



Percutaneous Repair of Paravalvular Prosthetic Regurgitation



Allison K. Cabalka, MD, Paul Sorajja, MD, Charanjit S. Rihal, MD, MBA

Inside This Issue

Mayo Clinic in Arizona
Pioneers Use of Cardiac
Mechanical Assist Devices.....4

IN THE NEWS
Stem Cell Study Helps
Clarify the Best Time for
Therapy to Aid Heart Attack
Survivors3

Milestone for Mayo Clinic
in Arizona: 100th Heart
Transplant Performed.....6

Elimination of Secondhand
Smoke Leads to Reduction
in Cardiac Events7

Surgical placement of a cardiac prosthetic valve improves cardiovascular symptoms and, in many patients, is a lifesaving procedure. In 3% to 6% of patients, however, paravalvular prosthetic regurgitation occurs and may lead to heart failure or hemolytic anemia. Traditionally, the treatment of symptomatic paravalvular prosthetic regurgitation has been open heart surgery. Operative repair may be challenging owing to anatomic or technical factors that led to the development of the prosthetic regurgitation, in addition to the associated surgical morbidity and mortality.

As a less invasive alternative, percutaneous approaches to the treatment of paravalvular prosthetic regurgitation have been developed. These percutaneous approaches use a variety of complex catheter techniques to deliver occluder devices to the site of paravalvular prosthetic regurgitation. “Among experienced operators, defects involving mechanical or biological prosthetic valves can be treated with procedural success rates of about 90% and a low risk (<5%) of complications,” according to Charanjit S. Rihal, MD, MBA, an interventional cardiologist and chair of the Division of Cardiovascular Diseases at Mayo Clinic in Rochester.

In a patient with paravalvular regurgitation involving an aortic prosthesis, the defect typically is engaged using a retrograde approach from the femoral artery (Figure 1). For patients with mitral defects, transseptal access to the left atrium is obtained from the femoral vein, followed by placement of a steerable sheath. The deflectable tip of

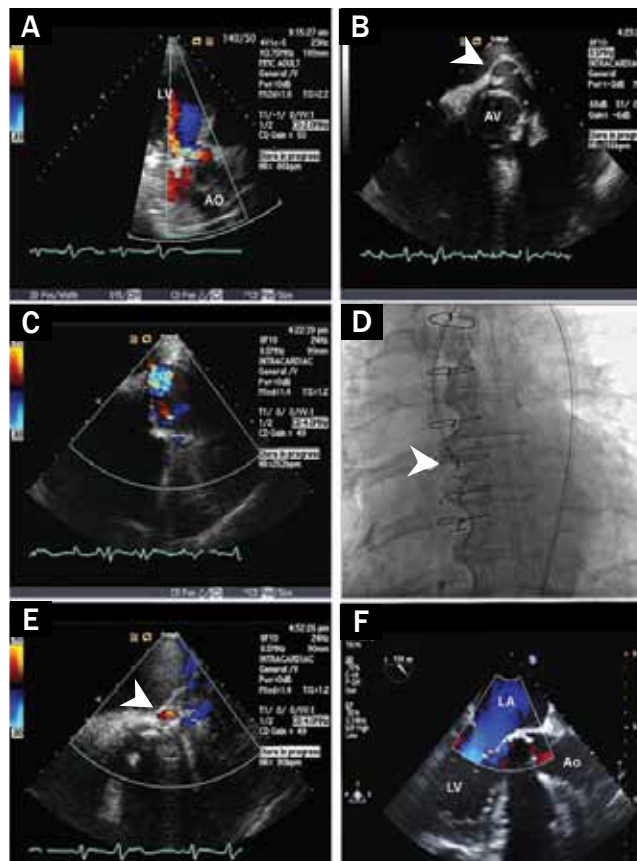


Figure 1. Percutaneous repair of paravalvular aortic prosthetic regurgitation. A, Transthoracic echocardiogram showing severe paravalvular regurgitation involving an aortic bioprosthesis. B and C, Intracardiac echocardiography showing the paravalvular defect (arrowhead in B) and regurgitation anterior to the valve prosthesis. D, Using a retroaortic approach, a 12-mm vascular plug (arrowhead) was placed across the defect. E, Immediately following placement of the device, there was minimal central regurgitation (arrowhead). F, Transesophageal echocardiogram 2 months after the procedure shows complete cessation of the paravalvular prosthetic regurgitation. AO indicates aorta; LA, left atrium; LV, left ventricle.

Pediatric Cardiology
Mayo Clinic in Rochester

Frank Cetta, MD, Chair
 Michael J. Ackerman, MD, PhD
 Allison K. Cabalka, MD
 Bryan C. Cannon, MD
 David J. Driscoll, MD
 Benjamin W. Eidem, MD
 Donald J. Hagler, MD
 Jonathan N. Johnson, MD
 Patrick W. O'Leary, MD
 Timothy M. Olson, MD

**Cardiac Catheterization and
 Interventional Cardiology**
Mayo Clinic in Rochester

John F. Bresnahan, MD,
Interim Director
 Gregory W. Barsness, MD
 Malcolm R. Bell, MD
 Patricia J. Best, MD
 Barry A. Borlaug, MD
 John F. Bresnahan, MD
 Allison K. Cabalka, MD
 Charles R. Cagin, DO*
 Frank Cetta, MD
 Robert P. Frantz, MD
 Rajiv Gulati, MD
 Donald J. Hagler, MD
 Joerg Herrmann, MD
 David R. Holmes Jr, MD
 Andre C. Lapeyre III, MD
 Amir Lerman, MD
 Verghese Mathew, MD
 Arashk Motiei, MD
 Rick A. Nishimura, MD
 Krishna M. Pamulapati, MD*
 Abhiram Prasad, MD
 Guy S. Reeder, MD
 Charanjit S. Rihal, MD, MBA
 Gupreet S. Sandhu, MD, PhD
 Mandeep Singh, MD, MPH*
 Ripudamanjit Singh, MD*
 Paul Sorajja, MD
 R. Thomas Tilbury, MD
 Henry H. Ting, MD

*Mayo Clinic Health System

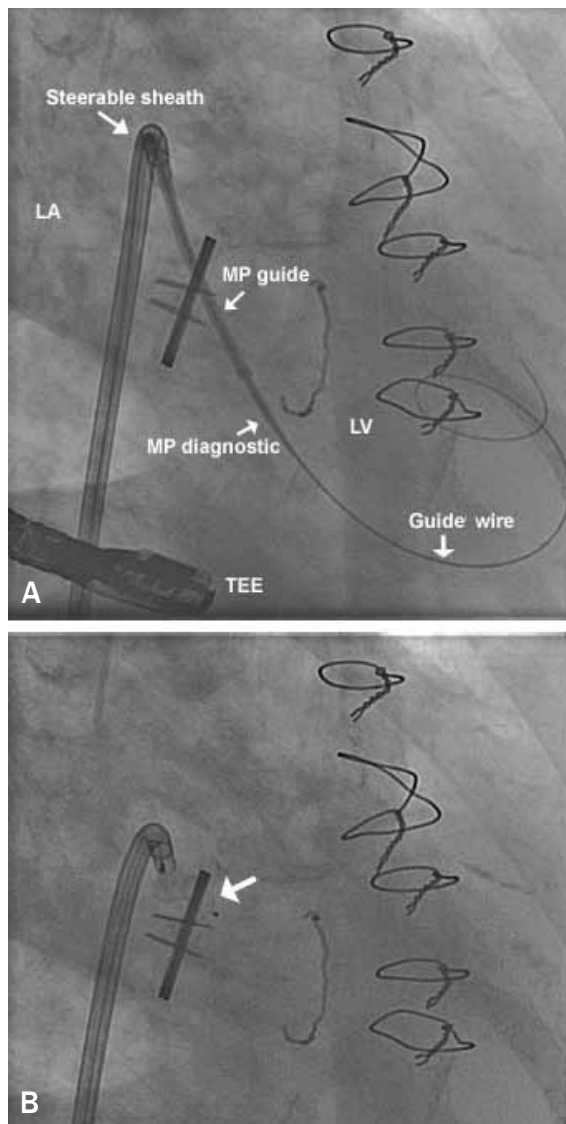


Figure 2. Percutaneous repair of paravalvular mitral prosthetic regurgitation. A, An 8.5F steerable sheath is used to engage the defect with a 5F multipurpose diagnostic catheter telescoped through a 6F multipurpose coronary guide catheter. **B,** With the guide wire across the defect, a 16-mm vascular plug (arrow) is placed into the left ventricle and brought back to the site of paravalvular defect under fluoroscopic and echocardiographic guidance. LA indicates left atrium; LV, left ventricle; MP, multipurpose; TEE, transesophageal echocardiography.

this sheath allows antegrade engagement of the mitral defect (Figure 2).

Once a prosthetic defect is crossed with a guide wire, a telescoped coronary guide catheter or a long delivery sheath is advanced, followed by placement of an appropriately sized occluder device in the defect. Echocardiography, which is essential, guides the procedure and allows its completion without the need for contrast. The occluder is released at the site of the paravalvular

defect after demonstration of considerable reduction in the regurgitation, stability of the device, and no interference with the prosthetic valve.

“Due to the serpiginous, calcific nature of some paravalvular defects, special techniques may be needed to pass delivery catheters,” says Paul Sorajja, MD, an interventional cardiologist at Mayo Clinic in Rochester. In these instances, an arteriovenous rail can be created, in which a guide wire is snared in a distal chamber and exteriorized. For patients with 2 left-sided mechanical prostheses, this wire rail also can be created by exteriorizing the wire through the left ventricular apex via direct left ventricular puncture. The operator then uses both ends of the rail to provide support for passage of a delivery catheter across the paravalvular defect.

Paravalvular prosthetic defects also may be highly eccentric or crescent shaped. As a result, coverage of these types of lesions with a single large occluder may result in prosthetic interference from device overhang. “In these cases, multiple devices with smaller diameters can be placed simultaneously using 2 delivery catheters or sequentially with an anchor-wire technique,” according to Allison K. Cabalka, MD, a pediatric interventional cardiologist at Mayo Clinic in Rochester. Imaging with 3-dimensional transesophageal echocardiography is helpful for examining the configuration of the defects to determine the potential need for these advanced catheterization techniques.

The Cardiac Catheterization Laboratory at Mayo Clinic in Rochester has been a leader in percutaneous repair of paravalvular prosthetic regurgitation, with more than 140 patients having undergone the procedure to date. Patients with paravalvular prosthetic regurgitation are routinely evaluated by expert echocardiologists and interventionists in dedicated specialty clinics. Candidates for percutaneous repair are patients with one or more of the following:

- moderately severe or severe paravalvular prosthetic regurgitation
- severe symptoms of dyspnea
- severe hemolytic anemia
- absence of active endocarditis
- progressive valve dehiscence

Informed consent is obtained following a detailed discussion about the risks of the procedure and the option of reoperation, which frequently includes consultation with cardiovascular surgery colleagues.

Given the potential for a less invasive alternative to open surgical correction, there has been great enthusiasm for percutaneous repair of paravalvular prosthetic regurgitation. Emerging techniques allow the routine use of this procedure in patient candidates and will continue to evolve to address this increasingly recognized complication of prosthetic valves.

IN MEMORY



Luis Bonilla, MD



David Hines

The Mayo Clinic community was deeply saddened to learn of the loss of Luis Bonilla, MD, a Mayo Clinic cardiac surgeon, and David Hines, a Mayo Clinic procurement technician. They were on board a helicopter flight from the Mayo Clinic campus in Florida, along with the pilot, to procure a heart for a Mayo Clinic transplant patient when the helicopter crashed. There were no survivors. Dr Bonilla transferred from Rochester to Mayo Clinic in Florida in November 2011 to join the Division of Cardiothoracic Surgery. Mr Hines joined St. Luke's Hospital in Jacksonville in 1999.



Mark J. Callahan, MD

The Division of Cardiovascular Disease at Mayo Clinic in Rochester was immensely saddened by the death of Mark J. Callahan, MD. Dr Callahan had been on staff since 1984, specializing in echocardiography. Dr Callahan was a revered teacher at Mayo Medical School and influenced generations of physicians.

IN THE NEWS

Stem Cell Study Helps Clarify the Best Time for Therapy to Aid Heart Attack Survivors

A research network led by Robert D. Simari, MD, found that stem cells obtained from bone marrow delivered 2 to 3 weeks after myocardial infarction did not improve heart function. This is the first study to systematically examine the timing and method of stem cell delivery and provides vital information for the field of cell therapy.

“Some data suggest that stem cell therapy is helpful within the first week after infarction,” says Dr Simari, a cardiologist at Mayo Clinic in Rochester, Minnesota, and chair of the Cardiovascular Cell Therapy Research Network. The network includes 5 clinics and other sites supported by the National Heart, Lung, and Blood Institute, part of the National Institutes of Health. “Our study helps identify the limits of when stem cell therapy might be beneficial. We now know that this therapy should not be extended 2 to 3 weeks after myocardial infarction. While it is safe to do so, we did not find any benefit to cardiac function after 6 months.”

The results were presented at the 2011 Scientific Sessions of the American Heart Association Meeting and were published in the November 16, 2011, issue of *JAMA*.



Saint Marys Hospital, Mayo Clinic in Rochester, has earned The Leapfrog Group's annual 2011 “Top Hospital” designation. Nationally, 54 hospitals received the “Top Hospital” designation, which recognizes hospitals that deliver the highest-quality care by preventing medical errors, reducing mortality for high-risk procedures such as heart bypass surgery, and reducing hospital readmissions for patients being treated for conditions such as pneumonia and heart attack.

RECOGNITION



Jack Rychik, MD, of Children's Hospital of Philadelphia, was the Sixth Annual David J. Driscoll, MD, Visiting Lecturer on September 8 and 9, 2011, at Mayo Clinic in Rochester. Dr Rychik (right) is a leader in pediatric echocardiography and a recognized expert in a broad range of areas, including fetal cardiac interventional imaging. Dr Driscoll (left) is the former chair of the Division of Pediatric Cardiology at Mayo Clinic in Rochester.

Mayo Clinic in Arizona Pioneers Use of Cardiac Mechanical Assist Devices



Francisco A. Arabia, MD, MBA, Robert L. Scott, MD, PhD

Heart Transplant and Mechanical Circulatory Support Mayo Clinic in Arizona

Francisco A. Arabia, MD, MBA,
Surgical Director

Patrick A. DeValeria, MD

Louis A. Lanza, MD

Octavio E. Pajaro, MD

Robert L. Scott, MD, PhD,
Medical Director

Radha S. Gopalan, MD

Anantharam V. Kalya, MD

D. Eric Steidley, MD

Cardiac transplantation offers patients with end-stage congestive heart failure a new lease on life. Unfortunately, donor availability continues to limit this lifesaving option. The development of mechanical ventricular assist devices (VADs) has provided alternative opportunities to these patients, either as bridge-to-transplant or as destination therapy. Importantly, many patients are able to leave the hospital and enjoy increased mobility.

“Patients with acute cardiogenic shock are some of the most difficult patients to manage, with hemodynamic instability frequently complicated by life-threatening arrhythmias,” according to Robert L. Scott, MD, PhD, medical director of the heart failure and transplantation program in the Division of Cardiovascular Diseases at Mayo Clinic in Arizona. While these patients benefit from the intensive and comprehensive care provided by tertiary care centers, many are too unstable for transport. Infrequent use of VADs by many hospitals makes it financially difficult to maintain devices in inventory and a challenge for medical and surgical personnel to maintain competency.

Doctors at Mayo Clinic in Arizona have overcome this barrier by developing an emergency transport team, based on the SWAT team approach pioneered by law enforcement. This highly specialized, multidisciplinary team was developed by Francisco A. Arabia, MD, MBA, chair of the Division of Cardiovascular and Thoracic Surgery at Mayo Clinic in Arizona and surgical director of cardiac transplantation. The team is deployed to local and regional hospitals requesting stabilization and transport assistance. “We may assist with medical management, and we are equipped to implant appropriate VADs at the referring hospital in order to stabilize the patient for transport,” says Dr Arabia. Support devices include right ventricular assist devices, left ventricular assist

devices, biventricular assist devices, and extracorporeal membrane oxygenation. Transport typically occurs within 48 hours via a specially equipped ambulance.

Since Mayo Clinic in Arizona began implanting VADs in 2005, almost 300 devices have been implanted by both the emergency transport team and the cardiac transplant program. Eleven different types of circulatory support devices are available, including the total mechanical heart (Figures 1 and 2), to support cardiac function, depending on the type and degree of heart failure. To date, the longest time a patient has been on VAD support is 1,595 days, or approximately 4.4 years. Technological improvements have resulted in smaller and lighter devices powered by portable battery packs compatible with near-normal lifestyles (Figure 3). In May 2010, Mayo Clinic in Arizona was the first center in the United States to dismiss a patient home on a total artificial heart to await heart transplant, which he received in January 2011.

The Joint Commission, in its most recent evaluation, gave high marks to the VAD program. Certification for all services was granted, calling the program at Mayo Clinic in Arizona “the poster child for VAD programs nationally.”

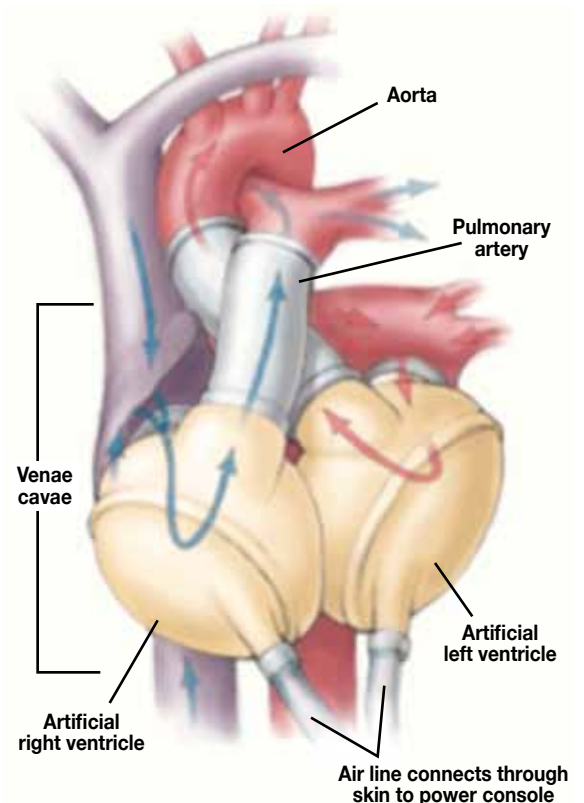


Figure 1. Diagram of total mechanical heart.

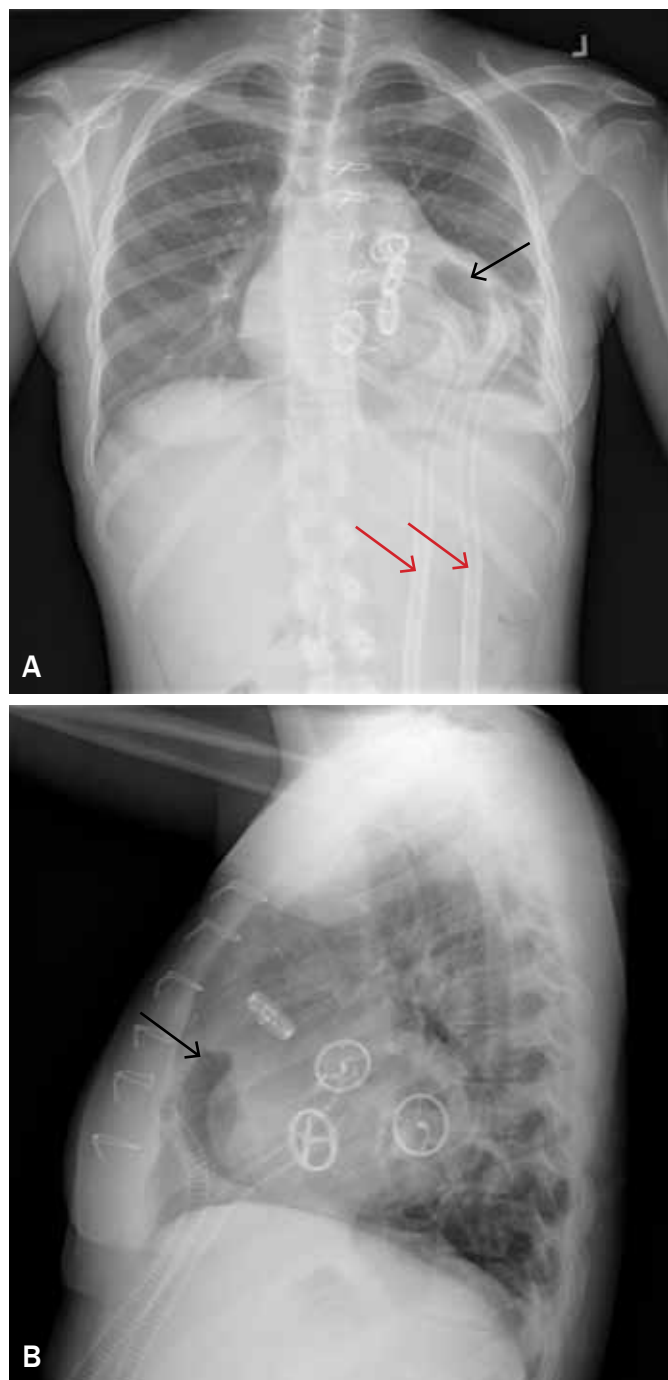


Figure 2. Posteroanterior (A) and lateral (B) chest x-ray views of a patient with a total mechanical heart. The black arrows indicate pneumatic chambers, and the red arrows show the airflow cables. The native cardiac valves have been removed; all valves are part of the mechanical heart.



Figure 3. Patient with total mechanical heart exercising. The battery pack is in the backpack on the chair.

Mayo Clinic Hospital in Phoenix, Arizona,

has been named one of Thomson Reuters 50 Top Cardiovascular Hospitals for 2011. The annual list is based on a quantitative study that identifies the nation's best providers of cardiovascular service. Selected from more than 1,000 US hospitals, these winners provide top-notch care and set new standards for the health care industry.



IN THE NEWS

Milestone for Mayo Clinic in Arizona: 100th Heart Transplant Performed



Mayo Clinic in Arizona performed its 100th heart transplant since the program opened in the fall of 2005. The first heart transplant patient, an Arizona woman, is doing well today following her transplant in October 2005. "We are proud of this 100th heart transplant milestone," says Francisco A. Arabia, MD, MBA, chair of the Division of Cardiovascular and Thoracic Surgery at Mayo Clinic in Arizona and director of the cardiac transplant program. "It is especially rewarding that the growth and success of the program means we

can continue to serve patients in the Valley and beyond." Of the 100 transplant patients, 41 were on a mechanical device and 24 were transiently supported by an artificial heart. This milestone was celebrated during a recent open house at the Mayo Clinic Hospital in Phoenix. Dr Arabia credits the work of Donor Network of Arizona for its commitment to bringing awareness to the need for organ donation so that more organs can be available to help others in need.

RECOGNITION



Farris K. Timimi, MD, a member of the Division of Cardiovascular Diseases at Mayo Clinic in Rochester, has been named the new medical director for the Mayo Clinic Center for Social Media.



Clarence Shub, MD, has been named a Distinguished Educator for 2011 by the Education Committee, Mayo Clinic in Rochester. This award recognizes individuals who have contributed in a substantial and sustained way to Mayo's educational mission. Dr Shub is a member of the Division of Cardiovascular Diseases.



Jane A. Linderbaum, MS, CNP, has received a 2011 Heart and Stroke Hero award from the Minnesota Chapter of the American Heart Association. The award was presented at the Heart and Stroke Gala in Minneapolis, Minnesota.

Partners in Practice

Mayo Clinic Online Services for Referring Physicians is a secure, user-friendly Web site that provides a window into the care of patients referred to Mayo Clinic through Online Services.

Online Services for Referring Physicians allows health care providers to

- Make appointment requests electronically, 24 hours a day, 7 days a week.
- View and print Mayo Clinic medical documents for patients referred through Online Services, including consultative and surgical notes, laboratory and radiology reports, and hospital discharge summaries.

Privacy

Users must register to access online services. Protecting patients' medical information is the responsibility of Mayo Clinic and all health care providers. Registered users are responsible for maintaining patient confidentiality. Patients sign a form indicating their consent to have protected health information viewed electronically by their referring provider.

To find Online Services or to view a demonstration, go to: <http://medprofosrp.mayoclinic.org>

IN THE NEWS

Elimination of Secondhand Smoke Leads to Reduction in Cardiac Events

The incidence of heart attacks and sudden deaths has declined by nearly half since smoking bans took effect in southeastern Minnesota, according to new research from Mayo Clinic in Rochester.

Data from the study bolster efforts to rid the nation's workplaces of secondhand smoke. Mayo researchers examined data beginning 18 months before the first smoke-free law was passed at restaurants in Olmsted County in 2002 and concluding 18 months after the law was expanded to cover all workplaces in 2007. They

found a 45% decline in myocardial infarction and cardiac deaths.

"That's a staggering number," said Richard D. Hurt, MD, the lead investigator and director of the Nicotine Dependence Center at Mayo Clinic in Rochester. Adult smoking rates also dropped 23% during the time period. Other risk factors, such as high blood pressure, high cholesterol, diabetes, and obesity remained stable or increased, according to the study, which was presented at the American Heart Association meeting in November 2011.

RECOGNITION

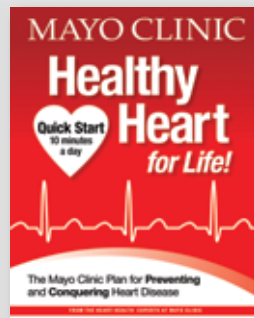


Robert E. Safford, MD, PhD, a cardiologist at Mayo Clinic in Florida, has received the Eugene Page Award. The award recognizes a physician who serves as a role model through consistent demonstration of commitment to excellence in clinical service. Dr Safford is nationally recognized as a thought leader in cardiovascular disease, with special expertise in the clinical application of echocardiography and other advanced imaging techniques. In addition to his academic contributions, Dr Safford has been a major architect in the development of the Department of Medicine at Mayo Clinic in Florida, serving as both chair of the Division of Cardiovascular Diseases and chair of the Department of Internal Medicine.



Tomas Konecny, MD, won first prize in the Young Investigator Competition at the American College of Chest Physicians Annual International Meeting. Dr Konecny's presentation was entitled "Pulmonary Function Testing Predicts Mortality in Patients With Chronic Obstructive Pulmonary Disease Undergoing Percutaneous Coronary Intervention." Thais D. Coutinho, MD, won first prize in the Young Investigator Competition of the American Heart Association's Council on Nutrition, Physical Activity and Metabolism at the AHA's 2011 Scientific Sessions. Dr Coutinho's presentation was entitled "Coronary Artery Disease Patients With Normal Body Mass Index but Central Obesity Have the Worst Long-term Survival When Compared to Other Patterns of Adiposity." Drs Coutinho and Konecny are both fellows in the cardiovascular training program at Mayo Clinic in Rochester.

NEW
From Mayo Clinic and
Time Home Entertainment Inc



Contact Us
Referrals and Consultations
Scottsdale/Phoenix, Arizona
866-629-6362
Jacksonville, Florida
800-634-1417
Rochester, Minnesota
Cardiology 800-471-1727
CV Surgery 866-827-8810
www.mayoclinic.org/medicalprofs

Upcoming Courses

CONTINUING MEDICAL EDUCATION, MAYO CLINIC

For additional information, visit www.mayo.edu/cme/cardiovascular-diseases, e-mail cme@mayo.edu, or phone 800-323-2688, 800-283-6296, 507-266-0677, or 507-266-6703, unless noted otherwise.

CARDIOLOGY BOARD REVIEW COURSES

Echocardiography Review Course for Boards and Recertification

Jun 2-5, 2012, Rochester, MN
Course directors: Charles J. Bruce, MD, Jae K. Oh, MD

Pediatric Cardiology Board Review Course

Aug 26-31, 2012, Laguna Beach, CA
Course directors: Frank Cetta Jr, MD, Benjamin W. Eidem, MD, Anthony Chang, MD

Electrophysiology for Boards and Recertification (Transseptal and Epicardial Workshop)

Sep 27, 2012, Rochester, MN
Course directors: Paul A. Friedman, MD, Thomas M. Munger, MD

Electrophysiology Review for Boards and Recertification

Sep 28-30, 2012, Rochester, MN
Course directors: Samuel J. Asirvatham, MD, Paul A. Friedman, MD, Thomas M. Munger, MD

Mayo Clinic Cardiovascular Review Course for Cardiology Boards and Recertification

Sep 29-Oct 4, 2012, Rochester, MN
Course directors: Rick A. Nishimura, MD, Steve R. Ommen, MD

9th Annual Mayo Clinic Interventional Cardiology Board Review

Oct 12-14, 2012, Rochester, MN
Course directors: Gregory W. Barsness, MD, Malcolm R. Bell, MD, Paul Sorajja, MD

NEW Cardiology in the Capital: Case-Based Clinical Decision Making

Apr 12-15, 2012, Washington, DC
Course directors: Heidi M. Connolly, MD, Bernard J. Gersh, MD, ChB, DPhil, Charanjit S. Rihal, MD

Echocardiography in the Nation's Capital: Focus for the Physician

Apr 16-18, 2012, Arlington, VA
Course directors: Fletcher A. Miller Jr, MD, Patricia A. Pellikka, MD, Sunil V. Mankad, MD

Echocardiography in the Nation's Capital: Focus for the Sonographer

Apr 19-21, 2012, Arlington, VA
Course directors: Barry L. Karon, MD, Fletcher A. Miller Jr, MD, Merri L. Bremer, RN, RDCS

NEW Transradial Angiography and Intervention Conference

May 4-5, 2012, Jacksonville, FL
Course directors: Issam Moussa, MD, Malcolm R. Bell, MD, Rajiv Gulati, MD, Charanjit S. Rihal, MD, MBA
Phone: 800-462-9633; e-mail: cme-jax@mayo.edu

Echo Fiesta: An In-Depth Review of Adult Echocardiography for Sonographers and Physicians

May 10-12, 2012, San Antonio, TX
Course directors: William K. Freeman, MD, Fletcher A. Miller Jr, MD

Controversies in Cardiovascular Disease

May 19-20, 2012, Minneapolis, MN
Course directors: Kevin L. Greason, MD, Sunil V. Mankad, MD

26th Annual Echocardiographic Symposium at Vail: New Technologies, Live Scanning, and Clinical Decision Making

Jul 23-26, 2012, Vail, CO
Course directors: George M. Gura Jr, MD, Fletcher A. Miller Jr, MD, Jae K. Oh, MD

Cardiology Update in Sedona

Aug 3-5, 2012, Sedona, AZ
Phone: 480-301-4580; e-mail: mca.cme@mayo.edu

NEW LOCATION Success With Heart Failure: Heart Failure for Clinical Practice

August 12-15, 2012, Tahoe, NV
Course directors: Barry A. Borlaug, MD, Brooks S. Edwards, MD, Barry L. Karon, MD

Echocardiography for the Sonographer

Sep 8-9, 2012, Rochester, MN
Course directors: Daniel D. Borgeson, MD, Merri L. Bremer, RN, RDCS, Barry L. Karon, MD, Fletcher A. Miller Jr, MD

2012 Advanced Ablation Course

Sep 8-10, 2012, Chicago, IL
Course directors: Douglas Packer, MD, David Wilber, MD, William Stevenson, MD

Mayo Clinic Cardiovascular Update

Editor: Margaret A. Lloyd, MD, MBA

Editorial Board: Charanjit S. Rihal, MD, MBA, Issam Moussa, MD, Win-Kuang Shen, MD, Joseph A. Dearani, MD, Frank Cetta, MD, Gurpreet S. Sandhu, MD, PhD, Nicole B. Engler, Marjorie G. Durhman

Managing Editor: Jane C. Wiggs, MLA, ELS

Art Director: Marjorie G. Durhman

Photography: Amanda R. Durhman

Cardiovascular Update is written for physicians and should be relied upon for medical education purposes only. It does not provide a complete overview of the topics covered and should not replace the independent judgment of a physician about the appropriateness or risks of a procedure for a given patient.

First International Biologic Valve Symposium

Sep 12, 2012, Rochester, MN
Course directors: Robert D. Simari, MD, Amir Lerman, MD

Internal Medicine Review for Nurse Practitioners, Physician Assistants and Primary Care Physicians

Sep 12-14, 2012, Rochester, MN
Course directors: Jane A. Linderbaum, RN, CNP, David A. Foley, MD, Rick A. Nishimura, MD, Mark R. Zellmer, PA

Challenges in Clinical Cardiology

Sep 14-16, 2012, Chicago, IL
Course directors: Charles J. Bruce, MD, Heidi M. Connolly, MD

Ventricular Function in Congenital and Acquired Heart Disease: From Doppler to Deformation

Oct 5-6, 2012, Rochester, MN
Jointly sponsored with The Hospital for Sick Children
Course directors: Benjamin W. Eidem, MD, Mark Friedberg, MD, Luc Mertens, MD

Echocardiography in Adult and Pediatric Congenital Heart Disease

Oct 7-10, 2012, Rochester, MN
Course director: Patrick W. O'Leary, MD

22nd Annual Cases in Echocardiography: TEE, Doppler, and Stress

Oct 24-27, 2012, Napa, CA
Course directors: Heidi M. Connolly, MD, Fletcher A. Miller Jr, MD, Rick A. Nishimura, MD

Southwest Electrophysiology Course: Bridging the Gap Between Specialist and Internist

Oct 25-27, 2012, Phoenix, AZ
Phone: 480-301-4580; e-mail: mca.cme@mayo.edu

Coronary Artery Disease: Prevention, Detection, and Treatment

Nov 15-17, 2012, Las Vegas, NV
Course directors: Amir Lerman, MD, Charanjit S. Rihal, MD, MBA, Robert D. Simari, MD

Echo on Marco Island: Case-Based Approach

Dec 6-9, 2012, Marco Island, FL
Course directors: Naser M. Ammash, MD, Roger L. Click, MD, PhD

The Heart Beat of Cardiology: Practical Application of Echocardiography

Dec 13-15, 2012, Chicago, IL
Course directors: Roberto M. Lang, MD, Steve R. Ommen, MD