

Heart WATCH FALL 2010

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

TandemHeart Can Provide Rescue Therapy for Patients With Critical Aortic Valve Stenosis

Abstract: Placement of the TandemHeart in patients with severe refractory cardiogenic shock and critical aortic valve stenosis improves end-organ function and allows elective aortic valve replacement.

In patients with an acute myocardial infarction or critical aortic valve stenosis who present with cardiac arrest or severe refractory cardiogenic shock (SRCS), high-dose inotropic therapy often yields unsatisfactory results. Patients undergoing aortic valve replacement (AVR) for critical aortic valve stenosis who subsequently develop postcardiotomy cardiogenic shock and cannot be weaned from cardiopulmonary bypass (CPB) have an extremely high risk of dying in the operating room. Although an intraaortic balloon pump (IABP) can provide adequate temporary support for some patients,

Dr. Gregoric, MD, Director of THI at St. Luke's Center for Cardiac Support. "Unlike an IABP, the pVAD achieves significant ventricular unloading, producing flow rates of up to 4 L/min at 7500 rpm."

Dr. Gregoric and his colleagues reviewed the records of 10 patients (6 men, 4 women) who presented with cardiac arrest or SRCS. Seven of the patients were in cardiac arrest and undergoing cardiopulmonary resuscitation (CPR), and the other 3 patients presented with SRCS. Eight patients received the TandemHeart in the catheterization laboratory and underwent AVR after hemodynamic stabilization. The other 2

"The most important factor in treating cardiogenic shock is immediate restoration of end-organ perfusion," says Biswajit Kar, MD, a cardiologist at THI at St. Luke's.

"Outcomes may be improved if the physician can initiate percutaneous mechanical circulatory support in the catheterization laboratory rather than rush patients with SRCS or CPR in progress to the operating room for a cardiac procedure requiring CPB," adds Pranav Loyalka, MD, also a cardiologist at THI at St. Luke's. "Using the TandemHeart as rescue therapy allows time for the patient's condition to stabilize, so that a cardiac procedure may then be performed electively."

The 8 patients who received the pVAD preoperatively in the catheterization laboratory later underwent uneventful AVR procedures. The total support period for all 10 patients averaged 10.9±5.6 days.

"Our results show that patients who need AVR for critical aortic valve stenosis and who have cardiac arrest or SRCS refractory to medical and IABP therapy may benefit from left ventricular unloading before undergoing cardiac operations," says Dr. Gregoric. "Preoperative placement of a pVAD enables resuscitation and cardiovascular stabilization until cardiac arrest or SRCS is reversed and end-organ function improves. In patients who have undergone prolonged CPR, this strategy also allows their neurologic status to be evaluated before they undergo surgery. We believe that using a percutaneous VAD as rescue therapy can lead to better outcomes in these patients, who otherwise have a prohibitively high surgical risk." ●

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The TandemHeart Percutaneous Ventricular Assist Device.

this method does not significantly improve survival in patients with postcardiotomy cardiogenic shock.

Few mechanical circulatory support systems are available for rescue therapy in such situations. Therefore, researchers at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at St. Luke's) analyzed the use of the TandemHeart Percutaneous Ventricular Assist Device (pVAD; Cardiac Assist Inc., Pittsburgh, PA) as rescue therapy for patients with cardiac arrest or SRCS before or after undergoing AVR for critical aortic valve stenosis (*Ann Thorac Surg* 2009;88:1822-7).

"The TandemHeart pVAD can be quickly inserted through the femoral artery in the cardiac catheterization laboratory or placed surgically during a cardiac procedure," says Igor D. Grego-

ric, MD, Director of THI at St. Luke's Center for Cardiac Support. "Unlike an IABP, the pVAD achieves significant ventricular unloading, producing flow rates of up to 4 L/min at 7500 rpm." Dr. Gregoric and his colleagues reviewed the records of 10 patients (6 men, 4 women) who presented with cardiac arrest or SRCS. Seven of the patients were in cardiac arrest and undergoing cardiopulmonary resuscitation (CPR), and the other 3 patients presented with SRCS. Eight patients received the TandemHeart in the catheterization laboratory and underwent AVR after hemodynamic stabilization. The other 2

patients, who were still undergoing CPR, were rushed directly to the operating room for emergency AVR. They could not be weaned from CPB because of postcardiotomy cardiogenic shock, so the TandemHeart pVAD was placed intraoperatively. At the time of device placement, all 10 patients were intubated and receiving maximal vasopressor support; 7 patients were also receiving IABP support. The 8 patients who received the TandemHeart in the catheterization laboratory were supported for 6.4±3.8 days, and their renal function significantly improved before AVR. One patient died of sepsis 34 days after AVR. The other 7 patients were discharged home and remain alive and well. The 2 patients who received the device in the operating room after AVR died on postoperative days 8 and 21.

Texas Heart Institute at St. Luke's Episcopal Hospital Is Ranked Among the Nation's Top 10 Heart Centers

Abstract: For 20 consecutive years, the Texas Heart Institute has been ranked as a top 10 heart center by *U.S. News & World Report*.

In the *U.S. News & World Report's* Best Hospital Ranking for 2010-2011, the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at St. Luke's) was ranked #4 among the top 10 heart and heart surgery centers in the United States, up from #5 in 2009. This marks the 20th consecutive year that THI has ranked among the top 10 heart and heart surgery centers in the United States. The annual rankings are designed to help patients or referring physicians find hospitals with the highest levels of skill in diagnosing, treating, and managing complex medical conditions. This year, the Cleveland Clinic in Cleveland, Ohio, was ranked #1, followed by the Mayo Clinic in Rochester, Minnesota, and John's Hopkins Hospital in Baltimore, Maryland. Massachusetts General Hospital, in Boston, was ranked #5.

The Texas Heart Institute at St. Luke's is the only heart center in Houston and in the entire Southwest to be listed among the top 10 by *U.S. News & World Report*. "Our institution's consistency in earning this honor over the past 20 years reflects the unwavering dedication of our physicians, scientists, and nursing and support staff. We value this recognition as we continue to expand our world-renowned leadership in the cardiovascular arena," says Denton A. Cooley, MD, founder and President Emeritus of THI.

U.S. News & World Report bases its rankings on how well hospitals and medical centers fare in complex and demanding situations. The top institutions share several qualities. They are referral centers, so their physicians typically treat sicker patients and perform larger numbers of difficult procedures. Additionally, the top institutions follow (and often propose) the most advanced treatment guidelines and use the latest imaging methods, surgical devices, and other technologies. They also have sophisticated facilities for translational research.

This year, *U.S. News & World Report* evaluated data from 4852 hospitals, of which only 152 met the criteria for being among the best in one or more specialties. Each hospital was assigned a score based on the Index of Hospital Quality



(IHQ), which assesses reputation; care-related factors, such as the availability of state-of-the-art technologies (eg, cardiac intensive care units, robotic surgery, and transplant services); patient volume; nurse-to-patient ratio; other important patient services (eg, cardiac rehabilitation facilities, hospice care, and pain-management programs); and mortality. The reputation score is obtained through a peer-review process in which a group of physicians selected at random from the American Medical Association's Physician Masterfile is surveyed for each of the 16 specialties noted in the ranking. Physicians are asked to list 5 hospitals that they consider to be among the best in their specialty for difficult cases, without regard to procedural costs or hospital location. Care-related factors and patient services are primarily measured by using the American Hospital Association Annual Survey Database and the Medicare Provider Analysis and Review File.*

Patient outcomes and information from physician surveys were assessed, and the 50 top-scoring hospitals in each category were

recognized. "We are highly gratified by this ranking and the consistent excellence it represents," adds James T. Willerson, MD, THI's President and Medical Director. "It reflects the life-saving advances we are making in the battle to prevent, treat, and cure cardiovascular disease." ●

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*Murphy et al. *U.S. News & World Report 2010/11 Best Hospitals Rankings Methodology*. *RTI International*; Aug 27, 2010. <http://static.usnews.com/documents/health/best-hospitals-methodology.pdf>.

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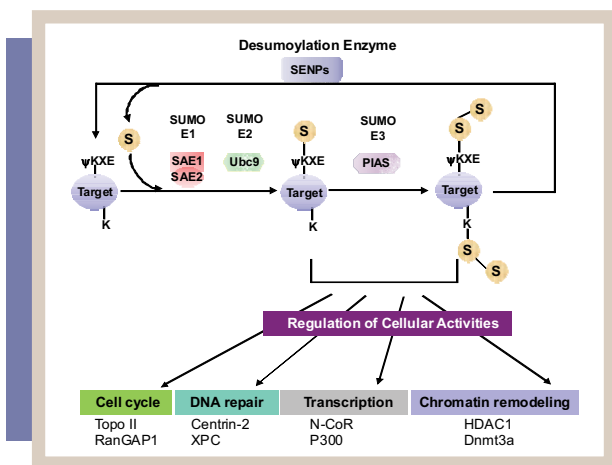
New Roles Emerge for Sumoylation in the Regulation of Cardiac Gene Expression

Abstract: Researchers at THI at St. Luke's are studying how sumoylation regulates cardiac gene expression and cardiogenesis.

Sumoylation is a type of post-translational modification by which a small ubiquitin-like modifier (SUMO) protein is covalently and reversibly conjugated to its target substrate. Since the discovery of SUMO proteins in 1996, they have been implicated in various biologic pathways, including cell proliferation and

cardiac transcription factors such as serum response factor (SRF), GATA4, Nkx2.5, and myocardin (the cardiac- and smooth muscle-specific transcriptional coactivator of SRF) are activated by sumoylation. In addition, other cardiac transcription factors—including myocyte

group and others have shown that cardiac transcription factors such as serum response factor (SRF), GATA4, Nkx2.5, and myocardin (the cardiac- and smooth muscle-specific transcriptional coactivator of SRF) are activated by sumoylation. In addition, other cardiac transcription factors—including myocyte



A model of the sumoylation pathway and its associated cellular activities. Small ubiquitin-like modifier (SUMO) proteins (S) can be covalently conjugated to a target lysine in the presence of SUMO E1 (SAE1/SAE2 heterodimer), SUMO E2 (Ubc9), and SUMO E3 (eg, protein inhibitors of activated STAT [PIAS]). SUMO proteins are released by sentrin-specific proteases (SENPs). ψKXE is the canonical amino acid sequence targeted by sumoylation, where (ψ) represents a large hydrophobic amino acid; (X), any residue; (E), glutamic acid; and (K), the target lysine.

eration, DNA replication and repair, chromatin remodeling, and transcriptional regulation. Recent studies have shown that SUMO proteins may also have an important role in cardiogenesis and heart disease.

Two leading experts in the developmental and genetic aspects of congenital heart disease—Robert J. Schwartz, PhD, Director of the Stem Cell Engineering Laboratory at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at St. Luke's), and Jun Wang, MD, PhD, a senior research scientist and principal investigator at THI at St. Luke's—have been studying the role of SUMO proteins in cardiovascular development. Recently, in a comprehensive review, these researchers highlighted advances that have been made in understanding the role of sumoylation in the regulation of cardiac gene expression (*Circ Res* 2010;107:19-29).

“The sumoylation of cardiac-specific transcription factors has been shown to regulate gene expression in the heart, which in turn affects cardiogenesis,” states Dr. Schwartz. His

enhancer factor-2 (MEF2), yin yang-1 (YY1), and prospero-related homeobox (Prox1)—have also been identified as substrates of sumoylation, although their effects after sumoylation have not been determined.

“Because many targets of sumoylation underlie most human congenital heart defects, altered sumoylation in the heart during either embryonic cardiac development or maintenance of postnatal heart function may promote abnormal gene expression that leads to cardiac malformation or dysfunction,” says Dr. Wang.

The components of the sumoylation and desumoylation pathways have also been shown to be crucial for cardiogenesis. “SUMO proteins are linked to their target by an E2 conjugating enzyme and can be removed by enzymes called sentrin-specific proteases (SENPs). Ubc9, the only SUMO E2 conjugating enzyme identified in vertebrates, is required for cell proliferation in the mouse embryo,” says Dr. Wang.

In addition, preliminary studies by Drs. Schwartz and Wang indicate that overexpres-

of targets essential for cell division, such as DNA topoisomerase II and RanGAP1.

“Although important discoveries have been made in this relatively new field of study,” Dr. Schwartz concludes, “a number of fundamental questions remain to be answered. One such question is whether or not environmental toxins, metabolites, and pharmaceutical agents modulate the sumoylation of key proteins to cause acquired heart disease. Future studies should bring forth new insights into how the sumoylation pathway is connected to heart disease.” ●

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Caucasian Race/Ethnicity is a Risk Factor for New-Onset Atrial Fibrillation After Coronary Artery Bypass Grafting

Abstract: In a retrospective study, researchers at THI at St. Luke's found that Caucasian race/ethnicity is an independent predictor of atrial fibrillation after coronary artery bypass grafting.

After coronary artery bypass grafting (CABG) surgery, up to 40% of patients develop atrial fibrillation (AF). Postoperative AF (POAF) increases the risk of thromboembolic complications, congestive heart failure, early postoperative stroke, and other morbidities while extending hospital stays and increasing health care costs.

"Only a few risk factors, such as advanced age, have been consistently associated with POAF," says Mehdi Razavi, MD, Director of Electrophysiology Clinical Research at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at St. Luke's).

"Race/ethnicity reportedly affects the incidence of AF in the general population, but few studies have examined racial/ethnic differences in the incidence of AF after CABG. This gap prompted us to study the association between race/ethnicity and new-onset AF after isolated CABG surgery," says Alireza Nazeri, MD, a Cardiology Fellow in the Department of Cardiology at THI at St. Luke's. Drs. Razavi and Nazeri were the lead investigators of this study, which was published in the journal *Heart Rhythm* (July 2010; E-pub ahead of print).

In collaboration with MacArthur A. Elayda, MD, PhD, and his team at THI's Department of Biostatistics and Epidemiology, Dr. Razavi, Dr. Nazeri, and their colleagues used the THI Research Database (THIRDBase) to obtain and analyze data from 5823 patients who underwent CABG from January 2000 through December 2008, excluding those who had concomitant operations or preexisting AF. They collected data on ethnicity, risk factors, demographics, and other patient characteristics, as well as operative and perioperative variables. Postoperative AF was defined as AF of any duration detected at any time between surgery and hospital discharge.

Univariate analysis was used to determine the patient characteristics that best predicted POAF. These predictors were then entered into a multivariate model, which was used to calculate the independent association between Caucasian race/ethnicity and an increased risk of POAF. In addition, a separate model was

"Caucasian race is an independent risk factor for the development of AF after CABG, and physicians should consider race and ethnicity when preoperatively evaluating risk in CABG patients."

—Mehdi Razavi, MD

used to match 715 Caucasian patients and 715 non-Caucasian patients by propensity scores computed from baseline variables, ensuring that the differences observed were not the result of known risk factors.

Overall, 1683 patients (28.9%) developed AF after CABG. The incidence of AF was significantly higher in Caucasian than in non-Caucasian patients (32.4% vs 21.3%; $P < .0001$). Logistic regression confirmed that Caucasian

race/ethnicity was an independent predictor of POAF (odds ratio [OR], 1.8; 95% confidence interval [CI], 1.5–2.0; $P < .0001$). In the propensity-matched patients, 27.1% of Caucasian patients and 18.6% of non-Caucasian patients developed POAF ($P < .0001$); again, the regression model identified Caucasian race/ethnicity as an independent predictor (OR, 1.7; 95% CI, 1.3–2.2; $P < .001$) (see Table). Obesity, congestive heart failure, and age were also significantly associated with POAF in the propensity-matched patients.

"The factors that contribute to racial/ethnic differences in the prevalence and incidence of POAF have not yet been identified, although genetic variations expressed in cardiac proteins or differences in the atrial conduction system or membrane stability may affect susceptibility to AF," says Dr. Nazeri.

"Race/ethnicity may be a surrogate for unrecognized variables. Nevertheless, Caucasian race is an independent risk factor for the development of AF after CABG, and physicians should consider race and ethnicity when preoperatively evaluating risk in CABG patients," adds Dr. Razavi. ●

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TABLE. INDEPENDENT PREDICTORS OF POSTOPERATIVE ATRIAL FIBRILLATION

Predictor	Odds Ratio	95% Confidence Interval	P Value
Obesity	1.4	1.0–2.0	.04
Caucasian race/ethnicity	1.7	1.3–2.2	<.0001
Congestive heart failure	1.8	1.3–2.6	.0002
Age (reference <50 years)			
50–59	3.7	1.7–8.3	.0006
60–69	4.7	2.1–10.4	.02
70–79	9.4	4.2–21.1	<.0001
≥80	15.9	5.5–45.9	<.0001

Impact of Duty-Hour Restrictions on the Outcomes of Coronary Artery Bypass Grafting

Abstract: At US hospitals, the 2003 implementation of duty-hour restrictions for resident physicians was associated with an increase in complications but not in mortality after coronary artery bypass.

On July 1, 2003, the Accreditation Council for Graduate Medical Education implemented an 80-hour/week restriction for resident physicians at teaching hospitals, culminating a 2-decade push for the reform of duty-hour regulations for residents. Proponents hoped that better-rested residents would make fewer medical errors; opponents feared that the shorter shifts and the lessened continuity of care would affect the quality of care. The effects of duty-hour reform on various medical and surgical outcomes have been examined in several studies, but little is known about the effects of the reform on complex cardiac operations.

For this reason, researchers at the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at St. Luke's) conducted a large-scale study to determine how the duty-hour reform has affected the outcomes of coronary artery bypass grafting (CABG) operations. To obtain a sample broader than those used in similar studies, the researchers used the United States Nationwide Inpatient Sample (NIS) database to review the outcomes of 614,177 CABG operations performed from 1998 through 2007. The primary end point of the study was in-hospital mortality, and the secondary end points were operative morbidity, length of hospital stay, and the rate of routine hospital discharge. The investigators selected CABG because it is a common but complex procedure that can require days of uninterrupted care with extensive resident involvement. The 1998–2007 period was chosen because it encompasses several years before and after the duty-hour reform. To control for any time bias, results from teaching hospitals were compared with results from nonteaching hospitals (ie, hospitals without residents).

“We found that the implementation of the duty-hour limitation for medical and surgical residents did not affect mortality rates in CABG patients,” says Joseph S. Coselli, MD, Chief of Adult Cardiac Surgery at THI at St. Luke's. “Although the in-hospital mortality rate decreased significantly at both teaching and nonteaching hospitals after the reform was enacted, there

“The increased risk of complications was not associated with a longer hospital stay or a higher mortality risk, which indicates that the complications were handled appropriately and were not allowed to progress to a more serious level.”

—Joseph S. Coselli, MD

was no significant difference between the decreases at the teaching and nonteaching hospitals.”

In contrast, the new regulations were associated with a higher risk of in-hospital complications at teaching hospitals (odds ratio, 1.5; 95% confidence interval, 1.43–1.58; $P < 0.001$). Linear regression analysis indicated that in teaching hospitals, there was an increase of 1 complication ($P < 0.001$) for every 66 CABG patients; in nonteaching hospitals, however, there was a decrease of 1 complication for every 33 CABG patients ($P < 0.001$). This difference was largely attributable to the higher rates of intraoperative and respiratory complications, including iatrogenic pneumothorax, seen at teaching hospitals after the duty-hour reform was implemented.

Additionally, implementation of the duty-hour reform was followed by a decrease in the hospital length of stay at both teaching and

nonteaching hospitals; however, patients at both types of hospitals were less likely to be routinely discharged home after the reform was implemented.

“These findings are probably related to the growing trend of transferring patients to ancillary facilities rather than keeping them in the hospital,” says Raja Gopaldas, MD, a cardiovascular surgical resident who is the first author on the study report (*J Surg Res* 2010;163:201–9). “Overall, the decreases in mortality, hospital stay, and routine discharge were probably due to the influence of time-related trends, not the duty-hour reform.”

There are several possible reasons for the link between the increase in complication rates and the 80-hour restriction. “When junior trainees work fewer hours, they probably interact less with their supervisors, and the transfer of information may be affected,” says Faisal G. Bakaeen, MD, a cardiothoracic surgeon at THI at St. Luke's and the lead researcher on the study. “Future studies are needed to identify the definitive reasons for the effect of duty-hour restrictions on the complication rate.”

“But our results also showed that the increased risk of complications was not associated with a longer hospital stay or a higher mortality risk,” adds Dr. Coselli, “which indicates that the complications were handled appropriately and were not allowed to progress to a more serious level.” ●

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Researchers Use Chromosome Variant to Predict Mortality After Cardiac Surgery

Abstract: A specific 9p21 variant is independently associated with all-cause mortality after primary coronary artery bypass graft surgery.

Recent genome-wide

association studies have identified variants in a chromosome 9p21 locus that are associated with coronary artery disease and myocardial infarction in nonsurgical populations. These 9p21 variants are located within a newly annotated noncoding RNA gene called antisense noncoding RNA in the INK4 locus. They are expressed in cell types integral to atherosclerosis and are adjacent to genes for the cyclin-dependent kinases CDKN2A and CDKN2B, which play a critical role in regulating cell aging, proliferation, and apoptosis.

Researchers at Harvard Medical School and the Texas Heart Institute at St. Luke's Episcopal Hospital (THI at St. Luke's) recently collaborated on a prospective, observational study of 846 white patients who underwent primary coronary artery bypass graft (CABG) surgery with the aid of cardiopulmonary bypass (CPB). This study was conducted at Brigham and Women's Hospital, in Boston, and at THI at St. Luke's (*Circulation* 2010;122:S60-5). The researchers sought to determine whether a specific 9p21 variant, rs10116277, is associated with an increased incidence of mortality in white patients after primary CABG surgery with CPB. They also investigated whether this association would provide additional predictive value to the logistic EuroSCORE that is commonly used for predicting mortality after cardiac surgery.

"In another recent study in which we also collaborated with Harvard researchers, we identified an association between the same variant in the 9p21 locus and perioperative myocardial injury (PMI) after isolated primary CABG surgery with CPB, independent of coronary disease severity," says Charles D. Collard, MD, Chief of Cardiovascular Anesthesiology and Director of Cardiovascular Anesthesiology Research at THI at St. Luke's and a coauthor of the present study. "Other researchers have used cardiac biomarker levels or electrocardiographic evidence of myocardial injury to show an association between the degree of PMI after CABG surgery and mortality. However, we believe that our current study is the first to relate the 9p21

variant associated with cardiovascular disease to mortality after CABG surgery."

The researchers found that the homozygote minor allele of rs10116277 was associated with a significantly increased risk of all-cause mortality, even after they adjusted for other clinical predictors of mortality in a Cox proportional hazards model ($P=0.026$). Compared to patients who carry either 1 minor allele or the major allele, patients who carry 2 copies of the minor allele of rs10116277 had a significantly greater risk of dying within 5 years after CABG surgery ($P=0.003$). The preoperative logistic EuroSCORE was significantly higher in the patients who died than in those who survived ($P<0.001$); moreover, the addition of rs10116277 to the logistic EuroSCORE significantly improved model prediction for mortality ($P=0.01$).

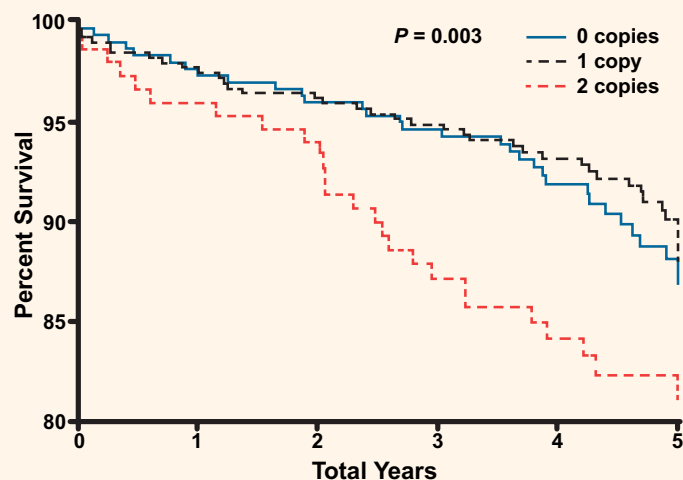
"We have shown that white patients who carry 2 copies of the minor allele of a common 9p21 variant, rs10116277, have an elevated risk

of dying within 5 years of CABG surgery," explains Dr. Collard. "This variant also contributes additional predictive value to the EuroSCORE prediction of postoperative mortality. Because 18% of our patients were homozygous for rs10116277, this appears to be a common disease-linked genotype."

"Although the mechanism of the association between 9p21 variants and mortality is not yet clear, our study confirms that there is a genetic basis for adverse perioperative outcomes," continues Dr. Collard. "If we can clarify the biologic processes associated with such genetic variants, we will be closer to devising novel therapies for treating postoperative complications and preventing mortality." ●

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Kaplan-Meier survival curves for patients with different numbers of rs10116277 risk allele copies. Probability value refers to no copies of the rs10116277 risk allele compared with 1 or 2 copies of the risk allele (recessive model). (Adapted from Muehlschlegel JD, et al. *Circulation* 2009;120:S928-9, with permission)

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Cover: Statue donated by Jonni and Ray Rogers 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

Future Direction of Stem Cells in Cardiovascular Disease Satellite Symposium American Heart Association Scientific Sessions

The Hyatt Regency Hotel, Chicago
November 13, 2010 • Chicago, Illinois
Program Director: James T. Willerson, MD

Tenth Texas Update in Cardiovascular Disease

Denton A. Cooley Auditorium
The Texas Heart Institute
December 3–4, 2010 • Houston, Texas
Program Director: James T. Willerson, MD

Twelfth Symposium on Cardiac Arrhythmias

The Houstonian Hotel
February 19, 2011 • Houston, Texas
Program Director: Ali Massumi, MD

For information about Texas Heart Institute CME activities, please e-mail cme@heart.thi.tmc.edu or call 713-218-2200. To view or complete selected online CME courses (certificates are available online), please visit www.cme.texasheart.org. New courses are added regularly.

SELECTED UPCOMING LOCAL, NATIONAL, AND INTERNATIONAL MEETINGS

American College of Surgeons 96th Annual Clinical Congress

October 3–7, 2010 • Washington, D.C.
<http://www.facs.org/clincon2010/index.html>

American Heart Association Scientific Sessions 2010

November 13–17, 2010 • Chicago, Illinois
<http://scientificsessions.americanheart.org/portal/scientificsessions/ss/>

Society of Thoracic Surgeons 47th Annual Meeting

January 31–February 2, 2011 • San Diego, California
<http://www.sts.org/sections/annualmeeting/>

International Society for Heart and Lung Transplantation 31st Annual Meeting and Scientific Sessions

April 13–16, 2011 • San Diego, California
Abstract submission deadline: November 19, 2010
<http://www.ishlt.org/meetings/annualMeeting.asp>

American Association for Thoracic Surgery 91st Annual Meeting

May 7–11, 2011 • Philadelphia, Pennsylvania
<http://www.aats.org/annualmeeting/>



For 20 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."