Dear Colleagues:

Medicine is not a quest for consensus; it’s a perpetual striving for better patient outcomes. Better outcomes are the product of individual and organizational commitments to continuous clinical improvement and innovation.

At Cleveland Clinic, innovation is part of our DNA. That is why we host a national summit every year to talk about it, and why we have an arm that spins off our capital of ideas.

Throughout this issue, you’ll find the word “innovation” mentioned frequently. We’ve brought together a collection of stories about innovation that recount exciting progress in the field of cardiovascular medicine and surgery. You’ll hear from the scientists who are at the bench exploring new ideas and the doctors who are at the bedside making them happen. Our cover story explores a wide range of innovations in which we demonstrate the parallel spirit of collaboration that is inherent in our group practice model.

Innovation takes many forms as we look toward the future of healthcare. We recount our ongoing work with devices — such as a continuous-flow artificial heart, a new stent-valve and biodegradable stents. In clinical trials, we’re working on one of the deadliest diseases known in the developed world - obesity - through groundbreaking trials of new weight-loss drugs. And we recount how we respond to patient care in the digital age with a story about how we’re bringing the popular tablet computers into our practice.

Aside from our commitment to exploring new frontiers, our patients benefit from our model of care right now. The hallmark of our system of care is collaboration, from our electronic medical records and physician communication systems such as MyConsult to our team approach to patient care. Patients First is also a critical part of our DNA at Cleveland Clinic.

Sincerely,

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Cardiac Consult offers updates on state-of-the-art diagnostic and management techniques from Cleveland Clinic heart and vascular specialists. Please direct correspondence to:

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Sydell and Arnold Miller Family Heart & Vascular Institute, ranked No. 1 in the nation for cardiac care by U.S. News & World Report every year since 1995, accommodates nearly 300,000 patient visits each year in world-class facilities. Staff are committed to researching and applying state-of-the-art diagnostic and management techniques. Cleveland Clinic is a not-for-profit, multispecialty academic medical center.

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A Totally New Total Artificial Heart

It’s compact, self-contained and constructed of titanium. It is powered through a slender cable connected to a lightweight battery. The whole device weighs less than a pound. And it self-adjusts depending on the needs of the patient.

The new device is the continuous-flow total artificial heart, or CFTAH. It’s markedly different than any other device on the market – it has no valve, and only one moving part. Biomedical engineers at Cleveland Clinic and its partner in the venture, Cleveland Heart Inc., are in fact working on two devices, – both referred to with the umbrella term “SmartHeart”: one is the CFTAH and the other a left ventricular assist device (LVAD).

CFTAH is the groundbreaking innovation. It demonstrates progress in the artificial heart area in two important ways: automatic speed control and self-regulation to balance right-left inlet pressures.

The Fewest Moving Parts Possible

The device is elegantly simple: it has one moving part and one electromechanical component. It does not have, or have the need for, valves, sensors, actuation mechanisms or flexible blood-pumping elements. A slender cable feeds the device power, which originates from a rechargeable battery that patients can easily strap on and that is largely invisible under most garments.

The unique design is the result of combining the best features of left and right VADs into a single-moving-part device. The simplicity of controlling only one function eliminates the need for sensors that balance functions of the two sides of the heart, reducing complexity and therefore failure risk to the system. Fewer moving parts will make the device more reliable and potentially less expensive than conventional devices.

“Our initial results with biocompatibility on this device are encouraging,” says Leonard Golding, MD Program Director of the artificial heart program. In addition, durability is improved, since the components of the device don’t make contact with each other, and therefore don’t wear out.” The device is also small and light – making it appropriate for small women and adolescent patients.

Born of Aerodynamic Sensibilities

Dr. Golding says that it was a former aerospace engineer, David Horvath, PhD, a staff member in the Department of Biomedical Engineering, who advocated pursuing what has become known as the CFTAH technology at Cleveland Clinic.

Mr. Horvath’s tenacity and skills drove the initial data collection and design work that led to grants from the NIH to take the concept to the next level. With additional government funding, further design enhancements ensued. Private funding from outside sources followed last year.

Keep it Simple

Dr. Nader Moazami, Surgical Director of Cardiac Transplantation and the Ventricular Assist Device Therapy Program, who is participating in studies of the device, is also encouraged by the evolution of the CFTAH. He is optimistic that this device, once it reaches the human trials stage within the next several years, will also help bridge the gap in solving a common problem – many patients have not only left-side but also right-side heart failure issues. Strides have been made with LVADs, but the pace has been slower with RVADs. The CFTAH may be a simple, durable solution to this imbalance.

And, he points out, this device can solve another problem common to those with older artificial hearts. “We can’t hear these new devices when they are operating,” Dr. Moazami says, “which makes them more socially acceptable.”

For additional information, contact Dr. Golding at 216.444.1205 or goldinl@ccf.org. Dr. Moazami can be reached at 216.444.6708 or moazami@ccf.org.
The concept of the mitral stent-valve delivery system was designed by José L. Navia, MD, a surgeon in the Department of Thoracic and Cardiovascular Surgery, and developed in conjunction with colleagues at the Lerner Research Institute and Cleveland Clinic Innovations. "The application of catheter-delivery techniques in high-risk patients is challenging, especially for patients with mitral regurgitation in whom transcatheter or minimally invasive procedures represent an unmet need," says Dr. Navia. A transcatheter-implanted mitral stent-valve may offer an effective treatment alternative for those patients who need mitral valve replacement but have dilated cardiomyopathy or other high-risk conditions.

Feasibility studies of the stent-valve delivered via open-heart direct implantation in an animal model demonstrate excellent functioning of the mitral valve. The concept for a stent to repair a mitral valve without sutures was broadened with the help of the Cleveland Clinic Innovations team. After receiving a patent for the concept of a catheter-based mitral valve replacement device, product development funds were provided by the Global Cardiovascular Innovation Center.

Dr. Navia worked with Lerner Research Institute engineers to develop and test prototypes. "After exploring different designs and receiving feedback, we developed a balloon-expandable stent in which we mounted a valve," he says. The sutureless delivery is accomplished through a design that uses two sets of stent wings that surround the valve and incorporate leaflets that press against the valve annulus. The wings open with stent expansion, so that the stent-valve attaches securely to the valve annulus through radial force. The prosthetic valve is positioned over the native valve.

Animal Studies Confirm Excellent Valve Performance

Feasibility studies were conducted on eight sheep over almost two years. The stent-valves were deployed in the mitral annular position, through a left thoracotomy access, cardiopulmonary bypass institution and direct valve implantation in a beating heart.

Sutures No More: Transcatheter Mitral Stent-Valve System

A novel sutureless transcatheter mitral stent-valve system may one day enable mitral valve replacement for patients with severe mitral regurgitation who were previously not candidates for surgery. Currently, mitral valve replacement can only be performed as a surgical procedure; all catheter-based valve replacement products are for the aortic valve.
Passing Out Leaflets

The Cleveland Clinic-developed ValveXchange® implants a permanent ring, or annulus, and allows doctors to replace worn leaflets with minimal fuss.

Tissue-based implantable valves are preferred to mechanical alternatives for valve replacement surgery. The bioprosthetic devices eliminate the need for recipients to follow a lifelong blood-thinning regimen. However, there are drawbacks. The bioprosthetic leaflets can wear out in five to 10 years. This calls for the replacement of the entire unit and a second surgery with inherent risks. But a new device now allows surgeons to exchange only the leaflets and leave the ring in place – all through a small incision.

Cleveland Clinic cardiac surgeon Lars Svensson, MD, PhD, helped develop a new valve replacement technology that eliminates the need for open-heart surgical implantation and replacement of prosthetic tissue valves. It’s called ValveXchange. This technology has three parts: a permanent implantable ring, easily replaceable leaflets, and the tools that can quickly implant the ring and remove and replace the leaflets.

The operation is performed through a small incision in the chest. Additional research on this device is needed to determine the procedure for reoperations if they should become necessary. If a second operation is later needed, it may possibly be done transapically via a small incision on the left chest wall. This would allow for replacement leaflets to be inserted after taking out the old leaflets.

If patients are not candidates for minimally invasive “keyhole” replacements, which currently demonstrate excellent results (99.4 percent survival in 2011, and 99.6 percent survival recorded during the first six months of 2012), some of these patients may be eligible for transcatheter aortic valve replacement (TAVR) – another minimally invasive approach.

Dr. Svensson performed the first-in-man implantation of ValveXchange in 2011. “There have been 24 patients implanted in Europe and the device should have European approval by summer of next year,” he says. “We will then start working on FDA approval for use in the United States.”

For more information, contact Dr. Svensson at 216.445.4813 or svenssl@ccf.org.

Visit clevelandclinic.org/heart

For additional information, contact Dr. Navia at 216.444.5104 or naviaj@ccf.org.
The idea to line endovascular stent grafts with peritoneal tissue was sparked 20 years ago, when Dr. Sarac was repairing a ruptured abdominal aortic aneurysm and noticed that the blood was clotting to everything except the peritoneal tissue. Based on that concept, he founded Peritec Biosciences, a Cleveland Clinic Innovations spin-off company that is focused on developing related clinical therapies.

Dr. Sarac’s research has resulted in two major innovations:

- A tissue-lined nitinol stent that resists fractures, to help prevent restenosis and occlusion.
- A fracture-resistant, tissue-lined bioabsorbable polymeric stent graft — that dissolves after three to six months — to treat arterial injuries as well as stenosis and occlusions.

“Our work has demonstrated that when bovine peritoneal tissue is used to line lower extremity arterial stents, it acts as a clot-resistant layer that improves patency and limits neointimal hyperplasia,” Dr. Sarac says. This technology has many potential clinical applications, starting with lower extremity stent grafts for arterial injuries and stents for blockages.

**Tissue-Lined Stent Grafts for Arterial Injuries**

Peritec Biosciences has been working on the development of a fracture-resistant tissue-lined nitinol stent for the past 10 years, research that has been supported by Peritec and an NIH Small Business Innovation Research grant. “Our data from extensive testing suggest that the peritoneum helps resist restenosis, does not clot and supports the stent from fractures,” Dr. Sarac says.

One application of Dr. Sarac’s research — minimally invasive repair of blood vessel injuries with tissue-lined nitinol stent grafts — was born on the battlefield. Dr. Sarac’s work stemmed from his service at Walter Reed Army Medical Center as a reservist during the wars in Iraq and Afghanistan. Severe blast trauma injuries in U.S. soldiers, which increased by tenfold, are caused primarily by the use of improvised explosive devices. To address this growing problem, the U.S. military’s Armed Forces Institute of Regenerative Medicine (AFIRM) has supported Peritec’s research.

“The preclinical work for a bioabsorbable tissue-lined stent graft has taken place over the past five years and has been supported by AFIRM,” Dr. Sarac says. The technology is designed to support the injured artery for three to six months to re-establish blood flow. The tissue heals into the vessel and the stent dissolves. The stent needs to be strong enough to resist early fatigue but dissolves to eliminate sequelae of long-term fatigue.

“The military initiated this research because of concerns about young soldiers having a metal prosthesis in their legs for many decades if they lived to be 60 to 80 years old,” Dr. Sarac says. “Because the stents are manufactured from polymer, they degrade as the injury heals, the fracture risk is also significantly decreased over time.”

**Major Clinical Trial for Arterial Blockages**

Peritec’s work to develop a fracture-resistant, tissue-lined nitinol stent graft has paved the way for a multicenter national trial that applies the same technology to the stenting of blocked arteries in the legs. “We have met with the Food and Drug Administration and are near completion of our preclinical work,” Dr. Sarac says. The clinical trial, which will include 200 patients, is expected to begin within a year. Future studies will evaluate the bioabsorbable stent technology for the treatment of lower extremity stenosis and occlusions.

Dr. Sarac says, “It is hoped that this ongoing research into tissue-lined nitinol and bioabsorbable stent technology for the lower extremities could have broader clinical implications for the treatment of blood vessel blockages in dialysis access, carotid arteries, and heart and liver failure TIPS [transjugular intrahepatic portosystemic shunts].”

For more information, contact Dr. Sarac at 216.445.5502 or saract@ccf.org.
Under-Cover ICDs
Subcutaneous ICDs Could be a Real Game Changer in Implant Technology

Subcutaneous implantable cardiac defibrillators (ICD) are a less invasive and potentially better alternative than transvenous ICDs for some patients with life-threatening ventricular tachyarrhythmias, particularly those on dialysis, with infections or with venous access issues.

Implant technology has changed a lot over the years, and so has the data supporting it,” says Bruce Wilkoff, MD, Director, Cardiac Pacing and Tachyarrhythmia Devices in the Department of Cardiovascular Medicine.

Because a subcutaneous ICD lead does not enter the vascular space and is not in direct contact with the heart, arrhythmia detection is accomplished differently than with transvenous ICDs.

Transvenous vs. Subcutaneous ICDs

Transvenous ICD leads fed directly into the vascular space detect heart rate only from a specific location dictated by the leads’ placement. This method provides limited insight about electrical activity outside the target area. Although it allows for excellent sensitivity in the detection of ventricular tachyarrhythmias, the trade-off can be diminished specificity and frequent inappropriate shocks. Performance is highly dependent on the programming of the device.

“With the subcutaneous ICD, you are looking at a larger view of the heart because the device does not actually touch the heart and the performance is less dependent on the programming,” says Dr. Wilkoff.

By using a series of sensing electrodes to record vectors of cardiac electrical conduction and the application of discrimination algorithms, subcutaneous ICDs “wait” until there is certainty that a tachyarrhythmia is detected before shocking a patient back into rhythm.

continued on next page ➢
Patients with venous access problems and those on dialysis in whom additional leads in their veins should be avoided are strong candidates for subcutaneous ICDs.

“This is a brand new way of identifying arrhythmias,” Dr. Wilkoff says. “This algorithmic approach to identifying arrhythmias may very well be a superior way of going about it.”

Subcutaneous placement obviates the possibility of leads dislodging from the heart. In addition, implanting and explanting electrodes is much easier with a subcutaneous ICD.

**Shocking News: The MADIT-RIT Trial**

A recent study showed that patients with tachyarrhythmias who have implantable ICDs fare better when the devices are programmed to wait out irregular heartbeats that aren’t sustained.

A randomized trial known as MADIT-RIT (Multicenter Automatic Defibrillator Implantation Trial — Reduce Inappropriate Therapy) showed that ICD therapy results in fewer inappropriate shocks and a reduced rate of all-cause mortality when programmed to detect ventricular tachycardia or fibrillation with two strategies: 1) deliver therapy at a heart rate of 200 bpm or higher or 2) with a prolonged delay in therapy at 170 bpm or higher. Both of these strategies were compared with conventional programming.

During 1.4 years of follow-up, the high rate and delayed therapy programming strategies reduced the risk of a first occurrence of an inappropriate shock by about 80 percent and reduced the rate of all-cause mortality by 55 percent.

The study was conducted using transvenous ICDs, but the encouraging results are consistent with the approaches used with subcutaneous ICD technology. Essentially, fewer shocks reduce risk for patients, and the subcutaneous ICD is more reliable at arrhythmia discrimination than are conventionally programmed transvenous ICDs. However, the transvenous ICD technology can further reduce shocks by using antitachycardia pacing, which causes no pain, if the ICD is appropriately programmed.

“We don’t know which is the best approach, but we do know there is a group of patients who are not suitable for venous leads, and those patients clearly will benefit from these developments in implant technology; on the other hand, some patients need protection from bradycardia or tachycardia with pacing, and traditional ICDs with intelligent programming will be the best solution for these patients,” Dr. Wilkoff says.

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Case Study

Difficult EVAR in Patient with Congestive Heart Failure

BY MICHAEL PARK, MD

Presentation
A 79-year-old woman with an 8.7 cm infrarenal abdominal aortic aneurysm and bilateral iliac arterial occlusion was referred for treatment. Her primary symptoms were bilateral leg claudication at short distances. She had been turned down for repair due to her medical comorbidities (history of congestive heart failure) and the inability to access her aorta for endovascular aneurysm repair (EVAR) due to her iliac arterial occlusions.

History
The patient’s most recent CT scan, which was an outside study, showed the aneurysm to be saccular, compounding the high risk of rupture already conferred by its large size. After reviewing the images, it was decided that even with her medical comorbidities, the immediate and high risk of rupture and the feasibility of repair compelled us to recommend repair.

Treatment
The patient’s aortic bifurcation was accessed via the right common iliac artery and both common femoral arteries, using a right retroperitoneal exposure and bilateral groin exposures.

A 10 mm ringed PTFE graft was sewn to the origin of the right common iliac artery after endarterectomy re-established patency. This allowed access to the aorta and to the left iliac system in an antegrade direction. A sheath was placed through the graft, and up-and-over access to the bifurcation was achieved.

The left external iliac artery was recanalized via the antegrade approach, and this was facilitated by retrograde wire access that allowed the external iliac artery to be identified. After ballooning the artery to ease access, a large nitinol stent was seated across the occlusion and post-dilated to 8 mm. This established access from the left groin.

Once this was done, EVAR was performed via the conduit and the recanalized left iliac system. The conduit was then anastomosed to the right common iliac artery. The final arteriogram showed successful exclusion of the aortic aneurysm with re-established flows to both legs.

Discussion
This was a challenging case that was made feasible by organizing the repair into five parts: access, conduit placement, left iliac artery recanalization, EVAR and right iliac bypass. Bailout or plan B was creation of an aorto-unii-iliac stent graft and femoro-femoral bypass. This particular stent graft was chosen because it allowed preservation of the aortic bifurcation for future interventions on the legs and because the particular design of the aortic cuff would seal what was a very challenging aortic neck. The patient was discharged after five days of recovery and was doing well at her recent one-month follow-up, walking without limitations.

Contact Dr. Park at 440.878.2500 or parkm3@ccf.org.
Cleveland Clinic clinicians and researchers are continually reporting new findings and techniques touching on all aspects of cardiovascular care. Surgeons and cardiovascular medicine specialists explore and meet new and varied technical challenges and test new equipment. Basic researchers delve into the cellular and molecular basis of cardiovascular disease, laying the groundwork for future treatments and cures. Here, we throw a spotlight on a few findings that have emerged from Cleveland Clinic in recent months.

**Bariatric Surgery Reduces Heart Disease Risk Factors**

Cleveland Clinic researchers performed the largest-known systematic review of weight-loss surgery and its effects on the heart. They found that bariatric surgery reduces the risk factors for cardiovascular disease and improves the structure and function of the heart. The study, led by James Young, MD, Chairman of the Endocrinology & Metabolism Institute, examined 73 bariatric surgeries and cardiovascular risk factor studies of nearly 20,000 patients who underwent weight-loss surgery. Researchers found that, prior to their surgery, about 44 percent of the patients suffered from hypertension, 24 percent from diabetes and 44 percent from high cholesterol. Following surgery, 63 percent saw their hypertension improve, 73 percent saw improvement in their diabetes and 65 percent had their cholesterol levels fall. The findings, co-authored by Amanda Vest, MD; and Helen Heneghan, MD; Shikhar agarwal, MD; and Philip Schauer, MD, Director of the Bariatric and Metabolic Institute, were published in *Heart*. Another study last year (STAMPEDE) by Cleveland Clinic researchers demonstrated that bariatric surgery along with optimum medical treatment was an effective treatment for diabetes.

**Mortality Linked to Worsening of Diastolic Function**

Cleveland Clinic cardiovascular medicine researchers led by Wael AlJaroudi, MD, of the Cardiovascular Medicine Section of Imaging, have shown that worsening of diastolic function raises a patient’s risk of death by 80 percent. The findings were published online in *Circulation*. Diastolic dysfunction is a powerful independent predictor of mortality, and clinicians should aggressively modify associated risk factors in hopes of altering outcomes.

**Endovascular Ascending Repair for Inoperable Acute Aortic Dissection**

Acute aortic dissection calls for immediate surgical attention. Conventional treatment involves open endovascular repair and requires circulatory arrest. A significant number of patients are not eligible for this procedure owing to age or comorbidities – leading almost inevitably to a fatal outcome. Eric Roselli, MD, of the Department of Thoracic and Cardiovascular Surgery, has developed a minimally invasive alternative. The procedure delivers a stent graft to the ascending aorta through an incision in the left-ventricular apex. The collapsible graft is expanded during rapid pacing. Fluoroscopy and transesophageal echocardiography guide delivery and post-procedure assessment. The procedure, to be published in the *Journal of the American College of Cardiology*, has been successful in three patients.
Discovery of Molecule that May Prevent Atherosclerosis

A naturally occurring molecule may play a role in preventing plaque buildup inside arteries, possibly leading to new plaque-fighting drugs and improved screening of patients at risk for developing atherosclerosis. Atherosclerosis is the result of macrophages in the vessel wall absorbing, processing and storing cholesterol in large amounts, leading to the development of arterial lesions. Researchers led by Eugene Podrez, MD, PhD, of Molecular Cardiology, have discovered that the intracellular enzyme Akt3 regulates lipid entry into macrophages and prevents the cells from storing excessive amounts of cholesterol and accumulating in the artery. The discovery could lead to new drugs to prevent atherosclerosis and help doctors produce screening tests to determine patients' risk level for developing the disease. Podrez and his colleagues are now looking into the particular mechanisms behind Akt3's role in regulating lipid processing and will attempt to replicate their results in humans. The study was published in *Cell Metabolism*.

Soda Drinking Increases Stroke Risk – Coffee Lowers It

Greater consumption of sugar-sweetened and low-calorie sodas has been associated with a higher risk of stroke. Conversely, consumption of caffeinated or decaffeinated coffee was associated with a lower risk. The study is one of the first to examine soda's affect on stroke risk. Previous research has linked sugar-sweetened beverage consumption with weight gain, diabetes, high blood pressure, high cholesterol, gout and coronary artery disease. In sugar-sweetened sodas, the sugar load can lead to rapid increases in blood glucose and insulin which may lead to glucose intolerance, insulin resistance and inflammation. These changes influence atherosclerosis, plaque stability and thrombosis – all of which are risk factors of ischemic stroke. Stroke risk appears higher in women than in men. The study also showed that men and women who consumed more than one serving of sugar-sweetened soda per day had higher rates of high blood pressure and high blood cholesterol and lower physical activity rates, and they were also more likely to consume red meat and whole-fat dairy products. Men and women who drank low-calorie soda had more chronic disease and a higher body mass index. The study, published in the *American Journal of Clinical Nutrition*, was led by Adam Bernstein, MD, of the Wellness Institute, and involved researchers from Harvard University.

Transcatheter Techniques Call for Vast Data Management

New minimally invasive endovascular treatments would be impossible without advanced imaging techniques. Transcatheter aortic valve replacement (TAVR) is a good example. This procedure implants collapsible replacement valves using a catheter-based technique, with no exposure of the operating field. It calls for intensive imaging in patient selection, preoperative planning and intraoperative decision-making, using multidetector 3-D CT scanning. The imaging process produces enormous amounts of data that need to be stored in a way that makes the data easily available across many locations and eventually become part of the patient's electronic medical record.

Managing all this data calls for unique storage and retrieval capabilities, as described by Paul Schoenhagen, MD, of the Heart & Vascular Institute and Imaging Institute, in *Current Cardiology Reports*. Successful management of this data involves communication among Cleveland Clinic’s central archiving system and workstations. Cleveland Clinic is developing a continually available, transportable longitudinal imaging file that can be integrated into the patient’s electronic medical record. This data will also be available for evidence-based decision support, quality management and outcomes reporting.
If a picture is worth a thousand words, then what’s a live video worth? When it comes to the post-op care of geographically distant cardiac surgery patients: Priceless.

“A significant number of patients who come to Cleveland Clinic’s Miller Family Heart & Vascular Institute aren’t from our backyard,” says Eiran Gorodeski, MD, MPH, Medical Director, Post-Acute Care Operations, and cardiologist, Section of Heart Failure and Cardiac Transplantation. “They come here from all over the country and all around the world.”

In fact, 50 percent travel to Cleveland Clinic from outside the state of Ohio, says Gina Cronin, Administrator for the Miller Family Heart & Vascular Institute. While this is a gratifying
statistic, it also presents a challenge related to postoperative follow-up care. “These patients can be nervous about returning home after having had any procedure, much less a major operation such as heart surgery,” she says.

In the spirit of answering that challenge by bringing together technological and clinical innovation, the Heart & Vascular Institute recently completed a telehealth pilot project using HIPAA-compliant software and tablet computers with Web cameras to test the idea of real-time post-op visits via video conferencing. Dr. Gorodeski was the medical director lead on the pilot, heading the team of nursing, technology and administrative professionals who worked on the effort. The project was the vision of Dr. Bruce Lytle, Chairman of the Miller Family Heart & Vascular Institute. The virtual care coordination initiative used the Intel-GE Care Innovations™ Guide, an FDA-cleared product that allows patients to connect securely with clinical staff via Wi-Fi connections from their homes.

“This technology gives the patient connectivity to Cleveland Clinic to continue the relationship,” Cronin says. That connectivity is increasingly important, she says, due to healthcare reform that requires Cleveland Clinic and other centers to be responsible for a patient’s care six months after an acute episode. Increasingly, reimbursements will be dependent on quality measures such as preventing unnecessary hospital readmissions during set time periods.

“This growing emphasis on longitudinal care reinforces the need to provide innovative approaches to care after discharge, especially for geographically distant patients,” Cronin says.

**Novel Care Delivery**

“For cardiac surgery patients who are unable to travel here for post-op visits, we thought, what if you could use video to see their body language, the color of their skin, how they’re breathing, how they’re sitting,” Dr. Gorodeski says. “That’s 95 percent of what doctors, nurse practitioners and nurses do at post-op appointments — they look at patients and talk to them.”

The operational pilot included 10 patients who came to Cleveland Clinic in person for their first post-op visit and then had four once-weekly virtual video visits. The patients who participated were screened to ensure that they were technologically savvy and had Wi-Fi connections in their homes.

The nurse or nurse practitioner, using the same software as the patient, dials the patient from a desktop computer for a prescheduled appointment, and they communicate securely using technology similar to video conferencing. The program’s software synchronizes data collected during the appointment with Cleveland Clinic’s electronic medical records system and provides access to the eprescribing system for medication refills and new prescriptions.

The face-to-face video interactions include asking the patient about the same issues that would be discussed in an on-site appoint-

ment: shortness of breath, pain, swollen feet, wound healing. “There were clinical signs that we picked up on,” says nurse manager Karen Trentanelli, RN-BC, BSN. “The technology even allows the patient to position his or her incision in front of the camera, so we can see how it’s healing.”

The video appointments allow clinicians to flag signs that a patient needs to be seen emergently. The venue also allows the nursing staff to make a clinical assessment of a patient’s perceived symptoms, Trentanelli says. For example, a patient may complain about shortness of breath. The nurse practitioner observes that the patient is not as short of breath as she perceives, and an unnecessary trip to the ED is averted.

Great potential exists to expand the reach and interactivity of the virtual care conferences, Dr. Gorodeski says. Multichannel video conferencing would allow a multidisciplinary team of nurse, pharmacist and/or physical therapist to consult with the patient simultaneously.

**Patient Engagement**

The two questions that the operational pilot sought to answer were: does the technology work, and do patients feel comfortable.

“We worked through some early hurdles to get the technology operational, and our patient selection ensured that patients were comfortable with the technology,” Cronin says.

Patients have been overwhelmingly positive about their virtual visit experience. “They feel more connected, and they feel like we care about them,” Dr. Gorodeski says. “Patients who otherwise would not be able to see us due to geographic distance are able to get valuable advice and guidance.”

The customized, secure tablets and software provided to patients engaged them in additional ways. Patients took surveys, including satisfaction surveys that are undergoing analysis. The tablets were preloaded with several patient education videos on relevant post-op topics such as wound care and pain management, and patients could also take interactive quizzes to test their knowledge.

**Looking Ahead**

“Video visits really are a new venue of care,” Dr. Gorodeski says. Cleveland Clinic is looking at the possibility of offering the technology to employer-sponsored group health plans that contract with them as part of their bundling of routine care services.

While third-party payers currently do not reimburse for virtual visits, telehealth is getting more and more attention from public and private payers. “Cleveland Clinic is visionary in its willingness to get ready for the future by funding pilots on these unique and novel ways to deliver care,” Dr. Gorodeski says. “It’s the right thing to do, patients love it, and in the near future it should be reimbursable — which will make it more feasible to deliver on a larger scale.”

For more information, contact Dr. Gorodeski at 216.636.6146 or gorodee@ccf.org.
Now it appears that the drought has ended, with two newly approved agents and at least one more nearing approval. This trend has been accompanied by increasingly rigorous requirements by the FDA to demonstrate CV safety, and Cleveland Clinic’s cardiologists are taking a lead role in the clinical trials.

Miller Family Heart & Vascular Institute cardiologists are leading:

- A phase 3 trial for the pipeline agent Contrave® (bupropion/naltrexone combination); and
- A phase 4 study for Qsymia™ (phentermine/topiramate combination).

With one-third of the American population now obese, these drugs hold great therapeutic promise.

Steven Nissen, MD, Chairman of Cardiovascular Medicine, says that studies such as the Cleveland Clinic-led STAMPEDE trial have demonstrated that bariatric surgery is an effective option to treat severely obese patients, while lifestyle modification is an option for those who are mildly overweight. “We needed treatment options for the moderately obese and for those patients who are not candidates for bariatric surgery, and these two agents have the potential to fill that gap,” says Dr. Nissen, who is an investigator for both trials, and is serving as the principal investigator for the Contrave study.

Contrave: Fastest-Enrolling FDA Trial in History

Contrave is a combination of the antidepressant and smoking cessation medication bupropion and the anti-addiction drug naltrexone. Initial studies have demonstrated that low doses of these two agents in combination can produce about a 10 percent loss of total body weight, potentially resulting in significant CV benefits.

While the most common side effect is nausea, studies also have found that the drug may slightly raise heart rate and blood pressure.

The multicenter, randomized, double-blind, placebo-controlled phase 3
The idea for a bupropion/naltrexone combination agent grew from the fact that patients taking bupropion lost about 5 percent of their total body weight. “However, the weight loss was not persistent, due to a neural pathway associated with endorphin release that eventually shuts down while the drug is taken — causing the patient’s appetite to return,” Dr. Nissen says. “Naltrexone is an antagonist to that pathway, and studies have found that low doses of these agents in combination bump up the persistent weight loss to 10 percent of total body weight.”

Once enough major adverse CV events occur in the total study population to produce significantly meaningful data, a decision will be made by the FDA about moving forward with approval, Dr. Nissen says. If the drug is found to be safe, approval should move forward rapidly, due to the pressing need for safe and effective drugs in this category.

Phase 4 Trial of Qsymia to Gather More Safety Data
In July 2012, the FDA approved the phentermine/topiramate extended-release combination Qsymia for chronic weight management in adults who are obese or overweight with at least one weight-related medical condition.

FDA approval of Qsymia was granted with the requirement of a phase 4 CV safety trial due to the slight increase in heart rate (1.7 HB per minute) that the agent causes. It’s anticipated that the trial, which will include at least 10,000 patients, will begin later in 2013, says A. Michael Lincoff, MD, Vice Chairman of the Department of Cardiovascular Medicine and the study’s principal investigator.

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Increasingly, the FDA has been mandating a more rigorous threshold for safety by requiring additional post-approval studies. “In 2009, this policy was formalized for all diabetes agents,” Dr. Lincoff says. “For obesity agents, the FDA appears to be leaning in that direction as well, given that diabetes is in lockstep with the obesity epidemic, and patients with diabetes are at greater risk of CV events.”

With Qsymia, 50 percent of patients achieve a 10 percent loss of total body weight, and 30 percent see a 15 percent loss. “This is more than twice the effect achieved with Belviq® [locaserin], which was approved in 2012 without any phase 4 study requirements for CV safety,” Dr. Lincoff says.

Qsymia has beneficial effects on blood pressure. When the weight-loss drug phentermine is combined with topiramate — previously approved for migraine and seizure prevention — they work synergistically and both are given in dosages lower than for their original indications. “Topiramate lowers blood pressure while phentermine raises it, and the combined effect is lower blood pressure,” Dr. Nissen says.

While the trial will be at minimum a noninferiority study, the possibility of a superiority trial is on the table. “We believe that the weight loss created by Qsymia could yield to superiority due in part to the lowered blood pressure and also due to initial findings of reduced incidence and severity of diabetes,” Dr. Lincoff says.

More Weight Loss More Safely
With both drugs, the mechanisms of action rely on the additive effects of two established agents affecting more than one neural pathway for better appetite suppression while also minimizing the dosage amounts and the side effects that can accompany larger doses.

The ultimate goal is simple: “More weight loss more safely,” Dr. Nissen says. These ongoing trials will result in knowledge that has the potential to safeguard patients’ CV health while also improving it.

For more information, contact Dr. Nissen at 216.444.6740 or nissens@ccf.org, Dr. Cho at 216.444.9353 or chol@ccf.org, and Dr. Lincoff at 216.444.6740 or lincofa@ccf.org.
New Book Explores Latest Valve Technology

In the past few years, percutaneous valve technology has received tremendous interest from clinicians and the public. Results of advancements in endovascular techniques have made this technology a potential option and a promising reality. A minimally invasive percutaneous system that allows for consistent, accurate positioning and rapid deployment of a collapsible/expandable stent-valve system is now a credible expectation.

A new book, *Percutaneous Valve Technology: Present and Future*, co-edited by José L. Navia, MD, Staff Surgeon in the Department of Thoracic and Cardiovascular Surgery, recounts the progress and the possibilities in the area of noninvasive medical treatments.

“We review the latest advances in this rapidly emerging medical technology,” says Dr. Navia about the book. “We evaluate the current state of this practice area and make predictions of progress in the near and far future. It is our hope that we’ve compiled a valuable resource for the general public, but more important, a helpful reference for our colleagues, including interventional radiologists, cardiac surgeons, cardiologists, cardiac anesthesiologists and industry leaders.”

*Percutaneous Valve Technology: Present and Future* is available at major national book retailers.
IMAGE PRESENTATION

Shown is classic medial-fibroplasia type fibromuscular dysplasia (FMD) of the right renal artery in a patient with difficult-to-manage hypertension.
Save the Dates for These Events and Conferences

16th Diastology, Valve and New Echo Technologies Summit: Featuring Contrast Echo Mini-Symposium

Feb. 24-27, 2013

Key Largo Marriott Bay Hotel
Key Largo, Fla.

This event features a multimodality imaging mini-symposium, which provides a unique opportunity for attendees to interact with key opinion leaders and receive updates in diastology, heart valve disease, new and emerging echo technologies, and multimodality imaging.

For more information or to register, visit ccfcme.org/echo13.

Primer in Vascular Disease

April 25-26, 2013

InterContinental Hotel & Bank of America Conference Center
Cleveland, Ohio

This two-day course is designed to provide a clinically based topical review of peripheral vascular disease and its various treatments for primary healthcare professionals. This will be accomplished through lectures from experts in the field, case presentation and audience participation.

For more information or to register, visit ccfcme.org/vascular13.

2013 Preceptorship in Carotid Ultrasound Interpretation

Available Courses

April 29-May 3 | Aug. 26-30 | Dec. 2-6

Cleveland Clinic Heart & Vascular Institute
Noninvasive Vascular Laboratory
Cleveland, Ohio

(class size is limited to six participants)

This intensive 4 1/2 day program will train the participant to interpret carotid duplex ultrasound examinations through a series of activities, including didactic lectures, preceptored interpretation sessions with staff physicians from Cleveland Clinic’s Noninvasive Vascular Laboratory, hands-on scanning sessions, and review of an extensive library of programmed-learning carotid cases with angiographic correlations.

For more information or to register, visit ccfcme.org/carotid13.

14th Annual Intensive Review of Cardiology

Aug. 17-21, 2013

InterContinental Hotel & Bank of America Conference Center
Cleveland, Ohio

This four-day symposium will focus on practicing cardiologists and the delivery of contemporary cardiovascular medicine including complex patient management decision-making. Cardiovascular Board Certification and Recertification Examination candidates may also find this symposium useful. The clinical evaluation and management of the patient encountered in daily practice will be highlighted. The current ACC/AHA guidelines supporting treatment and management recommendations will be referenced, as will treatment controversies and dilemmas. Interactive patient management evening sessions specific to electrophysiology, advanced imaging and the cardiac catheterization laboratory are also planned.

For more information, visit ccfcme.org/Cardioreview13.
About Cleveland Clinic

Cleveland Clinic is an integrated healthcare delivery system with local, national and international reach. At Cleveland Clinic, more than 2,800 physicians represent 120 medical specialties and subspecialties. We are a main campus, 18 family health centers, eight community hospitals, Cleveland Clinic Florida, the Cleveland Clinic Lou Ruvo Center for Brain Health in Las Vegas, Cleveland Clinic Canada, Sheikh Khalifa Medical City and Cleveland Clinic Abu Dhabi.

In 2012, Cleveland Clinic was ranked one of America’s top 4 hospitals in U.S. News & World Report’s annual “America’s Best Hospitals” survey. The survey ranks Cleveland Clinic among the nation’s top 10 hospitals in 14 specialty areas, and as the top hospital in three of those areas.

Resources for Physicians

Referring Physician Center and Hotline
Cleveland Clinic’s Referring Physician Center has established a 24/7 hotline — 855.REFER.123 (855.733.3712) — to streamline access to our array of medical services. Contact the Referring Physician Hotline for information on our clinical specialties and services, to schedule and confirm patient appointments, for assistance in resolving service-related issues, and to connect with Cleveland Clinic specialists.

Physician Directory
View all Cleveland Clinic staff online at clevelandclinic.org/staff.

Track Your Patient’s Care Online
DrConnect is a secure online service providing real-time information about the treatment your patient receives at Cleveland Clinic. Establish a DrConnect account at clevelandclinic.org/drconnect.

Critical Care Transport Worldwide
Cleveland Clinic’s critical care transport teams and fleet of vehicles are available to serve patients across the globe.

• To arrange for a critical care transfer, call 216.448.7000 or 866.547.1467 (see clevelandclinic.org/criticalcaretransport).

• For STEMI (ST elevated myocardial infarction), acute stroke, ICH (intracerebral hemorrhage), SAH (subarachnoid hemorrhage) or aortic syndrome transfers, call 877.379.CODE (2633).

Outcomes Data
View clinical Outcomes books from all Cleveland Clinic institutes at clevelandclinic.org/outcomes.

Clinical Trials
We offer thousands of clinical trials for qualifying patients. Visit clevelandclinic.org/clinicaltrials.

CME Opportunities: Live and Online
The Cleveland Clinic Center for Continuing Education’s website offers convenient, complimentary learning opportunities. Visit ccfme.org to learn more and use Cleveland Clinic’s myCME portal (available from the site) to manage your CME credits.

Executive Education
Cleveland Clinic has two education programs for healthcare executive leaders — the Executive Visitors’ Program and the two-week Samson Global Leadership Academy immersion program. Visit clevelandclinic.org/executiveeducation.

Same-Day Appointments
Cleveland Clinic offers same-day appointments to help your patients get the care they need, right away. Have your patients call our same-day appointment line, 216.444.CARE (2273) or 800.223.CARE (2273).
Cleveland Clinic Forges New Alliance with MedStar Heart Institute

In early January, Cleveland Clinic’s Miller Family Heart & Vascular Institute inked a deal with Washington, D.C.-based MedStar Heart Institute to promote pioneering research and clinical advances in cardiac care.

The clinical and research alliance will create an infrastructure to allow doctors to collaborate and to share resources. MedStar Heart Institute and Cleveland Clinic will work together to accelerate access to the most advanced research, technologies and techniques in cardiology and cardiac surgery. They will also share clinical policies, treatment protocols and research opportunities. In addition, staff will travel between the two institutions for training and to observe best practices.

This alliance builds on the Innovation Alliance that was forged between the two healthcare leaders in 2011, to benefit patients through collaborative innovation projects, research, clinical investigation and commercialization.