Go Red Luncheon*, cancer survivorship summits, and breast health community events.

Rapid growth has been our biggest hurdle, as well as our greatest success. Our program has surpassed all expectations by growing an average of 50% per year. Entrants into the program have been predominantly new patients, but they also have included existing cardiology patients who developed cancer and were referred to our program. The number of patients seen in our program annually starting in 2015 was 27, 36, 63, and 96, sequentially. Of our patients about two-thirds were seen initially as

| <b>TABLE 1 Location of Evaluation, Primary Diagnosis, and Therapeutic Agents for Cardio-Oncology Consultations</b>               |
|--|
| Location of cardio-oncology evaluation and referrals with a documented diagnosis   |
| Outpatient referral: 142 (64.0)  |
| Inpatient consultation: 80 (36.0)  |
| Reason for referral*   |
| Arrhythmia: 38 (17.0)  |
| Cardiovascular risk factor management: 36 (16.0)   |
| Decreased ejection fraction: 30 (13.0)   |
| Decompensated heart failure: 26 (12.0)   |
| Chest pain: 29 (13.0)  |
| Edema: 18 (8.0)  |
| Pre-chemotherapy assessment: 16 (7.0)  |
| Acute myocardial infarction: 12 (5.0)  |
| Unstable angina: 8 (3.0)   |
| Hypertension: 6 (3.0)  |
| Myocarditis: 4 (2.0)   |
| Other: 23 (10.0)   |
| Therapeutic agent†   |
| Taxanes: 86 (27.0)   |
| Anthracycline: 70 (22.0)   |
| Platinum compounds: 70 (22.0)  |
| Cytosan (cyclophosphamide for injection): 64 (20.0)  |
| Other alkylating agents: 27 (9.0)  |
| Vinca alkaloids: 37 (11.6)   |
| Anti-Her 2: 31 (10.0)  |
| Anti-vascular endothelial growth factor: 18 (6.0)  |
| Anti-CD20: 29 (9.0)  |
| Checkpoint inhibitor: 18 (6.0)   |
| Other: 80 (25.0)   |
| Values are n (%). *Patients may have had more than 1 diagnosis. †Patients many patients received more than 1 chemotherapy agent. |

outpatients, whereas the remainder were seen during a hospitalization. Not surprisingly, breast cancer and lymphoma were the first and second most common cancers in patients referred to the program, and 25% of patients were referred for either decreased left ventricular function or clinical heart failure. An additional 17% of patients were referred for arrhythmia (occasionally, we found, as a result of port migration into the right-sided heart structures), and 18% of patients were established cardiology patients who then required collaborative decision making. We performed 319 echocardiograms in this cohort, and there were 5 consultations placed to our electrophysiologist to move pacemaker or intracardiac defibrillator generators for oncological reasons. **Table 1** provides an additional summary of the characteristics of patients in our program. The diversity and complexity of cases illustrate the need for expertise in recognizing rare cardiovascular

complications of cancer therapy in smaller communities.

Recently the multidisciplinary team expanded geographically to include cardio-oncologists at the network's flagship campus and has included interested oncology and cardiology fellows. Our administrators share the same vision of continued growth because our Cancer Institute treated >3,400 patients across the network in 2017. Access was a concern, but as we grew, we added medical scribes who increased our capacity by 25% for patient visits. Our practice leaders also were seeking ways to optimize the productivity of our APCs. We opted to link our APCs with specific niches within our practice, including cardio-oncology, electrophysiology, and interventional cardiology. This has led to increased productivity as well as professional growth for our APCs.

We currently use expert consensus guidelines to determine which oncology patients should be referred to the cardio-oncology program (6,7). We are creating an algorithm in the form of a best practice advisory within our electronic medical records to be used by our oncologists and cardiologists. This best practice alert identifies patients at high and very high risk for cardiotoxicity and triggers a cardio-oncology consultation. This algorithm uses treatment- and chemotherapy-related risks and patient-related risk factors to create an overall cardiotoxicity risk score. Depending on the score, monitoring (echocardiograms with strain imaging and/or electrocardiograms) and management recommendations such as angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, carvedilol, and/or statins may be recommended.

As our program grows, we will continue to measure and monitor our performance in patient outcomes and best practices. The early success of our cardio-oncology program at Muhlenberg Hospital demonstrates that access to high-quality collaborative care in smaller facilities can help patients with cancer—who are already struggling with the high burden of care—spend more time where they want to be: close to home.

---

**ADDRESS FOR CORRESPONDENCE:** Dr. Deborah W. Sundlöf, Cardiology, Lehigh Valley Health Network, 2649 Schoenersville Road, Suite 301, Bethlehem, Pennsylvania 18017, USA. E-mail: [sundlofd@ptd.net](mailto:sundlofd@ptd.net). Twitter: [@DeborahWSundlof](https://twitter.com/DeborahWSundlof).

---

## REFERENCES

1. Heron M. Deaths: leading causes for 2016. *Natl Vital Stat Rep* 2018;67:1-77.
2. Benjamin EJ, Muntner P, Alonso A, et al. Heart disease and stroke statistics—2019 update: a report from the American Heart Association. *Circulation* 2019;139:e56-528.
3. Hayek SS, Ganatra S, Lenneman C, et al. Preparing the cardiovascular workforce to care for oncology patients. *J Am Coll Cardiol* 2019;73:2226-35.
4. Mehta LS, Watson KE, Barac A, et al. Cardiovascular disease and breast cancer: where these entities intersect: a scientific statement from the American Heart Association. *Circulation* 2018;137:e30-66.
5. American Hospital Association. *Fast Facts on U.S. Hospitals, 2019*. Chicago, Illinois: American Hospital Association; 2019. Available at: <https://www.aha.org/statistics/fast-facts-us-hospitals>. Accessed June 13, 2019.
6. Hermann J, Lerman A, Sandhu NP, et al. Evaluation and management of patients with heart disease and cancer: cardio-oncology. *Mayo Clin Proc* 2014;89:1287-306.
7. Virizuela JA, Garcia AM, De las Penas R, et al. SEOM clinical guidelines on cardiovascular toxicity (2018). *Clin Transl Oncol* 2019;21:94-105.

---

**KEY WORDS** anthracycline, arrhythmia, cancer, cardiomyopathy, cardiotoxicity, clinic, echocardiogram, myocarditis, tratuzumab