# HeartWATCH

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A Newsletter Produced by the Texas Heart Institute

Texas Heart® Institute

*at St. Luke's Episcopal Hospital*

# State-of-the-Art Cardiovascular Surgery

**Abstract:** As new treatments become available, cardiovascular surgeons are having to adjust and adapt, sometimes even returning to older techniques once viewed as outmoded.

**Today,** cardiovascular surgery is undergoing major changes as it builds on its earlier accomplishments. This issue of *Heart Watch* examines some of those changes, including hybrid surgical procedures, robot-assisted operations, and the use of surgical adhesives.

"As innovative treatments become available, older ones keep evolving and being applied in new ways," says Denton A. Cooley, MD, president and surgeon-in-chief of the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH).

"For instance, many patients can benefit from a hybrid approach in which transcatheter interventions and open operations are performed simultaneously," he continues. "Several cardiovascular centers (including THI at SLEH) now have hybrid suites that combine the features of a cardiac catheterization laboratory and an operating room. Our facility is the only heart center in the United States to have 2 such suites. The hybrid approach exemplifies a new paradigm: surgeons, interventional cardiologists, and radiologists working concurrently, within the same physical space, to obtain the best outcome. Such cooperation will be one of the hallmarks of future cardiovascular therapies."

Today's minimally invasive procedures allow coronary artery bypass graft (CABG) and valve operations to be performed on the beating or nonbeating heart through several small incisions. "To help surgeons maneuver in these confined spaces," says Dr. Cooley, "a new array of devices and techniques has become available. These innovations include robotically assisted endoscopic systems, which permit complicated procedures to be done precisely, safely, and quickly. Such a system is now available in our hybrid suite."

Other innovations being tested by THI surgeons include a biocompatible polymer that provides a bloodless operative field during CABG on the beating heart (*Heart Watch*, Summer 2005). The polymer is infused into the target artery, where it solidifies at body temperature and prevents bleeding. Once the bypass is completed, the polymer is dissolved with cold saline and eventually removed by the kidneys.

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>
> *– Denton A. Cooley, MD*
> *President & Surgeon-in-Chief*
> *Texas Heart Institute*

Anastomotic connectors also are being developed for minimally invasive CABG procedures (*Heart Watch*, Fall 2003). These devices create a sutureless anastomosis between a bypass graft and a coronary artery.

For some patients with coronary artery disease, advanced age or debilitated status precludes CABG surgery and even traditional percutaneous coronary intervention (PCI). In selected high-risk cases, a percutaneous ventricular assist device (pVAD) is being tested to provide circulatory support during high-risk PCI (*Heart Watch*, Summer 2005).

Dr. Cooley's 62-year career has spanned the entire history of modern heart surgery. He helped pioneer open heart techniques, which were made possible by the clinical introduction of cardiopulmonary bypass (CPB) in 1953. Until that time, the only available methods for treating valve disease and other intracardiac problems were closed techniques, performed on the beating heart and often involving blind finger palpation.

"It is interesting to see how some early techniques are coming back into favor," comments Dr. Cooley. "For instance, with the advent of CPB, operations on the beating heart were all but abandoned. Over the years, however, mounting evidence showed that CPB can cause serious complications. So beating-heart surgery was reintroduced, with the aid of minimally invasive techniques, to avoid the need for CPB whenever possible. Likewise, closed operations are again being reconsidered for treating aortic valve stenosis. Several new approaches have been described, including catheter-based valve implantation and, more recently, successful deployment of an aortic valve prosthesis through the apex of the left ventricle."

These are only a few examples of how cardiovascular surgery is changing and evolving in the 21st century. Since its founding in 1962, THI has helped pave the way, whether in open heart techniques, minimally invasive procedures, or hybrid approaches.

"To stay competitive, cardiovascular surgeons must be open to new concepts," says Dr. Cooley. "We must examine traditional concepts with a fresh eye. We must be willing to work more closely with cardiologists and other medical specialists. Whatever the future brings, cardiovascular surgery will remain a particularly rewarding specialty." ●

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# Hybrid Surgical Procedures Combine the Best of Surgery and Interventional Cardiology

**Abstract:** Hybrid procedures in specially equipped surgical suites enable surgeons and interventional cardiologists to work together on complex cases.

**In 1997,** coronary artery bypass graft (CABG) surgery was the most common revascularization procedure in the United States, performed 607,000 times. In the same year, 447,000 percutaneous coronary intervention (PCI) procedures were performed, and stents were implanted in approximately half of PCI cases. In 2003 (the latest year for which data are available), however, the situation was almost reversed: there were 467,000 CABG surgeries and 664,000 PCI procedures, and 84% of patients who had PCIs received stents, according to the American Heart Association's *2006 Heart Disease and Stroke Statistics—2006 Update*. Drug-eluting stents were not available in 1997, but today they are commonly used to prevent restenosis.

Does this mean that CABG surgery is on its way out? "No," says Ross M. Reul, MD, director of Surgical Innovation at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH). "A 2006 meta-analysis confirms that for many patients a mammary artery graft to the left anterior descending artery is still the best revascularization solution," says Dr. Reul, citing a recent study (*Eur J Cardiothorac Surg 2006;29:65–70*). "The good news is that we can now combine CABG surgery with percutaneous interventions, including stenting, in a single hybrid procedure."

Two hybrid surgical suites, opened in THI at SLEH in August 2005, are the sites of these procedures, in which minimally invasive surgery and PCIs are aided by advanced visualization technology. The same patient may receive a bypass graft in 1 artery and stents in others, all in the same session, without a sternal incision or cardiopulmonary bypass.

The Texas Heart Institute at SLEH was the third heart center in the United States to open a hybrid suite and is the only US center to have 2 such suites. Both facilities have advanced intraoperative imaging equipment, and both have access to the da Vinci® surgical robot (Intuitive Surgical, Inc., Sunnyvale, CA), which enables surgeons to perform minimally invasive procedures (*see story page 4*).

Minimally invasive surgery, such as a hybrid procedure combining stent placement and aortic valve replacement, can be performed through a small incision, thereby avoiding a sternotomy or cardiopulmonary bypass.

"We have many patients who are in different stages of disease; they may have multiple illnesses that put them at very high risk for conventional bypass surgery," says Ali Mortazavi, MD, interventional cardiologist on the staff of THI at SLEH and chief of Cardiology at Kelsey-Seybold Clinic. "At the same time, because these patients have complex coronary lesions, PCI revascularization may not be appropriate treatment. So mixing and matching these procedures in a single combined procedure, performed by a surgeon and an interventional cardiologist, makes perfect sense."

"We [Drs. Reul and Mortazavi] recently treated a patient with extensive calcification of the ascending aorta and aortic arch that extended into the innominate vessel. The left anterior descending artery was extensively diseased, with sequential complex lesions," explains Dr. Reul. "In a traditional CABG procedure with cardiopulmonary bypass, we clamp the aorta, but had we tried to do so in this case, pieces of the calcified aorta would probably have broken off and entered the circulation. In addition, the arteries on the back of the patient's heart were too deep in the heart muscle to attach the bypass grafts without using cardiopulmonary bypass. Therefore, we performed a hybrid procedure for this patient, which included off-pump internal mammary artery anastomoses to the left anterior descending artery and diagonal vessels, followed by percutaneous placement of stents in the intramuscular ramus and circumflex arteries."

"There are many other instances in which combining surgical and interventional procedures is the best solution for patients," says Dr. Reul. "If we can perform a smaller, less invasive procedure with a hybrid approach, we can offer patients a better recovery. Our goals are for patients to have less pain, a faster recovery, a shorter hospitalization, and a quicker return to their normal, productive lives." ●

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## Contents

# Is 16-Row Multislice CT Coronary Angiography Useful in Emergency Department Patients With Acute Chest Pain?

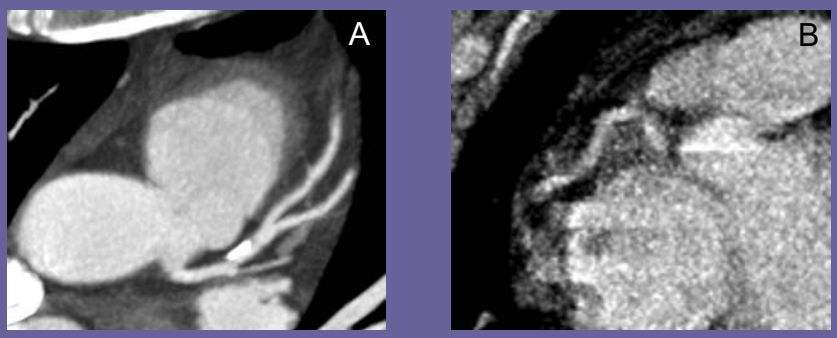
**Abstract:** Sixteen-row multislice spiral computed tomographic coronary angiography does not consistently provide diagnostically useful images in emergency department patients with chest pain.

**More than** 5 million Americans present at the emergency department (ED) with chest pain each year. These visits result in 2 million hospital admissions at a cost of more than $8 billion, and 10% to 50% of these cases of angina are of noncardiac origin. Safe, cost-effective management of ED patients who have possible cardiac ischemia or infarction is an ongoing challenge.

Conventional coronary angiography is the gold standard for evaluating coronary artery stenosis, but patient discomfort, possible complications, and cost have engendered newer, noninvasive methods for assessing the coronary arteries. Sixteen-row multislice spiral computed tomographic (MSCT) coronary angiography has shown excellent sensitivity and specificity in identifying coronary stenoses in selected patients (*JAMA 2005;293:2471–8*). One suggested application for this technique is cardiac triage for ED patients with possible coronary stenosis. Although it lacks the catheter-related risks of invasive coronary angiography, MCST-based angiography exposes patients to radiation, and both a high heart rate and calcification decrease the image quality. Newer, more powerful, 64-slice scanners may produce better images but are not routinely available in the ED.

"MSCT studies have shown enormous clinical potential in heart patients, but the usefulness of this technique in assessing coronary artery stenosis in the typical patient with acute chest pain in the ED has not been established," says Steffen Huber, MD, a research fellow in Cardiovascular Magnetic Resonance Imaging at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH).

To investigate this application, Dr. Huber and colleagues, including Scott D. Flamm, MD, director of MRI and Cardiovascular MRI Research (THI at SLEH), performed 16-row MSCT coronary angiography on 98 consecutive patients who presented to the ED at SLEH with chest pain. The physicians evaluated the image results for diagnostic usefulness and studied the factors that affected image quality.




Multiplanar reconstruction of (A) an image of excellent quality showing the left main coronary artery giving rise to the left anterior descending (LAD) coronary artery, with a mild calcified stenosis in the LAD artery in a patient with a low heart rate and low body mass index (BMI); and (B) a poor quality image of the proximal right coronary artery in a patient with a high heart rate and high BMI.

Patients underwent a standard workup; only 16 patients received β-blocker therapy.

Dr. Huber and colleagues reported that the MSCT angiograms were nondiagnostic in 46% of patients in whom at least 1 coronary vessel could not be evaluated for stenosis. Furthermore, for the 29% of patients with significantly higher heart rates, the angiograms had an overall poor image quality. Image quality correlated inversely with body mass index and heart rate.

"The 2 factors that reduced image quality—obesity and a high heart rate—are risk factors for atherosclerosis and noncardiac sources of pain and are routinely seen in ED patients with unexplained angina," states Dr. Huber. "Clear, useful images are more likely to be obtained from patients with a body mass index of less than 29 kg/m$^2$ and a heart rate of less than 66 bpm."

Other studies have reported a higher proportion of diagnostic results for MSCT coronary angiography (*J Am Coll Cardiol 2004;43:2265–70*; *J Am Coll Cardiol 2004;44:1230–7*). There are several possible explanations for these discrepancies.

"First, our study population differed in many ways," explains Dr. Flamm. "We enrolled consecutive ED patients with chest pain, and β-blockers were used only if medically indicated. Both heart rate and body mass index were higher in our patients than in those of other studies. Second, we used a rigorous definition of a diagnostic study because patients were excluded if an image from 1 coronary vessel was of poor quality. Also, we minimized patient radiation exposure by modulating the dose throughout the cardiac cycle, which can reduce visualization in patients with an irregular heart beat."

Huber and colleagues believe that without heart rate reduction techniques, 16-row MSCT coronary angiography is currently not useful for routine evaluation of ED patients with acute chest pain. "We will need to see a consistent yield of good, diagnostic images of the coronary vessels for this technique to be used routinely in the ED," says Dr. Flamm. "The use of 64-slice scanners or strategies for image reconstruction may help overcome some of the drawbacks associated with the current technology." ●

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# Robot-Assisted Cardiovascular Surgery Speeds Recovery

**Abstract:** Robotic assistance allows cardiovascular surgery to be performed without a sternotomy or cardiopulmonary bypass, permitting less traumatic procedures with less discomfort and a faster recovery.

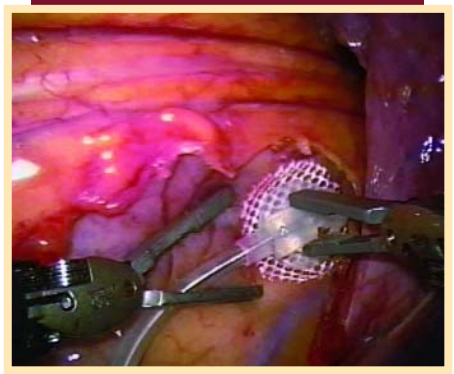
**Conventional surgery** to repair mitral valves in patients with stenosis or regurgitation is performed through a median sternotomy. Although this approach provides the surgeon with a wide view of the entire heart, recovery from the procedure may require up to a week of hospitalization and a lengthy convalescence during which the patient is unable to work.

Recent advances in robotics have enabled surgeons to repair mitral valves without a sternal incision. The da Vinci® Surgical System (Intuitive Surgical, Inc., Sunnyvale, CA), a robotic system approved for this use in 2002 by the US Food and Drug Administration, enables surgeons to perform a minimally invasive mitral repair.

The system has 3 functional parts: a surgeon's console, an instrument cart, and a visioning platform. While the surgeon sits at the console across the room from the patient, a computer interface translates the natural movements of the surgeon's fingers and wrists into microscopic movements of the instruments on 3 robotic arms, which enter the patient through 1-cm incisions. One of the robotic arms holds a camera scope, and the others carry surgical tools. A wraparound video-monitor station at the surgeon's console provides a magnified, 3-dimensional view of the surgical field. Both 0° and 30° endoscopes can be manipulated electronically to directly visualize structures within the closed chest.

The manipulating "fingers" at the ends of the robotic arms are only 4 mm long, enabling the surgeon to articulate them without restriction in the small spaces of the body. A microprocessor senses the movement of the controllers at the console and relays this digitized information to the robotic fingers, automatically filtering out tremors in the surgeon's hands.

"The robot can give you better visualization of the surgical field and make you more dexterous—even ambidextrous," says cardiovascular surgeon William E. Cohn, MD, director of Minimally Invasive Surgical Technology at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at SLEH). "The disadvantage is that you give up your sense of touch, which is a lot for a surgeon to give up," he continues. "But you gain a lot with the robot's 3-dimensional visualization and 7 degrees of freedom on the articulating wrists."



Robotic arms implant a pacemaker lead into the ventricular wall during cardiac resynchronization therapy.

A recent complex case at THI at SLEH illustrates the power of the robotic system. Ross M. Reul, MD, director of Surgical Innovation at THI at SLEH, performed robotic valve repair surgery for mitral regurgitation in a 72-year-old man. During the same operation, Dr. Reul also performed a Maze procedure to treat the patient's atrial fibrillation. Before minimally invasive robotic surgery became available, both procedures would have required a sternal incision and cardiopulmonary bypass.

"The robot allowed us to look directly at the valve in its normal orientation, without the pulling or distortion that is necessary with traditional surgery," Dr. Reul says. "Now, 2 years postoperatively, the patient is in excellent condition," he adds. "He describes his recovery as surprisingly easy, 'a piece of cake.' The valve has no residual leak, and the patient has no atrial fibrillation or flutter and requires no antiarrhythmia or anticoagulant medication. That's a real success story."

The robotic system at THI at SLEH is also used to harvest the left internal mammary artery for coronary bypass, to insert epicardial pacing leads, and to resect pericardial tumors.

"Robotic surgery may result in a potentially safer procedure, less discomfort, an easier recovery, and a quicker return to work for the patient," Dr. Reul notes. "Patients appreciate those advantages." ●

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## St. Luke's Episcopal Hospital Adds New CT Scan Technology

Until recently, the multidetector computed tomography (MDCT) scanners used to diagnose cardiac conditions lacked the speed and image resolution to create consistent images of the heart in motion, because they were limited to 8 and 16 slices. Now, the new Siemens Sensation 64 scanner (Siemens Medical Solutions USA, Inc., Malvern, PA) at St. Luke's Episcopal Hospital (SLEH), acquired in March 2006, enables researchers and physicians at the Texas Heart Institute at SLEH to capture 64 very thin cross-sections of the heart on a single rotation during a 6-second breathhold. The many rows of detectors allow multiple radiographs to be produced at the same time. The resulting images rival those produced by traditional, invasive angiographic procedures but at lower cost and risk to the patient. For example, the 64-slice scanner detects both calcified hard plaque in the arteries and soft plaque capable of rupturing and causing a heart attack. For patients with inconclusive indicators of coronary disease, such as an ambiguous stress test, 64-slice MDCT technology produces conclusive evidence to indicate whether treatment is needed.

# Preventing BioGlue®-Related Nerve and Cardiac Conduction Tissue Injury

**Abstract:** If not used judiciously, BioGlue®, a common surgical adhesive, can damage nerve and cardiac conduction tissue.

**Surgical adhesives** are a useful adjunct to standard suturing methods for cardiovascular repairs, because these adhesives create tight seals that can reduce intraoperative and postoperative blood loss. One such product, BioGlue® Surgical Adhesive (BioGlue) (CryoLife, Inc., Kennesaw, GA), is widely used in cardiovascular surgery. The US Food and Drug Administration approved BioGlue in 2001 for use in the surgical repair of large vessels, including the aorta.

Use of BioGlue surgical adhesive during graft repair of an ascending aortic dissection. BioGlue has been applied between the torn layers in the aortic root. The separated layers of the aortic arch have been repaired similarly; the anastomosis between the graft and the aorta has been reinforced with additional adhesive. (Image created by Scott Weldon for the Baylor College of Medicine. Used with permission.)

BioGlue consists of a 10% solution of glutaraldehyde and a 45% solution of bovine albumin. Stored separately, these components mix in the tip of the applicator when BioGlue is dispensed. Theoretically, the resulting chemical bond neutralizes the toxic effects of the glutaraldehyde (which otherwise can damage nerves and various organ tissues on contact), but there is not yet evidence to support this notion. Furthermore, much of the bonding process occurs during the minutes after the glue is dispensed, and recently published data suggest that some of the glutaraldehyde never bonds with the albumin (*Ann Thorac Surg 2005;79:1522–8*). This "free" glutaraldehyde could adversely affect patients in whom BioGlue is used.

To investigate this possibility, the effects of BioGlue on nerve and cardiac conduction tissue were recently studied by Scott A. LeMaire, MD, cardiovascular surgeon at the Texas Heart Institute at St. Luke's Episcopal Hospital and associate professor of surgery at Baylor College of Medicine, and his colleagues. The researchers performed median sternotomies on pigs and exposed the right phrenic nerve (the motor nerve of the diaphragm). The nerve was then coated with one of BioGlue's component substances (10% glutaraldehyde or 45% bovine albumin), BioGlue, or BioGlue on top of a layer of surgical gel. The researchers also treated the sinoatrial (SA) node with either BioGlue alone or BioGlue on top of gel.

"The results confirmed our suspicions about the toxicity of glutaraldehyde in BioGlue," Dr. LeMaire says. "In the phrenic nerve study, treating the nerve with bovine albumin had no respiratory effects, but applying BioGlue or 10% glutaraldehyde significantly impaired diaphragmatic function; in fact, all glutaraldehyde-treated pigs and most BioGlue-treated pigs without gel protection developed total diaphragmatic paralysis within 30 minutes of treatment. When their phrenic nerves were excised and examined microscopically, most showed mild-to-moderate segmental floccular myelin fragmentation. In the SA node study, BioGlue treatment without gel protection caused bradycardia in a few pigs; histologic examination of their hearts showed that all of them had coagulation necrosis throughout the epicardium and extending into the myocardium."

If surgical gel was applied before BioGlue, most of these toxic effects were prevented.

"Most of the gel-protected pigs in the phrenic nerve study had no respiratory paralysis after BioGlue was applied," says Dr. LeMaire. "Likewise, none of the pigs in the SA node study had bradycardia, and only a few had visible epicardial or myocardial necrosis near the SA node."

Although previous research has shown that glutaraldehyde is toxic to nerve and cardiac conduction tissue, this is the first in vivo study to show that even glutaraldehyde found in the BioGlue mixture can have these effects.

Previous porcine studies conducted by Dr. LeMaire's group and others have uncovered further potential complications of BioGlue, including embolization when BioGlue leaks through needle holes after vessel repair (*Ann Thorac Surg 2005;80:106–11*) and stunted aortic growth when BioGlue is used for aortic anastomosis in pediatric patients (*Ann Thorac Surg 2002;73:1500–6*). For these reasons, Dr. LeMaire recommends using BioGlue selectively and carefully.

"In patients with acute dissection, BioGlue is excellent for reattaching the separated layers of arterial tissue," says Dr. LeMaire. "It is also very useful for repairing areas where the tissue is especially friable. However, in these cases, BioGlue should be applied sparingly and carefully to avoid contact with nerves and cardiac tissue, which can be protected with gel." ●

## For more information:

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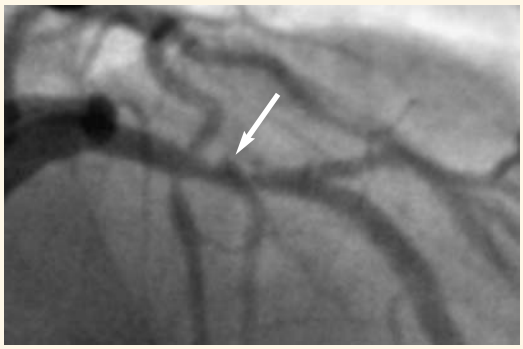
# Approaches to the Treatment of Unstable Angina: A Case Example

**Abstract:** Appropriate treatment for a patient with unstable angina is determined by clinical risk assessment, biomarkers of myocardial infarction, and the patient's particular factors.



Angiogram showing ruptured plaque (arrow) at proximal left anterior descending coronary artery in a patient with unstable angina.

**High-risk patients** with unstable angina—elderly patients, those with diabetes, or those with dynamic ST- and T-wave changes on ECG, for example—are especially prone to subsequent ischemic events resulting in myocardial infarction, repeat revascularization, or death. Such patients in particular benefit from early invasive treatment consisting of coronary stenting and adjunctive drug therapy.

According to the TACTICS-TIMI 18 study (*J Interv Cardiol 2004;17:81–6*), a randomized trial of invasive versus conservative treatment strategy for non–ST-segment elevation acute coronary syndrome (ACS), high-risk patients undergoing early invasive treatment with percutaneous coronary intervention (PCI) had fewer major cardiac events (death, myocardial infarction [MI], and recurrent ACS) in the 6 months after treatment. Drug therapy included aspirin, heparin, and a glycoprotein IIb/IIIa (Gp IIb/IIIa) inhibitor with procedural heparin therapy. In the REPLACE-2 study of antithrombotic therapy in PCI (*JAMA 2004; 292:696–703*), a direct thrombin inhibitor, bivalirudin (with only provisional Gp IIb/IIIa inhibition), provided protection from ischemic events similar to that of combined heparin and Gp IIb/IIIa inhibition and was associated with significantly less bleeding.

R. David Fish, MD, director of Interventional Cardiology Research and Education at the Texas Heart Institute at St. Luke's Episcopal Hospital, says, "A substantial reduction in bleeding is associated with a subsequent reduction in late mortality. This interesting finding in REPLACE-2 has also been highlighted by more recent observations suggesting that periprocedural bleeding, especially necessitating blood transfusion, has very negative implications for patients' long-term outcome and that we should adopt strategies to avoid it."

Although the reduced periprocedural bleeding associated with bivalirudin therapy can benefit most high-risk PCI patients, other factors must also be considered. The approach to drug therapy follows 2 main principles: universal clopidogrel preloading and selective use of Gp IIb/IIIa inhibitors. Clopidogrel's antiplatelet effect significantly reduces the incidence of ischemic complications both before and after PCI—without a significant increase in bleeding. For this reason, clopidogrel (600 mg) should be administered to each patient 2 hours before admission to the catheterization laboratory or as soon as practical after the diagnosis of unstable angina.

"For most patients, including those with unstable angina, clopidogrel preloading with bivalirudin administered during PCI has been shown to be safe and effective and is associated with substantially fewer bleeding complications than is Gp IIb/IIIa inhibition," Dr. Fish says. For these patients, the clopidogrel and bivalirudin combination also allows arterial closure with devices such as the Angio-Seal™ (St. Jude Medical, Inc., St. Paul, MN) at the end of the PCI procedure, even when patients are in a fully active antithrombotic state. This approach has permitted consistently rapid, uncomplicated recovery.

For PCI patients with evidence of heart tissue damage—ie, non–ST-segment elevation myocardial infarction—the role of bivalirudin is less clear, and studies are incomplete. The combination of heparin with Gp IIb/IIIa inhibitors during and after the procedure may still be the most effective approach to minimizing post-PCI ischemic events, despite the additional risk of bleeding. A Gp IIb/IIIa inhibitor should also be considered for patients with coronary thrombus or complex lesions.

The following example shows how these considerations may be used to determine periprocedural drug therapy. A 57-year-old woman presented with new-onset interscapular pain, which led to a stress test that suggested a large anterior cardiac defect. During the test, she developed accelerated hypertension and pain that suggested unstable angina. Biomarker levels (creatine phosphokinase-MB and troponin I) did not indicate an MI. She was referred to the catheterization laboratory, where she received clopidogrel (600 mg) immediately upon entry. A coronary angiogram revealed a stenotic ruptured plaque in the proximal left anterior descending (LAD) coronary artery (*see Figure*). Although the biomarker levels were normal, the high-acuity features of the lesion, such as ruptured plaque, were typical of lesions associated with acute MI. These factors influenced the decision to administer heparin and a Gp IIb/IIIa inhibitor during stent placement in the proximal LAD.

Dr. Fish notes that this treatment strategy takes into consideration the current evidence on the management of unstable angina but represents just 1 possible approach to this case. ●

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*Cover:* Sculpture donated by Elizabeth and John Hill 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

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

## Selected Upcoming National and International Meetings

### American College of Cardiology and The Society of Thoracic Surgeons: Controversies in the Treatment of Cardiovascular Disease—The Sixth in the Series
October 5–6, 2006 • Beverly Hills, CA
Abstract submission ends August 19, 2006.

### American Heart Association Scientific Sessions 2006
November 12–15, 2006 • Chicago, IL

### Society of Thoracic Surgeons 43rd Annual Meeting
January 29–31, 2007 • San Diego, CA

### American College of Cardiology 56th Annual Scientific Session
March 24–27, 2007 • New Orleans, LA
Abstract submission ends September 1, 2006.

### International Society for Heart and Lung Transplantation
27th Annual Meeting and Scientific Sessions
April 25–28, 2007 • San Francisco, CA
Abstract submission ends September 25, 2006.

### International Society for Heart Research 19th World Congress
June 22–26, 2007 • Bologna, Italy
Scientific Chair: James T. Willerson, MD
Abstract submission ends January 31, 2007.


For 15 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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