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Percutaneous Treatment of Varicose Veins Offers Less Invasive, More Effective Options



Henna Kalsi, MD

Chronic venous insufficiency affects almost 27% of the US population. There are 25 million patients with varicose veins and between 2 million and 6 million with advanced chronic venous insufficiency. More than 500,000 patients have venous ulcers that cost more than \$1 billion annually. Although lower extremity varicosities cannot be cured, various treatment modalities offer patients more (and more effective) options in treatment of this common condition. “Many of these newer percutaneous procedures can be done in the outpatient setting under local anesthesia, reducing the patient’s risk for anesthesia and affording quick recovery, and outcomes are quite comparable to surgical vein stripping,” says Henna Kalsi, MD, a cardiologist in the Gonda Vascular Center at Mayo Clinic in Rochester.

Types

Appropriate treatment depends on an understanding of the anatomy of lower extremity venous system. Varicose veins occur when the vessel walls weaken and dilate, preventing coaptation of the valves that prevent backflow. Alternatively, the valves themselves may become damaged from blood clots, resulting in backflow of blood. The pressure created by the force of gravity

on the unsupported column of blood then worsens the degree of venous incompetence. If untreated, patients may experience edema, pain, inflammation, and ulcer formation.

The 3 types of veins found in the lower extremities are the superficial veins, which lie just beneath the surface of the skin; the deep veins, which carry most of the blood back from the periphery; and the communicating (or perforating) veins, which connect the two (Figure 1). The 2 large superficial leg veins, the greater and short saphenous veins, along with their tributaries, frequently are involved.

Causes

The cause of varicose veins is unknown. More women than men are affected, and there is a genetic predisposition. Injury to the legs, sometimes remote, may con-

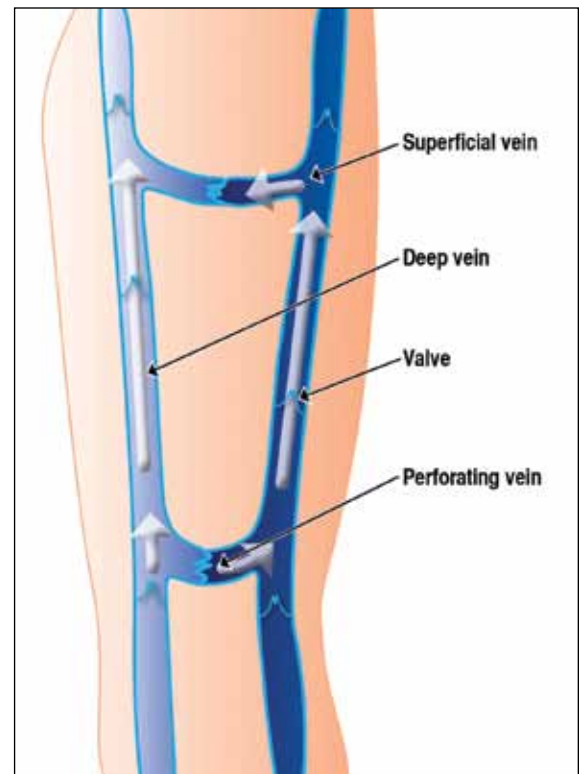


Figure 1. The relationship between deep, perforating, and superficial veins in the leg.

**Gonda Vascular Center
Mayo Clinic in Rochester**

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tribute to the development of varicosities. Occupations requiring long periods of standing (as opposed to walking) and hormonal factors such as the use of oral contraceptives, pregnancy, or menopause appear to be factors. Pregnancy, obesity, right heart failure, and tricuspid regurgitation may increase lower extremity venous pressure that may contribute to the formation of varicosities.

Diagnosis

Diagnosis can usually be made by clinical examination and noninvasive physiologic and anatomic testing. Spider veins or telangiectasias are small superficial veins near the surface of skin and occur mostly on thighs, ankles, or feet. Typically they are small, red and purple, and although they usually do not cause serious health problems, they may cause leg aching and tenderness. In contrast, large varicosities are bulging, ropey, and more than 5 mm in diameter. They may cause skin ulcers, stasis dermatitis, thrombosis, bleeding, swelling, and pain.

“Noninvasive testing has largely replaced the use of venograms and includes venous Doppler and duplex imaging and plethysmography,” says Dr Kalsi. “The location of valvular incompetence and presence of thrombus can be determined reliably with noninvasive testing.”

Treatment

Self-care is an important component of any treatment plan. A walking program, weight loss, and compression stockings are recommended, and patients should elevate their legs whenever possible. “Patients who have invasive treatment should understand that while these procedures address established varicosities, they do not prevent new varicose veins from forming,” says Dr Kalsi.

Outpatient sclerotherapy is frequently used in the treatment of spider veins and reticular veins. Morrhuate sodium is used as a sclerosing agent at Mayo Clinic, although other agents are available. Most patients need more than 1 session. Repeat sessions are performed about a month apart. After each session, compression stockings should be worn for 10 days. There are no activity restrictions, and patients can resume work the same day. The telangiectasias usually disappear in 6 to 8 weeks. The closure rate is between 80% and 90%. Potential complications include hyperpigmentation, arterial injury, and cutaneous ulcers. Foam sclerotherapy is used for large varicosities or saphenous veins, with a closure rate of 81% for the greater saphenous vein and an overall closure rate of 96%. Cutaneous Nd:YAG laser therapy has the advantage of treating varicosities without needles or sclerosant; however, sclerosing therapy has demonstrated superior clinical results in comparative trials.

Phlebectomy or surgical vein stripping involves surgically removing the large varicosities. Frequently,

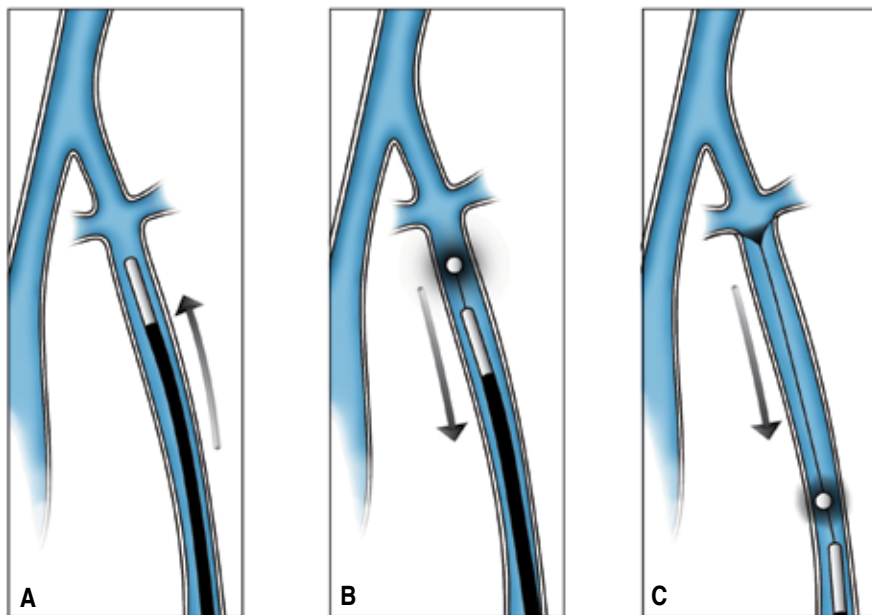
it is done in conjunction with thermal ablation to treat large varicosities. Surgical stripping of the great saphenous vein is performed under general anesthesia. Limited procedures involving 1 or 2 veins may be done on an outpatient basis with local anesthesia; more extensive procedures require general anesthesia.

Coil embolization is one approach to treating medium and large veins. Under ultrasound guidance, a catheter is inserted percutaneously and an embolization coil is deployed. Alcohol is then injected into the vein to complete obliteration of the vein (Figure 2).

Endovenous treatment options include radiofrequency ablation and thermal ablation. Endovascular treatments work by delivering thermal injury to the vein wall, which destroys the intimal layer and denatures collagen in media, resulting in fibrous occlusion of vein (Figure 3). These novel techniques have nearly replaced surgical vein stripping and have been used increasingly in the treatment of varicosities. Endovascular catheters deliver thermal energy to the vein wall to destroy the intima, denature collagen in the media, and result in fibrous occlusion of vein. Tumescence anesthesia reduces the risk of skin burns and paresthesias, helps with vein compression and analgesia, and reduces the need for general anesthesia. Successful vein occlusion with ab-



Figure 2. Endovascular coil at the saphenofemoral junction. As the delivery catheter is withdrawn, an alcohol solution is released, closing the rest of the vein to the level of the knee.



sence of reflux is more than 90%. “Patients note earlier return to work, less postoperative pain, better quality-of-life scores, and quicker recovery,” says Dr Kalsi.

The Gonda Vascular Center at Mayo Clinic offers comprehensive diagnostic evaluation of all peripheral vascular disease. Radiologists, surgeons, and vascular medicine specialists integrate their respective areas of expertise to develop patient-specific treatment recommendations. For further information about diagnosis or treatment of peripheral vascular disease or to make an appointment, please call 507-538-3270.

Figure 3. Endovenous thermal ablation. A, The catheter is percutaneously inserted into the vein. B, The tip is heated and the catheter is slowly withdrawn. C, Vein walls initially swell, then scar, obliterating the vein.

RECOGNITION



Raymond J. Gibbons, MD, was selected by the National Quality Forum to serve as chair of the Cardiovascular Endorsement Maintenance 2010 Steering Committee. This committee reviews measures that address cardiovascular conditions and procedures, including maintenance reviews of cardiovascular consensus standards endorsed prior to June 2008. Dr Gibbons has also received the Gold Heart Award from the American Heart Association. The award is the highest honor the association awards to those who have provided continued, distinguished service.



Raymond J. Gibbons, MD, and Martha Grogan, MD, participated in the Institute of Medicine Implementation Workshop on Standards for Systematic Review and Clinical Practice Guidelines in Washington, DC, on May 10-11, 2011. This workshop followed publication of the Institute of Medicine report entitled “Clinical Practice Guidelines We Can Trust.” Dr Gibbons served on the writing committee for this report. Dr Grogan spoke at the implementation workshop as cardiovascular editor of mayoclinic.com.



Benjamin W. Eidem, MD, has been named chair of the American Society of Echocardiography Pediatric and Congenital Heart Disease Council for a 2-year term. Merri L. Bremer, RN, has been appointed to the Board of Directors of the American Society of Echocardiography.



Douglas S. Beinborn has been elected to the Board of Trustees of the Heart Rhythm Society.

Transcatheter Aortic Valve Implantation: An Important New Approach to Treating Aortic Valve Stenosis



Charanjit S. Rihal, MD, David R. Holmes Jr, MD, Kevin L. Greason, MD, Rakesh M. Suri, MD, DPhil

Calcific aortic stenosis is the most common valve lesion in the United States. Severe aortic stenosis can present with shortness of breath, angina, syncope, or a combination of these symptoms. The prognosis for calcific aortic stenosis, if left untreated, is poor, with almost 50% of patients dying within 1 year. A study from Mayo Clinic in Rochester followed 622 patients with severe aortic stenosis (mean age, 72 years) for more than 5 years. Sudden death without preceding symptoms occurred at a rate of 1% per year in unoperated patients. After 5 years, only 33% remained symptom free. A peak aortic valve velocity greater than 4.5 m/s by Doppler echocardiography predicted symptoms, need for aortic valve replacement (AVR), and cardiac death. A number of series have shown that patients treated with surgical AVR have a more favorable prognosis than those who do not undergo AVR. Five-year survival was 90% with AVR and only 38% without AVR in a cohort of patients with severe asymptomatic aortic stenosis. Despite the grim prognosis of severe aortic stenosis, multiple series have demonstrated that 40% to 50% of elderly patients with severe aortic stenosis are untreated, primarily because of high surgical risk due to multiple medical comorbid conditions.

Recently, technology for implanting aortic valve prostheses in a minimally invasive manner has been developed. The randomized controlled PARTNER Cohort B trial prospectively compared the transcatheter aortic valve implantation (TAVI) of the Edwards-Sapien prosthesis delivered via the transfemoral route with standard medical therapy with or without valvuloplasty. By design, a high-risk cohort of patients was enrolled, with the mean age of 83 years and a mean Society of Thoracic Surgeons score of 11 to 12, indicative of very high surgical risk. Patients had frequent comorbid conditions, including coronary artery disease, prior coronary artery

bypass graft surgery, prior percutaneous coronary intervention, and lung disease. At 1 year, 50% of patients treated medically had died compared with 30% of those treated with TAVI. “This absolute risk reduction of 20% represents 200 lives saved per 1,000 patients treated and is reflected in a very small number-needed-to-treat of only 5 patients per life saved,” according to Charanjit S. Rihal, MD, an interventional cardiologist and chair of the Division of Cardiovascular Diseases at Mayo Clinic in Rochester. Similarly, mortality or repeat hospitalization was greatly reduced from 71% to 42% in the TAVI cohort.

Although the results of the PARTNER Cohort B trial were favorable, TAVI is not without procedural risk. Stroke occurred in 5% of patients undergoing TAVI by 30 days compared with stroke in only 1% of patients treated medically. Stroke may be attributable to embolization, hypotension, or a combination of both. Since the native valve leaflets are left in situ, paravalvular regurgitation around the cage of the stented valve was observed in more than half of patients. Ten percent of patients had moderate to severe paravalvular regurgitation. Mean gradients and aortic valve areas remained stable during the first year of follow-up, and the majority of patients reported their symptoms were improved.

In the PARTNER Cohort A trial, patients with severe aortic stenosis were randomly assigned to undergo either TAVI or conventional valve replacement surgery. The results of this arm of the PARTNER trial were presented at the recent American College of Cardiology meeting and published in the *New England Journal of Medicine*. This cohort of patients, like those in Cohort B, was elderly, with a mean age of 84 years. Approximately two-thirds of the TAVI group valves were implanted via the transfemoral route, and approximately one-third were implanted transapically. Although 30-day mortality was superior in the TAVI group, 1-year mortality was similar (Table 1), demonstrating noninferiority of TAVI compared with operative AVR. As in Cohort B, the concern centered on the stroke rate, which

Table 1. PARTNER Cohort A 30-Day and 1-Year Mortality

Endpoint	TAVI (%)	Surgery (%)
Mortality		
30 d	3.4	6.5
1 y	24.2	26.8

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was significantly higher in the TAVI group than in the surgical group at 1 year (Table 2). However, when the combined endpoint of major stroke and death is considered, there is no significant event difference between the 2 groups at 30 days and at 1 year (Table 3).

Kevin L. Greason, MD, a cardiovascular surgeon at Mayo Clinic in Rochester, points out that both cohorts had significant rates of vascular complications associated with TAVI. “Given the risk of stroke and major vascular complications associated with TAVI, standard AVR should still be strongly considered for those patients with ‘normal’ operative risk.”

Furthermore, the long-term durability of operative AVR has been demonstrated, although the long-term outcomes of TAVI have yet to be determined. Additionally, the procedure has thus far been evaluated only in elderly patients; outcomes and complication rates may differ in other patient groups.

These outcomes need to be considered in the context of the trial, according to David R. Holmes Jr, MD, a cardiologist at Mayo Clinic in Rochester and president of the American College of Cardiology. “The valve used in this trial was a first-generation device; current valves have a smaller profile delivery system that will facilitate implantation. Additionally, operators were by defini-

tion ‘inexperienced,’ as this is an investigational device, while experienced cardiovascular surgeons were implanting valves in the conventional manner.” He expects TAVI outcomes to improve and complication rates to decrease with newer devices and as operators gain skill.

“An improved ability to match the right patient to the right treatment may be one of the most important outcomes of the trial,” says Rakesh M. Suri, MD, DPhil, a cardiovascular surgeon at Mayo Clinic in Rochester. At Mayo Clinic, a multidisciplinary TAVI program has been established through collaboration of the Valvular Heart Disease Clinic, the Division of Cardiovascular Surgery, and the Interventional Cardiology Laboratory. Patients see a medical cardiologist, a clinical and research nurse, and a cardiovascular surgeon, who review patients’ status in twice-weekly team conferences. All agree that these integrated working relationships add greatly to the collective knowledge base that members of the team draw on to decide best patient practices. The team determines the costs (ie, increased morbidity) and benefits (ie, reduced mortality) of TAVI for each patient. Currently, the valve is investigational, and all patients provide informed consent when they are enrolled in a prospective research study under the auspices of a US Food and Drug Administration–approved protocol.

Table 2. PARTNER Cohort A 30-Day and 1-Year Rates of Transient Ischemic Attack and Major Stroke

Endpoint	TAVI (%)	Surgery (%)	P Value
Major stroke			
30 d	3.8	2.1	.20
1 y	5.1	2.4	.07
All stroke or TIA			
30 d	5.5	2.4	.04
1 y	8.3	4.3	.04

Table 3. PARTNER Cohort A 30-Day and 1-Year Combined Event Rate (Death and Major Stroke)

Endpoint	TAVI (%)	Surgery (%)	P Value
Death/major stroke			
30 d	6.9	8.2	.52
1 y	26.5	28.0	.68

- TAVI results in better survival compared with medical management in high-risk patients with severe aortic stenosis.
- The risk of major stroke is higher with TAVI than with surgical valve replacement both at 30 days and at 1 year.
- When the combination endpoint of major stroke and death are considered, there is no significant event difference between TAVI and operative aortic valve replacement at 30 days or at 1 year.
- The long-term durability of operative aortic valve replacement has been demonstrated, while long-term outcomes of TAVI have yet to be determined.

Mayo Clinic Offers Physician Resources via Social Media

Mayo Clinic's Center for Social Media is a premier social media center focused on health care. Dedicated to accelerating the adoption of social media for health-related purposes, the center aims to improve health literacy, health care delivery, and population health worldwide. Mayo Clinic's Divisions of Cardiovascular Diseases and Cardiovascular Surgery work collaboratively with the center to enhance communication to physicians via numerous social media platforms:

- **Physician Update Blog:** Tailored to physicians, this blog includes videos of Mayo experts discussing the latest patient care innovations, treatments, and research findings, including 15 heart-related topics. <http://physicianupdate.mayoclinic.org>
- **Mayo Clinic News Blog:** Announcing the latest Mayo Clinic news, this blog provides video, audio, and graphic resources, including more than 40 heart-related videos. <http://newsblog.mayoclinic.org>
- **YouTube:** With more than 4 million views, Mayo Clinic hosts the most popular health care provider channel, including 100,000 views to more than 75 heart-related videos. <http://www.youtube.com/user/mayoclinic?blend=1&ob=5>
- **Facebook:** Mayo has more than 55,000 Facebook fans. The Divisions of Cardiovascular Diseases and Cardiovascular Surgery recently created a page for medical professionals to receive continuing medical education notices, news, and referral-related information. <http://www.facebook.com/MayoClinicCardiovascular>

- **Twitter:** Mayo Clinic has more than 160,000 followers. At the recent American College of Cardiology meeting, Mayo Clinic had more than 60 tweets and re-tweets and over 237 clicks on shared links. Identifying tag: @MayoClinic
- **Mayo Clinic Podcast Blog:** Patients can hear, watch, and download extended conversations and brief news stories on a variety of diseases and conditions. <http://podcasts.mayoclinic.org>
- **Sharing Mayo Clinic Blog:** An online community to connect and share stories about Mayo that includes more than 25 heart-related patient stories. <http://sharing.mayoclinic.org>
- **Second Life:** Mayo Clinic cardiologists have offered 3 educational presentations on various heart-related topics. Additionally, Mayo Clinic's island offers health information and resources. <http://secondlife.com/destination/mayo-clinic>

In addition, Mayo Clinic's Social Media Health Network is a membership group for organizations interested in social media to improve health care and communication about health care issues. The network provides a platform for members to share information, resources, and the development of tools and best practices.

For more information on Mayo Clinic's social media resources, visit <http://socialmedia.mayoclinic.org> or contact Nicole Engler at 507-293-3811 or engler.nicole@mayo.edu.

RECOGNITION



Sharonne N. Hayes, MD, hosted "In the Prime of Her Life," a program addressing heart disease in women in New York City in February. The meeting was held at the Paley Center in New York City, which facilitates information sharing between the media and the lay public. Sessions were moderated by CNN anchor Soledad O'Brien and CBS medical correspondent Jonathan D. LaPook, MD. Mayo Clinic participants included Heidi M. Connolly, MD, Charanjit S. Rihal, MD, and Rakesh M. Suri, MD, DPhil.



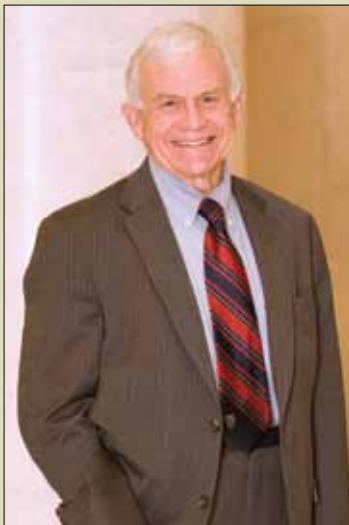
Nandan Anavekar, MB, BCh, has received the Cardiovascular Fellows Outstanding Clinical Achievement Award. Adelaide Olson, MD, PhD, has received the Cardiovascular Fellows Outstanding Research Award. Mario Goessl, MD, has received a Mayo Brothers Distinguished Fellowship Award. Six Mayo Clinic residents or fellows receive this annual award and are selected on the basis of outstanding clinical performance, humanitarian features, and outstanding scholarly activity.

NEW STAFF



John M. Stulak, MD, has joined the Division of Cardiovascular Surgery at Mayo Clinic in Rochester. After graduating from Temple University School of Medicine in Philadelphia, Pennsylvania, Dr Stulak performed his general surgery and thoracic and cardiovascular surgery training at Mayo Clinic. In addition, he recently completed a 1-year fellowship in heart transplantation and ventricular assist devices at the University of Michigan. Dr Stulak's clinical interests include surgical treatment of atrial fibrillation, heart failure surgery (mechanical circulatory support and transplantation), hypertrophic cardiomyopathy, and ascending aortic disease.

RECOGNITION



David R. Holmes Jr, MD, was installed as president of the American College of Cardiology at the annual meeting in April. Dr Holmes has been a member of American College of Cardiology for 33 years. He has been an active member on many committees such as the Learning Center Committee, Educational Program Committee, Strategic Education Directions Committee, and Interventional Spotlight Planning Committee. Dr Holmes is chairman of the ACC FAME initiative as well as codirector of Cardiology at Big Sky. Dr Holmes was the recipient of the Distinguished Scientist Award (Clinical Domain) from the ACC in 2006. He has served as governor of the Minnesota Chapter of the ACC and on the ACC Board of Trustees as well. At Mayo Clinic, he has been named the Edward W. and Betty Knight Scripps Professor in Cardiovascular Medicine in Honor of Dr George M. Gura Jr, and he is the former director of the cardiac catheterization laboratory at Mayo Clinic in Rochester.

IN THE NEWS

Genetic Variation and Risk of Myocardial Infarction

Testing for 11 specific genetic variations in hundreds of people with no history of heart disease provided information that led to revision of their estimated risk of myocardial infarction, say Mayo Clinic researchers, in a study presented at the American Heart Association's Scientific Sessions in Chicago last November. "The method we have been using for decades to predict risk of coronary artery disease is not ideal; many people thought to be at low risk experience myocardial infarction," says the study's lead researcher, Iftikhar Kullo, MD, a cardiologist at Mayo Clinic in Rochester.

The Mayo researchers are part of the eMERGE trial, funded by the National Human Genome Research Institute (NHGRI), to study human genetic variation and common human disorders, using electronic medical records. Mayo Clinic's role is to discover genetic variants that can help identify people at risk for vascular disease.

The 10-year probability of infarction is commonly estimated on the basis of the Framingham Risk Score (FRS), which uses conventional risk factors such as a patient's age, sex, lipid profile, blood pressure, and diabetes and smoking status. Mayo Clinic researchers looked at medical records of 1,262 people who had no history of heart disease. Using information from their medical records, they estimated the FRS for these individuals. Then, using blood samples, they tested for the presence of 11 gene variants, known as single nucleotide polymorphisms (SNPs), which have been validated as potential risk factors for coronary disease in a number of genome-wide association studies. Using the genetic markers alone, the researchers estimated the risk of myocardial infarction, and then modified the 10-year probability using the FRS groupings. This modification resulted in reclassification of 386 patients, about one-third of the participants. Dr Kullo acknowledges that these findings need to be replicated and validated in prospective studies before they are used in patient care; if genetic scores are validated, those likely to benefit most are individuals at intermediate risk. "Cardiologists are most uncertain of therapy in patients who fall into this group," he says.

Upcoming Courses

CONTINUING MEDICAL EDUCATION, MAYO CLINIC

To request additional information or to register, unless noted otherwise, please call 800-323-2688, e-mail cme@mayo.edu, or visit www.mayo.edu/cme.

CARDIOLOGY BOARD REVIEW COURSES

Mayo Cardiovascular Review Course for Cardiology Boards and Recertification

Sep 17-22, 2011, Rochester, MN
Course directors: Rick A. Nishimura, MD, Steve R. Ommen, MD

Electrophysiology Review for Boards and Recertification

Sep 9-11, 2011, Rochester, MN
Course directors: Paul A. Friedman, MD, Thomas M. Munger, MD

8th Annual Mayo Clinic Interventional Cardiology Board Review

Sep 9-11, 2011, Rochester, MN
Course directors: Gregory W. Barsness, MD, Malcolm M. Bell, MBBS, Paul Sorajja, MD

Focus Session on Echocardiography

Sep 16-17, 2011, Rochester, MN
Course director: Kyle W. Klarich, MD

Echocardiography for the Sonographer: Focus on Adult Echocardiography

Sep 18-20, 2011, Rochester, MN
Course directors: Fletcher A. Miller Jr, MD, Barry L. Karon, MD, Daniel D. Borgeson, MD, Merri L. Bremer, MEd, RN, RDCS

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

Sep 26-28, 2011, Rochester, MN
Course directors: Jane A. Linderbaum, PA, Mark R. Zellmer, PA-C, David A. Foley, MD, Rick A. Nishimura, MD

NEW Challenges in Clinical Cardiology: A Case-Based Update

Sep 30-Oct 2, 2011, Chicago, IL
Course directors: Charles J. Bruce, MD, Heidi M. Connolly, MD

27th Annual Echocardiography in Pediatric and Adult Congenital Heart Disease

Oct 9-12, 2011, Rochester, MN
Course director: Patrick W. O'Leary, MD

Imaging Ventricular Function in Congenital and Acquired Heart Disease: From Doppler to Deformation—State-of-the-Art in 2011

Oct 13-14, 2011, Rochester, MN
Course directors: Benjamin W. Eidem, MD, Luc Mertens, MD, PhD, Mark K. Friedberg, MD

Cases in Echocardiography, Cardiac CT and MRI

Oct 19-22, 2011, Napa, CA
Course directors: Heidi M. Connolly, MD, Rick A. Nishimura, MD, Fletcher A. Miller Jr, MD

Coronary Artery Disease: Prevention, Detection & Treatment

Oct 21-23, 2011, Las Vegas, NV
Course directors: Charanjit S. Rihal, MD, Amir Lerman, MD, Robert D. Simari, MD

Mayo Clinic at 2011 AHA Scientific Sessions

Nov 11-17, 2011, Orlando, FL
A number of topics have been selected to be presented as American Heart Association satellite events.
Phone: 507-266-6703; e-mail: rstdomcme@mayo.edu.

NEW Echo in Marco Island: A Case-Based Approach

Dec 1-4, 2011, Marco Island, FL
Course directors: Roger L. Click, MD, PhD, Naser M. Ammash, MD

The Heart Beat of Cardiology: Practical Application of Echocardiography

Dec 15-17, 2011, Chicago, IL
Course directors: Steve R. Ommen, MD, Roberto M. Lang, MD

NEW Hawaii Heart 2012: Case-Based Clinical Decision Making Using Echocardiography and Multimodality Imaging Presented by Mayo Clinic

Jan 16-20, 2012, Big Island, HI
Course directors: Charles Bruce, MD, Heidi Connolly, MD, Fletcher A. Miller Jr, MD

NEW Case Studies in Structural Heart Disease

Jan 27-29, 2012, Miami, FL
Course directors: Charanjit S. Rihal, MD, Maurice E. Sarano, MD

19th Annual Arrhythmias & the Heart: A Cardiology Update

Jan 30-Feb 3, 2012, Kauai, HI
Course directors: Douglas L. Packer, MD, Stephen C. Hammill, MD, Paul A. Friedman, MD

35th Annual Cardiovascular Conference at Snowbird

Feb 5-8, 2012, Snowbird, UT
Course directors: Douglas L. Packer, MD, Jeffrey L. Anderson, MD, George J. Klein, MD, Christopher O'Connor, MD

17th Annual Cardiology at Cancun: Topics in Clinical Cardiology

Feb 27-Mar 2, 2012, Cancun, Mexico
Course directors: Guy S. Reeder, MD, Steve R. Ommen, MD

Heart Failure Management for Nurse Practitioners, Physician Assistants, and Primary Care Providers

Mar 11-13, 2012, San Antonio, TX
Course directors: Barry L. Karon, MD, Jean A. Wagner, MS, CNP

19th Annual Echocardiographic Workshop on 2-D and Doppler Echocardiography at Vail

Mar 12-15, 2012, Vail, CO
Course directors: George M. Gura Jr, MD, Thomas Ryan, MD

Cardiology in the Capital 2012: Case-Based Clinical Decision Making

Apr 12-15, 2012, Washington, D.C.
Course directors: Heidi M. Connolly, MD, Bernard Gersh, MD, ChB, DPhil, Charanjit 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, MEd, RN, RDCS

Echo Fiesta

Apr 19-21, 2012, San Antonio, TX
Course directors: Fletcher A. Miller Jr, MD, William K. Freeman, 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

OTHER EDUCATION OPPORTUNITIES

ESC Congress 2011

Aug 27-31, 2011, Paris France
Web site: www.escardio.org/congresses/esc-2011

American Heart Association

Nov 12-16, 2011, Orlando, FL
Web site: scientificsessions.americanheart.org

American College of Cardiology

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