Transforming Cardiac Surgery with Transesophageal Echocardiography  pg 4

A major research grant for cardiac perfusion with computed tomography  pg 3
The latest in endovascular interventions for peripheral arterial disease  pg 6
Case Study: Successful LVAD therapy for a refractory heart failure patient  pg 7
Sharing Our Advances

The depth and breadth of our clinical offerings, the innovative advances of our research endeavors with Case Western Reserve University School of Medicine, and the effectiveness of our educational mission are propelling University Hospitals Harrington Heart & Vascular Institute at University Hospitals Case Medical Center to national leadership as a model of excellence and transformative force in modern cardiovascular medicine and surgery. In this issue of Heart & Vascular Innovations, we share the exemplary clinical advancements of several programs led by our renowned physicians, surgeons and staff.

In “Research Connection,” Hiram Bezerra, MD, PhD, Robert “Chip” Gilkeson, MD, and David Wilson, PhD, report on a novel method – cardiac perfusion with computed tomography (CT) – for assessing cardiac anatomy and performance. They provide an update on developments to support this new imaging technology as a result of a $2.5 million grant to Case Western Reserve University from the Ohio Third Frontier Commission in collaboration with the Philips Healthcare Global Advanced Imaging Innovation Center.

Edwin Avery, MD, illustrates in our cover story how transesophageal echocardiography (TEE) has transformed cardiac anesthesia and heart surgery by offering superior visualization of the heart to confirm pre-operative diagnoses and to support surgical interventions directly at the point-of-care. He has established numerous multidisciplinary educational and training activities for cardiac anesthesiologists, cardiac surgeons, cardiologists and trainees at UH Case Medical Center as well as other affiliate institutions of Case Western Reserve University School of Medicine.

Offering innovative technologies in vascular imaging and minimally invasive therapies, Sahil A. Parikh, MD, and Vikram Kashyap, MD, describe in our feature story their experiences with the new approaches to treat peripheral arterial disease. The importance of early detection and optimal medical treatments are discussed. Endovascular techniques for PAD continue to evolve and Drs. Parikh and Kashyap highlight cutting-edge therapies with drug-coated balloons and newly designed stents that are being evaluated in clinical trials in our institute’s Research & Innovation Center.

In “Case Study,” James Fang, MD, discusses treatment options for a patient with refractory heart failure who is not a transplant candidate. To improve his quality and length of life, he was treated with a left ventricular assist device as a permanent heart pump therapy.

Save the dates! I invite you to join us for our 3rd Annual Update on Vascular Disease in April 2012 and the 14th Biennial Midwest Platelet Conference in October 2012. See further details on the back panel of this issue. We hope to see you there.

To Heal. To Teach. To Discover.

Daniel I. Simon, MD, FACC, FAHA, FSCAI
Chief, Division of Cardiovascular Medicine
Director, UH Harrington Heart & Vascular Institute
University Hospitals Case Medical Center
Herman K. Hellerstein Professor of Cardiovascular Research
Case Western Reserve University School of Medicine

Heart & Vascular Innovations is published biannually by University Hospitals 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.

Heart & Vascular Innovations Winter 2012, Volume 3, Issue 2
Contributors: Daniel I. Simon, MD; Edwin G. Avery, MD; Hiram Grando Bezerra, MD; James Fang, MD, FACC; Robert “Chip” Gilkeson, MD; Sahil A. Parikh, MD; David L. Wilson, PhD
Marketing Manager: Tiffany Hatcher
Director of System Marketing: Donna Casey, RN, MBA

University Hospitals Case Medical Center
Cleveland, OH

The commitment to exceptional patient care begins with revolutionary discovery. University Hospitals Case Medical Center is the primary affiliate of Case Western Reserve University School of Medicine, a national leader in medical research and education and consistently ranked among the top research medical schools in the country by U.S. News & World Report. Through their faculty appointments at Case Western Reserve University School of Medicine, physicians at UH Case Medical Center are advancing medical care through innovative research and discovery that bring the latest treatment options to patients.
Looking into the Future

Cardiac perfusion with computed tomography may represent ‘one-stop shopping’ for patients

In a move that underscores the value of advancing the field of multimodality cardiac imaging, the Ohio Third Frontier Commission recently awarded a $1.6 million grant to Case Western Reserve University to support innovative new projects with a total implication of $2.5 million conducted in the Philips Healthcare Global Advanced Imaging Innovation Center, a collaboration among Case Western Reserve University, University Hospitals Case Medical Center, and Philips Healthcare. Among the research funded under the grant is a study of a novel method – cardiac perfusion with computed tomography (CT) – for assessing cardiac anatomy and performance.

A Dissociation

The project will be led by Hiram Grando Bezerra, MD, PhD, Medical Director, Cardiovascular Imaging Core laboratories, UH Case Medical Center; and Assistant Professor, Case Western Reserve University School of Medicine; and Robert “Chip” Gilkeson, MD, Director, Cardiothoracic Imaging, UH Case Medical Center; and Professor, Department of Radiology, Case Western Reserve University School of Medicine. David L. Wilson, PhD, Robert J. Herbold Professor of Biomedical Engineering, Case Western Reserve University, will direct efforts at Case Western Reserve University. Numerous scientists and engineers from Philips Healthcare will help optimize CT imaging for this important application.

Traditional cardiac CT imaging is primarily used to assess anatomy by means of high-resolution images that provide a detailed view of coronary artery blockages and cardiac contraction. Although the accuracy of cardiac CT imaging in identifying blockage is high, it provides little information regarding the physiological importance of the lesion. “The problem is that you may have a blockage that can be identified by CT, but you really don’t know if the blockage is leading to ischemia or hypo-perfusion,” says Dr. Bezerra, who was co-author of the first papers on CT perfusion in humans (JAAC 2009;1072–84; Radiology 2010;410–19; J Nucl Cardiol 2010;27–37).

“Nuclear medicine and stress MRI are examples of methods to assess perfusion of the myocardium, which can indirectly suggest that a blockage is present, but cannot visualize a stenosis in an artery. So it is difficult to connect the different sources of information to assess the location and effect of the blockage.”

Single Exam

Researchers are hoping a comprehensive cardiac CT exam performed in a high-end scanner, able to perform at lower radiation rates, will help bridge this gap. As such, the aim of the project is to examine whether adding perfusion information by means of direct quantification of the intensity of injected contrast in different regions of the myocardium is an efficient method for assessing both anatomy and physiology in a single exam, giving patients what Dr. Bezerra calls “one-stop shopping.” Investigators will develop novel hardware and software modifications to existing scanners to perform validation tests. Joining anatomy with function through a singular imaging technique may prove important in terms of earlier diagnosis and treatment planning, particularly because the presence of a blockage itself does not necessarily warrant invasive treatment. Using separate imaging modalities, by contrast, can lead to a mismatch in information.

“When you go back and forth between methods,” says Dr. Bezerra, “one technique may show that there is a blockage while the other may show no hypo-perfusion. This inconsistency is not only costly for the system; it makes patient care more difficult. The chance to answer both questions at once would impact cost logistics, and probably impact outcomes as well, because this is a more accurate approach.”

The study will initiate Phase I preclinical investigations in early 2012.

The Ohio Third Frontier Grant to Case Western Reserve University also includes $350,000 funding for Drs. Bezerra and Gilkeson to examine the utility of MRI cardiac perfusion in combination with treadmill training. This study will be conducted in collaboration with The Ohio State University.

Have Questions?

Contact us at HVI@UHhospitals.org.

Extended Benefits

The Ohio Third Frontier grant is projected to do more than just strengthen the Philips Healthcare Global Advanced Imaging Innovation Center. By focusing on creating a new product for Philips Healthcare, the project could also result in additional jobs for the Philips CT/NM business in Cleveland and important training opportunities for Case Western Reserve University’s medical and engineering students. The new technology also may bolster Philips’ position as a market leader in cardiac imaging technology.
As both a diagnostic tool and an adjunct monitoring device for perioperative and percutaneous procedures, transesophageal echocardiography (TEE) has become a boon to cardiac and noncardiac surgery alike. In contrast to standard transthoracic echocardiography, which employs an external ultrasound probe placed on the chest, TEE uses an endoscopic ultrasound probe positioned directly in the esophagus. Because it does not have to penetrate bone, muscle or the lungs, TEE can transmit detailed, high-fidelity images depicting the structure, function and hemodynamic performance of the heart and great vessels in a manner far superior to that of the transthoracic method. But its utility in cardiac and noncardiac perioperative environments is what underscores TEE’s potential to transform the future of cardiovascular anesthesia and surgery by offering superior visualization of the heart to confirm preoperative diagnoses and support surgical interventions directly at the point of care.

“We use TEE to check our work and can immediately address any suboptimal outcomes because our image acquisition and interpretation is done in real time,” says Edwin G. Avery, MD. Chief, Division of Cardiac Anesthesia, and Vice Chairman, Research, Department of Anesthesiology and Perioperative Medicine, University Hospitals Case Medical Center; Chief Anesthesia Officer, University Hospitals Harrington Heart & Vascular Institute; and Associate Professor of Anesthesiology, Case Western Reserve University School of Medicine.
repair. Because it does not require the chest to be opened, TEE can help surgeons observe the clinical effects of drug-based or mechanical interventions (for example, adjusting the settings of a mechanical cardiac assist device) and make changes where necessary.

**Knowledge Equals Power**

Appropriate training and education for the safe and effective use of TEE are imperative. To help ensure acquisition of the relevant skill sets (see sidebar “Setting the Standard”), Dr. Avery has established numerous multidisciplinary educational and training activities for UH Case Medical Center clinicians, which is reflected in the collaborative clinical care they provide when using TEE. “Our surgical and intensive care staff have come to rely on the accurate assessment that TEE provides to allow them to make confident perioperative decisions, but the learning curve is still somewhere around three years,” explains Dr. Avery. “However, the more you practice, the more you write, the more you work with people who are better at this than you are, the better you get.”

The Division of Cardiac Anesthesia hosts a Cardiac Anesthesia TEE Conference that has become one of the most well-attended, multidisciplinary gatherings within the department of anesthesia and cardiac service line and includes anesthesiologists, resident physicians from anesthesiology and internal medicine, cardiology fellows, cardiac surgeons, cardiologists, medical students and more. Several meetings have been multi-institutional, with participation from Cleveland Clinic Foundation and MetroHealth system colleagues. “This case conference series in particular was created as a foundation to identify and stimulate clinical research and education,” says Dr. Avery. “All of these efforts help create cohesiveness within the center and improve the quality of care that we deliver.”

**Combining Capabilities**

The cross-disciplinary aspect that characterizes TEE training and practice at UH Case Medical Center is also noticeable in the clinical research conducted within UH Harrington Heart & Vascular Institute. Since his arrival in 2010, Dr. Avery has generated clinical trials that draw on expertise from several divisions within the institute. The recently completed BRIDGE Study, which examined the effects of platelet inhibition in coronary bypass patients, included the divisions of Anesthesiology, Cardiovascular Medicine and Cardiac Surgery as well as investigators from the Cardiac Intensive Care Unit. Even more notable is that this cardiology-based research, and other studies currently under way, was led by Dr. Avery as the principal investigator. Prior to his arrival at UH Case Medical Center, anesthesia-related research at UH Case Medical Center was conducted primarily by the Anesthesia Pain Division. “To have an anesthesiologist leading joint clinical research efforts is opening interdisciplinary collaborations that did not previously exist within our institution,” says Dr. Avery.

In addition to conducting clinical trials, Dr. Avery continually develops academic publications and national presentations while holding a long-term faculty position at the most well-attended national perioperative echocardiography educational meeting – the Society of Cardiovascular Anesthesiologists Annual Comprehensive Review & Update of Perioperative Echocardiography. All of these clinical research and teaching activities help establish UH Case Medical Center and Case Western Reserve University School of Medicine as a national leader in TEE and academic anesthesiology, and while this has specific benefits in terms of future research and funding, Dr. Avery emphasizes that such productivity also serves a larger, more important purpose: “Simply put, it allows us to take better care of our patients.”

---

**Enhance Your Expertise**

For information on the next multidisciplinary Cardiac Anesthesia TEE Conference (there are three or four conferences scheduled per year), contact us at HVI@UHhospitals.org.

**Setting the Standard**

Academic institutions strive to incorporate intraoperative transesophageal echocardiography (TEE) into their clinical practice despite the challenging requirements associated with certification, and UH Case Medical Center is no different. Since the arrival of Edwin G. Avery, MD, the Case Cardiac Anesthesia group has grown from one member passing the certification examination to six members. Certification in perioperative TEE is attained through fulfillment of fellowship training or other clinical pathways as mandated by the National Board of Echocardiography (NBE). After successful completion of a particular TEE training pathway, individuals are eligible for board certification through an Advanced Perioperative Transesophageal Echocardiography Examination, offered by the NBE. Furthermore, certification is available for both anesthesiologists and non-anesthesiologists. And although hands-on experience with TEE should not be undervalued as part of training, Dr. Avery warns, “Having on-the-job training with TEE isn’t necessarily the same as having the appropriate clinical skills acquired through structured training exercises with appropriate supervision and successfully passing the written examination. TEE is a powerful clinical adjunct that if not used responsibly by appropriately trained individuals can result in misdiagnoses and suboptimal care.”
Both in terms of pathophysiology and treatment, peripheral arterial disease (PAD) resembles coronary artery disease (CAD). The narrowing of arteries outside the heart, commonly in the legs, that characterizes PAD is often an indicator of comorbid CAD. In fact, nearly 50 percent of PAD patients experience a cardiac event within five years of diagnosis. “Atherosclerosis that causes PAD is like a metastatic disease that occurs all over the body in every vessel,” says Sahil A. Parikh, MD, Director, Experimental Interventional Cardiology Laboratory, University Hospitals Case Medical Center; and Assistant Professor of Medicine, Case Western Reserve University School of Medicine. “Once it is in one vascular bed, it is likely to be everywhere. We just have to look hard enough to find it.”

Such pervasiveness underscores the importance of early detection and appropriate treatment. Typical noninvasive therapies include antiplatelet agents, antihypertensives and statins. When symptoms become so prohibitive that activities of daily living or vocational functioning are impaired or when patients become symptomatic even at rest — a harbinger that limb amputation may be warranted — more invasive techniques are considered. As in CAD, these endovascular interventions include balloon angioplasty, stent and atherectomy procedures that restore blood flow.

A Range of Options
Endovascular treatments for PAD continue to evolve, and the UH Harrington Heart & Vascular Institute at UH Case Medical Center is among a select number of medical centers testing a range of advanced procedures. Trials of newly designed stents may lead to the replacement of existing stents, which were created for the heart and are vulnerable to fracture when placed in the leg. Drug-coated angioplasty balloons and drug-coated stents, constructed to prevent scar tissue and restenosis, are being investigated at the Institute and are among the first to be used in Ohio. Additional protocols are studying such novel treatments as stem cell transplantation for patients at risk for amputation when vessel stenting or bypass is found to be inappropriate or ineffective.

These and other clinical studies for PAD patients may also help inform the treatment of related conditions. For instance, one current trial is examining use of renal artery ablation to address treatment-resistant hypertension, which Dr. Parikh calls particularly exciting because the procedure “uses the same skills we use for PAD to help us address a much bigger problem — hypertension.”

Shown in Panel A is a patient with 100 percent occlusion of the right common iliac artery (arrowhead). After crossing the occlusion, dilating it with balloon angioplasty and placing a stent, the artery is now widely patent with no residual stenosis (Panel B).

Merging Talents
Historically, PAD has been managed by internists and vascular surgeons, who helped pioneer the use of bypass procedures. Today, endovascular interventions are largely performed by cardiologists and vascular surgeons leveraging each specialty’s expertise. At UH Case Medical Center, both clinically and in research, these disciplines form a united front, with interventional cardiologists, vascular surgeons, experts from vascular medicine and noninvasive specialists such as radiologists combining their unique expertise. “Here at UH, PAD is seen by many different practitioners, but we try to work as a seamless team in a truly collaborative fashion to provide the best care possible,” says Vikram S. Kashyap, MD, Chief, Division of Vascular Surgery and Endovascular Therapy, UH Case Medical Center; Co-Director, UH Harrington Heart & Vascular Institute; and Professor of Surgery, Case Western Reserve University School of Medicine. “The critical goal is to save lives and prevent amputation, and using multimodality medical therapies allows this to be accomplished.”

To Refer Your Patients
Patients can be referred to Vascular Surgery, Interventional Cardiology and Vascular Medicine by calling 216-844-3800. For information about or referral into any of the clinical trials for PAD, please contact Stacey Mazzurco, RN, Manager, Clinical Trials, UH Harrington Heart & Vascular Institute at UH Case Medical Center at 216-844-3130 or Stacey.Mazzurco@UHhospitals.org.
Exploring Options
The Advanced Heart Failure & Transplant Center considers a host of treatments for refractory heart failure

A 70-year-old diabetic man with progressive renal dysfunction was referred to the Advanced Heart Failure & Transplant Center at University Hospitals Case Medical Center for medically refractory NYHA IV heart failure. He had undergone bypass surgery 10 years ago and placement of a biventricular pacemaker and defibrillator five years ago. Despite careful attention to dietary restrictions and medical therapy, he experienced repeated hospitalizations.

James Fang, MD, FACC, Director, Advanced Heart Failure & Transplant Center; Chief Medical Officer, UH Harrington Heart & Vascular Institute; and Professor of Medicine, Case Western Reserve University School of Medicine, discusses the patient’s options below.

Discussion
The definitive therapy for end-stage heart disease is cardiac transplantation. Unfortunately, most patients are not candidates because of comorbidities, most commonly advanced age and renal insufficiency. Furthermore, there are simply not enough donors to meet the needs of the thousands of patients in this country with advanced heart failure who could benefit from transplantation.

“In an advanced heart failure program, we can help clinicians, patients and other interested parties decide what treatment options, including transplantation, are in the patient’s best interest, understanding that such decisions are complex,” says Dr. Fang.

Treatment options for patients with advanced heart failure generally fall into four categories: 1) conventional therapies, such as modifications in medical or device therapy or high-risk surgeries, that may have not yet been reviewed; 2) heart transplantation; 3) surgically implanted permanent heart pumps, such as left ventricular assist devices (LVADs), also known as mechanical circulatory support (MCS); and 4) unique investigational treatments, such as stem cell therapy, that can only be offered in major medical centers. For some patients, palliative care may be the most appropriate option.

Treatment Consideration
In general, most patients will respond to conventional therapies that include medications, biventricular pacemakers, and/or surgical procedures such as coronary bypass or valve repair or replacement. When these options have been exhausted, clinicians should consider referring patients for other treatment options as described above. With respect to transplantation, age alone is not a contraindication, but advanced age makes transplant less ideal. In the case of this patient, age, in combination with his medical comorbidities of renal dysfunction and diabetes, made transplantation unrealistic.

Patients who are not transplant candidates, however, can be considered for permanent heart pump therapy, for example, LVADs. “These devices can support patients up to four to six years with a very good quality of life,” says Dr. Fang. “There are inconveniences such as anticoagulants and a percutaneous power source, but many heart patients have indwelling lines or take Coumadin, so these issues aren’t beyond the scope of what we do currently.” There is no age cutoff for LVAD implantation, but the decision to offer this therapy is complex and requires the collective expertise of a multidisciplinary team of physicians, surgeons, nurses and other allied health professionals.

If LVAD therapy is not thought to be practical or ideal, research programs involving investigational treatments can be offered. Access to these unique and novel therapies, like new drugs and stem cells, are often only available through an advanced heart disease treatment center, such as UH Harrington Heart & Vascular Institute at UH Case Medical Center, and are generally not available in the community.

Finally, when all these strategies have been exhausted, hospice and palliative care can be offered. “It’s very important to help families understand their options in a way that is compassionate and humane,” says Dr. Fang.

Evaluation and Outcome
Although the patient was considered a nonoptimal candidate for transplantation, he and his family were motivated to pursue strategies to improve his quality and length of life. Therefore, he agreed to undergo LVAD therapy and was discharged two weeks after implantation. He is now free of exertional symptoms and is enjoying a very good quality of life.

Expert Evaluation
For internal referrals for patient evaluation by the Advanced Heart Failure & Transplant Center, please call 216-844-5518. When calling from outside the medical center, dial 216-844-3800 and ask for a referral to the advanced heart failure center. For more information on our program, e-mail us at HV1@UHhospitals.org.
Save the Date

Please join us for these upcoming events:

**3rd Annual Update on Vascular Disease**

**When:** Saturday, April 28, 2012  
**Where:** Wolstein Research Building  
2103 Cornell Road  
Cleveland, OH 44106

Registration begins at 8 a.m.  
Presentations begin at 8:30 a.m.  
Breakfast and lunch will be served.

For more information, including how to register, please contact us at HVI@UHhospitals.org.

---

**14th Biennial Midwest Platelet Conference**

**When:** Thursday, October 18 – Friday, October 19, 2012  
**Where:** Wolstein Research Building  
2103 Cornell Road  
Cleveland, OH 44106

**Organizing Committee**  
Daniel I. Simon, MD  
Edward Plow, PhD  
Marvin Nieman, PhD  
Alvin Schmaier, MD  
Roy Silverstein, MD

**Plenary Session Speakers**  
Mark Kahn, MD (University of Pennsylvania)  
Jonathan Stamler, MD (University Hospitals Case Medical Center)  
Marc Sabatine, MD (Harvard Medical School)

**Thematic Sessions**  
Non-hemostatic functions of platelets (cancer, angiogenesis, immunity)  
Platelet receptors and signaling  
Vascular biology: Novel regulators of thrombosis

Plus:  
- Hot topic presentations  
- Poster competition  
- Rock and Roll Hall of Fame and Museum Gala

For more information or to register, please contact Meeting Coordinator, Susan Dowhan, at 216-368-3391 or Susan.Dowhan@UHhospitals.org.

---

University Hospitals of Cleveland  
Case Medical Center  
Cleveland | Ohio

The commitment to exceptional patient care begins with revolutionary discovery. University Hospitals Case Medical Center is the primary affiliate of Case Western Reserve University School of Medicine, a national leader in medical research and education and consistently ranked among the top research medical schools in the country by U.S. News & World Report. Through their faculty appointments at the Case Western Reserve University School of Medicine, physicians at UH Case Medical Center are advancing medical care through innovative research and discovery that bring the latest treatment options to patients.

Your Feedback Is Important

As a medical professional, your input is invaluable in helping us shape future issues of Heart & Vascular Innovations. We want to know what’s important to you. Do you want to read about cutting-edge research, learn about the latest technology, or hear firsthand case studies of how others in your specialty are improving and saving lives? Tell us what you want to read about and your name will be entered to win one of two Apple iPad 2s! Simply visit UHhospitals.org/innovations.