Heart WATCH

WINTER 2009

A Newsletter Produced by the Texas Heart Institute

Texas Heart® Institute

at St. Luke's Episcopal Hospital

Texas Heart Institute Cardiologist Performs Procedure to Stop an Unprecedented Ventricular "Electrical Storm"

Abstract: By performing ventricular tachycardia ablation, a THI cardiologist stopped an "electrical storm" in which the patient's implantable cardioverter-defibrillator fired up to 175 times over a period of several days.

In patients who have had a myocardial infarction, electrical "short-circuits" may arise from scars in the ventricles and result in ventricular tachycardia (VT)—an abnormal, life-threatening acceleration of the heart rate. Some patients will experience an "electrical storm" (3 or more VT episodes within 24 hours). To prevent sudden death, many VT patients receive an implantable cardioverter-defibrillator (ICD) that can deliver an electrical shock to "reset" the heart rhythm. Although ICDs can be lifesaving, they do not reduce VT recurrence. More seriously, frequent ICD shocks may, in some cases, result in cardiogenic shock and death due to severely depressed ventricular pumping function. Medical therapy with antiarrhythmic drugs is not always successful. Moreover, these drugs are often associated with serious side effects.

For ICD recipients who have recurrent VT and an unacceptable rate of ICD shocks despite optimal medical therapy, radiofrequency catheter ablation of the "short-circuit" is the most effective therapy. However, this approach is a high-risk procedure that requires special expertise to perform.

An unusual case of recurrent VT in an ICD recipient was recently treated by Jie Cheng, MD, PhD, Director of the Cardiac Electrophysiology Research Laboratory at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH). A nationally recognized expert in this field, Dr. Cheng has treated many VT patients and obtained excellent outcomes.

In the present case, the patient was 49-year-old Casey DeRouen, of New Iberia, Louisiana. He underwent coronary artery bypass surgery in 1999 and received an ICD in 2007. About 3 weeks before being referred to Dr. Cheng, Mr. DeRouen had a mini-stroke, and an electrical storm began, in which his ICD began firing every 15 to 20 minutes. He lost consciousness during some of these episodes and had a pulse rate of 200 to 250 beats/min. Physicians at his local hospital administered maximal doses of 2 antiarrhythmic drugs, including 800 mg of amiodarone daily (typical dose, 300-400 mg daily).

Casey DeRouen with cardiologist, Dr. Jie Cheng.

The patient was then referred to Dr. Cheng and urgently flown to Houston. Dr. Cheng performed high-risk VT ablation in the catheterization laboratory to stop the arrhythmia. The procedure was carried out with the assistance of a highly trained team, using computer-aided 3-dimensional mapping to detect the scar substrates responsible for VT, an ultrasound probe to help visualize various intracardiac structures, and other sophisticated equipment. The procedure was successfully completed in less than 4 hours, and the patient was discharged home the next day, with his heart in regular sinus rhythm.

"To my knowledge, nobody has ever survived that many ICD shocks before," says Dr. Cheng. "This case underscores the potential value of VT ablation in patients who have recurrent VT after ICD placement. The success of the procedure depends on close teamwork on the part of experienced physicians and supporting staff in the catheterization laboratory. The equipment and expertise necessary for performing this procedure are available at only a few tertiary referral centers in the United States."

Although VT ablation in patients with ischemic cardiomyopathy does not cure the underlying disease, it does provide relief from excessive ICD shocks, often greatly improving the patient's quality of life. Fortunately, Mr. DeRouen, like many others who have been treated by Dr. Cheng, was able to benefit from the specialized care offered by THI at SLEH. ●

For more information:

Dr. Jie Cheng

713.541.9955

Edward T. H. Yeh, MD, Named a McNair Scholar

This year, the Robert and Janice McNair Foundation established a $2.5 million fund to create the McNair Scholars Program at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH). Edward T. H. Yeh, MD, a professional staff member and an integral collaborator in the stem cell research program at THI at SLEH, was recently named the first McNair Scholar. Dr. Yeh also chairs the Department of Cardiology at The University of Texas M. D. Anderson Cancer Center. He is internationally recognized for helping to decipher the role of inflammation in the development of atherosclerosis, for using stem cells to repair damaged myocardium, and for discovering 3 novel biochemical pathways that revolutionized the understanding of cell-cycle progression and cell signaling. Dr. Yeh now plans to concentrate on identifying the mechanisms that allow fused human adult stem cells to produce new myocardial tissue. He will also develop methods for reprogramming skin fibroblasts to create stem cells for clinical use. "I am excited to be the first McNair Scholar," says Dr. Yeh. "This gift will allow me to help advance the treatment of cardiovascular disease with stem cell therapy."

Texas Heart Institute Researchers Study a Total Artificial Heart Comprising Dual Implantable Continuous Flow Pumps

Abstract: A $2.8-million grant will allow researchers at the Texas Heart Institute at St. Luke's Episcopal Hospital to continue developing a continuous flow total artificial heart.

Total artificial hearts

(TAHs) and left ventricular replacement devices based on the pulsatile-flow principle have rescued many dying patients, mainly by bridging them to transplantation; however, these pumps are bulky and complex. In contrast, continuous flow pumps are simpler, more durable than their pulsatile counterparts, and small enough to fit more patients.

The latest configuration of THI's dual MicroMed continuous flow total artificial heart is 75 percent smaller than other artificial hearts under development.

Because continuous flow pumps are sensitive to the pressure differential between preload and afterload, they respond to variations in inflow volume, thereby duplicating the Starling response of the normal heart. This characteristic potentially allows the output of these pumps to vary within a physiologic range even though the number of rotations per minute remains constant. Two such pumps can autoregulate their outputs at a constant pump rotational speed because the output pressure of 1 pump determines the input pressure of the other. This tandem arrangement is potentially ideal for biventricular replacement.

A $2.8-million National Institutes of Health (NIH) grant was recently awarded to researchers at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH) to study the effects of 2 MicroMed DeBakey (MicroMed Cardiovascular, Inc., Houston, TX) ventricular assist devices (VADs) used in tandem as a continuous flow TAH.

The grant was awarded under the NIH's Bioengineering Research Partnership (BRP), a program that encourages collaboration among medical and engineering experts. Dr. O. H. Frazier, Director of the Cardiovascular Surgical Research Laboratories at THI at SLEH, will lead a collaborative team of scientists and engineers from THI, MicroMed Cardiovascular, Inc., the University of Houston, and Rice University.

"I have been working in this field for more than 40 years, but the technical challenges inherent in developing a TAH have, to date, limited its application," says Dr. Frazier. "We are encouraged by the federal funding support for this effort, and we look forward to strengthening our collaborative relationships as we move forward with this research."

Dr. William E. Cohn, Co-Director of the Cardiovascular Surgical Research Laboratories at THI at SLEH and a renowned innovator of surgical devices, is leading efforts to optimize the device design and refine the surgical implantation technique.

"One of the challenges of TAH design has been maintaining a balance between systemic and pulmonary flow," says Dr. Cohn. "Dr. Frazier's innovative concept involves creating a TAH with 2 continuous flow pumps in hopes of exploiting their ability to regulate flow autonomously."

"In our calf studies to date," he continues, "the continuous flow TAH has readily generated physiologic pressure and flow while maintaining the balance between the systemic and pulmonary circulations. The TAH-implanted animals have been able to stand, eat, sleep and behave normally in every way. Several of them have exercised on a treadmill with TAH flows far in excess of those required to support human physiology."

According to Drs. Frazier and Cohn, the BRP grant will allow the team to take the next steps with the continuous flow TAH: (1) optimizing the pumps' anatomic fit in the chest cavity and the design of the inlet and outlet components; (2) designing the controller feedback system to keep hemodynamic values within an accepted range; (3) developing indwelling sensors to monitor tissue physiologic parameters, thus enhancing the sensitivity and responsiveness of the controller feedback system; and (4) investigating the effects of totally pulseless circulation on the recipient's physiology.

"I'm confident we can make this technology work," says Dr. Frazier. "Our initial studies in more than 2 dozen calves have yielded promising results. We hope that this artificial heart can be ready for human use within 3 to 5 years." ●

For more information:

Dr. William E. Cohn

Dr. O. H. Frazier

832.355.3000

Contents

Pneumococcal and Influenza Vaccination May Have Cardioprotective Effects

Abstract: Knowing that upper respiratory tract infections can trigger coronary syndromes, researchers at THI at SLEH continue to study the links between acute infection and heart disease.

Research has suggested that chronic infections may play a role in the progression of atherosclerotic lesions. However, when clinical trials of antibiotic therapy proved ineffective for preventing cardiovascular events, researchers lost interest in the role of chronic infection in cardiovascular disease. Nevertheless, unlike chronic infection, acute infection may cause acute coronary syndromes by triggering abrupt inflammatory changes in high-risk coronary plaques during the infection.

Mohammad Madjid, MD, Senior Research Scientist at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH), has long believed that preventing acute infection can lower the risk of cardiac death and other adverse events. Since 2000, he and S. Ward Casscells, MD, Associate Director of Basic Cardiology Research at THI at SLEH and US Assistant Secretary of Defense for Health Affairs, have been studying the link between influenza and seasonal spikes in cardiac mortality. Drs. Madjid and Casscells consider influenza infection a modifiable cardiac risk factor (see *Heart Watch*, Summer 2003 and Winter 2008; texasheart.org/heartwatch).

"Researchers, including Dr. James T. Willerson, President of THI at SLEH, have established that inflammation plays a critical role in the initiation and progression of atherosclerosis," says Dr. Madjid. "Atherosclerotic disease progresses slowly, but several intrinsic and extrinsic triggers may cause latent, stable atherosclerotic plaques to become inflamed and unstable. Such plaques can rupture, leading to thrombus formation, acute coronary syndromes, or sudden cardiac death. Upper respiratory infections can trigger these events."

Multiple case-control studies, cohort studies, and randomized clinical trials have shown that influenza vaccination can reduce the risk of recurrent myocardial infarction (MI), sudden cardiac death, stroke, and hospital admissions, as well as the need for revascularization procedures (*Circulation* 2003;108:2730-6; *Tex Heart Inst J* 2004;31:4-13). Results of newer studies suggest that pneumococcal vaccination may also be a safe and inexpensive tool for preventing cardiovascular events (*CMAJ* 2008;179:749-50).

ANNUAL INFLUENZA VACCINATION IS RECOMMENDED FOR

- persons at high risk for influenza-related complications and severe disease, including
  - —children aged 6–59 months
  - —pregnant women
  - —persons aged >50 years
  - —persons of any age with certain chronic medical conditions (including heart disease)
- persons who live with or care for persons at high risk, including
  - —household members who have frequent contact with the person at high risk and who can transmit influenza to that person
  - —health-care workers

According to Dr. Madjid, multiple mechanisms could contribute to the cardioprotective effect of the pneumococcal vaccine—the most important being the prevention of pneumonia, which has been shown to trigger MI. In addition, *Streptoccocus pneumoniae* and other respiratory pathogens may exert effects directly related to acute coronary syndromes.

"When we compared the coronary arteries of control patients with those of patients who died of acute systemic infection," says Dr. Madjid, "patients with acute infection had higher numbers of macrophages and T cells in the adventitia and periadventitial fat and more dendritic cells in the intima and media [*Tex Heart Inst J* 2007;34:11-8]. We believe that extensive systemic inflammation and an acute increase in inflammatory systemic markers occur along with local cellular inflammation, which activates the coagulation cascade."

In addition, upper respiratory infections may be associated with tachycardia, hemodynamic stress, fever, dehydration, increased plasma viscosity, release of endogenous catecholamines, demand ischemia, endothelial dysfunction, and pro-oxidant changes in high-density lipoprotein. Each of these factors can play a role in acute coronary syndromes.

"In past flu epidemics and pandemics—except for the 1918 Spanish flu pandemic—twice as many people died of cardiac causes as of pneumonia," continues Dr. Madjid. "In an autopsy-based study by our group and our Russian colleagues [*Eur Heart J* 2007;28:1205-10], we observed that influenza epidemics are associated with a sharp increase in the number of deaths caused by MI and ischemic heart disease."

Previous research by Drs. Madjid and Casscells has shown that less than 60% of patients with coronary heart disease receive the influenza vaccine.

"Clinicians and cardiac patients should closely follow the current national vaccination guidelines," says Dr. Madjid. "In the United States, pneumococcal and influenza vaccination rates are still well below established goals, but I am optimistic that attitudes toward vaccination for cardiac patients will gradually change." ●

For more information:

Dr. Mohammad Madjid

832.355.9330

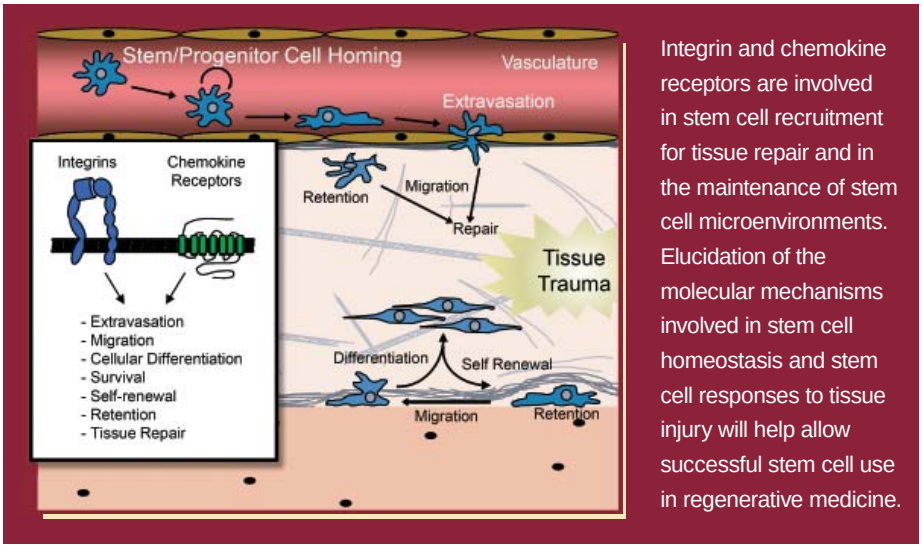
Researchers Study the Roles of Integrins and Chemokines in Stem Cell Mobilization, Homing, and Engraftment

Abstract: Investigators at THI at SLEH are studying intercellular adhesion molecules and chemokines in order to control cell movement and facilitate the repair of damaged cardiac tissue.

Integrins and chemokines are proteins that are intimately involved in the migration and engraftment of cells in the body. As a type of cell surface adhesion molecule, integrins facilitate tissue localization of different cells and transmit signals into the cell upon interacting with the extracellular matrix, other cells, and pathogens. Chemokines, a family of small chemotactic cytokines, are produced during inflammation and attract leukocytes and other immune cells to inflamed tissues. Integrins and chemokine receptors are expressed on the surface of all cells, including mesenchymal stem cells (MSCs), which are multipotent cells derived from the bone marrow and other adult tissues. MSCs are currently the subject of intense global research because they provide a basic understanding of tissue development and have the potential to be used as cell-based therapeutic agents.

Researchers in the Wafic Said Molecular Cardiology Research Laboratories at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH) have a special interest in integrins and chemokines. For several years, these researchers have been investigating basic mechanisms of cardiovascular disease in order to develop new therapies. Richard Dixon, PhD, was recently appointed the new Research Director of the Laboratories.

Dr. Dixon and his staff came to THI at SLEH from Encysive Pharmaceuticals, Inc., a drug-discovery and development company that Dr. Dixon cofounded with James T. Willerson, MD, President and Medical Director of THI at SLEH. Before cofounding Encysive, Dr. Dixon was Director of the Molecular Biology Department at Merck, Sharp, & Dohme Research Laboratories (Whitehouse Station, NJ). He and his team have been responsible for discovering several cardiovascular and anti-inflammatory drugs, including an integrin antagonist, that have entered clinical testing.



Integrin and chemokine receptors are involved in stem cell recruitment for tissue repair and in the maintenance of stem cell microenvironments. Elucidation of the molecular mechanisms involved in stem cell homeostasis and stem cell responses to tissue injury will help allow successful stem cell use in regenerative medicine.

According to Dr. Dixon, "The stem cell migration that occurs during tissue damage may be similar to leukocyte homing during inflammation. Chemokines play an important role in this migration by activating integrins on immune cells, allowing them to adhere firmly to the inflamed tissue. [See *Figure*.] We hope to develop methods for controlling stem cell movement that can be used to repair damaged heart tissue."

Dr. Dixon and his team will first identify which integrins and chemokine receptors are expressed on MSCs and which receptors are most important for homing to the heart and vasculature. The work done on this process by investigators at THI at SLEH and others will provide a good foundation for the new research. MSCs are being targeted because they can differentiate into many different cell types and because they have special immunomodulating properties that prevent activation of a recipient's immune system and permit allogeneic transplantation without rejection.

Dr. Dixon's research team has already designed screening systems for various integrins and chemokine receptors and a cell-free assay system for studying specific events in integrin signaling. The researchers previously used these systems at Encysive to identify antagonists that target integrins and chemokine receptors involved in recruiting leukocytes to the lungs, central nervous system, and gastrointestinal tract (*Pulm Pharmacol Ther* 2004;17:1-10). On the basis of this work, they designed small molecule antagonists that will eventually be used to treat various diseases.

"We should be able to use these same assay systems to develop agonists to mobilize MSCs to damaged heart tissue," says Dr. Dixon. "Additionally, the agonists could be mixed with MSCs and injected directly into infarct sites after a myocardial infarction."

Dr. Dixon plans to collaborate with the Stem Cell Center at THI at SLEH, which is directed by Emerson Perin, MD, PhD, and overseen by Dr. Willerson. Drs. Perin and Willerson have led numerous clinical and preclinical studies in which adult stem cells have been used to treat cardiovascular diseases. "Our relationship with the Stem Cell Center should help produce effective stem cell therapies for patients with cardiovascular disease," concludes Dr. Dixon. ●

For more information:

Dr. Richard Dixon

832.355.9137

Cold Blood and Cold Crystalloid Solution Provide Equivalent Renal Protection During TAAA Repair

Abstract: In a randomized trial, researchers at THI at SLEH have found that cold blood is no more effective than cold crystalloid solution for preventing renal injury after surgical thoracoabdominal aortic aneurysm repair.

A major hazard of surgically repairing thoracoabdominal aortic aneurysms (TAAAs) is ischemic renal injury, which can lead to potentially fatal postoperative morbidity. To prevent this problem, surgeons typically infuse the kidneys with a cold crystalloid solution intended to reduce these organs' metabolic demand, but this measure is not always effective. Therefore, in an effort to improve renal protection during surgical TAAA repair, surgeons at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH) performed a randomized clinical trial comparing cold blood with standard cold crystalloid solution (*J Vasc Surg* January 2009).

"In a previous trial [*Ann Thorac Surg* 2002;73:730-8], we had found that isothermic blood did not protect the kidneys as well as cold crystalloid solution during TAAA repair," says Scott A. LeMaire, MD, a cardiovascular surgeon at THI at SLEH and an Associate Professor and Director of Research in the Division of Cardiothoracic Surgery at Baylor College of Medicine. "Clearly, chilling the kidneys was more protective than oxygenating them. We theorized that cold blood could both chill the kidneys and provide them with nutrients, buffers, and oxygen, so we tested its usefulness in TAAA patients."

In the trial, funded by the Gillson Longenbaugh Foundation and the Baylor College of Medicine Junior Faculty Seed Funding Program, 172 patients scheduled to undergo surgical repair of Crawford extent II or III TAAAs were randomly assigned to 2 groups of 86 patients each. One group received a standard infusion of cold crystalloid (4°C lactated Ringer's solution); the other group underwent renal perfusion with blood that had been drained from the left inferior pulmonary vein and cooled to 4°C. In both groups, the fluid was delivered intermittently to the renal arteries to keep the kidneys cold without overcooling the rest of the body. Both techniques achieved deep (<28°C) renal hypothermia in almost all patients.

The degree of renal protection provided by each fluid was measured in several ways. First, the rate of renal failure requiring dialysis was computed for each group, as were rates of paraplegia/paraparesis, in-hospital and 30-day mortality, and the mean hospital length of stay. Second, a renal dysfunction score was assigned to each patient according to the degree of increase in the serum creatinine level after surgery. Third, 5 urinary biomarkers of renal injury were measured: retinol-binding protein, α-1 microglobulin, microalbumin, N-acetyl-β-D-glucosaminidase, and intestinal alkaline phosphatase.

POSTOPERATIVE OUTCOMES AFTER TAAA SURGERY WITH COLD CRYSTALLOID OR COLD BLOOD RENAL PERFUSION

	Crystalloid (n=86)	Blood (n=86)
In-hospital mortality	4 (5%)	6 (7%)
30-day mortality	4 (5%)	6 (7%)
Paraplegia or paraparesis	0	5 (6%)
Renal failure necessitating hemodialysis	3 (3%)	3 (3%)
Peak renal dysfunction score[a] ≥2	21 (24%)	27 (31%)
Hospital length of stay (days)	15.7 ± 14.7	15.7 ± 10.3

[a]Renal dysfunction scores are based on a scale of 1 to 5. A score of 2 or higher indicates an increase of 50% or more in the patient's serum creatinine level.

The investigators found that cold blood and cold crystalloid provided similar degrees of renal protection. Both groups had similar postoperative mortality rates, mean peak renal dysfunction scores, and lengths of hospital stay. Likewise, rates of renal failure requiring hemodialysis were the same in the two groups, and the levels of urinary biomarkers of renal injury did not differ significantly. Paraplegia and paraparesis were more common in the cold blood recipients (5/86) than in the cold crystalloid recipients (0/86); this difference approached statistical significance (P=.06).

"There may be a few reasons why we found no apparent advantage for cold blood over cold crystalloid," says Dr. LeMaire. "First, cold temperatures can reduce the efficiency with which hemoglobin transfers oxygen to cells, so the cold blood might have had a limited ability to oxygenate renal tissues. Second, for unclear reasons, patients who underwent cold blood perfusion had longer total ischemic times than patients who received cold crystalloid, although both groups had similar unprotected ischemic times. Third, we used intermittent perfusion instead of continuous perfusion to avoid the risks of overcooling the body. We don't know whether cold blood would have advantages if it were delivered to the kidneys continuously while the rest of the body was kept warm."

"Nonetheless," Dr. LeMaire adds, "because of these findings, and because the cold blood technique is somewhat cumbersome, we continue to use cold crystalloid for renal perfusion during TAAA repair." ●

For more information:

Dr. Scott A. LeMaire

Dr. Joseph S. Coselli

832.355.9910

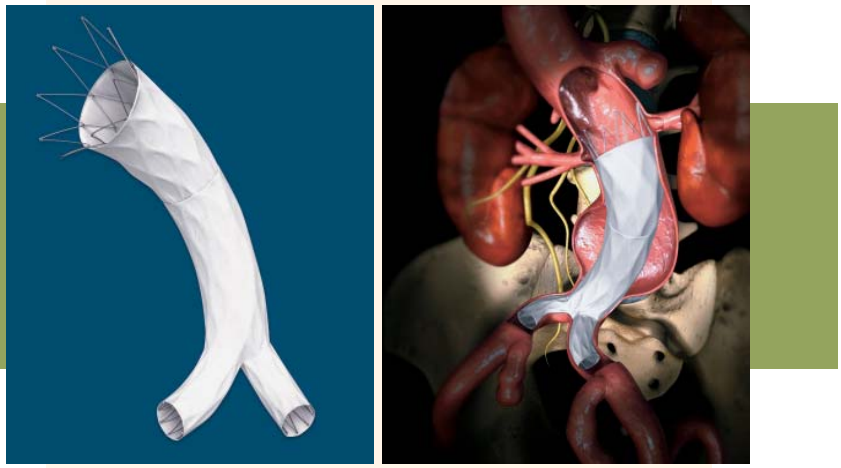
Cardiologist at THI at SLEH Is the First Physician in Texas to Implant the Powerlink XL Stent Graft

Abstract: A cardiologist at THI at SLEH has become the first in Texas to use an innovative new stent graft designed to treat abdominal aortic aneurysms that have an unusually large proximal neck.

Abdominal aortic aneurysms

(AAAs) affect about 1.7 million Americans, and AAA rupture is a leading cause of death. Traditionally, the only treatment option for these patients was surgical repair, but it entails a mortality of up to 50%. More recently, catheter-based technologies have made it possible for cardiologists to perform stent grafting of AAAs. However, this approach has not been appropriate for some AAAs, especially for those with a large proximal neck (diameter, 26 mm or more).

In October 2008, the US Food and Drug Administration approved a new stent graft, the Powerlink XL (Endologix, Inc., Irvine, CA) (see *Figures*), which offers minimally invasive treatment of AAAs to a wider range of patients. The XL model, which has been commercially available in Europe since 1999, is designed to treat AAAs that have a proximal aortic neck diameter of 23 to 32 mm.



The Powerlink XL stent graft (left). Artistic rendering (right) of the position of the stent graft, which rests at the junction of the abdominal aorta and the iliac arteries.

The first cardiologist in Texas to implant the Powerlink XL was Zvonimir Krajcer, MD, Co-director of the Peripheral Vascular Disease Service at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH), who originally pioneered the percutaneous repair of AAAs approximately a decade ago. In October 2008, he implanted the Powerlink XL in a 76-year-old man who had multiple comorbidities that precluded open AAA repair and whose aortic neck diameter was too large for a traditional stent graft. This was the third Powerlink XL implant in the United States and the first in Texas; it was also the first in the world to be performed percutaneously and with local anesthesia. The procedure took approximately 1.5 hours. The patient was able to eat shortly afterward and to get out of bed 6 hours later. He had an uncomplicated hospital course and was discharged home the following day.

"The Powerlink XL is a new innovation that, because of its larger size, enables us to effectively treat AAA patients who have a challenging aortic anatomy that hinders vascular access," says Dr. Krajcer. "Of all the devices commercially available in the United States to treat AAAs with a proximal neck diameter of more than 26 mm, this stent graft has the lowest-profile catheter. About 15% of AAA procedures involve such a neck size, so this device will greatly expand the treatment options for US patients."

Created as a single piece, the stent graft has a main body and 2 branching limbs. It is made of ePTFE fabric supported by a cobalt-chromium alloy stent. The 1-piece design facilitates device insertion by eliminating some of the guidewire maneuvers that would be needed for a multiple-piece device. Its unique mechanism allows it to be used in patients who have a compromised access vessel. Unlike other endoluminal stent grafts, the Powerlink XL necessitates the percutaneous insertion of only a single catheter, containing the main body of the stent graft, into 1 femoral artery. A small 9F access sheath is inserted into the other femoral artery through a tiny puncture. Once positioned anatomically in the aorta, the self-expanding stent exerts a radial force that anchors it against the aortic wall.

In November 2008, the manufacturer announced the favorable results of a prospective, multicenter clinical trial of the Powerlink XL, which achieved the primary endpoint of 1-year freedom from type I proximal endoleak.

"Our THI and SLEH team is proud to have pioneered the use of the Powerlink XL stent graft in Texas," concludes Dr. Krajcer. "Not only was our procedure successful, but it confirms THI's continued role as a leader in the treatment of cardiovascular disease." ●

Dr. Krajcer is a consultant for Endologix and receives an honorarium for organizing training courses for that company.

For more information:

Dr. Zvonimir Krajcer

713.790.9401

HeartWATCH

Editorial Office
832.355.6630

For physician referrals,
call 1.800.872.9355

Cover: Sculpture donated by Carolyn Farb for the Celebration of Hearts display in the Wallace D. Wilson Museum of the Texas Heart Institute at St. Luke's Episcopal Hospital —The Denton A. Cooley Building.

Calendar of Events

Texas Heart Institute Continuing Medical Education Symposia

Emerging Trends in the Practical Application of Electrophysiology in the Treatment of Heart Failure
Hotel Monteleone
February 6–7, 2009 • New Orleans, Louisiana
Program Director: Jie Cheng, MD, PhD

10th Symposium on Cardiac Arrhythmias
The Houstonian
February 28, 2009 • Houston, Texas
Program Director: Ali Massumi, MD

Future Direction of Stem Cells in Cardiovascular Disease Satellite Symposium at American College of Cardiology Scientific Sessions
The Peabody Hotel
March 28, 2009 • Orlando, Florida
Program Director: James T. Willerson, MD

Congestive Heart Failure Symposium Satellite Symposium at American College of Cardiology Scientific Sessions
The Peabody Hotel
March 28, 2009 • Orlando, Florida
Program Director: Reynolds M. Delgado III, MD

23rd Cardiovascular Magnetic Resonance Imaging Practicum
St. Luke's Episcopal Hospital
May 25–28, 2009 • Houston, Texas
Program Directors: Ben Cheong, MD, and Raja Muthupillai, PhD
For further information, please contact Teresa Rose at trose@sleh.com or 832.355.4201

Selected Upcoming Local, National, and International Meetings

Society of Thoracic Surgeons 45th Annual Meeting
January 26–28, 2009 • San Francisco, California

American College of Cardiology 58th Annual Scientific Sessions
March 29–31, 2009 • Orlando, Florida

International Society for Heart and Lung Transplantation 29th Annual Meeting and Scientific Sessions
April 22–25, 2009 • Paris, France

American Surgical Association 129th Annual Meeting
April 23–25, 2009 • Indian Wells, California

For information about the Texas Heart Institute CME activities listed above, please e-mail cme@heart.thi.tmc.edu or call 832.355.2157. To view selected CME presentations and other physician resources online, visit cme.texasheart.org.

For 18 consecutive years, the Texas Heart Institute at St. Luke's Episcopal Hospital has been ranked among the top 10 heart centers in the United States by *U.S. News & World Report*'s annual guide to "America's Best Hospitals."

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