HeartWATCH

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A Newsletter Produced by the Texas Heart Institute

Texas Heart® Institute

at St. Luke's Episcopal Hospital

The Search Continues for Simple, Reliable Predictors of Advanced Heart Failure

Abstract: Researchers continue to seek simple, easily obtainable, and reliable predictors of advanced heart failure.

Since its establishment in 1997, the Heart Failure Clinic of the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH) has improved the outcomes and quality of life of its patients with advanced heart failure through a coordinated program of treatment, education, and follow-up. However, over the last decade, heart failure mortality has continued to rise, while overall mortality has decreased. Moreover, an estimated 1 in 5 patients will die within 1 year after receiving a diagnosis of heart failure. Therefore, the clinic's practitioners continue to seek easier yet reliable ways of identifying patients who would benefit from early referral to the clinic.

"It is imperative that these patients be sent or referred to advanced heart failure clinics sooner rather than later," says Roberta C. Bogaev, MD, medical director of Heart Failure and Transplantation at THI at SLEH. "Ideally, referring physicians would have at their disposal a simple, reliable predictor of heart failure mortality at 1 year, especially in the outpatient setting. So far, however, all attempts to develop and validate such a predictor have failed."

One of the main reasons for this failure has been the difficulty of predicting when a patient's stable disease will progress to end-stage heart failure. This impasse may soon be breached.

In 1 recently published study, investigators in Kansas City and St. Louis evaluated the cardiovascular health and quality of life of 1,358 international patients who completed a validated self-assessment known as the Kansas City Cardiomyopathy Questionnaire (KCCQ) 1, 3, 6, and 12 months after being diagnosed with heart failure (*Circulation* 2007;115:1975-81). Every 5-point drop in the KCCQ score correlated with a 12% higher risk of cardiovascular death or hospitalization and an 11% higher risk of all-cause death. Therefore, the investigators believed that they had identified a convenient yet reliable tool for predicting imminent cardiovascular events and for individualizing treatment and follow-up.

Here at THI at SLEH, Dr. Bogaev and her colleagues in the Heart Failure Clinic are participating in a multicenter study, based at The Johns Hopkins University, that aims to determine whether any of 6 predetermined risk factors can predict survival in patients with low ejection fractions and advanced heart failure. All of the risk factors can be easily and routinely assessed during a 15-minute clinic visit. The 6 risk factors include an inability to walk more than 1 block, hospitalization within the last 6 months, symptomatic hypotension (ie, requiring a reduction or withdrawal of angiotensin-converting enzymes, β-blockers, or both), a diuretic dose of >1.5 mg/kg/day, a sodium level of <135 mg/dL, and a blood urea nitrogen level of >40 mg/dL.

"We'll gather the data about the target set of risk factors simply and easily, as answers to a short list of yes/no questions, during regular patient visits to the clinic," says Dr. Bogaev. "Unlike in the KCCQ study, however, our data will be based on clinical rather than self assessments and will be analyzed and reported only descriptively."

Now recruiting subjects, Dr. Bogaev and her coinvestigators plan to enroll a total of 200 patients. The study will include patients in New York Heart Association functional class IIIb or IV who have had clinically stable disease for at least 1 month and have at least 1 of the 6 clinical risk factors being studied. It will exclude any patient not expected to live for at least 2 more years.

"Although the descriptive data we collect will not be analyzed or reported for some time," says Dr. Bogaev, "we expect that they will point us to at least 1 potentially powerful clinical predictor of advanced heart failure. We will then subject that factor to more stringent and statistically powerful investigations."●

Predicting Advanced Heart Failure: Candidate Indicators for Heart Failure Clinic Referral

- Inability to walk >1 block
- Hospitalization within previous 6 months
- Symptomatic hypotension*
- Diuretic dose >1.5 mg/kg/day
- Sodium level <135 mg/dL
- Blood urea nitrogen level >40 mg/dL

**Defined as symptomatic hypotension requiring reduction or withdrawal of angiotensin-converting enzymes and/or β-blockers*

For more information:

Dr. Roberta C. Bogaev

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Roberta C. Bogaev, MD, Named Director of Advanced Heart Failure and Cardiac Transplantation

Roberta C. Bogaev, MD, has joined the staff of the Texas Heart Institute at St. Luke's Episcopal Hospital as the director of Advanced Heart Failure and Cardiac Transplantation. Dr. Bogaev was instrumental in developing the ventricular assist device and transplantation programs at the Texas Transplant Institute in San Antonio, Texas. She also founded and directed the annual "Deep in the Heart of Texas" Heart Failure Symposium in San Antonio. Dr. Bogaev is a member of several professional organizations, including the American College of Cardiology, American College of Physicians, American Heart Association, American Medical Association, and International Society for Heart & Lung Transplantation.

Heart Failure Program Addresses End-of-Life Care for Patients With Advanced Heart Failure

Abstract: Improving end-of-life care for patients with advanced heart failure will require a better understanding of heart failure's unpredictability and better continuity of care.

Despite treatment advances

that allow heart failure patients to live longer, better-quality lives, heart failure remains the leading cause of death—even surpassing all forms of cancer. According to the American Heart Association, heart failure mortality increased by 28% between 1994 and 2004 (*Circulation* 2007;115:e69-e171). Half of patients die within 5 years of diagnosis, many after entering a chronic state of advanced heart failure characterized by left ventricular systolic dysfunction, severe symptoms, and poor exercise capacity despite maximal therapy.

"Because chronic advanced heart failure is manageable but—short of cardiac transplantation—incurable, we want to be realistic yet hopeful with our patients," says Reynolds M. Delgado III, MD, medical director of Mechanical Support Devices for Heart Failure at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH). "We want them to understand that eventually their heart failure will progress to an end stage that requires palliative home health or hospice care."

The main goals of the Heart and Lung Transplant and Treatment Center at THI at SLEH are to optimize survival-enhancing medical therapies and provide surgical and research options, patient education, and appropriate management of comorbidities. However, another goal is to provide end-of-life palliative care for patients with advanced heart failure. By aggressively and palliatively managing their symptoms (in particular, fatigue and dyspnea), the Center aims to prevent acute or chronic exacerbations, improve functional ability and quality of life, and make appropriate hospice referrals when the time comes.

"Predicting when a patient will die of end-stage heart failure is difficult because the trajectory of progression—marked by debilitating, demoralizing cycles of symptomatic exacerbation, recovery, relative stability, and exacerbation again—is extremely unpredictable," says Erin K. Donaho, RN, one of the treatment center's heart failure clinical coordinators. "This unpredictability leaves many cardiologists reluctant to predict death within 6 months, as is required for the institution of hospice care."

> "End-of-life care should be considered in patients who have advanced, persistent [heart failure] with symptoms at rest despite repeated attempts to optimize pharmacologic and nonpharmacologic therapy, as evidenced by 1 or more of the following:
>
> - Frequent hospitalizations (3 or more per year)
> - Chronic poor quality of life with inability to accomplish activities of daily living
> - Need for intermittent or continuous intravenous support
> - Consideration of assist device as destination therapy"
>
> *Source: HFSA 2006 Comprehensive Heart Failure Practice Guideline. J Card Fail 2006;12(1): e1-e122.*

In the last several years, the American College of Cardiology/American Heart Association and the Heart Failure Society of America have addressed this situation by promulgating end-of-life guidelines. Both sets of guidelines underscore the need to discuss with patients their treatment options and prognosis whenever there is a change in clinical status. The guidelines also recommend the meaningful utilization of hospice care (eg, intravenous diuretics and inotropes in addition to opiates and anxiolytics) to treat fatigue, dyspnea, pain, and weakness and to promote continuity of care between the clinic, home, and hospice.

However, as the number of end-stage heart failure patients who require hospice care continues to rise, obstacles to the efficient and effective delivery of that care are becoming clearer (www.theheart.org, March 19, 2007). Chief among them are the hesitancy of palliative-care physicians and hospice staff untrained in the management of heart failure to care for such patients and the reluctance of cardiologists to refer their patients to hospice care because they fear that the caregivers there will stop medications. Their fears stem from the high cost of recommended medications, which hospices may not be able to afford because of limited Medicare reimbursement.

"If we're to improve end-of-life care of our patients, we need to face these shortcomings head on," says Dr. Delgado. "Hospice organizations must learn how to effectively manage end-stage heart failure and how to deliver palliative treatments that will make a heart failure patient's last days as comfortable and dignified as possible. At our Center, we've begun to achieve that goal by enlisting area hospice organizations as partners in managing terminal heart failure." ●

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Heart Failure Issue

Pharmacogenetics Leads the Way to Individualized Warfarin Therapy

Abstract: By allowing the warfarin induction regimen to be individualized, pharmacogenetics-based therapy may improve the safety and efficacy of anticoagulation treatment.

Heart failure is often accompanied by serious conditions, such as atrial fibrillation or thromboembolism, that warrant the use of the anticoagulant warfarin. Establishing an optimal therapeutic warfarin regimen is important for minimizing the risk of hemorrhage while maintaining a protective level of anticoagulation. However, the individual response to warfarin varies widely; the usual clinical dose ranges from 2 to 7 mg per day, with rare patients requiring as much as 20 mg per day. This variability, combined with a narrow window of efficacy, makes optimizing a warfarin regimen difficult. During the critical induction period, physicians often have to rely on trial-and-error dosing to achieve the desired degree of anticoagulation, as measured by a standardized prothrombin time. The recent identification of a gene that regulates warfarin responsiveness has opened the door to a pharmacogenetic approach to individualizing warfarin induction therapy.

At the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH), David Feldman, MD, director of Molecular Pathology, has been instrumental in forming an interdisciplinary team to pilot the use of pharmacogenetics to improve warfarin induction therapy. By using blood samples for genotype testing, Dr. Feldman's group believes they can predict a patient's responsiveness to warfarin and use this information to guide early dose selection.

Warfarin, a vitamin K antagonist, works by inhibiting the enzyme vitamin K epoxide reductase complex-1, which is encoded by a gene referred to as VKORC1. The VKORC1 enzyme regenerates the reduced form of vitamin K, which is necessary for activating several anticoagulation factors. Warfarin essentially interrupts the clotting cascade by interfering with the recycling of vitamin K.

Recently, common genetic variations, or polymorphisms, identified within the VKORC1 gene have been found to correlate with warfarin sensitivity and resistance (*New England J Med* 2005;352:2285-93). On the basis of their VKORC1 genotypes, patients fall into low-, intermediate-, and high-dose warfarin groups.

> *"Determining a patient's genotype may reduce the incidence of adverse events by allowing us to individualize the warfarin regimen for patients who need anticoagulation."*
>
> *—David N. Feldman, MD, Director of Molecular Pathology*

The intermediate group is usually heterozygous for the VKORC1 polymorphism. This variability in warfarin response appears to be caused by the transcriptional regulation of mRNA, which correlates with the actual amount of VKORC1 enzyme produced by the liver.

"A patient with a polymorphism that results in the production of large quantities of the VKORC1 enzyme will require higher doses of warfarin for effective anticoagulation than a patient who has lower VKORC1 enzyme levels," explains Dr. Feldman. "The VKORC1 genotype is a new tool that can be used to determine the best warfarin dose for most patients; however, the entire clinical picture must always be evaluated when starting a patient on warfarin therapy. Other factors also contribute to a patient's responsiveness to warfarin, so the therapeutic dose may differ from the genetically predicted dose in some patients. Warfarin dosing requirements also depend on clinical and environmental factors."

Another gene has been identified that contributes to the warfarin response. The cytochrome P-450 enzyme 2C9 (CYP2C9) is responsible for the metabolism of warfarin. Patients with polymorphisms in the CYP2C9 gene remove warfarin from the circulation at a slower rate and, therefore, require a lower warfarin dose. However, the VKORC1 gene accounts for a greater proportion of the interpatient variability in warfarin response than does the CYP2C9 gene.

"The Food and Drug Administration is considering formally recommending this genetic test as a guide for warfarin dosing," says Dr. Feldman. "Determining a patient's genotype may reduce the incidence of adverse events by allowing us to individualize the warfarin regimen for patients who need anticoagulation." ●

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Texas Heart Institute at St. Luke's Episcopal Hospital to Take Part in an NIH Stem Cell Study Consortium

The Texas Heart Institute at St. Luke's Episcopal Hospital is one of 5 centers selected by the National Institutes of Health to take part in a new national consortium on stem cell therapy, the Cardiovascular Cell Therapy Research Network. The network represents the first federally funded adult stem cell studies in which patients will be treated with stem cells taken from their own bodies. Physicians and scientists will explore the potential of stem cells taken from different sites in the body, and they will also study new techniques to process and deliver the stem cells.

Of the Multiple Types of Stem Cells, Can One Best Prevent Heart Failure?

Abstract: Several types of stem cells show promise for preventing heart failure in patients with chronic myocardial ischemia and myocardial infarction.

One of the newest and most promising investigational methods for treating heart failure is stem cell therapy. At the forefront of this research, Emerson C. Perin, MD, PhD, director of New Cardiovascular Interventional Technology at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH), has been scrutinizing all aspects of the complex biology of stem cell therapy.

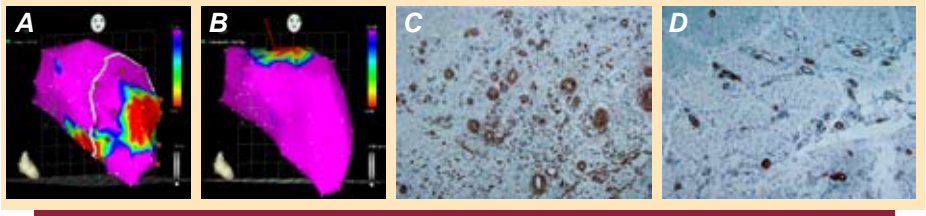
"One of the key questions is which cell type can most effectively improve perfusion and function and reverse remodeling in patients with heart failure," says Dr. Perin. "Stem cells probably work by generating new blood vessels or myocytes or by stimulating a paracrine response. The mechanism differs with the type of cell, and new cell types are constantly being tested for clinical potential, so determining the best cell type is challenging."

Autologous bone marrow–derived cells have been used in most clinical trials of heart failure. Bone marrow contains a heterogeneous assortment of cells. The mononuclear fraction of bone marrow cells (BMMNCs), also comprising a myriad of cell types, can be separated from unfractionated bone marrow cells by means of density gradient centrifugation. Using BMMNCs in heart failure patients who have no revascularization options, Dr. Perin's group and others have shown increases in perfusion, contractility, and exercise capacity, with few or no adverse effects (*Circulation* 2004;110(Suppl 1):213-8). Despite its safety and success, however, the BMMNC population is undefined and rather unsophisticated. To refine this therapy, researchers are trying to identify more "select" cell populations.

One such cell population comprises mesenchymal stem cells (MSCs), which are undifferentiated stromal cells of the bone marrow. "MSCs are excellent candidates for use in stem cell therapy because they have the pluripotent capacity to differentiate into a multitude of cells, and they can undergo limited expansion in culture," explains Dr. Perin.

Another select cell type is an adult stem cell in the bone marrow that expresses a high level of the enzyme aldehyde dehydrogenase (ALDH). A Food and Drug administration (FDA)–approved study of the transendocardial delivery of ALDH cells in ischemic heart failure (FOCUS Bright) is ongoing at THI at SLEH (see *Heart Watch*, Fall 2006, p. 4). "ALDH cells are very primitive, potent cells with a high angiogenic potential, and early results are quite encouraging," says Dr. Perin.

A promising new cell type, the mesenchymal precursor cell (MPC), has recently been "immunoselected" from bone marrow via the specific binding of a monoclonal antibody to a unique marker on its surface. This immunoselection process, developed by Angioblast Systems, Inc. (New York, NY), produces a precisely identified, highly concentrated population of MPCs. Furthermore, MPCs can be easily expanded in culture and, because of their low immunogenicity, can be obtained from allogeneic, or unrelated, donors. In preclinical studies in sheep, intramyocardial delivery of MPCs after acute infarction has resulted in arteriogenesis and significant cardiac improvement (see figure) (*Nat Clin Pract Cardiovasc Med* 2006:3(Suppl 1):S18-22).



Electromechanical mapping and targeted injections of mesenchymal precursor cells (MPCs) 5 days after myocardial infarction. A) Baseline map and transendocardial injections at the border of the infarction (tagged points). B) Follow-up map showing improvement of regional contractility in the injected areas (absence of red areas in the anterior wall). C) Histologic section of the myocardium at the segments injected with MPCs. (D) Histologic myocardial section from a placebo recipient.

In combination with Angioblast, THI at SLEH has recently been given clearance by the FDA to conduct phase II clinical trials of allogeneic MPCs in patients who have had an acute myocardial infarction.

"We will inject MPCs into patients 10 days postinfarction in this trial, and we hope that this approach will prevent apoptosis of cardiac myocytes, expansion of the infarcted area, and dilation of the left ventricle—essentially the cardiac remodeling that leads to heart failure," explains Dr. Perin. "Given the right stem cell regimen, we may someday focus not on treating heart failure but on preventing its development. Regardless of the approach, our studies have shown that stem cell therapy is a safe and promising treatment for patients with heart disease." ●

For more information:

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Ventricular Assist Devices Are Smaller, Simpler, and Saving More Lives

Abstract: Continual improvements in ventricular assist devices (VADs) are helping heart failure patients to survive longer and, in some cases, to recover.

Implantable ventricular assist devices (VADs) are being successfully used as both destination therapy and bridges to transplantation, allowing more patients with severe heart failure to survive and lead normal lives. However, older, pulsatile VADs are too large to implant in smaller patients, particularly women.

In the last few years, axial-flow VADs have been developed to deal with this problem. These devices can be made smaller than their pulsatile forebears because they have only 1 moving part—a rotating impeller that pushes blood forward like a fan pushes air. Being simpler than pulsatile pumps, axial-flow VADs have the additional advantage of being less prone to mechanical failure.

Two types of axial-flow VADs are currently used for long-term support at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH): the Jarvik 2000 Heart (Jarvik Heart, Inc., New York, NY) and the HeartMate II LVAS (Thoratec Corporation, Pleasanton, Calif). The choice of device for a particular patient depends mainly on which VAD design and implantation scheme best suit the clinical characteristics of that patient.

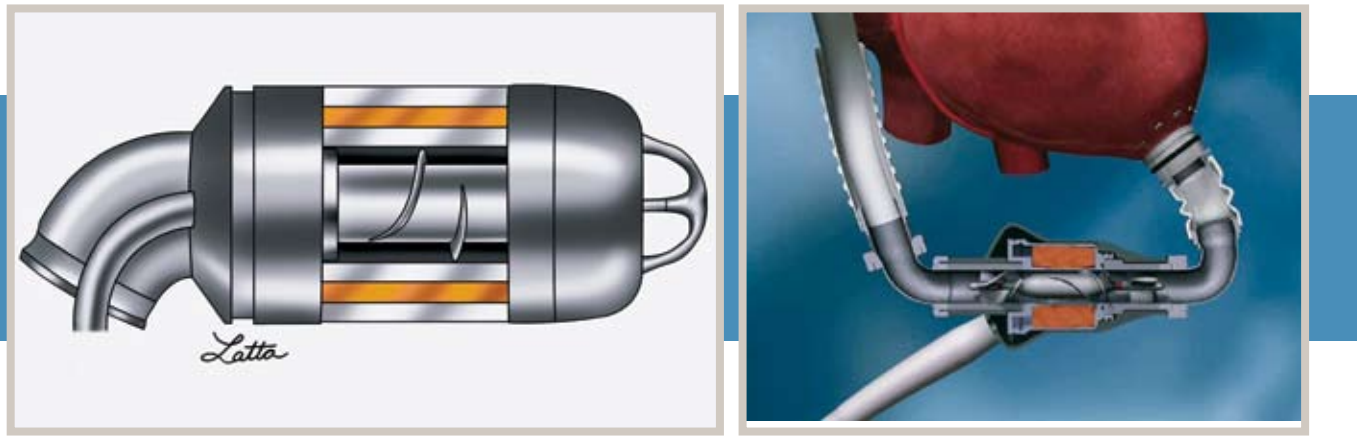
A recent CBS News story (texasheart.org/AboutUs/News/index.cfm) highlighted the use of an axial-flow VAD in a woman with severe heart failure at THI at SLEH. Now, 8 months after receiving the device, the patient has largely returned to her normal activities as a teacher and mother. Though on the waiting list for a heart transplant, she may never need one, because the reduction in her heart's workload has allowed the cardiac tissue to begin to recover its function.

"This phenomenon, called 'reverse remodeling,' happens to varying degrees in all VAD recipients," says O.H. Frazier, MD, director of the Center for Cardiac Support at THI at SLEH. Dr. Frazier, who has implanted more VADs than any other surgeon, adds, "In this patient's case, her heart is recovering well enough that someday she may be able to live a normal life without either a heart transplant or a VAD."

In addition to being small and mechanically simple, axial flow pumps have the advantage of preload sensitivity. In other words, they can adjust for differences between the pressures exerted by blood as it returns to the heart (inflow pressure) and as it leaves the heart (outflow pressure). Such adaptation is important, as preload varies with a person's body position and activity level.

"Because of the preload sensitivity of these pumps, we can even connect 2 of them to create a total artificial heart," says Dr. Frazier. "In the normal heart, the pressure is about 20 mm Hg higher in the right atrium and ventricle than in the left atrium and ventricle, because the right side of the heart has to supply the pulmonary circulation. The native heart can adjust to this difference, but a pulsatile total artificial heart cannot. However, when 2 preload-sensitive VADs are linked in sequence, each VAD automatically responds to changes in output from the other, so they can maintain a more physiologic pressure balance."

Dr. Frazier and his colleagues are currently developing such a dual, continuous flow pump. ●



Drawings of the Jarvik 2000 Heart (left) and the Thoratec HeartMate II LVAS (right).

For more information:

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Heart Transplantation Remains a Viable Option for Selected Patients With End-Stage Heart Failure

Abstract: Despite the growing popularity of left ventricular assist devices for the treatment of end-stage heart failure, heart transplantation remains a viable treatment for selected patients.

Since 1967, when Christiaan Barnard performed the first clinical heart transplant, this procedure continues to be a safe, reliable therapy that can prolong life and improve its overall quality in selected patients with end-stage heart disease. The current heart transplant program of the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH) was launched in 1982 with the advent of the antirejection drug cyclosporine. In 2006, the THI team, led by O.H. Frazier, MD, performed its 1,000th heart transplant, thereby probably surpassing every other heart center in the world.

Recently, THI at SLEH celebrated 23 patients who have reached or will surpass the 20th anniversary of their heart transplants this year. They represent more than 450 years of "extra life" achieved through heart transplantation.

"My transplant allowed me to rear my 2 children. They were 7 and 9 years old at the time of my transplant in April 1985. Now they're 29 and 31," says Penny Eastham. "How fortunate can you be? How do you thank someone for your life?"

After John Poindexter received his donor heart in 1985, he set a record by being discharged from the hospital just 10 days later. "I'm very happy to have achieved this anniversary. Medically, I've been lucky and done extremely well. I've maintained a healthy, full, and vibrant life," he says.

> *"How fortunate can you be? How do you thank someone for your life?"*
>
> *—Penny Eastham, 22-year transplant survivor*

According to Igor D. Gregoric, MD, a cardiothoracic surgeon at THI at SLEH, these long-term transplant survivors are proof that this procedure is a satisfactory option for the treatment of end-stage heart disease, especially for patients older than 40. Typically, younger patients may undergo left ventricular recovery with left ventricular assist device (LVAD) support. Recently, LVADs were removed from 5 young patients with chronic heart failure who had recovered sufficiently that transplantation was no longer necessary. Also, younger transplant recipients would be more likely to need another transplant in their lifetime.

"We have learned that long-term (>10-year) survival of heart transplant recipients is associated with the absence of several donor- and recipient-related risk factors. These factors include pretransplant diabetes, increased donor age, and rejection and infection episodes in the first 2 years after transplantation," says Dr. Gregoric. "Better control of these factors, particularly rejection and infection in the first 2 years, can improve the 10-year survival rate for our patients."

Unfortunately, the donor pool has been declining, with only 1600 heart transplants performed in the United States in 2006; consequently, there has been progressive expansion of the criteria for donor selection, including the upper age limit for potential donors.

"In the longer term, older donor age is mildly associated with shorter posttransplant survival," says Dr. Gregoric. "However, the clinical significance of donor age is small relative to the risk of premature death from heart failure. Nevertheless, matching older recipients with older donors makes good medical and ethical sense."

After the first postoperative year, transplant vasculopathy is the most frequent cause of death among heart transplant patients. Acute myocardial rejection, viral infection, and perioperative endothelial injury related to ischemia may contribute to the development of transplant vasculopathy. As recipients survive beyond 10 years, well-recognized factors such as hyperlipidemia may play an additional role in the development of transplant coronary artery disease. In slowing the progression of transplant vasculopathy, statin therapy is promising and may further improve long-term survival.

"Although LVADs are becoming the most widely used treatment for end-stage heart failure, cardiac transplantation will remain an option for a select group of patients, especially older patients," says Dr. Gregoric. "This procedure will continue to play a role in the treatment of end-stage heart failure." ●

For more information:

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THI Staff Member Is Appointed Assistant Secretary of Defense for Health Affairs

S. Ward Casscells III, MD, associate director of Cardiology Research at the Texas Heart Institute at St. Luke's Episcopal Hospital, has been appointed Assistant Secretary of Defense for Health Affairs. Dr. Casscells' new responsibilities include supervising the health and medical affairs of the Department of Defense (DoD), acting as principal advisor to the Secretary of Defense for all DoD health policies, programs, and activities, and overseeing all DoD health resources.

HeartWATCH

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For physician referrals,
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Cover: Glass hearts donated by Tiffany & Co. 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

7th Texas Update in Cardiovascular Advancements
July 28–29, 2007 • Houston, TX
Program Director: James T. Willerson, MD
Register online at cme.texasheart.org

Denton A. Cooley Cardiovascular Surgical Society 15th International Symposium
October 25–27, 2007 • Houston, TX
For more information visit www.cooleysociety.com

Selected Upcoming National and International Meetings

Society of Thoracic Surgeons: 2007 Thoracic Endografting Symposium
July 13–14, 2007 • Chicago, IL

American Association for Thoracic Surgeons: Valvular Heart Disease 2007
September 7–9, 2007 • Chicago, IL

American Society of Anesthesiologists Annual Meeting
October 13–17, 2007 • San Francisco, CA

American College of Chest Physicians
October 20–25, 2007 • Chicago, IL

American Heart Association
November 4–7, 2007 • Orlando, FL

Southern Thoracic Surgical Association
November 8–10, 2007 • Bonita Springs, FL

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 16 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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