DR. SAMIN K. SHARMA FAMILY FOUNDATION

Cardiac Catheterization Laboratory

2018 Clinical Outcomes & Innovations Report

Mount Sinai Heart

From Drs. Samin K. Sharma and Annapoorna S. Kini

Samin K. Sharma, MD, FACC, FSCAI

Senior Vice-President, Operations & Quality, Mount Sinai Heart

Director, Interventional Cardiology, Mount Sinai Health System

President, Mount Sinai Heart Network

Annapoorna S. Kini, MD, MRCP, FACC

Director, Cardiac Catheterization Laboratory

Director, Structural Heart Disease Program

Director, Interventional Cardiology Fellowship Program

We are proud to present this 10th edition of our *Clinical Outcomes & Innovations Report*. For more than ten years, we've been compiling this report of our procedural outcomes and volume, transparently sharing our results as compared to other centers in our region and across the country. In that time, the landscape of interventional cardiology has changed greatly—today, many centers offer percutaneous coronary intervention (PCI) as a life-saving intervention for diseases of the heart and peripheral arteries.

At The Mount Sinai Hospital, our Catheterization Laboratory remains a leader for several reasons, including:

- The talent of our team of interventionalists and supporting staff;
- Strict adherence to proven protocols and standards of care;
- Innovation and embrace of new technologies, techniques, and approaches, including participation in clinical trials that can benefit our patients;
- A heart team approach, which involves consulting with our colleagues in clinical cardiology and cardiac surgery to ensure the best course of care for each patient;
- Compassion and genuine concern for our patients' health, long after their procedure.

Our procedural outcomes data over the years support the statement that we have *perfected* the art of PCI. As a result, many patients who have been considered too high-risk to receive care elsewhere are referred here. As we accept ever more complex cases, our PCI complications continue to decline.

Patients remain at the center of everything we do, and in this publication, you will read the words of our grateful patients, many of whom had particularly challenging cases. As we look to 2019 and beyond, we will continue to pioneer new paths, setting the pace for another remarkable decade of innovation and excellence.

Table of Contents

For more information, visit **www.mountsinai.org/interventional-cardiology-cath-lab**

David L. Reich, MD

President and Chief Operating Officer,
The Mount Sinai Hospital

President, The Mount Sinai Hospital

In a world that feels as if it's in constant motion, 20 years seems like an eternity. Yet, according to the Department of Health, that's how long The Mount Sinai Hospital's Cardiac Catheterization Laboratory has had mortality rates that are among the lowest in New York State.

Anyone who has witnessed our Cardiac Catheterization Laboratory under the leadership of Samin Sharma, MD, and Annapoorna Kini, MD, would not be surprised.

There's an art and a science to interventional cardiology, and The Dr. Samin K. Sharma Family Foundation Cardiac Catheterization Laboratory has mastered both—employing talented interventionalists and applying consistent protocols to replicate excellent results over time.

In those 20 years, we've seen the field of interventional cardiology rapidly evolve, and our Catheterization Laboratory has been in the vanguard of that. Today, interventional cardiology is more than opening blocked arteries in the heart. Interventionalists are tackling complex multi-vessel disease, implanting devices, correcting congenital defects, and even replacing valves. And the team continues to push the envelope, leading and participating in groundbreaking clinical trials that will invent the next generation of life-saving procedures.

Cardiac care isn't the only way this remarkable group of physicians is touching hearts. These pages include stories from grateful patients, impressed not only by the expertise, but the humanity of the team here at Mount Sinai as they faced challenging medical circumstances.

We hope you enjoy reading this *Cardiac Catheterization Laboratory Clinical Outcomes & Innovations Report* and welcome your feedback on our progress.

Valentin Fuster, MD, PhD, MACC

Physician-in-Chief,
The Mount Sinai Hospital

Director, Mount Sinai Heart

Director, Zena and Michael A. Wiener Cardiovascular Institute and Marie-Josée and Henry R. Kravis Center for Cardiovascular Health

Richard Gorlin, MD, Heart Research Foundation Professor of Cardiology

Director, Mount Sinai Heart Physician-in-Chief, The Mount Sinai Hospital

As well-established leaders in cardiology, the team at The Samin K. Sharma Family Foundation Cardiac Catheterization Laboratory are finding new ways each day to offer hope to patients with a wide variety of cardiovascular disease. The leadership established by Samin K. Sharma, MD, and Annapoorna S. Kini, MD, is embraced by this exceptional group of interventional cardiologists, who approach each day with a sense of curiosity and innovation.

Safety is at the forefront of everything that happens in the Catheterization Laboratory, as is reflected in the exceptionally low complication rate. These excellent outcomes stem from the team's combined efforts to employ the most advanced techniques and technologies. The team's goal is always to put their patients' well-being first.

Each patient who walks through the doors of The Mount Sinai Hospital's Cardiac Catheterization Laboratory is treated not as a set of symptoms, but as an individual. They're encouraged to ask questions and take an active role in their care. In this way, cardiologists and patients work together to ensure positive outcomes. This effort to work both for and with patients has been met with gratitude, as you'll read in the following pages.

It has been my honor to witness the growth of our Cardiac Catheterization Laboratory to one of the busiest and most successful centers in the country. I'm proud to present this edition of the *Clinical Outcomes & Innovations Report*.

The Cardiac Catheterization Laboratory

“A dream doesn’t become reality through magic; it takes sweat, determination, and hard work.”

– **GEN. COLIN POWELL**
FORMER US SECRETARY OF STATE

AN OVERVIEW OF SERVICES AND OUTCOMES

The Cardiac Catheterization Laboratory at The Mount Sinai Hospital is among the highest-volume centers, yet also among the safest interventional catheterization laboratories in the United States. Each member of the Cardiac Catheterization Laboratory staff has a strong work ethic and takes pride in his or her contribution to the principal goal: delivery of efficient and safe care to patients in need. As a result, the Cardiac Catheterization Laboratory consistently reports a very high level of patient satisfaction; 62 percent of patients are discharged on the same day of the procedure.

The system of established standard protocols, rigorous attention to detail, and a strong sense of teamwork have helped us to achieve the

62 Percent

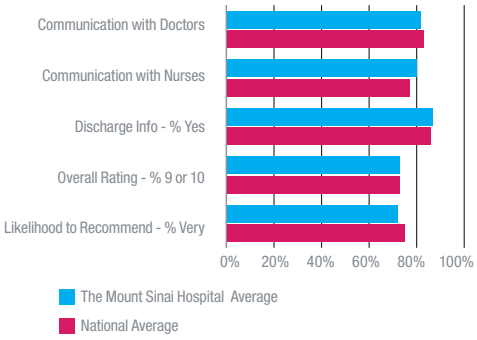
OF OUR ELECTIVE INTERVENTIONAL PATIENTS ARE DISCHARGED ON **THE SAME DAY** OF THE PROCEDURE

best interventional outcomes in the country. Overall angiographic success of non-CTO lesions remains over 99 percent in our Cardiac Catheterization Laboratory. We continue to improve our outcomes every year, maintaining low procedural complications in 2018. This remarkably low complication rate has been achieved despite high complexity and comorbid medical conditions of patients treated in the Cardiac Catheterization Laboratory.

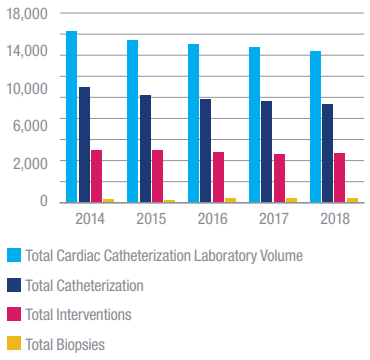
24.3% of 3,415

24.3% OF 3,415 CASES HAD PLAQUE MODIFICATION STRATEGY
BEFORE STENT IMPLANTATION DUE TO LESION COMPLEXITY

PATIENT SATISFACTION: 2018 HCAHPS SURVEY



GROWTH AND TRENDS IN CARDIAC CATHETERIZATION LABORATORY VOLUME AND PROCEDURES



37 Percent

OF PCI'S WERE DONE VIA **RADIAL ACCESS**

COMPARISON OF THE MOUNT SINAI HOSPITAL INTERVENTIONAL OUTCOMES WITH NEW YORK STATE DATA FOR 2014

Our Cardiac Catheterization Laboratory continues to serve the full range of cases, from simple to the most complex cases with high clinical comorbidities and complex angiographic characteristics. Despite that added complexity, the majority of PCI complications at The Mount Sinai Hospital have been one-third to one-half of the New York State hospitals.

Reports of risk-adjusted PCI mortality have consistently placed The Mount Sinai Hospital Cardiac Catheterization Laboratory among the lowest for in-hospital and 30-day risk-adjusted mortality, receiving the double star denoting statistically significantly lower RAMR than the statewide average consistently over the last 20 years of New York State Department of Health PCI reporting.

This lower 30-day risk-adjusted mortality can be attributed in large part to the experience and high procedural volume of the five senior full-time interventionalists, who together perform more than 3,000 cases per year. Our interventionalists frequently get double star notations (**) for PCI safety among 600 interventionalists practicing in the state.

NYS-DOH REPORT OF PCI 2013-2015
DATA ON THE TOP 10 VOLUME CENTERS IN NY STATE 30-DAY RAMR

PCI Statistics 2013-2015	# Cases	All Cases	Non-Emergency Cases	Emergency Cases
1. The Mount Sinai Hospital	**11,931**	**0.76****	**0.45****	**3.24**
2. Saint Francis Hospital	7,593	1.03	0.67	3.10
3. Columbia Presbyterian Hospital	7,355	1.06	0.79	2.10
4. North Shore University Hospital	6,052	0.89	0.64	1.93
5. Saint Joseph's Hospital	5,917	1.09	0.82	2.52
6. Beth Israel Hospital	4,960	1.16	0.76	2.94
7. Lenox Hill Hospital	4,905	1.09	0.65	3.84
8. Buffalo General Hospital	4,761	1.62*	1.00	4.19*
9. NYU Hospitals Center	4,422	1.19	0.76	3.23
10. LIJ Medical Center	4,364	1.04	0.83	1.60
NYS Total	**144,196**	**1.15**	**0.74**	**3.04**

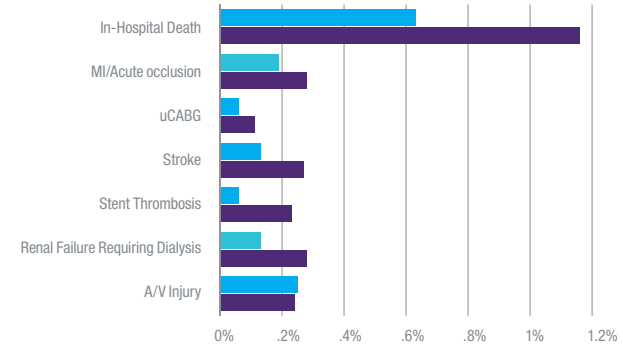
www.nyhealth.gov *Risk Adjusted Mortality Rate (RAMR) significantly higher than statewide rate
**Risk Adjusted Mortality Rate (RAMR) significantly lower than statewide rate

NYS-DOH 30-DAY RAMR FOR
PCI ** INTERVENTIONALIST AT MSH

Years/ # cases	All cases RAMR %	Non-Emergency cases RAMR %	**Interventionalist
2013-2015			
/3,356	0.66**	0.41**	Dr. Sharma
/2,693	0.65	0.27**	Dr. Kini
2012-2014			
/3,566	0.62**	0.36**	Dr. Sharma
/2,714	0.55**	0.19**	Dr. Kini
2011-2013			
/3,925	0.56**	0.38**	Dr. Sharma
/2,883	0.60	0.31**	Dr. Kini
/439	0.29**	0.16	Dr. Dangas
2010-2012			
/4.052	0.51**	0.35**	Dr. Sharma
/2,874	0.29**	0.21**	Dr. Kini
2009-2011			
/3,063	0.47**	0.33	Dr. Kini

www.nyhealth.gov **Risk Adjusted Mortality Rate (RAMR) significantly lower than statewide rate

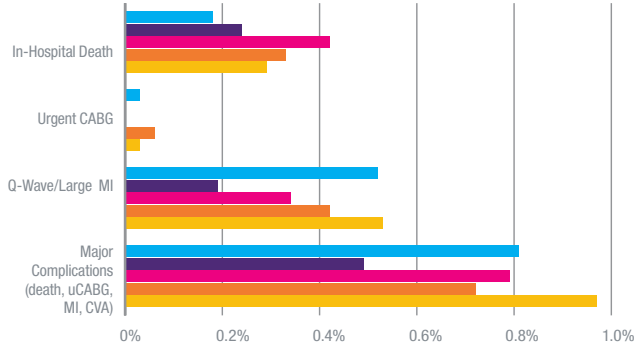
NYS-REPORTED MAJOR PCI COMPLICATIONS



The Mount Sinai Hospital (n=3,199) 2018

New York State (n=50,975) 2016

TEMPORAL TRENDS IN COMPLICATIONS OF PCI AT THE MOUNT SINAI HOSPITAL



2014 (n=3,819)

2015 (n=3,690)

2016 (n=3,536)

2017 (n=3,347)

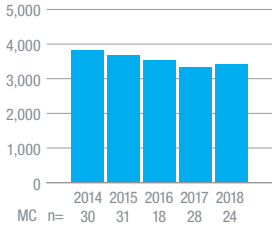
2018 (n=3,415)

20 Consecutive Years

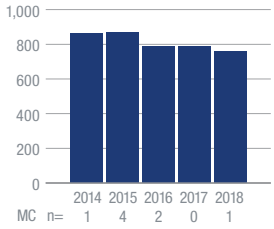
MOUNT SINAI CATHETERIZATION LABORATORY TOPS IN LOWER PCI MORTALITY IN **NY STATE.**

INTERVENTIONAL VOLUME AND MAJOR COMPLICATIONS (MC)

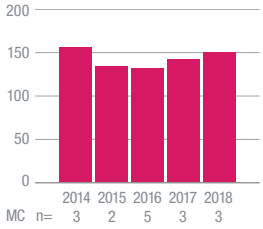
PCI



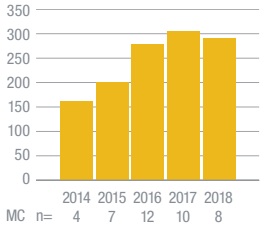
ENDOVASCULAR INTERVENTIONS



VALVULOPLASTY



TAVR/TAVI



Alcohol Septal Ablation = 23

MitraClip = 46

TMVR = 6

TriClip = 4

TTVR = 2

ASD Closure–Adult = 6

MC = Major Complications

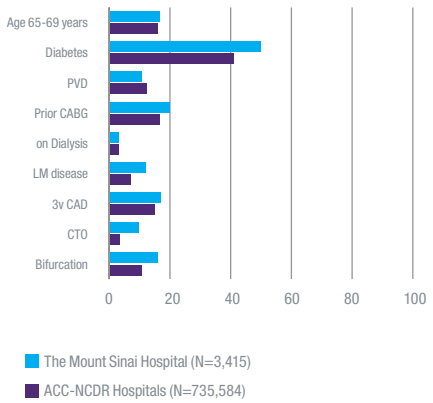
COMPARISON OF THE MOUNT SINAI HOSPITAL INTERVENTIONAL OUTCOMES WITH OTHER U.S. HOSPITALS—2018 ACC-NCDR REPORT

The American College of Cardiology-National Cardiovascular Data Registry (ACC-NCDR) reports the characteristics and in-hospital outcomes after PCI of more than 1,400 hospitals in the United States, providing data of 736,000 PCI patients annually.

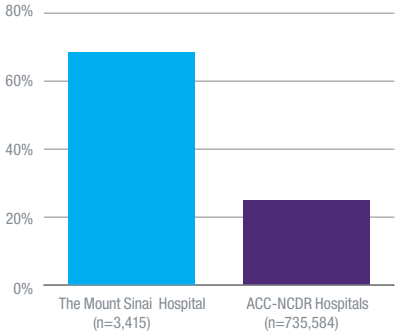
On these pages are the important baseline and procedure characteristics of The Mount Sinai Hospital (MSH) versus ACC-NCDR hospitals. These graphs show superior outcomes despite higher complexities for PCI patients at The Mount Sinai Hospital in comparison to other U.S. hospitals in the ACC-NCDR report for 2018.

Appropriateness of PCI has recently come under strong scrutiny. Cases that are inappropriate based on the published guidelines are not only risky to the patient, since the intervention is not indicated, but also are at risk of being denied reimbursement by federal agencies or insurance companies.

IMPORTANT BASELINE CLINICAL AND LESION CHARACTERISTICS OF PCI: ACC-NCDR DATA FOR 2018



FFR EVALUATION OF INTERMEDIATE STENOSIS LESION (40-70%) UNDERGOING PCI: MSH VS ACC-NCDR HOSPITALS 2018



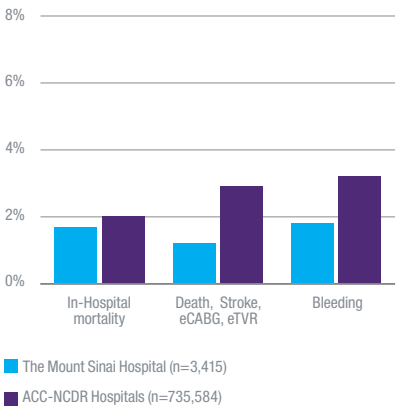
At Mount Sinai Heart, we have established evidence-based protocols for proper evaluation of CAD patients before scheduling catheterization and possible intervention and then rigorous application of the appropriate use criteria (AUC) of the American College of Cardiology; this has yielded one of the lowest rates of inappropriate PCI for stable CAD in the nation. Fractional flow reserve (FFR) has been increasingly adopted in our clinical practice, guiding the decision-making for appropriately indicated PCI.


Annapoorna S. Kini, MD, with the current interventional fellow class.

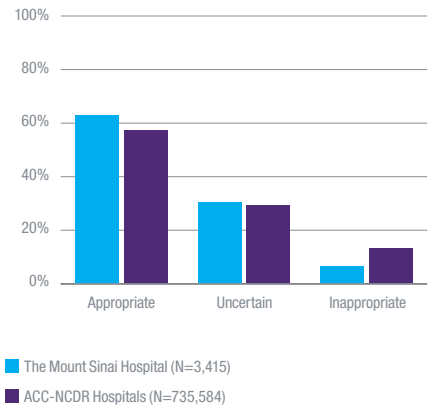
14,000 Cases Per Year

LED BY FIVE SENIOR FULL-TIME INTERVENTIONALISTS, WHO TOGETHER PERFORM MORE THAN 3,000 CASES PER YEAR.

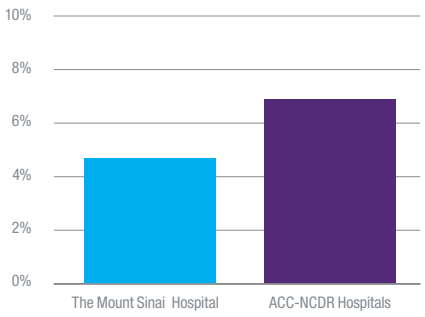
PCI COMPLICATIONS:
MSH VS. ACC-NCDR HOSPITALS 2018



APPROPRIATENESS OF PCI PROCEDURE
AUC EVALUATION OF PCI PROCEDURES
MSH VS. ACC-NCDR HOSPITALS IN 2018



STEMI PCI IN-HOSPITAL MORTALITY
MSH VS. ACC-NCDR HOSPITALS 2018



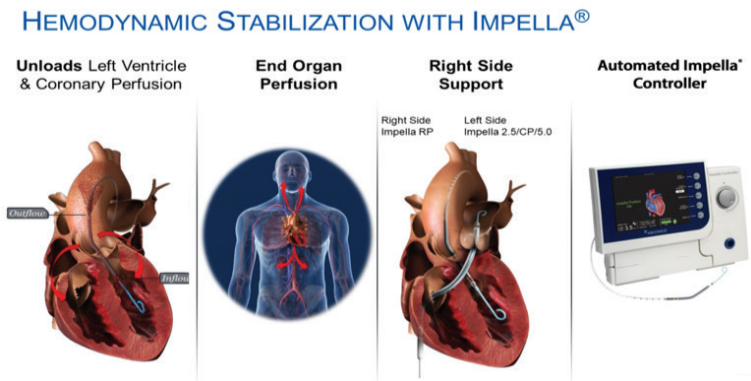
Complex High-Risk Percutaneous Coronary Interventions (PCI)

SAMIN K. SHARMA, MD & ANNAPOORNA S. KINI, MD

Data from several large, multicenter clinical trials continue to update our approach to clinical decision making for coronary revascularization. Two major trials have established a definite role for coronary artery bypass graft (CABG) surgery, especially in higher-angiographic-complexity cases, over percutaneous coronary intervention (PCI) with low long-term mortality and myocardial infarction (MI) but higher stroke rates. The SYNTAX trial employed a novel grading tool, known as the SYNTAX Score, to assess the complexity of coronary artery disease (CAD) based on several anatomical factors.

Based on data evidence, there is an increasing tendency at The Mount Sinai Hospital toward recommending surgery for patients with more complex CAD. Ultimately, the decision to have either surgery or PCI lies with the patient and his or her family, after consultation with the Heart Team, which includes a cardiologist, cardiothoracic surgeon, and cardiac interventionalist. Many patients (≈ 40 percent) with complex CAD choose revascularization with PCI, due to lower short-term complications and relative ease of recovery compared with surgery.

A recent trial comparing XIENCE drug-eluting stents (DES) with CABG in unprotected left main disease (EXCEL Trial) with SYNTAX Score <32 has shown equal results at three years follow-up after both modes of revascularization. Additional studies involving newer stents, combined with advanced imaging modalities before and during procedures, may tip the balance in favor of recommending PCI as first-line therapy for more patients with moderate to severe CAD.



Based on the current data and practice guidelines, the following patient groups will benefit more with CABG vs. PCI:

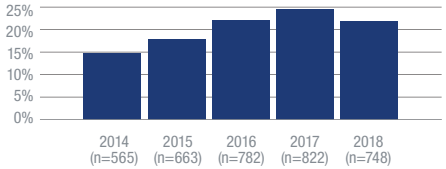
- Three-vessel CAD and SYNTAX Score >32
- Diabetics with three-vessel CAD or complex two-vessel CAD with prox-mid LAD lesion
- Left main ± additional vessel CAD with SYNTAX Score >32

In addition to expertise in treatment of CAD with PCI, our Catheterization Laboratory serves as a tertiary center for complex coronary intervention (bifurcation, calcified, left main, CTO, and/or vein graft lesions) and patients with low ejection fraction (LVEF <35 percent). We use a variety of adjunct interventional techniques in these complex coronary cases, such as atherectomy (for calcified lesions, 22 percent) and thrombectomy/distal protection devices (for thrombotic and vein graft lesions, in 3 percent).

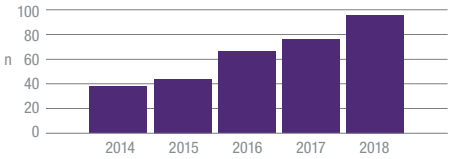
In a small number of complex lesion patients (≈ 5 percent) of PCI with reduced ejection fraction (LVEF <35 percent), we use LV assist devices such as IABP, Impella, or ECMO to safely and dependably perform these high-risk PCIs (protected PCI).

COMPLEX CORONARY INTERVENTIONS 2018

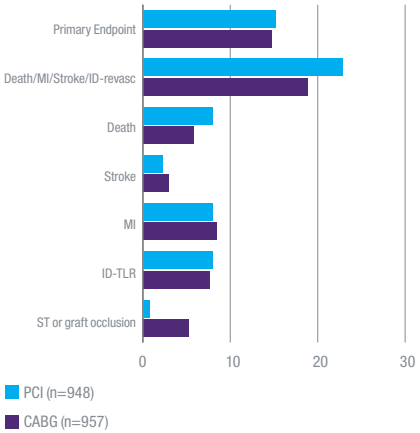
ATHERECTOMY CASES



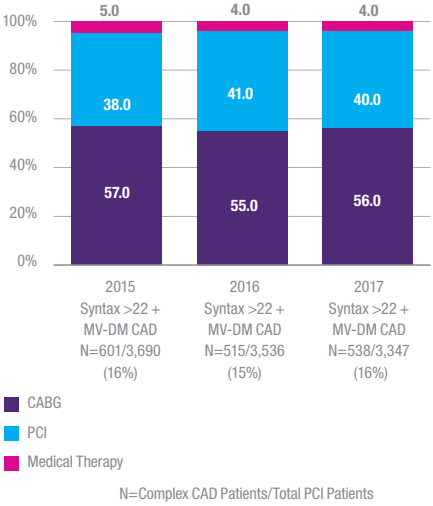
IMPELLA CASES (LVEF <35%)



EXCEL TRIAL: PRIMARY AND SECONDARY CLINICAL ENDPOINTS AT 3 YEARS



COMPLEX CAD (HIGH SYNTAX SCORE AND MV DIABETES) AT THE MOUNT SINAI HOSPITAL



N=Complex CAD Patients/Total PCI Patients

Tu Nyugen, 46

Diagnosis: Two-vessel coronary artery disease and chronic total occlusion

Treatment: Complex coronary intervention including placement of three stents

A couple of years ago, I started to feel pretty serious symptoms—I would feel bad in my stomach, and sometimes my back would hurt. It was hard to go about my daily activities, including work. When I would take a short walk, I would get tired quickly and be in pain."

I went to my cardiologist near my home in the Bronx and they told me I had five heart blockages and sent me to Mount Sinai. First, I spoke to a surgeon who suggested I would have to have open-heart surgery. I was scared and didn't want to be opened up.

Then I spoke to Dr. Sharma and he told me he could clear my blockages with stents. I was very relieved.

They took me into the procedure room the next morning and everything went according to plan.

"I want to tell people to go to Mount Sinai. Anyone who asks, I tell them, you have to go see Dr. Sharma."

They were able to clear the blockages, placing three stents in one vessel, which I was told is a complex procedure.

Pretty soon after my procedure, I started to feel more energy, I didn't feel tired and there was no more pain.

A few months later, I went in for a follow-up and Dr. Sharma was able to clear another blockage.

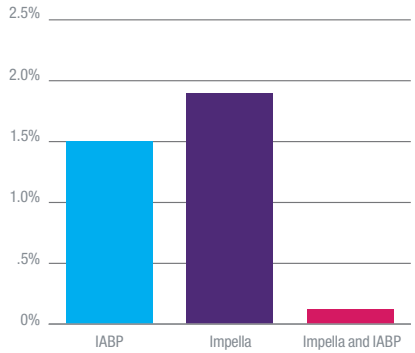
They check on me every six months, and make sure that everything is clear and I'm doing well. They have also encouraged me to make some lifestyle changes.

Now, I'm back to normal. I feel great, I'm back to work and all of my normal activities.

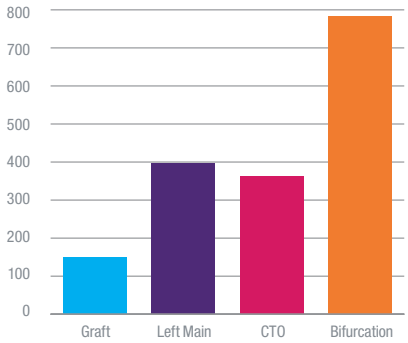
Dr. Sharma is a very good doctor. I can't believe it. The way he talks makes you feel comfortable. The nurses and everyone were very nice.

I want to tell people to go to Mount Sinai. Anyone who asks, I tell them, you have to go see Dr. Sharma."

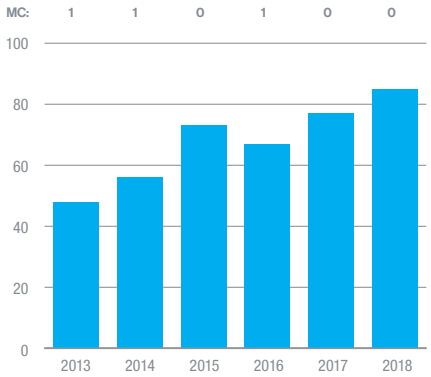
HIGH RISK PCI WITH LV SUPPORT IN 2018 AT THE MOUNT SINAI HOSPITAL (N=3,415)



TYPE OF CORONARY INTERVENTIONS IN 2018 (N=3,415)



IVBT VOLUME AT THE MOUNT SINAI HOSPITAL

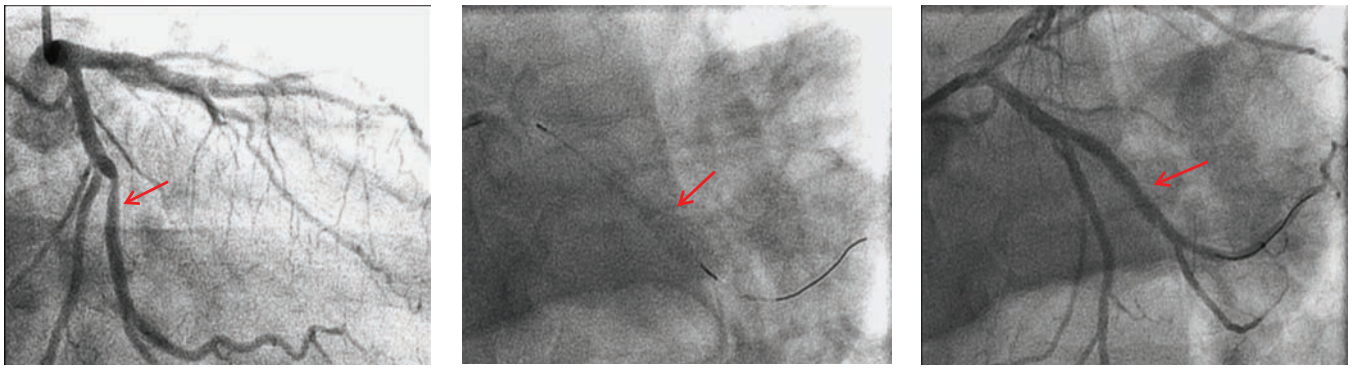


INTRAVASCULAR BRACHYTHERAPY (IVBT) FOR RECURRENT DES IN-STENT RESTENOSIS

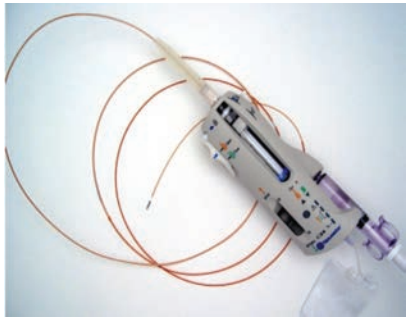
Patients with recurrent in-stent restenosis (ISR) of DES with more than two layers of stents are appropriate cases for IVBT using the Beta-Cath™ System to reduce subsequent restenosis. Our IVBT data over the last five years have shown excellent acute outcomes with <1 percent major complications (MC), no need for implantation of another stent, and long-term restenosis of 25 percent (compared to 55 percent in comparable recurrent DES ISR without IVBT).

Our recent analysis showed that IVBT offers significant effectiveness in reducing restenosis as well as major adverse events by 87 percent compared to the standard therapy, providing exceptional safety at one-year follow-up.

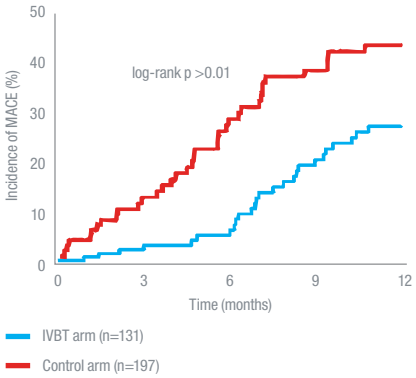
INTRAVASCULAR BRACHYTHERAPY TREATMENT



NOVOSTE™ BETA-CATH™ 3.5F SYSTEM



MACE AT ONE YEAR AFTER IVBT + PCI OF RECURRENT DES-ISR: MSH EXPERIENCE



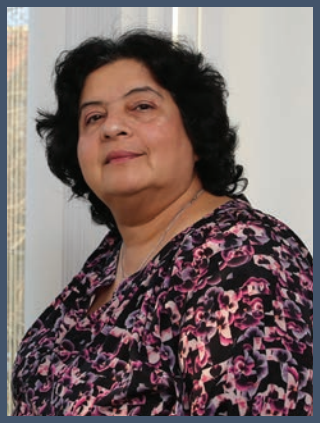
References

1. Everolimus-eluting stents or bypass surgery for left main coronary artery disease (EXCEL trial), N Engl J Med 2016;375:2223.

2. Current Status of Rotational Atherectomy, J Am Coll Cardiol Intv 2104;7:345

3. Intravascular Brachytherapy for the Management of Repeated Multimetal-Layered Drug-Eluting Coronary Stent Restenosis, Circ Cardiovasc Intrv 2018;11:e00683

Martha Bernal, 60



Diagnosis: Two-vessel coronary artery disease

Treatment: Placement of two drug-eluting stents in RCA and LCx

I have had a lot of health problems, as a cancer survivor and someone who has lived with high blood pressure for many years. Last year, things became more complicated when I began to feel shortness of breath and chest pain.

It felt like I had a huge cramp on the left side of my chest and the sensation traveled through the center of my chest up to my neck.

I went to see my cardiologist, and he did a few tests. He told me that I had a blockage, and gave me nitroglycerin for the angina. He suggested that I have a procedure to clear the blockages.

I asked around to find the best doctor for this kind of procedure and my oncologist recommended Dr. Sharma. He was very kind and worked to ease my concerns before the procedure.

"It was a wonderful experience because automatically I felt more energy."

In November of last year, I went to Mount Sinai. Dr. Sharma did a procedure to take a closer look at the blockage and inserted two stents. I was monitored for some time while I recovered, and I was able to go home the same day. Recovery seemed easy; I was able to drive later that day.

It was a wonderful experience because automatically I felt more energy, I'm able to walk faster without getting agitated and I'm able to climb the stairs without stopping.

Dr. Sharma is a great professional. He is very human. He takes time to explain and gives the patient security that everything will be fine. I had a very good experience with his associates and the other doctors and nurses.

If someone asked me about having a procedure here, I would recommend it right away.

INNOVATIONS

Update on Chronic Total Occlusion (CTO)

ANNAPOORNA S. KINI, MD

A chronic total occlusion (CTO) is defined as a complete obstruction in a coronary artery that is present for longer than three months. CTOs are commonly encountered in everyday practice in the Cardiac Catheterization Laboratory and are identified in up to 20 percent of all patients who are referred for diagnostic angiography.

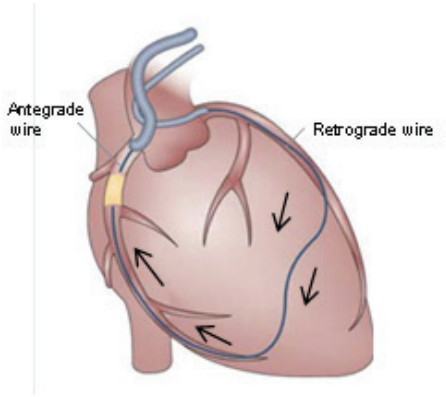
Numerous smaller collateral blood vessels are generally well developed in the region outside of a CTO, the blood flow through these vessels is similar to having a 90 percent coronary stenosis and is often insufficient, even at rest. Patients with CTOs often have atypical symptoms, such as shortness of breath and exercise limitations, rather than the typical angina pain that occurs in patients with less severe blockages. Several observational studies have demonstrated that successful CTO revascularization is associated with improved long-term survival and enhanced quality of life. The randomized trials have failed to show any benefit of routine CTO recanalization.

Recently, considerable progress has been achieved in percutaneous coronary interventions (PCI) for patients with CTOs. Important developments in dedicated equipment and techniques have resulted in high rates of success and low rates of complications, even in complex CTO cases.

Specialized guidewires, micro-catheters and small balloons have made it easier to penetrate complex CTO lesions. In rare calcified cases, CTO lesions can be tackled by using rotational and laser atherectomy. Recently the EXPERT CTO Trial in the United States demonstrated wire success rates of >90 percent, procedural success >96 percent, significant perforation =0 percent, and very low follow-up events at one year (<10 percent).

Our expert interventionalists have achieved high success rates in revascularizing CTOs, using both antegrade and retrograde approaches. The antegrade approach has been the conventional method of treating a CTO. The retrograde approach, which involves reaching the CTO via its collateral channel, has improved success rates in patients with complex CTOs that are not amenable to the antegrade technique.

RETROGRADE RECANALIZATION OF CTO

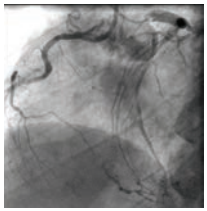


References:

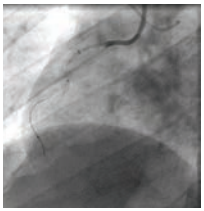
1. Safety and effectiveness of everolimus-eluting stents in chronic total coronary occlusion revascularization: results from the EXPERT CTO multicenter trial (evaluation of the XIENCE coronary stent, performance, and technique in chronic total occlusions). *J Am Coll Cardiol Intv* 2015;8:761.

2. Lee Seung-Whan, et al. Randomized Trial Evaluating Percutaneous Coronary Intervention for the Treatment of Chronic Total Occlusion: The DECISION-CTO Trial. *Circulation* 2019;139:1674–1683.

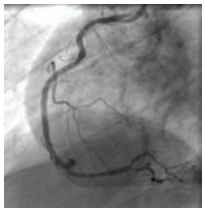
MID/DISTAL RCA CTO



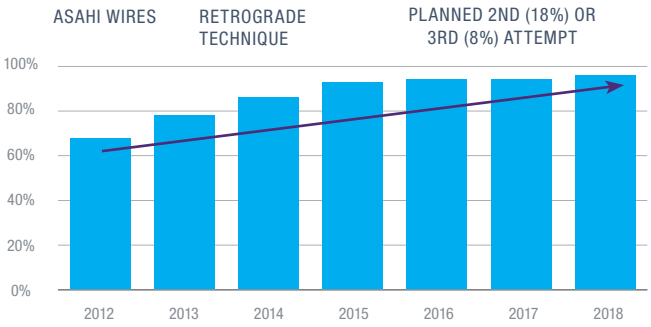
RECANALIZATION OF CTO WITH VARIOUS DEVICES



POST SINGLE DES OF RCA



PROCEDURAL SUCCESS OF PCI FOR CHRONIC TOTAL OCCLUSION AT THE MOUNT SINAI HOSPITAL



Martin Gold, 73

Diagnosis: Multi-vessel coronary artery disease

Treatment: Atherectomy and placement of three drug-eluting stents

In October of 2017, I was rushing up a steep stretch of 96th Street and felt a tight pressure across my chest . It wasn't going away and my breathing didn't feel right.

I'm active and had never had a reason to think I had a heart problem.

Something told me I should get checked out, so I got a referral to a cardiologist. After some tests, he determined that I had serious blockage in my arteries and would need stents. My internist said, "If it turns out you're going to need stents, I recommend Dr. Sharma—he's internationally known and outstanding." When I told the cardiologist, he said, "Oh yes, he's the best."

The cardiologist got in touch with Dr. Sharma to share my test results and Dr. Sharma said I should come over to Mount Sinai immediately.

"I was grateful to be connected with some of the best doctors in the world at Mount Sinai."

He had determined that I was at risk for having a heart attack.

I met a whole team of eight people. It was quite a greeting and quite an operation that got put together so fast—ready for me before I even arrived. They confirmed my original test results—one artery was 95 percent blocked and a second was 80–90 percent blocked.

They did three procedures inside the 95 percent clogged artery—they drilled out a wall of calcium, used an angioplasty balloon to push accumulated plaque up against the walls of the artery, and they placed three stents. I had no damage to the heart because of how quickly this was taken care of.

I was able to return to work at Columbia Law School in 48 hours. I was grateful to be connected with some of the best doctors in the world at Mount Sinai. What if I had been in the outer parts of Ethiopia or hiking in Australia—both of which I was actually able to do after this procedure.

I've already been telling people that if you ever need stents, this is the place to go.

INNOVATIONS

The World of Catheterization Procedure Apps: Innovative Educational Tools

ANNAPOORNA S. KINI, MD

The technological revolution has transformed the world of medical education. Mobile application-based approach to learning can help educators express their knowledge through highly interactive user interface and visualization of complex concepts. Mount Sinai Heart, under the leadership of Annapoorna S. Kini, MD, has produced a series of free educational mobile applications for phones and tablets over the last two years. The first app, BIFURCAID, was designed as a high-tech tool to simplify the complex subject of coronary artery bifurcation intervention by providing a step-by-step guidance in one of the most challenging interventional procedures. BIFURCAID was developed by Dr. Kini and her team of fellows in collaboration with Mount Sinai AppLab and released in October 2017. More than 2,170 users downloaded the app globally, using both the iOS (Apple) and Android (Google) platform during the first three months after the launch.

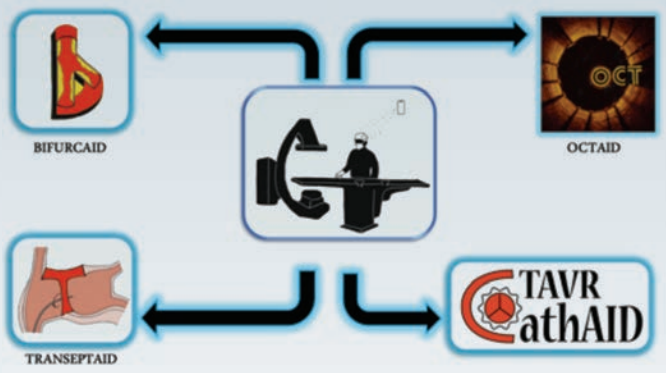
First, the app asks users to choose which process they want to explore, left main or non-left main bifurcation, and then guides them through decision support for the procedure, based on factors like vessel size, lesion morphology and location, and immediate procedural outcomes.

The aim of the second mobile app, OCTAID, was to teach medical professionals how to perform intracoronary optical coherence tomography (OCT) and interpret high-resolution OCT images of the vessel wall—to select the best treatment strategy before PCI and optimize post-PCI results. In addition to extensive background on OCT image acquisition and analysis, the app provides interactive features including several quizzes and an "Ask the Expert" section, that allows users to submit their images and questions.

Following the success of BIFURCAID and OCTAID, an educational app teaching how to perform transeptal puncture for various procedures, TRANSEPTAID, was launched in September of 2018. The app uses fluoroscopy and echocardiography images—combined with illustrations—to better describe anatomy, complications, and different techniques as it helps users navigate through challenging scenarios.

Currently, several new educational apps are being developed by Dr. Kini and are expected to be released later this year: an app guiding reaccess of coronary arteries after transcatheter aortic valve replacement (TAVR) procedure (TAVRcathAID), an educational tool for treatment of calcific lesions (CALCIFICAID), and a mobile application for optimization of transportation and treatment for patients presenting with ST-Elevation Myocardial Infarction (STEMIAID).

Dr. Kini believes that educational apps can have a significant impact on a new generation of cardiologists and are already shaping the future of cardiovascular education of the 21st century.

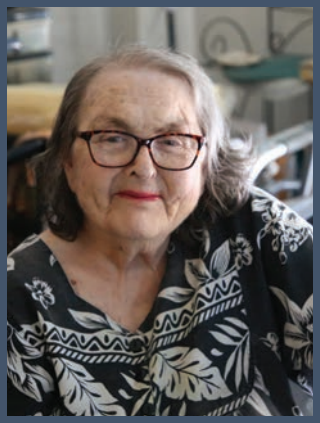


2,170+

MORE THAN 2,170 USERS DOWNLOADED THE APP GLOBALLY USING BOTH THE IOS (APPLE) AND ANDROID (GOOGLE) PLATFORM DURING THE FIRST THREE MONTHS AFTER THE LAUNCH.

Roberta Taylor, 81

"I feel wonderful. Dr. Kini and her associates, they're good-hearted people."



Diagnosis: Mitral valve insufficiency

Treatment: Placement of MitraClip XTR via right femoral vein

This past winter, I was having trouble with my breathing, and I was concerned. My primary care doctor suspected that I might have asthma. After visiting another specialist and ruling out asthma, my cardiologist, Kiruthika Balasundarum, MD, did some more tests. That's when they found out that the valves in my heart didn't close like they were supposed to, and I was going to need a procedure. She sent me to Annapoorna S. Kini, MD, right away.

Dr. Kini was great. She treated me like a champ. We discussed my options with the heart team, and because of my age, it was determined a major surgery wouldn't be a good option for me. Dr. Kini explained this new MitraClip procedure that would actually help my heart valve close the way it is supposed to. We scheduled the procedure before I left the hospital that day.

I came back about a week or two later for the procedure. It didn't seem to take long, and I only had to stay over in the hospital for one night so they could monitor me.

My breathing's gotten better and I'm feeling optimistic. I feel wonderful. Dr. Kini and her associates, they're good-hearted people.

Expanding Indications of Transcatheter Aortic Valve Replacement (TAVR)

SAMIN K. SHARMA, MD & ANNAPOORNA S. KINI, MD

Multiple trials of transcatheter aortic valve replacement (TAVR) in patients with varying various surgical risk (based on STS Score) have demonstrated its importance as a therapeutic option for patients who have severe, symptomatic calcific aortic stenosis (AS) and who are an extreme, high, or intermediate risk for cardiac surgery due to serious comorbidities.

The Surgical Replacement and Transcatheter Aortic Valve Implantation (SURTAVI) Trial was a multicenter clinical trial comparing percutaneous implantation of a self-expanding prosthesis to surgical valve replacement in patients with severe aortic stenosis and intermediate risk for surgery. The results showed that TAVR, in intermediate-surgical-risk patients with severe AS, was a non-inferior alternative to surgery and had a lower stroke rate.

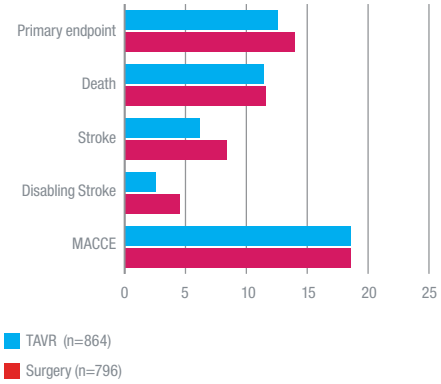
One small trial comparing surgical vs. transcatheter aortic valve replacement showed equivalent results after both strategies at 5-6 years along with better durability of transcatheter aortic valve replacement compared to surgical valve replacement

Two other trial results for low risk aortic stenosis patients will be released in March 2019 and are expected to establish TAVR as the dominant strategy for all eligible aortic stenosis patients.

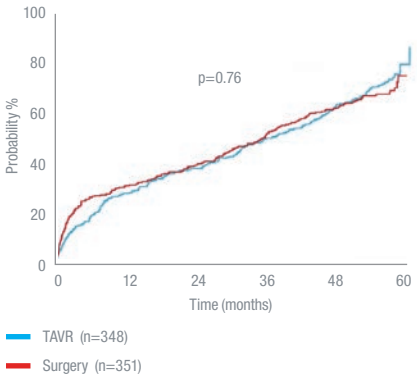
The SENTINEL Trial studied the risk of stroke in patients who have TAVR with the Sentinel Cerebral Protection System (which is an embolic filter designed to trap calcified and thrombotic deposits that become dislodged during the TAVR procedure). Results showed that use of the Sentinel device is associated with lower risk of brain infarction (42 percent) with a trend toward stroke rates compared to a control group.

The Sentinel Ulm Study showed lower stroke rate and mortality with the Sentinel device. At our center, the Sentinel device is routinely used during TAVR (60 percent of eligible cases).

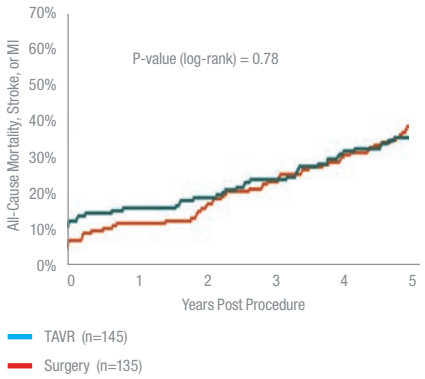
SURTAVI TRIAL: CLINICAL OUTCOMES
24 MONTHS



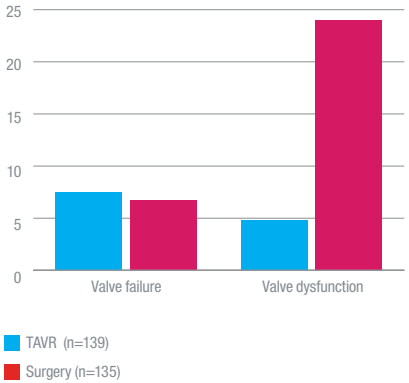
PARTNER 1 TRIAL:
5-YEAR CLINICAL OUTCOMES



NOTION TRIAL 5-YEAR CLINICAL OUTCOMES
ALL-CAUSE MORTALITY, STROKE, OR MI



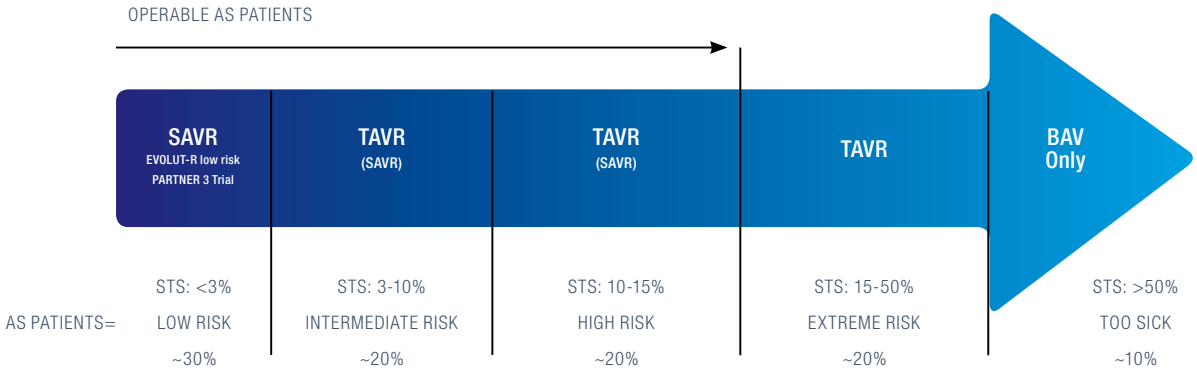
NOTION TRIAL:
AORTIC VALVE DURABILITY AT 6 YEARS



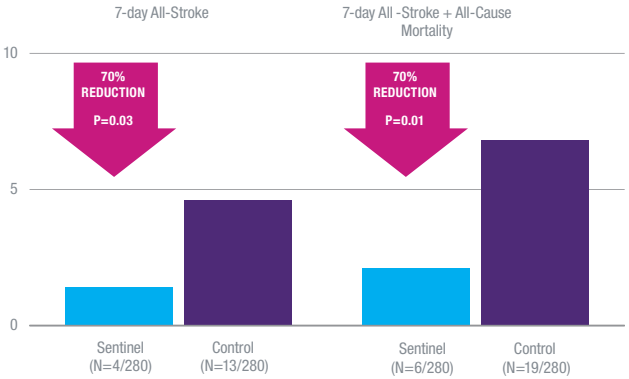
Sentinel Trial

THE SENTINEL TRIAL, TO ASSESS THE RISK OF STROKE IN PATIENTS WHO HAVE TAVR WITH THE SENTINEL CEREBRAL PROTECTION SYSTEM, SHOWED THAT USE OF THE SENTINEL DEVICE IS ASSOCIATED WITH **LOWER RISK OF BRAIN INFARCTION (42 PERCENT) WITH A TREND TOWARD STROKE RATES COMPARED TO A CONTROL GROUP.**

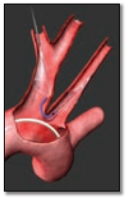
TAVR RECOMMENDATIONS BASED ON SURGICAL RISK (STS): MORE PATIENTS ARE APPROPRIATE FOR TAVR PROCEDURES AS SHOWN BELOW



ULM SENTINEL® STUDY OF CEREBRAL EMBOLIC PROTECTION IN TAVR
70% REDUCTION IN STROKE, AND STROKE AND DEATH, IN 560 PATIENT PROSPECTIVE PROPENSITY-SCORE MATCHED ALL-COMERS STUDY



SENTINEL® CEREBRAL PROTECTION SYSTEM



- Two independent filters capture and remove embolic material
- Polyurethane filter, pore size = 140 µm
- Standard right trans-radial sheath access (6F)
- One size accommodates most vessel sizes; fits ~90% of anatomies
- Deflectable compound-curve catheter facilitates cannulation of LCC
- Minimal profile in aortic arch (little interaction with other devices)

The Mount Sinai Hospital routinely employs three-dimensional transesophageal echocardiography (3D TEEecho) and 4D computed tomography (CT) to better evaluate the TAVR procedure. Image quality and details are highly relevant to the success of TAVR, which relies on the appropriate evaluation and measurement of the aortic annulus to prevent complications, such as paravalvular leak, prosthesis migration, coronary artery occlusion, or annulus rupture.

The Mount Sinai Hospital was the first center in the United States to deploy the CoreValve®, in December 2010. Since then, our TAVR volume and outcomes have improved significantly compared with other centers in the TVT registry.

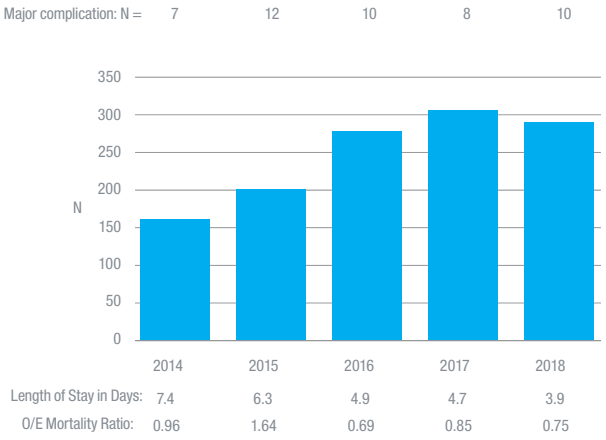
References

1.Surgical or transcatheter aortic valve replacement in intermediate-risk patients (SURTAVI). N Engl J Med 2017;376:1321.

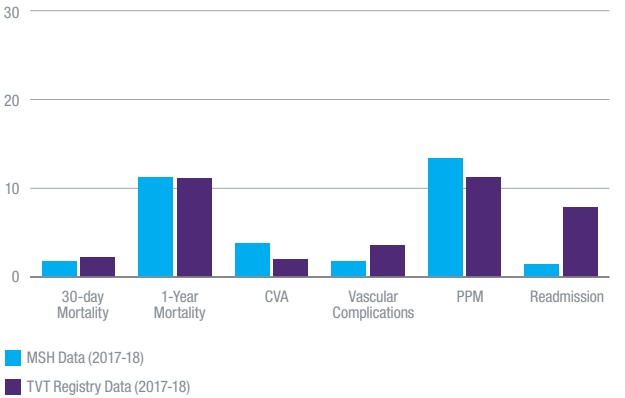
2. Durability of transcatheter and surgical bioprosthetic aortic valves in patients at lower surgical risk (NOTION). J Am Coll Cardiol 2019;73:546.

3. Cerebral embolic protection during transcatheter aortic valve replacement significantly reduces death and stroke compared with unprotected procedures. J Am Coll Cardiol Intv 2017;10:2297.

TAVR VOLUME AND OUTCOMES
MOUNT SINAI EXPERIENCE



TAVR OUTCOMES AT THE MOUNT SINAI HOSPITAL 2018
- 49% Evolut-R CoreValve, 51% SAPIEN-3
- 75% Conscious Sedation; 25% GA
- 88% Perc Femoral; 10% Cutdown femoral; 1.4% Subclavian; .06% Direct Aortic



Lola Maskovsky, 82

Diagnosis: Aortic stenosis and atherosclerosis in leg artery

Treatment: Placement of SAPIEN 3 TAVR device

I've received care from multiple doctors at Mount Sinai, and Mount Sinai has always been my hospital of choice. About two years ago, I was referred to Dr. Sharma because I was experiencing shortness of breath and I had been diagnosed with atrial fibrillation.

My cardiologist suspected it was a problem with my valve. In the cath lab, they were able to confirm two things—that my heart valve was the problem (stenosis) and that none of my coronary arteries were blocked. Dr. Sharma and his team determined that I was not a good candidate for major surgery with my other health issues, but I was a perfect candidate for a new procedure that would replace my valve without opening me up. "I had the procedure a couple days later.

"Every year, I get a call and have a follow-up test to make sure everything is going well, and I'm happy to go back."

Everything went very smoothly—Dr. Sharma runs a tight ship! They had to clear a small blockgage in an artery in my leg and then they placed the new valve. As soon as I came out of anesthesia I immediately felt great. I breathe much better now.

Recovery was practically nothing—a little rest and I was back to normal. It's truly amazing. My sister had surgery for a similar diagnosis and spent months with pain and recovery from major surgery.

Every year, I get a call and have a follow-up test to make sure everything is going well, and I'm happy to go back. Dr. Sharma is absolutely top, top notch. He's very thorough and he's very skillful and the staff at the Catheterization Laboratory is just wonderful. I would recommend Mount Sinai to anyone.

Transcatheter Mitral Valve Repair (TMVr) with MitraClip®: A Life Saver

ANNAPOORNA S. KINI, MD & ASAAD KHAN, MD

Mitral regurgitation (MR) or "leaky mitral valve" is a condition in which the two leaflets of this valve fail to seal effectively, resulting in some blood flowing back into the atrium every time the left ventricle squeezes. MR can originate from degenerative or structural defects as a result aging, infection, or congenital anomalies. In contrast, functional mitral regurgitation (FMR) occurs when coronary artery disease or events, such as a heart attack, change the size and shape of the heart muscle, preventing the mitral valve from opening and closing properly.

Patients typically complain of shortness of breath, fainting, dizziness, fatigue, chest pains (angina), and atrial fibrillation.

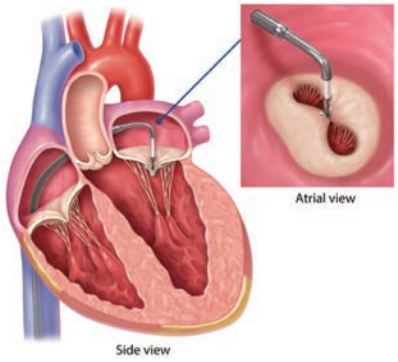
First-line treatment for patients with significant mitral regurgitation consists of medical management with drugs such as beta-blockers, ACE inhibitors, diuretics, and blood thinners such as Warfarin (if patient has atrial fibrillation).

For patients with persistent symptoms, open heart surgery and surgical repair or replacement of the defective heart valve is the recommended treatment.

The first percutaneous mitral repair procedures using the MitraClip device were done in 2003. MitraClip received FDA approval in October 2013 for use in patients with degenerative MR, and at prohibitive risk for conventional mitral valve surgery. The 2018 Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation (COAPT) trial randomized 614 patients with HFrEF (mean LVEF 31 percent) and moderate-severe or severe functional MR to receive percutaneous repair with MitraClip versus medical therapy alone and assessed for a primary outcome of hospitalization for heart failure. At two years, percutaneous mitral valve repair was associated with a 32.1 percent absolute reduction in heart failure hospitalization and a 16 percent absolute reduction in all cause death.

The results of the COAPT trial offer a new ray of hope to patients with heart failure secondary to severe mitral regurgitation who have failed all guideline-recommended therapies at maximally tolerated doses.

The MitraClip procedure is performed through a small incision in the groin, eliminating the need to open the chest and temporarily stop the heart. A tube is then passed up through the leg vessels to the right side of the heart and then to the left



side of the heart, using a technique known as trans-septal puncture. The MitraClip is then passed up through this tube and subsequently deployed in the desired position. In some cases, a second clip may be needed to ensure adequate reduction in regurgitation. The MitraClip remains securely in position, tightly bound to the mitral valve leaflets. This whole procedure is performed under high-definition 3D echocardiography guidance.

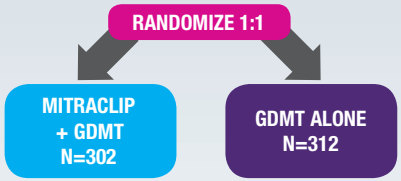
Following the procedure, patients are closely monitored for one to two days, with particular attention to arrhythmias and changes in blood results. By performing a comprehensive ultrasound of the heart within 24 hours of the procedure, the team is able to assess and analyze any remaining mitral valve leakage and rule out any possible complications. Mount Sinai performs a high volume of MitraClip procedures every year with excellent safety and long-term outcomes. We are currently ranked one of the top 15 centers nationwide for performance of this procedure.

References

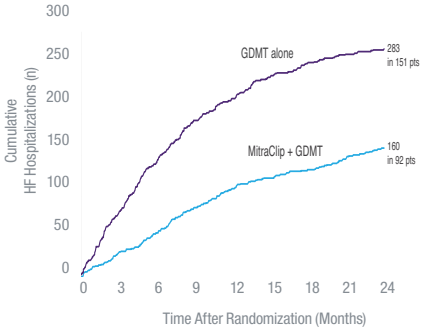
1. Stone et al. COAPT Trial. NEJM 2018; 379: 2307.

THE COAPT TRIAL

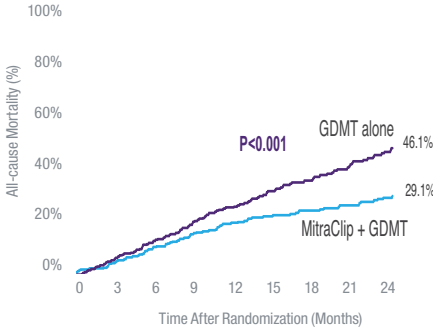
A multicenter trial in 614 patients with heart failure and moderate-to-severe or severe secondary MR who remained symptomatic despite maximally-tolerated GDMT



COAPT TRIAL:
ALL HOSPITALIZATIONS FOR HF WITHIN 24 MONTHS



COAPT TRIAL:
COAPT TRIAL: ALL-CAUSE MORTALITY



Jian Xu, 55

Diagnosis: Coronary artery disease, chronic total occlusion

Treatment: CTO PCI

"If anyone was ever in my situation, I would recommend Dr. Kini immediately."

If I walked up a hill, I would have pressure from my chest all the way to my throat. So in October 2017 I went to see my cardiologist and he did an echocardiogram. The echo came back very bad, which indicated I had possibly had a heart attack already. My cardiologist didn't pay attention to the test results, so in the next two weeks I felt the same pressure.

In November 2017 I had an angiogram, which showed I had a total blockage in my LAD (left anterior descending artery). My cardiologist recommended open heart surgery. I didn't like the idea, so I postponed that decision. I did my research and I eventually found Dr. Kini.

Annapoorna S. Kini, MD, examined my case and recommended more tests. Because my heart had already shown signs of heart attack, the left ventricle was damaged. She wanted to make sure it was still viable. She knew what to do and I trusted her decisions.

After the tests, she called and told me my ventricle was still viable, so I scheduled a CTO PCI in February 2018. That's a special name for the procedure. Before she could put a stent in my artery, she had to clean up all the blockage. Very few doctors could do that, but she was an expert in it.

After the procedure, as soon as I was able to get out of my bed, I felt a big difference. My recovery was very quick and I felt no pain. They kept me one night in the hospital and went home the second day. It was unbelievable.

I was told I needed to exercise regularly to keep the blood flowing. I walk at home on my treadmill and outside with my wife. Before my procedure she had to slow down and wait for me – now I walk faster than her!

If anyone was ever in my situation, I would recommend Dr. Kini immediately.

Evolving Transcatheter Mitral Valve Replacement (TMVR) Data and Technology

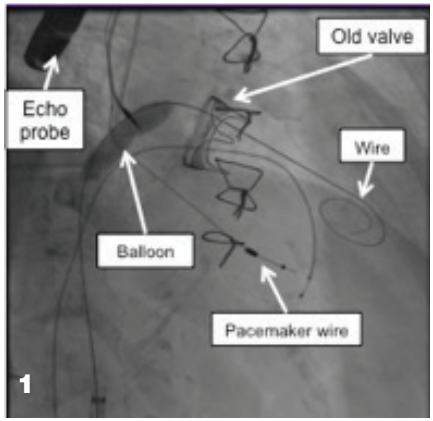
GEORGE DANGAS, MD, PHD & ANNAPOORNA S. KINI, MD

New treatment options have been developed for high risk patients with mitral valve disease, especially patients with heavily calcified mitral stenosis (MS), a narrowing of the mitral valve, and patients with failing bioprothestic valves or support rings in mitral position in need of new treatment strategies. In patients with MS, heavy local calcification leads to decreased mobility of the valve leaflets, with subsequent narrowing of the valve area and obstruction of blood flow. These patients cannot benefit as much from percutaneous balloon valvotomy as patients with MS caused by rheumatic disease. Due to the advanced age and frequent comorbidities in this patient population, surgery is often not feasible. This also applies to elderly patients who need mitral valve replacement due to a failing bioprosthetic valve or surgical repair with ring implantation.

Many patients with severe calcific mitral stenosis who are not candidates for standard mitral valve surgery due to surgical risk have been treated successfully with transcatheter mitral valve replacement (TMVR) with the use of aortic transcatheter heart valve devices.

These artificial heart valves consist of a stent to hold the study device in its intended position and valve leaflets (made of biological material derived from cows) to direct the flow of blood in the heart. They can be placed with the help of a catheter either through the femoral vein to the heart, or by puncture or incision of the left side of the chest, directly accessing the tip of the heart.

The type of access depends on several factors, including prior heart surgery and the size of heart chamber. In any case, the procedure is performed under general anesthesia. Fluoroscopy (x-rays) and ultrasound imaging are performed by external specialized equipment and placement of a probe in the esophagus in order to guide the procedure. A pacemaker often facilitates this procedure as well.

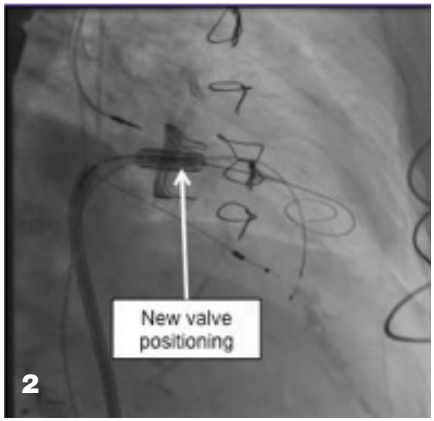


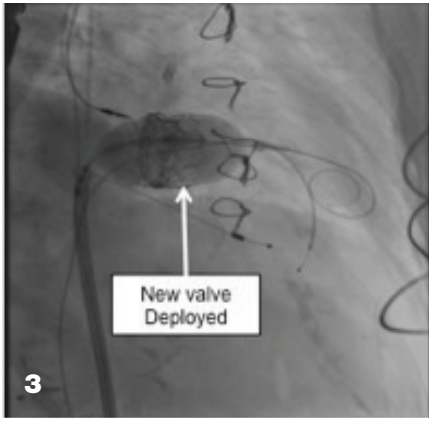
After the procedure, combination anticoagulant therapy may be prescribed for a certain time period, including aspirin.

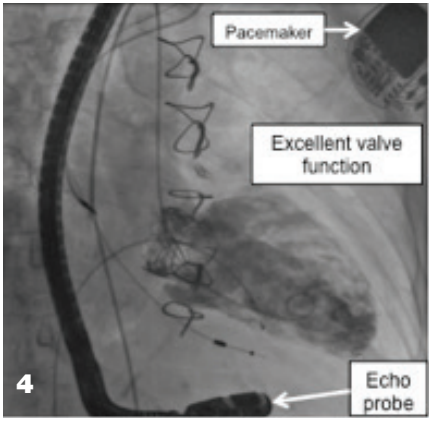
Most recently, the FDA has approved this technique in patients with failed surgical bioprosthesis based on a clinical trial conducted at major centers around the United States, including Mount Sinai Heart. Transcatheter heart valve implantation in patients with calcific mitral stenosis is exclusively performed in an investigational setting in patients who cannot have surgery.

References

1. Yoon, SH et al. Global TMVR Registry; EHJ 2018; 40: 441.

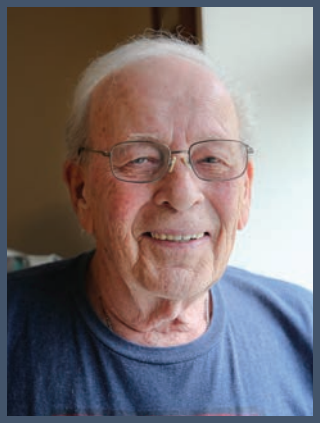






Miles Herzog, 84

"Dr. Dangas is a nice guy. He definitely knows what he's doing, and he handled the whole thing, 1-2-3."



Diagnosis: Two-vessel coronary artery disease and in-stent restenosis

Treatment: PTCA and placement of drug-eluting stent in RCA

In January, I suddenly felt short of breath and woozy—I was perspiring a lot. I've had five stents placed already, so I had a hunch it might be something with my heart. Turns out my hunch was right, I would later learn that I had had a heart attack.

My daughter brought me to the cardiologist's office, and he sent me to the hospital near my home. They prepped me and were ready to do the procedure, but it turns out the stent that was in one of my arteries had again become almost completely blocked, and my case required a special level of expertise.

I went in an ambulance to Mount Sinai in the city, and the next morning, I met Dr. Dangas, and he did the procedure. I believe it took about an hour. I spent another night in the hospital so they could monitor my case. Recovery was a piece of cake.

Dr. Dangas is a nice guy. He definitely knows what he's doing, and he handled the whole thing, 1-2-3. I would recommend getting cardiac care at Mount Sinai 100 percent.

INNOVATIONS

Improving PCI Outcomes With OCT and Co-Registration

ANNAPOORNA S. KINI, MD & YULIYA VENGRENYUK, PHD

Coronary angiography has been the workhorse for guiding percutaneous coronary intervention (PCI) for more than 40 years. At The Mount Sinai Hospital Cardiac Catheterization Laboratory, we incorporate several advanced intravascular imaging modalities to improve operator performance and procedural outcomes. Optical coherence tomography (OCT) uses near-infrared light to create images of the vessel wall with 10-20 times higher resolution and faster image acquisition compared to intravascular ultrasound (IVUS). Data from randomized clinical trials, registries, and meta-analyses strongly support the beneficial role of OCT in PCI guidance. One of the most recent additions to the toolbox available during the procedure is automated OCT-angiography co-registration, which allows the operator to establish direct correlation between OCT and angiography findings. Before PCI, an automatic "lumen profile" feature can quickly provide measurements for minimal lumen area (MLA), reference diameter and areas, lesion length, and diameter stenosis (DS) (see Figure. PRE). OCT-identified proximal and distal references are indicated by red and blue labels respectively on the corresponding angiography image to facilitate selection of stent landing zones with minimal disease and select optimal stent length. After the procedure, the system provides automatic detection of strut malapposition displaying segment with malapposed struts (OCT cross-section, arrows) in red on the OCT longitudinal view and angiography image (circled) (Figure. POST).

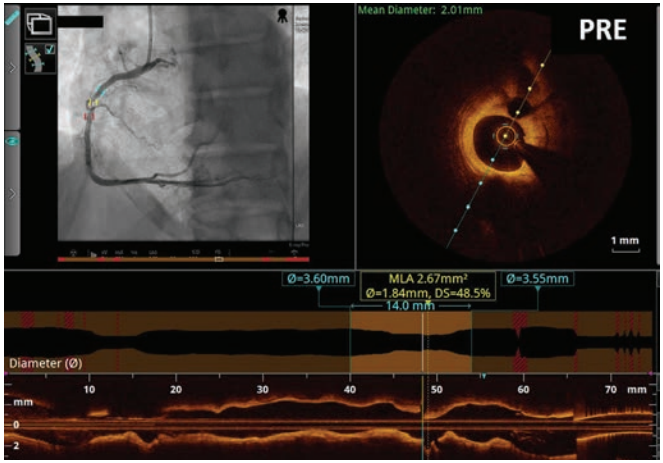
Optical Coherence Tomography

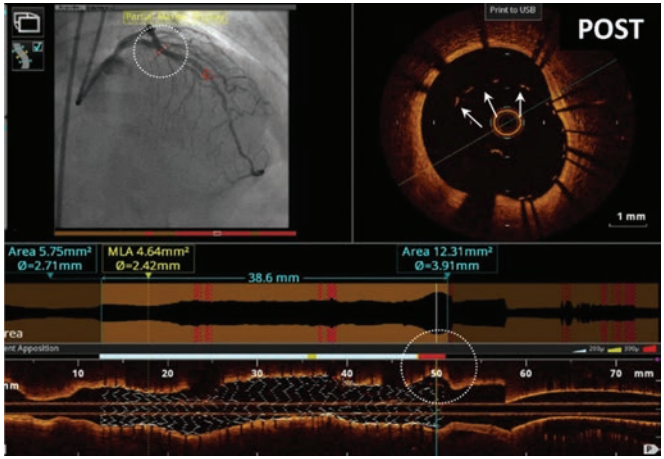
OPTICAL COHERENCE TOMOGRAPHY (OCT) USES NEAR-INFRARED LIGHT TO CREATE IMAGES OF THE VESSEL WALL WITH **10-20 TIMES HIGHER RESOLUTION AND FASTER IMAGE ACQUISITION** COMPARED TO INTRAVASCULAR ULTRASOUND (IVUS).

References

1. OCTAID—OCT Intra-Coronary Imaging App. Icahn School of Medicine at Mount Sinai (2018). Retrieved from octaidapp.com

2. Kini A, Narula J, Vengrenyuk Y, Sharma S. Atlas of Coronary Intravascular Optical Coherence Tomography. Springer 2017.





Hugh McGowan, 92

Diagnosis: Three-vessel coronary artery disease

Treatment: Rotational atherectomy and placement of seven drug-eluting stents

I had been feeling constantly tired and fatigued—frankly I attributed it to age. I had an appointment with my cardiologist, and he didn't like what he heard. I failed the stress test, and he recommended me for catheterization.

My wife knows one of the nurses who works in the Catheterization Laboratory, and she suggested, "you have got to see Dr. Sharma. He's the best." I did my homework on Mount Sinai and the Cath Lab, and determined this was the place to go. After the diagnostic catheterization, they took me into another room to meet the cardiac surgeon, because they were recommending open-heart surgery. I had already had several surgeries for unrelated conditions, so I didn't want to do open-heart surgery.

"I've been in the hospital a number of times with my spinal surgeries, and I have never experienced care like I have here."

"Dr. Sharma grabbed the bull by the horns, and they did the first procedure that day.

It was a complex case—I had a total of seven stents placed over two procedures about a month apart. Even after the first procedure, I felt a huge difference—it was night-and-day!

I was lucky I didn't have a heart attack—as Dr. Sharma said, when I came in, I was hanging by a thread of having a heart attack. Now, a month after the second procedure, I feel 20 years younger. I can go back to being active, to traveling. It's amazing.

I've been in the hospital a number of times with my spinal surgeries, and I have never experienced care like I have here.

Dr. Sharma was amazing. I understand that no one can hold a candle to what he can do.

INNOVATIONS

Drug-Coated Balloons for PAD

PRAKASH KRISHNAN, MD

Critical limb ischemia (CLI) is defined as the presence of pain at rest and/or tissue loss for at least two to four weeks that can be attributed to occlusive arterial disease. It is considered the end-stage of untreated or poorly treated peripheral artery disease (PAD). The natural course of CLI usually involves atherosclerotic plaque development at several levels of the inflow arteries (iliac and femoral arteries) as well as outflow arteries (tibial arteries).

CLI is associated with a poor prognosis, with one-year limb amputation rates of 30 percent and mortality of 25 percent, respectively. Nevertheless, nearly 10 percent of lower limb amputations are performed without an initial vascular evaluation in attempt to salvage the limb. The estimated lifetime direct health care cost for an amputee patient is $794,027.

Appropriate evaluation of CLI should include obtaining medical history, performing a physical exam, measuring the ankle-brachial index, and applying the most appropriate advanced imaging modalities (e.g. ultrasound, CT/MR angiography or invasive diagnostic by means of peripheral angiography).

Treatment of CLI is challenging and should comprise a multidisciplinary approach involving several medical and surgical disciplines (the CLI team consists of a vascular interventionist and surgeon, a podiatrist, an infectious disease physician, an endocrinologist, and representatives from vascular medicine, geriatric medicine, orthopedic and plastic surgery). Besides guideline directed medical therapy, treatment should focus on revascularization in attempt to salvage the limb. Several endovascular devices are currently available to treat stenoses in arteries below the knee (BTK), among which drug eluting stents (DES) have shown the most promising results, with significant reduction of major adverse events including limb amputations.

Recently, drug-coated balloons (DCB) were investigated for the treatment of BTK arteries. Two initial trials showed no advantage of DCB over plain balloon angioplasty (IN.Pact DEEP and BIOLUX

$794,027

NEARLY 10% OF LOWER LIMB AMPUTATIONS ARE PERFORMED WITHOUT AN INITIAL VASCULAR EVALUATION IN ATTEMPT TO SALVAGE THE LIMB. **THE ESTIMATED LIFETIME DIRECT HEALTH CARE COST FOR AN AMPUTEE PATIENT IS $794,027.**

P-II trials). However the more recently presented LUTONIX-BTK trial (presented at VIVA 2018) showed a significant reduction of amputations in CLI patients treated by DCB in comparison to BA with 14.6 percent relative risk reduction in primary efficacy endpoint [Composite of Limb Salvage and Primary Patency (Defined as freedom from a composite of above ankle amputation, target vessel occlusion, and clinically-driven target lesion revascularization)] at six months. Although further studies evaluating long-term outcomes in these patients are warranted, the results of LUTONIX-BTK represent an important milestone on the path to improved therapy options for CLI.

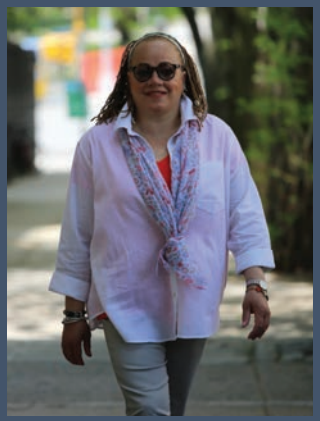
References

1.Gerhard-Herman MD, et al. 2016 AHA/ACC Guideline on the Management of Patients With Lower Extremity Peripheral Artery Disease: *Circulation.* 2017;135:e726-e779.

2. Shishehbor MH, et al. Critical Limb Ischemia: An Expert Statement. *J Am Coll Cardiol.* 2016;68:2002-2015.

3. Zeller T, et al. Paclitaxel-Coated Balloon in Infrapopliteal Arteries: 12-Month Results From the BIOLUX P-II Randomized Trial. *JACC Cardiovasc Interv.* 2015;8:1614-22.

Rhonda Peterson, 60



Diagnosis: Peripheral artery disease

Treatment: Peripheral diagnostic catheterization, peripheral intervention

I was experiencing tightness in my chest and in my legs. I didn't understand what these symptoms were at the time, but they wouldn't go away. I went to a clinic in my neighborhood for an echocardiogram and stress test, and from my results they referred me to Prakash Krishnan, MD, and Mount Sinai Hospital.

I was feeling apprehensive because heart disease runs in my family. I've been a patient of Dr. Krishnan's since 2006, and from my very first appointment with him, he was very hands-on and put me at ease. He said, "You're young, so I know this must be scary for you. But we're going to work through this."

I had my first stent put in with him, and then he came up with a plan that I would come back and see him every few months and I was put on some mild blood thinners. It was more about maintenance at the time.

"When you come in and you get that one-on-one attention from a doctor, that's profound."

Dr. Krishnan is that doctor who lets you know you will be okay and then he goes into what you need to do. I didn't understand what lifestyle changes I needed to make, so I asked him a lot of questions. He helped me quit smoking, put me on a better diet and encouraged me to take better care of myself, physically and mentally.

I've had quite a few procedures with Dr. Krishnan. I feel that he is a very dedicated doctor. When you come in and you get that one-on-one attention from a doctor, that's profound. Dr. Krishnan's team all know who you are and what your condition is about—that's why I kept going back. It was the best decision I made for my life.

INNOVATIONS

A Simple Way to Improve PCI Outcomes: The SHIELD II Trial

JOSEPH M. SWEENY, MD

Who would have thought that by inducing brief, controlled episodes of intermittent ischemia (inadequate blood supply) to the arm or leg could provide a safe, inexpensive and noninvasive way of protecting the heart against prolonged ischemia?

This is the question investigators across the United States, including The Mount Sinai Hospital, are asking. Remote Ischemic Preconditioning, also known as rIPC, is the process of inducing brief episodes of ischemia in one tissue to confer resistance to subsequent ischemic insults in a remote tissue. By using a blood pressure cuff on the arm to induce ischemia in the arm, rIPC has been shown to elicit a biological response that protects the body from subsequent ischemic damage associated with a myocardial infarction or percutaneous coronary intervention (PCI). The exact mechanism underlying this protective response remains under investigation and is the focus of much debate, but has been linked to upregulation of cardioprotective genes and suppression of pathogenic genes involved in ischemia reperfusion injury through a complex cascade of both humoral and neuronal mediated intracellular signaling pathways.

To date, clinical uses of rIPC have included myonecrosis during PCI, cardiac surgical procedures, vascular surgery, and prior to cardiac transplantation, as well as protecting brain and kidney during ischemic episodes.

The Mount Sinai Hospital Cardiac Catheterization Laboratory is currently a leading enrolling site for The SHIELD II trial, which is a multicenter, randomized controlled single-blinded study of the autoRIC device in subjects undergoing elective PCI. To date, this trial has enrolled roughly 500 patients, and its design focuses on assessing the safety and effectiveness of remote ischemic conditioning with the autoRIC prior to elective PCI.

The results could have an important impact on the way we treat patients undergoing elective PCI.

500 Patients

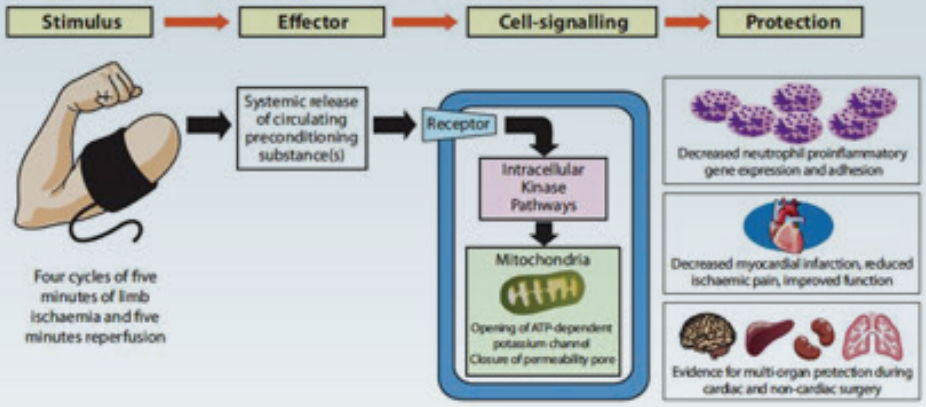
TO DATE, THIS TRIAL HAS ENROLLED ROUGHLY 500 PATIENTS AND ITS DESIGN FOCUSES ON ASSESSING THE **SAFETY AND EFFECTIVENESS OF REMOTE ISCHEMIC CONDITIONING WITH THE AUTORIC PRIOR TO ELECTIVE PCI.**

References

1.Kharbanda RK, Nielsen TT, Redington AN. Translation of remote ischemic preconditioning into clinical practice. Lancet. 2009;347(9700):1557-1565

2. Kloner RA, Clinical application of remote ischemic preconditioning. Circulation 2009;119:776-778.

3. Aimo A, et al. Cardioprotection by remote ischemic preconditioning: Mechanisms and clinical evidence. World Journal of Cardiology. 2015;10:621



Biological effects of remote ischemic preconditioning.

Ronald Shechtman, 73

Diagnosis: Acute STEMI: LAD coronary artery

Treatment: Diagnostic catheterization and coronary intervention via right femoral artery

I'd never been in a hospital bed before in my life. I'm someone who's in good physical shape—I ski regularly, I don't have high cholesterol, and I have no family history of heart problems. I woke up in the middle of the night on November 7 with a bad case of heartburn.

The pain intensified, so I woke up my wife, who called 911. The medics did a quick EKG and said, 'Sir, you're having a heart attack.'

They took me in an ambulance to the Emergency Department at Mount Sinai. That's where I met Dr. Sweeny, who told them to get me to the Catheterization Laboratory right away. They cleared the blocked artery, the one called the Widowmaker, and put a stent in. When I woke up, I didn't even know where the incision was. I wasn't in any pain or discomfort.

Dr. Sweeny explained what happened and what we were going to do to ensure I wouldn't be back in again for treatment. I'm in cardio physical therapy, I've lost weight, and I'm eating well—I've cut out the sugar, and I'm feeling great.

I'm so appreciative of the care and attention I got and continue to get from Dr. Sweeny and his team. They really seem to care, they're great at communication, and that makes a difference.

"They really seem to care, they're great at communication, and that makes a difference."

Ongoing Radial Intervention and Reducing Vascular Complications

NITIN BARMAN, MD

Percutaneous coronary intervention (PCI) with stenting continues to be a standard therapy for symptomatic obstructive coronary artery disease (CAD) in most patients. Originally performed through the femoral artery in the groin, it has been long demonstrated to be feasible through the radial artery, a smaller artery in the wrist.

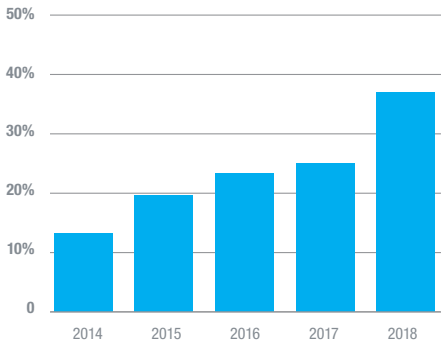
Utilizing the radial artery for coronary procedures results in less procedure-related bleeding and fewer vascular complications. Additionally, radial access for PCI has been shown to be strongly preferred by patients as it allows for earlier ambulation and discharge from the hospital, as well as a quicker return to normal function. But it wasn't until more substantial clinical benefits were proven in the last several years that intervention through the radial artery began to enjoy more widespread use.

The pivotal MATRIX trial, which compared radial versus femoral access in patients with ACS (acute coronary syndrome), demonstrated a significant reduction in major cardiovascular events in the radial group. Similarly, in a large meta-analysis of all randomized trials addressing this issue, which included nearly 20,000 patients, ACS patients receiving radial access enjoyed a 28 percent reduction in all-cause mortality.

Despite these significant findings, the majority of patients in the United States undergoing PCI continue to receive their procedure through the groin. Two main reasons for this are that patients who are the most likely to benefit from radial access (i.e. sicker patients) remain the least likely to receive radial PCI (the so-called risk/treatment paradox). This paradox occurs largely because of reduced operator experience. Similarly, many operators falsely believe the radial approach to be inferior for patients with more complicated blockages such as chronic total occlusions and left main bifurcations (i.e. branch point blockage of the main artery).

Two large published registry studies, PROGRESS CTO and COBIS II, have debunked this myth by demonstrating equivalent outcomes between radial and femoral access, in these most challenging patients. To surmount these barriers, The Mount Sinai Hospital maintains a training course in complex radial PCI, available to providers throughout the nation, to teach the skills necessary to perform complex radial procedures safely and successfully. Mount Sinai remains committed to providing the best possible care to all patients while educating other physicians in the process. Adhering to the mandates of patient care and education supports our position as a local and national leader in the area of transradial procedures.

GROWTH OF RADIAL PROCEDURES AT MSH



References

1. Valgimigli M, et al. Lancet. 2015;385 2465-76

2. Tajti P, et al. JACC Cardiovasc Interv. 2019 Feb 25;12(4):346-358

3. Chung S, et al. J Invasive Cardiol. 2015 Jan;27(1):35-40

Tackling Heart Disease in Women: A Global Initiative

ROXANA MEHRAN, MD

Cardiovascular disease (CVD) is the leading cause of death in women worldwide. Alarmingly, the data on the global burden of CVD in women have not changed much over the last 25 years. While there has been an overall decline in CVD mortality for women in high-income countries, this decline has plateaued in recent years and worse, mortality has increased in low-income countries. In fact, the increased risk of CVD-related death shifts from men to women in countries with a low socioeconomic index.

In order to understand how to improve the outcomes for women with CVD, clinical studies are needed. Unfortunately, women are still widely underrepresented in clinical trials, constituting roughly 30 percent of CVD trial participants. Further, many clinical trial organizers still do not conduct sex-based analyses of their trial data, creating a wider gap in knowledge of sex-based differences in CVD outcomes.

There are multiple reasons for the underrepresentation of women in clinical trials. Inclusion and exclusion criteria may disproportionately exclude women from enrollment based on the older age and excess of comorbidities of women compared to men when they present with CVD. Another reason may be due to the fact that women receive less invasive treatment compared to men, despite similar rates of disease, and therefore are less likely to be eligible for interventional trials. Some studies also suggest that women are generally more reluctant than men to participate in a clinical trial.

With such a high burden of CVD and CVD-related death in women worldwide, and a lack of sufficient evidence on how to prevent or improve CVD outcomes in female patients, *The Lancet* journal tapped Mount Sinai's Roxana Mehran, MD, to lead a Clinical Commission on Women and Cardiovascular Disease. The Commission will consist of a report, written by a global team of women cardiologists, and will be distributed worldwide by *The Lancet*. To support the Commission's distribution, a complementary website and digital campaign will also be developed. The aim is to summarize current evidence, outline data and treatment gaps, raise awareness, and provide innovative recommendations on further steps needed to improve clinical outcomes in women with cardiovascular disease.

The larger goal is to significantly and permanently reduce the global burden of CVD in women by the year 2030. The Lancet Women and Cardiovascular Disease Commission will launch in late 2019.

Panel: **Aims of *The Lancet* Commission on women and cardiovascular disease**

1. Summarise the existing scientific evidence and outline gaps in research and care for women with cardiovascular disease.
2. Present concrete recommendations for addressing related gaps, drawing on best practices from medical and non-medical fields.
3. Showcase leaders, innovators, and advocates for women with cardiovascular disease.
4. Generate global awareness about sex-specific disparities in cardiovascular disease and prompt needed additional research.
5. Provide a springboard into future activities furthering the impact of the Commission.

References:

1. Aggarwal NR, et al. Sex Differences in Ischemic Heart Disease: Advances, Obstacles, and Next Steps. Circ Cardiovasc Qual Outcomes. 2018 Feb;11(2):e004437. doi: 10.1161/CIRCOUTCOMES.117.004437.

2. Coakley M, et al. Dialogues on Diversifying Clinical Trials: Successful Strategies for Engaging Women and Minorities in Clinical Trials. J Women's Heal. 2012;21(7):713-716. doi:10.1089/jwh.2012.3733.

3. Mehran R, et al. The Lancet Commission on women and cardiovascular disease: time for a shift in women's health. Lancet. 2019 Feb 8. doi: 10.1016/S0140-6736(19)30315-0.

Advances in Our Understanding of Stem Cells in the Cardiovascular System

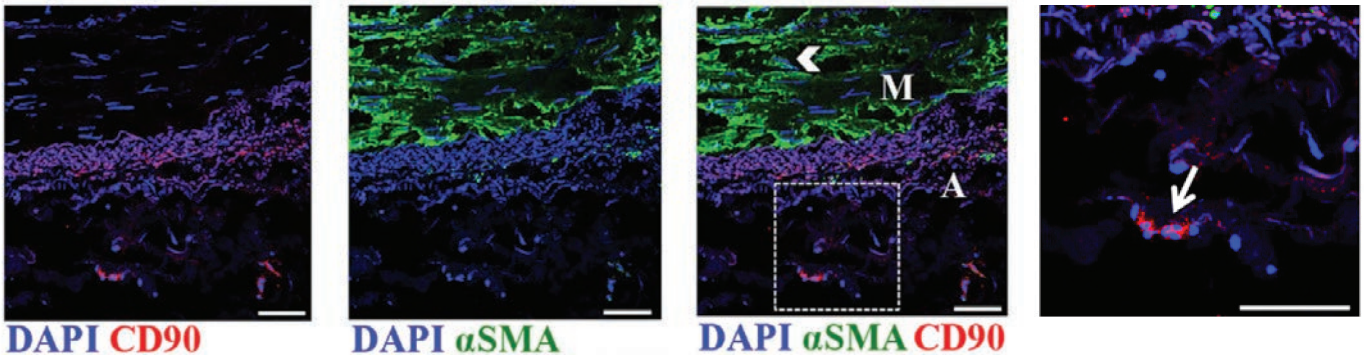
JASON KOVACIC, MD, PHD

Over the last two decades, enormous effort has gone into improving our understanding of the role of stem cells in the heart and vessels. Researchers also conducted many clinical studies to investigate if stem cells could be used as a therapy to treat patients with coronary artery disease (CAD) or other forms of cardiovascular disease (CVD).

Among the interventional cardiologists at Mount Sinai, Jason Kovacic, MD, was one of the early pioneers of using stem cell therapies to treat patients—more than a decade ago, he performed a study injecting stem cells into the coronary arteries of patients with severe CAD. This led to a recent, major paper where for the first time Dr. Kovacic described the existence of a rare population of stem cells in the outer layer of the vessel wall of adult humans. These cells, identified by a specific marker called CD90, fulfilled all the strict criteria to be defined as a population of "mesenchymal stem cells" (Figure). In addition, profiling of the genetic features of these stem cells showed they are likely to be key players in the development of CAD in patients.

References

1.Michelis KC, et al. CD90 Identifies adventitial mesenchymal progenitor cells in adult human medium- and large-sized arteries. Stem Cell Reports. 2018; 11: 242-57.



High power laser microscope picture of the outer blood vessel wall. The blue dots are individual cells (marked by a special marker called "DAPI"). The arrow head shows in green the muscular cells that make up the middle (M) layer of the blood vessel wall marked by αSMA. Shown in red in the very outer (bottom) adventitial (A) layer are a cluster of a few rare stem cells that are marked by CD90.

Venous Ablation for Varicose Veins

VISHAL KAPUR, MD

Veins contain tiny valves that open and close as needed to ensure that blood flows in a one-way direction toward the heart. Varicose, or enlarged, veins occur when these valves become weakened or damaged, allowing blood to flow backward and pool in the veins. The condition may develop as the veins lose elasticity due to aging or smoking. It is also caused by increased pressure on the veins due to pregnancy, obesity, and standing or sitting for long periods of time.

Symptoms of varicose veins may include swelling in the lower leg or ankle, pain or achiness, and skin problems such as itching, discoloration, and, in severe cases, ulceration. While varicose veins are not life-threatening, they can lead to significant discomfort and disability, particularly for those who have jobs or activities that require them to stand for long periods of time. Since many varicose veins are not visible, they are frequently underdiagnosed and undertreated. Varicose are two times more prevalent than coronary heart disease (CHD) and five times more prevalent than peripheral arterial disease (PAD)—with 30 million affected patients. However, only 1.9 million patients each year seek treatment and fewer—only 447,000 patients—are treated each year.

Patients with varicose veins might be surprised to learn this condition can be easily diagnosed with a simple ultrasound. If treatment is needed, most cases are easy to treat on an outpatient basis with minimally invasive methods that require little or no recovery time.

Physicians at Mount Sinai Heart are experienced in using latest technology for venous disease treatment with the latest being use of VenaSeal Closure System®. The concept behind this procedure is the use of cyanoacrylate (Super-Glue), which is injected in the veins to close them off.

We use Doppler ultrasound to locate the vein and guide placement of the catheter, which is inserted using only local anesthesia. The procedure is performed on an outpatient basis and is completed in 15–20 minutes. The patient is able to walk immediately after the procedure. Surveillance venous ultrasound is performed at defined intervals as part of follow-up. The advantage of VenaSeal is that it does not require multiple needle sticks or extensive use of local anesthesia, and there is no risk of nerve damage or any residual nerve pain, which might happen with other treatment modalities.

We also have experience in other venous treatment modalities, such as laser and radiofrequency thermal ablation. They are both proven to be equally effective, with trials showing similar one-year results in vein closure and reflux free period. At the end of 30 days, there is no difference in the pain and swelling between the two procedures. They are both considered standard of care in the treatment of varicose veins.

INNOVATIONS

Coordinating Ambulatory Cardiac Care in the Network

JEFFREY BANDER, MD

Following the establishment of the Hospital Readmissions Reduction Program (HRRP), reimbursement rates for early readmissions have been reduced with a maximum cap of three percent. Similarly, when readmission rates exceed the national average, institutions are subjected to fines under the Patient Protection and Affordable Care Act (PPACA).

While the survival rate for acute coronary syndrome (ACS) has now increased to 94.6 percent due to significant advancements in pharmacological therapies and intervention techniques, there remains a substantial risk of early readmission following discharge.

Within 30 days post-discharge, or the "vulnerable phase" occurrence of readmission is estimated at 20.8 percent. Of that population, 50.8 percent again presented with cardiovascular symptoms and another 7.7 percent with an index of suspicion.

The discrepancy between the success of hospital courses and readmission rates highlights the need for optimizing both transitional care while initiating discharge, as well as care coordination following their release. This can be better achieved through patient education, appropriate screenings, and fostering accessible care outside of the hospital.

Translational care and care coordination are essential to ensuring the overall success of a patient following acute treatment. This includes creating rapid post-discharge ambulatory follow-ups, improving health education and increasing health literacy. One such method our practice has utilized is leveraging technology that not only disperses information throughout the ambulatory care team to prevent lapses in care, but also fosters a patient's sense of control over their plan of care.

However, platforms cannot be universally applied to each patient, and using a combination of services, including ZocDoc, Referwell and Pareto allows patients and their caregivers to quickly schedule appointments. Additionally, there are programs such as Meds to Beds, which arranges for bedside visits by a pharmacist to review medications, and the BRIDGE program, which demonstrated patients with HF were 0.138 to 0.378 times less likely to be readmitted if they were educated on their condition prior to discharge.

Care coordination, which includes serial screening diagnostics, communication between ambulatory providers, and identification of high-risk patients, is also integral to improving outcomes.

Although true causality between comorbidities and readmissions has yet to be elucidated for cardiac-specific events, 32 percent of patients who were readmitted were also diabetic. There was also found to be a higher rate of incidence with renal failure patients (13.7 percent), though this was only found to correlate to general readmissions. For diabetics specifically, serial nuclear stress tests should be performed to assess for newly developed ischemia after the initial event. Additionally, obtaining serial echocardiograms and labs can rule out differential diagnoses for individuals with pre-existing comorbidities, or those who are at a higher risk of developing them.

A combination of these programs can be tailored specifically to ACS, and if appropriately utilized, can reduce readmission rates. Therefore, it is essential that we strive to match our immediate survival outcomes to the care we provide after the phase of acuity has passed.

References

1. Bumpus S, et al. A Transitional Care Model for Patients With Acute Coronary Syndrome. The American Journal of Accountable Care[Internet]. (2014).

2. Hospital Readmission Reduction Program [Internet]. CMS.gov Centers for Medicare & Medicaid Services. (2018).

3. Southern DA, Ngo J, Martin BJ, et al.Characterizing Types of Readmission After Acute Coronary Syndrome Hospitalization: Implications for Quality Reporting. Journal of the American Heart Association. 3(5) (2014).

Appropriate Antiplatelet Therapy Post DES: Stable vs. Unstable Patient

USMAN BABER, MD

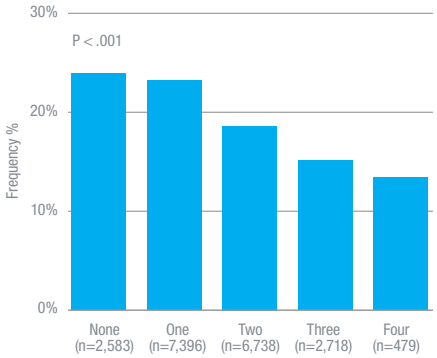
Decisions surrounding the choice, duration, and intensity of antiplatelet therapy are complex, given the difficulties in balancing risks for recurrent thrombosis and bleeding, along with challenges of ensuring adequate adherence in patients undergoing percutaneous coronary intervention (PCI) with drug-eluting stents (DES).

One of the first steps in this calculus is to characterize the patient in terms of acuity, from stable to presence of acute coronary syndrome (ACS). Informed by the results of large randomized trials, current guidelines stipulate that for unstable patients, the optimal antiplatelet therapy is treatment with either ticagrelor or prasugrel for at least one year. In routine clinical practice, however, most patients with acute presentations continue to receive clopidogrel instead of more potent agents. Moreover, increasing case complexity leads to more frequent use of clopidogrel, suggestive of a "risk treatment paradox" in ACS management (Figure). While reasons for these practice patterns remain complex, it is plausible that clinical concerns for bleeding complications result in therapeutic decisions that are risk averse in nature.

In the setting of stable coronary artery disease (CAD), dual antiplatelet therapy (DAPT) with aspirin and clopidogrel remains the preferred treatment. Historically, the duration of DAPT was one year due to concerns for stent thrombosis after PCI with DES. With iterative advances in DES technology, however, risks for stent thrombosis have diminished substantially. Coupled with increased awareness of bleeding-related morbidity, current recommendations now mandate only six months of DAPT after PCI with contemporary DES. Durations beyond this time point should be informed by empiric calculations of subsequent bleeding and thrombotic risk with tools such as the DAPT score.

Results from ongoing trials will continue to refine the optimal approach to provision of antiplatelet pharmacotherapy, comprising both acute and stable patients. Novel approaches include very short DAPT durations in high-bleeding-risk individuals, antiplatelet monotherapy with potent agents, and integration of risk scores to tailor the duration and intensity of therapy.

RISK TREATMENT PARADOX WITH PRASUGREL USE IN PROMETHEUS REGISTRY



DAPT SCORE

VARIABLE	POINTS
Age ≥ 75y	-2
Age 65 to < 75y	-1
Age <65 y	0
Current cigarette smoker	1
Diabetes mellitus	1
MI at presentation	1
Prior PCI or prior MI	1
Stent diameter <3mm	1
Paclitaxel-eluting stent	1
CHF or LVEF <30%	2
Saphenous vein graft PCI	2

Transcatheter Closure of Patent Foramen Ovale (PFO)

BARRY LOVE, MD

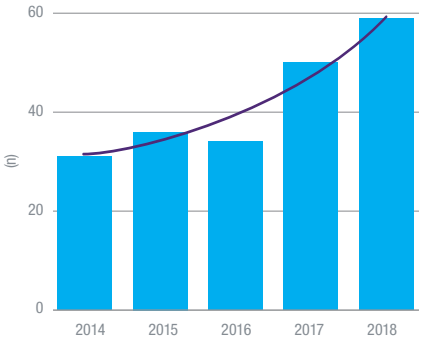
Transcatheter closure of Patent Foramen Ovale (PFO) has become a widely accepted practice in the United States over the past year and a half. Three major randomized controlled studies were published in late 2017 (RESPECT, REDUCE, CLOSE) and another in 2018 (DEFENSE PFO) that showed a significant statistical benefit to PFO closure in preventing recurrent stroke in patients with PFO. All patients in these trials were between 16 and 60 years of age and had suffered a first stroke. They all had a patent foramen ovale and had other mechanisms of stroke excluded. Patients were randomized to medical therapy or device closure. Over follow-up horizons that ranged between 3.2 and 5.9 years, there was a 50-70 percent reduction in stroke that favored device closure over medical therapy alone. Results of the DEFENSE-PFO trial were even more impressive. That trial focused on "high-risk" PFOs—those with atrial septal aneurysm or large PFO. In 120 patients randomized 1:1 and followed for two years, there was a 10.5 percent incidence of stroke in the medical group and none in the device group.

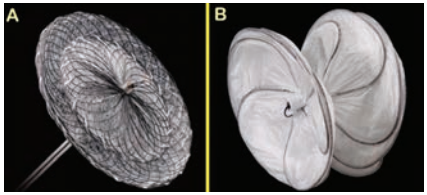
The incidence of significant adverse events in all four trials was low in both medical- and device-treated patients. There was some incidence of atrial fibrillation as low as 1 percent in the RESPECT trial and as high as five percent in CLOSE and REDUCE, but most of these events were periprocedural and did not commit the patient to long-term anticoagulation. On these data, the FDA approved the Amplatzer PFO Occluder in October 2016 and the Gore Septal Occluder a short time later, specifically for PFO closure.

We have been performing PFO closure at Mount Sinai since 2003 using a variety of devices in studies, under a limited HDE, off label, and since October 2016, with full FDA approval. In the more than 600 cases were have performed, our practice has evolved. We now do these cases with local anesthesia and minimal to no sedation. We obtain femoral venous access with two sheaths and are able to visualize the PFO using intracardiac echo. The PFO is crossed and closed, and patients recover for four hours and are discharged home the same day on a single antiplatelet agent. In the last 100 cases, our fluoroscopy time median is 1.5 minutes. A full procedure from access to hemostasis is typically 15–20 minutes.

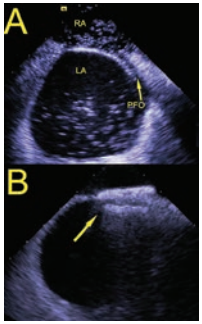
It remains important to carefully evaluate who is likely to benefit from PFO closure before proceeding with a procedure—even a low risk one. Between 20–30 percent of the population has a PFO, so it can be a bystander rather than causative in many cases. There are features of the PFO anatomy and patient risk factors, however, that can make the case stronger or weaker for PFO closure.

NUMBER OF PFO CLOSURES PERFORMED ANNUALLY AT MOUNT SINAI





FDA approved devices for PFO closure. (A) Amplatzer PFO Occluder (B) Gore Cardioform Septal Occluder



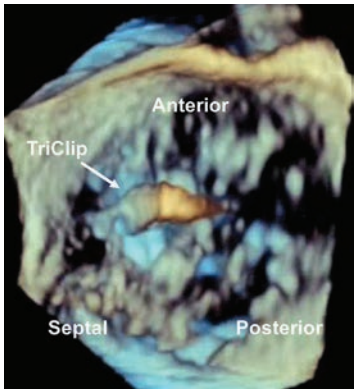
Intracardiac echocardiogram (ICE) showing PFO before (A) and after (B) closure with a 25mm Amplatzer PFO Occluder

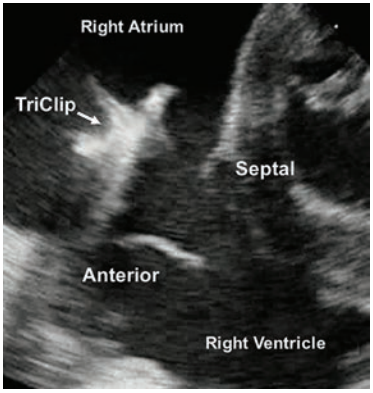
Transcatheter Tricuspid Valve Repair (TTVR)

GILBERT TANG, MD

Moderate or greater tricuspid regurgitation (TR) impacts more than 1.6 million patients—but currently only 0.4 percent undergo surgical treatment. Many patients who have had prior mitral valve surgery, intervention or pacemaker/AICD implantation have significant TR. They often suffer from shortness of breath, fatigue, bloated abdomen, liver congestion, leg edema, and right heart failure. If left untreated, some symptoms can result in death. Tricuspid valve surgery can be high risk, and there have been no minimally invasive treatment options for these patients until now.

Built upon the excellent outcomes in surgical tricuspid valve repair, The Mount Sinai Hospital is proud to be one of the few hospitals in the United States to offer the Transcatheter Tricuspid Clip (TriClip) repair in patients who have symptomatic moderate or greater TR and who are considered at intermediate or greater risk for open-heart surgery. As part of the TRILUMINATE TriClip tricuspid valve repair feasibility trial, a number of patients have already benefited from this procedure at Mount Sinai. In the TRILUMINATE pivotal trial, patients eligible for the study will be randomized between medical therapy or TricClip repair. Those with massive or worse tricuspid regurgitation can undergo TriClip repair directly. The Tricuspid Clip offers the same features and excellent safety profile as the MitraClip device; more than 700 transcatheter tricuspid valve repairs with the MitraClip system have been performed worldwide. Enrollment is currently underway for the TRILUMINATE study; Mount Sinai looks forward to treating patients with symptomatic tricuspid disease without open-heart surgery.





Top Ten Major Publications of 2018

1. Residual Inflammatory Risk and the Impact on Clinical Outcomes in Patients After Percutaneous Coronary Interventions.

Kalkman D, Aquino M, Claessen B, Baber U, Guedeney P, Sorrentino S, Vogel B, de Winter R, Sweeny J, Kovacic J, Shah S, Vijay P, Barman N, Kini A, Sharma S, Dangas G, Mehran R. *Eur Heart J. 2018 Dec 7;39(46):4101-4108. doi: 10.1093/eurheartj/ehy633.*

Persistent high RIR is observed frequently in patients undergoing PCI. In these patients, significantly higher all-cause mortality and MI rates are observed at 1 year follow-up. Residual inflammatory risk in patients undergoing PCI should be identified and treatment options should be further explored.

2 Developing a Mobile Application for Global Cardiovascular Education.

Bhatheja S, Fuster V, Chamaria S, Kakkar S, Zlatopolsky R, Rogers J, Otobo E, Atreja A, Sharma S, Kini A. *J Am Coll Cardiol. 2018 Nov 13;72(20):2518-2527. doi: 10.1016/j.jacc.2018.08.2183.*

Global reach, portability, swift learning, highly interactive user interface, and illustrations make mobile apps very effective educational tools. Sharing this app development experience may help other medical educators communicate their knowledge in more innovative ways, which will eventually help further the field of medical education.

3 Coronary Angiography and Percutaneous Coronary Intervention After Transcatheter Aortic Valve Replacement.

Yudi M, Sharma S, Tang G, Kini A. *J Am Coll Cardiol. 2018 Mar 27;71(12):1360-1378. doi: 10.1016/j.jacc.2018.01.057.*

Coronary angiography and PCI in patients after TAVR can be challenging. Intricate knowledge of the valve design and its relationship with the coronary ostia, sinus of Valsalva, and STJ anatomies can help predict the difficulty in coronary reaccess and identify a strategy to manage these patients. Proposed algorithms on cardiac catheterization and PCI may aid troubleshooting in the management of these complex clinical scenarios.

4. Macrophage Biology, Classification, and Phenotype in Cardiovascular Disease.

JACC Macrophage in CVD Series (Part 1,2,3,4). Williams J, Giannarelli C, Rahman A, Randolph G, Kovacic J. *J Am Coll Cardiol. 2018 Oct 30;72(18):2166-2180. doi: 10.1016/j.jacc.2018.08.2148.*

In this Part 1 of a 4-part review series covering the macrophage in cardiovascular disease, the focus is on the basic principles of macrophage development, heterogeneity, phenotype, tissue-specific differentiation, and functionality as a basis to understand their role in cardiovascular disease.

5. Effect of a Contrast Modulation System on Contrast Media Use and the Rate of Acute Kidney Injury After Coronary Angiography.

Mehran R, Faggioni M, Chandrasekhar J, Angiolillo D, Bertolet B, Jobe R, Al-Joundi B, Brar S, Dangas G, Batchelor W, Prasad A, Gurm H, Tumlin J, Stone G. *JACC Cardiovasc Interv. 2018 Aug 27;11(16):1601-1610. doi: 10.1016/j.jcin.2018.04.007.*

Use of the AVERT system was feasible and safe, with acceptable image quality during coronary angiography and PCI. AVERT significantly reduced CMV, with the extent of CMV reduction correlating with procedural complexity. No significant differences in CI-AKI were observed with AVERT in this trial. (AVERT Clinical Trial for Contrast Media Volume Reduction and Incidence of CIN [AVERT]; NCT01976299).

6. Intravascular Brachytherapy for the Management of Repeated Multimetal-Layered Drug-Eluting Coronary Stent Restenosis.

Varghese M, Bhatheja S, Baber U, Kezbor S, Chincholi A, Chamaria S, Buckstein M, Bakst R, Kini A, Sharma S. *Circ Cardiovasc Interv. 2018 Oct;11(10):e006832. doi: 10.1161/CIRCINTERVENTIONS.118.006832.*

Recurrence of coronary restenosis after multiple metal layers of stents remains a vexing problem of the current era. Our analysis reveals that IVBT offers significant value in this situation by reducing restenosis as well as MACE at the same time providing exceptional safety profile at 1-year follow-up. However, comparative trials with long-term follow-up are needed to rule out concerns, such as late catch-up phenomenon and very late ST.

7. Treatment Effect of Drug-Coated Balloons is Durable to Three Years in the Femoropopliteal Arteries.

Schneider P, Laird J, Tepe G, Brodmann M, Zeller T, Scheinert D, Metzger C, Micari A, Sachar R, Jaff MR, Wang H, Hasenbank M, Krishnan P. *Circ Cardiovasc Interv. 2018 Jan;11(1):e005891. doi: 10.1161/CIRCINTERVENTIONS.117.005891.*

Three-year results demonstrate a durable and superior treatment effect among patients treated with DCB versus standard PTA, with significantly higher primary patency and lower clinically-driven target lesion revascularization, resulting in similar functional improvements with reduced need for repeat interventions.

8. Procedural and One-Year Outcomes of Patients Treated with Orbital and Rotational Atherectomy with Mechanistic Insights from Optical Coherence Tomography.

Okamoto N, Ueda H, Bhatheja S, Vengrenyuk Y, Aquino M, Rabiei S, Barman N, Kapur V, Hasan C, Mehran R, Baber U, Kini A, Sharma SK. *EuroIntervention. 2018 Jun 26. pii: EIJ-D-17-01060. doi: 10.4244/EIJ-D-17-01060*

Sought to evaluate procedural complications and 1-year clinical outcomes for patients who underwent percutaneous coronary intervention (PCI) with orbital (OA) and rotational atherectomy (RA). OA use was associated with lower unadjusted but similar adjusted 1-year MACE outcomes compared to RA with higher rates of dissection and device-induced perforation.

9. Predictors of Side Branch Compromise in Calcified Bifurcation Lesions Treated with Orbital Atherectomy.

Barman N, Okamoto N, Ueda H, Chamaria S, Bhatheja S, Vengrenyuk Y, Gupta E, Sweeny J, Kapur V, Hasan C, Baber U, Moreno P, Sharma S, Kini A. *Catheter Cardiovasc Interv. 2018 Dec 3. doi: 10.1002/ccd.27992*

The aim of the study was to identify the predictors of side branch (SB) compromise in severely calcified bifurcation lesions treated with orbital atherectomy (OA). The severity of SB ostial disease and not MV plaque morphology contributed to SB compromise in severely calcified bifurcation lesions.

10. Comparison of Transaortic and Subclavian Approaches for Transcatheter Aortic Valve Replacement in Patients with No Transfemoral Access Options.

Asaad A, Kovacic J, Engstrom K, Stewart A, Anyanwu A, Basnet S, Aquino M, Baber U, Garcia L, Gidwani U, Dangas G, Kini A, Sharma S. *Structural Heart, 2:5, 463-468, DOI: 10.1080/24748706.2018.1497237*

The data shows a relatively low incidence of complications and comparable outcomes in these two groups. SCL or TAo access can be utilized as alternatives in patients with prohibitive ileofemoral anatomy, however, based on our limited data, subclavian access with self-expanding valves offers better outcomes.

Research and Clinical Trials

Study Title	Study Details	Sponsor	Principal Investigator(s) at MSH	Target Enrollment and Study Sites	Current Status/ Enrollment at MSH
EVOLUT-R Low Risk TAVR Continous Access Registry	Transcatheter aortic valve replacement (TAVR) in patients with severe, symptomatic Aortic Stenosis (AS) at low surgical risk by TAVR with the Medtronic CoreValve® System in selected patients.	Medtronic, Inc.	S. Sharma	1,200 (USA) 75 Centers	Ongoing/ 6 subjects enrolled
HYBRID Trial	Randomized trial of hybrid coronary revascularization versus percutaneous coronary intervention in multivessel coronary artery disease.	NHLBI	S. Sharma J. Puskas A. Kini	2,250 (Global) 60 Centers	Ongoing/ 5 Subjects Enrolled
SHIELD II Trial	Saftey and effeciveness of remote ischemic conditioning with the autoRIC prior to elective PCI study.	CellAegis, Inc.	J. Sweeny	716 (USA) 60 Centers	Ongoing/ 114 subjects enrolled
ORBID-FFR Trial	Optical coherence tomography predictors of functionally significant side branch compromise after provisional main vessel studying in coronary artery disease assessed by fractional flow reserve.	Boston Scientific Corp.	A. Kini	150 (USA) 1 Center	Ongoing/ 67 subjects enrolled
ENVISAGE TAVI-AF Trial	Edoxaban versus standard of care and their effects on clinical outcomes in patients having undergone transcatheter aortic valve implantation—in atrial fibrillation.	Daiichi Sankyo, Inc.	G. Dangas	200 (USA) 40 Centers	Ongoing/ 8 subjects enrolled

Study Title	Study Details	Sponsor	Principal Investigator(s) at MSH	Target Enrollment and Study Sites	Current Status/ Enrollment at MSH
XIENCE SHORT-DAPT Study	Comparing 3-month DAPT duration after Xience DES in patients with high-risk bleeding.	Abbott Vascular	U. Baber	400 (USA) 40 Centers	Ongoing/ 5 subjects enrolled
Global cVAD Registry	The global cVAD registry is an ongoing, observational, multicenter registry that includes patients receiving the Impella devices in the daily, routine clinical care per institutional standards and treating physician's discretion.	Abiomed	S. Sharma	1,200 (USA) 180 Centers	Ongoing/ 86 subjects enrolled
AEGIS-II	This is a phase 3, multicenter, double-blind, randomized, placebo-controlled, parallel-group study to evaluate the efficacy and safety of intravenous infusion of CSL112 (APO A-1) in subjects with acute coronary syndrome.	CSL Behring, LLC	N. Barman	17,400 (Global) 180 Centers	Ongoing/ 1 subject enrolled
Triluminate	The primary purpose of this study is to evaluate safety and effectiveness of the Tricuspid Valve Repair System (TVRS) for treating symptomatic moderate or greater tricuspid regurgitation in patients currently on medical management and who are deemed appropriate for percutaneous transcatheter intervention.	Abbott Vascular	A. Kini G. Tang	85 (Global) 20 Centers in USA	Ongoing/ 4 subjets enrolled
SPYRAL HTN ON OFF Study	Global clinical study of renal denervation with the Symplicity Spryal™ multi-electrode renal denervation system in patients with uncontrolled hypertension in the absence of antihypertensive medications.	Medtronic, Inc.	G. Dangas	433 (USA) 15 Centers	Ongoing/ 31 subjects enrolled

Samin K. Sharma, MD, FACC, FSCAI

Senior Vice-President, Operations & Quality, Mount Sinai Heart
Director, Interventional Cardiology, Mount Sinai Health System
President, Mount Sinai Heart Network
Anandi Lal Sharma Professor of Medicine (cardiology)

Clinical Interests:

Coronary Artery Disease

Interventional Cardiology

Valvular Intervention

212-241-4021
samin.sharma@mountsinai.org

Samin K. Sharma, MD, is a renowned interventional cardiology expert in New York, well known for performing high-risk complex coronary interventions (more than 1,500 interventions per year) with an extremely high success rate (greater than 99 percent) while achieving an extremely low complication rate (less than 0.2 percent major complication). He has received the prestigious two-star designation (significantly lower than expected mortality) numerous times by the New York State Department of Health and the Governor's Award of Excellence in Medicine in 1996.

He has served on New York State's Cardiac Advisory Board from 2004–2016. Under Dr. Sharma's leadership, The Mount Sinai Hospital Cardiac Catheterization Laboratory has become one of the safest and busiest centers in New York, providing state-of-the-art cardiac and interventional care for all types of simple and complex heart patients. In addition to coronary interventions, Dr. Sharma specializes in the non-surgical treatment of mitral and aortic valve disease including transcatheter aortic valve replacement (TAVR) and MitraClip procedures (TMVR).

He has been dubbed "master of Rotablator" and is regularly featured on national and local TV and in newspapers and magazines including *Newsday, Newsweek, New York Times, New York Post, Forbes, Wall Street Journal, New York Daily News, Washington Post, New York Magazine, India Abroad,* and *India Today*. He has received numerous awards: *2015 Honorary Master of Science PhD degree by Rajasthan University Jaipur India, 2014 Distinguished Physician Scientist by AAPI-QLI for excellence in Medicine, 2011 Ellis Island Medal of Honor, 2011 American Heart Association Achievement in Cardiovascular Science & Medicine Award, 2011 American Association of Physicians of Indian Origin (AAPI) Physician of the Year, 2010 Association of Indians in America (AIA) for Excellence in Medicine, 2003-2007 and 2010-2018 Best Doctors by New York Magazine, 2008-2018 Super Doctors, 2007 Jacobi Medallion Award by The Mount Sinai Hospital, 2007 Physician of the Year by The Mount Sinai Hospital.*

He has authored over 250 papers and 15 book chapters in the field of coronary interventions, structural heart disease and safety of percutaneous interventions. He is also a philanthropist, and The Mount Sinai Hospital Cardiac Catheterization Laboratory is now named the Dr. Samin K. Sharma Family Foundation Cardiac Catheterization Laboratory. Dr. Sharma has built a 250-bed heart hospital (EHCC) in his native Jaipur, India to provide the best care to all patients irrespective of their financial and social status.

He also enjoys teaching other cardiologists through the annual live symposium called the Complex Coronary Cases (CCC) Symposium, which is in its 22nd year. His live monthly webcast series, Complex Coronary Cases (www.ccclivecases.org), which broadcasts live procedures to 130 countries, is in its 10th year.

Annapoorna S. Kini, MD, MRCP, FACC

Director, Cardiac Catheterization Laboratory
Director, Structural Heart Disease Program
Director, Interventional Cardiology Fellowship Program
Zena and Michael A. Weiner Professor of Medicine

Clinical Interests:

Intravascular Imaging

Interventional Cardiology: CTO

Valvular Intervention

212-241-4181
annapoorna.kini@mountsinai.org

Annapoorna S. Kini, MD, is internationally acclaimed for her special expertise in performing complex coronary interventions especially in chronic total occlusion for patients with advanced coronary artery disease, high-risk interventional cases, and septal (alcohol) ablation for the treatment of obstructive hypertrophic cardiomyopathy. Dr. Kini has been the principal or co-investigator in numerous randomized clinical trials. She has extensive experience with mitral and aortic balloon valvuloplasty and has been among the first few interventional cardiologists in the country to use the transcutaneous aortic valve implantation procedure in the treatment of inoperable patients with critical aortic stenosis. She has also made history by performing the first live case performed entirely by women during the CRT meeting March 5, 2018.

Dr. Kini performs over 1,000 coronary interventions annually, the highest number by a female interventionist in the United States, with an extremely low complication rate of less than 0.3 percent; an official report from The Department of Health recognized Dr. Kini as the safest operator among 350 other physicians in the state of New York numerous times (2004-2016). She is the recipient of 2011 *Dean's Award for Excellence in Clinical Medicine* at The Mount Sinai Hospital. She also received the Physician of the year award in 2014 by The Mount Sinai Hospital nurses. She received the *Excellence in Medicine Award* by the National Association of Physicians of India (AAPI) in July 2016. In May 2017, she received the prestigious *Ellis Island Medal of Honor*, the highest award given to any immigrant civilian and in 2018 received the *American Heart Association's Heart of Gold Award*.

Dr. Kini is a keen researcher, particularly recognized for her studies pertaining to intra-coronary imaging studies including IVUS, NIRS and OCT, and trials such as YELLOW, CANARY and ORBID have made major headlines. She has published more than 100 peer-reviewed scientific publications, and book chapters in major cardiology textbooks. Dr. Kini is the recipient of the "Rock Star of Science" award from the American Heart Association. She is member of the Royal College of Physicians of London and Fellow of the American College of Cardiology. The most recent YELLOW II study was an ambitious translational combination of multi-modality imaging with clinically relevant cellular biology and comprehensive transcriptomics.

Dr. Kini is an excellent teacher, and is dedicated to the teaching of both cardiology and interventional fellows. In fact, the 2012 batch of Mount Sinai interventional fellows created a teaching award in her name, "The Annapoorna S. Kini Fellows' Choice Award" for excellence in teaching. Her achievements are not only limited to serving as the Director of the Annual Live Symposium of Complex Coronary Cases at The Mount Sinai Hospital, one of the most attended and respected meetings in the field of interventional cardiology in the country. She is also the director of monthly webcast program, CCC Live Cases (www.ccclivecases.org) that has a worldwide audience of 10,000+ physicians spanning over 130 countries.

Prakash Krishnan, MD, FACC

Director of Endovascular Services, The Mount Sinai Health System

Associate Professor of Medicine (Cardiology)

Associate Professor of Radiology

Clinical Interests:

Interventional Cardiology, Endovascular Intervention, Carotid Stenting

Prakash Krishnan, MD, is a world-renowned expert in peripheral vascular disease and is internationally recognized as a leader in the catheter-based treatment of peripheral arterial disease. Dr. Krishnan's expertise includes non-surgical treatment of coronary and peripheral vascular diseases including coronary stents, peripheral vascular angioplasty and stents, atherectomy, carotid stents, renal stents, renal denervation, and complex venous disease intervention. Dr. Krishnan is a patient advocate and an educator. He has built a robust community-based outreach program that serves a vast population of patients with complex coronary and peripheral arterial disease. He also serves as the Director of the Endovascular Intervention Fellowship in the Cardiac Catheterization Laboratory and has been educating interventionalists globally via live satellite transmissions at national and international meetings and with the monthly webcasts showcased on www.ccclivecases.org. He served as the co-national primary investigator in the ILLUMENATE Trial and is a leading authority in the performance of non-surgical interventions for peripheral arterial disease. He has received numerous awards and honors, most recently the Reverend Dr. Martin Luther King Legacy Award for Physician Services from Clergy with a Purpose. He has also served as editor of numerous textbooks on endovascular interventions and has authored numerous peer-reviewed articles and book chapters. He is co-director of the annual LINC Mount Sinai conference and The Mount Sinai Endovascular Fellows Course and has been a key faculty member for multiple national and international conferences.

212-241-5407 | prakash.krishnan@mountsinai.org

George D. Dangas, MD, PhD, FACC, MSCAI

Director, Cardiovascular Innovation

Professor of Medicine (Cardiology)

Professor of Surgery (Vascular)

Clinical Interests:

Interventional Cardiology, Valvular Heart Disease, Endovascular Intervention

George Dangas, MD, performs a wide spectrum of complex cardiovascular interventional procedures to treat coronary and valvular heart disease, aortic, carotid and peripheral arterial disease, and resistant hypertension. Dr. Dangas is a leading authority in the performance of nonsurgical cardiac and vascular interventions and in the development of innovative approaches to treat complex problems across many specialties. He is currently a trustee of the American College of Cardiology and editor-in-chief of *CardioSource WorldNews Interventions*, and has been chair of the Interventional Scientific Council and a trustee of the Society for Cardiovascular Angiography & Interventions. He is co-director of the annual conferences "Transcatheter Cardiovascular Therapeutics" and "Interventional Fellows' Courses" in the United States and Europe, and a key faculty and program committee member for multiple international conferences, including the ACCi2 Summit, ACCIS, AHA, and SCAI for many years. Dr. Dangas is the Director of Academic Affairs at the Cardiovascular Research Foundation.

212-241-7014 | george.dangas@mountsinai.org

Joseph M. Sweeny, MD, FACC

Medical Director, Ambulatory Cardiology Center

Assistant Professor of Medicine (Cardiology)

Clinical Interests:

Acute Myocardial Infarction, Fellows Education, Coronary Intervention

Joseph Sweeny, MD, performs both diagnostic cardiac catheterization and coronary interventions. He is the principal investigator of multiple national clinical trials and is actively involved in the interventional cardiology fellowship training program as the associate program director. In 2014, he became the medical director of the Lauder Ambulatory Cardiology Center, which provides comprehensive ambulatory clinical care and all kinds of non-invasive cardiac testing in one central location. His research has focused mainly on antiplatelet therapy in the treatment of acute coronary syndrome. He is the site principal investigator of an ongoing NIH-sponsored ischemia trial.

212-241-7016 | joseph.sweeny@mountsinai.org

Roxana Mehran, MD, FACC, FACP, FESC, MSCAI

Director, Interventional Cardiovascular Research and Clinical Trials

Professor of Medicine (Cardiology)

Professor of Population Health Science and Policy

Clinical Interests:

Restenosis Prevention, Contrast-Induced Acute Kidney Injury (AKI), Cardiovascular Disease in Women

Roxana Mehran, MD is an internationally renowned clinical research expert in the field of interventional cardiology. As Director of the Center for Interventional Cardiovascular Research and Clinical Trials at Mount Sinai, she has built a globally-respected academic research center focused on developing randomized clinical trials, outcomes research projects and high impact academic publications. A prolific researcher, she has served as principal investigator for numerous global studies, developed risk scores for bleeding and acute kidney injury, participates regularly in developing clinical guidelines, and has authored more than 900 peer-reviewed articles. She is a founder and Chief Scientific Officer of the Cardiovascular Research Foundation (CRF) and recently founded Women as One, an independent nonprofit organization dedicated to advancing opportunities for women in medicine. Very active within professional organizations, Dr. Mehran has been the Chair of the Interventional Council for the American College of Cardiology (ACC); Program Chair of the 2016 Annual Scientific Sessions of the Society for Cardiovascular Angiography and Interventions (SCAI), where she is also a co-founder of the Women in Innovations (WIN) Committee; and is a member of the American Heart Association's (AHA) Go Red for Women Scientific Advisory Group. Prior to Mount Sinai, Dr. Mehran held appointments at Columbia University Medical Center and Washington Hospital Center. She completed fellowships in cardiovascular disease and interventional cardiology at Mount Sinai Medical Center. Dr. Mehran is a recipient of the 2019 *Ellis Island Medal of Honor*.

212-659-9691 | roxana.mehran@mountsinai.org

FULL-TIME ATTENDINGS (LISTED ALPHABETICALLY)

Farah E. Atallah-Lajam, MD, FACC

Director, Mount Sinai Hospital Jackson Heights

Assistant Professor of Medicine

Clinical Interests: Clinical Cardiology, Cardiac Catheterization, Nuclear Cardiology

866-Heart-01 (St. Luke's)
718-879-1600 (Jackson Heights)
falcardiology@gmail.com

Usman Baber, MD, MS

Assistant Professor of Medicine (Cardiology)

Clinical Interests: Coronary Interventions, High-Risk Cardiac Populations, Cardiorenal Physiology

212-659-9691
usman.baber@mountsinai.org

Jeffrey Bander, MD, FACC

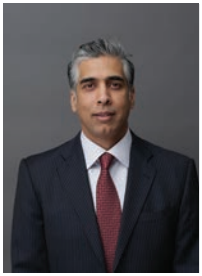
Medical Director, Network Development, Mount Sinai Hospital Network

Director of Operations, Cardiology, Mount Sinai Hospital West

Assistant Professor of Medicine (Cardiology)

Clinical Interests: Clinical Cardiology, Cardiac Catheterization, Coronary Interventions

212-381-0918
jeffrey.bander@mountsinai.org

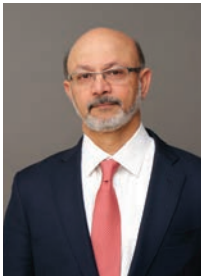


Nitin Barman, MD, FACC

Director, ADS Telemetry
Associate Professor of Medicine (Cardiology)

Clinical Interests: Clinical Cardiology, Transradial Intervention, AMI Intervention

212-241-1825
nitin.barman@mountsinai.org



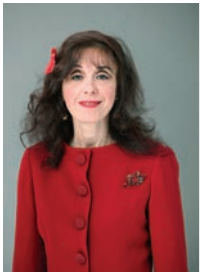
Srinivas Duvvuri, MD, FACC

Network Regional Medical Director, Staten Island

Associate Professor of Medicine (Cardiology)

Clinical Interests: General Cardiology, Cardiac Catheterization, Interventional Cardiology

718-981-2684
sd.heart1@gmail.com



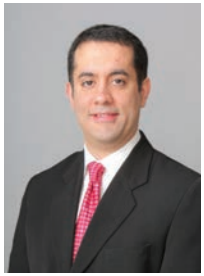
Lynne Glasser, MD

Director, Interventional Inpatient Service
Assistant Professor of Medicine (Cardiology)

Clinical Interests: Clinical Cardiology, Preventive Cardiology, Inpatient Cardiology

Since joining The Mount Sinai Hospital in November 2008, Dr. Glasser has been playing an important role in the treatment and management of interventional patients, before and after the procedure.

212-241-4521
lynne.glasser@mountsinai.org



Vishal Kapur, MD, FACC, FSCAI, RPVI

Director of Endovascular Services, Mount Sinai St. Luke's
Assistant Director, Endovascular Services, The Mount Sinai Hospital
Assistant Professor of Medicine (Cardiology)

Clinical Interests: Coronary Interventions, Peripheral Interventions, Non-Invasive Vascular Medicine

212-241-0898
vishal.kapur@mountsinai.org

Asaad Khan, MD, MRCP

Assistant Director, Interventional Structural Heart Disease Program, The Mount Sinai Hospital
Assistant Professor of Medicine (Cardiology)

Clinical Interests: Coronary Interventions, Structural Heart Disease Interventions, Structural Echo

212-241-0898
asaad.khan@mountsinai.org

Srinivas Kesanakurthy, MD

Director of Cardiac Catheterization Laboratory, The Brooklyn Hospital Center

Clinical Interests: Clinical Cardiology, Cardiac Catheterization, Coronary Interventions

718-250-8676
kesana@yahoo.com

Jason Kovacic, MD, PhD, FACC, FSCAI

Associate Professor of Medicine (Cardiology)

Clinical Interests: Atherosclerosis, Vascular Biology, Coronary Interventions

212-241-4059
jason.kovacic@mountsinai.org

Atul Kukar, DO, FACC, FSCAI, RPVI

Chief, Division of Cardiology, Mount Sinai Queens
Assistant Professor of Medicine

Clinical Interests: Coronary Interventions, Peripheral Interventions, General Cardiology

212-241-6422
atul.kukar@mountsinai.org

Stamatios Lerakis, MD, FACC, FASE

Professor of Medicine
Director, Noninvasive Cardiology
Director of Interventional Echocardiography

Clinical Interests: Structural Echocardiography, CT Angiography, Nuclear Cardiology

212-241-1002
stamatios.lerakis@mountsinai.org

FULL-TIME ATTENDINGS (LISTED ALPHABETICALLY)

Barry A. Love, MD, FSCAI

Director, Congenital Cardiac Catheterization Laboratory
Assistant Professor of Pediatrics and Medicine

Clinical Interests: Pediatric Catheterization and Intervention, Adult Congenital Heart Disease

212-241-9516
barry.love@mssm.edu

Sumeet Singh Mitter, MD, MSc

Advanced Heart Failure, Mechanical Circulatory Support and Transplant Cardiology

Assistant Professor of Medicine (Cardiology)

Clinical Interests: Infiltrative Cardiomyopathies, Endomyocardial Biopsy, IVAD Care

212-241-7300
sumeet.mitter@mountsinai.org

Noah Moss, MD

Medical Director, Mechanical Circulatory Support Center

Assistant Professor of Medicine

Clinical Interests: Mechanical Circulatory Support, Cardiac Transplantation, Endomyocardial Biopsy, CardioMEMS HF System

212-241-7300
noah.moss@mountsinai.org

Pedro R. Moreno, MD, FACC

Director, Cardiac Catherization Laboratory
Mount Sinai St. Luke's, Professor of Medicine (Cardiology)

Clinical Interests: Coronary Artery Disease, Interventional Cardiology, Plaque Imaging

212-523-2672
pedro.moreno@mountsinai.org

Jagat Narula, MD, PhD, MACC

Chief of Cardiology, Mount Sinai St. Luke's
Philip J. and Harriet L. Goodhart Chair in Cardiology, Professor of Medicine & Radiology

Clinical Interests: Noninvasive and Invasive Cardiovascular Imaging

212-523-4009
jagat.narula@mountsinai.org

William Schwartz, MD, FACC

Assistant Clinical Professor of Medicine (Cardiology)

Clinical Interests: Clinical Cardiology, Noninvasive Cardiology, Cardiac Catheterization

718-721-1500
wjsheartmd@aol.com

VOLUNTARY ATTENDINGS (LISTED ALPHABETICALLY)

Sandeep Singla, MD

Assistant Professor of Medicine (Cardiology)

Clinical Interests: Cardiac Catheterization, Cardiovascular Disease, Peripheral Artery Disease

212-241-5407
sandeep.singla@mountsinai.org

Javed Suleman, MD, FACC

Associate Clinical Professor of Medicine (Cardiology)

Clinical Interests Clinical Cardiology, Coronary Intervention, Primary PCI

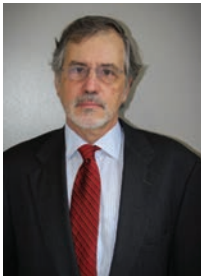
718-297-0440
javed.suleman@mountsinai.org

Gilbert Tang, MD, MBA, FRCSC, FACC

Surgical Director, Structural Heart Program, Associate Professor of Cardiovascular Surgery

Clinical Interests: Transcatheter Aortic and Mitral Valve Therapy, Transcatheter Tricuspid Repair)

646-761-0391
gilbert.tang@mountsinai.org



Alvaro Dominguez, MD

Adjunct Instructor Medicine (Cardiology)

Clinical Interests: Clinical Cardiology, Cardiac Catheterization, Interventional Cardiology

718-836-0009
alvaro.dominguez@mountsinai.org

Karthik Gujja, MD, MPH

Associate Director, Endovascular Interventions Clinical Instructor Medicine (Cardiology)

Clinical Interests: Peripheral Artery Disease, Endovascular Intervention, Venous Interventions

646-584-6460
karthik.gujja@mountsinai.org

Choudhury M. Hasan, MD

Assistant Clinical Professor of Medicine (Cardiology)

Clinical Interests: Cardiac Catheterization, Coronary Interventions, Echocardiography

718-657-8001
cmmhasan03@gmail.com

VOLUNTARY ATTENDINGS (LISTED ALPHABETICALLY)

José Meller, MD

Clinical Professor of Medicine (Cardiology)

Clinical Interests: Clinical Cardiology, Fellows Education, Cardiac Catheterization

212-988-3772

josemeller44@gmail.com

Tien Nguyen, MD

Assistant Clinical Professor of Medicine (Cardiology)

Clinical Interests: Clinical Cardiology, Cardiac Catheterization, Coronary Interventions

212-532-0888

tien.nguyen@nyheart.net

Vinod Patel, MD, FACC, FSCAI

Clinical Interests: Noninvasive Cardiology, Cardiac Catheterization, Peripheral Vascular Interventions

718-788-1688

drvinodpatel@gmail.com

Shelia Sahni, MD

Clinical Instructor Medicine, Cardiology

Clinical Interests: Interventional Cardiology, Echocardiography, Cardiovascular Disease

732-396-9500

sheila.sahni@mountsinai.org

Christopher Varughese, MD

Clinical Instructor of Medicine (Cardiology)

Clinical Interests: Cardiac Catheterization, Coronary Angioplasty, Peripheral Arterial and Venous Disease

718-727-7546

christopher.varughese@mountsinai.org

Beth Oliver, DNP, RN

Senior Vice President of Cardiac Services, Mount Sinai Health System

212-241-0796

beth.oliver@mountsinai.org

Beth Oliver is responsible for the executive leadership of clinical services within Mount Sinai Heart. She is a past recipient of the Ellen Fuller Award of Excellence in Nursing Leadership as well as the AHA Heart Hero Award. She is a member of Sigma Theta Tau, the National Nursing Honor Society; the American Organization of Nurse Executives (AONE); and the Board of Directors of the American Heart Association.

Jennifer Del Campo, MSN, FNP-C, CCRN, CMC

Clinical Nurse Manager

347-504-5487

jennifer.delcampo@mountsinai.org

Jennifer Del Campo joined The Mount Sinai Hospital Cardiac Catheterization Laboratory in 2005. She is a certified critical care nurse, an adult nurse practitioner, and is a member of the Sigma Theta Tau Nursing Honor Society. She became the lead NP for two years and in 2016 became Catheterization Laboratory manager. She effectively manages a unit with a diverse staff of more than 167 health professionals.

Haydee Garcia, MSN, ACNP-BC, CCRN-CMC

Nursing Director, Mount Sinai Heart

212-241-3058

haydee.garcia@mountsinai.org

Haydee Garcia started as a nurse practitioner in the Mount Sinai Hospital Cardiac Catheterization Laboratory in 2006, serving as the lead NP from 2010-2014 before transitioning into her leadership role in 2014 as nursing director for Mount Sinai Heart. She directs, oversees, and coordinates all administrative operations for the Cardiac Catheterization Laboratory, Post Intervention Units, Non-invasive Cardiology, Cardiovascular Ambulatory, and Cardiac Nurse Practitioners.

Tina M. Strazza, MSN, RN

Nurse Manager, Cardiac Catheterization Laboratory

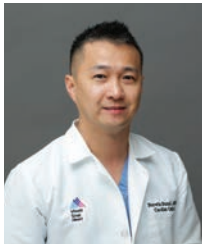
917-634-7340

tina.strazza@mountsinai.org

Tina Strazza has over 20 years of nursing experience in Critical Care, Cardiac Cath, EP Lab, IR Lab, and the Interventional Cardiology Sales Industry. In her previous role, she started and developed several new procedural programs, including moving TAVR from OR to a Catheterization Laboratory setting, starting TMVR, LAAC, EKOS programs in the Cardiac Catheterization Laboratory and establishing the nursing workflow for admissions and recovery of all cardiac interventional procedures.

NURSE PRACTITIONER TEAM

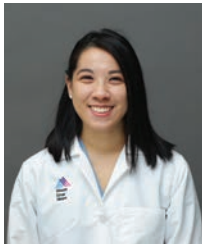
The Mount Sinai Hospital's dedicated staff of nurse practitioners work closely with the physicians in planning and implementing care from the time of intake to discharge, ensuring a quality experience at all points in the patient's visit.


Norwin Bunal

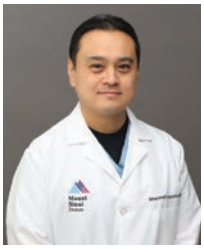

Leah Riggs Capra


Misael Dimatulac


Aira Fides Gonzalez

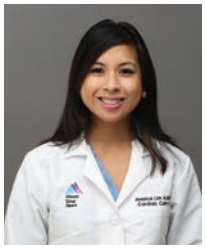

Michelle Hang


Hyo Jin Kang


Rheoneil Lascano


Vivian Lau

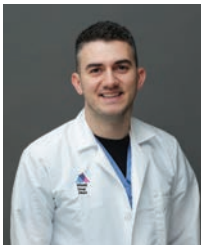

Dana Leichter


Jessica Lim

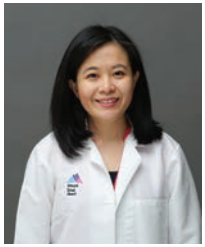

Gloria Manzanilla


Derek Pineda

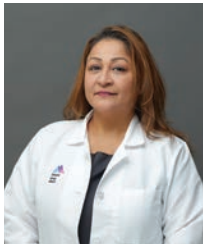

Supawadee Pitakmongkolkul


Daniel Prifti


Sandie Romain


Roannie Santos


Aanal Shah


Indra Sinanan


Richard Ternemille


Kevin Williams

INTERVENTIONAL CARDIOLOGY FELLOWS

Mount Sinai Heart's Interventional Cardiology Fellowship Program is the largest in the country, educating the next generation of clinical cardiology and interventional cardiology specialists. This well-regarded program, which combines academic and hands-on experience, has graduated physicians who are serving as noted leaders in community and academic medical centers.


Jossef Amirian, MD

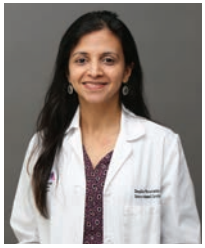

Serdar Farhan, MD


Natraj Katta, MD


Asma Khaliq, MD


Muhammad Khan, MD

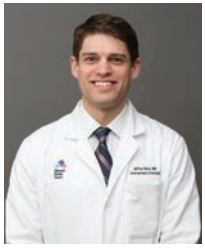

Parasuram Krishnamoorthy, MD

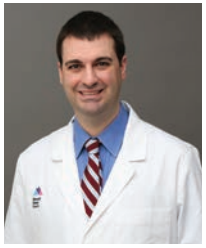

Deepika Narasimha, MD


Nileshkumar Patel, MD


Nish Patel, MD


Ruchir Patel, MD


Jeffrey Selan, MD


Gregory Serrao, MD

Interventional Research Team

From left: Santa Jimenez, Miguel Vasquez, Sowmya Muthiki, Yuliya Vengrenyuk, Faride Godoy, Madhav Sharma, Nicole Saint-Vrestil, Naotaka Okamoto

Supporting Staff

From left: Maria Diaz, Alexandra Enriquez, Maria Castillo, Maria Directo, Carol Henry, Shante Hines

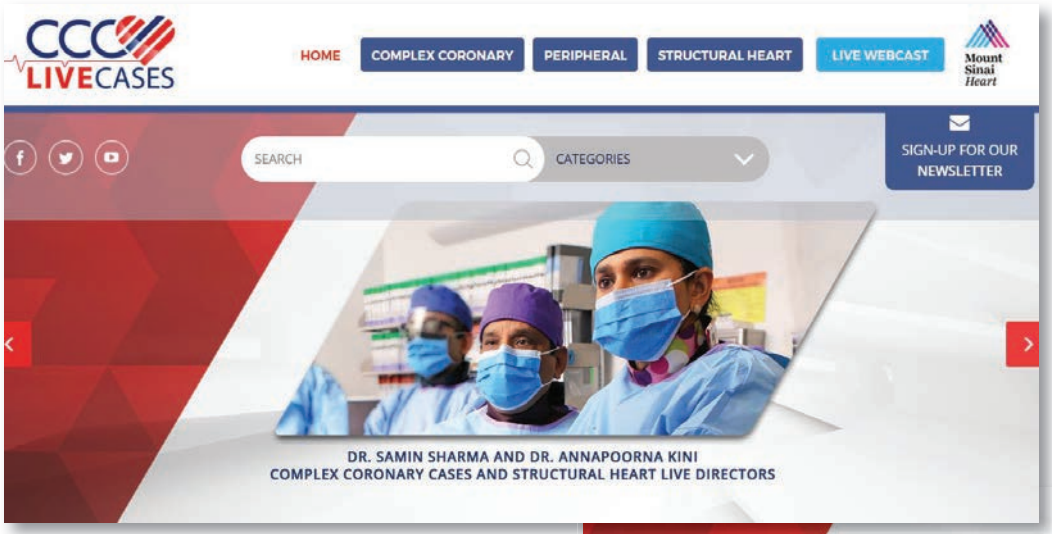
Interventional Database Team

From left: Pooja Vijay, Roja Thapi, Elena Ramos, Prathyusha Bande, Birju Narechania, Vaishvi Jhaveri

www.ccclivecases.org

YouTube

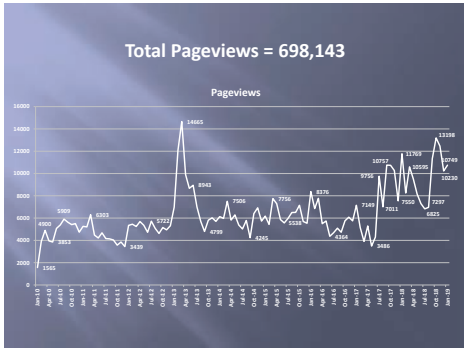
CCC LIVECASES



COMPLEX CORONARY CASES
Occurs 3rd Tuesday of the month at 8am

LIVE PERIPHERAL INTERVENTIONS
Every 4th Wednesday at 8am

STRUCTURAL HEART LIVE CASES
Evey 2nd Tuesday of every other month at 9am



WWW.CCCLIVECASES.ORG

GLOBAL CCC 2019
COMPLEX CORONARY CASES

SAVE THE DATE

June 13-14, 2019

Special Focus on Calcified, Bifurcation & Total Occlusion Lesions

COMPLEX CORONARY SYMPOSIUM DIRECTORS

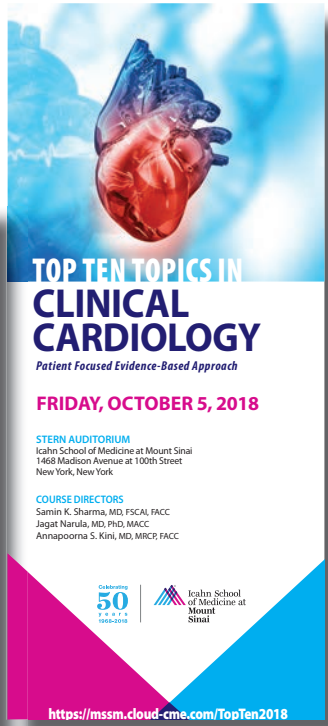
Samin K. Sharma, MD, FACC, FSCAI
Annapoorna S. Kini, MD, MRCP, FACC
Roxana Mehran, MD, FACC, FSCAI

CO-DIRECTORS

Usman Baber, MD, MS
Nitin Barman, MD, FACC
George Dangas, MD, PhD, FACC, FSCAI
Jason Kovacic, MD, PhD, FACC, FSCAI
Pedro R. Moreno, MD, FACC
Joseph M. Sweeny, MD, FACC

Mount Sinai Heart
DR. SAMIN K. SHARMA FAMILY FOUNDATION | CARDIAC CATHETERIZATION LABORATORY

www.cccsymposium.org



Save the Date:
Thursday, December 5, 2019

Save the Date:
Friday, October 4, 2019

Mount Sinai Heart holds several important educational events throughout the year, including our Top Ten Topics in Clinical Cardiology, LINC, and New York Transcatheter Valve Course. To learn more about upcoming events, visit mssm.cloud-cme.com or email kimberley.kostiw@mountsinai.org.

Cardiac Catheterization Laboratory Achievements

1 New York Magazine

Samin Sharma, MD (Total 11 times in 17 years), Pedro Moreno, MD (3rd year in a row) and Roxana Mehran, MD (2 times in 4 years).

2 New York Times Magazine

Samin Sharma, MD (11th year in a row), Annapoorna Kini, MD (9th year in a row), William Schwartz, MD (4th year in a row) and George Dangas, MD (2nd year in a row).

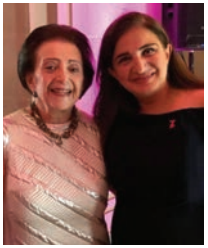
3 Castle Connolly Top Doctors

Samin Sharma, MD, Annapoorna Kini, MD, Prakash Krishnan, MD, George Dangas, MD, Pedro Moreno, MD, Roxana Mehran, MD, Joseph Sweeny, MD, and William Schwartz, MD.

CASTLE CONNOLLY TOP DOCTORS

4 Annapoorna Kini, MD, received the AHA Heart of Gold

5 Roxana Mehran, MD, received the Wenger Award—Excellence in Medical Leadership



Mount Sinai Heart Directory

Area	Telephone
MS Heart Director	212-241-7911
Cardiac Nursing	212-241-3483
Cardiac Rehab Program	212-241-8597
Cardiology Administration	212-241-4030
Cardiology Appointments	212-427-1540
Cardiology Privileges	212-241-4029
Cardiothoracic Surgery	212-659-6800
Cardiovascular MRI and CT Imaging	855-MSHEART
Catheterization Laboratories	212-241-5881
Cardiac Catheterization Laboratory Assistance (any issues)	**212-241-0935**
Catheterization Laboratory Events	212-241-0592
Catheterization Laboratory Office	212-241-4021
Catheterization Laboratory Research	212-241-0229
Catheterization Laboratory Scheduling	212-241-5136
Coronary Care Unit	212-241-7222
Electrophysiology/Pacemakers	212-241-7272
Genetic Disorders	212-241-3303
Heart Failure/Transplantation	212-241-7300
Lipid Management	212-241-7651
MS Heart Information Technology	212-241-4026
Noninvasive Cardiology	855-MSHEART
Pediatric Cardiology	212-241-8662
Pulmonary Hypertension	212-241-7300
To Transfer a Patient	212-241-6467
Vascular Laboratory	212-241-6773
Vascular Surgery	212-241-5315

Scan the following QR code to request an appointment:

Contact Info

To make an appointment:

Phone: 212-241-0884

To refer a patient:

Phone: 212-241-5136

Cardiac Catheterization Laboratory Mission:

"To improve outcomes and safety of interventional patients by delivering clinical innovations, unrivaled research, and personalized clinical care as a Team Concept."

Mount Sinai *Heart*