



An Introduction to the Westchester Medical Center  
**Cardio-Oncology Program**

Specialized, Comprehensive Care, Close to Home

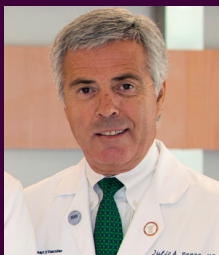
Summer 2018



Cardio-Oncology Program

**Heart & Vascular  
Institute**

Westchester Medical Center Health Network



Julio A. Panza, MD  
Chief of Cardiology

“The Westchester Medical Center Health Network (WMCHHealth) is proud to introduce the multispecialty WMCHHealth Cardio-Oncology Program, providing state-of-the-art cardiovascular care for cancer patients.

“This specialized program offers the highest quality consultative clinical services for cancer patients with cardiovascular issues, focusing on preventing, detecting and treating cardiotoxicity of cancer chemotherapy for inpatients and outpatients with no prior cardiovascular disease. It is based at WMCHHealth flagship Westchester Medical Center.

“The program represents a comprehensive clinical, academic, educational and scientific collaboration involving the oncology services, molecular and cell biology, pathology and various subspecialties of cardiovascular medicine. It centers on patient care, patient needs and patient respect.

“These pages contain a detailed description of the components that constitute the program.

“Thank you for placing your trust in the Cardio-Oncology Program and WMCHHealth.”



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### Appointments, Information, Referrals

914.909.6900  
914.493.2828 fax  
Ambulatory Care Pavilion  
100 Woods Road  
Valhalla, NY 10595

### Program Coordinator

Ana Sanchez Diaz  
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### Patient Transfers or Emergencies

Contact the Westchester Medical Center Transfer Center at 914.493.5555. Assistance is available around the clock, seven days a week.

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## Leadership

### Robust Expertise and Experience

The WMCHHealth Heart and Vascular Institute and WMCHHealth Cancer Institute are collaborating to provide state-of-the-art cardiovascular care of cancer patients. The leaders of the Cardio-Oncology Program are committed to providing leading-edge, compassionate treatment and healing. This exceptional team is close by, trustworthy and accessible to all, and hopes patients and physicians across the region share its vision.

### Director

**Diwakar Jain, MD, FACC, MASNC, FSNMMI**, has

performed extensive research in the field of cardio-oncology and has published several scientific publications in this field. He trained at Yale University School of Medicine

with the team of researchers that conducted pioneering studies on the cardiotoxicity of anthracyclines and published initial guidelines for the prevention of heart failure in patients undergoing anthracycline therapy. These



**Diwakar Jain, MD, FACC, MASNC, FSNMMI**

guidelines formed the basis and provided conceptual framework for all subsequent approaches to the prevention of anthracycline-induced heart failure.

Subsequently, Dr. Jain and his researchers conducted translational research to identify molecular and genomic markers of anthracycline cardiotoxicity and proposed guidelines for monitoring cardiotoxicity of Herceptin.

Dr. Jain is internationally renowned in the fields of nuclear cardiology and molecular cardiovascular imaging; behavior, mental stress and heart disease; and cardiotoxicity of cancer chemotherapy. He has published more than 135 scientific papers, review articles and book chapters. He also has co-authored two books. Dr. Jain has lectured extensively worldwide and earned many awards. He has served as a member of several editorial boards, has reviewed books and has served as a scientific reviewer for over 25 medical journals, including the Journal of the American Medical Association, Circulation, Journal of Nuclear Cardiology, Journal of the American College of Cardiology (JACC); JACC Cardiovascular Imaging; and the Journal of Nuclear Medicine.

### Optimum Care, Close To Home

Westchester Medical Center is poised to extend the Cardio-Oncology Program to WMCHHealth hospitals and outpatient facilities across the Hudson River Valley. It also intends to initiate research studies to enhance understanding of the mechanism of cardiotoxicity of various cancer therapeutic agents and develop novel approaches to prevent cardiotoxicity.

Cardiology and oncology health services play an increasingly vital role in the future of WMCHHealth. Both offer new, advanced care and technology to more patients at the main campus in Valhalla, as well as at network hospitals in the communities where patients live.

Physicians and patients choosing the WMCHHealth Cardio-Oncology Program will find doctors' visits, hospitalizations and follow-up appointments easier and less stressful – important factors in healing and recovery.

## Overview

**Cardio-oncology** is an emerging subspecialty addressing the complex interaction between cancer and the cardiovascular system. This involves monitoring, early detection, prevention and treatment of cardiotoxicity of cancer therapies. The development of newer therapies with lower or no cardiotoxicity, and careful planning of cancer therapy in patients with pre-existing cardiovascular disease to avoid overt cardiotoxicity and heart failure, are important aspects of this specialty.

Cancer is the second-largest cause of mortality in the United States. Early diagnosis, precise staging and therapy have significantly reduced mortality and increased longevity in cancer patients.

An estimated 14.5 million people nationwide live with a history of cancer. This number is projected to rise to 20 million over the next 10 years. Approximately 12,500 cases of cancer are diagnosed annually in children and adolescents in the United States.

There are more than 300,000 survivors of childhood cancers. The increased prevalence of cancer survivors is due in large part to chemotherapeutic agents, which unfortunately have severe side effects. As a result, a significant proportion of cancer survivors live with long-term adverse effects of cancer therapy, involving multiple organ systems.

Cardiovascular toxicity of cancer therapy is a major concern. Childhood cancer survivors face a high risk of late cardiovascular disease. The spectrum of cardiovascular complications of cancer therapy is wide and includes left ventricular (LV) dysfunction, congestive heart failure (CHF), coronary vasospasm, angina, myocardial infarction, arrhythmias, systemic hypertension, pericardial effusion, pulmonary fibrosis and pulmonary hypertension. The risk of cardiotoxicity is higher in patients with pre-existing cardiovascular diseases.

Cancers can affect the cardiovascular system in multiple ways. Tumors arising from the lungs, breast, esophagus and other mediastinal structures or those metastasizing to lungs or mediastinum can directly invade or compress the heart, great vessels or the pericardial space. Malignancies of plasma cells can result in deposition of immunoglobulins or their fragments in multiple organs, including the heart, leading to myocardial dysfunction, heart failure and arrhythmias. Cancers can affect the coagulation cascade, resulting in hypercoagulability and thromboembolic disorders.

A multi-specialty comprehensive approach is therefore required to address these aspects of cardio-oncology.

Cardiovascular Toxicity of Commonly Used Cancer-Therapy Agents	
Class and Agents	Cardiovascular toxicity
<b>Anthracycline agents</b> <i>Doxorubicin, Daunorubicin, Epirubicin, Idarubicin, Mitoxantrone</i>	Left ventricular dysfunction, congestive heart failure, myopericarditis
<b>HER2/Neu blockers</b> <i>Trastuzumab, Pertuzumab</i>	Left ventricular dysfunction, congestive heart failure
<b>Alkylating agents</b> <i>Cyclophosphamide, Ifosfamide, Cisplatin, Busulfan, Mitomycin</i>	Congestive heart failure, cardiac arrhythmias, hypertension, myopericarditis, thromboembolism
<b>Antimetabolites</b> <i>5-fluorouracil, Capecitabine, Cytarabine, Methotrexate, Fludarabine</i>	Coronary vasospasm, myocardial ischemia and infarction, myopericarditis, congestive heart failure
<b>Antimicrotubule agents</b> <i>Taxanes (Paclitaxel, Docetaxel), Vinca Alkaloids (Vincristine, Vinblastin)</i>	Bradycardia, hypotension congestive heart failure, myocardial ischemia, QT prolongation
<b>Antiangiogenic antibodies</b> <i>Bevacizumab</i>	Hypertension, myocardial ischemia
<b>Proteasome inhibitors</b> <i>Bortezomib, Carfilzomib</i>	Hypertension, congestive heart failure, myocardial ischemia, sudden cardiac death
<b>Tyrosine kinase inhibitors</b> <i>Imatinib, Dasatinib, Nilotinib, Sunitinib, Sorafenib, Lapatinib</i>	QT prolongation, hypertension, myocardial ischemia, congestive heart failure, thromboembolism
<b>Checkpoint inhibitors</b> <i>PD-1 antibodies (Nivolumab Opdivo™, Pembrolizumab Keytruda™), PD-L1 antibodies (Atezolizumab Tecentriq™, Durvalumab Imfinzi™), CTLA-4 antibodies (Ipilimumab Yervoy™)</i>	Atrial fibrillation, ventricular arrhythmias, congestive heart failure, myocarditis
<b>Interleukin-2</b>	Capillary leak syndrome, hypotension, arrhythmias, myocardial ischemia
<b>Antiandrogens and antiestrogens</b> <i>Abiraterone, Enzalutamide, Tamoxifen, Anastrozole</i>	Hyperlipidemia, thromboembolism, QT prolongation
<b>Miscellaneous</b> <i>Bleomycin</i>	Myopericarditis

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## Diagnostic Techniques Commonly Used in Cardio-Oncology

### **Echocardiography**

Echocardiography is used routinely to study the structure and function of various chambers of the heart, heart muscle, valves and the pericardial space surrounding the heart. This is the most commonly used non-invasive imaging test in patients with known or suspected heart disease. This test does not result in any radiation to the patients and can easily be repeated to track the changes in heart function over time. Recently, myocardial strain imaging using ultrasound has been found to be very useful for detecting adverse effects of cardiotoxic chemotherapy at an early stage. Global Longitudinal Strain Imaging of the heart is emerging as an important diagnostic tool for early detection and prevention of cardiotoxicity of cancer chemotherapy. Abnormal amounts of fluid can collect around the heart in patients with cancers arising from the lung, breast, esophagus and other structures in the chest due to a direct pericardial spread of the tumor or due to spread to the mediastinal lymph nodes. This interferes with the normal functioning of the heart and can sometimes be life-threatening. Echocardiography can readily detect this condition and can facilitate the removal of this abnormal fluid using relatively simple surgical procedures, which can be life-saving. Westchester Medical Center has state-of-the art echocardiography labs to serve adult and pediatric patient populations.

### **Nuclear Cardiovascular Imaging**

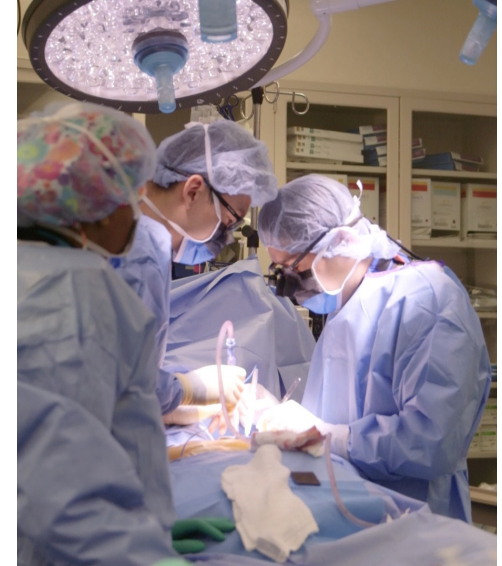
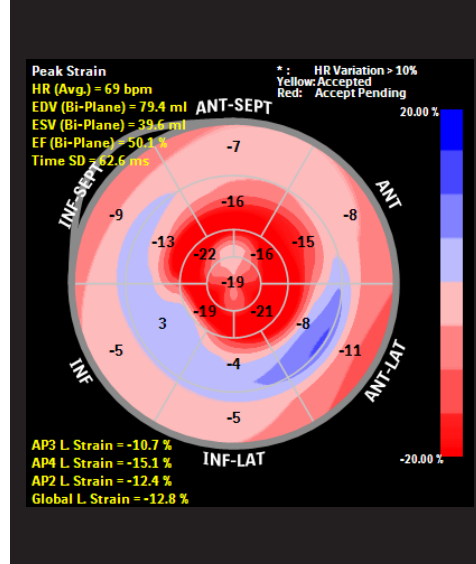
Cardiac imaging also can be performed using a number of radiopharmaceuticals, in conjunction with a treadmill exercise test or chemical stress test (pharmacological stress test), to detect coronary artery disease and identify patients who can benefit from more advanced diagnostic and therapeutic procedures such as coronary angiography and stent placement in the coronary arteries, and coronary artery bypass surgery. This test is highly useful in patients suspected to have coronary artery disease. This test can avoid invasive tests such as coronary angiography in patients who do not have underlying coronary artery disease. Nuclear-imaging tests also can be performed to study the function of the heart (MUGA scan). A subtle deterioration of cardiac function is often the first indication of cardiotoxicity of anthracycline agents and Herceptin. A prompt discontinuation of these medications at this stage can prevent serious damage to the heart muscle. Technetium-99m-pyrophosphate imaging and PET imaging of the heart can detect cardiac amyloidosis, a relatively uncommon but serious condition of the heart, in which abnormal proteins accumulate in the heart muscle and interfere with a proper functioning of the heart. Westchester Medical Center has state-of-the-art nuclear cardiovascular imaging labs to serve inpatients as well as outpatients.

### **Magnetic Resonance Imaging (Cardiac MRI)**

Magnetic Resonance is an advanced technique for imaging the structure and function of the heart. It provides detailed anatomical information about different chambers, valves and pericardial space surrounding the heart. Gadolinium-enhanced images of the heart can detect myocardial scarring due to a variety of reasons, such as old myocardial infarction, radiation-induced and chemotherapy-induced injury to the heart muscle. T1 Imaging of the heart can detect and further characterize abnormalities of the myocardial tissues. Westchester Medical Center has state-of-the-art cardiovascular MR imaging labs to serve inpatients as well as outpatients.

### **Exercise Stress-Testing**

This is a simple test to determine the functional capacity of the heart. An impaired functional capacity may be an early indication of heart disease. Exercise stress-testing often is combined with heart imaging with echocardiography, or nuclear imaging of the heart, to secure additional information about the valves, coronary arteries and heart function.



## Collaborating Disciplines in Cardio-Oncology

### Electrophysiology

Cancer patients may have pre-existing heart arrhythmias such as atrial fibrillation. Some cancer-therapy agents also may trigger or worsen these arrhythmias. Furthermore, sometimes there can be a significant interaction between commonly used treatments of these arrhythmias and cancer therapies. Careful planning may be required to address these issues. Some arrhythmias can be treated by catheter-based ablation procedures; their timing requires very careful planning. Westchester Medical Center has a world-class electrophysiology team to provide these services.

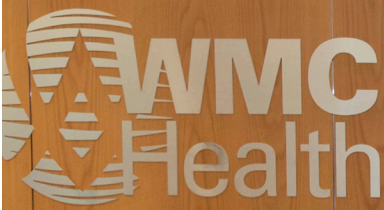
### Cardiac Catheterization

Patients with significant symptoms of heart disease or those with abnormal non-invasive imaging of the heart may require further evaluation of the heart by cardiac catheterization to detect narrowing of the heart's arteries. Cardiac catheterization often can be combined with a procedure to open these blocked arteries using balloon angioplasty and stenting of coronary arteries.

Cardiac catheterization also is helpful in the evaluation and treatment of patients with disease of the heart valves. Cardiac catheterization also is used to drain abnormal accumulation of fluid around the heart in patients with metastatic cancers. Westchester Medical Center has a state-of-the-art catheterization laboratory available 24 hours a day for urgent procedures.

### Cardiac Surgery

Cancer patients with heart disease may require heart surgery to treat the underlying heart disease. The timing of such surgery requires careful, thoughtful planning and coordination among multiple teams caring for these patients. Cancer patients sometimes require urgent surgery to drain abnormal fluid around the heart. Westchester Medical Center's cardiac surgical team is highly experienced in providing very high quality surgical care for cancer patients.



Members of the Cardio-Oncology Team (from left to right): Chhaya Aggarwal-Gupta, MD; Raquel Hinsch, NP; Julio Panza, MD; Shirelle Campos, MA; Anthon Fuisz, MD; Diwakar Jain, MD; Michael Fanucchi, MD; Mala Sharma, MD; Noemi Mercado, PA; Tanya Dutta, MD and Nader Abraham, PhD.

## Meet The Cardio-Oncology Program's Specialized Team

*Sustained Excellence, Groundbreaking Approaches and Improved Lives*

### **Director**

Diwakar Jain, MD, FACC,  
MASNC, FSNMMI

### **Program Coordinator**

Ana Sanchez Diaz

### **Physician Assistant**

Noemi Mercado, PA

### **Clinical Collaboration (Oncology)**

Michael Fanucchi, MD  
Mitchell Cairo, MD

### **Research Collaboration**

Michael Fanucchi, MD  
Mitchell Cairo, MD  
Nader Abraham, PhD  
John T. Fallon, MD

## Diagnostic and Therapeutic Tests and Procedures

### **Nuclear Cardiology Lab and PET Imaging**

Diwakar Jain, MD  
Perry Gerard, MD

### **Echocardiography Laboratory (TTE, TEE, Myocardial Strain Imaging)**

Mala Sharma, MD  
Tanya Dutta, MD

### **MRI**

Anthon Fuisz, MD

### **Pathology and Genomic and Cellular Biology**

John T. Fallon, MD  
Mitchell Cairo, MD

### **Electrophysiology**

Jason Jacobson, MD

### **Heart Failure Service**

Chhaya Aggarwal-Gupta, MD

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## About Westchester Medical Center Health Network

The Westchester Medical Center Health Network (WMCHealth) is a 1,700-bed healthcare system headquartered in Valhalla, NY, with 10 hospitals on eight campuses spanning 6,200 square miles of the Hudson Valley. WMCHealth employs more than 12,000 and has nearly 3,000 attending physicians. With Level 1, Level 2 and pediatric trauma centers, the region's only acute-care children's hospital, an academic medical center, several community hospitals, dozens of specialized institutes and centers, skilled nursing, assisted-living facilities, homecare services and one of the largest mental-health systems in New York State, WMCHealth is the pre-eminent provider of integrated healthcare in the Hudson Valley.

Visit [WMCHealth.org](http://WMCHealth.org).

### **Appointments, Information, Referrals**

914.909.6900  
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Ambulatory Care Pavilion  
100 Woods Road  
Valhalla, NY 10595

### **Inpatient Transfers or Emergencies**

Contact the Westchester Medical  
Center Transfer Center at  
914.493.5555.

#### *Westchester Medical Center Health Network includes*

Westchester Medical Center | Maria Fareri Children's Hospital | Behavioral Health Center | MidHudson Regional Hospital  
Good Samaritan Hospital | Bon Secours Community Hospital | St. Anthony Community Hospital  
HealthAlliance: Broadway Campus | HealthAlliance: Mary's Avenue Campus | Margaretville Hospital

[WMCHealth.org](http://WMCHealth.org)



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**Heart & Vascular  
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