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in care



HEALTH SYSTEM
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HISTORY IS MADE HERE

1848 The University of Michigan establishes its medical school



1871 James B. Angell (*right*) becomes president of the U-M. By the 1880s he has set up the first university hospital in the U.S.



1892 The U-M establishes its third university hospital, the first four-year medical school curriculum in the U.S., and the U-M's nursing school



1896 George Dock publishes "Some Notes on the Coronary Arteries," in which he makes an antemortem diagnosis of myocardial infarction and describes its pathophysiology

1897 Arthur Robertson Cushny (*below*) publishes a paper on the effects of digitalis on the mammalian heart

1906 Cushny authors the first description of atrial fibrillation in man



1908 Albion Walter Hewlett (*far right*) is named chair of the Department of Internal Medicine at the U-M; his book on clinical pathophysiology is the first in English. Hewlett was an important early physiologic cardiologist

1909 Hewlett publishes "The Clinical Value of the Electrocardiogram," correctly predicting the importance of electrocardiography



1915 Frank Norman Wilson observes, in a paper, a case of anomalous atrioventricular excitation, known today as Wolff-Parkinson-White syndrome

"One of the biggest challenges that can happen is when someone is referred too late, when other organs in the body are failing besides the heart. Getting involved in a patient's care when he or she is not yet critically ill is the best time to have conversations about what treatments are available."

—SCOTT HUMMEL, MD, MS



Scott Hummel, MD, MS



Left to right: Keith Aaronson, MD,
Todd Koelling, MD,
Francis Pagani, MD, PhD

BATTLING HEART FAILURE

In recent years, the University of Michigan Frankel Cardiovascular Center has played a key role in a flurry of research in how to conquer heart failure. A number of ongoing studies at the university hope to add to available treatment options.

"The EXPAND trial is probably the most important trial we have ongoing now. It might transform the way we do heart transplantation in this country," said Francis Pagani, MD, PhD, a cardiac surgeon at the Frankel Cardiovascular Center.

"We are one of 12 centers participating in EXPAND," he said. The trial is evaluating a new portable organ care system that perfuses the heart with oxygen and nutrients and keeps a donor heart functioning at normal body temperature while it is transported to a recipient. The trial is testing whether this method of maintaining the donor organ is superior to the current method of storing the heart on ice.

CENTER FOR LVAD RESEARCH

The MOMENTUM III trial, ongoing at 60 centers in the United States, is evaluating a new left ventricular assist device (LVAD) called HeartMate 3 (Thoratec). This implantable device circulates blood throughout the body when the heart is too weak to pump blood adequately on its own. Patients must have advanced heart failure that is refractory to current treatment to be eligible for the study. So far, 200 patients have been enrolled in the trial at the Frankel Cardiovascular Center.

The SynCardia Total Artificial Heart 50-cc trial is testing a smaller total artificial heart for use in women and smaller men. "One of the limitations with artificial heart technology is that it is so large it only fits in large-bodied people," said Dr. Pagani, speaking about the 70-cc total artificial heart. "The 50-cc size of this model makes it more suitable for smaller-bodied individuals."

The Cardiothoracic Surgical Trials Network Cell Therapy LVAD Trial II is examining whether injecting allogeneic stem cells into the heart during implantation of an LVAD can improve long-term myocardial function. "This is a significant trial that could give us important insights into the potential for stem cells to improve heart function in patients with advanced heart failure," said Dr. Pagani.

HEART FAILURE STUDIES AND SUPPORT

Scott Hummel, MD, MS, a cardiologist at the Frankel Cardiovascular Center, said his main area of interest is "diastolic" or "preserved ejection fraction" heart failure (HFpEF). "There are no broad evidence-based therapies for HFpEF yet, but we use exercise testing, imaging and sometimes catheterization to phenotype patients and direct treatment to the underlying mechanisms," said Dr. Hummel. "We also lead several clinical studies that are looking at the importance of dietary modifications."

For example, the DASH-DHF 2 (Dietary Approaches to Stop Hypertension in 'Diastolic' Heart Failure 2) study is investigating how recommended dietary changes affect heart and blood vessel function in patients with hypertensive HFpEF.



HISTORY IS MADE HERE

1920-1952

Frank Norman Wilson first designs and then continuously upgrades a Heart Station aimed at researching cardiovascular pathologies

1925

A new hospital is built in which the Heart Station is established especially to study cardiology

1928

John Alexander (below) creates the first formal Thoracic Surgery Residency in the United States at the University of Michigan



1931

Frank Norman Wilson and colleagues publish a paper in which theoretical values for electromotive forces are derived with bipolar leads; the concept of the central terminal is born

1932

Wilson (below) and colleagues publish a series of papers, including one in which they note that atrial fibrillation may be the first and only symptom of thyrotoxicosis



1940

The American Board of Internal Medicine decides internists can be certified as four types of subspecialists, of which cardiology is one



1941

Frank Norman Wilson and Franklin Johnston (below) report on a patient with angina pectoris and deduce that nicotine from cigarette smoke may play a role



NEW DRUGS OFFER NEW OPTIONS

In the past year, two new drugs have been approved for heart failure. Ivabradine (Corlanor, Amgen) was approved for patients:

- who have stable, symptomatic chronic heart failure with a left ventricular ejection fraction of 35% or less;
- who are also in sinus rhythm with a resting heart rate of at least 70 beats per minute; and
- who either are on maximally tolerated doses of β -blockers or have a contraindication to β -blocker use.

Sacubitril-valsartan (Entresto, Novartis) was approved for the treatment of chronic heart failure with reduced ejection fraction. The drug is a combination of sacubitril, a neprilysin inhibitor, and valsartan, an angiotensin II receptor blocker already used to treat heart failure.

"In a large clinical trial, Entresto was compared to an angiotensin-converting enzyme inhibitor and found to reduce cardiovascular death and heart failure hospitalization by 20%. The results are undeniably impressive, and the drug may have a big impact on our patients," said Scott Hummel, MD, MS. He said one challenge for clinicians is determining whether to use sacubitril-valsartan in patients who don't meet the enrollment criteria that were used in the clinical trial, for example, those with low blood pressure or more than moderate chronic kidney disease.

HISTORY IS MADE HERE

1943 Frank Norman Wilson's electrocardiography system incorporating the central terminal is formally adopted, thus paving the way for today's 12-lead electrocardiogram

1943 John Alexander successfully resects an aneurysm caused by coarctation of the aorta

1944 Cameron Haight (below) ligates a patent ductus arteriosus



1946 Sibley Hoobler (right) pens a hypertension follow-up clinic, one of the first in the country

1950 Franklin Davis Johnston initiates the U-M's cardiology fellowship training program




continued on page 9

PATIENT MANAGEMENT AND REFERRAL

In addition to the expertise of heart failure specialist physicians, nurse practitioners and physician assistants, patients benefit from a team of nurse case managers whose sole responsibility is to manage patients with heart failure. "We are studying the best methods for patient telemonitoring across the spectrum of heart failure, including patients with LVADs," said Dr. Hummel.

Dr. Hummel said the Frankel Cardiovascular Center welcomes referrals from and collaboration with other practices. Referring physicians should consult the suggested guidelines for referral of advanced heart failure patients. See table on page 7.

"One of the biggest challenges that can happen is when someone is referred too late, when other organs in the body are failing besides the heart," said Dr. Hummel. "Getting involved in a patient's care when he or she is not yet critically ill is the best time to have conversations about what treatments are available." 

GUIDELINES FOR REFERRAL

ADVANCED HEART FAILURE THERAPY: VENTRICULAR ASSIST DEVICE THERAPY AND/OR HEART TRANSPLANTATION

Patients should have:

- At least class III heart failure symptoms
- LVEF \leq 35% (This guideline is not necessary for patients with "diastolic" or "preserved ejection fraction" heart failure that is due to restrictive cardiomyopathies, e.g., hypertrophic cardiomyopathy, sarcoidosis.)

And any of the following criteria:

- Early end-stage organ dysfunction
 - BUN \geq 45 mg/dL
 - Cr \geq 1.6 mg/dL or CrCl \leq 45 cc/min
- Serum sodium \leq 135 mEq/L
- Hemodynamic instability
 - Ventricular arrhythmias
 - Hypotension
 - Low cardiac output
- Hospitalization for heart failure in the past 6 months
- Intolerance/withdrawal of evidence-based heart failure oral agents
- Nonresponsive to CRT/BiV pacing
- Being considered for or currently on inotropes
- Cardiac cachexia
- High diuretic dose
 - Furosemide \geq 160 mg/d
 - Torsemide \geq 80 mg/d
 - Bumetanide \geq 4 mg/d
- Seattle Heart Failure score \geq 1.5 or 1-year mortality estimate $>$ 15%
- Peak exercise oxygen consumption \leq 55% of predicted or absolute number (\leq 14 mL/kg/min for women or \leq 16 mL/kg/min for men)
- 6MWT (distance, \leq 350 m)

Recommended Testing Before Evaluation (within 3 months):

- Abdominal ultrasound (to evaluate for AAA and hepatic disease)
- Ankle-brachial index test
- Carotid duplex scan
- Chemistries and complete blood count
- Chest radiograph
- ECG
- Echocardiogram
- Noncontrast CT scan of the thorax (if history of prior cardiac surgery)
- Peak VO₂ and 6MWT distance (if available)
- Pulmonary function test
- Right heart catheterization (if available)

6MWT, 6-minute walk test; **AAA**, abdominal aortic aneurysm; **BiV**, biventricular; **BUN**, blood urea nitrogen; **Cr**, serum creatinine; **CrCl**, creatinine clearance; **CRT**, cardiac resynchronization therapy; **LVEF**, left ventricular ejection fraction; **VO₂**, maximal oxygen consumption

MEET DAVID PIERCE

WARM FEET AGAIN

After a heart attack at 41 years of age and an eventual diagnosis of heart failure, David Pierce underwent implantation in 2004 of a left ventricular assist device (LVAD), at the age of 52. Today, he is the longest living recipient of a HeartMate II LVAD in the entire United States.

Before receiving an LVAD, David had difficulty negotiating stairs, and a favored pastime, dancing with his wife, was becoming a thing of the past. "I couldn't walk more than 15 feet without stopping," he said. "I had zero stamina—none whatsoever."

He was very concerned about what doctors could do for him as his disease progressed, and was worried about what would happen to his wife and whether he would be able to watch his grandkids grow up. At first, upon hearing about the option of LVAD implantation, Mr. Pierce was not enthusiastic, struggling with the notion of having the medical device implanted in him. But as he discussed it with his doctors, he gradually realized this was his one option, the only way he could stay alive.

As Mr. Pierce's condition inexorably worsened, he was referred for implantation to Francis D. Pagani, MD, PhD, the director of U-M's Center for Circulatory Support.

Patients approved for LVAD implantation suffer not only from a steadily deteriorating disease state but also a greatly reduced quality of life. LVAD implantation is a game changer for many of these patients, as it can suddenly improve a patient's quality of life and immediately heighten his or her chances for survival.

The U-M Frankel Cardiovascular Center's LVAD program has successfully implanted about 600 of these devices, amassing extensive, vital experience in the procedure.

Mr. Pierce's health sharply improved after implantation of the LVAD device. His wife noted that, on the morning of surgery, "David went in with cold feet and came out with warm feet and a new outlook on life. He was so nice and warm, which he hadn't been in a long time."

"I have a good life right now, and the LVAD keeps me there — it keeps me happy."

He spent a week or two in the ICU, and with multiple lines hooked up to him he thought the experience was difficult at the time. He now looks back on those days as not being as onerous as he imagined, and realizes that the operation he had back then has set up years of enjoying a life that had been slipping away from him.

Commonly among heart patients, Mr. Pierce suffered from some depression around this time, but worked with a psychologist to regain perspective, a process he recommends for others. "It has helped me immensely."

He is still waiting for a heart, but he can accept living the rest of his life with the LVAD if necessary since he is satisfied with its performance and is used to it. "I have a good life right now, and [the LVAD] keeps me there ... it keeps me happy."

The U-M's LVAD team can be reached at 800-962-3555.



TAVR

TEAM CARE FOR AORTIC VALVE REPLACEMENT PATIENTS

Clinicians at the University of Michigan Frankel Cardiovascular Center say their refined processes have optimized aortic stenosis treatment, shortened the time between referral and surgery, and led to excellent outcomes.

According to G. Michael Deeb, MD, who is Herbert Sloan Collegiate Professor of Cardiac Surgery and Director of the Multidisciplinary Aortic Clinic at the Frankel Cardiovascular Center, aortic stenosis patients are treated by a team of cardiovascular surgeons, cardiologists and a host of other subspecialists who collaboratively choose the most appropriate treatment, whether it be open surgery or transcatheter aortic valve replacement (TAVR).

"The Centers for Medicare & Medicaid Services have guidelines that specify these surgeries should be joint efforts by interventional cardiologists and cardiac surgeons, but we've taken that model several steps further," said Dr. Deeb.

HISTORY IS MADE HERE

1951 Herbert Sloan (right) and associates perform a successful repair of an aortic aneurysm

1952 Franklin Davis Johnston becomes head of the Heart Station



1953 Cameron Haight inaugurates a closed mitral valvulotomy procedure

1955 Herbert Sloan and associates repair a coarctation

1956 Sloan performs the U-M's first open heart surgery



TAVR

A TEAM APPROACH

Each Tuesday, subspecialists at the Frankel Cardiovascular Center meet and review upcoming valve replacement patients. They discuss topics ranging from the physiology of aortic stenosis to the ethics of performing a particular procedure in a patient, and then determine the most suitable treatment for a given patient.

"The team includes three interventional cardiologists; four cardiac surgeons; imaging physicians who help us decide which size valve to use and where to position it; and research coordinators," Dr. Deeb explained. "We decide whether patients qualify for TAVR, open surgery, if they are a good fit for one of our clinical trials or if they are too sick to undergo a procedure at all."

According to Stanley J. Chetcuti, MD, who is Eric J. Topol Collegiate Professor of Cardiovascular Medicine and Associate Professor of Internal Medicine at the university, the devices used for TAVR are "constantly evolving, and we have access to the most sophisticated and effective valves."

The two most frequently used commercial valves at the University of Michigan are Medtronic's Evolut R and Edwards

Lifesciences' SAPIEN 3, both of which reduce the risk for valvular leakage, Dr. Chetcuti said. The Evolut R is repositionable, allowing clinicians to place the valve, release it up to 90%, determine if there is a leak and then either fully release the valve or reposition it in another location if necessary.

"If we need to, we repeat this process until we find a good position," said Dr. Chetcuti.

The SAPIEN 3, on the other hand, reduces the risk for leakage by placing a skirt around the valve to tightly seal the edges, Dr. Chetcuti explained.

ONGOING CLINICAL TRIALS

Dr. Chetcuti added that the team is also participating in several studies, most of which involve randomization of patients to open surgery or a TAVR device (see page 12-13).

"Right now, we're completing two trials for patients at moderate risk of mortality with surgery," said Dr. Chetcuti. "We're also excited to be studying Boston Scientific's Lotus Valve, which is a self-adjusting, repositionable and retrievable valve. Further, we anticipate an upcoming study with a larger-diameter version of the Evolut R, which would allow us to treat an additional 10% of patients with aortic stenosis who would otherwise have anatomy too large to qualify for TAVR."

The university closely tracks patient outcomes, logging clinical, demographic, procedural and follow-up information from each procedure into separate national and state registries.

"Our outcomes from 2014 were very encouraging," noted Dr. Chetcuti, who anticipated the team will have conducted more than 600 TAVR procedures by the end of 2015. "In fact, our outcomes with the Medtronic CoreValve and the Edwards SAPIEN 3 were better than the data from other pivotal studies. Our model is clearly working in our patients' favor."



"The team includes three interventional cardiologists; four cardiac surgeons; imaging physicians who help us decide which size valve to use and where to position it; and research coordinators."

—G. MICHAEL DEEB, MD



Above: Stanley Chetcuti, MD; Himanshu Patel, MD; P. Michael Grossman, MD; G. Michael Deeb, MD; Matthew Romano, MD; and Daniel Stephen Menees, MD

HISTORY IS MADE HERE

1958 Marion (Bill) DeWeese (left) places the first vena cava sieve to prevent pulmonary embolism

1959 DeWeese performs the world's first aortorenal bypass

1961 Richard D. Judge (below) and Joe D. Morris implant a pacemaker transthoracically

1962 Herbert Sloan and colleagues report on results from 600 open-heart surgeries



1962 Sloan performs the world's first successful correction of truncus arteriosus, as well as the first successful correction of total anomalous pulmonary venous return

1962 An adult cardiac catheterization laboratory with cine-angiography is constructed at University Hospital

1963 The U-M's first coronary care unit opens

1967 Benedict Lucchesi, a cardiovascular pharmacologist, demonstrates the addictive properties of nicotine and shows that its systemic administration can reduce the frequency of cigarette smoking

1968 Donald Kahn performs the U-M's first coronary artery bypass graft surgery, as well as the first heart transplant

1968 Benedict Lucchesi demonstrates the role of glucagon as an antidote to restore cardiac contractility in hearts depressed by beta-adrenergic blockade

1969 Park Weed Willis III replaces Franklin Johnston as chief of cardiology; he and coworkers also are among the first to note the familial occurrence of mitral valve prolapse

1972 Richard Lampman establishes the Work Performance Laboratory

1972 William J. Fry establishes the U-M Division of Vascular Surgery

continued on page 14

TRANSCATHETER VALVE-IN-VALVE IMPLANTATION:

NEW OPTION FOR BIOPROSTHETIC VALVE FAILURE

Recently, an important option for heart valve implantation has been approved, and is already available at the University of Michigan (U-M) Frankel Cardiovascular Center.

The SAPIEN XT (Edwards Lifesciences) transcatheter heart valve allows for minimally invasive aortic valve-in-valve procedures, which offers an important option for the patient whose previously implanted but compromised prosthetic valve needs to be replaced, but who wishes to avoid open surgery.

There is a large population of patients whose prosthetic valves await replacement. Many patients with congenital heart diseases whose bicuspid valves were replaced with prosthetic valves will require numerous procedures through the years as their implanted valves become compromised. These repeated cardiac surgeries are associated with significant morbidity and mortality.

In the valve-in-valve procedure, the new valve is tightly placed within the failing bioprosthetic valve. Although the procedure has been approved, it had been performed selectively at U-M several times; thus, expertise in this complex approach is already available.

The PARTNER II (Placement of AoRTic TraNscathetER Valves) trial found an overall one-year survival rate of 86.6% and a stroke rate of 3.7% in a 197-patient, multicenter study of this high-risk population. Survival at 30 days was 100%.

STRONG ONE-YEAR DATA

SAPIEN 3

High-risk and inoperable patients underwent TAVR and received the Edwards Sapien 3 aortic valve. Most patients were more than 80 years old and underwent transfemoral TAVR.

One-year survival rate: **85.6%**

Disabling stroke rate after one year: **2.4%***

Patients with severe paravalvular leak: **0**

* Although 2.7% had moderate paravalvular leak, this type of leak was not associated with increased risks for death, clinical valve thrombosis or structural valve deterioration.

Evolut R

Another study of 60 patients who underwent TAVR and received the Evolut R valve showed similar survival rates at one year. Patients in this multicenter international study were considered to be at high or extreme risk for mortality with surgery.

6-month survival rate: **95%**

One-year survival rate: **93.3%**

One-year stroke rate: **3.4%**

Surgeons from left to right:
P. Michael Grossman, G. Michael Deeb,
Stanley J. Chetcuti

ELECTROPHYSIOLOGY TREATMENT FOR ARRHYTHMIA

There is a bidirectional relationship between research and clinical care. Research at the highest level helps improve outcomes, while challenges faced in clinical care raise the next questions that will advance treatment options.

"It is important for the clinicians who first see these patients to understand that there are advanced treatment options. The most important is proper and timely identification of the patients who may benefit from more advanced specialized diagnostic and treatment options."

—HAKAN ORAL, MD

The electrophysiology (EP) lab at the University of Michigan Frankel Cardiovascular Center is one of the preeminent facilities for EP in the United States.

"We have been a pioneer and leader for many of the techniques that have improved outcomes in patients with complex and difficult-to-treat arrhythmias, with a comprehensive focus on the patient, and we have had excellent outcomes," said Hakan Oral, MD, director of Cardiac Electrophysiology.

TREATMENT OPTIONS

Whether patients are referred for atrial fibrillation (AF), paroxysmal supraventricular tachycardia, Wolff-Parkinson-White (WPW) syndrome, life-threatening

ventricular arrhythmias or for cardiac implantable devices such as ICDs, pacemakers, cardiac resynchronization therapy or other devices for prevention of stroke in patients with AF, the Cardiac Arrhythmia Service at the Frankel Cardiovascular Center is well prepared to offer optimal therapeutic options.

For AF, the Cardiac Arrhythmia Service has been one of the pioneers and a leader in ablation of AF and other arrhythmias—specifically ventricular arrhythmias—and has helped to move the field forward.

"AF, and ventricular arrhythmias in general, has been a rapidly expanding field, and it is important for the clinicians who first see these patients to understand there are advanced treatment options," said Dr. Oral. "There are many opportunities to help these patients."

THE TEAM

The Cardiac Arrhythmia Service has nine faculty clinical cardiac electrophysiologists with substantial expertise and experience in their fields, both in clinical care and research. Drs. Fred Morady,

Frank Bogun, Aman Chugh, Frank Pelosi, Thomas Crawford, Rakesh Latchamsetty, Hamid Ghanbari, Ryan Cunnane and Oral have collectively contributed more than 500 peer-reviewed studies in advancing the field of electrophysiology over the last decades.

In addition to its faculty, a major strength of the Cardiac Arrhythmia Service is the dedicated team of nurse practitioners, physician assistants, nurses, technologists and staff who help to deliver ideal patient experiences and play a critical role in this clinical mission. **M**



Hakan Oral, MD

ATRIAL FIBRILLATION

AF is the most common sustained arrhythmia, with surging incidence and prevalence rates over the past two decades. This increase has been particularly steep in the United States, which has one of the highest incidence rates on a per-capita basis in the world. AF places patients at increased risk for thromboembolic events, stroke, heart failure and death.



HISTORY IS MADE HERE

1972 Joseph Bookstein publishes the first in a series of landmark papers from a National Cooperative Study on the radiological aspects of renal artery disease

1973 Ernie Reynolds publishes "Planning for Cardiac Care: A Guide to the Planning and Design of Cardiac Care Facilities," which would become a major source for facility designers for two decades

1973 The U-M's Noninvasive Vascular Laboratory is established

1975 James Stanley publishes the definitive classification of arterial fibrodysplasia

1977 Bertram Pitt arrives at the U-M as chief of cardiology

1977 Pitt and H. William Strauss publish an influential textbook on nuclear cardiology

1979 The cardiac rehabilitation program is initiated

1982 James Stanley establishes the U-M Vascular Surgery Fellowship, which over the next few decades will train one of eight Vascular Surgery program directors in America

1983 William O'Neill performs the U-M's first primary angioplasty

1984 Fred Morady arrives at the U-M and quickly establishes it as an internationally recognized electrophysiology research center

1984 William O'Neill performs the world's first coronary atherectomy

1985 Eric Topol joins the U-M. Topol and others found the Thrombolysis and Angioplasty in Myocardial Infarction (TAMI) research group, establishing the concept of the multicenter randomized trial

1985 As director of the Coronary Care Unit, John Nicklas initiates an outpatient management program for congestive heart failure

1987 William Kou observes that flecainide has the potential to induce life-threatening arrhythmias, particularly in the presence of myocardial ischemia

IMPROVING SURVIVAL IN PATIENTS WITH MITRAL VALVE REGURGITATION

"Physicians who detect or suspect mitral valve regurgitation should send their patients for evaluation before there is significant deterioration. In addition, repairs will improve quality of life in a symptomatic patient, so there is no value in waiting."

—STEVEN F. BOLLING, MD



The correlation between volume of mitral valve repairs performed each year and the success rate of those repairs has been demonstrated repeatedly in published studies. That's important since very few centers in the United States come anywhere near the volume of mitral valve repairs performed by cardiac surgeons at the University of Michigan Frankel Cardiovascular Center.

"Mitral valve regurgitation is a disease you can often cure. If a repair can be performed, the life expectancy of the patient can be restored to what it would have been in the absence of regurgitation," explained Steven F. Bolling, MD, professor of cardiac surgery and director of the Multidisciplinary Mitral Valve Clinic at the Frankel Cardiovascular Center.

In hospitals that are not equipped to offer repair, the default treatment is often a prosthetic valve, whether mechanical or created from animal tissue. For patients who otherwise have an extended expected survival, the data are clear.

GREATER CHANCES FOR SUCCESS

"Bioprosthetic valves fail over time. In eight to 10 years, the patient will need a replacement, which introduces additional costs as well as risks. In good candidates, repair will eliminate mitral valve regurgitation as a cause of cardiovascular dysfunction," said Dr. Bolling, who is one of the preeminent experts in this field. Indeed, Dr. Bolling is one of only three cardiac surgeons in the United States who perform more than 100 cases of mitral valve repair annually.

It has been estimated that 175 mitral valve repairs are required before cardiac surgeons achieve an optimal level of skill, yet few cardiac surgeons perform this many cases in their lifetime. Indeed, most do only a few cases per year. At the Frankel Cardiovascular Center, where Dr. Bolling is one of several cardiac surgeons performing a high volume of mitral valve repairs, the success rate now exceeds 99%. By contrast, surveys show that surgeons who do not do a high rate of these procedures have lower success rates (*Ann Thorac Surg* 2010;90[6]:1904-1911).

INDIVIDUALIZED CARE

While early referral is key for best outcomes, not every patient with mitral valve regurgitation is a candidate for repair. In some, a prosthesis may be the best option, particularly for those with a limited life span who have significant deterioration of the mitral valve, rheumatic disease or possibly some ischemic-related causes of mitral valve regurgitation. In others, newer options can be considered. Many of these innovations are being developed or tested at the Frankel Cardiovascular Center through clinical trials.

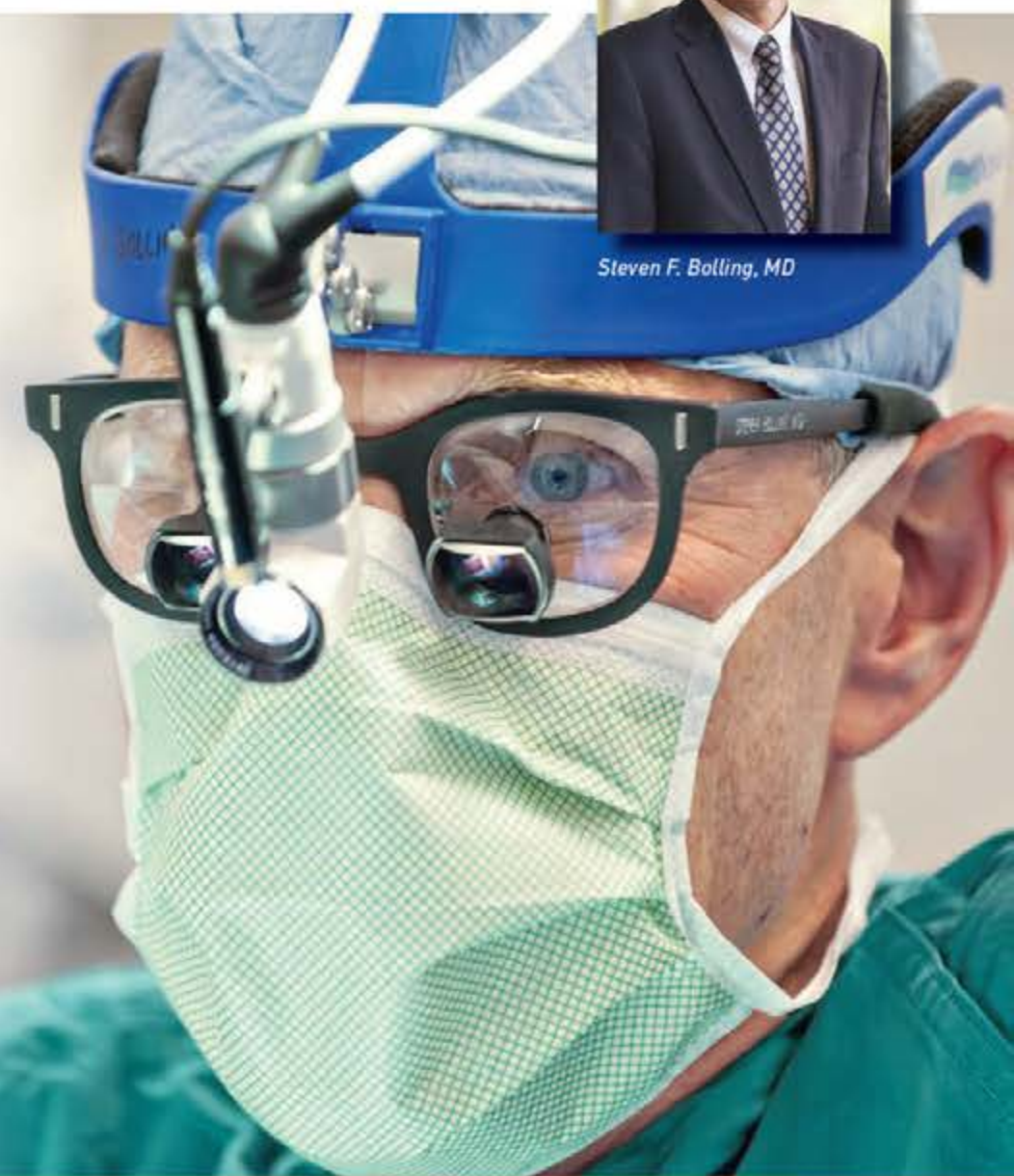
"We are not just specialists in repair. Our strength is that we are skilled with the full spectrum of options so we can individualize therapy," Dr. Bolling said. **M**

"The data suggest that volume is perhaps the single most important factor for determining success, and we manage thousands of patients with mitral valve disease."

—STEVEN F. BOLLING, MD



Steven F. Bolling, MD



HISTORY IS MADE HERE

1987 Starting this year, Bertram Pitt begins serving in a leadership role in a series of major multicenter clinical trials, including the SOLVD, PLAC, QUIET, ELITE, ELITE II, RALES and AVERT trials

1989 The Conrad Jobst Vascular Surgery Research Laboratories are established

1989 Elizabeth Nabel and colleagues publish the first report of a transplanted gene expressing a protein in a living animal

1990 The first Conrad Jobst Lecture is given by Michael DeBakey

1994 The Milton Bryant Lectureship is inaugurated

1994 Seigo Izumo becomes chief of Cardiology Division



1994 Kim Eagle (*left*) is recruited as chief of Clinical Cardiology and director of the Heart Care program

1996 Eagle and colleagues form the International Registry of Acute Aortic Dissections, which now includes 43 centers worldwide

1997 Elizabeth G. Nabel (*right*) becomes chief of cardiology, the first woman to hold the title. She goes on to become the director of the National Heart, Lung and Blood Institute and later the president of Brigham & Women's Hospital



2001 Blue Cross Blue Shield of Michigan Cardiovascular Consortium- Percutaneous Coronary Intervention (BMC2-PCI), led by P. Michael Grossman and Hitinder Gurm, is the first Collaborative Quality Initiative and assesses outcomes following angioplasty procedures

2001 Richard Prager is the project director of the Michigan Society of Thoracic and Cardiovascular Surgeons (MSTCVS) Quality Collaborative, whose goal is improving the care of adult cardiac and thoracic surgery patients

2003 David J. Pinsky becomes chief of cardiology

PULMONARY ARTERIAL HYPERTENSION: EARLY REFERRAL, COMPREHENSIVE CARE ARE KEY



The Pulmonary Hypertension Program at the University of Michigan Frankel Cardiovascular Center is the largest, most comprehensive pulmonary hypertension center in the state. It is one of the largest centers for chronic thromboembolic disease in the Midwest and one of the few centers in the region to offer pulmonary thromboendarterectomy as a treatment option for chronic thromboembolic pulmonary hypertension.

"We have been in existence since the 1990s, and we are the only center in the state that has been certified by the Pulmonary Hypertension Association as a program of comprehensive care. That involved a review process, and we met all the criteria," said Vallerie McLaughlin, MD, (above left) director of the Pulmonary Hypertension Program. "We have three highly trained physicians and three highly trained clinical nurses that have been doing this for years. I've been doing this for 20 years."

The center has dedicated research and clerical staff, and the program's clinical team liaises closely with other U-M specialties, including radiology, infectious diseases, rheumatology and pulmonary. The full-service center, which works closely with patient support groups, is very patient-oriented.

Dr. McLaughlin said few clinicians have the expertise needed to treat pulmonary arterial hypertension, a rare disease. "We have everything needed to take care of these patients," she said. "Pulmonary arterial hypertension is a complex disease, and most clinicians don't have very much experience with it. Collaborative care with a pulmonary hypertension center—such as ours—and local physicians is in a patient's best interest. Early referral is key and leads to improved outcomes."

"Collaborative care with a pulmonary hypertension center—such as ours—and local physicians is in a patient's best interest. Early referral is key and leads to improved outcomes."

—VALLERIE MCLAUGHLIN, MD

CAUSES AND SYMPTOMS

A congenital heart defect, heart valve problems or other health issues can trigger pulmonary hypertension (PH). When there are no other underlying heart and lung disease or other illnesses, it is called primary pulmonary hypertension. Primary PH is reported most often in women between ages 21 and 40.

Pulmonary hypertension can make everyday activities exhausting and lead to life-threatening heart failure.

Patients with PH may experience:

- Fatigue
- Dizziness
- Shortness of breath

Comprehensive evaluation with right-heart catheterization, a pulmonary function test, a ventilation perfusion lung scan to measure air and blood flow to the lungs, and heart tests can lead to the right diagnosis and treatment options. **M**

MEET KATIE MEZWA

BACK ON THE FIELD

Katie Mezwa, an active 22-year old, first noticed her symptoms on the lacrosse field. Her journey took many months to understand the causes behind her blurry vision, fatigue and chest pain during routine practice.

With shortness of breath as the main symptom, pulmonary hypertension is often misdiagnosed. Katie's on-field performance was in trouble because of the high blood pressure in the loop of vessels connecting her heart and lungs.

TREATMENT OPTIONS

With treatment led by Dr. Vallerie McLaughlin, director of the University of Michigan Pulmonary Hypertension Program, Katie manages her pulmonary hypertension with a daily calcium channel blocker to help dilate her blood vessels for easier blood flow.

While a rare disease, researchers are taking a closer look at the molecular basis for PH and testing easier-to-use drugs that can signal vasodilation in the blood vessels in the lungs and improve heart function.

Since the diagnosis, Katie says she's focusing on living a normal life, which includes playing for the University of Michigan Women's Club Lacrosse team as the team earned its first national title. Katie earned the Women's Collegiate Lacrosse Association Division 1 Player of the Year Award.

"To me, that award is a testament to my hard work and dedication, and a great reminder that even a heart condition can't hold me back," says the 2015 U-M graduate whose future goals involve improving global health.



HISTORY IS MADE HERE

2007 James Stanley and Thomas Wakefield establish one of the first three Vascular Surgery residency training programs in the country at U-M

2007 The U-M Cardiovascular Center, with an innovative synergistic leadership model, opens its doors, providing comprehensive care in a single center. The founding directors represent vascular surgery (James Stanley), cardiology (David J. Pinsky), clinical cardiology (Kim Eagle) and cardiac surgery (Richard L. Prager). Today, the directors include Drs. Eagle, Pinsky and Prager, as well as Thomas W. Wakefield (vascular surgery), Stephanie Diccione-MacDonald (nursing) and Linda Larin (chief administrative officer)

2007 Jose Jalife leads the Center for Arrhythmia Research, which focuses on basic science research

2008 Jim Froehlich and colleagues initiate the Michigan Anticoagulation Quality Improvement Initiative (MAQI2), a statewide registry tracking anticoagulation management

2012 The Berguer Lectureship is established

2013 The U-M Cardiovascular Center is renamed the Frankel Cardiovascular Center in recognition of the support received from the Samuel and Jean Frankel Foundation. It ranks among the top such centers in the nation for heart, vascular and stroke care



UMHS PROVIDER PORTAL

The UMHS Provider Portal is a secure web-based application for referring providers and their staff to access their patient's U-M medical information. This portal makes it easy to view your patient's medical records in real-time:

- Appointment notifications
- Admission notifications
- Emergency department notes
- Laboratory and radiological test results
- Physician/clinic letters

To enroll your practice or learn more, visit www.uofmhealth.org/providerportal or call M-LINE at 800-962-3555 to speak to a Physician Relations representative.

HISTORY IS MADE HERE *See page 2 for the beginning of our story*

2013 David Pinsky, chief of cardiovascular medicine, and Alan Saltiel, director of the U-M Life Sciences Institute, co-direct a partnership with Technion—Israeli Institute of Technology and the Weizmann Institute to focus on heart disease research



2014 Thomas Wakefield and Sumi Sood receive NIH funding to treat clinical DVT for the first time with an anti-inflammatory approach, using an inhibitor to E-selectin