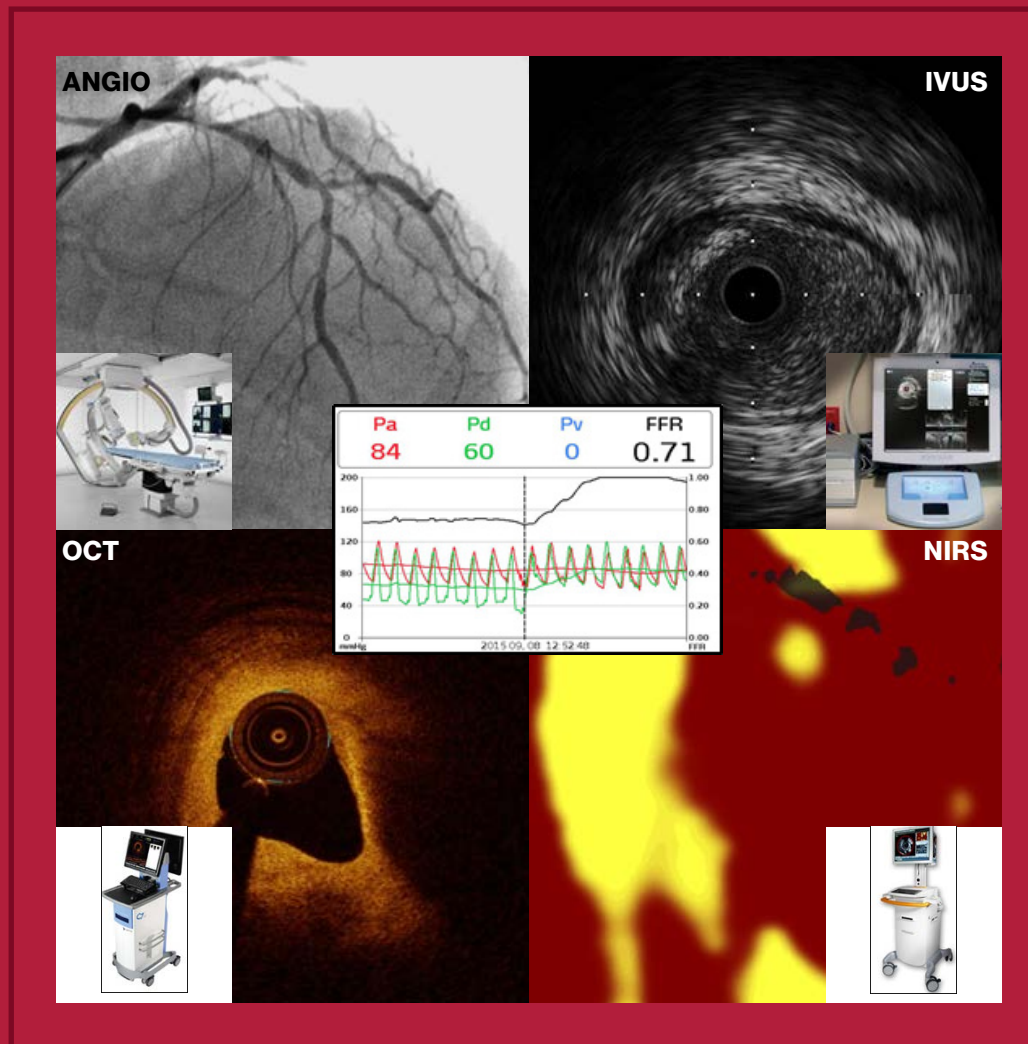


# CARDIAC CATHETERIZATION LABORATORY

## 2015 CLINICAL OUTCOMES REPORT





**Samin K. Sharma, MD**

Director, Clinical & Interventional Cardiology  
President, Mount Sinai Heart Network  
Dean, International Clinical Affiliations  
Zena & Michael A. Wiener Professor of Medicine

# A Message from Samin K. Sharma, MD and Annapoorna S. Kini, MD

## Dear Colleague

We of the Cardiac Catheterization Laboratory at The Mount Sinai Hospital are proud to present our patient-centered 2015 outcomes report, a comprehensive overview of the work being done at one of the nation's finest cardiac catheterization laboratories. Public reporting of quality outcomes and patient safety data is increasingly being mandated for transparency by various organizations and stakeholders. Like every year, in this issue, we report our performance metrics and compare them to regional and national standards, with the sole purpose of providing the best care to our heart patients.

Technical and technological advances in the field of percutaneous coronary intervention (PCI) have resulted in a relentless drive for procedural excellence. Our procedural outcome data over the last five years will support the statement that we have *perfected* the art of PCI.

The management of coronary artery disease (CAD) patients is rapidly changing, with medical therapy playing a major role in the routine management of CAD patients and PCI being used in moderate to severe CAD as well as in patients with acute coronary symptoms. Patients with extensive CAD are best healed by coronary artery bypass graft surgery (CABG) to improve long-term survival. Overall rates of graft percutaneous and surgical revascularization have decreased due to aggressive and optimal medical management of CAD patients. Despite the increasing complexity of PCI cases, we have observed an overall decline in complications of PCI because of our expertise, teamwork, and dedication in treating each patient as an individual. We are committed to the universal use of innovative and evidence-based standardized medical protocols, which have contributed to our extraordinary success. It is not unusual for patients who have been deemed "inoperable for advanced extensive cardiac disease" to come to us, be treated successfully, and go home with smiles on their faces.

In order to remain at the top, we will continue to employ cutting-edge technology and techniques that are now the hallmarks of our success. In this issue we will provide details of several procedures and techniques which are routinely done at our center. Our constantly changing innovative strategies have contributed to our national and international recognition and will highlight these innovations through stories of grateful patients. Our goal for 2016 is to rise to eminence from excellence by innovation and well-organized comprehensive care in the field of interventional cardiology.



**Annapoorna S. Kini, MD**

Director, Cardiac Catheterization Laboratory  
Director, Interventional Cardiology  
Fellowship Program  
Professor of Medicine, Cardiology

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For more information, visit [www.mountsinai.org/interventional-cardiology-cath-lab](http://www.mountsinai.org/interventional-cardiology-cath-lab)



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# Welcome

The Mount Sinai Hospital Cardiac Catheterization Laboratory has demonstrated many years of excellent quality and outcomes. The safety record is impressive, especially in light of the growing numbers of complex interventions for coronary, valvular, congenital, and electrophysiological diseases. The safety record in outcomes registry results and the strong research output speak to the excellence of the clinical and research teams. It is therefore a pleasure to introduce this seventh edition of the *Cardiac Catheterization Laboratory Clinical Outcomes Report*.

The leadership of Samin K. Sharma, MD and Annapoorna S. Kini, MD and the dedication of the teams of physicians, advanced practice nurses, physician assistants and technical staff are inextricably linked to the superb safety record. The team's dedication to continuous quality improvement, extensive data analysis, and patient satisfaction exemplifies The Mount Sinai Hospital's commitment to its missions of clinical care, education, and research.

We hope you find this seventh edition of the *Cardiac Catheterization Laboratory Clinical Outcomes Report* to be informative.





# A Message from Valentin Fuster, MD, PhD, MACC



## **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

Now in its ninth year, Mount Sinai Heart is firmly positioned as a global leader in every aspect of cardiovascular medicine. The Cardiac Catheterization Laboratory, led by Samin K. Sharma, MD, and Annapoorna S. Kini, MD, has played no small part in that success.

Dr. Sharma, Dr. Kini and the Cardiac Catheterization Laboratory team are passionate about finding opportunities to improve care and quality of life for patients living with coronary artery disease. They do not just settle for the standard of care; they care deeply about doing what's best for each patient, even if it means occasionally challenging the status quo.

To accomplish this goal, the Cardiac Catheterization Lab at Mount Sinai Heart is an active participant and leader in numerous international clinical trials. Many of these studies are aimed at fine-tuning clinical practice and balancing the efficacy of interventional therapies with the risk of cardiovascular events in real-world patients. In the last few years, our Cardiac Catheterization Laboratory, under the direction of Dr. Kini, has made remarkable progress in its use of intravascular imaging during interventional procedures.

In 2010, The Mount Sinai Hospital was the first center in the United States to implant the revolutionary percutaneous CoreValve®. The patient who received that first device is alive and well at age 92, and continues to sing Dr. Sharma's praises.

We maintain this pioneering spirit, working to perfect the next generation of techniques and technologies. This past year, we were among the first centers to use the CardioMEMS™ HF, a tiny implantable device that allows our doctors to monitor heart failure patients and helps to avoid further hospitalization.

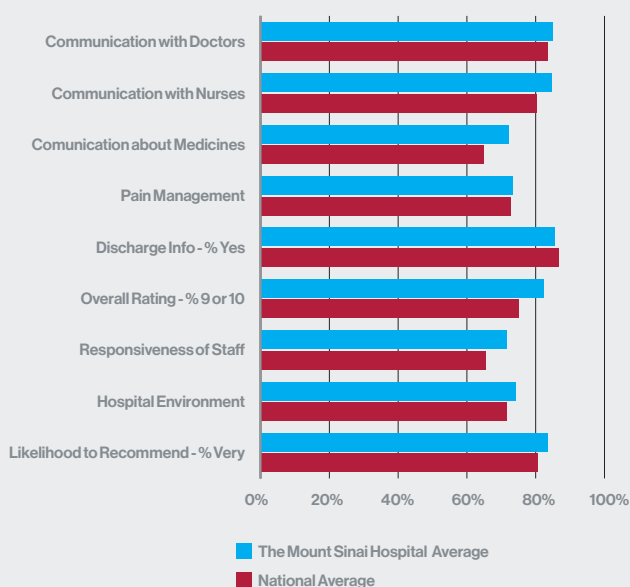
Mount Sinai Heart is equipped with the latest imaging and diagnostic technologies, enabling our physicians to deliver interventional therapies precisely where needed—and avoid unnecessary procedures. For example, we use 3D transesophageal echocardiography to help us select patients who are candidates for procedures such as transcatheter mitral valve repair with MitraClip®.

A substantial portion of this book is devoted to describing the innovative diagnostic and therapeutic interventions that we offer. Some of the many topics that we discuss in this section are the heart team approach to complex percutaneous coronary interventions; implantable devices that provide ventricular support; efforts to improve survival for patients who have sudden cardiac arrest; and approaches to treating patients with critical limb ischemia.

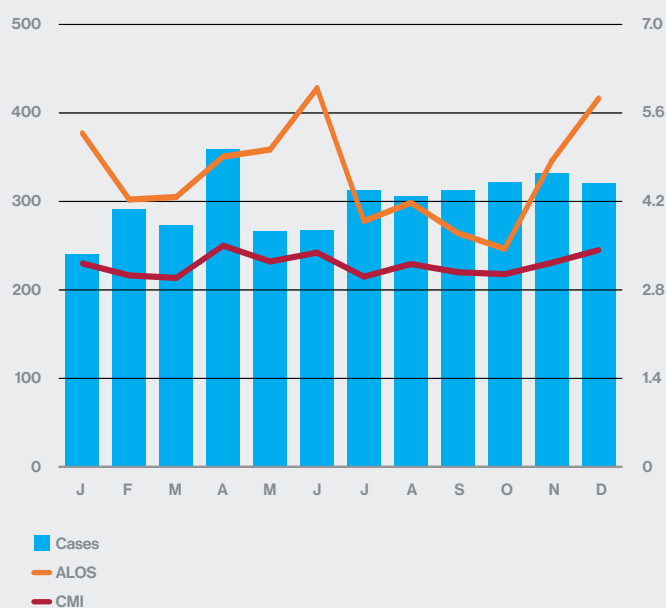
Once again, we have included several testimonials from patients who have been treated by Dr. Sharma and his team. These testimonials describe, in the patients' own words, the dedication, professionalism and expertise of the doctors at The Mount Sinai Hospital's Cardiac Catheterization Laboratory. Although each scenario is a little different, all of the patients featured in these testimonials share a common admiration and gratitude for the physicians who always put patient care first.

# The Cardiac Catheterization Laboratory

Patient Satisfaction: 2014 HCAHPS Survey



Inpatient Volume CMI, and ALOS 2014



## An Overview of Services and Outcomes

The Greek philosopher Socrates once said, “The secret of change is to focus all of your energy not on fighting the old, but on building the new.” That essential concept is one of the guiding principles of the success of our Cardiac Catheterization Laboratory.

Mount Sinai Heart, encompassing clinicians, scientists, nurses, and associated caregivers under the leadership of visionary director Valentin Fuster, MD, PhD, has emerged as a premier center delivering a complete range of clinical and research options to patients suffering from a variety of cardiovascular ailments. The extraordinary care we offer has resulted in our ascent nationally from 50th in 2007 to 10th in 2014 (*U.S. News & World Report 2014*).

The Cardiac Catheterization Laboratory at Mount Sinai Heart is among the highest volume, safest interventional catheterization laboratories in the United States. Consisting of seven adult catheterization rooms (three equipped for endovascular procedures), the Cardiac Catheterization Laboratory is established as the tertiary center for complex coronary, valvular, and vascular interventions. Two of the rooms (hybrid catheterization laboratories) are equipped to perform transcatheter aortic valve replacement (TAVR). All catheterization rooms are equipped with intravascular ultrasound (IVUS) and fractional flow reserve (FFR) capabilities. Our Cardiac Catheterization Laboratory has incorporated other imaging modalities, such as optical coherence tomography (OCT) and near-infrared spectroscopy (NIRS). In addition, we have access to the hybrid OR suite to perform TAVR requiring complex vascular access.

Efficiently managing the growing catheterization volume and the complexity of invasive cases is demanding on our physical infrastructure and our Cardiac Catheterization Laboratory staff. The numbers of both medical and nonmedical staff have shown tremendous growth, to more than 165, with the ultimate goal of delivering safe, appropriate, and excellent care.

Presently there are nine full-time attendings, including six senior attendings (who provide guidance and help during complex cases to other faculty), 20 full-time affiliate attendings, four part-time attendings and 11 voluntary attendings. 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 of the lab: 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.

One very important aspect of patient satisfaction is making the in-hospital stay as short as possible. With this in mind, approximately 62 percent of our elective interventional patients are safely discharged on the day of the procedure

(Ambulatory PCI) following an established ambulatory discharge protocol. Others with more complex interventions, comorbid conditions and higher acuity are admitted for observation overnight with planned discharge home the next day. The chart on the facing page depicts our inpatient volume, average length of stay (ALOS, which is usually 0.95 of expected LOS), and case mix index (CMI, measure of a patient's medical acuity based on associated medical conditions, which is quite high; approximately 3.2).

In this competitive environment, only the best can flourish, and that is exactly what our Cardiac Catheterization Laboratory has done, delivering the best and the safest invasive/interventional care to cardiac patients, with innovation and procedural excellence. On the following pages are some of the important attributes of the Cardiac Catheterization Laboratory. Our Cardiac Catheterization Laboratory takes pride in educating future clinical and Interventional Cardiology Specialists by establishing a rigorous academic and hands-on training program for the largest interventional fellowship program in the United States. Below are the interventional fellows for 2014 (ACGME and non-ACGME fellows).

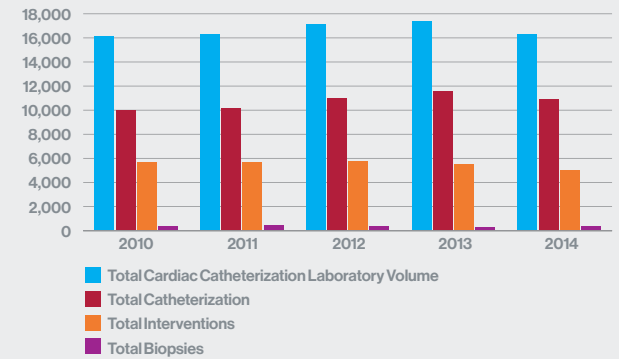


## Comparative Quality Parameters of Interventional Procedures

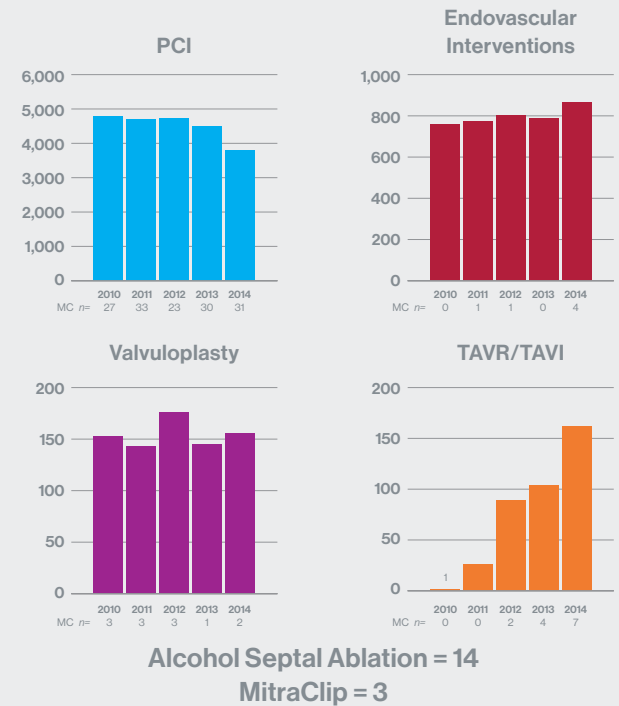
### Growth and Trends in Cardiac Catheterization Laboratory Volume and Procedures

The volume of diagnostic catheterization and interventional procedures at The Mount Sinai Hospital Cardiac Catheterization Laboratory has shown a 6.5 percent decline in 2014 from 2013; largely due to a 15 percent decline in PCI cases with an approximately 8 percent increase in valvuloplasties and endovascular interventions along with significant (56 percent) growth in TAVR procedures.

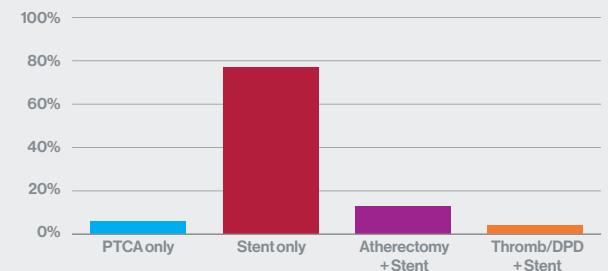
### Growth and Trends in Cardiac Catheterization Laboratory Volume and Procedures



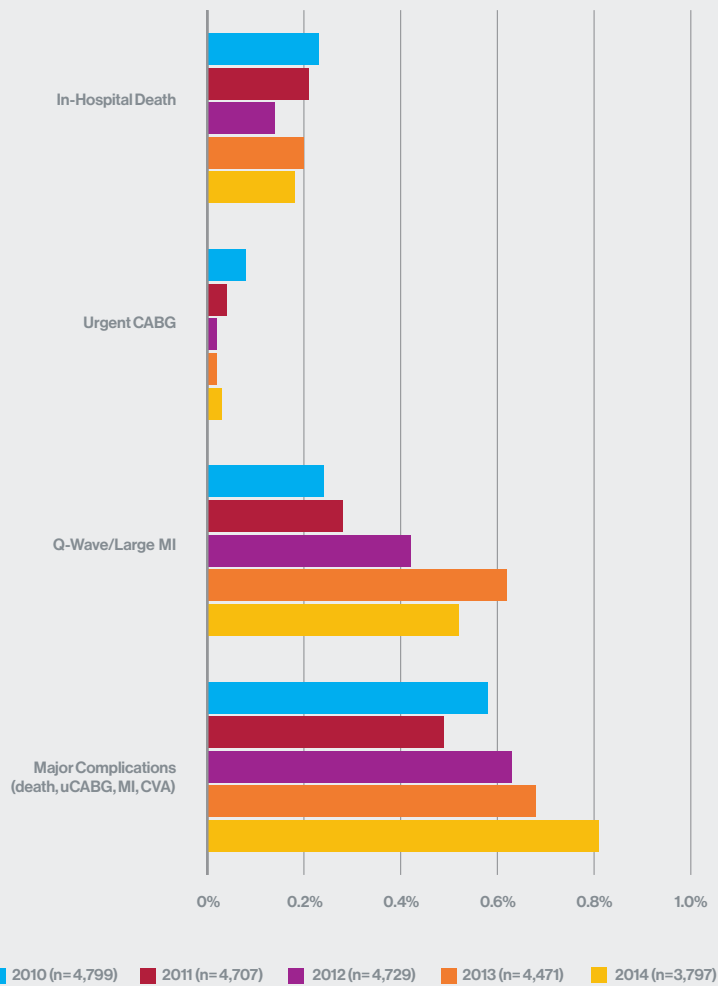
### Interventional Volume and Major Complications (MC)



### Type of Coronary Interventions in 2014 (n=3,797 PCIs)



## Temporal Trends in Complications of PCI at The Mount Sinai Hospital

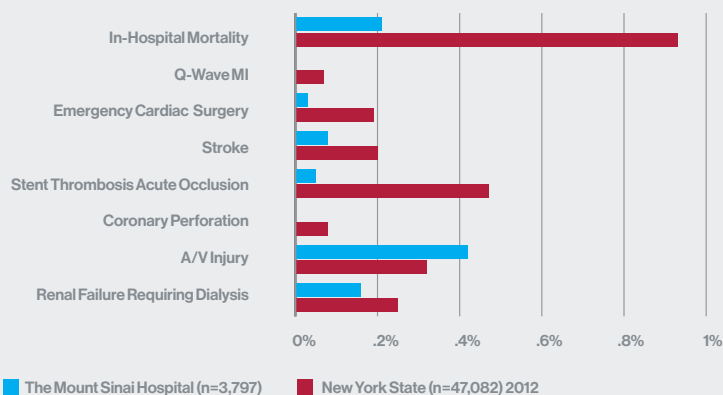


Total percutaneous interventions encompass percutaneous coronary interventions (PCI for coronary artery disease), endovascular interventions (for diseased limb, cerebral, or renal arteries), valvuloplasties (for stenosed aortic or mitral valves); transcatheter aortic valve replacement/implantation (TAVR/TAVI) for stenosed aortic valves; alcohol septal ablation (ASA) for hypertrophic obstructive cardiomyopathy (HOCM); and atrial septal defect/patent foramen ovale (ASD/PFO) closure. In 2014, there was a decline in total diagnostic procedures, with a 10 percent decline in total intervention to 5,018 from 5,549 of 2013: 3,819 PCI, 864 endovascular interventions, 148 balloon aortic valvuloplasties, eight balloon mitral valvuloplasties, 162 TAVR, and 14 alcohol septal ablations (ASA). In 2014, we started performing MitraClip® procedures for inoperable degenerative or functional severe mitral regurgitation; a total of three cases were done. Since 2012, intravascular brachytherapy (IVBT) has been applied for recurrent in-stent restenosis (two or more times) after drug eluting stents. Our cumulative experience now includes more than 250 successful IVBT cases with a restenosis rate of about 20 percent compared to 60 percent without IVBT. Carotid stenting is now routinely being performed by our interventionalists, in conjunction with vascular surgeons; 26 cases were successfully performed in 2014 with only one major complication. The majority of PCIs (94 percent) are done using stents [drug-eluting stents (DES) in 94 percent; bare metal stents (BMS) in 6 percent] with adjunct 13 percent rotational/orbital atherectomy and 4 percent thrombectomy/embolic protection device, and remaining 6 percent percutaneous transluminal coronary angioplasty (PTCA) or atherotomy PTCA only.

## NY State Department of Health-Reported PCI Volumes in Comparison to Other NY Centers

The chart on page seven shows The Mount Sinai Hospital's Cardiac Catheterization Laboratory volume of all types of interventions over the past five years. Our lab rose to the top position among New York State hospitals in 2005 and has continued to deliver interventional care to the highest number of patients compared to other NY State hospitals for the last eight years, according to NY State Department of Health statistics.

## NYS-Reported Major Complications Following PCI 2014



## Interventional Outcomes and Temporal Complications Trends

The system of established standard protocols, rigorous attention to minute detail and a strong sense of teamwork have helped us to achieve the best interventional outcomes in the country. We continue to improve our outcomes every year, with unprecedented low procedural complications in 2014; combined major complication of death, large MI, urgent CABG, and CVA cases was approximately 0.8 percent.



**Figure 1: NYS-DOH Report of PCI 2010-2012**  
Data on the Top 10 Volume Centers in NY State 30-Day RAMR

PCI Statistics 2010-2012	# Cases	All Cases	Non-Emergency Cases	Emergency Cases
<b>1. The Mount Sinai Hospital</b>	<b>14,168</b>	<b>0.59**</b>	<b>0.38**</b>	<b>1.84</b>
2. Columbia Presbyterian Hospital	8,666	0.69**	0.43**	2.31
3. Saint Francis Hospital	7,907	0.87	0.58	2.56
4. Lenox Hill Hospital	6,514	0.89	0.68	2.01
5. Saint Joseph's Hospital	5,510	0.85	0.68	1.64
6. LIJ Medical Center	5,173	1.08	0.65	3.57
7. North Shore University Hospital	5,706	0.56**	0.46	1.18**
8. Rochester General Hospital	5,636	0.90	0.56	3.21
9. Stony Brook Hospital	4,632	1.17	0.70	3.74
10. Beth Israel Medical Center	4,321	1.24	0.87	3.49
<b>NYS Total</b>	<b>151,605</b>	<b>0.93</b>	<b>0.59</b>	<b>2.77</b>

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

This remarkably low complication rate has been achieved despite high complexity and co-morbid medical conditions of patients being treated in the Cardiac Catheterization Laboratory. Reports of risk-adjusted PCI mortality over the last 15 years by the NY State Department of Health have consistently placed The Mount Sinai Hospital Cardiac Catheterization Laboratory among the lowest for in-hospital and 30-day risk-adjusted mortality. The most recent NY State Department of Health report of 30-day risk-adjusted mortality rate (RAMR) for year 2012 has shown our incidence of 0.60 percent for all cases, 0.36 percent for elective cases and 1.84 percent for emergency PCI cases; which is about 30 percent lower than the statewide average. In the latest 2010-2012 PCI report (Figure 1), we are one of three centers to receive a double-star (\*\*) notation of superior safety in at least two PCI categories (all cases and non-emergency cases; receiving the double star denoting statistically significantly lower RAMR than the statewide average has been a constant over the last 16 years of NY State Department of Health PCI reporting. Receiving the double star this year in two PCI categories for a single year in the 2012 report is truly unprecedented by any PCI center in NY State (Figure 2).

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 over 3,500 cases per year. In the earlier reports, Dr. Sharma in 2008, Dr. Moreno in 2010, Dr. Kini in 2011 and Dr. Sharma and Dr. Kini in 2012 were awarded the double star by NY State denoting significantly lower 30-day risk-adjusted mortality among approximately 600 interventionalists practicing in the state (Figure 3). In the recent 2010-2012 in NY State Department of Health (DOH) report, Dr. Sharma and Dr. Kini were the only interventionalists who received a double star (\*\*) in both PCI categories with top volume signifying treating the greatest number of patients with the lowest complications.

**Figure 2: NYS-DOH Report of PCI 2012**  
Data on the Top 10 Volume Centers in NY State 30-Day RAMR

PCI Statistics 2012	# Cases	All Cases	Non-Emergency Cases
<b>1. The Mount Sinai Hospital</b>	<b>4,708</b>	<b>0.60**</b>	<b>0.36**</b>
2. Columbia Presbyterian Hospital	2,791	0.67	0.30**
3. Saint Francis Hospital	2,300	1.04	0.62
4. Saint Joseph's Hospital	2,015	0.85	0.68
5. Buffalo General Hospital	1,781	1.35	0.98
6. Rochester General Hospital	1,647	1.08	0.51
7. LIJ Medical Center	1,615	1.03	0.77
8. Lenox Hill Hospital	1,498	0.72	0.48
9. Weill Cornell Hospital	1,444	1.03	0.76
10. Stony Brook Hospital	1,347	1.32	0.79
<b>NYS Total</b>	<b>47,045</b>	<b>1.0</b>	<b>0.64</b>

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

**Figure 3: NYS-DOH 30-day RAMR for PCI \*\* Interventionalist at MSH**

Years/ # cases	All cases RAMR %	Non-Emergency cases RAMR %	**Interventionalist
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
2008-2010 / 1,447	0.29**	0.24	Dr. Moreno
2006-2008 / 3,790	0.44**	0.32**	Dr. Sharma

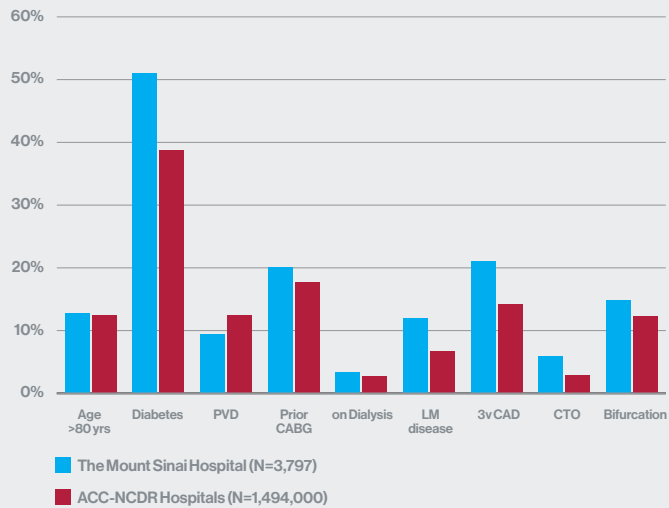
www.nyhealth.gov \*\*Risk Adjusted Mortality Rate (RAMR) significantly lower than statewide rate

**Figure 4: Baseline Demographics and Risk Factor Comparison of The Mount Sinai Hospital 2014 vs. NY State 2012**

	MSH (n=3,797)	NYS (n=47,082)
Ethnicity, Hispanic/Asian (%)	22.20/22.05	11.06/9.45
Primary Payer; Medicaid (%)	26.25	10.0
Age >=85 Years (%)	5.35	4.40
Peripheral Vascular Disease (%)	14.04	9.2
DM on Medication (%)	46.66	35.56
Renal Failure on Dialysis (%)	3.54	2.37
Prior CVA (%)	11.90	10.28
Left Main Disease (%)	3.97	4.29
Rotational Atherectomy (%)	14.01	2.37
DES use (%)	80.86	73.1

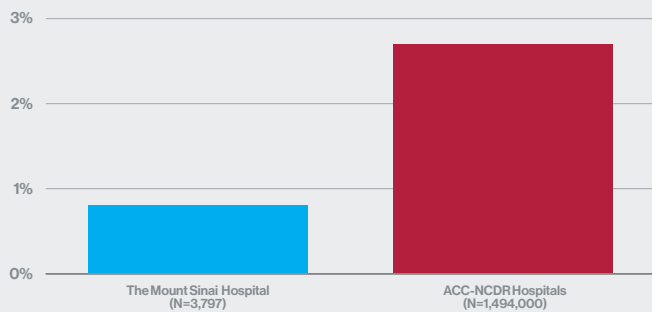
www.nyhealth.gov \*\*Risk Adjusted Mortality Rate (RAMR) significantly lower than statewide rate

### Important Baseline Clinical and Lesion Characteristics of PCI: ACC-NCDR Data for 2014

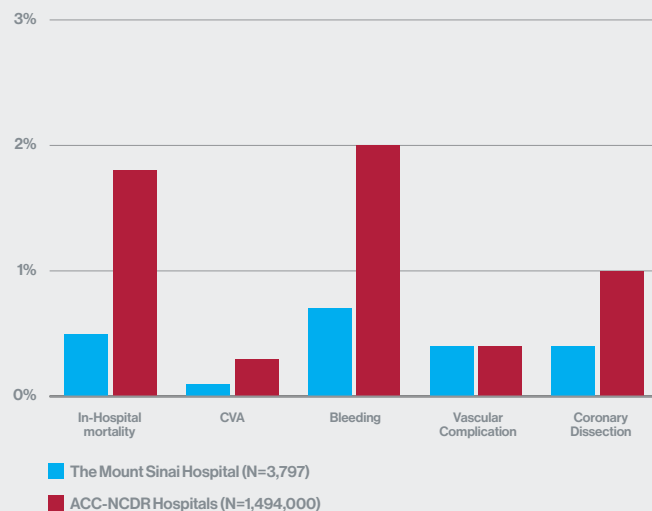


### National PCI Outcome Metrics; Major Complications

Composite: Proportion of PCI Patients with Death, eCABG, Stroke or rTVR; ACC-NCDR (n=1,400 hospitals) for 2014



### PCI Complications: MSH vs. ACC-NCDR Hospitals 2014



These low complication rates, credited to a uniform protocol across all staff, are all the more remarkable for the fact that our Cardiac Catheterization Laboratory accepts the most difficult coronary and valvular cases, many of them deemed too risky or “not-doable” elsewhere. The comparative data of patients’ clinical characteristics, as shown in the table on page nine, confirms significantly better outcomes in most of the commonly reported procedural complications despite higher adverse factors of PCI patients when compared to NY State (Figure 4).

### Comparison of The Mount Sinai Hospital Interventional Outcomes with Other US Hospitals as per ACC-NCDR Report for 2014

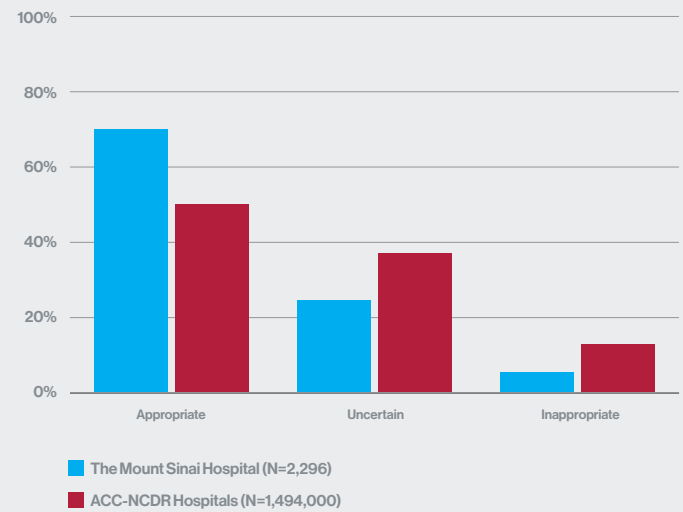
The American College of Cardiology-National Cardiovascular Data Registry (ACC-NCDR) reports the characteristics and in-hospital outcomes after PCI of >1,400 hospitals in the United States providing data of >1 million PCI patients.

Following are the important baseline and procedure characteristics of The Mount Sinai Hospital (MSH) versus ACC-NCDR hospitals.

The graphs on these pages show the superior outcomes of PCI patients at The Mount Sinai Hospital in comparison to other US hospitals in the ACC-NCDR report for 2014.



**Appropriateness of PCI Procedure  
(n=1,400 hospitals; >1.4 million PCIs) for 2014**  
AUC Evaluation of PCI Procedures



### Appropriateness of PCI for Stable CAD

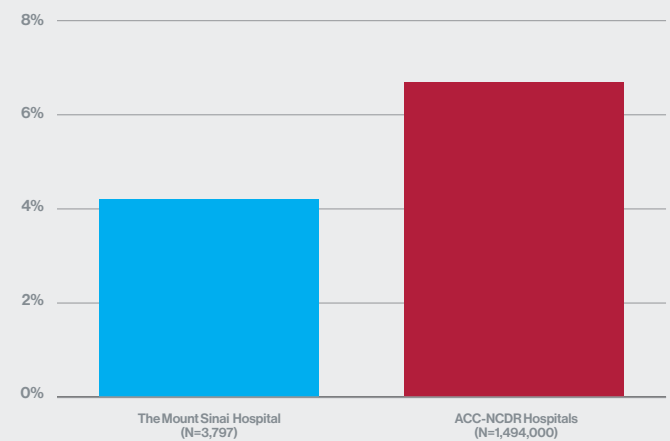
Appropriateness of PCI has recently come under strong scrutiny. Cases that are inappropriate based on the published guidelines are not only risky to the patient, since the intervention is not indicated, but also risk being denied reimbursement by the federal agencies. At Mount Sinai Heart, we established the evidence-based protocol of proper evaluation of CAD patients before scheduling for 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.

### In-Hospital Mortality of STEMI Patients

The rate of PCI procedures performed in less than 90 minutes is an important quality CMS parameter and is publicly reported for all hospitals. The proportion of STEMI patients at The Mount Sinai Hospital undergoing PCI in less than 90 minutes was 88 percent in 2014.

According to the 2014 ACC/NCDR Report, risk-adjusted mortality of STEMI patients at Mount Sinai Heart is approximately 50 percent lower than that of other comparable US hospitals.

**STEMI PCI In-Hospital Mortality  
MSH vs. ACC-NCDR Hospitals 2014**



## INNOVATIONS

# Heart Team Approach to Complex Percutaneous Coronary Interventions (PCI)

### Key Points

- We employ a heart team approach where the patient consults with a cardiologist, cardiothoracic surgeon and cardiac interventionalist to determine the best course of treatment.
- For patients with comorbidities including diabetes and extensive multivessel disease, studies have demonstrated CABG surgery is associated with fewer complications than PCI.
- At Mount Sinai Heart, we have been recommending surgery for patients with complex CAD, and 60 percent of patients have complied with that recommendation.
- We continue to participate in studies to ensure we pursue the best outcome for every patient.



To view a prerecorded case featuring PCI of an unprotected left main artery, scan the QR code above.



To view a prerecorded case featuring PCI of a complex high risk IABP, scan the QR code above.



**Samin K. Sharma, MD**



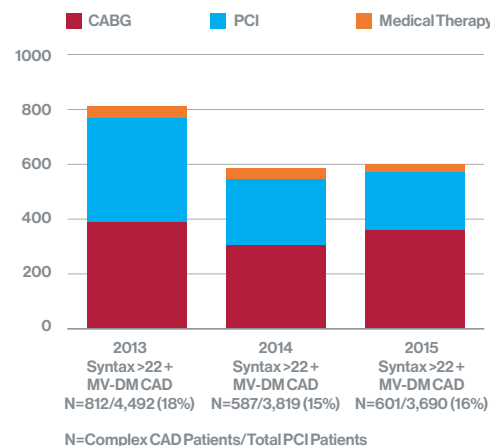
**Annapoorna S. Kini, MD**

Data from several large, multicenter clinical trials continue to inform our approach to clinical decision making for patients who have complex coronary artery disease (CAD). The SYNTAX (SYNergy Between Percutaneous Coronary Intervention with TAXus and Cardiac Surgery) trial employed a novel grading tool, known as the SYNTAX score, to assess the complexity of CAD based on several anatomical factors. Investigators sought to determine whether SYNTAX score could help guide treatment choices—percutaneous cardiac interventions (PCI) or coronary artery bypass graft (CABG) surgery—for patients with complex CAD who are candidates for either procedure.

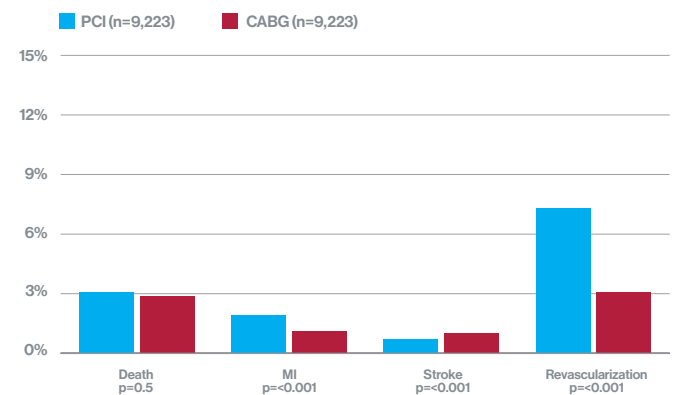
Five-year follow-up data, reported in 2012, revealed that patients in the CABG arm with moderate to severe CAD, indicated by a SYNTAX score of 22 or higher, had a significantly lower risk of death, myocardial infarction, stroke or revascularization compared with patients in the PCI group with a similar SYNTAX score. Results were comparable among patients who were diabetic and those who were not diabetic. The investigators concluded that CABG should remain first-line therapy for patients with more severe CAD who can withstand surgery.

The Mount Sinai Hospital served as the international clinical coordinating center for another large clinical trial, known as FREEDOM (Future Revascularization

### Revascularization Choices for High SYNTAX Score Patients at The Mount Sinai Hospital



### Four-Year Outcomes with Newer Generation DES vs CABG in Complex CAD: NYS Data Registry





Evaluation in Patients with Diabetes Mellitus: Optimal Management of Multivessel Disease). Results from this trial echoed those of the SYNTAX trial. For patients with diabetes and complex CAD, CABG surgery significantly lowered the risk of death and heart attack or stroke compared with PCI. However, CABG significantly increased the risk of non-fatal stroke.

Based on this evidence, there is an increasing tendency at The Mount Sinai Hospital, as at other heart centers, toward recommending surgery for patients with more complex CAD. Ultimately, however, the decision to have surgery or PCI lies with the patient and a family member, when possible, after consultation with all members of the heart team, including a cardiologist, cardiothoracic surgeon and cardiac interventionalist. Many patients with complex CAD choose revascularization with PCI, due to the relative ease of recovery compared with surgery. Data collected over the past few years at Mount Sinai Heart reveal that a majority of our patients with complex CAD complied with recommendations to have CABG surgery.

Since the conclusion of the SYNTAX trial in 2008, in which patients in the PCI arm were treated with the paclitaxel-eluting stent, a new generation of drug-eluting stent systems have arrived in the clinic. These newer stents, such as the zotarolimus-eluting stent and the everolimus-eluting stent, are smaller and can be deployed with the use of improved balloon technology. Data from a registry-based study of 34,819 patients with multivessel CAD revealed that patients who underwent PCI with an everolimus-eluting stent had a lower short-term risk of death and stroke compared with those who had CABG surgery. However, PCI was associated with a higher risk of repeat revascularization and myocardial infarction and no difference in death. The latest generation of vascular stents incorporate biodegradable polymers that may inhibit late restenosis and thrombosis. Additional studies that take these design changes into account, combined with the use of more 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.



**PATIENT:** Anthony Pepe, age 54

**DIAGNOSIS:** Chronic total occlusion after failed CABG surgery

**TREATMENT:** Atherectomy and stent placement in two arteries

“I don’t think I’d be alive right now if this procedure wasn’t done so quickly.”

“I had a heart attack in May, and had triple bypass surgery at another hospital. After the surgery, I was feeling good and was doing a lot of walking to get my strength back. Then, about two and a half months later, I started getting some of the same symptoms from before the heart attack—tingling in my fingers and an uncomfortable feeling in my chest and my arms. I realized that something was really wrong.

“I went back to the hospital where they did the bypass. It turned out that two of the grafts had failed and there was a kink in the main artery they had fixed. The doctors there wanted to treat me with medication while they decided what to do. I was feeling terrible, and felt like my condition was getting worse.

“A friend of mine suggested I contact a rabbi he knew who had been able to get him a much-needed appointment with a specialist at a hospital in New York City. I called the rabbi—mind you, I’m not even Jewish—and within a few days, he called back and said I had an appointment that Friday morning with Dr. Goldman, a cardiologist at Mount Sinai Heart.

“About 45 minutes after my wife and I spoke with Dr. Goldman, we had the information from my recent surgery and follow-up visit transferred to Mount Sinai. Dr. Goldman said I needed at least two stents and he could arrange for Dr. Sharma to do the procedure right away. Later that same afternoon, I was in the procedure room.

“Dr. Sharma ended up putting in two stents—one in the main artery and another in one of the grafts. He called me two days later to see how I was feeling. It was wonderful to have the doctor who performed the procedure call me himself; I think it shows how Dr. Sharma truly cares about his patients.

“I’m going through cardiac rehab near where I live, and I’m on medications because of the stents. Dr. Sharma and Dr. Goldman saved my life—that’s how bad I was feeling when I went to Mount Sinai. I don’t think I’d be alive right now if this procedure wasn’t done so quickly. My feeling is you don’t want to do this kind of thing anywhere except Mount Sinai.”



## Key Points

- Mitral valve regurgitation is a common valve disorder and has been traditionally addressed with open surgery.
- New approaches allow interventionalists to address this condition percutaneously.
- Mount Sinai Heart is studying outcomes for this MitraClip® device as they compare to outcomes for surgical and medical approaches.
- We use the latest imaging techniques both to ensure that patients are a good candidate for the procedure, and to monitor their progress once the device is implanted.

# Selecting Candidates for Transcatheter Mitral Valve Repair



**Samin K. Sharma, MD**



**Annapoorna S. Kini, MD**



**Partho P. Sengupta, MD**

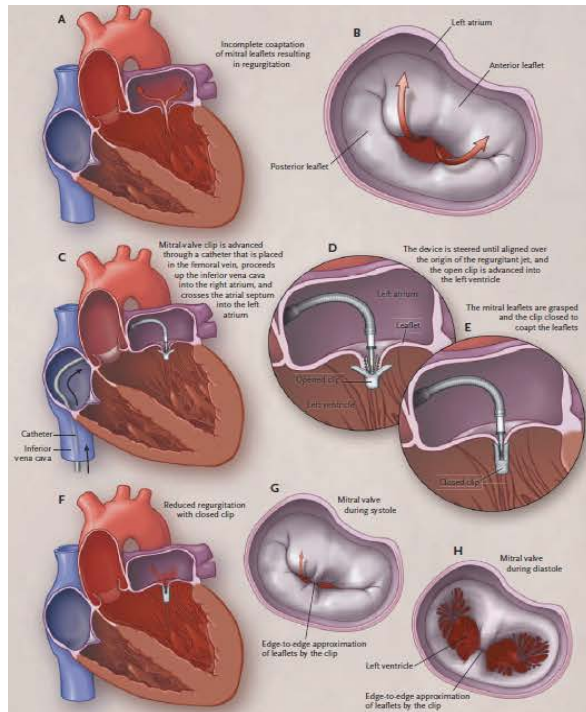
Mitral valve regurgitation is a common valve disorder that causes blood to leak backwards through the mitral valve and into the left atrium as the heart muscle contracts. Mitral regurgitation can originate from degenerative or structural defects due to aging, infection or congenital anomalies. In contrast, functional mitral regurgitation 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. In people with moderate to severe mitral regurgitation, the left ventricle

works harder to keep up with the body's demand for oxygenated blood. Over time, this dysfunction can lead to enlargement of the left ventricle, weakening of the myocardium and pulmonary hypertension.

Surgery—either to repair or replace a leaky mitral valve—has been the principal therapeutic option for patients with chronic, severe mitral regurgitation that is not controlled with medication. A less invasive option, which involves transcatheter implantation of a device that essentially sutures the valve leaflets and increases their coaptation, is indicated for patients with severe degenerative mitral regurgitation with a high risk of complications from surgery.

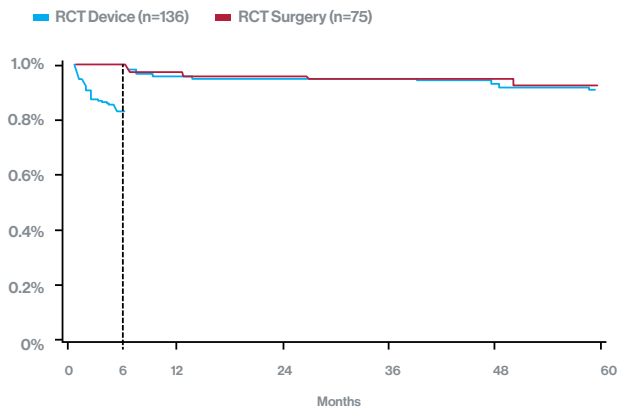
The EVEREST (Endovascular Valve Edge-to-Edge Repair Study) II Trial is a randomized study comparing the transcatheter approach using MitraClip®—a tiny cobalt chromium clip that sutures the anterior and posterior mitral valve leaflets—with surgery in patients with moderate to severe mitral regurgitation who are candidates for either procedure. After five years, the study has demonstrated that MitraClip was associated with a similar risk of death compared with mitral valve surgery after excluding patients who required surgery within six months. However, patients who were treated with the MitraClip had a significantly higher rate of residual mitral regurgitation two years after the procedure compared with those who had surgery (14 versus 3 percent).

Another clinical trial, COAPT, is now getting underway in 85 US sites. The study will compare transcatheter mitral valve repair with standard therapy—medications,



## EVEREST II Trial: Five-Year Clinical Outcomes of MitraClip vs. Surgery for Mitral Regurgitation

### Freedom from Death or MV Surgery Beyond 6 Months



pacemaker implantation or other treatments—and standard therapy alone in approximately 430 patients with significant functional mitral regurgitation who are not candidates for surgery.

At Mount Sinai Heart, we employ a variety of sophisticated imaging techniques to select patients who are most likely to benefit from transcatheter mitral valve repair. Three-dimensional transesophageal echocardiography (3D TEE) allows us to assess the location and size of the gap and identify structural abnormalities that could reduce the effectiveness of the transcatheter approach. Using 3D TEE, we can exclude patients with a prolapse on the sides of the valve leaflet; a gap that exceeds 1 cm in width; excessive calcium deposits on the leaflet tips; and abnormal thickening of the septum wall. Strain echocardiography enables us to accurately measure ventricular function, which can also aid in selecting appropriate candidates for the transcatheter-based procedure.

We continue to monitor patients throughout the procedure with 3D TEE, providing us with detailed images that assist in device placement. After placement of the device, we use particle imaging velocimetry to measure blood flow throughout the chambers of the heart.

We are exploring the use of 3D printing to create heart valve models to assist in treatment planning.



**PATIENT:** Wallace Sokolsky, age 89

**DIAGNOSIS:** Stable CAD, Recent Stroke

**TREATMENT:** Multiple PCIs in last 12 years

“Twice he has saved my life,  
and I am so grateful for it.”

“I have been a college professor since 1949. Over the many years, I have taught history, philosophy...jokes. Last August, when I suddenly became unable to walk steadily without holding on, I knew it was no joke.

“I called my doctor, who said I should go to the hospital immediately. I went right to The Mount Sinai Hospital, where I had been a patient of Dr. Sharma’s for several years. A few years ago, Dr. Sharma had performed a procedure to insert two stents into my coronary arteries, which had become blocked. Last year, he performed an emergency stent procedure because my left ventricle was failing. If he hadn’t treated me immediately, I might not have survived another 10 days.

“This time, I had suffered a stroke. As the hours passed, the symptoms became more apparent—the stroke left my right arm and leg paralyzed, and I was having difficulty talking.

“Dr. Sharma performed tests, modified the dosages of my diabetes and blood pressure medications, and admitted me to the hospital until I could be transferred to a rehabilitation unit to regain some mobility.

“After my stroke, I remained in rehabilitation for a couple of months. Although I have made a lot of progress, I’m reconciled to living with some limits on my recovery. After all, I am nearly 90. I am a World War II veteran and I attended the Sorbonne in 1945, courtesy of the US Army. I taught at New York University and the City University of New York, and gave more than 3,000 public lectures.

“Dr. Sharma has an excellent team who does all of the preliminary work, but it is he who threads the delicate catheters and instruments into the heart, which requires a great deal of skill. Twice, Dr. Sharma has been awarded the highest honors for his expertise in cardiac catheterization. He is world-renowned for his talent as a physician. But he is never too important to fail to show up for my appointments and review my chart himself.

“Each time Dr. Sharma has treated me, he has gotten to the bottom of my condition quickly and skillfully. Twice he has saved my life, and I am so grateful for it. I don’t know how else to thank him except by telling you how much he means to me—and by writing limericks just for him.”

## Key Points

- Mount Sinai Heart was an early pioneer in TAVR therapy for patients with severe aortic stenosis (AS).
- The Mount Sinai Hospital has participated in trials including the CoreValve and SURTAVI trials, and continues to participate in clinical research to improve TAVR outcomes in patients with severe AS.
- We are always evaluating new imaging techniques to ensure ideal placement and enhance the success rates of TAVR devices in our patients.

# Procedure Outcomes with Transcatheter Aortic Valve Replacement



**Samin K. Sharma, MD**



**Annapoorna S. Kini, MD**



**Jason Kovacic, MD, PhD**

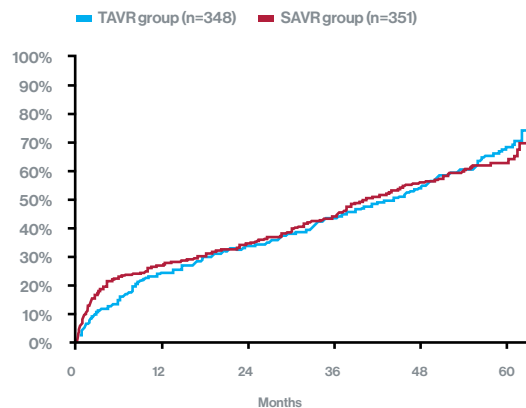
Multiple trials of transcatheter aortic valve replacement (TAVR) have shown that it is an important therapeutic option for patients with severe, symptomatic aortic stenosis due to coronary artery disease (CAD) who are high at risk for cardiac surgery due to serious comorbidities or excessive calcification of the aortic valve.

The Mount Sinai Hospital continues to participate in clinical research to improve TAVR outcomes in patients with severe aortic stenosis. The PARTNER II Trial will compare TAVR in more than 3,300 inoperable patients who are randomized to receive the first-generation

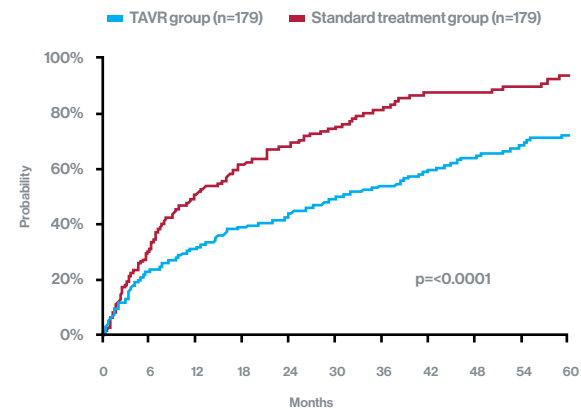
SAPIEN® transcatheter heart valve or the second-generation, smaller Sapien XT device. Importantly, PARTNER II will also examine differences in outcomes among patients who have TAVR via a transfemoral (groin), transapical (under the chest) or transaortic (a small incision above the breastbone) approach.

The Surgical Replacement and Transcatheter Aortic Valve Implantation (SURTAVI) Trial is a multicenter clinical trial comparing percutaneous implantation of a self-expanding device called the CoreValve System with surgical valve replacement in patients with severe aortic stenosis and intermediate risk for surgery.

**5-Year Mortality in PARTNER A High Risk Surgical Group**



**5-Year Mortality in PARTNER B Inoperable Group**



To view a prerecorded case featuring a TAVR using CoreValve, scan the QR code above.

Another study is being performed to assess the risk of stroke in patients who have transcatheter valve replacement with the Sentinel Cerebral Protection System, which includes an embolic filter that is designed to trap calcified deposits that become dislodged during the procedure.

### **Advanced Imaging to Enhance TAVR Success**

Radiologists at Mount Sinai Heart routinely employ three-dimensional transesophageal echocardiography (3D TEE echo), which produces superior images of the aortic route than computed tomography (CT). Image quality and detail 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 one of the earliest centers to demonstrate the safety of TAVR with 3D transthoracic echo (3D TTE), in which patients are given conscious sedation. This approach is associated with fewer complications, faster recovery time and less procedural time than 3D TTE, which requires the patient to be intubated during general anesthesia.

In addition, our researchers are evaluating the use of robotic technology to insert the 3D TTE probe. This approach may reduce the risk of exposure to radiation and operator fatigue during insertion of the probe.



**PATIENT:** Ralph Martell, age 88

**DIAGNOSIS:** Aortic valve disease with stenosis

**TREATMENT:** TAVR with CoreValve

“I don’t think there is anyone near where I live who has the experience with this procedure that Dr. Sharma has.”

“I had a heart murmur and was having some shortness of breath. The cardiologist who I saw in Ithaca examined me and said that my aortic valve was deteriorating, and I would need to have it replaced. I also needed surgery for another health condition, but I couldn’t have that taken care of without addressing my heart problem first. My doctor didn’t think open heart surgery was a good idea because of my age and because I live by myself in a remote area. My dear, special friend, who also happens to be a doctor, had referred some of her patients to Dr. Sharma, who replaces these valves without open heart surgery. She suggested I see him as soon as possible.

“The procedure was very successful. I stayed at Mount Sinai in the cardiac care unit for about five days. The team there was fantastic. They answered all of my questions, as well as my daughter’s. The nurses were very responsive and friendly.

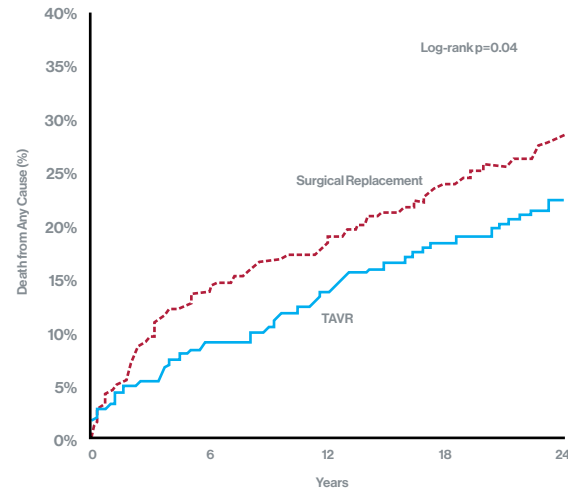
“I am recovering at a rehab facility now in Ithaca, not too far from where I live. I seem to be getting better every day. Before I had the procedure, I couldn’t walk very steadily and got tired easily. Now I am feeling much more vigorous. My daughter comes to visit me every day and takes me out. My appetite is coming back as well as my strength. They say I may be able to go home in the next few days. If I’m feeling up to it, I plan to do some traveling in a few months.

“I don’t think there is anyone near where I live who has the experience with this procedure that Dr. Sharma has. Things might not have gone so well if I had been treated by someone with less experience. I am very happy I took my friend’s advice and went to see Dr. Sharma.”

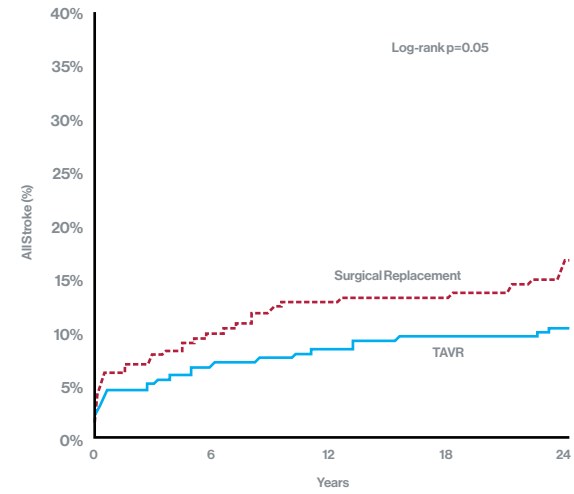


## CoreValve Pivotal Trial: 2-Year Clinical Outcomes in High-Risk Aortic Stenosis

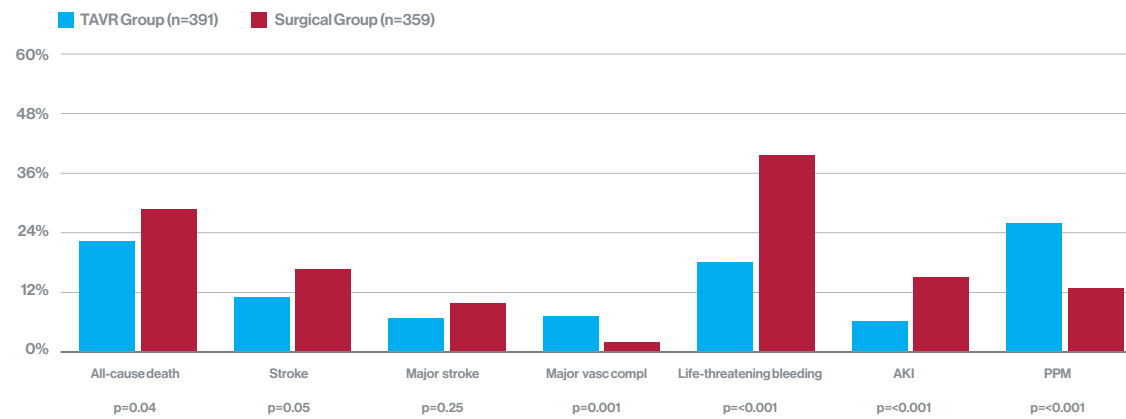
### All-Cause Mortality



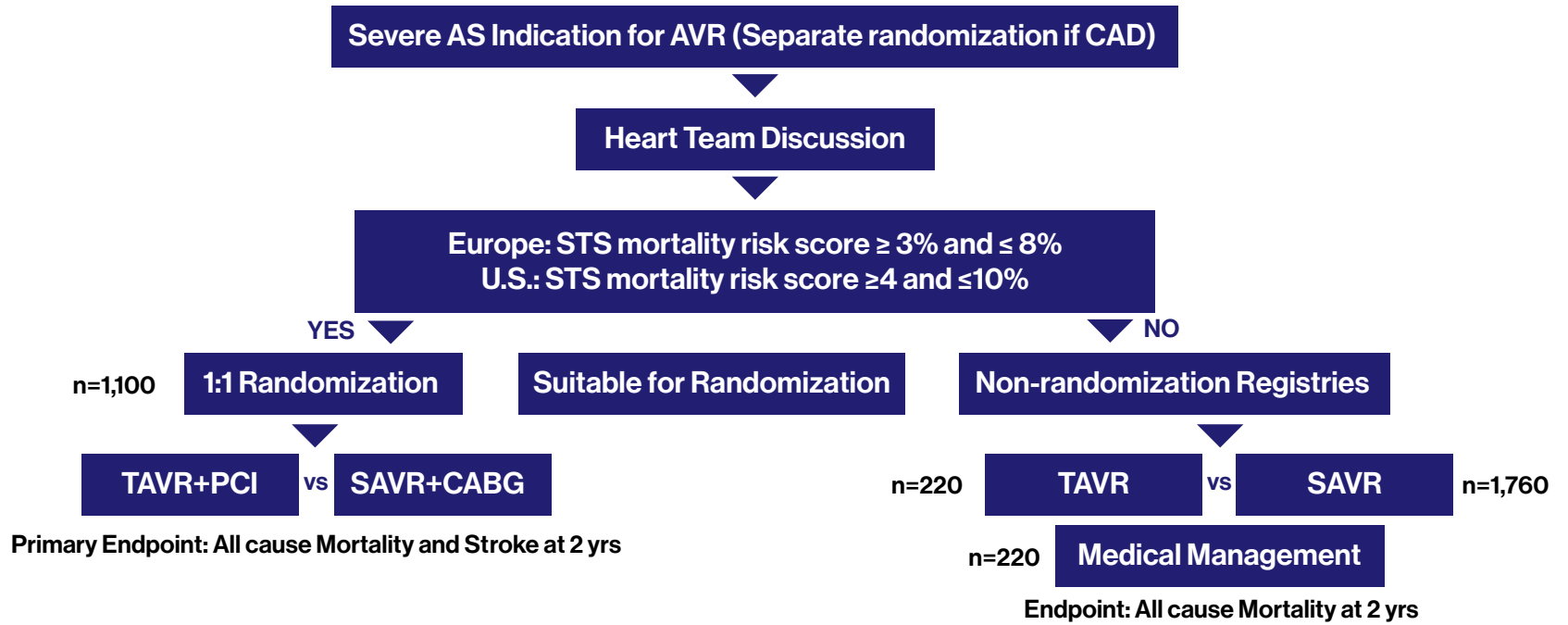
### All Stroke



## CoreValve Pivotal Trial: Two-Year Clinical Outcomes in High Risk Aortic Stenosis





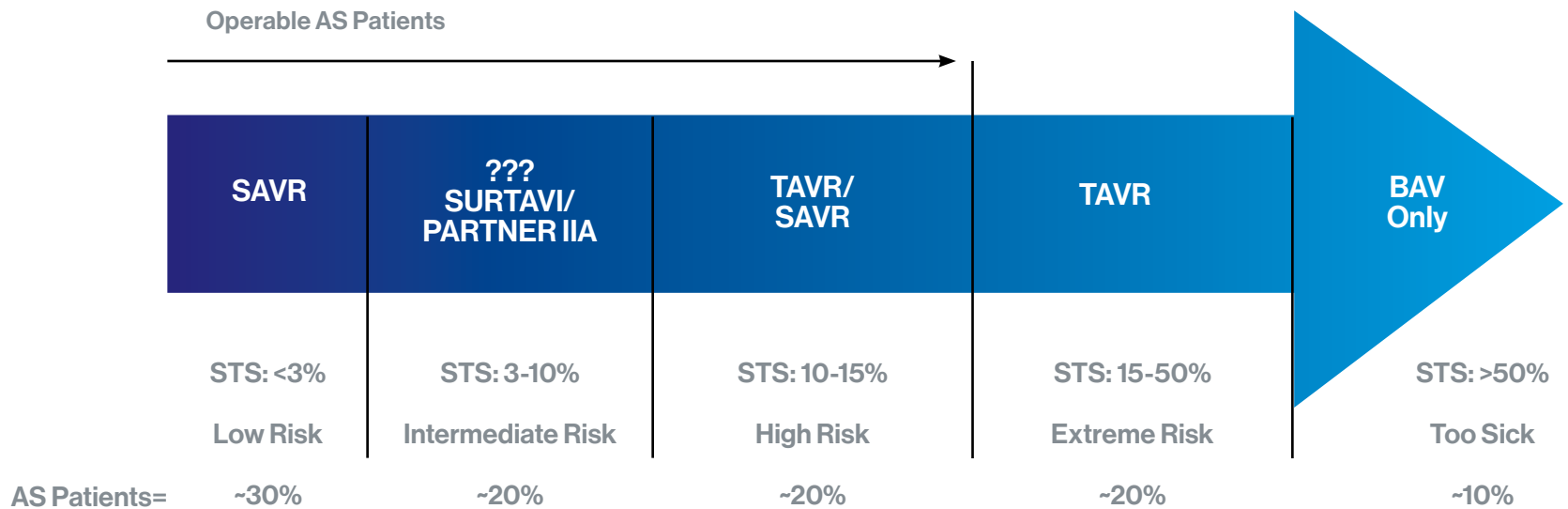


**Transcatheter Aortic Valves Replacement (TAVR)**

**Recommendations Based on Surgical Risk**

Patients with prohibitive surgical risk are appropriate for TAVR even with low STS risk:

- Hostile mediastinum, egg-shell aorta, RT
- Prior CABG with IM stuck to mediastinum
- Severe COPD, extreme frailty



## Key Points

- Most patients for whom TAVR is indicated are elderly and/or frail with complicating comorbid conditions.
- Although TAVR is associated with faster recovery and fewer complications, appropriate discharge planning is vital to ensuring that success.
- Discharge planning should begin at the initial planning meeting with the patient and their family and be considered at every step.
- Patient education, medication adherence, follow-up and coordination with the patient's cardiologist and PCP are vital to optimal outcomes.

# Transcatheter Aortic Valve Replacement Discharge Planning



**Samin K. Sharma, MD**



**Melissa Mattimore, ACNP-BC**

Discharge planning for patients who undergo the transcatheter aortic valve replacement (TAVR) is particularly challenging. Many of these patients are elderly and frail, with multiple comorbid conditions that make surgical valve replacement too risky. Failure to identify and communicate a patient's needs before, during and after the TAVR can adversely affect discharge planning and increase the risk for rehospitalization.

At Mount Sinai Heart, discharge planning begins well before a patient has the TAVR, during our initial meeting with the patient and family. Evaluation of the patient's physical condition, level of functioning and mobility allows us to anticipate issues that may arise after the procedure and plan accordingly. If we suspect that subacute rehabilitation may be needed, the family will have time to investigate rehabilitation options prior to the procedure and share preferences with the staff before discharge. Our patients may also consider a new option, intensive visiting nurse care, which provides a home-based alternative to subacute rehabilitation.

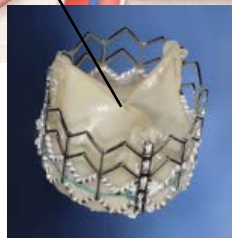
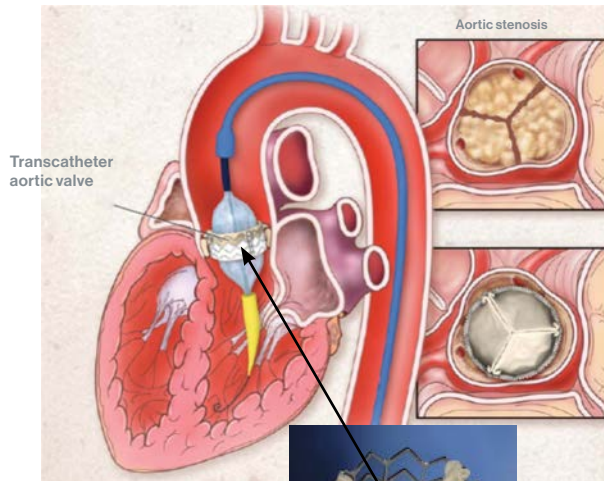
Post-procedure care and evaluation of TAVR patients is performed in a manner that ensures patient safety and comfort during their hospital stay and results in appropriate and timely discharge. Immediate care is provided in our specialized intensive care unit, with input from a multidisciplinary team that includes cardiologists, intensivists, nurses, social workers, physical therapists

and other specialists as needed. Early removal of invasive lines is performed and contributes to a reduced ICU length of stay. Early mobilization reduces inflammation, metabolic disturbances, pulmonary and thromboembolic complications and deconditioning. When appropriate, patients are transferred to a telemetry unit for post-TAVR monitoring until discharge.

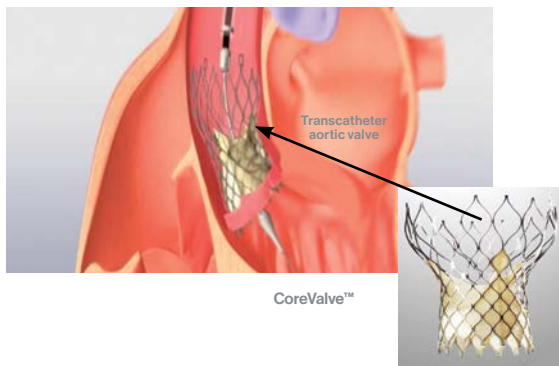
A physical therapy consult occurs one day after the TAVR to assist with mobilization and begin evaluating the patient's immediate and long-term needs after discharge. Additional assessments are required to assess changing or evolving needs throughout their stay.

Communication and education of the patient and family are a critical component of our discharge strategy. This entails giving the patient and family clear written and verbal instructions about the care plan and when to call a physician. A member of our team calls the patient within one week after discharge to assess the patient's clinical condition, wound healing, adherence to the medical therapy regimen and schedule or confirm the 30-day follow-up appointment. We send a discharge report and detailed summary of the patient's procedure to the patient's referring cardiologist. Additional notes and recommendations from follow-up appointments are also communicated to the physician to optimize patient care.

## Percutaneous Heart Valves Available In the United States



Edwards SAPIEN® Valve



CoreValve™

### Approved Transcatheter Aortic Valves

	Edwards Sapien Valve	Medtronic CoreValve
First in man	June 2002	April 2004
Expansion	Balloon-expandable	Self-expandable
Frame	Stainless steel	Nitinol
Valve material	Bovine	Porcine
Sheath size	22-24 Fr	18 Fr
Aortic annulus	18-25mm	20-27 mm
Access site	Transfemoral, Transapical	Transfemoral, Subclavian, Direct Aortic



**PATIENT:** Richard Melosh, age 92

**DIAGNOSIS:** Stable chronic heart failure since TAVR

**TREATMENT:** Transcatheter aortic valve replacement (TAVR) with CoreValve (first to receive this treatment in the USA on December 18, 2010).

“I see Dr. Sharma every year at my annual checkup, and he is still the same professional, hardworking doctor I have come to know and trust.”

“I had already had some experience with Dr. Sharma, who treated me in the mid-1990s with some coronary stents. But about 10 years after that procedure, in 2010, I was beginning to run out of gas. My cardiologist at Mount Sinai, Dr. Weisenseel, suggested that I see Dr. Sharma again, who might be able to treat me without having to go through surgery.

“Dr. Sharma examined me and recommended that I get another procedure to replace my coronary artery valve, which wasn’t working properly. He planned to give me a new type of coronary valve using a catheter that would be placed into my femoral artery. I would be the first one of his patients to get this treatment as part of a clinical trial. Knowing how competent and professional Dr. Sharma is, I agreed to the plan.

“I had a very smooth recovery, thanks to the excellent care I received from Dr. Sharma and his wonderful team and the support of my loving family. I see Dr. Sharma every year at my annual checkup, and he is still the same professional, hardworking doctor I have come to know and trust. I am doing pretty well for a 92-year-old, and this treatment helped me a lot, no question about it. I would highly recommend Dr. Sharma to other people who are having heart problems.”

## Key Points

- For HOCM patients with persistent symptoms, open heart surgery and surgical removal of the overgrown heart muscle (myectomy) is recommended.
- The Mount Sinai Hospital Cardiac Catheterization Laboratory offers alcohol septal ablation (ASA) to a select group of HOCM patients, with refractory symptoms, which avoids open heart surgery.
- This procedure involves a slow injection of 98 percent alcohol via catheter in a carefully selected artery supplying blood to the overgrown tissue in the enlarged septum.
- Recent reports suggest that improvement of left ventricular outflow gradients with ASA improves prognosis and results are comparable to myectomy.



To view a prerecorded case featuring alcohol septal ablation, scan the QR code above.

# Alcohol Septal Ablation (ASA)



Annapoorna S. Kini, MD



Asaad A. Khan, MD

Hypertrophic obstructive cardiomyopathy (HOCM) is usually genetic/familial and reveals itself in the second or third decade of life. Patients typically complain of exertional chest pain, shortness of breath, fatigue, fainting, palpitations and rarely may even present with sudden death. Patients with symptomatic HOCM can be treated in multiple ways. First-line treatment in symptomatic HOCM patients consists of medical management with drugs such as beta-blockers, calcium channel blockers and other negatively inotropic medications (drugs that slow the heart rate and improve the filling of the heart). For patients with persistent symptoms, open heart surgery and surgical removal of the overgrown heart muscle (septal myectomy) to enhance blood flow from the left ventricle is the recommended treatment.

The Mount Sinai Hospital Cardiac Catheterization Laboratory is one of the relatively few high-volume centers offering a select group of HOCM patients with refractory or persistent symptoms another choice. Alcohol septal ablation (ASA) is now an alternative treatment to reduce the size and contractility of tissue obstructing the blood flow out of the left ventricle. This minimally invasive procedure does not require general anesthesia or lengthy recovery time and is rarely associated with complications happening with open heart septal myectomy. Approximately 10 percent of patients who undergo ASA develop arrhythmias (such

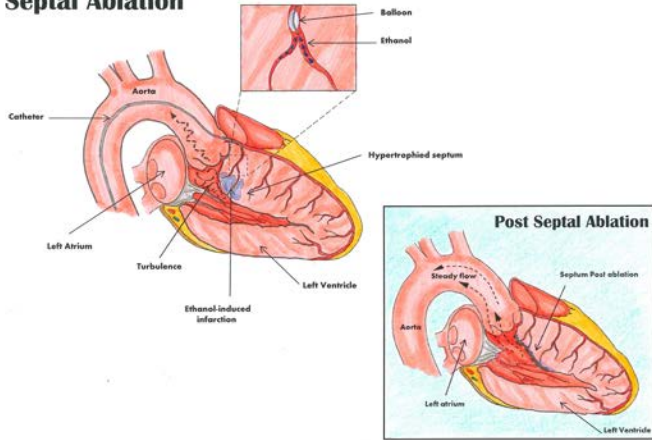
as slowing of the heart) which may require insertion of a permanent pacemaker. Recent reports have suggested that improvement of left ventricular outflow gradients with ASA improves prognosis of these patients.

While selecting patients for this procedure, we follow certain standards based on echocardiographic assessment of the hypertrophic heart muscle. The hypertrophic heart muscle measurement must be between 16 mm and 26 mm thick to achieve optimum results. Thickness less than 16 mm is usually responsive to medical management while septums thicker than 26 mm should not undergo ASA. Another subgroup (a rare entity) is mid cavity obstruction in HOCM affecting elderly women with hypertension. We have performed ASA in this group of patients with good symptom relief.

As ASA is done percutaneously, it avoids the need for surgery but yields similar success in terms of removing overgrown heart muscle. This procedure involves a slow injection of 98 percent alcohol via catheter in a carefully selected artery supplying blood to the overgrown tissue in the enlarged septum. The highly concentrated alcohol is injected slowly (1-3cc/second) directly into the heart muscle and is left in place for several minutes. The treatment effect starts immediately by causing controlled cell death at the target location. Typically, the goal is to remove no more than two grams of obstructive muscle mass, as complications such as irregular heart beat can



## Septal Ablation



occur (requiring permanent pacemaker insertion) if a more aggressive approach is used. During the procedure, with the help of our highly experienced staff, we are able to visualize the heart from all sides utilizing various imaging techniques such as X-ray fluoroscopy and echocardiography. This approach helps us ensure correct catheter placement resulting in a very controlled area of cell destruction. Strict adherence to our highly cautious patient selection protocols complimented by extremely efficient post-procedure management in CCU has helped optimize our outcomes.

Following the procedure, the ASA patients are closely monitored in ICU for two days. We are particularly attentive to arrhythmias and changes in blood chemistry. By tracking the volume of creatinine kinase (heart enzyme) we can quantify the extent of controlled cell damage. Our range value is from 700 to 1,500 enzyme units per liter. Patients typically report immediate improvement in their symptoms and once safely stabilized, are able to go home with minimal restriction on physical activity for the following 2-4 weeks. The ablative process completes over several weeks as a thin layer of scar tissue forms and LV diastolic function improves. We do follow-up echocardiograms of the post-operative patient in 3-6 months.



**PATIENT:** Judith Schwartz, age 75

**DIAGNOSIS:** Hypertrophic obstructive cardiomyopathy

**TREATMENT:** Alcohol septal ablation

“I love Dr. Kini because she gave me my life back. She is a very special person.”

“I couldn’t find enough good adjectives to describe Dr. Kini. I came to Mount Sinai because I had a muscle in my heart that was very thick. Apparently, I was born with this condition, and over the years it was getting worse.

“I was having great difficulty breathing. My hairline was receding and my nails were peeling down to the quick, probably because I wasn’t getting enough oxygen. I couldn’t breathe well enough to talk on the phone. I couldn’t even get to the dentist. I was almost ready to settle for the long recuperation I would have needed to have open heart surgery because I couldn’t live this way any longer.

“I was in the hospital for something completely unrelated, and during the night, the staff thought I had had a heart attack because I was having difficulty breathing. The next day, they decided to catheterize my heart, and found that my condition had gotten much worse. My cardiologist recommended I see Dr. Kini, who might be able to provide

a new treatment that could treat the heart muscle without open heart surgery.

“Dr. Kini did an electrocardiogram, and the next thing I knew she was scheduling me for an appointment. She used alcohol to burn the muscle and remove the part that was too thick, which opened up the blockage. Throughout my treatment, Dr. Kini was very calm. I think we got along great.

“Instead of a 6-month recovery from open heart surgery, I had a 6-day recovery. Right after the procedure, I had an abnormal heart rhythm, so the heart team came to check on me and make sure I was OK. According to my cardiologist, I probably had this condition all along, but I didn’t need a pacemaker and it went away on its own.

“Now my hair is growing back and I have nails again. I can walk, take the stairs, do everything. My husband is sick, but now I’m able to take care of him. I feel like I’m 20 years younger. I love Dr. Kini because she gave me my life back. She is a very special person.”



# Update on Chronic Total Occlusion

## Key Points

- A chronic total occlusion (CTO) is a complete obstruction of a coronary artery that has been present for three months.
- CTOs are identified in up to 20 percent of all patients who are referred for diagnostic angiography.
- New imaging technologies like coronary computed tomography angiography allows us to analyze these lesions before intervention to determine the best strategy for PCI.
- We also employ a novel retrograde approach that has improved our success rates with these challenging lesions.
- All CTOs are first approached antegradely.
- Retrograde CTO approach is used rarely as the first line, but is used after 1-2 failed attempts of antegrade approach.
- Combined antegrade and retrograde approach has increased the CTO success to over 90 percent.



Annapoorna S. Kini, MD

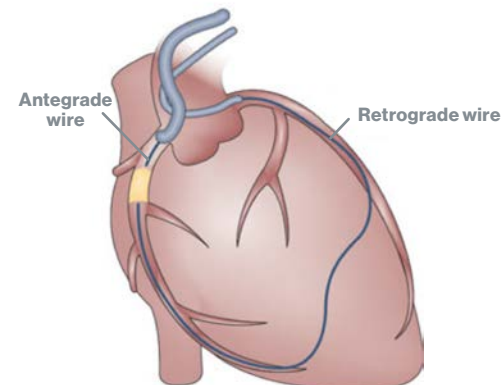
A chronic total occlusion (CTO) is defined as a complete obstruction in a coronary artery that is present for longer than three months. CTOs are commonly encountered in everyday practice in the cardiac catheterization laboratory, and are identified in up to 20 percent of all patients who are referred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

Although 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 95 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.

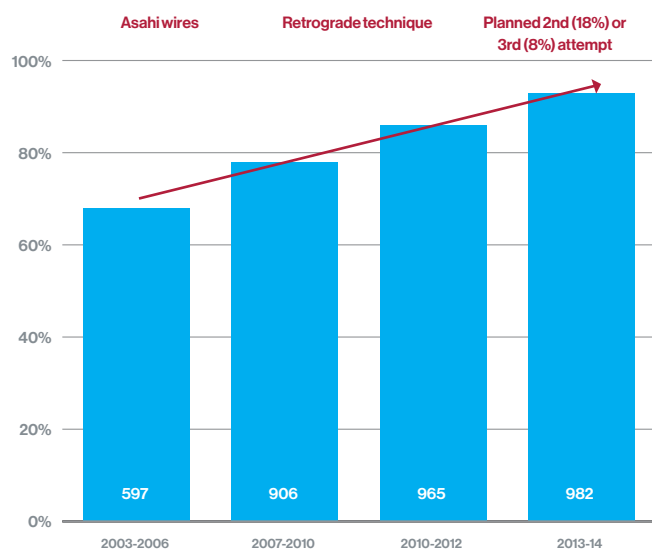
Recently, considerable progress has been achieved in percutaneous coronary interventions (PCI) for patients with CTOs. Important developments in dedicated

equipment and techniques have resulted in high rates of success and low rates of complications, even in complex CTO cases. Coronary computed tomography angiography is a noninvasive imaging modality that enables the precise assessment of CTO lesions. This technique would be helpful in determining the CTO-PCI strategy and contributing to the success of these procedures. 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.

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.



### Volume and Procedural Success of PCI for Chronic Total Occlusion at The Mount Sinai Hospital



**PATIENT:** Charles Bockus, age 81

**DIAGNOSIS:** One-vessel coronary artery disease

**TREATMENT:** Placement of drug-eluting stent in left circumflex coronary artery

“I liked the hospital very much—it was a very nice place and the people working with her were top-notch.”

“I’ve lived in Florida for about 20 years, but I still spend a few months up in Connecticut during the summer and early fall. I had gone to see a doctor at my local hospital in Florida who told me I should have something done about the blockages in some of my coronary arteries, but then changed his mind.

“I decided to look for a doctor in New York City because there’s a lot of talent there. So I did some research on the Internet and found Dr. Kini. I read her bio on the Mount Sinai Hospital website, and I thought that anybody who does 1,000 procedures a year is someone who has lots of experience. I decided to make an appointment.

“I brought all of my hospital records from Florida. Dr. Kini looked at them and told me that something needed to be done about the blockages in two of my arteries. I guess she deemed them to be important arteries. Her recommendation was to put in some stents,

so I did it. I had the first procedure in early July and the second one in mid-September.

“I liked the hospital very much—it was a very nice place and the people working with her were top-notch. They went out of their way to help if you had an issue you wanted to discuss. When I sent a text message to Vivian Lau, a nurse practitioner who works with Dr. Kini, she would respond right away, and I really appreciated that. The people at Mount Sinai Heart really understand that the customer is the most important person in the process, and I think that’s definitely one of their strong points.

“The procedures were successful, as I learned from my follow-up appointment with Dr. Kini. I’m definitely feeling better. Now I’m getting some physical therapy so I can get back into shape and start taking long walks again.”

## INNOVATIONS

# Invasive Imaging in the Cardiac Catheterization Laboratory

### Key Points

- Advanced intravascular imaging allows our operators to improve their performance and patient safety.
- All intermediate coronary artery lesion interventions at our center are guided by fractional flow reserve.
- The Mount Sinai Hospital was the first in the world to implement the optical coherence tomography system (OPTIS).



**Annapoorna S. Kini, MD**



**Yuliya Vengrenyuk, PhD**



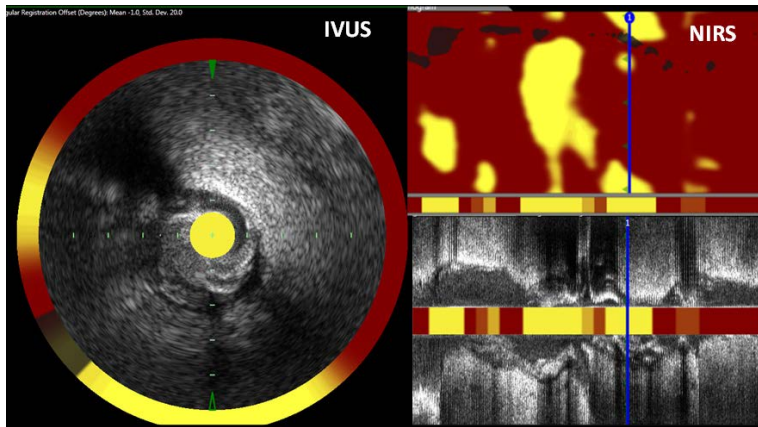
**Jagat Narula, MD, PhD**

The Cardiac Catheterization Laboratory at The Mount Sinai Hospital incorporates several advanced intravascular imaging/physiology modalities to allow operators to improve their performance and patient safety. Intravascular ultrasound (IVUS) allows us to determine the amount of atheromatous plaque built up at any particular point in coronary arteries. It has been used routinely in cardiac catheterization laboratories for decades. Recently developed near infrared spectroscopy (NIRS) has the ability to identify lipid core plaques based on the chemical makeup of the lesion. We use combined NIRS and IVUS to assess the anatomy and lipid content of the vessel. The new technology has been used in a series of YELLOW (Reduction in Yellow Plaque by Aggressive Lipid-Lowering Therapy) trials to determine the impact of short-term intensive statin therapy on plaque lipid content.

Fractional flow reserve (FFR) is a technique that measures pressure differences across a coronary artery stenosis to determine whether the stenosis affects oxygen delivery to the heart muscle and induces myocardial ischemia. In a recent multicenter trial, FAME

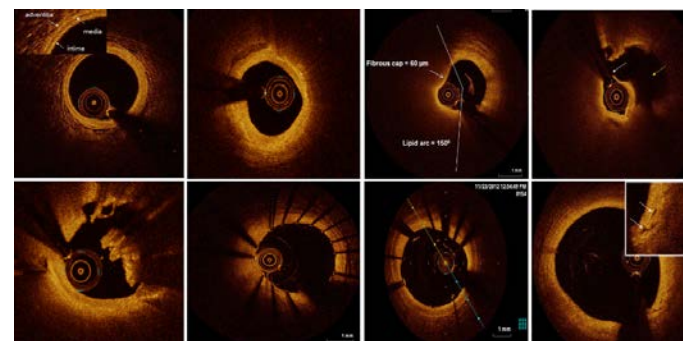
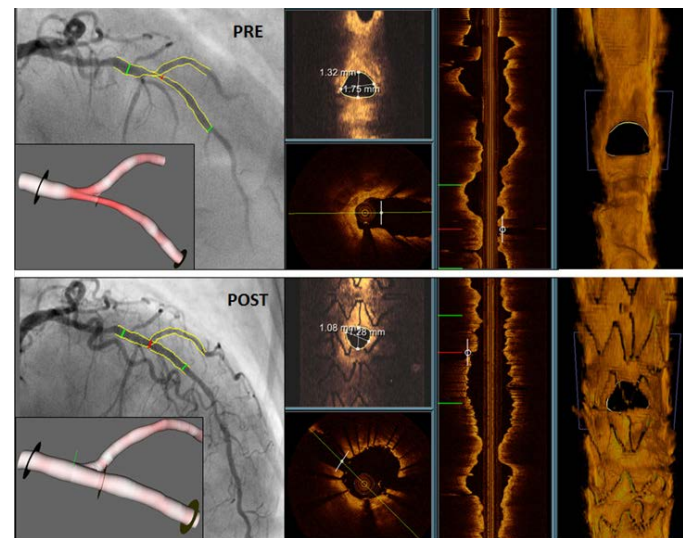
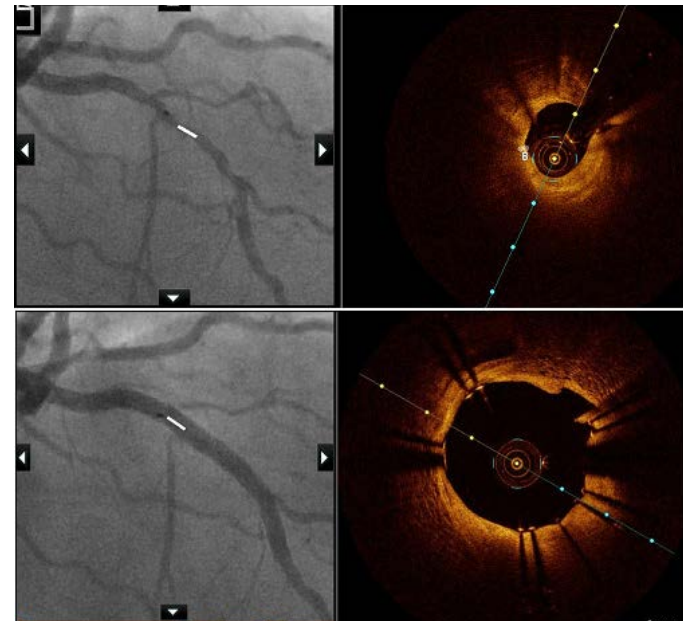
(FFR versus Angiography for Multivessel Evaluation), a physiologically guided approach was found superior compared to the standard angiographically guided approach for percutaneous revascularization in patients with multivessel coronary artery disease. All intermediate coronary artery lesion interventions in the Cardiac Catheterization Laboratory are guided by FFR.

Optical coherence tomography (OCT) is a more recent light-based imaging modality which offers 10 times higher resolution and 40 times faster imaging acquisition compared with IVUS. In addition, it can provide 3D reconstructions of OCT images to better characterize stent expansion and apposition, tissue coverage, and side branches. In October 2014, The Mount Sinai Hospital Cardiac Catheterization Laboratory was the first in the world to implement the OPTIS/integrated system, which offers OCT and angiography co-registration to “map” culprit lesions and provide the visual data necessary to guide stent selection and deployment. New technology supports procedural decisions by providing high-resolution, 3D OCT views of coronary anatomy while mapping the exact location of physician’s current view via angiogram.



Occlusion of the side branch after main branch stent implantation is a potential concern during PCI of coronary bifurcations. OCT imaging can help characterize side branch occlusion, select an appropriate treatment strategy, and estimate the effect of side branch treatment. We used OCT to identify the predictors of side branch stenosis developed after provisional stenting of the main vessel in a recent trial, ORBID (Three-dimensional Optical Coherence Tomography Guided Assessment of Side Branch Vessel after Provisional Main Vessel Stenting in Coronary Artery Disease). Our first YELLOW trial demonstrated that short-term statin treatment leads to lipid regression as assessed by NIRS. This is crucial, since lipid-rich coronary plaques are at increased risk for rupture and thrombus leading to events. A combination of IVUS/NIRS and OCT imaging has been used in the current YELLOW II trial to extend our initial findings and link them to changes in plaque morphology with alterations in HDL function, gene expression and macrophage behavior.

We are committed each day to improving the outcomes of our patients. Our imaging and physiology center of excellence in the Cardiac Catheterization Laboratory has enabled us to get there.





## Key Points

- Although bare metal stents (BMS) and drug-eluting stents (DES) are safe and effective in the short term, long-term restenosis remains a key concern.
- A new generation of bioabsorbable DES eliminates some of those concerns by dissolving within three years of implantation.
- Mount Sinai Heart has been a key site in clinical trials to compare the efficacy of bioabsorbable stents with metal drug-eluting stents.
- Advanced imaging remains vital to determining the best intervention for each patient and their unique lesion.

# Update on Bioabsorbable Vascular Scaffold Technology



**George Dangas,  
MD, PhD**



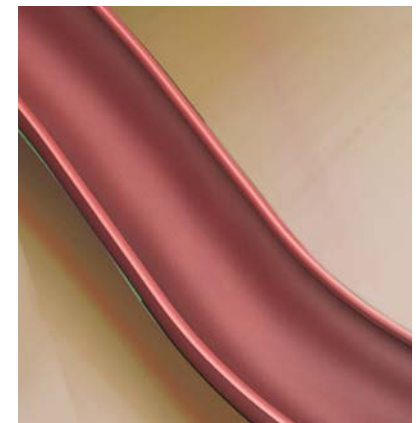
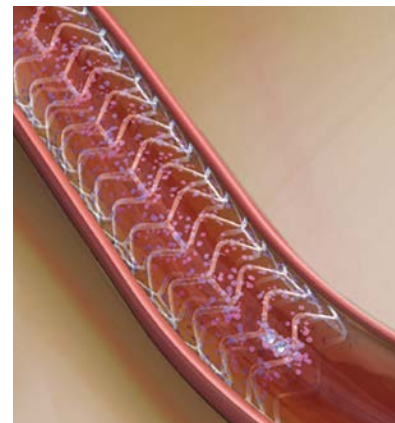
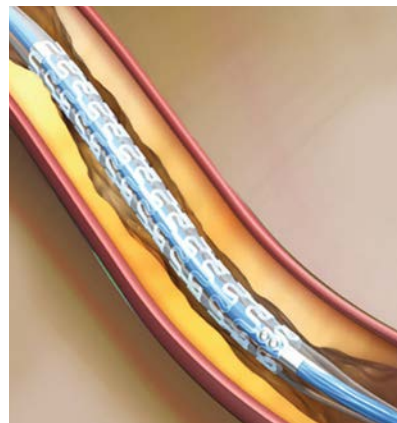
**Annapoorna S.  
Kini, MD**

Improvements in drug-eluting stent technology have reduced the risk of early failure of bare metal stents, but concerns remain about their viability over the long term. A new generation of bioabsorbable drug-eluting vascular stents may help to achieve long-term patency of the target coronary vessel and avoid complications associated with bare metal stents and drug-eluting metal stents.

Bioabsorbable stents are composed of bioabsorbable polymers—materials, such as polylactic acid, that are commonly used in dissolving sutures. These stents provide the controlled release of an antiproliferative medication, such as everolimus. Most begin dissolving within months and are completely dissolved within three years after implantation.

The advantage of bioabsorbable stents is based on the physiology of coronary vessels, which normally dilate and contract according to the body's needs. Bare metal stents interfere with this process through the introduction of neointimal hyperplasia, causing the vessel to collapse and leading to restenosis. In addition, evidence suggests that first-generation drug-eluting stents cause ongoing vascular inflammation, which may lead to late thrombosis.

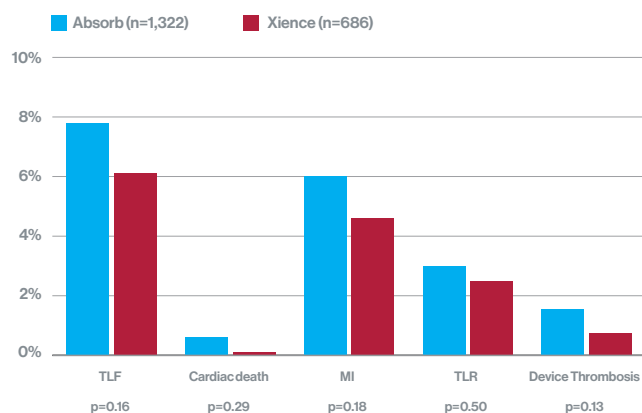
In contrast, bioabsorbable drug-eluting stents may restore the ability of the target vessel to dilate and contract normally. The Mount Sinai Hospital is participating in several clinical trials to compare the efficacy of bioabsorbable stents with metal drug-eluting stents. One randomized study, the ABSORB substudy, includes a patient arm to evaluate the effect of the Abbott Absorb® Bioresorbable Vascular Scaffold on vasomotion of the target vessel after the device dissolves.



Throughout these clinical investigations, we have learned that meticulous imaging studies and lesion preparation are key to the long-term success of a vascular stent. Imaging techniques such as optical coherence tomography provide highly detailed images of the vessel anatomy and tortuosity as well as information about the composition of a lesion. This information allows us to determine whether lesion preparation with rotational or laser atherectomy are required to reduce irregular vessel anatomy, eliminate calcium deposits and optimize stent placement.

These studies have also revealed the importance of identifying an effective medical therapy to enhance the success of stent procedures. Functional blood tests, performed in the Cardiac Catheterization Laboratory immediately before or after stent procedures, enable us to determine which medical regimen may be most effective for each patient after discharge from the hospital. This approach is also emerging as a critical tool in decreasing the risk of bleeding, stroke or other heart-related complications after percutaneous aortic or mitral valve implantation.

### ABSORB III Trial: 1-Year Outcomes Components



**PATIENT:** Nelly Rodriguez, age 77

**DIAGNOSIS:** Restenosis in left anterior descending (LAD) coronary artery

**TREATMENT:** PCI with drug-eluting stent in LAD

“Dr. Dangas is very dignified, knowledgeable and, above all, human.”

“I have known Dr. Dangas for over 17 years. During that time, he has helped me many times with my heart disease, which caused blockages in many of my arteries, including in my legs. He also told me that if I lost weight and stopped smoking, I would have a better chance of living and preventing more problems.

“In 2012, I was having a lot of chest pain and then I had a heart attack. Dr. Dangas examined me and explained that if I got a stent put into one of the arteries in my heart I would feel a lot better. He was right. After I got the stent, I had an easy recovery and my symptoms weren’t so bad. I was able to lead a normal life again.

“I still have a heart condition, so I contact him if I feel any symptoms. I call the office, and I can always get in touch with him when

I need to. He even talks to my daughter, who sometimes calls or sends him an email when she is worried about me. From time to time, he makes changes to my medication regimen. When he doesn’t hear from me, he tells me he misses me. He always reassures me that as long as I follow his instructions, eat healthy, and remain smoke-free, the stents he has put into my arteries over the years should last and I will feel well.

“Dr. Dangas is very dignified, knowledgeable and, above all, human. He is the kind of person who will sit with you and take the time to listen. He knows all of my stories, and all about my daughter. He is the only person I would trust to help me with my heart condition. I would recommend Dr. Dangas to anyone with my eyes closed!

## Key Points

- Critical limb ischemia (CLI) is characterized by a severe blockage of the arteries in the lower extremities.
- Left untreated, the five-year mortality rate for CLI is as high as 60 percent.
- At Mount Sinai Heart, we employ several approaches to treat this condition including balloon angioplasty, stent placement and laser or rotational atherectomy.
- We are able to prevent amputation in more than 90 percent of patients and help improve their quality of life.

# Management of Critical Limb Ischemia



**Prakash Krishnan,  
MD, FACC**



**Sachin Jain, MD**

Critical limb ischemia (CLI) is an advanced form of peripheral artery disease that is characterized by a severe blockage of the arteries in the lower extremities. This blockage causes a marked reduction in blood flow to the legs and feet, resulting in pain or numbness in the thigh or buttock while at rest (Rutherford III stage 5 disease), a noticeable decrease in limb temperature, and shiny or smooth skin on the affected area. Without treatment, many people with CLI develop non-healing ulcers in the legs and feet. Major risk factors include uncontrolled diabetes and smoking.

Patients with CLI often have an increased risk for tissue loss or amputation and an unacceptably low quality of life, similar to patients with end-stage cancer. The five-year mortality rate for patients with this condition is as high as 60 percent, with coronary events and strokes accounting for at least 70 percent of deaths in this population.

Early assessment and aggressive revascularization are essential to preventing amputation in patients with CLI. A study of more than 20,000 patients revealed that 54 percent of patients with CLI had not undergone

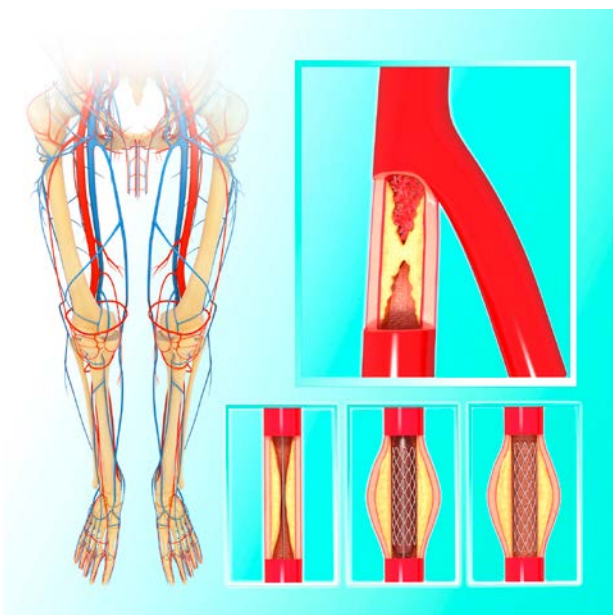
diagnostic or vascular interventions in the year before an amputation. In another study of 417 patients who had at least one below-the-knee amputation, only 35 percent had undergone ankle-brachial index (ABI) to measure blood pressure in the limb and 16 percent had angiography to assess their condition before amputation. Of the patients who had an assessment with ABI or angiography, only 33 percent had a revascularization procedure—either bypass surgery or balloon angioplasty—before amputation.

At Mount Sinai Heart, our team of interventional cardiologists and radiologists perform a comprehensive diagnostic workup that includes ABI, duplex ultrasound, and angiography to evaluate the blockage and measure blood flow in the affected vessel. Specialists in wound care management, infectious diseases and vascular surgery may participate in the diagnostic workup for patients who have ulcers in addition to pain.

Depending on the location and extent of the blockage, we may perform one or more interventional procedures, such as balloon angioplasty, stent placement, and laser or rotational atherectomy to remove it and restore blood

flow to the affected limb. We have particular expertise in revascularizing infrapopliteal (below-the-knee) arteries, which are commonly treated with surgical bypass elsewhere. Our success is enhanced by treating obstructions in proximal blood vessels above the leg first, clearing a pathway for blood flow directly to the foot. Typically, we access diseased blood vessels by inserting a catheter into the femoral artery (in the groin). However, in some cases, we may access these vessels via the foot or through dual access in the foot and groin. In the vast majority of patients—including those without comorbid conditions such as kidney dysfunction or anemia—we treat multiple blood vessels at the same time. Most patients return home the day after their procedure.

Our multidisciplinary, aggressive approach has produced exceptional outcomes for patients with CLI, sparing more than 90 percent of patients from the agony of amputation and improving patient quality of life.



**PATIENT:** Kamala Ramachandran, age 71

**DIAGNOSIS:** Critical limb ischemia

**TREATMENT:** Percutaneous transluminal angioplasty with atherectomy of right anterior tibial artery

“I had a very good experience with Dr. Krishnan and am grateful for his help.”

“I have been living with type 2 diabetes for 38 years. Because of my chronic diabetes, I have diabetic neuropathy and peripheral arterial disease.

“Last summer, I had taken a trip to India. While I was there, I walked around in some places without shoes. I developed an open wound in one of the toes on my left foot and the toe started to turn blue. I saw a doctor back at home who performed a bone scan. Unfortunately, the bone scan revealed that I had developed osteomyelitis, a serious bone infection, and the toe would have to be amputated.

“The doctor who performed my amputation became concerned that I might develop osteomyelitis in one of my right toes, which was starting to show some changes. He suggested that I speak with Dr. Krishnan, who could perform tests to measure the circulation in my right leg and offer treatment to open up the blood flow there. Maybe this would prevent another amputation.

“As it so happened, I had been treated at Mount Sinai in 2012 for a heart attack. Dr. Krishnan was able to review my test results, which included a PVR (pulse volume recording) study to measure blood flow in my legs. The PVR showed that I had a problem with the circulation in my legs. Knowing my medical history, Dr. Krishnan recommended having an angiogram to see exactly where the blockage was so that he could remove it and increase blood flow in the artery in my leg.

“I decided to have the procedure in September. Dr. Krishnan placed a catheter into my right leg through the left femoral artery and performed an angiography. The angiogram showed where the blockage was, and Dr. Krishnan was able to remove the plaque and calcifications from the artery in my leg. After the procedure, the toe on my right foot started to look much better. Dr. Krishnan says there is no need for any further treatment, and I should be able to avoid another amputation. Now I can go about my normal activities. I had a very good experience with Dr. Krishnan and am grateful for his help.”



## Key Points

- In the United States alone, sudden cardiac arrest strikes 38 people per hour outside of a hospital setting, and fewer than 10 percent of these patients survive.
- The most common event triggering sudden cardiac arrest is ventricular fibrillation, a rapid, chaotic heart rhythm that prevents the heart from pumping blood.
- Our cardiac catheterization lab is staffed 24 hours a day, 7 days a week, enabling our multidisciplinary cardiac arrest team to respond with life-saving therapies immediately.
- In combination with medical excellence, community-based education programs that teach risk factors and train people in the use of CPR and AED improve the chance of survival for those who experience cardiac arrest.

# Managing Out-of-Hospital Cardiac Arrest



Joseph Sweeny, MD



Jeffrey Bander, MD

Sudden cardiac arrest, or sudden cardiac death, is the abrupt loss of heart function, breathing and consciousness that can be triggered by a sustained electrical disturbance in the heart. Worldwide, sudden cardiac arrest is a major cause of morbidity and mortality. In the United States alone, sudden cardiac arrest strikes 38 people per hour outside of a hospital setting, and fewer than 10 percent of these patients survive. Of those who survive, many experience some degree of brain damage.

The most common event triggering sudden cardiac arrest is ventricular fibrillation, a rapid, chaotic heart rhythm that prevents the heart from pumping blood. The risk of ventricular fibrillation is higher in people who have had a heart attack, a congenital heart problem, an electrolyte imbalance or an injury that damages the heart muscle. In about 80 percent of cases, cardiac arrest is also associated with a blockage in one or more coronary arteries due to coronary artery disease and blood clot formation.

Over the past 30 years, we have learned a great deal about factors that increase the chance of surviving an out-of-hospital cardiac arrest and how to better

manage patients when they arrive at the hospital. Having a witnessed cardiac arrest by a bystander who can perform effective and immediate cardiopulmonary resuscitation is the number one life-saving factor. Access to an automatic external defibrillator (AED) and rapid transportation to a medical center that has the capability to perform emergent coronary angiography and percutaneous coronary interventions also increases the chance of survival. Certain features of a cardiac arrest decrease the chance of survival, including having an initial heart rhythm that is non-ventricular fibrillation or non-ventricular tachycardia in nature, which usually respond to rapid treatment with an AED; failure to induce the return of spontaneous circulation within 30 minutes of the cardiac arrest; and cardiac arrest that occurs in a patient over age 85.

At Mount Sinai Heart, our success in resuscitating patients who experience out-of-hospital cardiac arrest and preventing neurological damage is attributed to a number of factors. Our Cardiac Catheterization Laboratory is staffed 24 hours a day, 7 days a week, enabling us to respond with life-saving therapies immediately. Our multidisciplinary cardiac arrest

team includes emergency medicine specialists, interventional cardiologists, cardiologists, neurologists, neuro-intensivists and cardiac intensivists. The team uses the latest protocols to prevent neurologic damage, such as therapeutic hypothermia, which cools the body's temperature to approximately 32° to 34° C and reduces the brain's need for oxygen. Our physicians also perform coronary angiography to identify and treat blockages in the heart that may have caused the cardiac arrest. In many cases, we also implant an internal defibrillator in the chest that monitors future heart rhythms and can provide a shock to the heart to prevent a future cardiac arrest.

Each year, The Mount Sinai Hospital hosts a series of free "Heart Hero" workshops to teach people how to recognize the risk factors for developing cardiovascular disease, which can lead to cardiac arrest. In addition, the workshops will train people in the use of life-saving techniques such as CPR and AED. By combining community-based education programs with medical excellence, we hope to continue to improve the chance of survival for those who experience cardiac arrest.



**PATIENT:** Otis Hooper, age 53

**DIAGNOSIS:** Out-of-hospital cardiac arrest

**TREATMENT:** PCI

"I honestly don't think I would be here today if the ambulance hadn't brought me to Mount Sinai."

"Last summer, I had been hospitalized for shortness of breath and chest pain. I thought that it was just my asthma acting up. The doctors at the first hospital I went to couldn't figure out what was wrong, so they sent me to another hospital, where they gave me nitroglycerine and sent me home. Nobody told me I had a heart problem.

"Then a couple of weeks later, I went to a cookout and started to feel terrible. I had no idea what was happening. I walked inside the house with my wife, and then I passed out. My wife called 911 and somebody gave me CPR. Apparently, my heart had stopped working—I was in cardiac arrest. When the ambulance arrived, the emergency technicians used a portable defibrillator to get my heart working again before bringing me to the hospital. Fortunately, the ambulance took me to The Mount Sinai Hospital.

"When I got to Mount Sinai, they brought me to the Cardiac Catheterization Laboratory so they could do some tests. They found out that I had a clogged artery, which had caused the heart attack that led to my cardiac arrest, and they fixed it right then and there with a stent. I didn't know that any of this was happening because I was still unconscious, but my wife was there while they did all of these tests and Dr. Sweeny put in the stent. When I woke up about four days later, I found out what had happened.

"Now I'm doing great. I have to take some medication because of the stent, but my echocardiogram showed that my heart is doing a lot better. I honestly don't think I would be here today if the ambulance hadn't brought me to Mount Sinai."

## Key Points

- Secundum atrial septal defect (ASD) is a hole in the wall that separates the upper chambers of the heart. As oxygenated blood from the left atrium mixes with oxygen-poor blood in the right atrium, the left and right atria and the right ventricle may become enlarged.
- Many ASDs are first recognized during infancy or childhood, but it is not uncommon for an ASD to be discovered during adulthood.
- After the use of increasingly advanced septal occluders, Mount Sinai Heart was one of 20 US centers to participate in a clinical trial to develop a new device, the Gore® CardioForm Septal Occluder, which is softer, yet remains firmly in place.
- With the FDA approval of this device in 2015, more patients than ever can take advantage of this minimally invasive approach.

# Transcatheter-Based ASD Closure



Barry Love, MD

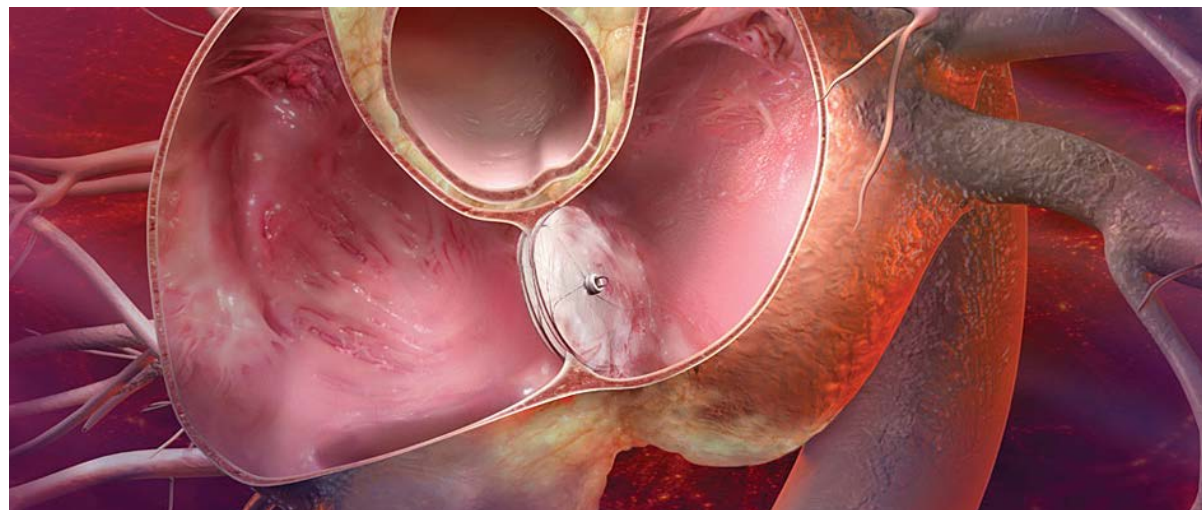
Secundum atrial septal defect (ASD)—a hole in the wall that separates the upper chambers of the heart—is one of the most common congenital heart defects. Many ASDs are first recognized during infancy or childhood, but it is not uncommon for an ASD to be discovered during adulthood.

An ASD allows some of the oxygenated blood in the left atrium to flow into the right atrium, where it mixes with oxygen-poor blood before moving on to the right ventricle and pulmonary artery. Depending on the size of the ASD and how much blood flows into the right side of the heart, the left and right atria and the right ventricle may become enlarged.

Typically, we close ASDs in children who have evidence of right heart enlargement to prevent complications later in life, such as atrial fibrillation, due to chronic stretching of the heart muscle; congestive heart failure

associated with an overabundance of fluid in the heart; and pulmonary infections or hypertension associated with the additional burden placed on the pulmonary artery and lung bed. In adults who have already begun to experience these complications, closure of the defect can improve exercise tolerance.

Since the 1960s, ASD closure has largely been an inpatient surgical procedure. For decades, efforts to develop an effective transcatheter-based approach to ASD closure had been hindered by design and technological limitations. But in 2001, the US FDA approved the Amplatzer™ Septal Occluder, a Dacron-covered nitinol mesh frame that offered a safe and effective, minimally invasive alternative to surgical ASD closure. Although the Amplatzer device represented a significant advance in transcatheter-based approaches to ASD closure, it constituted a



less-than-perfect solution. In particular, patients with insufficient rims around the circumference of the ASD were at small risk for device erosion, which could allow the device to push into the aorta or atrial roof. The Gore® Helex Septal Occluder, introduced in 2006, was designed to mitigate this risk. But because the device was designed to treat small ASDs and was difficult to deploy, it did not significantly expand the use of transcatheter ASD closure.

Starting in 2011, Mount Sinai Heart was one of 20 US centers to participate in a clinical trial to develop a new device, called the Gore® CardioForm Septal Occluder. The device is composed of fabric stretched over multiple nitinol petals. This design is revolutionary in that it is softer than previous occluders, decreasing the risk of erosion into nearby structures, yet remains firmly in place once it has been deployed. In addition, the device contains a tension-free retrieval cord, allowing the operator to reposition it until it is in the desired position. At Mount Sinai Heart, we typically perform transcatheter ASD closure under transesophageal echocardiographic guidance to ensure optimal device placement.

With the FDA approval of this device in 2015, more patients than ever can take advantage of this minimally invasive approach to ASD closure. Further, the delivery system used to place the device is small enough to permit treatment in children as young as 3, offering parents a measure of reassurance in being able to avoid the risks of open heart surgery while decreasing the risk of complications later in life.



**PATIENT:** Ayaat Malik, age 5

**DIAGNOSIS:** Atrial septal defect with enlargement of the right side of the heart

**TREATMENT:** Transcatheter closure of atrial septal defect with Gore® CardioForm Occluder

“Dr. Love is a nice guy, and he took really good care of our daughter.”

“My daughter, Ayaat, was born with a little hole in her heart. She didn’t have any noticeable symptoms, but our doctor told us that she had a heart murmur and was concerned. Eventually, he told us we should go to Mount Sinai for more tests. Her condition was getting worse, and our doctor was worried she would have some more serious heart problems if we didn’t get it fixed.

“Dr. Love checked her heart and said that our daughter needed a procedure to close the hole. He said that we had two choices: Ayaat could have surgery or she could have a special device inserted to cover up the hole. Dr. Love didn’t want to force us into anything. He told us the choice was ours. Surgery involves cutting into the chest, and we didn’t like that idea, so we decided to have the device.

“After the procedure, our daughter came home the very next day. She needed to take aspirin for a few months after the procedure, but she didn’t need any other medications. Not long after that, we took her on a two-month-long vacation to visit our family in Bangladesh.

“Dr. Love is a nice guy, and he took really good care of our daughter. Now, I only need to take Ayaat for a checkup every year. The doctor’s office calls me when it’s time to make an appointment. It is such a relief knowing that our daughter had this procedure. She feels fine and is doing well in school, so everything is good.”



## Key Points

- The Centers for Medicare and Medicaid Services has made it a national priority to reduce hospital readmissions for heart failure patients, and we have made it a priority at The Mount Sinai Hospital with our multidisciplinary Advanced Heart Failure and Transplantation team.
- For patients with New York Heart Association Class III heart failure, the FDA has approved the CardioMEMS™ HF System to measure pulmonary artery pressure with a battery-less, dime-sized sensor.
- The CHAMPION clinical trial showed 37 percent fewer readmissions and improvements in quality of life for patients monitored with the device.
- Data from the device is wirelessly transmitted to our office, allowing us to closely monitor patients before symptoms arise for highly individualized, up-to-the-minute care.

# Preventing Rehospitalization in Heart Failure Patients



Raymond Bietry, MD

Each year, nearly 1 million people are hospitalized in the United States with a primary diagnosis of congestive heart failure, at an annual cost of more than \$17 billion. Nearly 30 percent of those patients are readmitted to the hospital within 6 to 9 months of discharge. In an effort to improve outcomes and patient quality of life, the Centers for Medicare and Medicaid Services has made it a national priority to reduce hospital readmissions for heart failure patients.

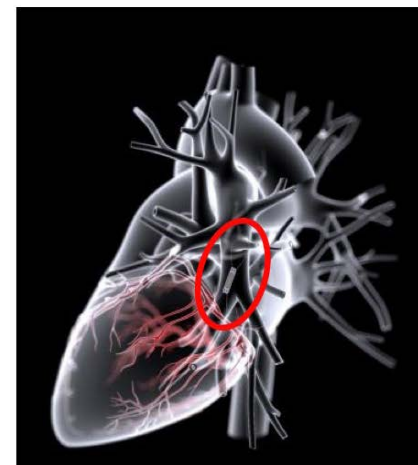
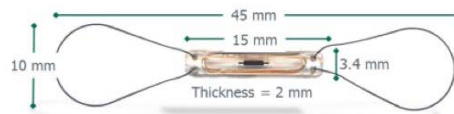
Our multidisciplinary Advanced Heart Failure and Transplantation team is committed to reducing the risk of readmission for heart failure patients who have been hospitalized at The Mount Sinai Hospital. Prior to discharge, patients meet with a physician, nutritionist, social worker, and nurse educator. Patients are given detailed instructions to seek medical attention when

they develop signs of worsening heart function such as weight gain, edema, fatigue and shortness of breath. Unfortunately, these signs occur late in the development of decompensated heart failure and provide little time to react and avoid hospitalization.

Today, our heart center is among the first to adopt a new tool to help reduce readmissions and improve quality of life for heart failure patients. The CardioMEMS™ HF System is an implantable device that has been FDA-approved for patients with New York Heart Association Class III heart failure who have been hospitalized during the past year. The device measures pulmonary artery pressure—an early indicator of heart failure decompensation—with a battery-less, dime-sized sensor. In the CHAMPION clinical trial, heart failure patients who were randomized to receive

Target location for pulmonary artery pressure sensor

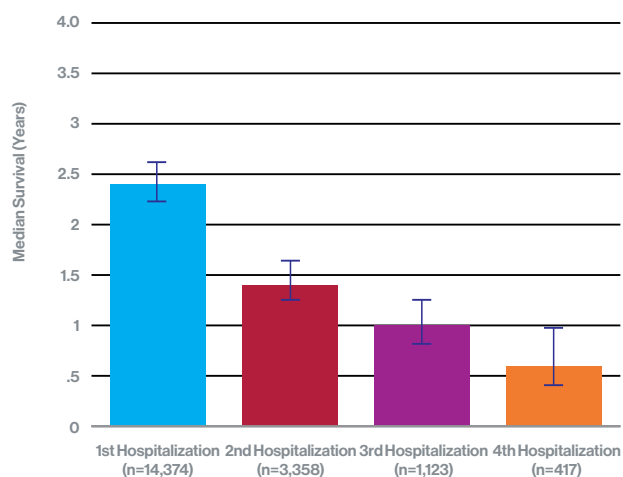
The pulmonary artery pressure sensor is implanted via a right heart catheterization procedure via femoral vein approach.



the CardioMEMS device had 37 percent fewer readmissions compared with a control group. The study also showed improvements in quality of life for patients who were monitored with the device. The device was shown to benefit patients with both reduced and preserved ventricular function.

The device is percutaneously placed in the distal branch of the pulmonary artery, using a catheter that is advanced through the femoral vein. The patient is instructed to take daily pressure readings from home using an external measurement system that wirelessly transmits the data to our office. Information about the patient's pulmonary artery systolic, diastolic and mean pressures is available for clinicians to review and trend on a secure website. This allows us to closely monitor for increases in pulmonary artery pressures, which is an early sign of worsening heart failure that can be detected before symptoms arise. Our medical team can provide proactive, individualized treatment without waiting for the onset of symptoms or a quarterly visit to the physician's office. We work closely with referring physicians to ensure that they, too, have the latest information when a patient's condition worsens, precipitating a change in the treatment plan. In this manner, we are able to offer our heart failure patients highly individualized, up-to-the-minute care that may translate into better quality of life and fewer readmissions.

**Mortality and HF Hospitalization**



**PATIENT:** Sheena Bellinger, age 59

**DIAGNOSIS:** Chronic heart failure

**TREATMENT:** Implantation of CardioMEMS™ HF system to monitor heart rate and pulmonary artery pressure

“It’s reassuring to know that my doctor can see what’s going on with my heart and can tell me if I need to come to the hospital.”

“Before I was treated by Dr. Bietry, I had been going to the hospital every two weeks because of my heart failure symptoms. I had shortness of breath and fluid around my heart. I could barely walk less than a half a block. The last time I was hospitalized, I was in for a whole month. I am on a waiting list for a heart transplant, but Dr. Bietry thought I would be a good candidate for a new heart monitor that would allow him to check my heart condition without bringing me back to the hospital. He thought this could buy me some time while I was on the wait list. I hadn’t heard of anyone else getting this device, but Dr. Bietry said a couple of his patients had it. I said that if it could work for me, sure, I’ll go ahead and get it. I didn’t enjoy going to the hospital every couple of weeks.

“The procedure went very well and I don’t feel the device at all. Every morning, I lay on a special pillow that sends information from the device to Mount Sinai, and the doctors there can monitor my condition. The pillow tells me when the data has gone through to the doctor’s office. If there’s a problem with the machine, I can call a technician and they tell me how to fix it.

“I still have follow-up appointments every two months, and the doctor uses information from the machine to decide whether or not to adjust my medications.

“I was very pleased when Dr. Bietry introduced me to this little gadget. It’s reassuring to know that my doctor can see what’s going on with my heart and can tell me if I need to come to the hospital. I’ve been out of the hospital for two months since I got this procedure.”

## Key Points

- Recent studies show that catheter insertion via the radial artery (in the wrist) prior to percutaneous coronary intervention (PCI) is winning favor from an increasing number of physicians.
- Data from the RIVAL and MATRIX trials demonstrate that, in certain patient subgroups, radial access resulted in fewer adverse outcomes, such as heart attack and death, than femoral artery (located in the groin) access.
- The European Society of Cardiology recently endorsed a “radial first” approach for PCI and gave a Class 1A recommendation for radial PCI in the ACS.
- Although formal guidelines do not yet exist in the US, Mount Sinai Heart expects to be at the forefront of the transradial approach trend with ongoing technological improvements and training.

# Radial Access for Percutaneous Coronary Interventions



Nitin Barman, MD

Catheter insertion via the femoral artery (located in the groin) prior to percutaneous coronary intervention (PCI) remains the norm in the United States. But in light of evidence from recent studies, insertion via the radial artery (in the wrist) is beginning to win favor from an increasing number of physicians.

Although smaller than the femoral artery, the radial artery is relatively superficial and has few important nerves running alongside it. This combination of factors makes radial insertion more comfortable for most patients than femoral insertion. In addition, radial insertion does not require patients to remain on bedrest and allows for immediate post-procedural mobility, offering a quality-of-life advantage compared with femoral access.

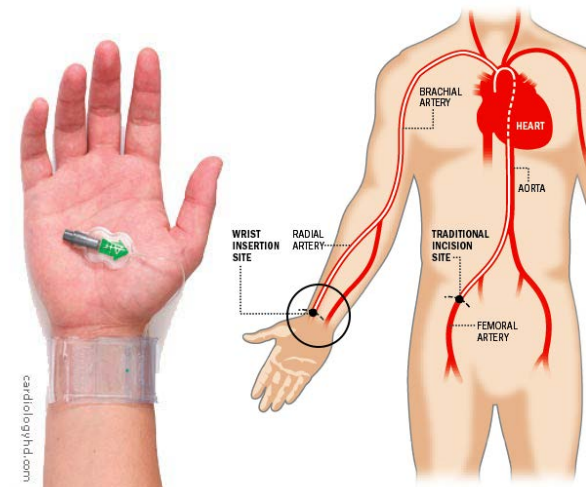
In the RIVAL (Radial vs femoral access for PCI) Trial, more than 7,000 patients with acute coronary syndrome were randomized to PCI using either the transradial or transfemoral approach. Both groups had similar rates of death, myocardial infarction and stroke, although radial access was associated with fewer vascular complications. In addition, 90 percent of patients in this group reported a preference for transradial catheter insertion should they need another procedure in the future.

Another large, randomized trial known as MATRIX (Minimizing adverse hemorrhagic events by transradial access site and systemic implementation of angiox), compared radial and femoral access in patients with ACS (acute coronary syndrome), including those with STEMI (ST elevation and myocardial infarction) and non-STEMI patients. There was a reduced rate of major cardiovascular events and bleeding in the radial group. A large meta-analyses of randomized trials, including both

MATRIX and RIVAL data, demonstrated that, in certain patient subgroups, radial access resulted in fewer adverse outcomes, such as heart attack and death.

Based on these overwhelmingly positive data, the European Society of Cardiology recently endorsed a “radial first” approach to performing PCI in patients, including recommendations for physician training and patient selection. They also gave a Class 1A recommendation (strongest possible) to radial access for acute coronary syndrome.

Although formal guidelines do not yet exist in the United States, the National Cardiovascular Data Registry’s CathPCI Registry reported that 16 percent of PCI procedures were performed using the transradial approach in 2014, up from 4 percent in 2010. With ongoing technological improvements and efforts to ensure that all of our interventional cardiologists are trained in this technique, Mount Sinai Heart expects to be at the forefront of this important trend.



# Real-World Antiplatelet Strategies



Roxana Mehran, MD

In 2011, the American Heart Association recommended prescribing dual antiplatelet therapy (DAPT), including aspirin and a platelet-aggregation inhibitor such as clopidogrel (Plavix®), for at least a year after percutaneous placement of a coronary drug-eluting stent. The guidelines, based on evidence using the first generation of drug-eluting stents, were intended to prevent stent thrombosis—the formation of blood clots around a coronary stent—and reduce the risk of major adverse cardiac events such as heart attack and stroke.

Recently, however, studies have demonstrated that discontinuing DAPT therapy after a few weeks did not increase the risk of thrombosis and related cardiac events with the newest generation of drug-eluting stents. Furthermore, there is no clear guidance on the appropriate medical therapy for patients with atrial fibrillation, a common comorbidity in patients who undergo a percutaneous coronary intervention (PCI), after stent placement. Adding an anticoagulant such as warfarin (Coumadin)—the standard of care for patients with atrial fibrillation—to DAPT increases the medication burden for patients as well as the risk of bleeding complications for patients who may require non-vascular medical procedures. In addition, opinions vary about how to balance bleeding and ischemic risk in patients with other comorbid conditions, including diabetes and chronic kidney disease.

Mount Sinai Heart is leading two large international studies that will address these important issues and, hopefully, encourage medical therapy after PCI to reflect these real-world conditions.

This year, our investigators launched the TWILIGHT study to compare the safety and efficacy of ticagrelor (Brilinta®) alone and DAPT with aspirin and ticagrelor in patients who are at high risk for stent thrombosis. The study, which is the first of its kind to evaluate the role of DAPT in this population, will enroll 9,000 patients in up to 100 medical centers in the United States, Canada and Europe. Participants will be randomized to continue on DAPT or ticagrelor plus a placebo for another 12 months. The study will determine the impact of these medication regimens on major bleeding complications and ischemic events.

The AVIATOR 2 study, which will be launched in the coming months, will compare the safety and efficacy of different antiplatelet strategies—DAPT alone or DAPT with an anticoagulant such as warfarin (Coumadin)—in 2,500 patients with atrial fibrillation who have undergone PCI. Clinical endpoints will include death, non-fatal myocardial infarction, stroke, stent thrombosis, target lesion revascularization and major bleeding. Investigators will use a smartphone-based tool to evaluate the factors affecting the selection of a particular medical regimen, patient adherence to the regimen and the relationship between adherence and outcomes.

As the trials get underway, we hope to capture data that enables us to identify a more patient-centered, individualized approach to providing percutaneous coronary interventions. Our hope is that these studies will help clinicians better understand how to balance the risk of bleeding and ischemic events in real-world patients with a variety of risk factors who undergo PCI.

## Key Points

- After percutaneous placement of a coronary drug-eluting stent, the American Heart Association recommended a year of dual antiplatelet therapy (DAPT) to prevent stent thrombosis—the formation of blood clots around a coronary stent—and reduce the risk of heart attack or stroke.
- Mount Sinai Heart is leading two large international studies to address this recommendation, taking into account the bleeding and ischemic risk with comorbid conditions, as well as patient medication burden.
- The TWILIGHT study and AVIATOR 2 studies hope to capture data to help identify a more patient-centered, individualized approach to providing percutaneous coronary interventions.



## Key Points

- Varicose veins are very common, affecting 30 million patients.
- Only a small percentage of patients seek and receive treatment for varicose veins.
- Diagnosis and treatment are easy, and can be performed in an outpatient setting.
- Mount Sinai Heart employs the latest imaging and treatment modalities to ensure safe and effective treatment for varicose veins.

# 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 more common than coronary artery disease—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 they 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 thermal endovenous ablation to treat varicose veins. In thermal ablation, laser energy or high-

frequency radiowaves are delivered to the vein via a catheter. The energy superheats the affected vein and closes it off, redirecting blood flow to healthy veins. We use Doppler ultrasound to locate the vein and guide placement of the catheter, which is inserted using only local anesthesia. Endovenous thermal ablation is performed on a completely outpatient basis and is completed in 15-20 minutes. The patient is able to walk home immediately after the procedure. Surveillance venous ultrasound is performed at defined intervals as part of follow-up.

Both laser and radiofrequency thermal ablation methods are 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.

ClariVein® is a newer treatment option for patients with varicose veins. This method uses a specialized catheter with a rotating tip to scrape the inner lining of the wall of the vein before injecting a gel-based solution to destroy the vein tissue and close it off. Although the procedure causes none of the swelling and inflammation associated with thermal ablation, it is not always covered by insurance.

# Common Synergism Between Chronic Kidney and Cardiovascular Diseases



Usman Baber, MD

Renal dysfunction, or chronic kidney disease (CKD), is a very common and morbid medical condition that affects millions of Americans with substantial public health and economic implications. While most individuals with CKD are understandably concerned about deteriorating renal function or the need for dialysis, the vast majority of these patients are at much higher risk for a major cardiovascular event, such as myocardial infarction, compared to progressive renal loss. As a result, it is imperative that medical care for such patients involves a multidisciplinary approach that includes collaboration between cardiologists and nephrologists.

This collaborative spirit also extends to research activities conducted at Mount Sinai Heart to better understand the cardiovascular pathology in these patients in an effort to devise better preventive and treatment approaches. As an example, investigators from The Mount Sinai Hospital Cardiac Catheterization Laboratory, working in concert with basic scientists and clinical nephrologists, studied the relationship between platelet function and renal disease among patients undergoing stent implantation. These results highlighted, for the first time, a synergism between underlying renal disease and diabetes mellitus on platelet reactivity, opening the pathway for possible

future investigative efforts. In a separate study, we were able to show that thrombus formation in CKD patients is more rapid compared to those without renal dysfunction, suggesting that coagulation pathways are fundamentally altered in this patient population.

The need for developing an evidence base to understand and, ultimately, improve the treatment of patients with CKD is further highlighted by the fact that such patients are usually excluded from major clinical trials in cardiovascular medicine. This truly represents a missed opportunity as up to 30-40 percent of patients with cardiovascular disease also have underlying renal dysfunction. While the physiologic connections between the renal and cardiovascular systems have long been appreciated, it is only very recently that we have begun to appreciate the existence of a true “cardio-renal” pathology that requires dedicated study and attention. We embrace this challenge at The Mount Sinai Hospital, both from a clinical and investigative perspective, and hope to improve the care and outcomes of the many individuals with both renal and cardiovascular conditions.

## Key Points

- Patients with chronic kidney disease (CKD) have a high risk for a major cardiovascular event, making collaborative medical care between cardiologists and nephrologists imperative.
- Collaborative research at The Mount Sinai Hospital inspires future investigative efforts, with a study that highlights the relationship between renal disease and diabetes mellitus, as well as a study that shows altered coagulation pathways and rapid thrombus formation in CKD patients.
- Up to 30-40 percent of patients with cardiovascular disease also have underlying renal dysfunction, and we embrace the challenge to further study “cardio-renal” pathology to improve the treatment of patients with CKD.

# Research and Clinical Trials

In addition to unprecedented clinical success, The Mount Sinai Hospital Cardiac Catheterization Laboratory leads the field of Interventional Cardiology by conducting its own investigator-initiated trials and in participating in numerous multi-center trials. The most important research developments of 2015 are the CoreValve® TAVR and Yellow Trial involving multimodality imaging. Also, key scientific publications on various interventional outcomes/results from our huge interventional database repository of over 42,000 PCI patients since 2000 and over 600 patients in the multimodality imaging database since 2012 continue to advance the field of Interventional Cardiology in a safe and progressive manner.

## Top Ten Major Publications:

**1.** A simplified approach to bifurcation lesions in medium-to-large size vessels: Simultaneous kissing stents (SKS) technique. *Am J Cardiol* 94: 913, 2004. Also SKS-DES in large bifurcation lesions. Sharma S, Ahsan C, Lee J, Kim M, Fisher E, Steinhamer A, Kini A. *Cathet Cardiovasc Interv* 65:10, 2005.

**Clinical Implications:** There are various techniques for PCI of large bifurcation coronary lesions but none of them is perfect. We invented a simplified bifurcation technique of placing two stents side-by-side with excellent short-term outcomes and lower restenosis (<5 percent) at 15 months of follow-up.

**2.** Changing outcomes and treatment strategies for wire induced coronary perforations in the era of bivalirudin use. Kini A, Rafael O, Sarkar K, Rajdev S, Jakkula M, Mares A, Kaplish D, Krishnan P, Kim M, Sharma S. *Cathet Cardiovasc Intervent* 74:700, 2009.

**Clinical Implications:** This publication challenges the common practice of deferring bivalirudine use in cases of potential coronary perforation (largely due to lack of an antidote). Our systematic analysis showed that guidewire induced coronary perforation if occurs with bivalirudin use had benign course compared to occurring with heparin. This can simply be explained on the basis of short bivalirudin half-life.

**3.** Outcomes of Patients Discharged the Same Day Following Percutaneous Coronary Intervention. Patel M, Kim M, Karajgikar R, Kodali V, Kaplish D, Lee P, Moreno P, Krishnan P, Sharma S, Kini A; *J Am Coll Cardiol Intv*, 3:851, 2011.

**Clinical Implications:** This largest series of same day discharge of PCI patients (n=2400) provided the system process for safe discharge of selected PCI patients with extremely low (<1 percent) major or minor cardiovascular and bleeding events at 30 days.

**4.** Changes in Plaque Lipid Content After Short-Term Intensive Versus Standard Statin Therapy/ The YELLOW Trial (Reduction in Yellow Plaque by Aggressive Lipid-Lowering Therapy). Kini A, Baber U, Kovacic J, Limaye A, Ziad A, Sweeny J, Maehara A, Mehran R, Dangas G, Mintz G, Fuster V, Narula J, Sharma S, Moreno P. *J Am Coll Cardiol* 62:21, 2013.

**Clinical Implications:** This is the first study to show reduction in lipid content in the plaque as measured by near-infrared spectroscopy by high dose statin in the living patients. This observation has now led to two other trials in this field of lipid imaging.

**5.** Cessation of dual antiplatelet treatment and cardiac events after percutaneous coronary intervention (PARIS): 2 year results from a prospective observational study. Mehran R, Baber U, Steg P, Ariti C, Weisz G, Witzenbichler B, Henry T, Kini A, Stuckey T, Cohen D, Berger P, Iakovou I, Dangas G, Waksman R, Antoniucci D, Sartori S, Krucoff M, Hermiller J, Shawl F, Gibson C, Chieffo A, Alu M, Moliterno D, Colombo A, Pocock S. *Lancet* 382: 1714, 2013.

**Clinical Implications:** This study showed that brief interruption of dual antiplatelet therapy done by the physician did not increase the chances of stent thrombosis, while unsupervised DAPT discontinuation is associated with high stent thrombosis and MACE rates.

**6. Effect of bivalirudin on aortic valve intervention outcomes (BRAVO) study: a two-centre registry study comparing bivalirudin and unfractionated heparin in balloon aortic valvuloplasty.** Kini A, Yu J, Cohen M, Mehran R, Baber U, Sartori S, Vlachojannis G, Kovacic J, Pyo R, O'Neill B, Singh V, Jacobs E, Poludasu S, Moreno P, Kim M, Krishnan P, Sharma S, Dangas G. *EuroIntervention* 10:3, 2014.

**Clinical Implications:** This study reported for the first time the superiority of bivalirudin over unfractionated heparin during balloon aortic valvuloplasty in reducing major bleeding and vascular complications. Hence one third to half bolus dose of bivalirudin has now become standard during the BAV procedure.

**7. Current Status of Rotational Atherectomy.** Tomey M, Kini A, Sharma S. *JACC Cardiovascular Intervention* 4:345, 2014.

**Clinical Implications:** This review article added the recent understanding of and use and outcomes of rotational atherectomy with heavily calcified lesions. This manuscript also summarized the updated techniques of rotablator and algorithm to manage the complex calcified lesions.

**8. Combined NIRS and IVUS imaging detects vulnerable plaque using a single catheter system: a head-to-head comparison with OCT.** Roleder T, Kovacic J, Ali Z, Sharma R, Cristea E, Moreno P, Sharma S, Narula J, Kini A. *EuroIntervention* 10:303, 2014.

**Clinical Implications:** Using OCT as the gold standard to define vulnerable plaque (TCFA: thin-cap fibroatheroma), positive remodeling, high plaque burden and greater lipid core burden on dual NIRS-IVUS imaging were the best predictions of TCFA. This novel finding has led to additional research work and publications in the field of imaging predictors of periprocedural MI.

**9. Clustering of acute and subacute stent thrombosis related to the introduction of generic clopidogrel.** Kovacic J, Mehran R, Sweeny J, Li J, Moreno P, Baber U, Krishnan P, Badimon J, Hulot J, Kini A, Sharma S. *J Cardiovasc Pharmacol Ther* 19:201, 2014.

**Clinical Implications:** This publication described the series of high risk PCI cases who developed stent thrombosis after the use of generic clopidogrel. Hence we should use potent antiplatelet agents (Brilinta® or Effient®) in high risk and ACS PCI cases.

**10. Preventing stenting in acute myocardial intervention.** Pollack A, King S, Handa R, Sharma S. *JACC Cardiovascular Intervention* 8:131, 2014.

**Clinical Implications:** This review article underscores the rationale of multivessel stenting rather than the culprit vessel PCI only in STEMI patients with multivessel CAD. This evolving approach is rapidly being adopted by many interventionalists involved in performing the STEMI intervention.



# Research and Clinical Trials

Study Title	Study Details	Sponsor	Principal Investigator(s)	Target Enrollment and Study Sites	Current Status/ Enrollment at MSH
ABSORB Trial	A Clinical Evaluation of Absorb™ BVS, the everolimus-eluting bioabsorbable vascular scaffold, in the treatment of subjects with <i>de novo</i> native coronary artery lesions.	Abbott Vascular	A. Kini	2,200 (USA) 120 Centers	Closed Enrollment/ 41 subjects enrolled
SURTAVI Trial	The purpose of the study is to investigate the safety and efficacy of transcatheter aortic valve implantation (TAVI) in patients with severe, symptomatic Aortic Stenosis (AS) at intermediate surgical risk by randomizing patients to either Surgical Aortic Valve Replacement (SAVR) or TAVI with the Medtronic CoreValve® System.	Cardiovascular Systems Inc.	S. Sharma	2,500 (USA) 75 Centers	Ongoing/ 26 subjects enrolled
YELLOW II Trial	Reduction in Coronary Yellow Plaque, Lipids and Vascular Inflammation by Aggressive Lipid Lowering.	AstraZeneca	A. Kini	80 (USA) 1 Center	Ongoing/ 62 subjects enrolled
MACE Trial	Multicenter Perspective Study to Evaluate Outcomes of Moderate to Severely Calcified Coronary Lesions.	Cardiovascular Systems Inc.	S. Sharma	350 (USA) 40 Centers	Ongoing/ 37 subjects enrolled
COAPT Trial	The purpose of the Cardiovascular Outcomes Assessment of the MitraClip® Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation (COAPT) Trial is to confirm the safety and effectiveness of the MitraClip® System for the treatment of moderate-to-severe or severe functional mitral regurgitation (FMR) in Symptomatic Heart Failure Subjects.	Abbott Vascular	S. Sharma	430 (USA) 52 Centers	Ongoing/ 1 subject enrolled

Study Title	Study Details	Sponsor	Principal Investigator(s)	Target Enrollment and Study Sites	Current Status/ Enrollment at MSH
Renal Guard Trial	A study to evaluate RenalGuard System Safety & Efficiency When Compared With Standard Care in the Prevention of Contrast Induced Nephropathy (CIN) in the setting of a Catheterization Laboratory.	PLC Medical Systems	G. Dangas	326 (USA) 20 centers	Ongoing/ 27 subjects enrolled
AVERT TRIAL	A prospective, randomized, parallel group, multi-center clinical evaluation to assess the AVERT™ System device for contrast volume reduction and incidence of CIN	OSPREY Medical	G. Dangas	578 (USA) 37 Centers	Closed Enrollment/ 27 subjects enrolled
ILLUMENATE Trial	Prospective, Randomized, Multicenter, Single-Blind Study for the Treatment of Subjects Presenting with De Novo Occluded/Stenotic or Re-occluded/ Restenotic Lesions of the Superficial Femoral or Popliteal Arteries using a Paclitaxel-Coated or Bare Percutaneous Transluminal Angioplasty Balloon Catheter.	CV Ingenuity Corporation	J. Wiley	360 (USA) 45 Centers	Ongoing/ 37 subjects enrolled
Ischemia Trial	International Study of Comparative Health Effectiveness with Medical versus Invasive Approaches	NHLBI	J. Sweeny	8,000 (Global) 400 Centers	Ongoing/ 4 subjects enrolled
COAST Trial	Multi-center prospective global study designed to evaluate performance of the Diamondback 360® Coronary Micro Crown Orbital Atherectomy System in treating de novo, severely calcified lesions.	Cardiovascular Systems Inc.	S. Sharma	100 (Global) 12 Centers	Ongoing/ 12 subjects enrolled

#### Conflicts of Interest

Samin K. Sharma, MD - Abbott Vascular Inc., ABIOMED Inc., Boston Scientific Corporation, Cardiovascular Systems Inc., TriReme

Annapoorna S. Kini, MD - None

George Dangas, MD - Abbott Vascular Inc., Boston Scientific Corporation, Medtronic

Jose Wiley, MD - None

Joseph Sweeny, MD - None

## FULL-TIME SENIOR ATTENDINGS



### **Samin K. Sharma, MD, FACC, FSCAI**

**Director, Clinical and Interventional Cardiology**

**President, Mount Sinai Heart Network**

**Dean of International Clinical Affiliations**

**Zena and Michael A. Wiener Professor of Medicine (Cardiology)**

#### **Education and Training**

- MBBS: SMS Medical College Jaipur, India
- Residency, Internal Medicine: NY Infirmary; Beekman Downtown Hospital, NY
- Fellowship, Cardiology: City Hospital Center at Elmhurst, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

Samin K. Sharma, MD, is an interventional cardiology expert, well known for performing high risk complex coronary interventions with an extremely high success rate (>99 percent) while achieving an extremely low complication rate (<0.5 percent major complication). He has received the prestigious two star designation (significantly lower than expected mortality) numerous times by the NY 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 since 2004. 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 magazine 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*, *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)*, *2010 Association of Indians in America (AIA) for excellence in Medicine, 2003-2007 and 2010-2015 Best Doctors by New York Magazine*, *2008-2015 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 210 papers and 13 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 as 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.

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#### **Clinical Interests:**

**Coronary Artery Disease**

**Interventional Cardiology**

**Valvular Intervention**

# Annapoorna S. Kini, MD, MRCP, FACC

**Director, Cardiac Catheterization Laboratory**  
**Professor of Medicine (Cardiology)**  
**Director, Interventional Cardiology Fellowship**

## Education and Training

- MBBS: Kasturba Medical College Mangalore, India
- Residency, Medicine/Cardiology: University of Wales Cardiology, UK
- Fellowship, Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

Annapoorna Kini, MD, performs over 1,000 coronary interventions annually (the highest number by a female interventionalist in the United States) with an extremely low complication rate of <0.3 percent. According to the New York State Department of Health Report for 2004-2006, 2005-2007, 2009-2011 and 2010-2012, Dr. Kini received the two star status for percutaneous coronary intervention (PCI) safety amongst >500 other Interventionalists. She is highly regarded for performing complex coronary interventions, especially in chronic total occlusions for patients with advanced heart disease, with the utmost safety and excellent long-term results. She is also a national expert in various intracoronary imaging modalities such as optical coherence tomography and near-infrared spectroscopy. Dr. Kini also specializes in the noncoronary interventions of mitral and aortic balloon valvuloplasty, alcohol septal ablation for obstructive hypertrophic cardiomyopathy and catheter-based aortic valve implantations. Besides being a superb interventionalist, Dr. Kini is an excellent teacher, educating both cardiology and interventional fellows on various aspects of cardiac catheterization and coronary interventional techniques. As Director, she has taken a leadership role in enhancing the research programs of The Mount Sinai Cardiac Catheterization Laboratory. Several projects in coronary imaging are currently under way, including the YELLOW Trial and various YELLOW substudies. Dr. Kini is also the lead enroller for several multicenter national clinical studies, including the Tryton Side Branch Stent study, Color Registry and the Expert CTO trial. She has played a key role in educating interventionalists globally in the technical aspects of complex coronary interventions via monthly webcasts on [www.ccclivecases.org](http://www.ccclivecases.org) and [www.structuralheartlivecases.org](http://www.structuralheartlivecases.org).

In 2011, Dr. Kini received the "Rock Star of Science" award from the American Heart Association. She is the recipient of 2011 Dean's Award for Excellence in Clinical Medicine at the The Mount Sinai Hospital for unprecedented clinical skills. She was listed as a *New York Times Magazine* Super Doctor every year since 2009.



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**Clinical Interests:**  
Intravascular Imaging  
Interventional Cardiology: CTO  
Hypertrophic Obstructive Cardiomyopathy





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**Clinical Interests:**

Coronary Artery Disease  
Interventional Cardiology  
Plaque Imaging



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**Clinical Interests:**

Interventional Cardiology  
Peripheral Artery Disease  
Endovascular Intervention

## Pedro R. Moreno, MD, FACC

**Professor of Medicine (Cardiology)**

**Director, Translational Research, Cardiac Catheterization Laboratory**

### Education and Training

- MBBS: Universidad Javeriana, Bogota
- Residency, Internal Medicine: Brigham and Women's Hospital
- Fellowship, Cardiology: Massachusetts General Hospital
- Fellowship, Interventional Cardiology: Massachusetts General Hospital

Pedro R. Moreno, MD, is a world-renowned expert in atherosclerosis and a pioneer in the understanding of inflammation and acute coronary syndromes. His groundbreaking work with atherosclerotic neovascularization, intraplaque hemorrhage, the role of macrophages and tissue factor in patients with acute coronary syndromes has greatly enhanced the body of knowledge in this emerging area of cardiology. These findings provided the rationale for revolutionary state-of-the-art therapies including anti-inflammatory and anti-proliferative drug-eluting stents used worldwide. His research using near-infrared spectroscopy was pivotal in the development of the now-ubiquitous LipiScan catheter. He is board certified in cardiology and interventional cardiology and committed to teaching around the world, with professorships in multiple international organizations. Dr. Moreno works to improve cardiovascular health in the Latino community of New York, with extensive clinical work and educational media interviews. As an interventionalist, Dr. Moreno performs more than 500 procedures with less than 1 percent major complications. For this, Dr. Moreno was awarded the two-star safety award by the New York State Department of Health in 2013.

## Prakash Krishnan, MD, FACC

**Assistant Professor of Medicine (Cardiology)**

**Director of Endovascular Services**

### Education and Training

- MBBS: Rajah Muthiah Medical College, Chidambaram, Tamil Nadu, India
- Residency, Internal Medicine: St. Vincent's Medical Center of Richmond, New York, NY
- Fellowship, Cardiology: Ochsner Clinic Foundation, New Orleans, LA
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Endovascular Intervention: North Central Heart Institute, Sioux Falls, SD

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 nonsurgical 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 diseases at offices in all five boroughs. He is the Director of the Endovascular Intervention Fellowship in the Cardiac Catheterization Laboratory and has been educating interventionalists globally via various live satellite transmissions within national and international meetings and with the monthly webcast showcased at [www.peripheralinterventions.org](http://www.peripheralinterventions.org). He is the current Co-National Primary investigator in the ILLUMINATE Trial, a multicenter randomized control study evaluating the safety and efficacy of the Stellarex drug coated balloon in femoro-popliteal lesions. 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 in 2016. He has authored numerous peer-reviewed articles and book chapters on peripheral arterial disease and is the Co-Director of the annual Live Symposium of Complex Coronary and Vascular Cases, an Icahn School of Medicine at Mount Sinai and Cardiovascular Institute-supported program, and Director of Mount Sinai's Peripheral Interventions Live webcast.

# George Dangas, MD, PhD, FACC, FSCAI

Professor of Medicine (Cardiology)

Professor of Surgery (Vascular)

Director, Cardiovascular Innovation

## Education and Training

- MD, PhD: National Kapodistrian University of Athens, Greece
- DHM: Naval School of Hyperbaric Medicine, Hellenic Navy, Athens
- Residency, Internal Medicine: Miriam Hospital, Brown University, Providence, RI
- Fellowship, Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

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 has been 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.

# Roxana Mehran, MD, FACC, FACP, FCCP, FESC, FAHA, FSCAI

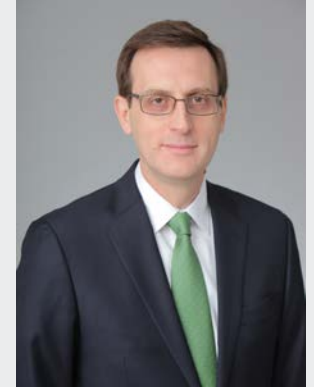
Professor of Medicine (Evidence and Health Policy)

Director, Interventional Cardiovascular Research and Clinical Trials

## Education and Training

- MD: St. George's University School of Medicine, Grenada, WI
- Residency, Internal Medicine: University of Connecticut
- Fellowship, Cardiovascular Disease: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

Roxana Mehran, MD, is internationally recognized for her work as a clinical trial specialist with complex data analyses. Her research interests expand from mechanisms of restenosis to treatment and prevention of acute kidney injury in cardiac patients, outcomes research, and advancing pharmacologic and interventional treatments for acute coronary syndromes and acute myocardial infarction. In addition to founding a highly regarded academic research organization at the Cardiovascular Research Foundation, she is a widely published author and is the most sought-out speaker at national and international scientific conferences. She has served as course co-director of the annual Transcatheter Cardiovascular Therapeutics (TCT) conference for the last 15 years. Dr. Mehran is a member of the editorial board of multiple peer-reviewed journals and has served on the Board of Trustees of SCAI, the program committee of the AHA Scientific Sessions, and the writing committee of the ACC/AHA PCI guidelines. She is a member of the Board of Directors for Harboring Hearts, and the program chair for the Society of Cardiac Angiography and Interventions Women in Innovations (SCAI- WIN) Initiative. Dr. Mehran is a practicing interventional cardiologist and is active in the teaching program of Cardiology at the Icahn School of Medicine at Mount Sinai.



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**Clinical Interests:**  
Interventional Cardiology  
Valvular Heart Disease  
Endovascular Intervention



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**Clinical Interests:**  
Restenosis Prevention  
Contrast-Induced Acute  
Kidney Injury (AKI)  
Cardiovascular Disease in Women

## FULL-TIME ATTENDINGS

### Sean P. Pinney, MD, FACC

Associate Professor of Medicine (Cardiology)

Director, Advanced Heart Failure and Cardiac Transplant Program

#### Education and Training

- MD: Georgetown University School of Medicine
- Residency, Internal Medicine: Beth Israel Deaconess Medical Center, Boston
- Fellowship, Cardiology: Columbia-Presbyterian Medical Center

Sean Pinney, MD, is a well-known cardiologist specializing in the management of patients with advanced heart failure. Together with cardiothoracic surgeon Anelechi Anyanwu, MD, Dr. Pinney established The Mount Sinai Hospital's ventricular assist device program, which offers a broad array of temporary and implantable devices for patients with cardiac failure. Under his leadership, the Heart Transplant Program at The Mount Sinai Hospital has increased its clinical volume and improved patient outcomes. He has been recognized by his peers and Castle Connolly as being one of New York's best doctors. Dr. Pinney is an active clinical researcher who has led both NIH- and industry-sponsored trials in the areas of cardiac transplantation and mechanical circulatory support. He serves on the American College of Cardiology Heart Failure and Transplant Committee, the United Network for Organ Sharing (UNOS) MPSC Committee, and the medical advisory board for the New York Organ Donor Network.



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#### Clinical Interests:

Cardiac Catheterization  
Cardiac Transplantation  
Heart Failure



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#### Clinical Interests:

Pediatric Catheterization  
and Intervention  
Adult Congenital Heart Disease

### Barry A. Love, MD, FSCAI

Assistant Professor of Pediatrics and Medicine

Director, Congenital Cardiac Catheterization Laboratory

#### Education and Training

- MD: University of Western Ontario
- Residency, Pediatrics: McGill University Medical Center
- Fellowship: Children's Hospital Boston

Barry Love, MD, is Director of the Congenital Cardiac Catheterization Laboratory at Mount Sinai Heart. Dr. Love holds a joint appointment in both the Department of Pediatrics and the Department of Medicine and is one of only a few physicians who perform interventional procedures on patients with congenital heart disease from infancy through adulthood. He has been a pioneer in extending many of the techniques used in the treatment of congenital heart disease to acquired heart lesions in adults such as perivalvular leaks and post-infarction ventricular septal defects. He has been recognized by Castle Connolly as one of America's Top Doctors and is listed as a New York Times Magazine Super Doctor. Dr. Love's research interest is in new device technologies and he is a principal investigator for several device trials in congenital heart disease.

# Joseph M. Sweeny, MD, FACC

Assistant Professor of Medicine (Cardiology)

## Education and Training

- MD: Georgetown University School of Medicine, Washington, DC
- Residency: Hospital of the University of Pennsylvania, Philadelphia, PA
- Fellowship, Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

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.



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**Clinical Interests:**  
Acute Myocardial Infarction  
Fellows Education  
Coronary Intervention





## FULL-TIME AFFILIATE ATTENDINGS (LISTED ALPHABETICALLY)



### Farah E. Atallah-Lajam, MD

Associate Clinical Professor of Medicine (Cardiology)

#### Education and Training

- MD: Universidad Autonoma De Santo Domingo, Santo Domingo
- Residency, Internal Medicine: Elmhurst Hospital
- Fellowship, Cardiology: Brooklyn Hospital Center
- Fellowship, Cardiac Catheterization, Nuclear Cardiology: Lenox Hill Hospital, NY

**Clinical Interests:** Clinical Cardiology, Cardiac Catheterization, Coronary Interventions, Nuclear Cardiology

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### Usman Baber, MD, MS

Assistant Professor of Medicine (Cardiology)

#### Education and Training

- MD: University of Texas Southwestern Medical Center, Dallas, TX
- MS: Columbia University, NY
- Residency, Internal Medicine: Parkland Memorial Hospital, Dallas, TX
- Fellowship, Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

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

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### Jeffrey Bander, MD

Assistant Professor of Medicine (Cardiology)

#### Education and Training

- MD: Harvard Medical School
- Residency: Columbia Presbyterian Medical Center, NY
- Fellowship, Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Clinical Cardiology, Cardiac Catheterization, Coronary Interventions

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### Nitin Barman, MD

Associate Professor of Medicine (Cardiology)

#### Education and Training

- MD: University of Chicago
- Residency, Internal Medicine: University of California, San Francisco
- Fellowship, Cardiology: Cleveland Clinic Foundation
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Transradial Coronary Angiography and Intervention, Complex Coronary Artery Disease, Treatment of Acute Myocardial Infarction, Peripheral Artery Disease Intervention, Transcatheter Aortic Valve Replacement

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## Michael J. Domanski, MD

Professor of Medicine

Director, Heart Failure Research

Director, Inpatient Heart Failure Program

### Education and Training

- MD: University of Maryland School of Medicine
- Residency, Internal Medicine: Pennsylvania State University of School of Medicine
- Fellowship, Cardiology: Vanderbilt University School of Medicine

**Clinical Interests:** Clinical Cardiology, Cardiac Catheterization, Coronary Interventions

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## Srinivas Duvvuri, MD

Associate Professor of Medicine (Cardiology)

### Education and Training

- MD: University of the West Indies Faculty of Medical Sciences
- Residency, Internal Medicine: Howard University
- Fellowship, Cardiovascular Disease: UMDNJ-New Jersey Medical School
- Fellowship, Cardiovascular Disease: Mount Sinai School of Medicine

**Clinical Interests:** General Cardiology, Interventional Cardiology

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## Lynne Glasser, MD

Assistant Professor of Medicine (Cardiology)

Director, Interventional Inpatient Service

### Education and Training

- MD: SUNY Downstate Medical Center, NY
- Residency, Internal Medicine: New York University Medical Center
- Fellowship, Cardiology: Manhattan Veterans Administration Medical Center

**Clinical Interests:** Clinical Cardiology, Preventive 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.

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## Radha Gopalan, MD

Associate Professor of Medicine (Cardiology)

### Education and Training

- MD: St. George's University
- Residency, Internal Medicine: Beth Israel Medical Center (Newark)
- Fellowship, Cardiovascular Disease: Cooper Hospital-Univ. Med. Center
- Fellowship, Heart Failure & Cardiac Transplant: Hahnemann University Hospital
- Fellowship, Electrophysiology/Cardiology: Hahnemann University Hospital

**Clinical Interests:** Clinical Cardiology, Cardiac Catheterization, Coronary Interventions

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## Vishal Kapur, MD

Assistant Professor of Medicine (Cardiology)  
Assistant Director of Endovascular Interventions

### Education and Training

- MD: University College of Medical Sciences, University of Delhi, India
- Residency: University of Texas Medical Branch
- Fellowship, Cardiology: Methodist DeBakey Heart & Vascular Center/UTMB, TX
- Fellowship, Interventional Cardiology: Columbia University Medical Center, NY
- Fellowship, Endovascular Medicine: Columbia University Medical Center, NY

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

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## Jason Kovacic, MD, PhD

Associate Professor of Medicine (Cardiology)

### Education and Training

- MD: University of Melbourne, Australia
- PhD: Victor Chang Cardiac Research Institute through University of New South Wales, Australia
- Residency, Internal Medicine: Prince of Wales Hospital, Sydney, Australia
- Fellowship, Cardiology: St. Vincent's Hospital, Sydney, Australia
- Fellowship, Vascular Biology: National Heart Lung and Blood Institute, National Institutes of Health
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Coronary Interventions, Clinical Cardiology, Vascular Biology, Atherosclerosis

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## Atul M. Limaye, MD, MRCP

Assistant Professor of Medicine (Cardiology)

### Education and Training

- MBBS: MAMC, University of Delhi, India
- Residency: Bronx Lebanon Hospital Center, NY
- Fellowship, Noninvasive Cardiology: Brigham & Women's Hospital, Boston
- Fellowship, Cardiology: Montefiore Medical Center, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Clinical Cardiology, Coronary Interventions, Peripheral Interventions

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## Jagat Narula, MD, PhD

Philip J. and Harriet L. Goodhart Professor of Medicine

Associate Dean for Global Health

Director, Cardiovascular Imaging Program

Director of Operations, Mount Sinai Heart Network

### Education and Training

- MD: SMS Medical School, India
- Fellowship [Cardiology, Heart Failure & Transplantation, Nuclear Cardiology]:  
Massachusetts General Hospital and Harvard Medical School

**Clinical Interests:** Noninvasive and Invasive Cardiovascular Imaging

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## Sameet Palkhiwala, MD

Assistant Clinical Professor of Medicine (Cardiology)  
Director of Cardiology, Mount Sinai Queens

### Education and Training

- MD: New York Medical College
- Residency, Internal Medicine: St. Luke's-Roosevelt Medical Center
- Fellowship, Cardiology: St. Vincent's Medical Center
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Clinical Cardiology, Endovascular Interventions, Coronary Interventions

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## William J. Schwartz, MD

Assistant Clinical Professor of Medicine (Cardiology)

### Education and Training

- MD: Albert Einstein College of Medicine, NY
- Residency, Internal Medicine: Bronx Municipal Hospital Center
- Fellowship, Cardiology: Bronx Municipal Hospital Center
- Fellowship, Cardiac Catheterization: New York University Medical Center

**Clinical Interests:** Clinical Cardiology, Noninvasive Cardiology, Cardiac Catheterization

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## Partho P. Sengupta, MD

Associate Professor of Medicine (Cardiology)  
Director, Interventional Echocardiography  
Director, Cardiac Ultrasound Research & Core Lab

### Education and Training

- MD: Government Medical College, Nagpur, India
- Residency: Mayo Clinic, Rochester, MN
- Fellowship, Cardiology: Mayo Clinic, Scottsdale, AZ
- Fellowship, Advanced Fellowship in Echocardiography: Mayo Brothers Distinguished
- Fellowship: Mayo Clinic School of Medicine, Rochester, MN

**Clinical Interests:** Structural Heart Imaging, Cardiac Muscle and Fluid Mechanics; Automated Imaging Algorithms

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## Joshua Shatzkes, MD

Assistant Professor of Medicine (Cardiology)

### Education and Training

- MD: SUNY Downstate Medical Center
- Residency, Internal Medicine: Yale-New Haven Hospital
- Fellowship, Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Cardiovascular Disease, Preventive Cardiology, Noninvasive Cardiovascular Imaging

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## Michael Alan G. Sicat, MD

Assistant Professor of Medicine (Cardiology)

### Education and Training

- MD: University of the East Ramon Magsaysay Memorial Med CTR, Quezon City, Philippines
- Residency: Staten Island University Hospital
- Fellowship: St Vincent Catholic Medical Center of NY - Staten Island Track

**Clinical Interests:** Clinical Cardiology, Cardiac Catheterization

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## Javed Suleman, MD

Associate Clinical Professor of Medicine (Cardiology)

### Education and Training

- MBBS: Sindh Medical College, Pakistan
- Residency, Internal Medicine: Salem Hospital
- Fellowship, Cardiology: Saint Vincent Hospital, Worcester, MA
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Clinical Cardiology, Cardiac Catheterization, Coronary Intervention, Primary PCI, Global Cardiac Disease Initiative

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## Christopher Varughese, MD

Clinical Instructor of Medicine (Cardiology)

### Education and Training

- MD: Howard University College of Medicine
- Residency, Internal Medicine: Montefiore Medical Center/Albert Einstein College of Medicine
- Fellowship, Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Atherectomy/Angioplasty of Non-coronary Vessel, Cardiac Catheterization, Coronary Angioplasty, Coronary Stenting, Heart Attack/Acute Coronary Syndrome, Peripheral Vascular Arterial and Venous Disease

**Phone: 718-204-7200 Email: christopher.varughese@mountsinai.org**

## PART-TIME ATTENDINGS (LISTED ALPHABETICALLY)

### George Fernaine, MD

Assistant Clinical Professor of Medicine (Cardiology)

#### Education and Training

- MD: SUNY Downstate Medical Center, NY
- Residency, Internal Medicine: St. Vincent's Hospital
- Fellowship, Cardiology: St. Vincent's Hospital
- Fellowship, Interventional Cardiology: Lenox Hill Hospital, NY

**Clinical Interests:** Clinical Cardiology, Coronary Interventions, Peripheral Interventions

**Phone:** 718-238-0098 **Email:** george.fernaine@mountsinai.org



### Karthik Gujja, MD

Clinical Instructor Medicine (Cardiology)

Assistant Director, Endovascular Interventions

#### Education and Training

- Internship, Internal Medicine: Long Island College Hospital
- Fellowship, Cardiology: Beth Israel Medical Center
- Fellowship, Interventional Cardiology: Beth Israel Medical Center
- Fellowship, Endovascular Intervention/Peripheral: The Mount Sinai Hospital, NY

**Clinical Interests:** Interventional Cardiology, Peripheral Artery Disease, Endovascular Intervention, Venous Interventions

**Phone:** 646-584-6460 **Email:** karthik.gujja@mountsinai.org



### Srinivas Kesanakurthy, MD

Assistant Clinical Professor of Medicine (Cardiology)

#### Education and Training

- MBBS: Rangaraya Medical College, Kakinada, India
- Residency: Lenox Hill Hospital, NY
- Fellowship, Cardiology: Lenox Hill Hospital, NY
- Fellowship, Interventional Cardiology: Lenox Hill Hospital, NY

**Clinical Interests:** Clinical Cardiology, Cardiac Catheterization, Coronary Interventions

**Phone:** 646-335-2795 **Email:** kesana@yahoo.com



### Robert A. Zaloom, MD

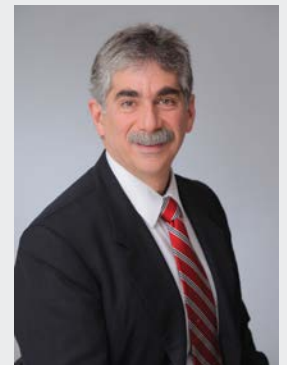
Assistant Clinical Professor of Medicine (Cardiology)

#### Education and Training

- MD: Ross University School of Medicine
- Residency, Internal Medicine: Lutheran Medical Center
- Fellowship, Cardiology: SUNY Downstate Medical Center, NY

**Clinical Interests:** Clinical Cardiology, Echocardiography, Cardiac Catheterization

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## VOLUNTARY ATTENDINGS (LISTED ALPHABETICALLY)



### **Dimitrios Bliagos, MD**

**Assistant Professor of Medicine (Cardiology)**

#### **Education and Training**

- MD: SUNY Stony Brook
- Internship/Residency: NY Presbyterian Columbia University Medical Center
- Fellowship, General Cardiology: Montefiore Medical Center
- Fellowship, Interventional Cardiology: NY Presbyterian Columbia University Medical Center
- Fellowship, Endovascular Intervention: NY Presbyterian Columbia University Medical Center

**Clinical Interests:** Clinical Cardiology, Coronary Intervention, Endovascular Intervention

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### **Alvaro Dominguez, MD**

**Adjunct Instructor Medicine (Cardiology)**

#### **Education and Training**

- MD: Facultad de Medicina-Universidad de la Republica
- Residency, Internal Medicine: Universidad de la Republica
- Residency, Internal Medicine: The Brooklyn Hospital Center
- Fellowship, Cardiology: The Brooklyn Hospital Center

**Clinical Interests:** Clinical Cardiology, Internal Cardiology

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### **Asim Hameedi, MD**

**Clinical Instructor of Medicine (Cardiology)**

#### **Education and Training**

- MD: SUNY Downstate Medical Center, NY
- Residency: Albert Einstein College of Medicine/Montefiore Medical Center, NY
- Fellowship, Cardiology: SUNY Downstate Medical Center, NY
- Fellowship, Interventional Cardiology: SUNY Downstate Medical Center, NY

**Clinical Interests:** Clinical Cardiology, Internal Cardiology

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### **Choudhury M. Hasan, MD**

**Assistant Clinical Professor of Medicine (Cardiology)**

#### **Education and Training**

- MBBS: Dhaka Medical College, Dhaka, Bangladesh
- Residency, Internal Medicine: Brooklyn Hospital Center
- Fellowship, Cardiology: Brooklyn Hospital Center
- Fellowship, Interventional Cardiology: Deborah Heart and Lung Center

**Clinical Interests:** Cardiac Catheterization, Coronary Interventions, Echocardiography

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## Timothy G. Jayasundera, MD

Clinical Instructor of Medicine (Cardiology)

### Education and Training

- MD: Ross University School of Medicine
- Residency: Georgetown University Medical Center
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Cardiology: Drexel Hahnemann University Hospital; Philadelphia, PA

**Clinical Interests:** Interventional Cardiology, Aspirin and Clopidogrel Resistance, Acute Coronary Syndromes

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## Johnny Lee, MD

Assistant Clinical Professor of Medicine (Cardiology)

### Education and Training

- MD: Mount Sinai School of Medicine
- Residency, Internal Medicine: The Mount Sinai Hospital, NY
- Fellowship, Cardiology: The Mount Sinai Hospital, NY
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Clinical Cardiology, Noninvasive Cardiology, Coronary Interventions

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## Paul C. Lee, MD

Associate Professor of Medicine (Cardiology)

### Education and Training

- MD: University of Minnesota
- Residency, Internal Medicine: The Mount Sinai Hospital, NY
- Fellowship, Cardiology: The Mount Sinai Hospital
- Fellowship, Clinical Heart Failure and Molecular Cardiology: University of Toronto

**Clinical Interests:** Clinical Cardiology, Biostatistics, Interventional Cardiology

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## José Meller, MD

Clinical Professor of Medicine (Cardiology)

### Education and Training

- MD: Catholic University of Chile, Santiago
- Residency, Internal Medicine: The Mount Sinai Hospital, NY
- Fellowship, Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Clinical Cardiology, Fellows Education, Cardiac Catheterization

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## **Niranjan K. Mittal, MD**

**Clinical Instructor of Medicine (Cardiology)**

### **Education and Training**

- MBBS: Government Medical College, Patiala, India
- Residency, Internal Medicine: Jamaica Hospital, NY
- Fellowship, Cardiology: Brooklyn Hospital Center
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Cardiac Imaging, Interventional Cardiology

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## **Vinod Patel, MD**

**Assistant Professor of Medicine (Cardiology)**

### **Education and Training**

- MD: Saurashtra University, M.P. Shah Medical College, Gujarat, India
- Residency, Internal Medicine: Resurrection Hospitals/Stitch School of Medicine, Loyola University, Chicago
- Fellowship, Cardiology: University of South Florida
- Fellowship, Cardiology Imaging: University of Alabama at Birmingham
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

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

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## **Anuj Shah, MD**

**Assistant Professor Medicine (Cardiology)**

### **Education and Training**

- MD: Gujarat University, India
- Residency: Internal Medicine: University of Connecticut
- Fellowship, Cardiovascular Disease: Hartford Hospital, University of Connecticut
- Fellowship, Interventional Cardiology: The Mount Sinai Hospital, NY

**Clinical Interests:** Interventional Cardiology, Peripheral Vascular Disease and Interventions

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## **Mohammad Zgheib, MD**

**Assistant Clinical Professor Medicine (Cardiology)**

### **Education and Training**

- MD: Lebanese University
- Residency, Internal Medicine: Staten Island University Hospital
- Residency, Cardiovascular Disease: SUNY Downstate Medical Center
- Fellowship, Interventional Cardiology: St. Vincent's Hospital Medical Center of NY

**Clinical Interests:** Peripheral Vascular Disease with Angioplasty And Stenting, Cardiac Catheterization/Coronary & Cardiac Interventions, Wound Care, Atrioventricular Septal Defect (ASD)/Patent Foramen Ovale (PFO) Endovascular Repair, Carotid Artery Stenting, Renal Artery Stenting And Dialysis Access Interventions

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## CARDIAC CATHETERIZATION LABORATORY ADMINISTRATIVE STAFF

### **Beth Oliver, DNP, RN**

Senior Vice President of Cardiac Services, Mount Sinai Health System

#### **Education and Training**

- BS, Nursing: University of Massachusetts, Boston
- Nurse Practitioner Certification: Columbia University
- DNP: Case Western University

Beth Oliver is responsible for the executive leadership of clinical services within Mount Sinai Heart. Beth 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.

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### **Rosario Marasigan, RN**

Clinical Nurse Manager

#### **Education and Training**

- BS: Nursing: Philippine Women's University

Rosario Marasigan has been the clinical nurse manager since 2006. In this role she efficiently and effectively manages a unit with a complex staff of more than 167 health professionals. Rosario was an excellent clinical and charge nurse for 16 years prior to becoming the manager. Being a nursing instructor in the past makes her a great teacher at the bedside and a role model for our new nurses in the Cardiac Catheterization Laboratory. She is a certified critical care nurse and an active member of AACN since 1990.

**Phone: 212-241-1835    Email: [rosario.marasigan@mountsinai.org](mailto:rosario.marasigan@mountsinai.org)**



### **Gregory Gojkovich**

Operations Manager

#### **Education and Training**

- AA Degree, Moorpark College, California

Greg Gojkovich joined The Mount Sinai Hospital Cardiac Catheterization Laboratory in January 1987. In 1992, he accepted a cardiac catheterization laboratory operational manager position at Beth Israel Medical Center, New York, NY. He returned to Mount Sinai in 2001.

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## 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.



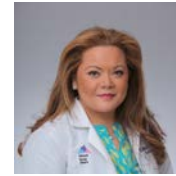
Antonietta Tolentino



Chondra Bhim



Dominique Sicile



Gloria Manzanilla



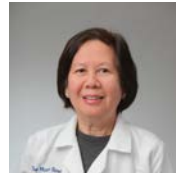
Jenifer Del Campo



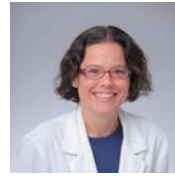
Kevin Williams



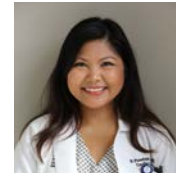
Kristelle Pulido



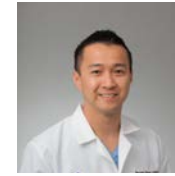
Leticia Jakasal



Melissa Mattimore



Nerissa Plondaya



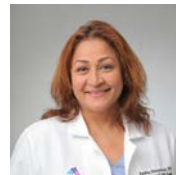
Norwin Bunal



Rheoneil Lascano



Sandie Romain



Sinanan Indra



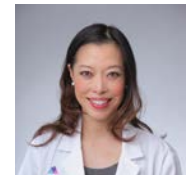
Supawadee Pitakmongkolkul



Taurean Harrilal (PA)



Tia Coleman



Vivian Lau

## Interventional Cardiology Fellows

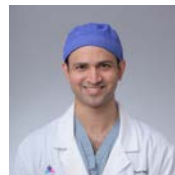
Mount Sinai Heart's Interventional Cardiology Fellowship Program is the largest in the country, educating the next generation of clinical cardiology and interventional cardiology specialists. This well-regarded program, which combines academic and hands-on experience, has graduated physicians who are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



Anitha Rajamanickam, MD



Bhaskar Purushottam, MD



Faisal Saiful, MD



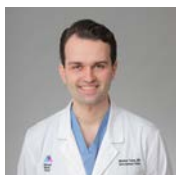
Ganesh Athappan, MD



Gopala Krishna Rao, MD



Juan Terre, MD



Matthew Tomey, MD



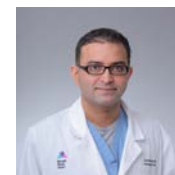
Sachin Jain, MD



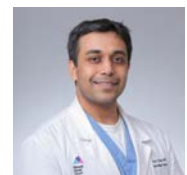
Sadik Panwar, MD



Shiny Mathewkutty, MD



Suresh Sharma, MD



Vinoy Singh Prasad, MD

## Interventional Database Team

Left to Right: Pooja Vijay, Swathi Roy,  
Birju Narechania, Delenia Gulle, Roja Thapi  
Not Pictured: Elena Ramos



## Interventional Research Team

Left to Right: Sadako Motoyama, Jacobo Pena,  
Yonandy Barrientos, Jay Louik, Omar Meelu,  
Yuliya Vengrenyuk, Sandeep Basnet, Pedro Veras,  
Arjun Bhat, Safwan Kezbor, Vilma Mejia  
Not Pictured: Hugo Bloise-Adames,  
Arthur Tarricone, Miguel Vasquez



## Supporting Staff

Back Row: Era Zuberko, StacyAnn Reid,  
Kimberley Kostiw, Daysy Carate,  
Debra Bradley  
Front Row: Maria Directo, Pearl Tongson  
Not Pictured: Maria Diaz





19<sup>TH</sup> ANNUAL



**SAVE THE DATE!**  
**JUNE 14 -17, 2016**

**New York, New York**

**Discount Registration Prior To May 22nd!**

**SPECIAL FOCUS ON CALCIFIED, BIFURCATION & TOTAL OCCLUSION LESIONS**

<b>Tuesday, June 14th</b>	<b>ENDOASCULAR FELLOWS COURSE</b>
<b>Wednesday, June 15th</b>	<b>ENDOASCULAR SYMPOSIUM</b>
<b>Thursday, June 16th</b>	<b>CORONARY / STRUCTURAL HEART SYMPOSIUM</b>
<b>Friday, June 17th</b>	<b>INTERVENTIONAL BOARD REVIEW NURSE/ TECHNOLOGIST SYMPOSIUM</b>



**CORONARY/STRUCTURAL HEART SYMPOSIUM DIRECTORS**

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

**CORONARY/STRUCTURAL HEART SYMPOSIUM CO-DIRECTORS**

George Dangas, MD, PhD, FACC, FSCAI  
Roxana Mehran, MD, FACC, FSCAI  
Jason Kovacic, MD, PhD, FACC, FSCAI  
Joseph M. Sweeny, MD  
Pedro R. Moreno, MD, FACC  
Partho P. Sengupta, MD, DM, FACC, FASE

**ENDOASCULAR SYMPOSIUM DIRECTOR**

Prakash Krishnan, MD, FACC  
Peter L. Faries, MD, FACS

**ENDOASCULAR SYMPOSIUM CO-DIRECTORS**

J. Michael Bacharach, MD, FACC, FSCAI  
Vishal Kapur, MD, FACC, FSCAI  
Karthik Gujja, MD, MPH

**NURSE/TECHNOLOGIST SYMPOSIUM DIRECTORS**

Beth Oliver, DNP, RN  
Antonietta Tolentino, MSN, ANP-C

**HIGHLIGHTS**

- COMPLEX CALCIFIED HIGH-RISK CORONARY CASES
- UNPROTECTED LEFT MAIN
- CHRONIC TOTAL OCCLUSION
- ALCOHOL SEPTAL ABLATION
- AORTIC AND MITRAL VALVULOPLASTY
- TRANSCATHETER AORTIC VALVE REPLACEMENT
- ENDOASCULAR INTERVENTION OF CALCIFIED LESIONS, TOTAL OCCLUSIONS AND TIBIAL DISEASE



**For Full Agendas and Additional Details Visit**  
**[www.cccsymposium.org](http://www.cccsymposium.org)**





# Mount Sinai Heart Live Cases

## Purpose

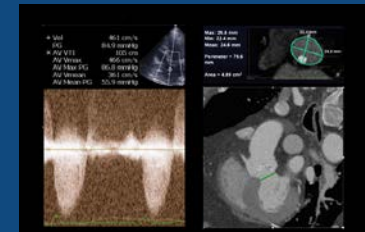
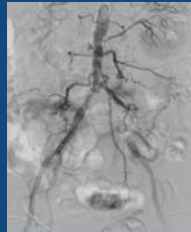
These live seminars will highlight in-depth procedural techniques for managing complex cardiac cases. They will be streamed in real time over the Internet and viewers can participate in our online didactic discussion.

## Learning Objectives

- Discuss the rationale for choice of intervention for complex cases
- Demonstrate the use of plaque modification techniques
- Demonstrate the application of large, randomized clinical trial results within an interventional clinical perspective

## Target Audience

Cardiologists, interventional cardiologists, fellows, cardiovascular technicians, and cardiac catheterization laboratory nurses.



## Complex Coronary Cases

3rd Tuesday of the month, 8 am

January 19, 2016  
February 16, 2016  
March 15, 2016  
April 19, 2016  
May 17, 2016  
June 21, 2016  
July 19, 2016  
August 16, 2016  
September 20, 2016  
October 18, 2016  
November 15, 2016  
December 20, 2016

[www.ccclivecases.org](http://www.ccclivecases.org)



## Peripheral Interventions

4th Wednesday of the month, 8 am

January 27, 2016  
February 24, 2016  
March 23, 2016  
April 27, 2016  
May 25, 2016  
June 22, 2016  
July 27, 2016  
August 24, 2016  
September 28, 2016  
October 26, 2016  
November 16, 2016  
December 28, 2016

[www.peripheralinterventions.org](http://www.peripheralinterventions.org)



## Structural Heart Live Cases

2nd Tuesday of every other month, 9 am

February 9, 2016  
April 12, 2016  
June 14, 2016  
August 9, 2016  
October 11, 2016  
December 13, 2016

[www.structuralheartlivecases.org](http://www.structuralheartlivecases.org)



**AVERAGE 6,000 PAGE VIEWS PER MONTH IN 127 COUNTRIES.**

# Cardiac Catheterization Laboratory Achievements

## NEW YORK MAGAZINE

Dr. Samin K. Sharma has been listed as Best Doctor from 2006-2008 and 2011-2015. Dr. George Dangas and Dr. Roxana Mehran were also recognized.

1



### Samin K. Sharma, MD (Interventional Cardiology)

Hospital: [Mount Sinai Hospital](#)

City, State: New York, NY

Phone: 212-427-1540

Board Cert: Internal Medicine

[View This Doctor's Website](#)

### George Dangas, MD/PhD (Cardiovascular Disease)

Hospital: [Mount Sinai Hospital](#)

[Mount Sinai Hospital of Queens](#)

City, State: New York, NY

Phone: 212-241-7014

Board Cert: Interventional Cardiology

### Roxana Mehran, MD (Interventional Cardiology)

Hospital: [Mount Sinai Hospital](#)

City, State: New York, NY

Phone: 212-659-9691

Board Cert: Cardiovascular Disease



2

## NEW YORK TIMES MAGAZINE

Dr. Samin K. Sharma and Dr. Annapoorna S. Kini were listed as Super Doctors in 2015.

3

CASTLE  
CONNOLLY  
TOP DOCTORS



## CASTLE CONNOLLY TOP DOCTORS

Dr. Samin K. Sharma,  
Dr. Prakash Krishnan,  
Dr. Pedro Moreno,  
Dr. Roxana Mehran and  
Dr. George Dangas listed as  
Castle Connolly Top Doctors.



4

## DR. PEDRO MORENO

Dr. Pedro Moreno appointed  
Director of Mount Sinai  
St. Luke's Cardiac  
Catheterization Laboratory.

5



## DR. ROXANA MEHRAN

Dr. Roxana Mehran appointed  
Chair of the Scientific Sessions of  
SCAI, Chair of the Interventional  
Council of ACC and Member  
of PCI Guidelines and DAPT  
Guidelines Writing Committee.

# Mount Sinai Heart Directory

<b>Area</b>	<b>Telephone</b>
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
<b>Cardiac Catheterization Laboratory Assistance ('any issues')</b>	<b>212-241-0935</b>
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

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Marketing and Communications





**The mission of the Cardiac Catheterization  
Laboratory at Mount Sinai Heart is:**

**“To improve outcomes and safety of Interventional  
patients by delivering clinical innovations,  
unrivaled research, and personalized  
clinical care as a Team Concept.”**

