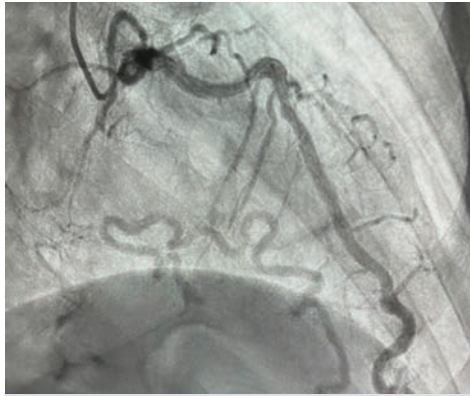


Cath Lab Digest

A product, news & clinical update for the cardiac catheterization laboratory specialist



ANOMALIES

Rare Variant of the Obtuse Marginal Artery Originating From the Left Anterior Descending Coronary Artery

Seyed Khalafi, MS; Mehdi Khalafi, MD; Giri D. Mundluru, MD

Abstract

Coronary artery anomalies are a rare phenomena in cardiology. CAA is infrequently reported as most are indolent and found incidentally on cardiac imaging. We report the case of a 76-year-old male with a history of hypertension, peripheral arterial disease, myocardial infarction 2 years prior, and hyperlipidemia, presenting with dyspnea on exertion. The patient had an abnormal stress test and underwent a left and right coronary artery catheterization that showed a mid-LAD stenosis of 80% and a chronic total occlusion of the RCA. On angiography, the patient had a left obtuse marginal artery originating from the LAD.

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In This Issue

Is Your Lab Using Intravascular Imaging Enough?

Morton J. Kern, MD

The scientific literature is packed with data on why intravascular imaging should be routine for PCI, both before and after stent placement. However, the discordance between the evidence and guidelines with the actual use of imaging across the country and around the world demonstrates that not all operators practice PCI with imaging. Why do some operators avoid using imaging for routine practice? I thought I'd look again at this question, as it has been asked for decades since the introduction of imaging (the same can be said about physiology).

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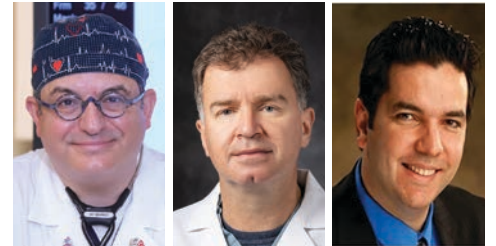
PROGRAM SPOTLIGHT

Interventional Cardio-Oncology at The University of Texas MD Anderson Cancer Center

Cath Lab Digest talks with:

- Mehmet Çilingiroğlu, MD, FSCAI, FACC, FESC, FAHA
- Cezar A. Iliescu, MD, FACC, FSCAI
- Konstantinos Marmagkiolis, MD, MBA, FACC, FSCAI

The Department of Cardiology at MD Anderson and its team was the first in the world to provide comprehensive cardiac care to patients with cancer, focusing on the prevention, diagnosis, and treatment of cancer therapy-induced cardiotoxicity.



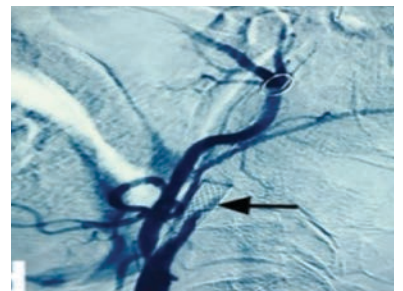
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CATH LAB MANAGEMENT

Strategies for Training Healthcare Professionals in the Post-COVID Era

Samantha Propper, MBA, BS, RCIS

The COVID-19 pandemic has exposed many of the longstanding challenges in the healthcare industry, including staffing shortages and the need for ongoing training and education for healthcare professionals. In the cath lab, understaffing can lead to a lack of education and knowledge, as staff are often in survival mode, just trying to make it through cases. Even as the pandemic begins to subside, healthcare facilities are still struggling to train staff members who may have only 2-3 years of experience or less.



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Interventional Cardio-Oncology at The University of Texas MD Anderson Cancer Center

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Can you tell us about treating cancer patients and your work with this unique population at MD Anderson?

Dr. Cezar Iliescu, Medical Director, MD Anderson Cardiac Catheterization Laboratory: MD Anderson had a groundbreaking idea in 2008 to establish the first cath lab in a cancer center worldwide. Given the challenges that cancer patients face, it is critical for cardiologists to be involved in their care. Cancer patients require specialized treatment, and their resilience is distinct from

other patients. At MD Anderson, we use a single biplane lab with biplane imaging for all patients, as it reduces the amount of contrast needed, which is essential since cancer patients receive nephrotoxic drugs. We also treat patients at Memorial Hermann-Texas Medical Center and Texas Heart Institute at Baylor St. Luke's Medical Center. Our cath lab procedures are not solely diagnostic or interventional; we aim to defer many things in the acute phase and employ intravascular imaging such as optical coherence tomography or intravascular



Darla Wagner, RN, Kara Thompson, MD, Gerryross Tomakin (First Nurse Manager of the First Cath Lab in a Cancer Center), Elizabeth Shelton Martin, NP, Saleemah Smith, PA, MaryBeth Young, RN, Richard Ainslie, RN, Richard Smalling, MD, Jean Bernard Durand, MD, and Cezar Iliescu, MD.



Cath Lab team members with Mehmet Çilingiroğlu, MD.



Cezar Iliescu, MD, Dean Silagan, RN, and Richard Ainslie, RN.

ultrasound imaging and functional assessment to make informed decisions in each case.

Dr. Konstantinos Marmagkiolis: Over the past decade, my colleagues, Dr. Iliescu, Dr. Çilingiroğlu, and I, have devoted our research to studying the management of cancer patients in the cath lab. Our investigation includes patients who are awaiting cancer treatment, those who are currently undergoing cancer treatment, and those who have survived cancer. The objective of our research is to identify the ways in which cancer therapy intersects with the cath lab, ensuring safe deferral of treatment when possible, or safe administration of necessary cardiac treatment.¹⁻³ Specifically, we focus on the impact of chemotherapy agents on the coronary arteries, which can result in heart attacks, formation of clots, acceleration of coronary artery disease, or coronary artery spasms through various mechanisms. With an understanding of how chemotherapy agents are affecting a patient's coronary disease, we are better equipped to manage patients already undergoing cancer therapy.^{4,5}

Dr. Mehmet Çilingiroğlu: One in 150 people living right now has cancer or is a cancer survivor. Immunotherapy and individualized therapy help patients with cancer to live longer. What these patients die from is actually not their cancer; they die from cardiovascular disease, which is the leading cause of death in cancer patients. Both chemotherapeutic agents and radiation therapy have long-term, non-negligible effects, as well as negative effects for cardiovascular remodeling. Patients who received their required chemotherapy, radiation therapy, and/or immunotherapy, have a much higher risk — 3 to 5 times higher risk — of having any kind of vascular/cardiovascular disease state. That can mean a heart attack, stroke, peripheral arterial disease, constrictive pericarditis from radiation, mitral valve calcification, etc. Patients die or become disabled from the cardiovascular effects of chemotherapy, immunotherapy, and radiation. Diagnosing these



Echo Tech Leemon Thomas, Cezar Iliescu, MD, and Rafael Go, MD. Triple guidance: fluoro, Sonosite (Fuji Medical), and echo for pericardial effusion.



Mehmet Çilingiroğlu, MD, in the cath lab.

patients properly, in a timely manner, and treating them is of key importance to their survival. Our goal is to diagnose these patients early so that we can treat them while they are living long enough from their cancer treatment to enjoy life. Ten or 20 years ago, a patient with cancer might not have followed up with a cardiologist unless they had a heart problem. Today, we know that every single patient who has cancer and receives chemotherapy and/or radiation therapy should be seen by a cardiologist. Perhaps a regular cardiologist most likely at the beginning, but as treatment goes on and the disease state advances, a cardio-oncology specialist has to be seeing and treating these patients.

What are some of the challenges in treating cardiovascular disease in cancer patients?

Dr. Cezar Iliescu: Our biggest challenge has been thrombocytopenia. Most of our patients have thrombocytopenia from the cancer treatments, from the disease itself, and from the myelosuppression. We started working on this problem and expanded the field to where we now have a pathway for treatment^{6,7} and can do interventions on these patients without loss. To our surprise, we found that platelet counts above 50,000 are exactly like platelet counts above 100,000. There is no significant difference between them. If patients are above 50,000, we treat them as though they have normal platelet counts. Below 50,000, it is a discussion of what to do next. We put our algorithm in the 2017 Society for Cardiovascular Angiography and Interventions (SCAI) expert consensus statement⁸ and the algorithm is now embedded in the European Society of Cardiology Guidelines for cardio-oncology⁹ as well. Our platelet thresholds are 10,000 and above for aspirin, and 30,000 and above for P2Y12 inhibition. Below these thresholds, it is not that we don't do those cases — we do — but we inform the patient about the obviously prohibitive risk of bleeding, and that there is no 'plan B'. If something bad happens, we are going to have to absorb the



Advanced Practice Providers Myrshia Hunter, PA, Hasana O'Neal, PA, and Elizabeth Mooney, NP, with Executive Assistant Sonia Perez.

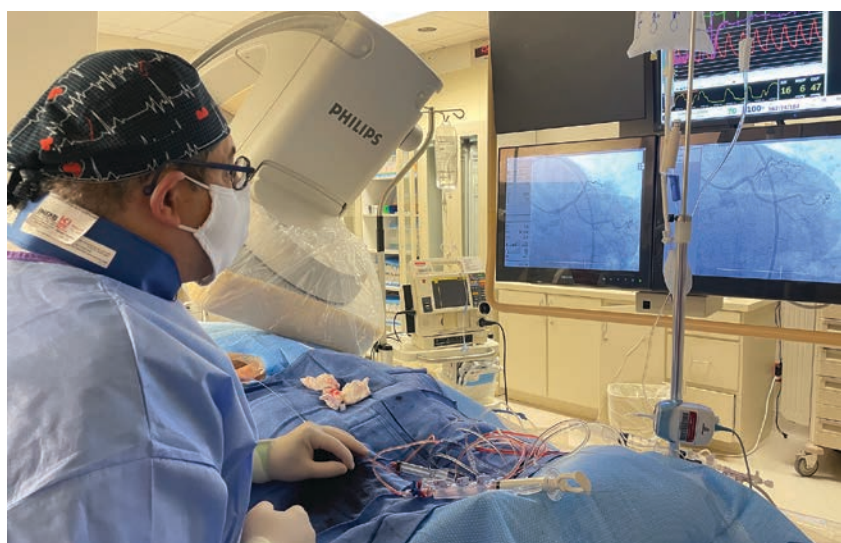
loss with them. The oncologist also has to balance the risks, especially in hematological malignancies, where we are concerned for vessel friability and the risk of intracranial bleed. If the oncologist feels that the risk of bleeding is acceptable, we do the procedure, irrespective of the platelet count. We have stented patients with platelets at 4000 or 5000, and these patients have done well, without any serious complication. These procedures can be done with a good understanding that the risk is high, there is no plan B, and with a meticulous access for hemostasis. We do very delicate, continuous aspiration and flushing of the catheters and wires, because again, cancer patients are prothrombotic as well as have an increased risk of bleeding. From this experience, we have expanded our practice to doing pericardiocentesis in patients with low platelets, using subxiphoid access and apical access. We have published our approach^{10,11} on how to do pericardiocentesis in cancer patients with thrombocytopenia in an algorithm defining everything we do in this high-risk procedure. But



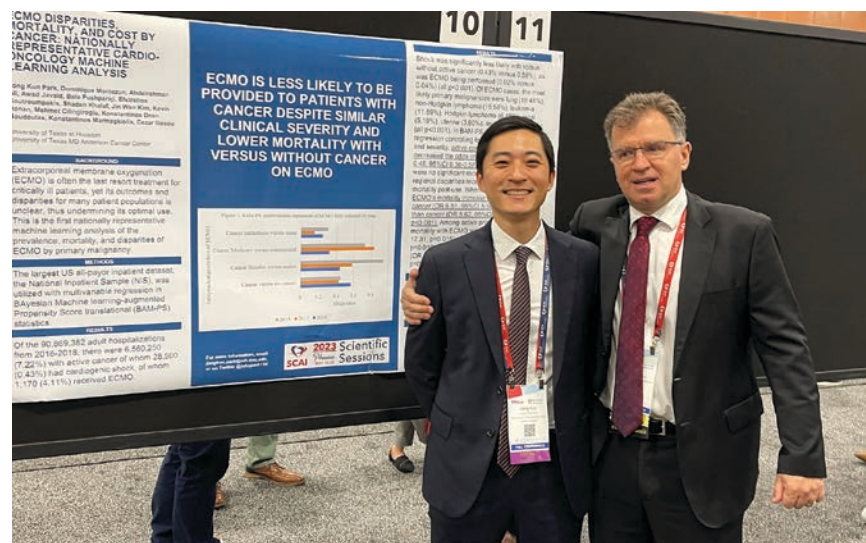
Cezar Iliescu, MD, Rafael Go, MD (Cardiology Fellow, future Interventional Cardiology Fellow, Corewell Health Grand Rapids, Michigan), Anjelica Hinojosa, Nurse Manager Pulmonary Procedures and Cath Lab, Leendert Keus, Director of Pulmonary Procedures and Cath Lab.

we have not lost a patient. We are able to do it with a micropuncture needle and wires, and a Cook Medical 5-inch drain which is very, very smooth and delicate, and easily gets in. Equipment is a huge part of the story. Without it, the procedure is almost impossible, because then you have to go with stiffer wires to advance the catheters.

Dr. Mehmet Çilingiroğlu: A platelet count of 20,000 is quite low, and so initially we asked, how can I do the angiogram? Most of the time we used radial access, but we wondered, will the patient be safe? Will the patient bleed? We used to think, 10 years ago, that patients with a platelet count of 20,000 might bleed to death if we gave them clopidogrel and intervened on them, but we have found that this is not the case. Cancer patients do have enough platelets for us to be able to do a heart cath, put in stents, and treat them with dual antiplatelet therapy. Our therapies can be shorter because we do imaging studies to make sure that the patient has stent coverage of the lesion and



Mehmet Çilingiroğlu, MD, performing a procedure in the cath lab.



John Park, MD, IM Resident, presenting at the Society for Cardiovascular Angiography and Interventions (SCAI) Scientific Sessions, and Cezar Ilescu, MD.

well expanded and apposed to the vessel wall. They have short-term dual antiplatelet therapy and they are safe. Let's say that we have to stop antiplatelet therapy. We can do optical coherence tomography (OCT) imaging in these patients, look again at the stent apposition and stent expansion, and with greater confidence, tell the patient, "Yes, you can hold off on your antiplatelet therapy for your surgery or biopsy."¹² It is unique. If Mr. X is going to have angiogram, comes into the prep area, and we find out that his platelet count is 10,000,

“We are privileged to treat some of the most complex patients, as cancer patients with cardiovascular disease are among the sickest and require impeccable procedures due to their limited reserves. In the past, we saw high mortality and morbidity rates, but today we have been able to nullify these rates.”

in a regular cath lab, they are going to immediately to call you and say, “Doc, you want to cancel the patient because the patient's platelet count is 10,000.” That doesn't happen at MD Anderson.

Of the different chemotherapeutic agents, the most well-known is Adriamycin, used in females with breast cancer. Unfortunately, once patients take Adriamycin, they can start having some adverse effects in the pumping function of the heart. We had a nurse practitioner who was 45 years old and had breast cancer. She had Adriamycin treatment and after that, she developed severe heart failure. Her coronaries were open, she had no blockages,

her ejection fraction was only 20%, and she had severe leakage in her mitral valve. Surgery said that they could not treat her because her ejection fraction (EF) was severely reduced (left ventricular [LV] EF 20% with severe global hypokinesis) and she had severe mitral regurgitation. We placed a MitraClip (Abbott Vascular) in this patient and with the combination of guideline-directed medical therapy (GDMT), her EF came back to normal in six months. Her structural disease was a result of her chemotherapy. Without immediate cardio-oncology consultation and intervention, an effective cancer therapy would have stopped or been altered, and her cancer may have progressed. She is now not only breast cancer-free after chemotherapy treatment, but after having a MitraClip placed, she went back to practicing actively as an APN in her hospital emergency department.

We had another patient, a university professor, who had colon and bladder cancer. Both cancers were treated, he was disease free, but he was at the age of 85 and had severe stenosis of his aortic valve. In such patients who have cancer, how do we decide whether to treat them for their structural heart disease such as mitral regurgitation or aortic stenosis, and when we do we treat them conservatively? Ultimately, we treated this patient with transcatheter aortic valve implantation with minimally invasive therapy. He survived 5 years after that and did very well.

Cancer patients are surviving longer because we have much better chemotherapeutic agents, we have better region-specific radiation therapy instead of radiating the whole chest, and we take basic preventive measures from the cardiac standpoint, in terms of monitoring any onset of disease. For example, in those patients on Adriamycin, we can see when this agent starts showing its effects on the myocardium. We now have LV strain measurement. Before patients even have any reduction in their EF, they start having problems that we can see on the LV strain, which allows us to make an earlier diagnosis and provide treatment. We can stop the chemotherapy as soon as we can see that their LV strain pattern is becoming abnormal.

We also need to make sure that stents are well-expanded in patients who have cancer, because of the procedures they continue to undergo, such as biopsies and surgery. We all know the problem with angiograms. Angiograms cannot necessarily show if the stent is well expanded and well apposed. We use OCT to make sure that the stent is well expanded and well apposed to the vessel wall so that the drugs on the stents can get into the vessel and prevent restenosis. If the patient has restenosis and returns, we use OCT to understand whether it is an under-expanded stent or tissue growth, and if so, what kind of tissue is growing inside the stent, so that we can give patients the proper therapy.¹³

Dr. Konstantinos Marmagkiolis: Cancer patients are at risk for a unique condition known as takotsubo cardiomyopathy, which is more prevalent in this population compared to the general public. While initial theories attributed this occurrence to emotional stress, we now believe that it is a multifactorial condition, as it has been observed in up to 10% of cancer patients with suspected acute coronary syndrome.¹⁴ Our research has identified several chemotherapy agents that can cause or increase the risk of takotsubo. This condition can mimic acute coronary syndromes and its definitive diagnosis is made in the cath lab. Without proper diagnosis, medical therapy may involve aspirin, clopidogrel, or even anticoagulation, which can pose risks for cancer patients who commonly experience anemia and thrombocytopenia. Treatment of takotsubo cardiomyopathy in cancer patients involves avoidance of antiplatelet therapy, making an accurate diagnosis crucial.

Can you share more about structural heart disease treatment in cancer patients?

Dr. Konstantinos Marmagkiolis: We take advantage of the minimally invasive nature of transcatheter aortic valve replacement (TAVR) in the cancer patient population to avoid deep anesthesia whenever possible.^{15,16} Many centers now use conscious sedation or local anesthesia during TAVR.



Mehmet Çilingiroğlu, MD (at right)

If a patient is at high risk of stroke, we have a low threshold for using the Sentinel device (Boston Scientific) for stroke prevention, especially if they have a history of hypercoagulation. The POPular TAVI trial, which compared single antiplatelet therapy to dual antiplatelet therapy, was a significant advance for cancer patients who had previously been deprived of TAVR due to the need for aspirin and clopidogrel after the procedure. The trial showed that single antiplatelet therapy after TAVR is as effective as dual antiplatelet therapy. This has been a major step in enabling TAVR for cancer patients. With tight collaboration with our oncology colleagues, we strive to be efficient in completing the process in an expedited manner, knowing that cancer patients need to have their TAVR and return to their cancer therapy as soon as possible.



Nicolas Palaskas, MD (Co-Director MD Anderson Cardiac Cath Lab), Anita Deswal, MD (Chair Cardiology Department MDACC, Chair Onco-Cardiology Section ACC), Cezar Iliescu, MD (Director MDACC Cath Lab), William Marrs, RN.



Konstantinos Marmagkiolis, MD, Cindy Grines, MD, and Cezar Iliescu, MD.

There is limited data on the use of MitraClip in cancer patients, but short observational studies have shown that it can safely be used to treat mitral valve regurgitation in these patients. Most cancer patients have to discontinue cancer therapy because of heart failure triggered by cancer therapy. Treating them with MitraClip to control their heart failure symptoms can allow them to quickly return to cancer therapy and better tolerate it.

The Watchman (Boston Scientific) procedure for left atrial appendage occlusion recently received FDA approval for dual antiplatelet therapy (aspirin and clopidogrel) after implantation. Previously, patients who received the Watchman were required to stay on oral anticoagulation (OAC) for 45 days, which was a major obstacle for cancer patients due to their anemia and thrombocytopenia. The fear was that cancer patients would experience a major bleed with OAC, as most of them require surgeries or biopsies for their cancer therapy, which cannot be done while on OAC. Aspirin and clopidogrel are much better tolerated by cancer patients going through surgeries and other treatments.

Since structural heart procedures are now minimally invasive, we have moved away from open cut down for TAVR. With MitraClip and Watchman, we use veins for access, and most patients can ambulate the same day and return to their regular activities within 2 to 3 days.

Any final thoughts?

Dr. Cezar Iliescu: Over a decade ago, Dr. Çilingiroğlu, Dr. Marmagkiolis, and I collaborated on a SCAI expert consensus statement.¹ Dr. Çilingiroğlu and Dr. Marmagkiolis reached out to me, as at that time, I was the only one involved specifically with the cardiovascular treatment of cancer patients. This collaboration has been invaluable, and I am grateful for their support and dedication. Dr. Cindy Grines has also been a mentor to us and a great supporter of our work in this field from the beginning. We have had a large team, including Mayo Clinic's Dr. Joerg Herrmann, advanced imaging help from Eric Yang from UCLA, as well as many of our imaging people

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here at the University of Texas. This multidisciplinary effort has been crucial to our success. We are privileged to treat some of the most complex patients, as cancer patients with cardiovascular disease are among the sickest and require impeccable procedures due to their limited reserves. In the past, we saw high mortality and morbidity rates, but today we have been able to nullify these rates. Since cancer care is personalized, we cannot randomize patients. To gather data in the cancer patient population, we are utilizing machine learning and artificial intelligence to compare data from our own and other large registries.¹⁷⁻²¹ It may be the only way we are going to get data in the cancer patient population. ■

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