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DEAR COLLEAGUE,

Sanger Heart & Vascular Institute, part of Carolinas HealthCare System, has been a cardiovascular care leader in the community, region and beyond for more than 50 years. Our commitment to providing exceptional care to our patients is at the forefront of what we do and is the impetus behind our significant breakthroughs in heart care over the years.

Our blueprint is simple: Recruit the finest physicians and clinicians. Foster collaboration between disciplines. Relentlessly pursue quality. Transform processes. Build relationships. Put patients and families first.

We strive to lead the way in developing life-saving heart care advancements. Over the past two years, we performed the world’s first in-human branched stent graft implantation specifically designed for branch vessel repair of thoracic aortic aneurysms, implanted the first total artificial heart in the region, and piloted a care redesign initiative that will increase access to high-quality and coordinated cardiovascular care for patients throughout the Carolinas.

Our collaborative model is built around making the best decisions for our patients and cultivates a unique environment comprising the most talented cardiovascular specialists, integrated into one team, and spanning across the region.

We’ve come a long way since Paul Sanger and Francis Robicsek pioneered advanced heart care in the Charlotte area in the 1950s. But their spirit of innovation thrives to this day at Sanger Heart & Vascular Institute.

Paul G. Colavita, MD
President, Sanger Heart & Vascular Institute
WHO WE ARE


Sanger Heart & Vascular Institute was founded more than 50 years ago on these principles, which are still the driving force behind our endeavors.

Carolina HealthCare System’s network of more than 900 care locations includes academic medical centers, hospitals, physician practices, destination centers, and surgical and rehabilitation centers. As part of this system, Sanger Heart & Vascular Institute includes locations in North and South Carolina where physicians work as one team to provide the highest quality heart care.

Sanger encompasses more than 100 physicians, 74 advanced care practitioners and 20 care centers in the Carolinas. Patients benefit from a culture of collaboration that ensures a superior patient experience and access to the most advanced care in the region.

Sanger is home to the region’s largest chest pain network and is the only provider of heart transplant and adult congenital heart disease services in the region. For several, consecutive years, Levine Children’s Hospital has ranked a “Best Children’s Hospital” by U.S. News & World Report in multiple specialties, including cardiology and heart surgery.
ACUTE CARDIAC CARE

As the region’s largest and most comprehensive chest pain network, Sanger Heart & Vascular Institute is a national leader in expedient, coordinated acute cardiac care. Our treatment times are consistently better than the national average, which translates to better outcomes for our patients.

Patients who need subspecialty care can most often receive treatment in an acute setting close to home and, if a higher level of expertise is required, can be transferred to a specialty center quickly and seamlessly.

Setting the Standard

The American Heart Association has recognized several Carolinas HealthCare System facilities for heart care; two locations were awarded its Gold Plus Quality Achievement Award for heart attack care.

Sanger coordinates our nine accredited Chest Pain Centers, first responders and cardiovascular specialists to deliver faster care to patients who present with chest pain and MI symptoms.

Our Code STEMI program offers a multidisciplinary approach in which patients experiencing an ST-segment elevation MI are rapidly identified and treated with primary angioplasty. For those presenting to hospitals outside of metro Charlotte, immediate transfer to an angioplasty center offers the same life-saving care and rapid assessment and treatment.

Sanger also participates in RACE CARS (Regional Approach to Cardiovascular Emergencies Cardiac Arrest Resuscitation System), the largest statewide system of emergency cardiovascular care, which coordinates 122 hospitals and 540 EMS agencies to quickly and consistently diagnose and treat MIs and sudden cardiac arrest.

Future of Medicine in Action Today

Our coordinated multi-location research approach enables Sanger to participate in clinical trials that bring novel technologies to our patients across the region.
PERCUTANEOUS INTERVENTIONS

Sanger Heart & Vascular Institute is designated as a comprehensive percutaneous intervention center for heart attack patients. Our expert invasive and interventional cardiologists perform the latest cardiac diagnostic evaluations and percutaneous coronary interventions (PCIs) for patients with both acute and stable coronary disease.

24/7 Care

Comprehensive heart care is not a 9-to-5 endeavor, and the ability to offer patients the tests and treatments they need, at any hour, is a service of which Sanger Heart & Vascular Institute is proud. Cardiac catheterization is available around the clock at Carolinas Medical Center as well as three of our tertiary hospitals: Carolinas HealthCare System NorthEast, Carolinas HealthCare System Pineville and Carolinas HealthCare System Blue Ridge.

PCIs, including angioplasty and stenting, are performed to treat:
- Acute ST elevation myocardial infarction (STEMI)
- Acute coronary syndromes, including unstable angina and non-ST elevation myocardial infarction (NSTEMI)
- Stable angina

Carolinas HealthCare System Union also offers scheduled PCI services.

Expertise at Work

Advances in PCI have been shown to greatly improve outcomes in patients with acute myocardial infarction, making it the predominant reperfusion strategy for STEMI — and an area of expertise at Sanger. Of the hundreds of patients with coronary artery disease treated at Sanger each year, 25 percent of PCIs are for patients with STEMI, 60 percent are for patients with unstable angina or NSTEMI and 15 percent are for patients with stable angina.

To treat congenital structural heart defects, Sanger’s interventional cardiologists perform:
- Percutaneous closures of atrial septal defects and patent foramen ovale
- Percutaneous mitral valve repair
- Transcatheter aortic valve replacement (TAVR)
- Left atrial appendage occlusion for the prevention of stroke in the setting of atrial fibrillation

Leading the Way

Sanger is actively participating in a host of PCI research initiatives. Among these is the industry-sponsored ABSORB trial, evaluating the use of a bio-absorbable stent in place of a traditional stent. This trial is designed to examine whether a drug-eluting stent absorbed by the body over one to two years will result in less long-term inflammatory risk than a stainless steel stent.

Sanger is also involved in the NIH-sponsored EXCEL trial, looking at stenting of the left main coronary artery in patients with significant left main coronary artery disease as an alternative to open-heart surgery. To date, stenting has been considered too high risk for this population, but evidence from recent registries shows it may be a reasonable option. In this trial, patients will be randomized to open-heart surgery versus stenting and followed for three years.
Established more than 50 years ago by Francis Robicsek, MD, Sanger Heart & Vascular Institute began as a cardiothoracic and vascular surgery group. Since its inception, Sanger has fostered open-door, multidisciplinary collaboration with an evidence-based approach providing quaternary-level care to all patients.

We offer the advantage of one team working across a three-hospital network, providing expertise across the spectrum of cardiothoracic surgery, including:

- Coronary artery bypass grafting – CABG (on and off pump)
- Isolated valve surgery
- Combination of CABG and valve procedures
- Cardiac transplantation and mechanical circulatory support
- Thoracic non-cardiac surgery
- Thoracic aortic and vascular surgery
- Adult congenital surgery
- Multiple minimally invasive surgical options

Sanger has received a three-star rating from the Society of Thoracic Surgeons five times out of the last eight reporting periods, recognizing Sanger’s quality outcomes and commitment to providing leading cardiac care.

Sanger’s physicians, and in particular the cardiothoracic surgeons, are active in national and international efforts to expand and improve healthcare. These efforts have spanned decades and include overseeing the creation of Guatemala’s first major healthcare center at Roosevelt Hospital in Guatemala City in 1973, and initiating the first cardiac surgery program in Belize at Karl Heusner Memorial Hospital in Belize City.

The cardiothoracic surgical program is active in a number of ongoing clinical trials, giving our patients access to the most advanced treatment modalities in cardiothoracic surgery.

Sanger offers cardiothoracic surgical services at Carolinas Medical Center, as well as Carolinas HealthCare System Pineville and Carolinas HealthCare System NorthEast. While quaternary-level care patients are treated at Carolinas Medical Center, all other practice locations offer tertiary-level care.
Collaborative Care
The heart valve team at Sanger Heart & Vascular Institute includes:

- Cardiothoracic surgeons with expertise in valve surgery
- Interventional cardiologists specializing in catheter-based valve replacement and repair
- Cardiac imaging specialists with expertise in 3D transesophageal echocardiography, cardiac CT angiography and cardiac MRI
- Heart failure specialists who are experts in ventricular assist devices and cardiac transplant
- A dedicated, full-time heart valve team nurse navigator who coordinates care for every patient

PROGRAM HIGHLIGHTS

Aortic valve disease
Sanger’s cardiothoracic surgeons, interventional cardiologists and echocardiographers are among the first in the region selected to perform transcatheter aortic valve replacement (TAVR) for patients with severe aortic stenosis who are too ill to undergo open-heart surgery. TAVR is an important advance or adjunct in the use of minimally invasive procedures for patients with aortic stenosis and offers improved patient outcomes.

Mitral valve disease
Patients with mitral valve disease have the benefit of our expertise in mitral valve repair, including open and minimally invasive surgery. Sanger is one of the most experienced centers in the United States conducting percutaneous repair for mitral valve regurgitation. It is also one of the only centers in the Southeast to perform balloon mitral valvuloplasty for mitral stenosis.

Congenital heart disease
For patients with congenital heart defects, Sanger is one of just a few centers in the region with expertise in congenital pulmonic valve surgery. One option is the use of advanced percutaneous pulmonary valve replacement for failed conduits that can delay the need for open-heart surgery.

Transcatheter closure of perivalvular leak
Sanger is one of only a small number of centers in the United States with expertise in transcatheter closure of perivalvular leaks in patients with previous aortic and mitral valve replacement.
ARRHYTHMIA MANAGEMENT

Sanger Heart & Vascular Institute’s Arrhythmia and Device Center provides care for patients with complex heart rhythm abnormalities. Therapy offerings include the treatment of supraventricular tachycardia (SVT), atrial fibrillation (both catheter and surgical ablation) and ventricular tachycardia (endocardial, epicardial and hemodynamic support-assisted approaches).

Atrial Fibrillation Center

The Atrial Fibrillation Center is a vertically integrated approach to a-fib care. The center combines access to cardiac electrophysiologists, cardiac surgeons, sleep physicians and a tailored anticoagulation approach to provide comprehensive care to the patient. The center contains a robust clinical research arm, including participation in the National Institutes of Health CABANA Trial, as well as left atrial appendage occlusion. Our clinical offerings allow our complex arrhythmia patients to have access to leading-edge care without having to travel far.

Cardiac Rhythm Device Center

Sanger’s Cardiac Rhythm Device Center provides comprehensive device options including cardiac pacemakers, implantable cardiac defibrillators (ICDs), and cardiac resynchronization therapy (CRT-P, CRT-D), as well as the completely subcutaneous ICD (SICD). Beyond device therapy, we participate in North Carolina’s Regional Approach to Cardiovascular Emergencies Cardiac Arrest Resuscitation System (RACE CARS) initiative aimed at reducing mortality from out-of-hospital sudden cardiac death.

The center’s close collaboration with the Sanger heart failure and transplantation division allows an integrated approach to the care of heart failure patients. This includes the use of device-based heart failure diagnostics, which has made Sanger a training site for specialists from around the nation. Collaborative clinical research includes the implantation of North Carolina’s first left atrial pressure sensing device for patient-directed heart failure care (LAPTOP Trial).

Cardiac Lead/Device Management

Sanger’s lead and device clinic follows more than 10,000 patients using a remote strategy aimed at early recognition of arrhythmias and mechanical device abnormalities. Our remote strategy allows a 24/7, close-to-home approach to device management for patients. As one of the highest volume programs in the region, Sanger’s lead management program employs a comprehensive approach to lead extraction and device management. Our program utilizes a primary laser-based approach designed to safely and efficiently extract leads. Our belief in complete patient care led us to develop an ICD support group aimed at improving coping strategies and education for our cardiac device patients.

Our 10 cardiac electrophysiologists practice across three tertiary and quaternary medical centers through a coordinated effort that provides advanced care close to home.
HEART FAILURE

Sanger Heart & Vascular Institute’s Heart Failure Clinic emphasizes early diagnosis and treatment of heart failure so that progression may be prevented. In addition to a specially trained staff, including nurses with advanced certification, our access to heart failure clinical investigations and research studies allows us to offer the best care possible.

The heart failure team’s commitment to developing innovative processes is evident in our implementation of the Heart Success program, a Carolinas HealthCare System initiative designed to standardize and optimize care for patients living with heart failure. The Heart Success program, a transition clinic for heart failure patients, is made up of a diverse team of caregivers, including a dietitian, pharmacist, patient navigator, social worker and specially trained nurse, as well as staff for TeleHealth and remote diagnostic monitoring.

This team-based approach allows us to treat complex cases, engage patients and their families so they adhere to physician directions, and identify better ways to manage high-risk patients and improve outcomes. Plotted in Lincolnton, NC, the virtual component of the Heart Success program makes advanced care available to patients who live farther away, ensuring high-quality care no matter where the patient lives.

Heart Failure 30-Day All Cause Readmission Rates 2010-2013*

![Graph showing heart failure readmission rates from 2010 to 2013](image)

*30-day all cause same facility, Premier Database
A virtual model of Heart Success was implemented in 2013, using technology to connect the team without travel to the quaternary center.

Advanced Heart Failure

For most heart failure patients, standard medical therapy and device therapy is sufficient to improve quality of life. For patients who do not respond to standard medical treatment, Sanger has advanced therapies available.

Aside from Heart Success, primary care physicians and cardiologists may also refer patients into Sanger’s long-term heart failure clinic for continued disease management. With physicians board certified in advanced heart failure and heart transplant, and a specially trained staff, we are regional leaders in the care for advanced heart failure.

Pulmonary Hypertension

Sanger is the only facility in the region to provide specialized care to patients with pulmonary hypertension. Our multidisciplinary team utilizes a range of therapies, from oral medications to continuous intravenous infusions.

Cardio-Oncology

The specialized cardio-oncology clinic at Sanger treats oncology patients who have pre-existent heart disease or who develop congestive heart failure or cardiotoxicity as a result of their treatment. Our cardiology and oncology teams’ integrated approach allows patients to have access to specialists in both fields who collaborate to determine the best course for treatment.

Hypertrophic Cardiomyopathy

Sanger’s hypertrophic cardiomyopathy clinic is one of the few programs in the country dedicated to this genetic heart condition. The clinic provides sub-specialty expertise from a multi-disciplinary team of physicians, including adult and pediatric cardiologists, a heart failure cardiologist, electrophysiologist, cardiothoracic surgeon, cardiac imaging specialist and genetic testing. Offering the full range of treatment options – medical management, device implantation, cardiac surgery and alcohol septal ablation – the program further emphasizes patient and family education, incorporating extensive genetic testing and counseling.

The clinic’s multidisciplinary specialists meet regularly to determine each patient’s comprehensive treatment plan. Led by John Symanski, MD, an adult cardiologist with expertise in cardiac rhythm device management, Gonzalo Wallis, MD, a pediatric cardiologist, and Larry Watts, MD, a cardiothoracic surgeon, the team has established excellent treatment outcomes for this often-asymptomatic condition that, when untreated, is a common cause of sudden cardiac arrest.

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MECHANICAL CIRCULATORY SUPPORT 
AND HEART TRANSPLANTATION

Mechanical Circulatory Support
Sanger Heart & Vascular Institute implanted its first left ventricular assist device (LVAD) in 1995. Since then, we have become a regional leader in mechanical circulatory support, utilizing temporary or permanent LVADs for destination therapy in patients who are not candidates for heart transplant or as a bridge to transplant.

In 2010, Sanger was awarded a Disease-Specific Certification by Centers for Medicare & Medicaid Services and The Joint Commission to do destination therapy for Medicare patients.

Transplantation
Since conducting its first heart transplant in 1986, Sanger Heart & Vascular Institute is now one of the busiest transplant centers in the Carolinas, averaging 20 to 25 transplants per year.

Patients are seen in our transplant clinic and evaluated by a board-certified cardiologist, transplant coordinator, transplant social worker and dietitian. Our multidisciplinary transplantation team meets weekly to determine the best course of treatment for each patient, whether it is advanced medical therapies, mechanical circulatory support or cardiac transplantation.

Our patient navigators help with other issues, such as care before the transplant and fostering family support. Once a patient is in the post-intervention phase, he or she returns to the outpatient clinic to be monitored for rejection, infection or other comorbidities. The ultimate success of transplant depends on getting the patient appropriate, comprehensive care throughout the course of treatment.

Sanger’s culture of innovation in the cardiovascular field was demonstrated early in 2014 when we became the first in North and South Carolina to implant a total artificial heart. Before this breakthrough, patients waiting for a transplant were left with limited options unless they had the resources to travel outside of the region. The total artificial heart allows patients to live as normal a life as possible while they wait for a donor heart.

Excellence in Transplant

<table>
<thead>
<tr>
<th>KEY FACTS</th>
<th>CAROLINAS HEALTHCARE SYSTEM</th>
<th>NATIONWIDE</th>
</tr>
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<tbody>
<tr>
<td>1 year patient survival*</td>
<td>94.85%</td>
<td>90.39%</td>
</tr>
<tr>
<td>3 year patient survival*</td>
<td>95.74%</td>
<td>84.36%</td>
</tr>
<tr>
<td>Average time on wait list</td>
<td>5.1 months</td>
<td>8.1 months</td>
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</tbody>
</table>

*Scientific Registry of Transplant Recipients, June 2015

Program Components
Heart transplant success necessitates appropriate, comprehensive care throughout the course of treatment. Sanger’s program incorporates a range of support services in addition to advanced medical and surgical care. Patient navigators, transplant coordinators, dietitians and medical social workers engage with patients to ensure they are comfortable with and knowledgeable about their treatment.

Reaching Milestones
In 2014, Sanger Heart & Vascular Institute implanted the first total artificial heart in North and South Carolina. The total artificial heart implantation follows a number of milestones already achieved by the Sanger team, including our first transplant in 1986, first neonate transplant in 1990, and first LVAD implantation in 1995. We performed our 500th heart transplantation in 2012 and 100th LVAD in 2013.

LifeShare Partnership
LifeShare of the Carolinas is a not-for-profit organ procurement organization that links transplant patients with organ donors. It works closely with the United Network for Organ Sharing and facilities across Western North Carolina to identify potential donors and assist throughout the donation process.

Through its collaboration with LifeShare, Sanger is able to perform 20 to 25 transplants annually and remove patients from the waiting list faster than the national average.
Aortic Center

Aneurysms, dissections and complex arteriosclerotic occlusive disease of the aorta are the focus and expertise of the Aortic Center of Carolinas HealthCare System’s Sanger Heart & Vascular Institute. More than 50 percent of the patients seen at the Aortic Center are referred for the treatment of aneurysms, with another 30 percent referred for dissections. The remaining patients are seen for a combination of occlusive disease or failure of a previous operation.

A Range of Surgical Treatments

The Aortic Center offers surgical treatments that include emergent and elective complex endovascular repair and hybrid repair, which uses minimally invasive procedures in conjunction with endovascular procedures.

Advanced programs include:

- Code dissection – coordinated patient transfer and evaluation for aortic dissections
- Thoracic and abdominal aortic repair
- Thoracoabdominal aortic repair
- Complex arch reconstruction, including valve replacement
- Coronary bypass, sometimes with a later endovascular repair
- Bypass of the vessels to the head and neck with reconstruction of the aortic arch, a complex procedure that sometimes requires hypothermic circulatory arrest and bypass

Code Rupture

The Aortic Center and its staff have dedicated themselves to developing a rapid-response team to transport and treat patients with ruptured abdominal aortic aneurysms. When a rupture occurs, an integrated, system-wide protocol called Code Rupture is activated. The patient is transferred via MedCenter Air to Carolinas Medical Center, one of only two centers in North Carolina with a special treatment protocol for ruptured abdominal aneurysms. There, surgical and catheterization teams are standing by to receive the patient. If needed, a CT scanner is immediately available. The patient may be taken directly to our hybrid operating room where both open and endovascular surgical procedures can be performed. The surgical intensive care unit and the physicians of the surgical critical care service are standing by to receive the patient after a successful repair. This seamless approach ensures patients receive the treatment they need when seconds count.

Leading the Future of Aortic Care

Sanger is uniquely qualified to deliver surgical repair of aortic aneurysms because of our in-depth research focus. As part of Carolinas HealthCare System’s mission to offer the latest clinical trials, the Sanger surgical team, led by Frank Arko, MD, became the first in the world to implant a branched stent graft specifically designed for branch vessel repair of a thoracic aortic aneurysm (TAA). Sanger was one of nine centers chosen by the US Food and Drug Administration for a pilot program to encourage and facilitate early studies on the use of innovative medical devices for first-in-human trials in the United States. This device and surgical approach is the first arch graft available in a clinical trial.

The branched stent graft design is based on an FDA-approved stent and could fill the need for repairing TAAs in patients whose aneurysms are inaccessible by traditional surgical methods.
VASCULAR CENTER

The expert team of vascular cardiologists and vascular surgeons at Sanger Heart & Vascular Institute works in close collaboration with referring physicians to offer comprehensive evaluation and treatment of arterial and peripheral vascular disease in four hospital locations in the Charlotte region.

Diagnostic Capabilities
Sanger boasts conveniently located Intersocietal Accreditation Commission-certified vascular diagnostic labs throughout the region. This access to high-end diagnostic evaluation allows for rapid diagnosis and evaluation of vascular conditions.

Treatment Implementation
Approximately half of the vascular procedures performed at the Vascular Center are endovascular or minimally invasive procedures that use a combination of balloons, stents and atherectomy rechanneling devices. When the goals of treatment cannot be achieved with endovascular techniques alone, more traditional open procedures, or a combination of open and endovascular techniques, or hybrid procedures, may be utilized.

The common procedures performed at the Vascular Center are:
- Endarterectomy for disease of the carotid artery
- Repair of abdominal aortic aneurysm or occlusion
- Revascularization of the lower extremities through open and endovascular approaches
- Surgical and medical approaches for the treatment of venous disease
- Dialysis access
- Thoracic outlet surgery

Residency Program
The faculty of Sanger is training the vascular surgeons of tomorrow through our highly competitive vascular residency program – one of the first peripheral vascular training programs in the country.
Sanger also shares its expertise through numerous industry training programs sponsored by the Vascular Center. Vascular surgeons, cardiovascular surgeons and cardiologists come from across the United States and around the world to learn advanced techniques in intravascular ultrasound, complex thoracic endografting and endovascular stent grafting.
CARDIAC PREVENTION AND REHABILITATION

Sanger Heart & Vascular Institute is focused on ensuring all eligible cardiac patients have access to cardiac rehabilitation. This critical service is effective in reducing re-hospitalization, as well as cardiovascular and all-cause mortality in patients with cardiovascular disease.

Cornerstone of Care
At Sanger, cardiac rehabilitation is tailored to meet a variety of cardiac needs. Services fall into these categories:

<table>
<thead>
<tr>
<th>Primary Cardiac Wellness</th>
<th>Secondary Prevention and Treatment</th>
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<tbody>
<tr>
<td>Patients with chronic stable angina</td>
<td>Patients at risk for cardiac disease due to family history, genetics, lifestyle issues or obesity</td>
</tr>
<tr>
<td>Patients who have had a myocardial infarction, coronary artery stenting or bypass, valve surgery or transplant surgery</td>
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Teamwork
The Sanger cardiac prevention and rehabilitation team comprises specialists with an interest in preventive care, including cardiologists, nurse practitioners, cardiac nurses, exercise physiologists and nutritionists. Also on the team are psychologists who conduct group sessions to address the psychosocial aspects of chronic heart disease.

Benefits of Cardiac Rehab
Sanger’s cardiac rehabilitation services are designed to restore strength and stamina, as well as reduce the risk of advancing heart disease.

This is accomplished through the provision of targeted activities:

- Individualized, supervised exercise programs
- Nutritional assessment and counseling
- Personalized analysis of diet, blood cholesterol levels and BMI
- Medication review and management
- Stress management and psychosocial support
- Smoking cessation coaching

For hospitalized patients who have had a myocardial infarction or cardiac surgery, a connection with cardiac rehabilitation services is part of their discharge pathway.

Shared Medical Appointments
Sanger has developed an innovative “shared medical appointment” to strengthen the post-hospital rehabilitation connection. Under the guidance of a cardiac physician, patients learn about and discuss cardiac disease on a personal level with one another, sharing what happened to them, why it happened and what steps they can take to ensure it doesn’t happen again. This group setting provides greater learning opportunities for follow-up care.

Convenient, Quality Care
The convenience of Sanger’s cardiac rehabilitation and prevention services at nine outpatient locations throughout the region promotes recovery for those who have experienced a cardiac event and enables those who need a preventive care program to access primary cardiac wellness services.

The program has been certified by the American Association of Cardiovascular and Pulmonary Rehabilitation.
CARDIAC IMAGING

Technology
Excellent care requires the latest technologies available. Some of our advanced cardiac imaging procedures include:
• Transthoracic and transesophageal with 3D imaging
• Cardiac computed tomography angiography (CTA)
• Cardiac magnetic resonance imaging (MRI)
• Myocardial perfusion imaging for viability and ischemia
• Positron emission tomography (PET) scan
• Vascular ultrasound

Sanger Heart & Vascular Institute has acquired the latest cardiac MRI scanner, allowing for excellent quality imaging without radiation exposure to the patient. Additionally, our state-of-the-art CT scanner is well suited for routine and advanced cardiac imaging that spans coronary, structural and congenital heart disease in both pediatric and adult patients.

Team-Based Culture
Imaging specialists work hand-in-hand with cardiovascular surgeons in imaging meetings that outline operative procedures in advance of surgery. These specialists are present in the operating room to evaluate the quality and completion of a cardiac repair or valve replacement. They join heart failure specialists in assessing left ventricular function, as well as the impact and proper functioning of ventricular assist devices.

In collaboration with oncologists, imaging specialists use the latest imaging techniques, such as strain analysis, for early detection of cardiotoxicity and chemotherapy-related cardiac changes in patients receiving chemotherapy. They work with colleagues in the Adult Congenital Heart Clinic to outline the specific pathology involved in each case.

Leading-Edge Research
Sanger’s cardiac imaging program is participating in the EVEREST MitraClip® study, an innovative technique for repairing mitral valves percutaneously. It has also participated in multiple studies on transcutaneous aortic valve replacement using CTA and echocardiography for patient evaluation.

Award-Winning Care
Sanger was nationally recognized by the American College of Cardiology for participation in its FOCUS initiative to reduce the number of unnecessary cardiac studies. The imaging team’s efforts led to a 30% increase in appropriateness of imaging orders. Sanger is also the recipient of the Premier Breakthrough Award for Quality in Appropriate Use of Cardiovascular Imaging Initiatives.

Sanger Heart & Vascular Institute offers patients individualized care through a network of specialists working as a team.
CONGENITAL HEART CENTER

Carolina HealthCare System’s Congenital Heart Center is one of the largest and most comprehensive pediatric hospital between Washington, D.C. and Atlanta.

Adult Congenital Heart Disease

As a result of treatment advances for children with congenital heart defects, a new patient population of adults with congenital heart disease has emerged. Providing evidence-based, guideline-directed care to these individuals is the focus of Sanger Heart & Vascular Institute’s adult congenital heart disease (ACHD) program.

The Sanger ACHD program is the only one in the region that offers ACHD-specialized care by a team of cardiologists, heart surgeons, cardiac anesthesiologists, pulmonary hypertension specialists, transplant specialists, imaging specialists and nurses working in cardiovascular medicine.

Program Specialties

Each patient seen in the ACHD program works with physicians on a comprehensive care plan that addresses medications, potential surgical interventions and lifestyle modifications. Patients initially undergo a clinical evaluation, a congenital echocardiogram, and cardiac MRI or CT, if necessary, and subsequently visit Sanger one to two times annually.

The program is led by Jorge Alegría, MD, one of a small number of physicians in the nation to have conducted an ACHD fellowship.

Program specialties include:

- Congenital heart surgery
- Interventional cardiology
- Pulmonary hypertension
- Heart failure
- Heart transplant
- Pediatric cardiology
- Imaging
- Electrophysiology
- High-risk obstetrics

Surgical Expertise

The surgeons in the ACHD program have extensive experience working with adult congenital heart disease. Since 2007, they have performed over 360 surgeries, including:

- Fontan revision
- Aortic root aneurysms
- Closure of atrial septal defects
- Percutaneous valve replacement
- Pulmonary valve repair/replacement
- Tricuspid valve replacement
- Transplantation

Partnerships in Care

Sanger physicians engage in a collaborative model of care, providing consultation or specialized services while patients continue to work with their cardiologist or primary care physician at home. In these situations, all providers help determine the patient’s individualized treatment plan.

Specifically, Sanger specialists work with referring physicians in a variety of contexts, including:

- Meeting with the practice team to discuss ACHD treatment options and developments
- Offering interventional and surgical options by the team’s sub-specialized adult congenital surgeons
- Complementing the care already provided by the patient’s cardiologist

The team welcomes referrals or consultations for patients at any stage of their journey. Many patients seen at Sanger had pediatric heart surgery and are now in need of high-quality adult maintenance care. Others have been recently diagnosed with ACHD and would like a specialized team to help establish a care plan. For some individuals who have long lived with ACHD, development of new symptoms may bring them to Sanger.

Expert Care for Patients of All Ages

At Levine Children’s Hospital, the Congenital Heart Center’s team of board-certified pediatric cardiovascular specialists, pediatric advanced clinical practitioners, pediatric anesthesiologists and pediatricians collaborate to deliver the most effective care for patients of all ages with congenital heart defects – from the womb to adulthood.

Their extensive capabilities encompass diverse areas of sub-specialization, including fetal cardiology, neonatal cardiac surgery, pediatric cardiac surgery, heart failure, heart transplantation and adult congenital heart disease.

Congenital heart conditions treated include:

- Atrial septal defect
- Coarctation of the aorta
- Hypoplastic left heart syndrome
- Marfan syndrome
- Pulmonary atresia
- Transposition of the great arteries
- Truncus arteriosus
- Ventricular septal defect

Cutting-Edge Services

The most advanced diagnostic and imaging technologies and surgical procedures are available at the Congenital Heart Center. Cardiac services include:

- Fetal echocardiography and cardiology
- Electrophysiological evaluation and treatment
- Noninvasive and invasive diagnostics
- Cardiac catheterization and interventions
- Pediatric cardiology: evaluation, treatment and follow-up care
- Pediatric and adult congenital cardiac surgery: open, minimally invasive and robotic
- Heart transplant
- Implantation of ventricular assist devices
- Extracorporeal membrane oxygenation
- Pediatric cardiovascular critical care unit
- Adult congenital heart care

A Commitment to Excellence

The Congenital Heart Center at Levine Children’s Hospital is among the busiest in the Southeast. The center consistently meets or exceeds several key national outcome measures, including 30-day survival rate, surgical mortality rate for neonates, infant surgical mortality rate and catheter-associated bloodstream infection rate.

The Congenital Heart Center is also actively involved in clinical research, including participation in exclusive trials for the use of septal occluders and a prospective, multicenter study to assess an implantable pediatric ventricular assist device.
PEDIATRIC CARDIOVASCULAR SERVICES

Levine Children’s Hospital is trusted by families as a leader in children’s heart care and is recognized by physicians as a top-rated international referral center. The hospital has received national recognition as a Center of Excellence and repeatedly ranks on U.S. News & World Report’s list of “Best Children’s Hospitals” in multiple specialties, including cardiology and heart surgery.

Levine Children’s Hospital is distinguished by superior outcomes in survival after complex surgery, prevention of infections and pressure ulcers, and advanced technologies. It is also recognized for its specialized clinics, clinical support services, patient and family support services, and quality of care.

Outstanding in the Region

Levine Children’s Hospital is a leader in providing advanced pediatric cardiac services, including a comprehensive catheterization and intervention program. The surgical team uses the most advanced approaches to neonatal and pediatric open-heart surgery, minimally invasive and robotic surgery, implantation of ventricular assist devices, heart transplants and the use of extracorporeal membrane oxygenation (ECMO) for premature infants and children with respiratory failure.

Levine Children’s Hospital also offers the region’s first dedicated pediatric cardiovascular intensive care unit, providing specialized cardiac postoperative care.

Comprehensive Approach

Sanger Heart & Vascular Institute’s board-certified pediatric cardiologists, cardiac surgeons and cardiac interventionalists, work closely with other specialists to offer comprehensive diagnostics and treatment for infants and children with heart disease and defects. The skill and experience of this multidisciplinary team enables them to perform state-of-the-art evaluations and treatments for:

- Atrial and ventricular arrhythmias
- Bradyarrhythmias
- Congenital heart defects
- Familial hyperlipidemia
- Structural heart murmurs
- Previously repaired or palliated cardiac defects
- Prolonged QT syndrome
- Syncope
- Structural abnormalities or malformations of the chest

Leading Diagnostics

Physicians, nurses and technicians are specially trained in the use of the most advanced diagnostic and imaging technologies for the identification and analysis of heart abnormalities and diseases, including:

- Electrophysiologic evaluation of arrhythmias
- Heart failure evaluation and management
- Pacemaker and implantable cardioverter defibrillator device evaluation and monitoring
- Peripheral vascular evaluation
- Three-dimensional echocardiography and fetal echocardiography
Physicians at Sanger Heart & Vascular Institute are continually seeking ways to improve the treatment of cardiovascular disease through global and national clinical trials. The results are published in leading medical journals and in Sanger’s own publications for the benefit of medical professionals, patients and the public.

Stent Grafting for Complex Aortic Aneurysm (FDA Early Feasibility Program)
Led by Frank Arko, MD, vascular specialists at Sanger Heart & Vascular Institute were the first in the world to perform an in-human branched stent graft implantation, specially designed to repair descending thoracic aortic aneurysms encroaching on the left subclavian artery using an endovascular approach. This endeavor was part of an FDA initiative to encourage early-stage research on innovative medical devices.

Stem Cell Therapy for Congestive Heart Failure (DREAM-HF)
Joseph D. Mishkin, MD, FACC, from Sanger’s heart failure team, is the principal investigator in this five-year multi-center trial. The trial evaluates stem cell therapy in the treatment of patients with class 2 to 3 congestive heart failure secondary to either ischemic or non-ischemic cardiomyopathy. Patients are on optimal medical therapy and are randomized to receive either intramyocardial injections of allogeneic mesenchymal progenitor cells or a placebo. Clinical endpoints include all-cause mortality, cardiac mortality and hospitalizations. Parameters of left ventricular function and quality of life are also being assessed.

Transcatheter Mitral Valve Repair (COAPT Trial)
This multicenter, industry-sponsored clinical trial evaluates the use of the first percutaneous mitral valve repair therapy device in heart failure patients with moderate to severe functional mitral regurgitation who are high-risk candidates for conventional surgery. The repair is minimally invasive. Sanger’s Michael Rinaldi, MD, was one of the first interventional cardiologists in the world to perform the procedure and participated in the pivotal EVEREST study comparing percutaneous mitral valve repair therapy to surgery in standard risk surgical patients.

Stem Cell Therapy for Refractory Angina (RENEW Stem Cell Study)
Sanger is one of only 50 centers nationwide participating in this randomized controlled trial investigating the efficacy of stem cells for the treatment of refractory angina. Patients are treated with autologous stem cells harvested from the patient’s own blood for the purpose of growing new blood vessels in the heart.

Transcatheter Aortic Valve Replacement (SURTAVI Study)
Sanger was selected to participate in a multi-center, industry-sponsored clinical trial based on its active trans-catheter aortic valve replacement program. SURTAVI compares the use of an investigational catheter-delivered valve replacement system with conventional open-heart surgery in patients with severe aortic stenosis who are at moderate risk for conventional aortic valve surgery.

A SELECTION OF PUBLICATIONS AND PRESENTATIONS

Physicians at Sanger Heart & Vascular Institute also published several articles in 2013, including:

- Brian D. Powell, MD, ScD, published several articles, including:
  - “Percutaneous pacemaker or implantable cardioverter defibrillator lead removal in an attempt to improve symptomatic tricuspid regurgitation” (Europace)
  - “Impact of shock energy and ventricular rhythm on success of first shock therapy: The ALTITUDE First Shock Study” (Heart Rhythm)
  - “Atrophicventricular node ablation in atrial fibrillation patients with cardiac resynchronization therapy: Benefits beyond rate control” (The Journal of Innovations in Cardiac Rhythm Management)
  - “Delayed intronsncd deflection onset in surface ECG lateral leads predicts left ventricular reverse remodeling after cardiac resynchronization therapy” (Heart Rhythm)

- Frank R. Arko, MD, published:
  - “Endovascular Aneurysm Repair: Current Status and Techniques for Expanding Indications and Improving Outcomes” (Seminars in Vascular Surgery, September 2012)

- Michael J. Rinaldi, MD, published several collaborative articles in 2013, including:
  - “Platelet Reactivity and Clinical Outcome in Patients Receiving Drug-eluting Stents” (The Lancet, Vol. 382, Iss. 9912)
  - “Percutaneous Mitral Valve Repair in the Initial EVEREST Cohort: Evidence of Reverse Left Ventricular Remodeling” (Circulation: Cardiovascular Imaging, July 2013)
  - “Impact of Point of Care Platelet Function Testing Among Patients with and without Acute Coronary Syndromes Undergoing PCI with Drug Eluting Stents: ADEPT DES sub study” (presented at the American College of Oncology meeting, San Francisco)
COMMUNITY OUTREACH

Sanger Heart & Vascular Institute is committed to engaging directly with the community through educational and civic activities designed for patients and physicians.

Support Groups
Because Sanger recognizes the need to tend to patients’ emotional health, support groups for patients with cardiac disease and their families include The Implantable Cardiac Defibrillator Support Group, Levine Cardiac Kids and The Heart Success Support Group.

Walk With a Doc
One Saturday each month, patients with cardiac disease are invited to join cardiac physicians for breakfast, a brief talk on a heart health-related topic and a 45-minute walk. Walk With a Doc enables patients to connect with physicians in a way that is far more personal than clinical, fostering patient education and building trust in the cardiac care team.

YMCA
Through a partnership with the YMCA of Greater Charlotte, a medical referral program identifies and recommends patients to Sanger who may be in need of cardiac rehabilitation services. A post-graduate maintenance program though the YMCA allows patients who have completed the supervised rehabilitation program to continue their exercises in a local, familiar place.

Cupid’s Cup
Each February, Sanger Heart & Vascular Institute sponsors Cupid’s Cup, a 5K walk/run that promotes fitness, and raises funds for cardiac rehabilitation scholarships.

Camp LUCK
Camp LUCK (Lucky Unlimited Cardiac Kids) is a not-for-profit, medically supervised camp for children with heart disease and their families. During one week in August, children ages seven to 14 who have heart disease bring a sibling for a traditional summer camp experience. The camp is free for all children. Sanger providers spend time with campers, helping them make the most of their camp experience.

International Medical Outreach
Since October 2011, the International Medical Outreach program, a collaboration between Carolinas HealthCare System and the Heineman Foundation of Charlotte, has sent cardiology teams from Sanger to perform catheterizations in Belize each month and will continue to send teams until the interventional cardiologist at Karl Heusner Memorial Hospital is trained to perform catheterizations alone.
COOL UNDER PRESSURE

A Roman philosopher once said “Luck is what happens when preparation meets opportunity.” Omar Carter, a 25-year-old former Appalachian State University basketball star, probably agrees.

How Omar Beat the Odds

In 2013, Omar was playing basketball, and after a routine fast break, he collapsed, unresponsive.

Kelly Thomas, a cardiac intensive care unit nurse with Sanger Heart & Vascular Institute, was watching the game from the stands. She ran to Omar’s aid, first grabbing his wrist to check for a pulse. No pulse. She began chest compressions and asked for an AED. Omar’s pulse came back, but he was still unresponsive.

When the medics arrived, Thomas called ahead to the emergency room at Carolinas Medical Center to alert them that a “Code Cool” patient was on the way.

Sanger Heart & Vascular Institute at Carolinas Medical Center performs more Code Cool procedures than any hospital in the region. The protocol not only uses therapeutic hypothermia, but offers a comprehensive post-cardiac arrest care bundle, Sanger’s standard of care, developed through evidence-based practices.

Code Cool utilizes specific hemodynamic and ventilator-optimization goals to provide early therapy for patients, optimizing neurological outcome. The 24-hour, seven-days-a-week ICU specialist, cardiologist and interventionalist coverage ensures expert care is always available.

In Omar’s case, it was uncertain if the Code Cool would pay off. But, after 24 hours of treatment he was awakened and showed no signs of long-term damage. “You could tell quickly that Omar was still in there,” said Alan Heffner, MD.

One week later, Omar was discharged from the hospital. He was given a second chance at life thanks to the experienced staff of one of the busiest Code Cool centers in the United States, and the luck of having a Carolinas HealthCare System nurse at the basketball game that night.
MAKE A REFERRAL

We accept referrals from physicians far and wide, and look forward to transitioning each patient back to his or her referring physician for ongoing care post-treatment. To coordinate a referral to any Sanger Heart & Vascular Institute location, contact our referral coordinator at 877-999-SHVI (7484). Our representatives are available 24 hours a day, seven days a week.

With an extensive network of more than 25 outpatient facilities and hospitals, Sanger Heart & Vascular Institute is dedicated to delivering expert heart care across the Carolinas.

SANGER HEART & VASCULAR INSTITUTE LOCATIONS

CAROLINAS HEALTHCARE SYSTEM HOSPITAL

LOCATIONS

 Carolina HealthCare.org/Sanger-Heart
LEADERSHIP

Paul Colavita, MD
President
Medical School: Wake Forest University
Residency: Internal Medicine, Georgetown University Hospital
Fellowship: Cardiovascular Disease and Electrophysiology, Duke University

Joseph T. McGinn, Jr., MD
Chief, Division of Thoracic and Cardiovascular Surgery
Medical School: State University of New York Downstate Medical Center
Residency: Cardiothoracic Surgery, Long Island Jewish Medical Center
Residency: General Surgery, State University of New York Downstate Medical Center

Geoffrey Rose, MD
Chief, Adult Cardiology
Medical School: University of Pennsylvania
Residency: Internal Medicine (Chief Resident), Hospital of the University of Pennsylvania
Fellowship: Cardiovascular Disease and Cardiac Ultrasound, Massachusetts General Hospital

William Downey, MD
Medical Director, Interventional Cardiology
Medical School: Duke University
Residency: Internal Medicine and Interventional Cardiology, Brigham and Women’s Hospital
Fellowship: Cardiovascular Disease and Interventional Cardiology, Massachusetts General Hospital

Sanjeev Gulati, MD
Medical Director, Heart Failure and Transplant Services
Medical School: University of Pennsylvania
Residency: Internal Medicine, Johns Hopkins University
Fellowship: Cardiology, Johns Hopkins University

René Herlong, MD
Medical Director, Pediatric Cardiology
Medical School: Duke University
Residency: Pediatrics, Baylor College of Medicine
Fellowship: Pediatric Cardiology, Duke University

Thomas Johnson, MD
Medical Director, Imaging
Medical School: Emory University
Residency: Internal Medicine, Emory University
Fellowship: Cardiology, Emory University

Rohit Mehta, MD
Medical Director, Cardiac Electrophysiology
Medical School: University of Arkansas
Residency: Internal Medicine, The Ohio State University Medical Center
Fellowship: Cardiovascular Disease (Chief Cardiovascular Fellow) and Electrophysiology, The Ohio State University Medical Center

Michael Rinaldi, MD
Director, Cardiovascular Research
Medical School: Cornell University
Residency: Internal Medicine, Beth Israel Deaconess Medical Center
Fellowship: Cardiovascular Disease and Interventional Cardiology, Beth Israel Deaconess Medical Center at Harvard University | Vascular Medicine and Peripheral Vascular Intervention, St. Elizabeth’s Medical Center

Timothy Roush, MD
Medical Director, Vascular Surgery
Medical School: Uniformed Services University of Health Sciences
Residency: Surgery, Naval Medical Center
Fellowship: Vascular Surgery, Carolinas Medical Center
James Bower, MD
Medical Director, Metro Region
Medical School: Pennsylvania State University
Residency: Internal Medicine, Pennsylvania State University
Fellowship: Cardiology, Pennsylvania State University

Craig Clinard, MD
Medical Director, North Region
Medical School: Wake Forest University
Residency: Internal Medicine, Carolinas Medical Center
Fellowship: Cardiovascular Medicine, University of Florida

Kushal Handa, MD
Medical Director, Southeast Region
Medical School: University of London
Residency: Internal Medicine, Mount Sinai Medical Center
Fellowship: Cardiovascular Disease, Mount Sinai Medical Center
Electrophysiology, University of Wisconsin

Justin Haynie, MD
Medical Director, South Region
Medical School: Wake Forest University
Residency: University of Alabama Hospital
Fellowship: Interventional Cardiology and Peripheral Vascular Intervention, Rush University Medical Center

Ashesh Patel, MD
Medical Director, Northeast Region
Medical School: University of Virginia
Residency: Internal Medicine, University of Virginia
Fellowship: Cardiology, Medical College of Virginia

Nelson Seen, MD
Medical Director, West Region
Medical School: Wake Forest University
Residency: Internal Medicine, St. Luke’s Hospital (Chief Resident)
Fellowship: Cardiology, University of Connecticut

Eric Skipper, MD
Medical Director, Adult Cardiovascular Surgery
Medical School: Wake Forest University
Residency: Cardiovascular & Thoracic Surgery, Carolinas Medical Center
Surgery, East Carolina University
Fellowship: Cardiothoracic Surgery (Research Fellow), East Carolina University

Mason Ellerbe
Vice President, Hospital Operations

Scott Moroney
Vice President, Ambulatory Services
With more than 100 physicians, 75 advanced care practitioners and 20 care locations in the Carolinas, Sanger Heart & Vascular Institute is the region's most comprehensive and experienced cardiovascular institute, and has been providing expert cardiovascular care for more than 50 years.