HeartWATCH

WINTER 2004

A NEWSLETTER PRODUCED BY THE TEXAS HEART INSTITUTE

TEXAS HEART® INSTITUTE
at St. Luke's Episcopal Hospital

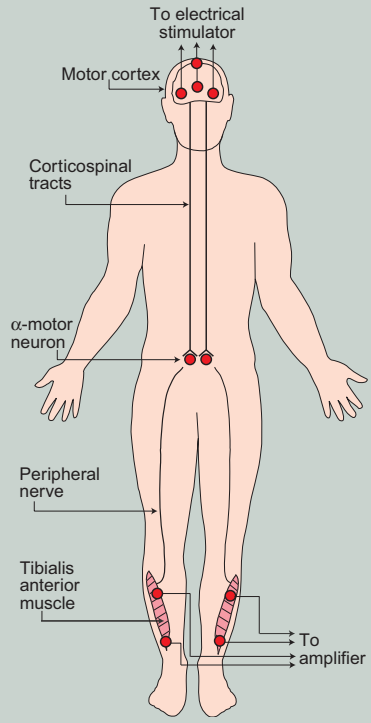
Intraoperative Spinal Cord Monitoring May Decrease Risk of Neurologic Injury During Aortic Aneurysm Repair

Abstract: Spinal cord monitoring with transcranial motor-evoked potentials may lower the risk of spinal neurologic injury in patients undergoing thoracoabdominal aortic aneurysm repair.

One of the most serious potential complications of thoracoabdominal aortic aneurysm (TAAA) repair is neurologic injury of the spinal cord. Although the repair itself may be successful, spinal cord ischemia during the procedure can permanently injure the efferent motor neurons, causing weakness (paraparesis) or paralysis (paraplegia) of the lower extremities. Two recent studies estimate the risk of paraparesis and paraplegia after TAAA repair at 4.6–10% (*Ann Thorac Surg* 2003;75:113–119,508–513).

Intraoperative monitoring of spinal cord function offers a potential solution to this problem. Recently, surgeons from the Texas Heart Institute (THI) at St. Luke's Episcopal Hospital (SLEH) visited the University Hospital of Maastricht in the Netherlands, where they were trained by Michael J. Jacobs, M.D., a former visiting surgeon at THI/SLEH, in spinal cord monitoring with transcranial motor-evoked potentials (TcMEP). Developed by Dr. Jacobs and colleagues, TcMEP involves stimulating the motor cortex of the brain via an electrode placed on the scalp. The electrical stimulus elicits a signal that travels through the corticospinal tract and activates the α-motor neurons in the anterior horn of the spinal cord. These neurons relay the signal to the peripheral nerves, causing tiny muscular contractions that are recorded via surface electrodes over the left and right anterior tibial muscles and bilateral thenar muscles.

In the United States, TcMEP has been used for several years in orthopedic and neurologic spinal operations. However, it has not been widely applied to cardiac procedures; in fact, it was only this year that the Food and Drug Administration approved the use of TcMEP monitoring during TAAA repair. In these cases, baseline TcMEP recordings are made every 5 minutes until the aorta is crossclamped. Recordings are then made once per minute during and after crossclamping. A response amplitude of less than 25% of the baseline amplitude indicates spinal cord ischemia. Igor Gregoric, M.D., the THI/SLEH surgeon who led the training visit to Maastricht, explains how doctors respond when spinal cord ischemia is detected during surgery.



Pathway of the TcMEP signal from the brain to the muscles. The resulting muscular contractions are recorded by surface electrodes connected to an amplifier. (From *J Thorac Cardiovasc Surg* 1997;113:87–100; adapted with permission.)

"If we detect a problem," Dr. Gregoric explains, "we have several options for restoring an adequate oxygen supply to the spinal cord. We can raise the patient's blood pressure, increase bypass pump output to improve arterial blood flow, decrease the pressure of the cerebrospinal fluid, change our crossclamp strategy, or alter our plan for reimplanting the intercostal arteries. These interventions can preserve spinal motor neurons that might otherwise be irreparably damaged."

Studies conducted by Dr. Jacobs and colleagues suggest that, by monitoring with TcMEP and taking appropriate action when spinal ischemia occurs during TAAA repair, one can reduce the risk of postoperative paraplegia and paraparesis to 2% or less (*J Vasc Surg* 1999;29:48–59; *Ann Surg* 1999;230:742–749). Adverse events related to TcMEP are extremely rare. Also, whereas other neuromonitoring techniques require the insertion of needle electrodes directly into the brain or spinal cord, TcMEP monitoring is completely noninvasive, keeping both the risks and the costs of monitoring low while providing even more accurate feedback.

THI/SLEH plans to begin using TcMEP in TAAA patients in the very near future, becoming one of the only centers in the United States to offer this technique.

"TcMEP has the potential to make TAAA repair safer," says Dr. Gregoric, "at very little additional expense. For those reasons, the use of TcMEP is likely, eventually, to become standard practice in TAAA procedures." ●

For more information:

Dr. Igor Gregoric

832.355.3000

Clinical Trials Update

On November 11, 2003, surgeons at THI/SLEH performed the first implantation of a HeartMate II left ventricular assist device (Thoratec Corporation, Pleasanton, CA) in the United States. The procedure, performed on an 18-year-old man, initiated a small multicenter trial to evaluate the device's safety and efficacy in a total of 7 patients with end-stage heart failure. The HeartMate II is a next-generation continuous-flow pump designed to be smaller and quieter than other approved assist devices and to adjust its output automatically in response to cardiac demand.

Adults with Congenital Heart Disease Require Specialized Care

Abstract: The growing number of adults with congenital heart disease highlights the need for trained specialists and clinics dedicated to the care of these patients.

Over the last 60 years, advances in the diagnosis and surgical treatment of congenital heart disease—many of which have been made by physicians at the Texas Heart Institute (THI) at St. Luke's Episcopal Hospital (SLEH)—have greatly improved patients' postoperative survival. From the advent of open heart surgery in the mid 1950s to the present day, complex defects, such as hypoplastic left heart syndrome and tetralogy of Fallot, and simple defects, such as atrial and ventricular septal defects, have become treatable and manageable. This success has resulted in a burgeoning population of patients now living with adult congenital heart disease (ACHD). In the United States alone, their number is nearing 1 million and increasing rapidly (*Circulation* 2002;105:2318–2323; *N Engl J Med* 2000; 342:256–263,334–342).

Patients with ACHD pose special clinical problems for cardiologists. Adult cardiologists may be unfamiliar with the altered cardiac anatomy and physiology of a patient who underwent repair of a complex congenital defect, whereas pediatric cardiologists may be unfamiliar with the finer points in diagnosis and management of adult diseases, such as coronary artery disease and diabetes, that are often superimposed upon existing CHD. Consequently, the smooth transfer of adults with CHD from pediatric to adult care is often difficult to accomplish.

"In many cases, the transfer is never truly complete," says Jeffrey A. Towbin, M.D., chief of Pediatric Cardiology at THI and Texas Children's Hospital (TCH) and professor of Pediatric Cardiology at Baylor College of Medicine (BCM). "The patient's pediatric cardiologist often remains the primary caregiver and so by default becomes involved with an adult patient. When reoperation or noncardiac surgery is needed, the special circumstances often mean that a pediatric cardiac surgeon performs the procedure."

In recent years, various groups in North America and Europe have begun exploring ways to make the transition from pediatric to adult care smoother and to streamline care (*J Am Coll Cardiol* 2001;1161–1198). They have suggested the establishment of regional ACHD centers in which pediatric and adult cardiologists would work as teams and the establishment of programs for training ACHD specialists who would lead such centers. THI/SLEH is uniquely positioned to address both challenges.

"I have always believed that any institution devoted to treating cardiovascular disease would need to offer treatment for both children and adults," states Denton A. Cooley, M.D., founder and president of THI. "So, from the start, we considered it important to develop a strong multidisciplinary program and to have close affiliations with both SLEH and TCH."

Today, many members of THI's professional staff hold joint appointments at SLEH and TCH and have ready access to state-of-the-art facilities for echocardiography, cardiac imaging, and heart catheterization. Plans are underway to put this combination of personnel and facilities together in an ACHD clinic at SLEH sometime within the next year.

Working in that clinic will be 2 cardiologists who are now being trained as ACHD specialists in an adult/pediatric fellowship program administered jointly by SLEH, TCH, and BCM. Established 3 years ago, the 5-year program is teaching trainees to recognize, diagnose, and manage congenital heart disease and acquired cardiovascular disease in adults.

"Right now, the program is the only one of its kind in the Southwest and one of only a handful in the United States," says James M. Wilson, M.D., director of Cardiology Education at THI/SLEH and assistant chief of Cardiology at SLEH. "Our aim is to help create a workforce of cardiologists who are specifically trained and qualified to care for patients with ACHD, lead ACHD centers, and teach other cardiologists who want to specialize in this field." ●

Previously Repaired Defects Commonly Encountered in Adults with Congenital Heart Disease

- Atrial septal defect
- Bicuspid aortic valve
- Aortic coarctation
- Tetralogy of Fallot
- Transposition of great arteries
- Hypoplastic left heart syndrome repaired by Fontan procedure

For more information:

Dr. Jeffrey Towbin

832.826.5600

Dr. James M. Wilson

832.355.6676

Contents

Percutaneous Circulatory Assist Devices May Help Patients in Cardiogenic Shock

Abstract: Cardiogenic shock is a leading cause of death among heart attack patients; percutaneous circulatory assist devices may improve these patients' chances of survival.

Cardiogenic shock—a decline in cardiac output that prevents an adequate supply of oxygen to the body's organs—is a leading cause of death for patients who have had an acute myocardial infarction. Vasopressors, inotropic medications, and intra-aortic balloon pumps can boost circulation temporarily, but coronary angioplasty or bypass surgery is often necessary for long-term survival. However, these procedures frequently must be performed before the patient has recovered enough to undergo them with maximal safety.

Recently, physicians have begun exploring a new option for treating cardiogenic shock: percutaneous circulatory assistance. In this technique, an external pump is connected to the circulatory system via input and output cannulas. The device supplements the heart's pumping action, improving blood flow until the patient is strong enough to undergo surgery or angioplasty.

The Food and Drug Administration (FDA) has approved this use of percutaneous circulatory assist devices in clinical trials. The Texas Heart Institute (THI) at St. Luke's Episcopal Hospital (SLEH) is involved in trials of 2 such devices: the TandemHeart percutaneous ventricular assist device (CardiacAssist, Inc., Pittsburgh, PA) and the Cancion Cardiac Recovery System (CRS) (Orqis Medical, Lake Forest, CA). In each device, a rotating impeller is the sole moving part, which extends the life of the pump and reduces the risk of device-related thrombosis. The cannulas are relatively easy to insert, so these percutaneous devices produce far fewer complications than fully implantable pumps.

TandemHeart (left) and Cancion CRS (right) percutaneous circulatory assist devices.

According to Reynolds M. Delgado III, M.D., a THI/SLEH cardiologist involved in the TandemHeart trial, the device has performed well so far. "Since the trial began," Dr. Delgado says, "we have used the TandemHeart to treat cardiogenic shock in 5 patients. The results have been better for this indication than they have been for fully implantable pumps, which can be associated with very high mortality rates."

THI/SLEH physicians recently became the first in the United States to take advantage of another potential application of the TandemHeart device. "Last fall," Dr. Delgado explains, "the FDA approved the TandemHeart for use during angioplasty or bypass procedures in patients at high risk for cardiogenic shock. The rationale is that, unlike cardiopulmonary bypass machines, the TandemHeart can provide circulatory support without requiring cardiac arrest or creation of a large wound. We have used the TandemHeart in 2 patients who were both in very fragile health but who needed an unprotected stent angioplasty of the left main coronary artery. In both cases, the procedures were extremely successful."

The Cancion CRS is in an earlier stage of testing than the TandemHeart. It has only recently been approved for use at THI/SLEH and has not yet been used in patients. However, this device has important advantages over the TandemHeart. First, the Cancion CRS uses a frictionless magnetic-levitation pump, which may reduce the risk of thrombosis even more than would the low-friction impeller used in the TandemHeart. Second, whereas the TandemHeart's inflow cannula is often implanted in the left atrium, necessitating penetration of the heart muscle, the cannulas of the Cancion CRS remain in the arteries; the inflow cannula is inserted into the femoral artery, and the outflow cannula is threaded up into the descending aorta.

"Once it is placed in the descending aorta, the tip of the cannula turns back on itself," explains Branislav Radovancevic, MD, associate director of Cardiovascular Surgery and Transplant Research at THI/SLEH and a consultant in the Cancion CRS trial, "so it pushes the blood in the same direction the heart does. This reduces the resistance in the bloodstream and takes some of the workload off the heart."

The ability of percutaneous circulatory assist devices to help patients in cardiogenic shock and to reduce procedure-related risks is only beginning to be examined. For the benefit of its patients, THI/SLEH remains committed to participating in trials of these devices. ●

For more information:

Dr. Reynolds M. Delgado III

713.383.9300

Dr. Branislav Radovancevic

832.355.2289

Inflammatory Marker Research Heats Up

According to recent findings (*N Engl J Med* 2003;349:1595–1604), high blood levels of the inflammatory marker myeloperoxidase can be used to predict increased risk of heart attack in patients with chest pain. Myeloperoxidase thus joins C-reactive protein (*see Fall 2003 Heart Watch*) as a powerful predictive inflammatory marker.

Percutaneous Coronary Intervention Versus Fibrinolysis as Initial Treatment for Acute Myocardial Infarction

Abstract: Percutaneous coronary intervention (PCI) is superior to fibrinolysis immediately after acute myocardial infarction, even if reperfusion is delayed several hours for transfer to an appropriate PCI center.

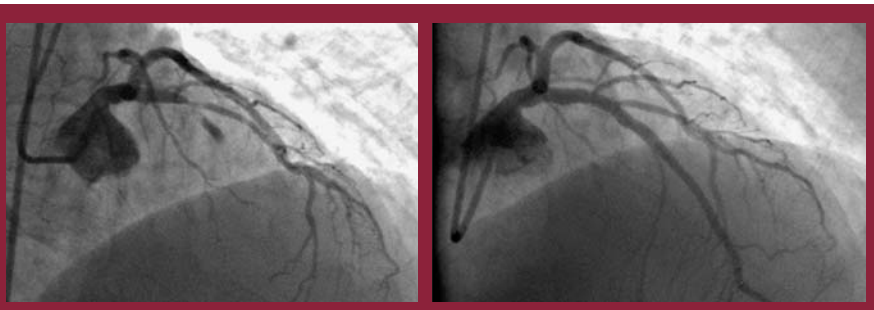
Each year, about 1.1 million Americans have an acute myocardial infarction (AMI). For these patients, the timing of reperfusion may mean the difference between life and death. Although percutaneous coronary intervention (PCI) (balloon and/or stent angioplasty) is considered superior to fibrinolysis, it is rarely offered by local hospitals, where patients with an evolving AMI typically present. In comparison, fibrinolysis with clot-busting drugs is an effective therapy offered by most emergency rooms in the United States. Therefore, fibrinolysis is more commonly used for initial treatment of an AMI. Nevertheless, physicians have wondered whether, even at the cost of several hours' delay, transfer to a PCI center might be more economical and clinically effective.

To answer this question, Danish researchers recently studied 1,500 heart attack victims at 24 hospitals without PCI services and at 5 hospitals with PCI services. The patients randomly received either fibrinolysis at the nearest participating facility or angioplasty at a PCI center within 3 hours' travel time. The PCI patients were more likely to survive and had a lower complication rate (8.5% vs 14.2%) (*N Engl J Med* 2003;349:733–742). The most important benefit of PCI was decreased risk of reinfarction, a predictor of 30-day mortality.

Paolo Angelini, M.D., an interventional cardiologist at the Texas Heart Institute (THI) and St. Luke's Episcopal Hospital (SLEH), says that, like other reversals of conventional medical wisdom, this discovery should gradually change the way patients are treated.

"Of course, successful PCI depends on the operator's skill and the volume of PCIs performed," he says. "Another requirement is a quick, efficient transfer system." In the Danish study, only 4% of patients were deemed unable to tolerate transfer to a PCI center. Transfer itself accounted for only 14% of the time elapsed from the onset of symptoms to the initiation of therapy.

"Here in the United States," says Dr. Angelini, "our transfer systems are not as well organized and efficient, especially in rural areas. After presenting at a local hospital, heart attack victims must await the next available emergency vehicle before being transferred to a PCI center. We need an integrated approach that can provide rapid triage and transport, minimizing delay."



(Left) Angiogram showing obstructed left anterior descending coronary artery and diagonal branch after acute myocardial infarction (AMI). (Right) Angiogram of same vessels after percutaneous revascularization 1 hour after AMI onset.

Many cardiologists believe that, like trauma victims, patients with an evolving AMI should be taken directly to a specialized center. Paramedics would perform 12-lead electrocardiography in the field and administer fibrinolysis at half the standard dose during transport to a PCI center. According to Dr. Angelini, a pilot trial of this strategy is being undertaken at 2 centers in the United States.

One proponent of immediate admission to a PCI center is Roberto Lufschanowski, M.D., a THI/SLEH cardiologist who recently had a heart attack himself. He was treated within the hour with direct angioplasty plus stent placement, resulting in a rapid recovery and return to his normal daily activities.

Dr. Angelini believes that, until the results of new protocols such as fibrinolysis in the ambulance and PCI on admission are available for analysis, the best policy is to perform direct angioplasty when it is available within 3 hours after the onset of chest pain. Conversely, if the AMI is recent and a PCI center is more than 1 hour away, fibrinolysis should be performed first and then the patient transferred as soon as possible for PCI. With this policy, all AMI patients can have the best opportunity to survive a heart attack with minimal damage, regardless of the distance involved. ●

For more information:

Dr. Paolo Angelini

713.790.9401

Emergency Department Expansion Bolsters Cardiac Services

Patients who arrive at SLEH by ambulance for primary PCI after an AMI *(see story this page)* will benefit from ongoing expansion of the emergency department (ED). The recently completed first phase has increased the number of treatment rooms from 25 to 28; each room is fully equipped for state-of-the-art cardiovascular monitoring and advanced emergency cardiac treatment. The expansion complements an existing digital radiology suite and picture archiving and communications system (PACS) that would allow instant sharing of radiographic images with physicians in the cardiac catheterization laboratory in the event a patient is transferred there from the ED.

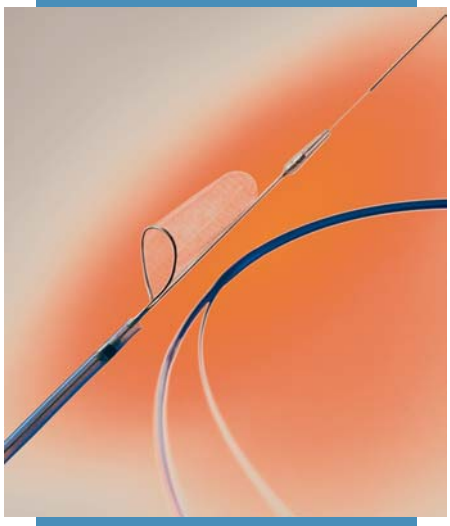
THI/SLEH Cardiologists Are Trained to Use a New Embolic Protection Device

Abstract: Via an interactive patient simulator, several THI/SLEH cardiologists have been trained to use a filter designed to capture distal emboli, which often complicate percutaneous coronary interventions.

During interventions in diseased saphenous vein grafts (SVGs), distal embolization can be a problem because soft material, including cholesterol, lipid-rich macrophages, and fibrin, may become dislodged from beneath the fibrous cap, especially in older grafts. Embolization decreases blood flow to the distal vascular bed, causing periprocedural end-organ ischemia, absence of reflow, and myocardial infarction. Independent predictors of distal embolization include diffuse degeneration, large plaque volume, and vein graft friability. Although glycoprotein (GP) IIb/IIIa inhibitors reduce the incidence of embolization and ischemic complications during percutaneous interventions in native coronary arteries, these agents are not as effective during vein graft interventions. Therefore, embolic protection devices, or filters, may find increased use as an adjunct to percutaneous interventional procedures in SVGs.

Via an interactive patient simulator, several cardiologists from the Texas Heart Institute (THI) at St. Luke's Episcopal Hospital (SLEH) have been trained to use the FilterWire EX™ Embolic Protection System (Boston Scientific Corporation, Natick, MA), the first filter-based system approved by the Food and Drug Administration for use during treatment of SVG disease.

This guidewire-mounted embolic filter (<3.5-French) is designed to reduce complications during balloon angioplasty and stenting in SVGs by capturing embolic material that becomes dislodged during stent placement. The polyurethane filter has 110-µm pores that permit antegrade blood flow while providing distal protection. The FilterWire's loop-basket (which resembles a butterfly net) opens against the inner wall of the vessel and traps any debris coming downstream. The filter's off-center opening allows later device retraction and removal. The nitinol basket frame supports the filter and facilitates fluoroscopic visualization during device delivery, deployment, and removal.



The FilterWire EX™ Embolic Protection System captures embolic debris that might become dislodged during interventional procedures such as angioplasty and stent placement. (Reprinted with permission from Boston Scientific Corporation.)

"Angioplasty and stent placement in SVGs is common but, unfortunately, so is embolization," says R. David Fish, M.D., director of Interventional Cardiology Research and Education at THI. "The FilterWire's main advantage over other embolic protection devices is that blood flow does not have to be stopped during the procedure. By maintaining perfusion, we can perform SVG interventions with fewer complications and less discomfort for our patients.

"Many of these patients would ordinarily require repeat bypass surgery. With the FilterWire, we can safely and effectively intervene in some cases without redo surgery," adds Dr. Fish.

THI/SLEH was an investigational site for testing the FilterWire in the treatment of SVG disease. To train cardiologists, Boston Scientific and the SimSuite™ Medical Simulation Corporation (Denver, CO) joined forces to create a mobile simulation training unit—essentially a rolling catheterization laboratory and classroom in one. A key feature of the training unit is Simantha™, a computerized mannequin that can interact with the cardiologist and whose vascular structure feels like that of a real patient.

The virtual training sessions for the FilterWire included 4 patient scenarios, based on actual cases. Each scenario presented a different anatomic configuration and different complications, all designed to challenge the trainee on several key learning points. After cardiologists were briefed on each scenario by a virtual emergency room doctor, they proceeded to treat Simantha.

THI/SLEH has opened its own dedicated simulation training center, which offers a number of training scenarios for cardiologists. These range from specialized courses for devices such as the FilterWire to general clinical scenarios such as cardiac arrest during angioplasty.

"Simulation training can provide stepwise, disciplined training for our fellows and recurrent training for our staff cardiologists," says Dr. Fish. "With simulation training, we can explore catheter techniques for use in high-risk patients or in emergencies and otherwise unusual situations. Simulation training also helps disseminate new cath lab technologies, because it allows us to sharpen our skills and to practice using new devices, such as the FilterWire, before they are used in patients." ●

For more information:

Dr. R. David Fish

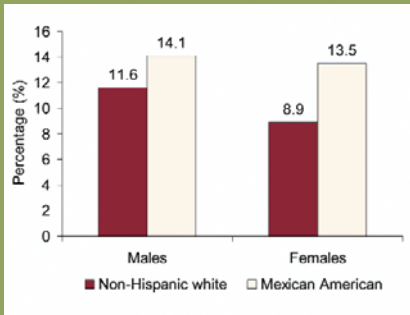
713.791.9400

Managing Obesity, Diabetes, and Cardiovascular Disease in America's Growing Hispanic Population

Abstract: Early intervention, follow-up, education, and outreach are keys to managing obesity, diabetes, and cardiovascular disease in the Hispanic community.

Hispanics are the fastest growing minority in the United States, and Mexican Americans are its largest subgroup. According to the American Heart Association, more than a quarter of Mexican Americans have some form of cardiovascular disease (CVD), similar to the overall rate in non-Hispanic whites. However, Mexican Americans are also more likely to be overweight or obese and to have diabetes. The confluence of obesity, diabetes, and CVD in this expanding patient population has important clinical implications for physicians and institutions, such as the Texas Heart Institute (THI) and St. Luke's Episcopal Hospital (SLEH), that are based in regions with increasingly large Hispanic populations.

"Because so many Hispanic patients are obese," says Robert J. Card, M.D., a cardiologist at THI/SLEH whose practice is one-third Hispanic, "diabetes is almost a given. They also have related renal and vascular comorbidities. Therefore, it's important that these patients, especially those with 2 or more risk factors for CVD, be followed closely, undergo annual stress testing, and have their hypertension and diabetes kept under control. Equally crucial, however, is to prevent these conditions from taking hold in at-risk families."



Percentage of overweight U.S. adolescents. (*Source:* NHANES III [1988–94]. Available at cdc.gov/nchs/data. Accessed 12/10/03.)

Of particular concern are Hispanic families' attitudes toward diet and lifestyle and how these attitudes may affect younger family members. Data from the National Health and Nutrition Examination Survey (NHANES) show that, between the 1960s and the late 1990s, the percentage of overweight adolescents rose from 5% to 14%, the highest increases occurring among Mexican Americans and blacks. Diabetes, sleep apnea, hypertension, and risk factors for atherosclerosis—once seen almost exclusively in adults—are now appearing more frequently in overweight children.

"Education is critical," says Dr. Card. "Physicians should not hesitate to help patients and their families develop realistic nutritional and exercise plans. Physicians can assess whether family members are ready to lower their CVD risk by gauging how concerned they are about weight issues and by identifying dietary and lifestyle behaviors that the family is willing to change. As I tell my patients, good nutrition is not a 6-week experiment, but a permanent lifestyle change."

To expand its educational outreach to Hispanics, THI has been translating the information on many key cardiovascular topics on its Web site into Spanish. The audience for such information is growing: approximately 1 in 5 visitors to THI's Web site are Spanish speaking, and a 2002 Nielsen/NetRatings survey revealed that more than 7.5 million Hispanics accessed the Internet from home in June 2002, a 13% increase from the year before.

At present, medical monitoring and patient education are the best preventive tools available. On the horizon is another: genetic screening. The ongoing San Antonio Family Heart Study is investigating the genetic contribution to heart disease risk in 1,400 members of more than 40 large Mexican American families. The study is being conducted by researchers from the Southwest Foundation for Biomedical Research and The University of Texas Health Science Center at San Antonio with funding from the National Heart, Lung, and Blood Institute. Fourteen candidate genes have already been targeted, including those that influence fat mass, insulin level, and leptin level (a signal for satiety).

"The care of Hispanic patients with CVD will change dramatically once these genes are sequenced and genetic screening can be done," says Dr. Card. "Intervening early, especially in adolescence, before dietary and lifestyle patterns become fixed, will reduce the chances of persistent obesity and its associated cardiovascular complications.

"Through a concerted, caring program of early intervention, follow-up, education, and outreach, we can help Hispanic families realize that obesity and diabetes can be successfully treated and managed long before the warning signs and symptoms of atherosclerosis ever appear," concludes Dr. Card. ●

For more information:

Dr. Robert J. Card

713.797.1620

National Heart Failure Registry

Since April 2003, THI/SLEH has been enrolling patients in a novel, clinic-based national heart failure registry. The paperless, computerized registry, called Advancent, will eventually maintain data on 100,000 patients from 60 U.S. centers—including approximately 1,500 patients from THI/SLEH— who are being treated for left ventricular dysfunction (i.e., an ejection fraction of ≤40%). The registry will allow insight into the real-world application of therapies for left ventricular dysfunction by a wide range of practitioners.

HeartWATCH

Editorial Office 832.355.6630
jrichard@heart.thi.tmc.edu

For physician referrals,
call 1.800.872.9355

Cover: Artwork donated by Mrs. Lyndon B. "Lady Bird" Johnson 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 Symposium

Texas Heart Institute Implantable LVADs as a Temporary Bridge or as Destination Therapy

May 21–22, 2004
Houston, Texas
Program Directors: O.H. Frazier, M.D.; Frank W. Smart, M.D.; James T. Willerson, M.D.

For information about the CME activity listed above, please contact cme@heart.thi.tmc.edu or call 832.355.2157.

Selected Upcoming National and International Meetings

Society of Thoracic Surgeons 40th Annual Meeting

January 26–28, 2004
San Antonio, Texas

American College of Cardiology 53rd Annual Scientific Session

March 7–10, 2004
New Orleans, Louisiana

International Society for Heart and Lung Transplantation 24th Annual Meeting and Scientific Sessions

April 21–24, 2004
San Francisco, California

American Heart Association Scientific Sessions 2004

November 7–10, 2004
New Orleans, Louisiana
Abstract submission begins: March 15, 2004
Abstract submission deadline: May 28, 2004

HeartWATCH
WINTER 2004

Texas Heart® Institute
Scientific Publications
Mail Code 1-194
P.O. Box 20345
Houston, Texas 77225-0345
texasheartinstitute.org

Non-Profit
Organization
U.S. Postage
PAID
Houston, Texas
Permit No. 7249