MAYO CLINIC

CARDIOVASCULAR UPDATE

CLINICAL CARDIOLOGY AND CARDIOVASCULAR SURGERY NEWS

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Inside This Issue

New Cardiovascular Division Leadership Announced

Charanjit S. (Chet) Rihal, MD, MBA

Robert D. Simari, MD

Charanjit S. (Chet) Rihal, MD, MBA, is professor of medicine in the College of Medicine, Mayo Clinic, and the new chair of the Division of Cardiovascular Diseases at Mayo Clinic in Rochester. He is a 1985 graduate of the University of Manitoba in Canada. He completed postgraduate training in internal medicine, cardiovascular diseases, and interventional cardiology at Mayo Clinic, following which he was a member of the faculty at McMaster University, Hamilton, Ontario. Since 1995 he has been a member of the Mayo Clinic staff. He is board-certified by the American Board of Internal Medicine with subspecialty boards in cardiovascular disease and interventional cardiology. Dr Rihal received his MBA from the Carlson School of Management, University of Minnesota, in 2000 and has served as director of the Cardiac Catheterization Laboratory since 2003.

Dr Rihal's clinical interests are interventional cardiology, high-risk PCI, acute coronary syndromes, and structural heart disease; his research interests focus on the evaluation of revascularization therapies for coronary artery disease, clinical and economic outcomes among patients undergoing PCI, and new anticoagulation strategies. Dr Rihal has been the recipient of a Mayo Clinic Cardiovascular Teacher of the Year award 8 times.

Robert D. Simari, MD, professor of medicine in the College of Medicine, Mayo Clinic, has been named vice chair of the Division of Cardiovascular Diseases at Mayo Clinic in Rochester. Dr Simari obtained his undergraduate degree at the University of Notre Dame in Indiana and graduated from medical school at the University of Kansas. Dr Simari completed his internal medicine residency at Beth Israel Hospital in Boston and his cardiovascular fellowship and interventional cardiology training at Mayo Clinic in Rochester. Following his clinical training, he completed a postdoctoral fellowship in the laboratory of Dr Elizabeth G. Nabel at the University of Michigan. Dr Simari's area of interest is the biological response to vascular injury and the development of new biological therapies for cardiovascular disease. His translational work has included the development of new genetic, cell- and peptide-based therapies. Dr Simari chairs the Cardiovascular Cell Therapy Research Network (CCTRN), sponsored by the National Institutes of Health, currently conducting clinical trials of autologous cell delivery for patients with severe left ventricular dysfunction. He also served as a charter member of the NIH Vascular Cell and Molecular Biology Study Section and on the NIH Recombinant DNA Advisory Committee. He was elected to the American Society of Clinical Investigation in 2005.

Epicardial Radiofrequency Catheter Ablation for Ventricular Arrhythmias

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***Mayo Health System*

Since the release of enhanced indications (earlier in the past decade) for implantable cardioverter-defibrillator (ICD) placement, patients at risk for ventricular arrhythmias have received life-extending device therapies. Thus, tertiary electrophysiology centers across the country are faced with an increasing number of patients who have ICD/drug–refractory reentrant ventricular arrhythmias and electrical storm (ES).

From prior studies, it is believed that more than 10% of ICD patients experience ES within 2 years of implantation. Further, with the introduction in the past 15 years of nontransplant strategies such as left ventricular assist devices and cardiac resynchronization therapy (CRT) for management of drug-refractory congestive heart failure (CHF), additional patients who would otherwise have died from CHF are experiencing ES, requiring medical attention.

For patients with ES, Class I–indicated treatments (according to the ACC/AHA/ESC 2006 Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death) include coronary artery bypass grafting, percutaneous coronary intervention, intravenous β-blockers, and intravenous amiodarone. The major Class II treatment is radiofrequency ablation (RFA), used as a required modality in at least 10% of ES patients presenting to large tertiary centers.

Two important trials of ventricular tachycardia (VT) ablation for secondary prevention of ES in patients with structural heart disease have appeared recently in the literature. These studies used saline-irrigated, cooled-tip RFA devices to create deeper endocardial lesions. Nonetheless, only 60% of patients in each trial were "free" of shocks at 6 months of follow-up. Multiple VT circuits, CHF, age, and lack of an incessant, hemodynamically well-tolerated VT to map were predictive of recurrence. Many left ventricular (LV) walls have a muscle thickness of more than 1 cm, beyond the lesion field depth of current catheter technologies. Furthermore, patients with dilated cardiomyopathy may have a higher scar density appropriate for anchoring linear RFA lesions on the outside of the heart, rather than the endocardial surfaces. Such is the case with a disease of the Amazon jungle, Chagas disease, caused by the parasitic protozoan *Trypanosoma cruzi* and transmitted by the blood-sucking assassin bug ("kissing bug"). Chagas disease causes heart failure, conduction system disease, and ventricular arrhythmias. South American medical colleagues were quick to discover that the scars that produced the VT in these patients were chiefly epicardial, not endocardial, and could be more readily mapped and ablated from outside the heart rather than from the inside. While this could be accomplished surgically, a less invasive percutaneous approach was needed.

The initial experiences with epicardial mapping and ablation using a percutaneous approach were developed by Dr Eduardo Sosa and colleagues at the Heart Institute (InCor), University of São Paulo Medical School in Brazil. They reported a percutaneous epicardial approach for placement of electrophysiologic hardware in 1999. This technique involves the subxiphoid placement of sheaths into an intact, closed pericardial space. The pericardium typically contains 30 to 50 mL of straw-colored fluid and as such is a virtual space. By accessing the pericardial space, electrophysiologists can map and ablate simultaneously from the endocardial and epicardial surfaces, thus facilitating full-thickness lesion generation

CLINICAL TRIALS

CABANA: Catheter Ablation vs Antiarrhythmic Drug Therapy for Atrial Fibrillation

This multicenter study, involving 3,000 patients, proposes that the treatment strategy of percutaneous left atrial catheter ablation for the purpose of the elimination of atrial fibrillation (AF) is superior to current state-of-the-art therapy with either rate-control or antiarrhythmic drugs for reducing total mortality (primary end point) and decreasing the composite end point of total cardiovascular mortality, disabling stroke, serious bleeding, and cardiac arrest (secondary end point) in patients with recent-onset AF requiring treatment.

For more information contact
Laura Peterson: 507-255-7456 or CABANA@mayo.edu
Douglas L. Packer, MD: 507-255-7456

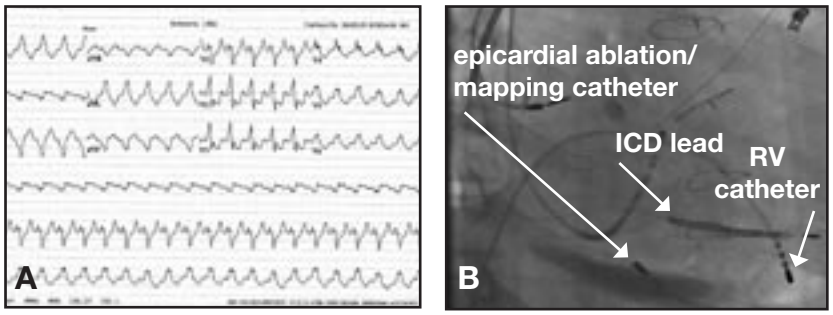

Figure 1. A, The electrocardiogram of the VT is consistent with an inferior wall exit. B, Right anterior oblique fluoroscopic projection. An ICD lead and an endocardial apical RV catheters are present. Contrast dye within the inferior pericardial space is shown as well as the epicardial sheath and ablation/mapping catheter.

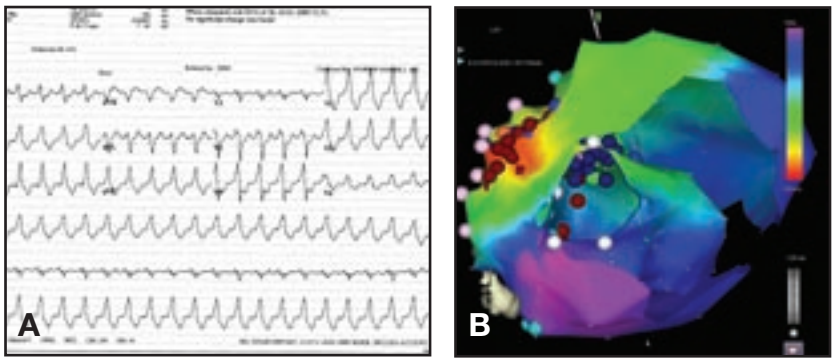

Figure 2. A, Lateral exit is suggested by QRS morphology on this electrocardiogram. B, This location is confirmed by simultaneous epicardial and endocardial activation maps, demonstrating an early breakout on the epicardial lateral left ventricle.

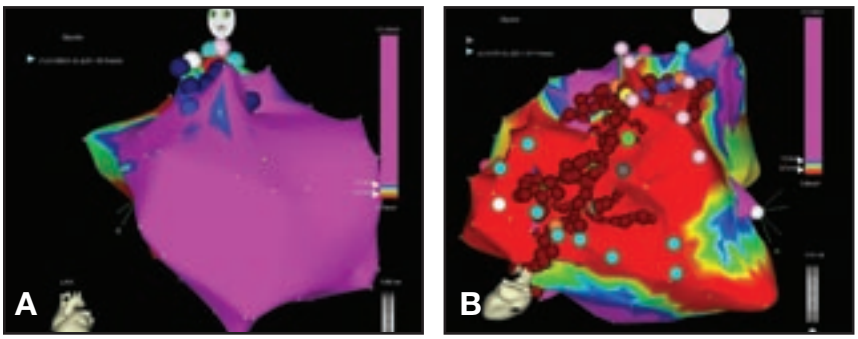

Figure 3. Voltage maps of the endocardial (A) and epicardial (B) surfaces are shown with the voltage sites in red. A large epicardial scar is shown with normal voltages inside the left ventricle.

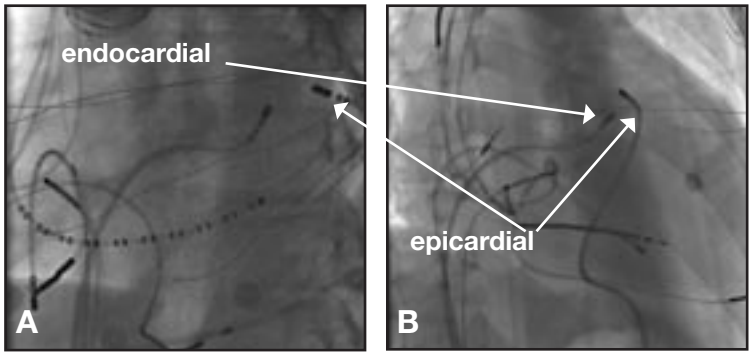

Figure 4. Left (A) and right (B) anterior oblique fluoroscopic views of the endocardial and epicardial ablation catheters across from each other at anterolateral LV sites.

in the left ventricle. Additional care must be taken in the epicardial space to avoid adjacent structures that are normally protected from thermal trauma on the inside of the heart (coronary arteries, phrenic nerve, pulmonary tissues). Several groups in Europe, Asia, and North America have visited São Paulo to gain experience with this important technique.

The percutaneous epicardial ablation program at Mayo Clinic in Rochester, Minnesota, began in 2004. Multiple patients have undergone endocardial mapping and ablation with no obvious scar even being noted; subsequent epicardial mapping demonstrated a definite epicardial scar substrate to which ablation could be applied, alleviating the patient's ventricular arrhythmia. While the typical patient has underlying structural heart disease, many patients with normal hearts and highly symptomatic premature ventricular contraction (PVC) or VT foci in the left ventricle (which cannot be accessed from traditional approaches using the LV outflow tract or the aortic cusp) are presenting for epicardial treatment.

Both fluoroscopic and echocardiographic imaging with contrast dye is used to facilitate access to the pericardial space. Most patients have the pericardial sheath removed either the evening of the procedure or within 48 hours after placement. The images shown in Figure 1 are from a 57-year-old man with prior inferior myocardial infarction, ICD placement for recurrent VT, shocks despite amiodarone, and 2 prior endocardial mitral isthmus ablations.

Another example is a 48-year-old man whose VT is shown in Figure 2. He had dilated cardiomyopathy, LV ejection fraction of 25%, an ICD enabled with CRT with multiple ICD shocks, and 2 prior unsuccessful ablation attempts.

Figure 3 shows voltage maps of the endocardial and epicardial surfaces, illustrating catheter positions in the same patient shown in Figure 2. Figure 4 shows fluoroscopic views of the endocardial and epicardial ablation catheters across from each other at anterolateral LV sites in the same patient.

In these examples, epicardial activation, voltage mapping, and epicardial RFA were critical and necessary to achieve the desired clinical effects. Both ventricular rhythms terminated with epicardial energy delivery.

As experience with ablation of patients with structural heart disease and reentrant VT, as well as younger patients with focal epicardial VT or PVC foci and associated tachycardia-induced cardiomyopathy has widened, electrophysiologists and cardiologists are exploring other areas that could prove fruitful if assisted by this valuable percutaneous epicardial access technique. In the future this approach will include devices for left atrial appendage occlusion, reservoirs for drug delivery, epicardial pacing, and genotherapies.

Mayo Clinic Physicians Perform First Minnesota Implantation of Transcatheter Pulmonary Valve

Allison K. Cabalka, Donald J. Hagler, MD, Frank Cetta, MD

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Pediatric cardiologists at Mayo Clinic have performed the first transcatheter prosthetic pulmonary valve implants in Minnesota. The Melody pulmonary valve (Medtronic Corporation, Minneapolis, Minnesota), a 3-cusp bovine jugular valve mounted within a platinum iridium stent (Figure 1), was approved by the US Food and Drug Administration earlier this year and is the first transcatheter valve to receive such approval in the United States under Humanitarian Device Exemption criteria (Table).

Right ventricle (RV)–to–pulmonary artery (PA) conduits have played an important role in the repair of numerous congenital heart defects since the 1970s, including tetralogy of Fallot, truncus arteriosus, and pulmonary atresia with ventricular septal defect. Prosthetic valves are placed in the pulmonary position as a component of the Ross procedure. Unfortunately, all conduits and bioprosthetic valves have a finite lifespan. In adults, the average lifespan for a RV-PA conduit or pulmonary bioprosthetic valve is approximately 10 years; however, in young patients the duration may be much shorter. "Pulmonary valve dysfunction may be attributable to pulmonary regurgitation, stenosis of the valve leaflets, or a combination of both," according to Allison K. Cabalka, MD, director of the Pediatric and Congenital Cardiac Catheterization Laboratory at Mayo Clinic in Rochester, Minnesota. "Patients experience progressive right ventricular dilation, systolic dysfunction, reduced exercise tolerance, and an increased risk of cardiac arrhythmias and sudden death."

The first transcatheter pulmonary valve was inserted by Dr Philipp Bonhoeffer in 2000. The current transcatheter valve, a redesigned version of the original valve, has been used in Europe and Canada for several years. Since 2007, the valve has been available at a limited number of US centers for initial clinical trials. Procedural complications included conduit rupture requiring urgent surgery and device removal in 1 patient, wide complex tachycardia in 1 patient, and distal PA guide wire perforation in 1 patient. No deaths occurred in the US study. Peak systolic conduit gradient decreased from 37 mm Hg to less than 20 mm Hg. No patient had more than mild pulmonary regurgitation after implantation of the transcatheter valve, whereas 94% of these patients had moderately severe or severe regurgitation before implantation. At 6-month follow-up of the clinical trial patients, the mean gradient by Doppler echocardiography across the conduit valve was 22 mm Hg. Stent fractures have occurred in approximately 20% of the patients who received implants; however, only a small number of these require placement of a second transcatheter valve due to progressive dysfunction of the original implant.

Before implantation, the anatomy of the right ventricular outflow tract and its relationship to the course of the coronary arteries are evaluated in detail. Test inflation with a balloon across the conduit is performed to ensure that no compression of the proximal coronary arteries occurs and that conduit size is appropriate for valve implantation. "If coronary

Table. Transcatheter Pulmonary Valve Implantation Criteria

Inclusion Criteria
- Objective evidence of right ventricle–to–pulmonary artery conduit dysfunction: moderate to severe valve regurgitation or stenosis (mean gradient ≥35 mm Hg)
- Venous anatomy able to accommodate a 22F delivery system
- Right ventricle–to–pulmonary artery conduit ≥16 mm in diameter at original implantation

Exclusion Criteria
- Active endocarditis
- Native right ventricular outflow tract without a conduit

Figure 1. The transcatheter valve is composed of a trileaflet bovine jugular venous valve and a balloon-expandable stent.

compression occurs during the test inflation, the patient is not a candidate for the current transcatheter system," says Frank Cetta, MD, chair of the Division of Pediatric Cardiology at Mayo Clinic in Rochester. The system is delivered over a stiff guide wire into the right ventricular outflow tract, usually through femoral venous access, although a jugular venous approach may be used if the femoral veins are obstructed. "Implantation of the transcatheter valve is performed under fluoroscopic imaging with follow-up hemodynamics and angiography to confirm normal valve function without significant gradient or regurgitation," according to Donald J. Hagler, MD, a pediatric cardiologist at Mayo Clinic in Rochester.

Currently, the longest follow-up of patients in the United States who have received the transcatheter valve is 3 years, and the longest international follow-up is approximately 10 years. "The overall hope is that the durability of the transcatheter valve will be similar to that of bioprosthetic valves implanted surgically," says Dr Cabalka. Patients may even be candidates for repeat transcatheter valve implantation, thus, forestalling cardiac surgery. Before the transcatheter valve became available, open heart surgery (often with repeat median sternotomies and repetitive exposure to cardiopulmonary bypass) was the only way to treat a dysfunctional pulmonary valve conduit. The ability to replace the pulmonary valve using a transcatheter technique may improve the long-term prognosis and reduce the need for open heart procedures for these patients.

Case Presentations

Case 1

A 19-year-old man was born with tetralogy of Fallot (large ventricular septal defect, severe RV outflow obstruction, aortic override, and right ventricular hypertrophy). He underwent surgical repair in infancy but required early reoperation because of severe right ventricular outflow obstruction, leaving him with free pulmonary regurgitation. He then underwent placement of a 27-mm porcine bioprosthetic valve in 2001 at Mayo Clinic in Rochester to treat severe pulmonary regurgitation. In early 2010, he presented with reduced exercise tolerance and was found to have combined severe bioprosthetic pulmonary valve stenosis and regurgitation, warranting conduit revision.

Case 2

A 49-year-old man underwent a Ross procedure in 1997 in his home hospital for treatment of bicuspid aortic valve disease; a 24-mm pulmonary homograft was implanted in the right ventricular outflow tract. He later required ascending aortic graft placement. He developed endocarditis of his pulmonary homograft in 2009, which was successfully treated, but left him with flail leaflets, severe pulmonary valve regurgitation, and moderate stenosis (Figure 2 A). Pulmonary valve replacement was recommended, and his primary cardiologist referred him to Mayo Clinic for treatment.

Case Follow-up

Images obtained during implantation are shown in Figure 2 B and C. Follow-up Doppler echocardiography shows normal valve function (Figure 3). There were no procedural complications. Both patients who received implants in May 2010 at Mayo Clinic were dismissed from the hospital within 24 hours and are doing well in short-term follow-up. Both patients returned to normal activities and work within a few days of hospital discharge.

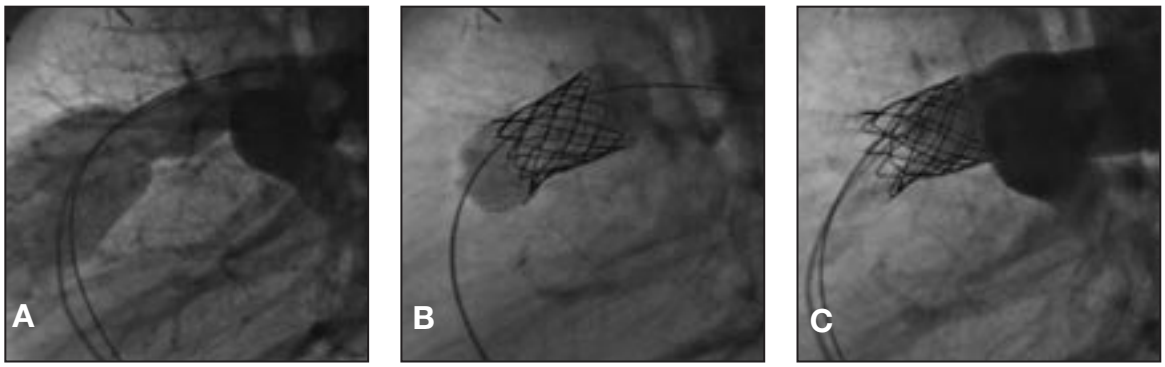

Figure 2. A, Lateral plane angiogram before intervention shows narrowing of the existing pulmonary homograft and severe pulmonary valve regurgitation with opacification of the right ventricular outflow tract despite contrast injection in the distal pulmonary artery. B, Lateral projection of balloon inflated to deliver the percutaneous pulmonary valve. C, Follow-up angiography shows resolution of pulmonary regurgitation and expansion of the narrowed right ventricular outflow tract.

Additional Information

For additional information regarding use of the transcatheter pulmonary valve at Mayo Clinic in Rochester, please contact Drs Cabalka, Cetta, or Hagler via the Division of Pediatric Cardiology, 507-266-0676.

Pulmonary Arterial Hypertension: Climbing and Researching for a Cure

Robert P. Frantz, MD

Intravenous epoprostenol was approved for the treatment of pulmonary arterial hypertension (PAH) in 1996, providing an important but complex treatment option for this difficult disease that disproportionately affects women. Recognizing the need for a dedicated team of nurses and physicians to care for these remarkable patients in an intensive longitudinal fashion, Michael D. McGoon, MD, established the Pulmonary Hypertension Clinic at Mayo Clinic in Rochester, Minnesota, in 1997. Efforts to find additional therapy have led to the approval of endothelin antagonists, phosphodiesterase-5 inhibitors, and an array of prostanoids delivered by various routes, making decision making regarding optimal treatment for individual patients ever more complex. The Pulmonary Hypertension Clinic has participated in most of the clinical trials that led to approval of these medications and provided the opportunity for patients to have access to cutting-edge therapies. Despite continued advances, the prognosis for PAH remains limited, with annual mortality rates in the range of 10%, depending on severity and the context in which it occurs. Robert P. Frantz, MD, director of the Pulmonary Hypertension Clinic, is passionate in the pursuit of improved treatment. This passion prompted him to climb Mount Kilimanjaro (highest point in Africa at 19,330 feet) this year to raise awareness and funds for pulmonary hypertension research and education on behalf of the Pulmonary Hypertension Association.

Friends and fellow PAH care providers Raymond Benza, MD, and Jessica Lazar, PA, from Allegheny General Hospital in Pittsburgh committed to climb Kilimanjaro with Dr Frantz. Following many months of dedicated training, which, for Dr Frantz, included climbing up and down 20 flights of stairs 4 times daily, the team set off in February. After 7 days of traversing around the mountain, gaining altitude and acclimatizing, the team started the ascent. "With a midnight start at 15,000 feet, we began our climb up the mountain," says Dr Frantz. "It was cold,

IN THE NEWS

Mayo Clinic Expedition Assesses the Physiologic Response of Humans Exposed to Extreme Environments

In February, members of a research team from Mayo Clinic in Rochester, Minnesota, accompanied extreme athlete Diane Van Deren as she reached the summit of Mount Aconcagua in the Argentinian Andes. The Mayo team, led by cardiology researcher Bruce D. Johnson, PhD, monitored Ms Van Deren's vital signs as she ascended the highest peak in the Western Hemisphere (22,841 feet) to assess the physiologic response of humans exposed to extreme environments.

Dr Johnson believes much can be learned from elite athletes like Ms Van Deren. "It's fun to watch somebody out in the wilderness exposed to extreme environments. It's even more fascinating to see what's happening to breathing, heart rate, and blood oxygen, and to see how the human body adapts," he says. Understanding compensatory physiology in unusual environments will help researchers understand better how the body adapts when it's under the stress of disease and illness.

Before the trip, Diane Van Deren visited Mayo Clinic so that researchers could get baseline measures of her health before she began the expedition. A noted "ultra-endurance athlete," Ms Van Deren, a 49-year-old mother of three, underwent Mayo's extreme human performance testing protocol before returning home to Colorado to train for her trip.

Dr Johnson spent part of last year at the South Pole, collecting physiologic data on the people who work there. In addition to studying Ms Van Deren, he also tested a range of technology that may be used eventually to monitor patients remotely.

Dr Johnson and Ms Van Deren during the climb of Mount

Figure. Dr Frantz at the summit of Mount Kilimanjaro.

windy, and steep, but as we climbed, we were able to watch the moon set behind the mountain and see the Southern Cross in the sky." At dawn, the team reached the summit of Mount Kilimanjaro (Figure).

Knowing that patients and their families were following the climb on the Internet, raising funds for PAH research, and conducting their own Unity Walks was a powerful motivator for the team as they climbed. "The sense of community and an appreciation for the dyspnea that our PAH patients live with so gracefully every day brought tears to my eyes," says Dr Frantz. More than $100,000 was raised to support PAH awareness and research efforts.

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Current Trends in PAH Research

Novel Vasodilators

The Pulmonary Hypertension Clinic is participating in multiple critical multicenter studies of novel agents. Traditionally, PAH therapies have focused on vasodilator approaches, and these approaches continue with ongoing clinical studies of the soluble guanylate cyclase activator riociguat. Another important approach involves the prostacyclin (IP) receptor agonist selexipag. The IP receptor is a G protein–coupled receptor that stimulates the formation of cyclic adenosine monophosphate. An orally bioavailable prostanoid, treprostinil diethanolamine, is also being studied. All the agents appear promising for expanding PAH treatment options.

Exploring Synergism

Animal studies conducted in the laboratory of Frank V. Brozovich, MD, PhD, at Mayo Clinic in Rochester suggest that angiotensin-converting enzyme inhibitors may augment the vasodilating potential of phosphodiesterase-5 inhibitors by influencing myosin light-chain phosphatase isoforms. The MELISSA study (Modulating Effects of Lisinopril on Phosphodiesterase-5 Inhibitors in Pulmonary Arterial Hypertension) is a Mayo Clinic investigator–initiated translational research project examining this concept.

Antiproliferative Approaches

It has long been recognized that PAH involves not just vasoconstriction but also proliferative changes that obstruct the pulmonary vascular bed. Antiproliferative approaches represent a major new direction in PAH research. The tyrosine kinase inhibitor imatinib represents the first of a series of such agents and is the subject of a multicenter randomized clinical trial currently enrolling patients at Mayo Clinic.

Combination Therapy

Given the number of approved therapies, there is an ongoing need to assess the efficacy of combinations of these agents. In addition, examination of therapeutic strategies (up-front combination therapy vs sequential therapy) is being pursued with endothelin antagonists and phosphodiesterase-5 inhibitors.

Epidemiology of PAH

Mayo Clinic is the leading enroller in the national pulmonary hypertension REVEAL registry, which has resulted in numerous publications that shed light on the factors influencing prognosis in PAH. The impact of a 3,000-patient registry for an uncommon disease such as PAH has been enormous. Publications from Mayo Clinic's own PAH database also continue to make substantive contributions to the field. In addition, Mayo is participating in an observational study (DETECT) that follows scleroderma patients without PAH to help find early markers that PAH is developing.

Quantitation of Right Ventricular Function

Progressive right ventricular (RV) failure is a worrisome feature of PAH. Mayo Clinic is leading the way in identifying better ways to detect and follow RV dysfunction, including sophisticated echocardiographic measures of RV stress and strain and quantitation of RV function by magnetic resonance imaging. In addition, relationships between biomarkers such as N-terminal brain natriuretic peptide and right ventricular function are being studied to further define the role of serial biomarkers in following the progress of PAH patients.

Cardiopulmonary Exercise Testing

Traditionally the 6-minute walk has been the predominant test used to determine exercise capacity in patients with PAH. However, there is increasing interest in gas exchange data available with cardiopulmonary exercise testing. In addition, a portable laptop–based assessment of gas exchange performed during a step test in the Pulmonary Hypertension Clinic is being studied. It is hoped that such techniques will provide additional useful information for PAH patients.

"Despite significant advances in PAH therapy, treating this condition remains complex and requires expert management," says Dr Frantz. "In addition, ongoing studies of novel therapies have no chance of being successful if patients who may be eligible for such studies are not referred to centers deeply committed to furthering understanding of optimal PAH therapy."

Additional Information

For information about the Mayo Clinic Pulmonary Hypertension Clinic, please call 507-284-3994, or visit the Web site at http://www.mayoclinic.org/cardiovascular-disease-rst/pulmhyperclinic.html.

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 Update 2010: The Heart of the Matter
Aug 6-8, 2010, Sedona, AZ
Phone: 480-301-4580; e-mail: mca.cme@mayo.edu

Success With Failure: New Strategies for the Evaluation and Treatment of Congestive Heart Failure
Aug 8-10, 2010, Whistler, BC

24th Annual Echocardiographic Symposium at Vail: New Technologies, Live Scanning, and Clinical Decision Making
Aug 15-19, 2010, Vail, CO

Echocardiography Review Course for Boards and Recertification
Aug 21-24, 2010, Rochester, MN

Electrophysiology Review for Boards and Recertification
Aug 25-28, 2010, Rochester MN

Pediatric Cardiology 2010 Board Review Course
Aug 29-Sep 3, 2010, Dana Point, CA

Cardiovascular Review Course for Cardiology Boards and Recertification: Precourse Echo Focus Session
Sep 24-25, 2010, Rochester, MN

Cardiovascular Review Course for Cardiology Boards and Recertification
Sep 25-30, 2010, Rochester, MN

Echocardiography for the Sonographer: Focus on Adult Echocardiography
Sep 26-28, Rochester, MN

Interventional Cardiology Board Review
Oct 1-3, 2010, Rochester, MN

26th Annual Echocardiography in Pediatric and Adult Congenital Heart Disease
Oct 10-13, 2010, Rochester, MN

Cases in Echocardiography: TEE, Doppler, and Stress—Interpretation and Clinical Decision Making for the Advanced Echocardiographer
Oct 20-23, 2010, Napa, CA

10th Annual Nutrition and Wellness in Health and Disease
Nov 4-5, 2010, San Francisco, CA

Pericardial Disease: Diagnosis, Management & Clinical Mimickers
(satellite symposium in conjunction with 2010 American Heart Association Scientific Sessions)
Nov 13, 2010, Chicago, IL
Phone: 507-266-0677; e-mail: cvcme@mayo.edu

The Heart Beat of Cardiology: From Stethoscope to Echoscope
Dec 9-11, 2010, Chicago, IL

Arrhythmias and the Heart
Jan 31-Feb 3, 2011, Big Island, HI

16th Annual Cardiology at Cancun
Feb 28-Mar 4, 2011, Cancun, Mexico

18th Annual Echocardiographic Workshop on 2-D and Doppler Echocardiography at Vail
Mar 6-10, 2011, Vail, CO

Other Education Opportunities

American Heart Association Scientific Sessions
Nov 13-17, 2010, Chicago, IL
Web: scientificsessions.americanheart.org

RECOGNITION


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Paul Sorajja, MD


Andre C. Lapeyre III, MD


Rick A. Nishimura, MD


David J. Driscoll, MD, Farris K. Timimi, MD, Malcolm R. Bell, MD

Rick A. Nishimura, MD, has been inducted as a Master of the American College of Physicians. Masters comprise a small group of highly distinguished physicians who have made significant contributions to the science and art of medicine.

Carole A. Warnes, MD, was recognized at the International Congress on Cardiac Problems in Pregnancy in Valencia, Spain, for her outstanding contributions to teaching, research, and patient care of cardiac problems in pregnancy.

Paul Sorajja, MD, was chosen by the internal medicine residents at Mayo Clinic in Rochester to receive the 2010 Outstanding Cardiology Inpatient Teacher Award. **Andre C. Lapeyre III, MD**, received the 2010 Innovation in Education Award.

Farris K. Timimi, MD, and **Malcolm R. Bell, MD**, members of the Division of Cardiovascular Diseases, and **David J. Driscoll, MD**, a member of the Division of Pediatric Cardiology, received 2010 Mayo Clinic Teacher of the Year Awards.

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