Department Overview

Cleveland Clinic Heart and Vascular Institute is one of the largest cardiovascular specialty groups in the world, providing patients with expert medical management and a full range of therapies.

Our areas of expertise combine research, education and clinical practice to provide innovative and scientifically-based treatments for cardiovascular disease. The commitment of our physicians and scientists to the prevention and cure of cardiovascular disease has led to innovative care, better outcomes and improved quality of life for patients with cardiovascular disease.

One of the most important measures of the quality of medical care is represented by the actual outcomes by diagnosis or procedure. In this Cardiovascular Medicine Outcomes report, you’ll learn why Cleveland Clinic has been ranked number one since 1995 by *U.S. News & World Report* for cardiac care.
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An immune cell known as a monocyte (blue) sends forth tubular filaments (red) in the direction of a chemical associated with the inflammation of atherosclerotic plaque.

Image courtesy of Ravi S. Mishra, Ph.D., and Martha K. Cathcart, Ph.D., Department of Cell Biology, Cleveland Clinic Lerner Research Institute.
Chairman’s Letter

One of the most important measures of the quality of medical care is represented in the actual outcomes by diagnosis or procedure. The Cleveland Clinic Department of Cardiovascular Medicine is committed to not only providing the best possible outcomes, but also providing this information to the medical community and the public.

We are pleased to present our third edition of “Cardiovascular Medicine Outcomes,” an abridged review of the Department’s results, trends and treatment approaches. This resource underscores some of the innovations and scientific research that distinguish the department.

We are dedicated to improving the quality, and extending the lives of, patients with cardiovascular disease. We believe it is important to share this information with our referring physicians, potential patients, alumni and individuals interested in our cardiovascular medicine program. We look forward to collaborating with all referring physicians in providing care for patients with cardiovascular disease.

Our department will continue to strive to improve outcomes in cardiovascular medicine; not just for the patients who we are privileged to care for today, but also for generations of patients in the future.

Steven E. Nissen, M.D.
Chairman, Department of Cardiovascular Medicine
Cleveland Clinic Heart and Vascular Institute
THE NEW HEART OF CLEVELAND CLINIC

Construction of the new, one million square foot Heart and Vascular Institute is expected to be completed in 2008. The 10-story hospital tower and technology center will feature:

The Sydell and Arnold Miller Family Pavilion: The new gateway and main entrance to Cleveland Clinic, the Sydell and Arnold Miller Family Pavilion will feature outpatient diagnostic facilities, including 115 examination rooms and 170 physician offices.

There also will be laboratories and other clinical facilities to support our many specialty areas.

Technology Building: Surgeons and cardiologists will carry out complex and highly technical procedures, and patients will receive around-the-clock intensive care. The Technology Building will feature:

- 16 cardiothoracic operating rooms
- 12 cardiac catheterization labs
- 8 electrophysiology labs
- Combined catheterization, electrophysiology, surgery preparation, and recovery area
- A hospital unit for patients to recover from same-day procedures
- 4 specialized intensive care units, including a coronary intensive care unit, a heart failure intensive care unit, and two surgical intensive care units
- Cardiac radiology and nuclear medicine facilities

Hospital Tower: Inpatient facilities will feature 288 hospital beds (most in private rooms), with a focus on amenities that promote our “healing hospitality” concept of patient care.

Fully Equipped Conference Center: Telemedicine, satellite video, and digital imaging capabilities will enable doctors from around the world to meet, confer and share knowledge.
# Department Review

Total Patient Visits: 234,098
Total New Patients: 5,812
Admissions (Acute and Post-acute Patients): 12,515
Average Length of Stay (Acute and Post-acute Patients): 6.72 days
Total Beds: 333
Coronary Intensive Care Beds: 16
Heart Failure Intensive Care Beds: 8
Cardiovascular Surgery Intensive Care Beds: 69
Cardiology/Cardiothoracic Beds: 242

NON-SURGICAL PROCEDURES

Diagnostic Catheterization Procedures: 9,985
Interventional Cardiac Procedures: 2,707
Interventional Carotid Procedures: 134
Interventional Peripheral Vascular Procedures: 738
Myocardial Biopsies: 1,419
Noninvasive Vascular Procedures: 29,298
Percutaneous Aortic Valvuloplasty Procedures: 43
Percutaneous Mitral Valvuloplasty Procedures: 19
Percutaneous Atrial Septal Defect (ASD) Closures: 22
Percutaneous Patent Foramen Ovale (PFO) Closures: 42

#1

Ranking of Cleveland Clinic’s cardiac program for the past 12 years in U.S. News & World Report’s annual “America’s Best Hospitals” survey.

5,812

Number of new patients seen at Cleveland Clinic Heart and Vascular Institute in 2006.
ELECTROPHYSIOLOGY PROCEDURES

Electrophysiology Diagnostic Studies ------------------------------- 1,492
Total Electrophysiology Ablations ----------------------------------- 1,436
Pulmonary Vein Isolation Catheter Ablation Procedures for Atrial Fibrillation -------------------------------------------- 933
Total Device Implants ------------------------------------------------ 1,197
Permanent Pacemaker Implants -------------------------------------- 473
(including 19 biventricular pacemaker implants and 14 loop recorder implants)
Implantable Cardiac Defibrillator (ICD) Insertions ------------- 738
(including 280 biventricular ICD implants)
Cardioversions ------------------------------------------------------- 934
Lead Extractions ----------------------------------------------------- 332

DIAGNOSTIC AND IMAGING PROCEDURES

Stress Tests ------------------------------------------------------------- 12,842
Echocardiograms (Echos) ----------------------------------------------- 51,718
Electrocardiograms (ECGs) --------------------------------------------- 120,318

SURGICAL PROCEDURES

Open Heart Surgeries ------------------------------------------------ 3,537
Coronary Artery Bypass Graft Procedures ----------------------------- 659
Valve Surgeries (Primary and Reoperations) -------------------------- 2,127
Adult Heart Transplants --------------------------------------------- 76
(including two heart/lung transplants and one heart/liver transplant)
Adult Lung Transplants --------------------------------------------- 64
Pediatric Heart Transplants ------------------------------------------ 7
Surgical Procedures for Atrial Fibrillation --
Surgical Ablations, Maze Procedures ---------------------------------- 392
Thoracic Aorta Procedures ------------------------------------------ 1,050

234,098
Total patient visits at Cleveland Clinic Heart and Vascular Institute in 2006.

20%
Percent of cardiovascular medicine patients who came from outside the state of Ohio in 2006.
Coronary Artery Disease

External Benchmarking

The Cleveland Clinic interventional group believes it is extremely important, both for their own quality review and for the sake of potential patients, to compare their results with those of other major hospitals. The American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR®) provides such outcomes nationally.

50%
Lower risk of unplanned emergency bypass surgery for PCI at Cleveland Clinic compared with the national average. (See page 7.)

27%
Lower risk-adjusted mortality for PCI at Cleveland Clinic compared with the national average.

BENCHMARKING CLEVELAND CLINIC VS OTHER LARGE (>500 PCI/yr) ACC-NCDR® HOSPITALS

<table>
<thead>
<tr>
<th>Baseline Patient Characteristics</th>
<th>Cleveland Clinic (%)</th>
<th>Other (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (&gt;75 yrs)</td>
<td>24.6</td>
<td>19.7*</td>
</tr>
<tr>
<td>Prior myocardial infarction (MI)</td>
<td>37.0</td>
<td>30.1*</td>
</tr>
<tr>
<td>Heart failure</td>
<td>15.4</td>
<td>10.9*</td>
</tr>
<tr>
<td>Diabetes</td>
<td>37</td>
<td>33.5*</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>5.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Prior bypass surgery (CABG)</td>
<td>34.1</td>
<td>20.5**</td>
</tr>
<tr>
<td>CHF at time of PCI</td>
<td>8.7</td>
<td>8.6</td>
</tr>
<tr>
<td>Severe left ventricular function</td>
<td>9.2</td>
<td>5.1*</td>
</tr>
<tr>
<td>Multi-vessel disease</td>
<td>53.2</td>
<td>45.4*</td>
</tr>
<tr>
<td>More than one stenosis treated</td>
<td>76.0</td>
<td>56.6**</td>
</tr>
</tbody>
</table>

*p<.05  **p<0.01

Cleveland Clinic percutaneous coronary interventional (PCI) procedure patients more often have had prior MI, prior bypass surgery and more frequently have severe left ventricular function than patients at other hospitals.

Receiving timely and appropriate adjunctive care before and after angioplasty is important to optimize outcomes, and has been recognized by the American College of Cardiology as an important performance measure.

Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cleveland Clinic (%)</th>
<th>Other (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin before procedure (%)</td>
<td>98.1</td>
<td>93.6*</td>
</tr>
<tr>
<td>Beta blocker in indicated population before procedure (%)</td>
<td>80.3</td>
<td>70.5*</td>
</tr>
<tr>
<td>Statins before procedure (%)</td>
<td>84.7</td>
<td>61.2*</td>
</tr>
<tr>
<td>Door to balloon time (all ST elevation MI patients) – minutes</td>
<td>112</td>
<td>148</td>
</tr>
<tr>
<td>Aspirin at discharge (%)</td>
<td>99.6</td>
<td>96.6*</td>
</tr>
<tr>
<td>ACE-inhibitors at discharge (%)</td>
<td>73.2</td>
<td>76.0</td>
</tr>
<tr>
<td>Beta blockers in indicated population at discharge (%)</td>
<td>85.3</td>
<td>78.9*</td>
</tr>
<tr>
<td>Statins at discharge (%)</td>
<td>96.0</td>
<td>82.5**</td>
</tr>
</tbody>
</table>

*p<.05  **p<0.01
DIAGNOSTIC CARDIAC CATHETERIZATION COMPLICATIONS

The rate of procedural complications for diagnostic cardiac catheterizations, including acute MI, emergent CABG surgery, stroke and death, has continued to decline from year to year.

PCI RISK-ADJUSTED MORTALITY AND UNPLANNED BYPASS SURGERY

After adjustment for complexity and severity of illness, the mortality rate of PCI procedures and the incidence of unplanned bypass surgery at Cleveland Clinic are lower than national averages, reported by the American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR®).

### PCI Characteristics and Complications

<table>
<thead>
<tr>
<th>PCI Characteristics and Complications</th>
<th>Cleveland Clinic (%)</th>
<th>Other (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood transfusion</td>
<td>3.2</td>
<td>3.8*</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Major vascular complications</td>
<td>1.6</td>
<td>1.8</td>
</tr>
</tbody>
</table>

*p<.05
Cleveland Clinic interventionalists have played a major role in the development of drug-eluting stents. Consistent with data from large-scale trials, we have noted reductions in revascularization rates among our patients who had drug-eluting stents placed.

The plot shows rates of freedom from revascularization among Cleveland Clinic patients from 2000 to 2005.

*BMS: Bare Metal Stents

Perhaps due to better patient selection or superior implantation techniques, long-term follow-up of patients receiving drug-eluting stents at Cleveland Clinic doesn’t show the excess mortality risk reported by some other institutions.
TREATMENT OF CHRONIC TOTAL CORONARY ARTERY OCCLUSIONS

Success in the treatment of chronic totally blocked arteries has been associated with improved survival and freedom from bypass surgery. New techniques and greater experience allow this to be more frequently accomplished.

Annual # of Patients with Chronic Total Artery Occlusions

TREATMENT OF UNPROTECTED LEFT MAIN TRUNK STENOSIS

Blockages in the critically-located left main trunk often are best treated with bypass surgery. Newer stenting techniques, however, allow treatment of some high-risk patients with stents instead of surgery.

Annual # of Patients with Unprotected Left Main Trunk Stenosis

2006 Procedural success: 99.4%
2006 In-hospital mortality: 1.8%
(Excluding those presenting with acute MI)

Retrograde Approach

After being unable to place a guide wire antegrade across the totally blocked proximal left circumflex coronary artery, the occlusion was approached retrograde by passing a wire through collaterals to the circumflex, using the bypass graft to the right coronary as the conduit. The occlusion was then successfully dilated and stented. Special guide catheters, wires and balloons are usually necessary for this approach to be successful.
Coronary Artery Disease

IVUS CASES REVIEWED AT CLEVELAND CLINIC

Intravascular ultrasound (IVUS), performed along with cardiac catheterization, is used to obtain detailed images of the walls of blood vessels. A miniature transducer on the tip of a coronary catheter is threaded through the coronary arteries and, using high-frequency sound waves, produces detailed images of the walls of the arteries.

The IVUS Core Laboratory specializes in the analysis of intravascular ultrasound images. We use a consistent set of analysis definitions and measurements methods. Personnel undergo extensive training in order to perform high-quality quantitative intravascular ultrasound measurements. All these factors make us uniquely qualified to analyze IVUS endpoints in multicenter clinical trials.

Because it allows direct observation of the plaque burden of the vascular wall rather than its lumen size, IVUS provides a precise and continuous measure of the progression of atherosclerosis.

1,448

Number of IVUS studies analyzed in the Core Lab in 2006.

Research

ASTEROID TRIAL: REGRESSION OF ATHEROSCLEROSIS WITH INTENSIVE STATIN THERAPY

Research in the Intravascular Ultrasound (IVUS) Core Lab is focused on the use of intravascular ultrasound to evaluate the impact of new medical therapies on the rate of progression of coronary atherosclerotic plaque.

In the ASTEROID (A Study to Evaluate the Effect of Rosuvastatin on Intravascular Ultrasound-Derived Coronary Atheroma Burden) trial, we demonstrated that lowering LDL cholesterol to very low levels with intensive statin therapy and raising HDL cholesterol levels resulted in the regression of atherosclerosis in patients with coronary artery disease.

Researchers found that rosuvastatin (Crestor) treatment (40 mg/dl) in patients with preexisting coronary disease reduced LDL cholesterol by 53 percent from baseline measurements to 60.8 mg/dL, the lowest level ever achieved in a statin outcomes trial. There also was a statistically significant increase in HDL cholesterol of 14 percent. This very intensive statin regimen was well tolerated and led to a highly significant and unprecedented reversal of coronary artery disease in all patient groups.

Research

CHARISMA STUDY: PLAVIX AND ASPIRIN

CHARISMA (Clopidogrel for High Atherothrombotic Risk and Ischemic Stabilization, Management and Avoidance) was a 15,600-subject, multicenter, international, placebo-controlled study of clopidogrel plus low-dose aspirin (75-162 mg), compared to low-dose aspirin alone, for the prevention of ischemic complications (stroke, MI, cardiovascular death) in patients at increased risk for such events. The study found that while clopidogrel (Plavix) plus aspirin was not effective in patients with multiple risk factors only, it may be effective in secondary prevention, or preventing a second heart attack or stroke, in people who have already experienced one of these events or in those who have peripheral arterial disease. Future research will focus on identifying the appropriate patient population who could benefit from dual antiplatelet therapy.


AARG ANTI-INFLAMMATORY ACTIONS OF HIGH-DOSE ATORVASTATIN

This Phase 4 clinical trial is evaluating the effect of a high dose statin (atorvastatin 80 mg) compared with lower dose (atorvastatin 10 mg/ezetimibe) combination therapy to determine reduction in LDL cholesterol, as well as a reduction in circulating myeloperoxidase (MPO) levels, in primary prevention patients eligible for lipid-lowering therapy. Sponsored by Pfizer, Inc.

SOCIOECONOMIC STATUS AND MORTALITY

Cleveland Clinic researchers demonstrated that the link between socioeconomic status and mortality is partly related to physical fitness. Based on an epidemiological study of over 30,000 Cleveland Clinic patients, the researchers confirmed that as socioeconomic status worsens, mortality increases, even after accounting for a variety of clinical factors. All of these patients had exercise testing as part of their clinical care. When the exercise test findings (particularly physical fitness) were factored in, nearly half of the association between socioeconomic status and death risk could be explained.


CORONARY ARTERY DISEASE RESEARCH

Through the Preventive Cardiology and Women’s Cardiovascular Center Programs (see pages 12-13), the Cleveland Clinic will continue at the forefront of research and applied medicine for the best possible patient care. Our Heart and Vascular Institute physicians, scientists and researchers continue to make advancements in understanding and treating cardiovascular disease. Some of our research has paved the way for the development of novel biomarkers and discovery of genes responsible for coronary artery disease.
SECTION OF PREVENTIVE CARDIOLOGY AND REHABILITATION

We offer a wide range of programs and specialty services to comprehensively address prevention of the development and progression of cardiovascular disease. Our programs include:

- Nutritional services
- Prescriptive exercise programs
- Stress testing
- Multiple cardiovascular risk reduction programs, particularly for higher-risk populations
- Peripheral vascular rehabilitation program in collaboration with Vascular Medicine
- Comprehensive cardiovascular care for women

In addition, our focus is on providing community outreach programs that support cardiac health. Other initiatives include continuing medical education programs for physicians and health care providers through our web site, podcasts, and web casts, as well as our continuing lecture series.

PATIENT VOLUME

![Patient Volume Chart]

OUTCOME MEASURES

The Section tracks outcomes on numerous cardiovascular risk factors, including lipid levels (total cholesterol (TC), HDL, LDL, triglycerides (TG)), blood pressure, body mass index, Framingham risk score, diabetes, smoking, high sensitivity c-reactive protein and emerging non-traditional cardiac risk factors. The Cardiac Rehabilitation Program reports outcomes related to quality of life, functional capacity, blood pressure and compliance.
PREVENTIVE CARDIOLOGY ADULT PATIENTS

This graph represents all adult patients who initially entered the Preventive Cardiology program and had two follow-up visits in 2006.

Typically, the patients first seen in the Preventive Cardiology program are already taking lipid-lowering drugs and have mixed dyslipidemia, or a history of statin intolerance. Despite this, our patients achieved significant improvements in fasting lipid profiles.

WOMEN’S CARDIOVASCULAR CENTER

The Women’s Cardiovascular Center, directed by Leslie Cho, M.D., provides comprehensive cardiovascular medical care to women, with a special focus on prevention. A multidisciplinary team of providers, including physicians, nurse practitioners, nurses, dietitians and exercise physiologists, collaborate to treat women with cardiovascular disease as well as to help women prevent the development and progression of cardiovascular disease.

The Women’s Cardiovascular Center has special expertise in the following subspecialty areas: preventive cardiology, coronary artery disease, heart failure, arrhythmia, valve disease, vascular disease, pregnancy and heart disease.

September 14, 2006

Grand opening of the Women’s Cardiovascular Center.

The Center had one of the highest percentages (19%) of new patients to the Cleveland Clinic in 2006.

Pictured left to right: Leslie Cho, M.D., Stanley Hazen, M.D., and Steven Nissen, M.D.
Prevention

PREVENTIVE CARDIOLOGY PEDIATRIC LIPID CLINIC PATIENTS
This graph represents all patients aged <18 years who had two follow-up visits in 2006. The Pediatric Lipid Clinic offers expert medication and lifestyle management for genetic dyslipidemic patients and their families.

PREVENTIVE CARDIOLOGY HIGH-RISK PATIENT POPULATIONS
Preventive Cardiology focuses on preventive cardiovascular medicine in higher-risk populations, offering aggressive risk reduction programs. We have a multi-disciplinary team and collaborate with several other specialties – including Endocrinology, Rheumatology, Nephrology, Pediatrics and Bariatric Surgery – to target these high-risk groups for evaluation and care.

INTENSIVE GROUP WEIGHT LOSS PROGRAM
A review of patients’ weight loss success with our standard care weight reduction recommendations suggested that increased effectiveness was needed for most patients. In 2006, Preventive Cardiology began offering an intensive, comprehensive group weight loss program. The program focuses on both weight loss and cardiovascular risk reduction through lifestyle changes.

This graph represents the difference in weight loss between patients who completed the intensive group weight loss program and patients who had one Preventive Cardiology consult plus one visit with the dietitian (standard care).
CARDIAC REHABILITATION PATIENTS

Participants in our Cardiac Rehabilitation Program demonstrate marked improvements in fasting lipid profiles, indices of diabetes control, functional capacity, blood pressure, and both physical and psychosocial measures. This table represents the average entry and exit parameters of 2006 program participants for whom one or more risk factors were identified as elevated, and targeted goals for optimal cardiovascular risk reduction were defined.

<table>
<thead>
<tr>
<th></th>
<th>Entry</th>
<th>Exit</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>175</td>
<td>146</td>
<td>-17</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>400</td>
<td>311</td>
<td>-22</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>153</td>
<td>86</td>
<td>-44</td>
</tr>
<tr>
<td>Systolic blood pressure (mm/Hg)</td>
<td>145</td>
<td>123</td>
<td>-15</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm/Hg)</td>
<td>93</td>
<td>81</td>
<td>-13</td>
</tr>
<tr>
<td>Fasting blood glucose (mg/dl)</td>
<td>178</td>
<td>151</td>
<td>-15</td>
</tr>
<tr>
<td>Functional capacity (METS)</td>
<td>6.7</td>
<td>8.2</td>
<td>+22</td>
</tr>
<tr>
<td>SF-36 PCS</td>
<td>39</td>
<td>45</td>
<td>+15</td>
</tr>
<tr>
<td>SF-36 MCS</td>
<td>50</td>
<td>52</td>
<td>+4</td>
</tr>
</tbody>
</table>

EXERCISE PRESCRIPTIONS

The need for physician supervised exercise programs is steadily increasing. Preventive Cardiology offers exercise prescriptions to start individuals on a safe and effective exercise regimen.

Exercise Prescriptions are office visits combined with exercise stress testing to individually tailor a person’s exercise program. A complete medical history, exercise history with exercise test results, limited physical exam, quality of life questionnaire, and readiness for change are assessed.

10 lbs

Average number of pounds lost by each participant in the intensive group weight loss program in 2006.
PULMONARY VEIN ANTRUM ISOLATION PROCEDURE
Pulmonary vein antrum isolation (PVAI) is a treatment for atrial fibrillation in which high-frequency energy is applied through catheters in the blood vessels of the atrium to the pulmonary vein openings (ostia). This energy produces a circular scar that blocks any impulses firing from within the pulmonary veins, thereby “disconnecting” the pathway of the abnormal rhythm and preventing atrial fibrillation. In some cases, ablation also may be performed in other parts of the heart such as the superior vena cava.

PVAI is an effective treatment option for patients with symptomatic atrial fibrillation who failed medical therapy.

IMPROVED OUTCOMES FOR ATRIAL MYOPATHY PATIENTS
Much work has been done to improve the procedural outcomes for patients with atrial myopathy. Atrial myopathy or “scarring” of the left atrium has been identified as the number one predictor of procedural failure. The success rate in this patient population, usually with persistent or permanent atrial fibrillation, improved from 40% in 2005 to 60% in 2006.

PVAI COMPARISON STUDY
Ninety-one patients who were followed for more than two months were randomly selected for inclusion in this Cleveland Clinic comparison study; 46 of these patients had pulmonary vein antrum isolation with superior vena cava isolation plus ablation of atrial fibrillation nests, while the other 45 patients had pulmonary vein isolation with superior vena cava isolation only. The table below shows the outcomes of each group.

<table>
<thead>
<tr>
<th>Pulmonary Vein Isolation with Superior Vena Cava Isolation Plus Ablation of Atrial Fibrillation Nests</th>
<th>Pulmonary Vein Isolation with Superior Vena Cava Isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Volume</td>
<td>46 patients</td>
</tr>
<tr>
<td>Atrial Fibrillation Recurrence Rate</td>
<td>11%</td>
</tr>
<tr>
<td>Pers/Perm Rate</td>
<td>20%</td>
</tr>
<tr>
<td>Procedure Time</td>
<td>191±59 minutes</td>
</tr>
<tr>
<td>Fluoroscopy Time</td>
<td>68±29 minutes</td>
</tr>
<tr>
<td>Complications</td>
<td>None</td>
</tr>
</tbody>
</table>

2006 Procedure Volume: 933
80% success rate*
0.6% stroke risk
<1.0% risk of severe pulmonary vein stenosis

*Success rates for PVAI are defined as a restored normal sinus rhythm without dependency on medications to control the heart rhythm for at least 6 months post-procedure. Success rates for repeat ablations range from 90-95%.
SPECTRAL MAPPING
Real-time spectral mapping is done to identify areas of fibrillar myocardium or “atrial fibrillation nests” while patients are in normal sinus rhythm.

REAL-TIME SPECTRAL MAPPING - SINUS RHYTHM
The illustration below shows the difference between the normal compact myocardium compared to the abnormal fibrillar myocardium seen with spectral mapping.

REAL-TIME SPECTRAL MAPPING
The illustration below shows the spectral map pre- and post-ablation of atrial fibrillation nests within the left atrial appendage.

Number of state-of-the-art electrophysiology laboratories where a wide range of diagnostic mapping and treatment procedures are performed for patients with suspected rhythm abnormalities.

Other ablations performed for various types of arrhythmias in 2006.
Cardiac Arrhythmias

DEVICE IMPLANTS

The Electrophysiology Lab utilizes the latest technology in devices including pacemakers (PM), implantable cardiac defibrillators (ICD), biventricular pacemakers (BIV PM) and biventricular ICDs (BIV ICD). See also page 39.

![Graph showing device implants from 2003 to 2006]

11 infections occurred in the total device implants for 2006; infection rate was low at 0.9%.

DEVICE LEAD EXTRACTIONS

The most common indications for pacemaker and defibrillator lead extraction are: an infection which cannot be cured without removal of the device and the leads, a blockage of the blood vessel the lead goes through, or an electrical malfunction of the lead wire or insulation.

To minimize trauma and damage to heart tissue, Cleveland Clinic electrophysiologists use an excimer laser to melt away the scar tissue encasing and trapping the leads inside the vein and heart. The laser is a less invasive approach to removing the leads and replaces heart surgery in most cases.

Although the lead extraction procedure is technically difficult and is associated with a risk of major complications, our data demonstrate that with the appropriate training, tools and experience, the procedure can be performed with an excellent success rate. Our success rate is defined as removal of all of the required leads without causing bleeding from the veins or heart.

<table>
<thead>
<tr>
<th>Year</th>
<th># Extraction Procedures</th>
<th>#Leads Extracted</th>
<th>Clinical Success</th>
<th>% Major Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>357</td>
<td>636</td>
<td>99.2%</td>
<td>0.00%</td>
</tr>
<tr>
<td>2005</td>
<td>326</td>
<td>610</td>
<td>99.70%</td>
<td>0.30%</td>
</tr>
<tr>
<td>2004</td>
<td>273</td>
<td>473</td>
<td>100.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>2003</td>
<td>291</td>
<td>496</td>
<td>99.00%</td>
<td>0.70%</td>
</tr>
<tr>
<td>2002</td>
<td>279</td>
<td>461</td>
<td>99.60%</td>
<td>0.40%</td>
</tr>
<tr>
<td>2001</td>
<td>324</td>
<td>562</td>
<td>98.80%</td>
<td>0.30%</td>
</tr>
<tr>
<td>Total</td>
<td>1850</td>
<td>3238</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>308</td>
<td>540</td>
<td>99.4%</td>
<td>0.28%</td>
</tr>
</tbody>
</table>
DEVICE CLINIC

The Device Clinic in the Section of Electrophysiology and Pacing uses remote monitoring devices to evaluate the function of implanted devices including pacemakers, implantable cardioverter defibrillators (ICDs) and biventricular pacemaker and defibrillator devices (cardiac resynchronization therapy or CRT-P and CRT-D).

These sophisticated monitoring devices provide clinicians with the ability to frequently check the diagnostic data of implanted devices so they can remotely manage the care of patients receiving device therapy. And, patients benefit from the convenience of follow-up right in their homes.

DEVICE EVALUATIONS

All device evaluations are linked to each patient’s electronic medical record. The data can be provided when necessary via secure access to referring physicians, including those outside of the Cleveland Clinic.

4,110 Number of remote follow-ups in 2006 to monitor the function of implanted devices. 14,576 Device evaluations in 2006.
ARRHYTHMIA MONITORING LABORATORY

The Arrhythmia Monitoring Laboratory provides patients with all forms of heart monitoring recorders and transmitters. The Laboratory receives the monitor transmissions from patients around the world and provides the recorded data to the electrophysiology team. Information from the arrhythmia monitors is linked to the patient’s electronic medical record.

REMOTE PACEMAKER AND ICD FOLLOW-UP

Traditional care of ICD and pacemaker patients required frequent in-person device follow-up visits. However, the ability to remotely evaluate ICD and pacemaker patient populations was added in 2006. This increased availability for remote follow-up transmissions positively impacts patients’ access to care.
Syncope

TILT TEST VOLUME
Our volume of tilt table tests continues to rise, from 597 tilts performed in 2000 to 1,044 in 2006. Nearly half of patients being tested range in age from 21 to 50 years.

In addition, there have been consistently more women who have undergone tilt testing than men throughout the past several years, with 665 women and 379 men tested in 2006.

DISTRIBUTION OF TILT TABLE RESULTS
This chart shows distribution of hemodynamic causes of tilt-induced progressive orthostatic hypotension (POH) and postural orthostatic tachycardia syndrome (POTS); and vasovagal causes of syncope (not preceded by POTS or POH). Normal results indicate patients had normal blood pressure and heart rate responses to the tilt test. (Note: some patients may have more than one diagnosis.)

PATIENT RESPONSE TO TREATMENT
This data set includes new and former patients of the Syncope Clinic who were followed until their symptoms improved from their baseline visit in 2006. Symptoms were grouped as follows:

- Dizziness, fatigue, imbalance, headache (former and new dizzy categories in graph below)
- Arrhythmia, heart palpitations, chest pain (former and new palpitations in graph below)
- Syncope, near-syncope, falls (former and new syncope in graph below)

Probability of Symptom Improvement Within 10 Months (%)

N = total number of patients who presented with these symptom categories in 2006.
Syncope

SYNCOPE PROCEDURE VOLUME

<table>
<thead>
<tr>
<th>Procedure</th>
<th>2006 Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilt Table Tests</td>
<td>1044</td>
</tr>
<tr>
<td>Hemodynamic Tests</td>
<td>497</td>
</tr>
<tr>
<td>Autoreflexes/HRV Tests</td>
<td>249</td>
</tr>
<tr>
<td>Echocardiograms</td>
<td>140</td>
</tr>
<tr>
<td>Total Blood Volume Tests</td>
<td>578</td>
</tr>
<tr>
<td>Isuprel and Isuprel Tilt Table Tests</td>
<td>11</td>
</tr>
</tbody>
</table>

Research

SYNCOPE AFTER INTENTIONAL WEIGHT LOSS

To evaluate a noted trend of some obese patients who reported symptoms of near or frank syncope after intentional weight loss, Cleveland Clinic Syncope Clinic researchers analyzed the response of heart rate and blood pressure to postural challenge in relation to weight loss.

The analysis included 29 consecutive patients who had deliberately lost weight and reported symptoms of syncope (19) or near-syncope (10) and underwent head-upright tilt table testing (HUTT). In 27 patients, symptoms first occurred after weight loss.

Of the 10 patients who had bariatric surgery, frank syncope occurred in seven and near-syncope occurred in three. Nine patients had an abnormal test. Median time from surgery to first symptom was 31 months, with a mean weight loss of 87 kg.

The findings suggest that syncope and near-syncope may be late complications of intentional weight loss. In patients who had bariatric surgery, symptoms occurred at a later interval than in those who intentionally lost weight without surgical intervention. This occurred despite a greater degree of weight loss in those patients who underwent surgery. The mechanism of syncope may differ in the two groups.

This data will be presented in a poster session at the 28th Annual Scientific Sessions of the Heart Rhythm Society in Denver, May 9-12, 2007.

6% Syncope becomes more prevalent with advancing age, occurring in as many as 6 percent of people over age 75.

3.5% Syncope is a common condition, affecting 3 percent of men and 3.5 percent of women at some point in life.
Peripheral and Vascular Disease

PERIPHERAL INTERVENTIONAL PROCEDURES
Each year, the volume for peripheral interventions has steadily increased, while complications continue to decline.

Cardiovascular interventionalists utilize an array of different therapies to treat vascular occlusions, including:

- Percutaneous transluminal angioplasty (PTA) using various balloon and cutting devices; stents; radiation therapy; and laser-, radiofrequency- and ultrasound-guided catheters
- Venous thrombectomy (surgical removal of a vein clot)
- Thrombolytic therapy (medications used to dissolve blood clots)

Other procedures performed by cardiovascular interventionalists include:

Upper extremity procedures: Angina is the most common indication for diagnostic and interventional procedures, such as angioplasty/stenting, in an artery to the arm. Angina results from compromised blood flow to an in situ mammary artery bypass graft.

Renal and mesenteric procedures: Patients with atherosclerotic arterial disease to the kidney and mesentery receive targeted treatment from our multidisciplinary team, including interventional and vascular medicine specialists, as well as nephrologists and gastroenterologists.

Pulmonary angiography: Pulmonary hypertension and suspected pulmonary embolus are evaluated with pulmonary angiography.

Diagnostic and interventional venous procedures: Venous occlusive diseases, such as deep vein thrombosis and venous scarring due to venous catheters or device leads, are treated with venous procedures such as venogram, venous thrombectomy, IVC filter, AV fistula closure, venous stent or venous angioplasty.

LOWER EXTREMIT Y INTERVENTIONAL PROCEDURES
Our endovascular specialists are skilled in performing procedures on the peripheral arteries, including angioplasty, stenting, thrombectomy and thrombolysis.

2006 Complications

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissection</td>
<td>1.8%</td>
</tr>
<tr>
<td>Leg Repair</td>
<td>0.9%</td>
</tr>
<tr>
<td>Hematoma &gt;5 cm</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

Annual # of Procedures
Research

**VIVA**

The ViVEXX™ Carotid Revascularization (VIVA) trial is a prospective, multi-center, non-randomized registry for high surgical risk patients to test the safety and efficacy of the Bard® ViVEXX™ Carotid Stent and Emboshield® BareWire™ Rapid Exchange Embolic Protection System for the treatment of extracranial carotid artery stenosis. *Sponsored by C. R. Bard, Inc.*

**PROTECT**

The PROTECTed Carotid Artery Stenting in Subjects at High Risk for Endarterectomy (PROTECT) trial is a prospective, non-randomized, multi-center, single arm trial to evaluate the long-term safety, efficacy, and durability of the Xact® Rapid Exchange Carotid Stent System used in conjunction with the Emboshield® Pro Rapid Exchange Embolic Protection System (Generation 5) and the Emboshield® BareWire™ Rapid Exchange Embolic Protection System, in the treatment of atherosclerotic carotid artery disease in high surgical risk patients. *Sponsored by Abbott Laboratories.*

**CAPTURE 2**

The Carotid ACCULINK/ACCUNET Post Approval Trial to Uncover Rare Events (Capture 2) is a prospective, non-randomized, multi-center, descriptive, post-approval registry to provide: 1) An ongoing post-market surveillance to document clinical outcomes and 2) Additional information about the RX ACCULINK™ carotid stent and RX ACCUNET™ Embolic protection device so it can be safely used by a wide range of physicians under commercial use conditions in patients with carotid artery disease. *Sponsored by Abbott Laboratories.*
Cerebrovascular Disease

DIAGNOSTIC CEREBROVASCULAR ANGIOGRAPHY

<table>
<thead>
<tr>
<th>Year</th>
<th>Procedures</th>
<th>Complications*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>221</td>
<td>0.5%</td>
</tr>
<tr>
<td>2005</td>
<td>247</td>
<td>0%</td>
</tr>
<tr>
<td>2004</td>
<td>286</td>
<td>0%</td>
</tr>
<tr>
<td>2003</td>
<td>252</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

*Procedural complications include TIA, stroke and femoral artery dissection

CAROTID INTERVENTIONS

Cleveland Clinic interventionalists specialize in carotid angioplasty and stenting with emboli protection, providing patients access to a non-surgical option for carotid occlusive diseases. Our complication rate remained low at 2.1% in 2006 – almost half the global average of 3.98%.

30-Day Complications

<table>
<thead>
<tr>
<th>Year</th>
<th>TIA</th>
<th>Stroke</th>
<th>Death</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>2.1%</td>
</tr>
<tr>
<td>2005</td>
<td>0.5%</td>
<td>0.5%</td>
<td>1.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>2004</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0%</td>
<td>0.8%</td>
</tr>
<tr>
<td>2003</td>
<td>0.8%</td>
<td>0.8%</td>
<td>0.4%</td>
<td>2.0%</td>
</tr>
</tbody>
</table>


CEREBROVASCULAR INTERVENTIONS

Carotid angioplasty and stenting, as well as vertebral and intracranial angioplasty and stenting, are used to restore blood flow to the brain and reduce the risk of stroke.
Vascular Disease

NON-INVASIVE VASCULAR LABORATORY

The Non-invasive Vascular Laboratory provides services to inpatient and outpatient areas, performing approximately 30,000 studies annually. Tests include:

- Arterial duplex ultrasound (carotid, renal, mesenteric, peripheral and graft surveillance)
- Venous duplex ultrasound of the upper and lower extremities
- Venous reflux testing
- Intra-operative duplex
- Non-invasive arterial physiologic testing (segmental pressures and pulse volume recordings)
- Measurement of carotid intimal-medial thickness (CIMT) - for clinical and research applications

The high quality of our laboratory has been recognized repeatedly with accreditation by the Intersocietal Commission for the Accreditation of Vascular Laboratories (ICAVL).

TOTAL NON-INVASIVE VASCULAR LAB STUDIES

<table>
<thead>
<tr>
<th>Annual # Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000</td>
</tr>
<tr>
<td>25,000</td>
</tr>
<tr>
<td>20,000</td>
</tr>
<tr>
<td>15,000</td>
</tr>
<tr>
<td>10,000</td>
</tr>
<tr>
<td>5,000</td>
</tr>
</tbody>
</table>

2002 2003 2004 2005 2006

NON-INVASIVE VASCULAR LAB - ULTRASOUND STUDY DISTRIBUTION

- Arterial Duplex
- Arterial Mapping (Mammary Artery)
- Carotid Duplex
- Eval of Mass
- Renal/Mesenteric Duplex
- Venous Duplex
- Valvular Incomp
- Vein Mapping

Color power Doppler of a renal artery with fibromuscular dysplasia (FMD)
Vascular Medicine specialists manage patients with the following conditions:

- Diffuse and premature atherosclerosis
- Peripheral arterial disease (PAD)
- Carotid artery disease
- Visceral ischemic syndromes
- Renovascular disease
- Arterial aneurysms
- Dissection of the aorta and other peripheral arteries
- Atheromatous embolization
- Deep venous thrombosis
- Pulmonary embolism
- Post thrombotic syndrome
- Chronic venous insufficiency
- Varicose and spider veins
- Hypercoagulable (thrombophilia) conditions
- Anticoagulants
- Lymphedema
- Vasculitis
- Thromboangiitis obliterans (Buerger’s disease)
- Vasospastic diseases including Raynaud’s phenomenon
- Vascular diseases related to extremes in environmental temperature
- Leg ulcers
- Diabetic foot lesions
- Digital ulceration secondary to connective tissue disorders
- The swollen limb
- Pseudoaneurysms

The vast majority of patients were free of complications. Minor bleeds were generally self-limited and did not require hospitalization. Generally accepted complications -- including new venous thromboembolic (VTE) events and bleeding complications -- were rare.
Research

SAFETY AND EFFICACY OF AD2/HYPOXIA INDUCIBLE FACTOR (HIF)-1α/VP16 GENE TRANSFER IN PATIENTS WITH INTERMITTENT CLAUDICATION

This Phase 2 clinical research study is examining the safety of an experimental gene transfer agent, Ad2/HIF-1α/VP16, and its ability to stimulate angiogenesis in an attempt to improve blood flow in the legs of patients with severe intermittent claudication and peripheral arterial disease. *Sponsored by Genzyme Corp.*

FUNCTIONAL IMPROVEMENT THROUGH REVASCULARIZATION OF THE EXTREMITIES FOR PERIPHERAL ARTERIAL DISEASE (FIRE-PAD)

The primary objective of this clinical study is to determine whether catheter-based revascularization of the lower extremities improves functional capacity and quality of life among patients with intermittent claudication. The study will also investigate whether improvements in functional capacity result in increased physical activity and a less sedentary lifestyle. *Sponsored by the American College of Cardiology and the National Institutes of Health General Clinical Research Center (GCRC) of the Cleveland Clinic.*

CRESCENDO: COMPREHENSIVE RIMONABANT EVALUATION STUDY OF CARDIOVASCULAR ENDPOINTS AND OUTCOMES

The primary objective of this Phase 3 clinical trial is to show whether rimonabant reduces the risk of a heart attack, stroke or cardiovascular death in patients with abdominal obesity and other cardiovascular risk factors. The secondary objective is to show whether rimonabant reduces the risk of MI, stroke, cardiovascular death or cardiovascular hospitalization in these patients. *Sponsored by Sanofi-Aventis.*
Hypertrophic Cardiomyopathy

HYPERTROPHIC CARDIOMYOPATHY

Hypertrophic obstructive cardiomyopathy (HOCM) is a disease in which there is thickening of the lower chambers of the heart, especially of the septal tissue. This condition may cause decreased blood flow from the heart to the aorta.

Because of improved surgical outcomes with septal myectomy and the availability of percutaneous septal ablation, the volume of HOCM patients referred to our center has increased over recent years.

<table>
<thead>
<tr>
<th>2006 Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>781 total HOCM outpatients</td>
</tr>
<tr>
<td>241 new HOCM patients</td>
</tr>
<tr>
<td>174 septal myectomies</td>
</tr>
</tbody>
</table>

ETHANOL SEPTAL ABLATION FOR HOCM

Ethanol septal ablation is a nonsurgical treatment method performed for select patients in the cardiac catheterization laboratory. Ethanol septal ablation involves the injection of a small amount of pure alcohol into the small coronary artery branch that supplies blood flow to the septum. The alcohol is directed to the area of the septal wall that narrows the passage from the left ventricle to the aorta. This procedure permanently scars and shrinks the area of the heart muscle to reduce the obstruction and symptoms without requiring surgical removal.

SEPTAL MYECTOMY FOR HOCM

Septal myectomy is a surgical procedure in which a wedge of thickened septal tissue is removed to improve blood flow from the lower heart chamber to the aorta. The volume of septal myectomies performed at Cleveland Clinic in 2006 increased 37% from the previous year, and 42% of these procedures were performed in conjunction with a valve procedure.
Structural Heart Disease

ATRIAL SEPTAL DEFECT (ASD) / PATENT FORAMEN OVALE (PFO) OCCLUSION DEVICES

The AMPLATZER® Septal Occluder and the CardioSEAL® Septal Occluder are two transcatheter closure devices used at Cleveland Clinic to allow nonsurgical treatment of ASD and PFO defects.

2006 Volume: 64
- 42 PFO Closures;
- 22 ASD Closures

Success rate: 98%

2006 Complications: 0%
(including need for surgery, stroke, MI, death)

Patients Requiring Repeat Procedure: 0

ADULT CONGENITAL HEART DISEASE CLINIC

Congenital heart disease is among the fastest growing segments of the adult cardiovascular disease population. The multidisciplinary Adult Congenital Heart Disease Program was developed in 2005 to provide comprehensive care to patients with congenital heart disease surviving to or presenting in adulthood. Directed by Richard Krasuski, M.D., the program consists of an outpatient clinic and an inpatient consultation service. It offers advanced noninvasive imaging, diagnostic and interventional cardiac catheterization, electrophysiologic therapy, device implantation and cardiothoracic surgical treatment options. Richard Sterba, M.D., Pediatric Cardiology, is collaborating with Dr. Krasuski in the outpatient clinic.

2006 was a year of considerable growth for the Adult Congenital Heart Disease Clinic. There were over 400 patient visits; 40% were new patient referrals.

There were 130 diagnostic cardiac catheterizations for congenital heart disease or newly diagnosed pulmonary hypertension. Patient cases included transposition of the great vessels (surgically or congenitally corrected), tetralogy of Fallot, Eisenmenger syndrome, coarctation of the aorta and hypoplastic heart.

Despite the complexity of this patient population, catheterization-related morbidity was no different than the diagnostic laboratory average. Forty-five patients underwent vasodilator challenges with inhaled nitric oxide and 22 complex interventions were performed including coarctation stenting, patent ductus arteriosus closure and pulmonic valvuloplasty. The success rate for interventions was 100%, and there were no serious complications or patients who required repeat procedures.

INTERVENTIONAL PROCEDURES FOR CONGENITAL HEART DISEASE

![Graph showing Interventions for Congenital Heart Disease]
Valve Disease: Percutaneous Therapies

Percutaneous balloon aortic and mitral valvuloplasty (valvotomy) procedures, performed in the catheterization laboratory, open narrowed valves and improve the overall function of the heart. (See also pages 36-38.)

**PERCUTANEOUS BALLOON MITRAL VALVULOPLASTY**

10-Year Cumulative Complications:

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Stroke incidence</td>
<td>0.5%</td>
</tr>
<tr>
<td>Deaths</td>
<td>0</td>
</tr>
<tr>
<td>Emergency surgery</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

**PERCUTANEOUS BALLOON AORTIC VALVULOPLASTY**

In a Cleveland Clinic study, ninety-nine patients with symptomatic severe aortic stenosis who were not candidates for surgical aortic valve replacement underwent percutaneous balloon aortic valvuloplasty. One-third of these patients improved sufficiently to undergo surgical aortic valve replacement.

These plots show the cumulative survival rates of patients who underwent balloon valvuloplasty only and those who underwent surgical valve replacement (AVR) within three months of balloon aortic valvuloplasty. Patients who ultimately underwent surgical treatment had improved survival.

In 2006, 43 percutaneous balloon aortic valvuloplasty procedures were performed.
Heart transplants performed at Cleveland Clinic since the inception of the Cardiac Transplant Program.

U.S. heart transplants performed from 7/1/05 to 6/30/06.**

U.S. heart/lung transplants performed from 7/1/05 to 6/30/06.**

**Source: www.ustransplant.org

Combined Heart-Liver Transplant

On November 14, 2006, Lorene Parker became an Ohio “medical first.” After an 11-hour operation involving several teams of surgeons, the 50-year-old Michigan resident became Ohio’s first heart-liver transplant recipient.

Ms. Parker, a former cardiac nurse, developed cardiomyopathy, possibly as a result of a viral infection. She was already being treated for hepatitis C, which she contracted from a needle stick at work. When it became apparent that she would need a heart transplant, she was told her liver would need to be transplanted simultaneously; the immunosuppressive therapy for her new heart would destroy her liver otherwise.

Cardiothoracic surgeon Nicholas Smedira, M.D., transplanted Ms. Parker’s heart, and general surgeon Charles Miller, M.D., transplanted the liver.

Since Cleveland Clinic’s heart transplant program began in 1984, more than 1,200 hearts have been transplanted. Cleveland Clinic’s liver transplant program recently performed its 1,000th transplant.
QUALITY IMPROVEMENT

“Get with the Guidelines-Heart Failure” (GWTG-HF) is the American Heart Association’s quality improvement initiative that provides hospital staff with tools that follow evidence-based guidelines and procedures for treating heart failure patients to decrease re-hospitalizations and to reduce the number of deaths in these patients.

Cleveland Clinic has been recognized as an official Participating GWTG-HF Hospital (valid from May 2006 to May 2007). Cleveland Clinic was one of 11 out of 219 sites to be awarded the GWTG-HF Initial Achievement Award from the American Heart Association in November, 2006. This recognition signifies that Cleveland Clinic has reached an aggressive goal of treating heart failure patients with 85 percent compliance to core standard levels of care outlined by the American Heart Association/American College of Cardiology secondary prevention guidelines for heart failure patients.

Research

**HF-ACTION: HEART FAILURE AND A CONTROLLED TRIAL INVESTIGATING OUTCOMES OF EXERCISE TRAINING**

The purpose of this study is to see if a long-term exercise program affects illness and survival of patients with heart failure. Sponsored by the National Institutes of Health.

---

94,907
Number of patients waiting for an organ transplant as of 2/1/07.*

2,863
Number of patients waiting for a heart transplant as of 2/1/07.*

136
Number of patients waiting for a heart/lung transplant as of 2/1/07.*

*Statistics based on data from the Organ Procurement and Transplantation Network of the U.S. Department of Health and Human Services: www.optn.org/data
Heart Failure and Cardiac Transplant Medicine

HEART TRANSPLANT VOLUME

Cleveland Clinic’s Cardiac Transplant Program remains the leading center in both Ohio and the Midwest and is positioned as the third largest program in the U.S.

In 2006, 76 heart transplants were performed, including the first heart/liver transplant and one heart/lung transplant. In comparison, other U.S. heart programs perform an average of 7 to 19 heart transplants in one year.


REDUCED WAITING TIME FOR HEART TRANSPLANT


Heart transplants performed at Cleveland Clinic since the inception of the Cardiac Transplant Program.
HEART TRANSPLANT SURVIVAL

Cleveland Clinic’s heart transplant patients have had excellent long-term survival, exceeding national benchmarks.

* 150 Cleveland Clinic patients who received transplants between 01/01/2003 and 06/30/2005; p=0.104
** 151 Cleveland Clinic patients who received transplants between 01/01/2001 and 06/30/2003; p=<0.01
Δ Expected based on risk adjustment


WAITING LIST MORTALITY*

Patients placed on wait list between 01/01/2004 and 12/31/2004

*Cleveland Clinic waiting list mortality is not significantly different than the expected waitlist mortality rate, which is adjusted for age, race, ethnicity, gender, primary diagnosis, blood type, time on the waiting list and medical urgency status.

Percutaneous aortic valve replacement is a new treatment being investigated for select patients with severe symptomatic aortic stenosis. During the procedure, a compressed tissue heart valve is placed on a balloon-mounted catheter and is positioned directly in the diseased aortic valve. Once in position, the balloon is inflated to secure the position of the implant. The native diseased valve stays between the new valve and the aortic wall. This procedure may be a viable nonsurgical option for high-risk patients or those who are not candidates for surgical aortic valve replacement due to comorbid conditions.

Innovations

A) Balloon valvuloplasty in preparation for valve placement;  B) Balloon catheter with valve in the diseased valve;  C) Balloon inflation to implant the valve;  D) Valve in place

The Cleveland Clinic Department of Cardiovascular Medicine was one of three cardiac centers participating in the feasibility trial to test the safety and efficacy of percutaneous aortic valve replacement. Currently, our Department is one of two centers that will start to test this procedure prospectively compared to medical or surgical therapy.
PERCUTANEOUS MITRAL VALVE REPAIR: NON-SURGICAL TREATMENT OF MITRAL REGURGITATION

In the EVEREST II (Endovascular Valve Edge to Edge Repair Study) trial, cardiologists are investigating whether a small metal clip (manufactured by Evalve, Inc.) delivered and positioned via a catheter, can safely hold the mitral valve leaflets together to treat mitral valve regurgitation (MR). Ultrasound and fluoroscopy are used to guide the placement of the clip, which connects the mitral valve leaflet edges. Placement of the single metal clip is adjusted until optimal improvement in hemodynamics is observed; then the clip is released and the catheter withdrawn.

Evalve Percutaneous Valve Repair System

Images used with permission from Evalve, Inc.
Caution: investigational device - limited by US federal law to investigational use.

Probability of Event Free Clinical Success (%)
PERCUTANEOUS PLACEMENT OF VENTRICULAR ASSIST DEVICE

Cleveland Clinic continues to use the TandemHeart® PTVA® System, a centrifugal left ventricular assist device (VAD) manufactured by CardiacAssist, Inc. The TandemHeart® is inserted percutaneously and allows rapid implementation of circulatory support in the cardiac catheterization laboratory or operating room. The TandemHeart® is being investigated as a treatment for select patients recovering after revascularization of acutely occluded coronary arteries. It can be used to temporarily support patients in cardiogenic shock as a bridge to other circulatory support devices or to recovery. It may also be used to support patients after surgery when weaning from cardiopulmonary bypass has failed.

WATCHMAN

The WATCHMAN® Left Atrial Appendage Filter System continues to be used as an investigational device at Cleveland Clinic in the Cardiac Catheterization Lab. The WATCHMAN® device provides a less invasive alternative to the surgical removal of the left atrial appendage, a potential source of blood clots in patients with atrial fibrillation. The filter system consists of a rounded, self-expanding device that isolates the left atrial appendage and prevents clots from dislodging. This device can be permanently implanted in the ostium of the left atrial appendage during an interventional procedure, such as pulmonary vein antrum isolation. The device eliminates the need for Coumadin which is often given to patients with atrial fibrillation to reduce the risk of blood clots and stroke.

The WATCHMAN® device is comprised of a self-expanding nitinol frame structure with fixation barbs and a permeable polyester fabric that covers the atrial face of the device.

Images used with permission from Atritech, Inc.
**MAGNETIC NAVIGATION SYSTEM**

Using computerized, magnetic navigation to precisely control therapeutic catheters during ablation and biventricular device implant procedures continues to change the way common and complex cardiac arrhythmias are treated.

The Stereotaxis Niobe® Magnetic Navigation System (MNS – Stereotaxis, Inc.) is an interventional workstation used in the Cleveland Clinic Electrophysiology Lab. Stereotaxis technology allows electrophysiologists to direct and digitally navigate catheter-based therapeutic and diagnostic devices along complex trajectories within the heart and coronary vasculature.

The system utilizes two permanent magnets located on opposite sides of the patient table. A magnetic actuator is used to control percutaneous devices, as well as provide real-time imaging and computer control of compatible catheters and guidewires that have small magnets embedded in the tips. The magnetic actuator orients the magnetic catheter or wire tip in a precisely defined field, thus “pointing” the tip in the desired direction.

The Celsius® RMT Diagnostic and Ablation Catheter has been recently approved by the FDA for use with the Stereotaxis system. This catheter is used at Cleveland Clinic to perform endocardial ablation for the treatment of cardiac arrhythmias. Previously, a catheter was manually advanced and rotated to reach specific points in the heart in order to map and ablate arrhythmia. The Stereotaxis system adds computer control and automation so electrophysiologists can precisely steer the magnetically-enabled catheters during the procedure.
COMPREHENSIVE NON-INVASIVE ASSESSMENT OF CORONARY ARTERY DISEASE AND AORTIC ANATOMY

Multi-detector computed tomography (MDCT) and magnetic resonance imaging (MRI) scans of the heart allow comprehensive assessment of early and advance stages of coronary artery disease.

Using advanced 64-detector and dual-source MDCT technology, coronary computed tomography angiography (coronary CTA) is being evaluated as a noninvasive method for detecting coronary artery narrowing or blockages, as well as atherosclerotic plaque build-up in the vessel wall.

Advanced 1.5 and 3.0 Tesla MRI scanners allow additional assessment of associated disturbance of heart muscle (myocardial) function, myocardial blood flow, and assessment of myocardial scar tissue.

Other innovative applications include the precise assessment of the aortic root before aortic valve/aortic root surgery using 3-D and 4-D CT image reconstructions. This is applied in the setting of conventional open heart surgery and novel percutaneous approaches.

The Cardiovascular Imaging Center at the Cleveland Clinic is one of a few leading cardiovascular centers refining the applications for these advanced technologies.
**SPECKLE TRACKING**

A newly developed echocardiographic technique called “speckle-tracking” is being used at Cleveland Clinic to localize contraction abnormalities within the ventricle. By integrating information from the three standard apical views, a bull’s-eye plot can be generated, summarizing contraction throughout the ventricle in a single image.

This image shows an inferoposterior infarct (blue) with normal wall motion elsewhere (red).

Speckle tracking can also quantify the twisting motion of the heart, which is essential for normal contraction and subsequent filling of the ventricle. As shown here, the apex twists counter-clockwise and the base twists clockwise, yielding a “torsion” between these planes of 12-14 degrees.

This has been the subject of several research publications in the past two years, including:


*Notomi Y, et al. Assessment of left ventricular torsional deformation by Doppler tissue imaging: Validation study with tagged magnetic resonance imaging. Circulation, March 8, 2005; 111(9):1141-7.*

Innovations

3D ECHOCARDIOGRAPHY

3D echocardiography is an innovative imaging method recently implemented at Cleveland Clinic. This new technique provides unique en-face or surgical views of heart valves, such as the mitral and aortic valves, which cannot be obtained by conventional 2D echocardiography. 3D echo provides accurate heart chamber volumes and functions when images are of high quality. Multiple 3D echo systems, including Phillips, GE and Siemens, are used at Cleveland Clinic. 3D Echocardiography is directed by Takahiro Shiota, M.D.

3D LEFT VENTRICULAR VOLUMES WITH SEGMENTAL WALL MOTION

Sixteen segmental wall motions can be semi-automatically evaluated with new 3D echo software. Temporal change in segmental LV volumes can be also displayed (left panel, bottom right).

MITRAL VALVE SURGICAL VIEWS

A surgical view of a mitral valve prolapse (middle scallop.)

Transthoracic 3D echo of cleft of the anterior leaflet.

Transthoracic 3D echo of mitral valve stenosis.
Mitral regurgitation seen in three different apical plane views.

Severe functional mitral regurgitation imaged by color Doppler 3D echo. Note that the proximal isovelocity surface area (PISA) shape and size are different among these images. Mitral regurgitation appears to pass through the valve coaptation curve (lower left panel).

GLOBAL CARDIOVASCULAR INNOVATION CENTER (GCIC)

Cleveland Clinic, in collaboration Fairfax Renaissance Development Corporation (FRDC) and more than 20 biomedical and academic institutions, will receive $60 million from the State of Ohio to develop a Global Cardiovascular Innovation Center (GCIC).

The grant is the largest-ever made under Ohio’s Third Frontier Project, the State’s billion dollar effort to expand Ohio’s high-tech research capabilities, promote innovation and create high-paying jobs. The GCIC will be designated as the “Wright Mega-Center of Innovation,” allowing the project to draw significant state financial support for operations and capital expenses. The funding will be granted over five years.

The GCIC will develop and acquire new technologies for the treatment of cardiovascular disease, spin off new companies and recruit experienced leaders and emerging companies to establish an internationally recognized cluster of cardiovascular expertise. It will build upon Cleveland Clinic’s unrivaled cardiovascular clinical expertise, its multidisciplinary approach to understanding the factors underlying heart disease and the Clinic’s history of innovation.
Cleveland Clinic Cardiovascular Coordinating Center (C⁵) is an Academic Research Organization (ARO) that provides clinical and academic expertise to support the development, implementation and successful conclusion of cardiovascular clinical trials sponsored by the pharmaceutical industry, the National Institutes of Health, Cleveland Clinic and other academic organizations.

C⁵ has over 100 employees who specialize in the planning, coordination, management and conduct of cardiovascular clinical trials. C⁵ includes these specialty areas: project management, data management, biostatistics, new business and seven core laboratories. The clinical and academic expertise of Cleveland Clinic physicians and scientists, combined with our experience and expertise in clinical trial management, promote success through every phase of a clinical trial.

C⁵ continues to broaden their research scope by participating in multi-disciplinary studies that include other medical specialties such as bariatric surgery, gastroenterology and emergency medicine.

**DIRECTOR:**
A. Michael Lincoff, M.D., Director, Cleveland Clinic Cardiovascular Coordinating Center
Vice-Chairman for Research, Department of Cardiovascular Medicine

**ASSOCIATE DIRECTORS:**
Deepak Bhatt, M.D., Drug Trials
Sorin Brener, M.D. Clinical Events Committee, Angiography Core Lab
Wael Jaber, M.D. Imaging Core Lab
David Martin, M.D. Electrophysiology Trials
Stephen Nicholls, M.D., Ph.D., Intravascular Ultrasound Core Lab and Atherosclerosis Trials
W.H. Wilson Tang, M.D., Heart Failure Trials
Oussama Wazni, M.D., Electrophysiology Trials
Patrick Whitlow, M.D. Cardiovascular Device Trials

**MANAGER OF CARDIOVASCULAR RESEARCH:**
Joan Booth, R.N.
**BREADTH OF EXPERIENCE**

The table at left highlights our experience managing a wide variety of clinical trials.

**SITE-BASED RESEARCH**

C5 site-based research currently includes 25 active studies and 20 studies pending open in heart failure, invasive cardiology and vascular medicine. There are also 80 cardiovascular genetics registries. Other site-based research includes the specialties of electrophysiology, cardiovascular imaging, and preventive cardiology and rehabilitation.

<table>
<thead>
<tr>
<th>Platelet GP IIb/IIIa Inhibitors</th>
<th>Enrollment</th>
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<tbody>
<tr>
<td>EPILOG Abciximab in PTCA</td>
<td>2,800</td>
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<td>EPISTENT Abciximab in stenting</td>
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<td>RAPPORT Abciximab in primary PCI</td>
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<td>ERASER Abciximab for restenosis</td>
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<td>TARGET Abciximab vs. Tirofiban for PCI</td>
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<td>FINESSE Abciximab in facilitated PCI for MI</td>
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<td><strong>Clopidogrel</strong></td>
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<tr>
<td>CREDO Clopidogrel during PCI</td>
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<td>CHARISMA Clopidogrel for prevention</td>
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<td><strong>Direct Thrombin Inhibitors</strong></td>
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<td>CACHET Bivalirudin pilot in PCI</td>
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<td>REPLACE 1 Bivalirudin in PCI</td>
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<td>REPLACE 2 Bivalirudin vs. GP IIb/IIIa in PCI</td>
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<tr>
<td><strong>Other Antithrombotics</strong></td>
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<td>ASIS Modified Factor VII in PCI</td>
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<tr>
<td>CRUISE Eptifibatide and Enoxaparin in PCI</td>
<td>260</td>
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<tr>
<td>SHINE Hexadecasaccharide in ACS/PCI</td>
<td>540</td>
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<td><strong>Atherosclerosis Progression – Lipid Agents</strong></td>
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<td>Esperion Apo A1 Milano HDL (IVUS)</td>
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<td>ACTIVATE ACAT inhibitor (IVUS)</td>
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<td>REVERSAL Atorvastatin vs. Pravastatin (IVUS)</td>
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<tr>
<td>ASTEROID Rosuvastatin (IVUS)</td>
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<tr>
<td>ILLUSTRATE CETP Inhibitor – Torcetrapib (IVUS)</td>
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<td><strong>Atherosclerosis Progression – Other Agents</strong></td>
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<td>CAMELOT/NORMALISE Amlodipine vs. Enalapril (IVUS)</td>
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<td>EMBF / EMBB PPAR alpha (IVUS)</td>
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<td>PERISCOPE Pioglitazone vs. Glimepridine (IVUS)</td>
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<td>PPAR Rosiglitazone – CV events pilot</td>
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<tr>
<td><strong>Cannaboid Receptor Antagonist</strong></td>
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<td>STRADIVARIUS Rimonabant - IVUS</td>
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<td>CRESCENDO Rimonabant – CV events</td>
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<tr>
<td><strong>COX-2 Inhibitors</strong></td>
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<tr>
<td>PRECISION Celecoxib vs NSAIDS – CV events</td>
<td>20,000</td>
</tr>
</tbody>
</table>
In 2006, there were over 2.7 million visits to the Heart and Vascular Institute website from 1.9 unique individuals. This represents a 35 percent increase from 2005.

The most frequently visited page on our website was about heart attack symptoms.

ONLINE NURSE CHATS

The personalized “Chat Online with a Nurse” feature was added to the Heart and Vascular Institute website to allow web visitors to be instantly connected to our highly-trained cardiovascular registered nurses via an online “chat.” Web users can type in a question and receive a “real-time” reply through a secure connection, during designated hours.

The nurses are available to provide information, not to diagnose conditions. They can simultaneously chat and direct the user to specific web pages for more information. The user can choose to remain anonymous, and the correspondence is strictly confidential.

In just over one month, the nurses chatted with 437 individuals.

SPECIAL ASSISTANCE FOR OUT-OF-STATE PATIENTS

800.223.2273 ext. 55580
E-mail: medicalconcierge@ccf.org

The Cleveland Clinic’s Medical Concierge program is a complimentary service for patients who travel to Cleveland Clinic from outside Ohio. Our patient care representatives facilitate and coordinate the scheduling of multiple appointments; provide access to discounts on airline tickets and hotels, when available; make reservations for hotel or housing accommodations; and arrange leisure activities.
Patient Experience

We ask our patients about their experience and satisfaction with the services provided by our staff. Although our patients are already indicating we provide excellent care, we are committed to continual improvement.

OVERALL QUALITY OF INPATIENT CARE

% Responses

0 20 40 60 80 100

Excellent Very Good Good Fair Poor

Response Choices 2006, N = 1,047

This service excellence data shows calendar year 2006 results from an external patient experience survey administered for Cleveland Clinic.

A new national standard patient experience survey instrument called H-CAHPS was instituted across the country on October 1, 2006. Public reporting of initial results on the Centers for Medicare and Medicaid Services (CMS) Hospital Compare website (hospitalcompare.hhs.gov) is anticipated in late 2007. Accordingly, Cleveland Clinic will transition to reporting H-CAHPS inpatient service excellence results in the 2007 outcomes booklet.

OVERALL QUALITY OF OUTPATIENT CARE

% Responses

0 20 40 60 80 100

Excellent Very Good Good Fair Poor

Response Choices 2006, N = 5,032
HEART AND VASCULAR RESOURCE CENTER

Phone: 216.445.9288; toll-free 866.289.6911
E-mail: Use the “Contact Us” format at www.clevelandclinic.org/heart

The Heart and Vascular Resource Center is staffed by cardiovascular registered nurses who are dedicated to providing education and support to patients and families who are faced with cardiovascular and thoracic disease. Together, our nurses have almost 100 years of cardiovascular nursing experience. Along with our new online chat feature, these nurses are responsible for answering e-mails and phone calls that come into the Heart and Vascular Institute.

Resource and Information Center Funding

AT&T donated a gift of $1 million to improve communication and education resources for patients and families through traditional educational and support materials, as well as advanced technology. In addition to online nurse “chats” and web mail services, live web events will help patients and families from around the world understand their cardiovascular condition and treatment options.

In the new Sydell and Arnold Miller Family Pavilion, the Resource and Information Center will offer a physical space to provide educational and support materials to the thousands of patients and families who visit the Heart and Vascular Institute each year.

Patient Experience

OVERALL QUALITY OF CARDIAC CATHETERIZATION LAB

Response data from January through June, 2006

% Responses

<table>
<thead>
<tr>
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<th>%</th>
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<td>Excellent</td>
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<td>10</td>
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<tr>
<td>Fair</td>
<td>1</td>
</tr>
<tr>
<td>Poor</td>
<td>0</td>
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</table>

Response Choices 2006, N = 115
When Christopher Milde was just 2 days old, he was diagnosed with Wolf-Parkinson-White syndrome, a rare type of arrhythmia or heart rhythm disorder. Medication to control his symptoms only worked for so long. Eventually the episodes of arrhythmia increased wildly — his heart rate would skyrocket to 280 beats a minute — causing many trips to the emergency room. Controlling Chris’s symptoms also was complicated by the fact that he has Down syndrome, autistic spectrum disorder and obsessive-compulsive disorder.

Chris’s parents, Christie and Colin, sought the advice of several experts and were told that Andrea Natale, M.D., a Cleveland Clinic expert in cardiac arrhythmia, was the only person who could help their son. His condition required cardiac ablation, but not using a standard approach. Twice before, Chris had undergone attempts at ablation, but they both failed. The Mildes felt Dr. Natale was their only hope.

Desperate, Christie applied to the Larry King Cardiac Foundation for help. Within just weeks, they had an answer — and an appointment at Cleveland Clinic for an evaluation and treatment.

A day after Dr. Natale performed the ablation procedure, an EKG showed that 13-year-old Chris’s arrhythmia was history. For Chris, it means being able to participate in more activities and go to summer camp. For his parents, it’s one less thing their son will have to worry about when he’s grown.
DEPARTMENT OF CARDIOVASCULAR MEDICINE

Steven E. Nissen, M.D.
Chairman

Randall C. Starling, M.D., M.P.H. and
E. Murat Tuzcu, M.D.
Vice Chairmen, Clinical Affairs

A. Michael Lchioff, M.D.
Vice Chairman, Research

AORTA CENTER, MARFAN SYNDROME CLinic AND CONNECTIVE TISSUE DISORDER CLinic

Our multidisciplinary team of experts provides ongoing comprehensive care for patients with Marfan syndrome and diseases of the aorta, as well as those with connective tissue disorders, such as Ehler-Danlos disorder, polychondritis, scleroderma, osteogenesis imperfecta, polycystic kidney disease and Turner syndrome. Genetic screening and ongoing research and education provide patients with innovative therapies.

Lars Svensson, M.D., Ph.D.
Director

Eugene Blackstone, M.D.
Brian Clark, M.D., Ph.D.
Roy Greenberg, M.D.
Brian A. Griffin, M.D.
Richard A. Grimm, D.O.
Bruce Lytle, M.D.
Eric Roselli, M.D.
Maran Thamilarasan, M.D.
Timothy Williams, M.D.

CARDIAC ELECTROPHYSIOLOGY AND PACING

We offer a wide range of electrophysiology and mapping procedures to diagnose and treat suspected heart rhythm abnormalities.

Andrea Natale, M.D.
Section Head
Medical Director, Center for Atrial Fibrillation
Director, Electrophysiology Laboratories

Mauricio Arruda, M.D.
Mandee Bhargava, M.D.
J. David Burkhardt, M.D.
Lon W. Castle, M.D.
Mina K. Chung, M.D.
Jennifer E. Cummings, M.D.
Thomas Dresing, M.D.
Fetnat Fouad-Tarazi, M.D.
Fredrick J. Jaeger, D.O.
Mohamed Kanj, M.D.
David O. Martin, M.D., M.P.H.
Robert D. Mosteller, M.D.
Walid I. Saliba, M.D.
Robert A. Schweikert, M.D.
Richard Sterba, M.D.
Patrick J. Tchou, M.D.
Oussama Wazni, M.D.
Bruce L. Wilkoff, M.D.
CARDIOVASCULAR IMAGING

We have one of the largest and most experienced imaging centers in the United States. Cleveland Clinic cardiovascular imaging specialists have pioneered the use of stress echocardiography in evaluating heart valve disease, hypertrophic cardiomyopathy, aortic aneurysm, patent foramen ovale, and diastolic dysfunction in amyloidosis and constrictive pericarditis.

We also use a variety of other imaging techniques including TEE, nuclear imaging, cardiac MRI and coronary CTA to diagnose and optimize treatment plans for patients with cardiovascular disease.

James D. Thomas, M.D.
Section Head
Manuel Cerqueira, M.D.
Milind Desai, M.D.
Scott Flamm, M.D.
Brian A. Griffin, M.D.
Richard A. Grimm, D.O.
Wael Jaber, M.D.
Allan L. Klein, M.D.
Harry M. Lever, M.D.
Chiara Liguori, M.D.
Venugopal Menon, M.D.
L. Leonardo Rodriguez, M.D.
Paul Schoenhagen, M.D.
Ellen Mayer-Sabik, M.D.
Takahiro Shiota, M.D.
Srikanth Sola, M.D.
William James Stewart, M.D.
Maran Thamilarasan, M.D.

CLINICAL CARDIOLOGY

We offer the latest innovations in cardiac care and clinical therapies to patients of all ages, including state-of-the-art tests and procedures to assist in accurate diagnosis and treatment planning.

Gary S. Francis, M.D.
Section Head
Raghavendra R. Allareddy, M.D.*
Arman Askari, M.D.
Ajay Bhargava, M.D.
Caroline Casserly, M.D., M.B.A.
Michael Faulx, M.D.
Adriana Fodor, M.D.*
Heather Gornik, M.D.
Donald F. Hammer, M.D.
Joel B. Holland, M.D.
Julie Huang, M.D.
Fuad Y. Jubran, M.D.
Vidyasagar Kalahasti, M.D.
Richard Krasuski, M.D.
Michael S. Lauer, M.D.
Thomas Lutz, M.D.*
Girish Mood, M.D.*
Steven E. Nissen, M.D.
Marc S. Penn, M.D., Ph.D.
Mehdi Razavi, M.D.*
Michael B. Rocco, M.D.
Michael B. Rollins, M.D.
Dennis J. Rupp, M.D.
Kenneth E. Shafer, M.D.
Mustaphasahim Shaaraoui, M.D.*
Derek Smith, M.D.*
Terrence G. Tulisiak, M.D.
Donald A. Underwood, M.D.
Bennett Werner, M.D.
Timothy Williams, M.D.

*Hospitalists
HEART FAILURE AND CARDIAC TRANSPLANT MEDICINE

The George M. and Linda H. Kaufman Center for Heart Failure offers a comprehensive, integrative approach to the research, diagnosis and treatment of heart failure and cardiomyopathy. Cleveland Clinic Cardiac Transplant program is a recognized leader in the field, and is the leading center in Ohio and the Midwest.

Randall C. Starling, M.D., M.P.H.
Section Head, Heart Failure and Cardiac Transplant Medicine
Medical Director, Kaufman Center for Heart Failure

Corinne Bott-Silverman, M.D.
Mazen Hanna, M.D.
Robert E. Hobbs, M.D.
Eileen Hsich, M.D.
Karen B. James, M.D.
Christine Moravec, Ph.D.
Gustavo Rincon, M.D.
W.H. Wilson Tang, M.D.
David O. Taylor, M.D.
Mohamad H. Yamani, M.D.
James B. Young, M.D.

INVASIVE CARDIOLOGY

We offer cutting-edge diagnostic tests and non-surgical interventional treatments for atherosclerosis and congenital heart disease, using stents, angioplasty, intravascular ultrasound, embolic-protection devices and enhanced external counterpulsation (EECP).

Coronary angiography was developed at Cleveland Clinic in 1958 by F. Mason Sones, M.D. The F. Mason Sones Cardiac Catheterization Laboratory features eight catheterization laboratories and more than 45 catheterizations are performed on a typical day.

Stephen Ellis, M.D.
Section Head and Director, Sones Cardiac Catheterization Laboratory and Co-Director, Cardiac Genebank

Christopher Bajzer, M.D.*
Deepak Bhatt, M.D.*
Corinne Bott-Silverman, M.D.
Sorin Brener, M.D.*
Leslie Cho, M.D.*
Khosrow Dorosti, M.D.
Michael Faulx, M.D.
Irving Franco, M.D.*
Mazen Hanna, M.D.
Frederick A. Heupler, Jr., M.D.
Robert E. Hobbs, M.D.
Vidyasagar Kalahasti, M.D.
Samir Kapadia, M.D.*†
Richard Krasuski, M.D.†
A. Michael Lincoff, M.D.*
Marc S. Penn, M.D., Ph.D.
Russell E. Raymond, D.O.*
Gustavo Rincon, M.D.
Conrad C. Simpfendorfer, M.D.*
E. Murat Tuzcu, M.D.*†
Patrick L. Whitlow, M.D.*

*Coronary Interventionalists
†Interventionalists who also perform percutaneous structural heart procedures
PREVENTIVE CARDIOLOGY AND REHABILITATION

Our mission is to reduce the development and/or progression of coronary artery disease as demonstrated by a reduction in cardiac events. Our treatment approach encompasses both cardiovascular disease prevention and rehabilitation.

The Women’s Cardiovascular Center is an outpatient clinical program in this Section, which utilizes a multidisciplinary team of providers to prevent the occurrence or progression of cardiovascular disease in women.

Stanley L. Hazen, M.D., Ph.D.
Section Head, Preventive Cardiology and Rehabilitation Director, Center for Cardiovascular Diagnostics and Prevention

Leslie Cho, M.D.
Medical Director, Preventive Cardiology and Rehabilitation Director, Women’s Cardiovascular Center

Gordon Blackburn, Ph.D.
Program Director, Cardiac Rehabilitation

John Campbell, M.D.
Department of General Internal Medicine

Byron Hoogwerf, M.D.
Department of Endocrinology

Julie Huang, M.D.
Department of Cardiovascular Medicine

Sangeeta Kashyap, M.D.
Department of Endocrinology

Richard Lorber, M.D.
Department of Pediatric Cardiology

Leo Pozuelo, M.D.
Department of Psychiatry and Psychology

Michael Rocco, M.D.
Department of Cardiovascular Medicine

Doug Rogers, M.D.
Head, Section of Pediatric Endocrinology

Paul Schoenhagen, M.D.
Department of Diagnostic Radiology

Donald Vidt, M.D.
Department of Nephrology

VAScular MEDICINE

Our dedicated group of physicians continues to grow and provide innovative world-class care. Vascular medicine specialists provide expert care for a wide variety of conditions. The section operates both inpatient and outpatient consultative services. In addition, it has several specialized outpatient clinics including

We offer comprehensive vascular care including the diagnosis and management of arterial, venous and lymphatic disorders, as well as acute and long-term care of patients with hypercoagulable disorders.

John R. Bartholomew, M.D.
Section Head, Vascular Medicine and Staff Physician, Hematology and Medical Oncology

Firas Al Solaiman, M.D.
Christopher Bajzer, M.D.*
Deepak Bhatt, M.D.*
Teresa Carman, M.D.
Leslie Cho, M.D.*
Carmen Fonseca, M.D.
Heather Gornik, M.D.
Douglas Joseph, D.O.
Samir Kapadia, M.D.*
Michael Maier, D.P.M.
William Ruschhaupt, M.D.
Patrick L. Whitlow, M.D.*

*Vascular interventionalists who perform interventional and endovascular procedures
FELLOWSHIP PROGRAM IN CARDIOVASCULAR MEDICINE

Our Fellowship Program is the largest cardiovascular disease fellowship program in the United States, with over 60 core and advanced fellows currently enrolled.

Brian A. Griffin, M.D.
Director, Cardiovascular Medicine Fellowship Program

Arman Askari, M.D.
Associate Director, Cardiovascular Medicine Fellowship Program

Marc S. Penn, M.D., Ph.D.
Associate Director, Cardiovascular Medicine Fellowship Program

Samir Kapadia, M.D.
Director, Intervention Fellowship Program

CLEVELAND CLINIC REGIONAL MEDICAL PRACTICE

These locations offer cardiovascular medicine specialty services in neighboring Cleveland communities.

Cleveland Clinic Beachwood
Family Health and Surgery Center
Joel B. Holland, M.D.
Michael B. Rocco, M.D.

Cleveland Clinic Independence
Family Health and Surgery Center
Michael B. Rollins, M.D.

Cleveland Clinic Lorain
Family Health Center
Samuel Puccinelli, Jr., M.D.
Richard Sterba, M.D. – Pediatric Cardiology

Cleveland Clinic Strongsville
Family Health and Surgery Center
Terrence G. Tulisiak, M.D.

Cleveland Clinic Westlake
Family Health and Surgery Center
Caroline Casserly, M.D., M.B.A.
Lon W. Castle, M.D.
Thomas B. Edel, M.D.
Robert D. Mosteller, M.D.
Ashoka Nautiyal, M.D.
Samuel Puccinelli, Jr., M.D.
Curtis Rimmerman, M.D.

Cleveland Clinic Willoughby Hills
Family Health and Surgery Center
Dennis J. Rupp, M.D.

Cleveland Clinic Wooster
Family Health and Surgery Center
Kenneth E. Shafer, M.D.
Bennett Werner, M.D.
Richard Sterba, M.D. – Pediatric Cardiology

CARDIOVASCULAR MEDICINE, CLEVELAND CLINIC FLORIDA

Craig Asher, M.D.
Howard S. Bush, M.D.
Bernardo Fernandez, M.D.
Kenneth R. Fromkin, M.D.
Marcelo Eduardo Helguera, M.D.
Gian M. Novaro, M.D.
Sergio Pinski, M.D.
Michael Shen, M.D., M.S.
## Contact Information

<table>
<thead>
<tr>
<th><strong>Web Address</strong></th>
<th><strong><a href="http://www.clevelandclinic.org/heart">www.clevelandclinic.org/heart</a></strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct to Cardiologist</strong></td>
<td>A Cleveland Clinic operator-assisted telephone number. State the doctor’s name, and you will be connected directly to the office.</td>
</tr>
<tr>
<td></td>
<td><strong>216.444.2200</strong></td>
</tr>
<tr>
<td></td>
<td><strong>800.223.2273</strong></td>
</tr>
<tr>
<td><strong>Cardiovascular Medicine Appointments</strong></td>
<td><strong>216.444.4462</strong></td>
</tr>
<tr>
<td></td>
<td><strong>800.223.2273 ext. 44462</strong></td>
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<tr>
<td><strong>Preventive Cardiology and Rehabilitation Appointments</strong></td>
<td><strong>216.444.9353</strong></td>
</tr>
<tr>
<td></td>
<td><strong>800.223.2273 ext. 49353</strong></td>
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<tr>
<td><strong>Women's Cardiovascular Center</strong></td>
<td><strong>216.444.9343</strong></td>
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<tr>
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<td><strong>800.223.1696</strong></td>
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<td><strong>Vascular Medicine Appointments</strong></td>
<td><strong>216.444.4420</strong></td>
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<td><strong>800.223.2273 ext. 44420</strong></td>
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<tr>
<td><strong>Cardiovascular Medicine Research</strong></td>
<td><strong>216.445.4138</strong></td>
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<td><strong>800.223.2273 ext. 54138</strong></td>
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<tr>
<td><strong>Cardiothoracic Surgery Research</strong></td>
<td><strong>216.444.6712</strong></td>
</tr>
<tr>
<td></td>
<td><strong>800.223.2273 ext. 46712</strong></td>
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<tr>
<td><strong>Heart Failure Research</strong></td>
<td><strong>216.445.6572</strong></td>
</tr>
<tr>
<td></td>
<td><strong>800.223.2273 ext. 56572</strong></td>
</tr>
<tr>
<td><strong>Evaluation for Cardiac Surgery</strong></td>
<td>Surgical nurse practice managers will expedite the review of patient records with a Cleveland Clinic surgeon and address questions.</td>
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<tr>
<td></td>
<td><strong>216.444.3500</strong></td>
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<td></td>
<td><strong>877.8.HEART1</strong></td>
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</tbody>
</table>

*continued on page 56*
## Contact Information

| **Hospital Transfers** | The Appointment Center provides physicians with 24/7 hospital transfer assistance. | 216.444.8302  
800.553.5056 |
|------------------------|---------------------------------------------------------------------------------|------------------|
| **Insurance Counselors:**  
Cardiovascular Medicine | 216.444.9434  
800.223.2273 ext. 49434 | **Insurance Counselors:**  
Cardiovascular Surgery | 216.445.0430  
800.223.2273 ext. 50430 |
| **Service for Out-of-State Patients** | Our Medical Concierge patient care representatives help facilitate appointments for out-of-state patients. | 800.223.2273 ext. 55580  
medicalconcierge@ccf.org |
| **eCleveland Clinic** | A service for patients including remote medical second opinion consultations and nutrition consultations, an online health management tool, remote cardiology film second opinion, and more. | www.eclevelandclinic.org |
| **DrConnect** | Whether you are referring from near or far, our eClevelandClinic service, DrConnect, can streamline communication from Cleveland Clinic physicians to your office. This online tool offers you secure access to your patient’s treatment progress at Cleveland Clinic. With one-click convenience, you can track your patients’ care using the secure DrConnect website. To establish a DrConnect account, visit or email: | www.eclevelandclinic.org  
drconnect@ccf.org |
| **Heart and Vascular Institute Resource Center** | Registered nurses are available to answer patients’ questions. Monday-Friday, 8:30 am to 4:00 pm. | 216.445.9288  
866.289.6911 |
Founded in 1921, Cleveland Clinic is a not-for-profit academic medical center that integrates clinical and hospital care with research and education. Today, 1,700 Cleveland Clinic physicians and scientists practice in 120 medical specialties and subspecialties. Cleveland Clinic’s main campus, with 41 buildings spanning 130 acres, includes a 1,000-bed hospital, an outpatient clinic, subspecialty centers, and supporting laboratories and facilities.

Cleveland Clinic also operates 13 family health centers, 8 community hospitals and 2 affiliate hospitals, and a medical facility in Weston, Florida.

Cleveland Clinic is determined to exceed the expectations of patients, families, and referring physicians. In light of this goal, we are committed to providing accurate and timely information about our patient care. Through participation in national initiatives, Cleveland Clinic supports transparent public reporting of healthcare quality data.

Cleveland Clinic participates in the following public reporting initiatives:

- Joint Commission Performance Measurement Initiative (qualitycheck.org)
- Centers for Medicare and Medicaid Services (CMS) Hospital Compare (hospitalcompare.hhs.gov)
- The Leapfrog Group (leapfroggroup.org)
- Ohio Department of Health Service Reporting (odh.state.oh.us)

In addition, this publication was produced to assist patients and referring physicians in making informed decisions. To that end, information about care and services is provided, with a focus on outcomes of care. For more information, please visit the Cleveland Clinic Quality web site at clevelandclinic.org/quality.

#1 Heart Center in America

For the 12th year in a row, the Cleveland Clinic Heart and Vascular Institute has been ranked America’s number one heart program in U.S. News & World Report’s prestigious “Best Hospitals” survey.