Cleveland Clinic is the home to 2 Centers of Innovation dedicated to the development and commercialization of novel solutions for cardiovascular patient care. The Global Cardiovascular Innovation Center (GCIC) is a multi-institutional consortium founded in 2007, and made possible through a $60 million grant from the State of Ohio's Third Frontier Program. Cleveland Clinic was also recently awarded a $10 million grant from the National Institutes of Health (NIH) National Heart, Lung and Blood Institute (NHLBI) to establish an NIH Center for Accelerated Innovations (NCAI). The NCAI-Cleveland Clinic, also a multi-institutional initiative, is 1 of 3 inaugural NCAIs established with the mission to provide an integrated, systematic, and comprehensive approach to the translation of early stage biomedical innovations from the research laboratory to commercial development and successful use in the treatment of patients. Together the 2 Centers provide a continuum of project funding, expert project management guidance, and programs for educating and mentoring researchers, clinicians, and developers, resulting in successful introduction of innovative cardiovascular technology for the benefit of patients worldwide.
**Micra Transcatheter Pacing System**

Advances in pacemaker technology have recently expanded to include leadless devices. Cleveland Clinic physicians have consistently been at the forefront of this technology to offer patients innovative options to manage their cardiac rhythm disorders. In 2014, our physicians performed one of the first implantations of the Micra™ Transcatheter Pacing System (TPS) in the United States. In total, they successfully implanted 4 of these devices within the year. The Micra™ TPS is used to treat patients with bradycardia who need pacing on 1 side of the heart. The device, which is about the size of a multivitamin, is placed directly into the heart using a catheter.

**Grand Pre Sternal Closure System**

Cleveland Clinic surgeons helped develop a novel sternal closure system for patients who require a sternotomy. The Grand Pre™ Sternal Closure System is manufactured by JACE Medical. The device allows surgeons to attach titanium plates to the sternum before the bone is cut. This allows for a true anatomic and quick closure at the end of surgery, thereby reducing the overall procedure time. The system creates rigid sternal fixation, which has been associated with less pain and improved bone healing.
iTransmit

Cleveland Clinic researchers found smartphones to be a useful tool to help patients transmit heart rhythm information following an ablation for atrial fibrillation. The iTransmit study collected recordings sent electronically with the use of a specially designed iPhone case that records electrocardiographic tracing. Recordings produced 100% sensitivity and 97% specificity for the detection of atrial fibrillation and atrial flutter (considered as one disease state). The majority (92%) of patients preferred transmission via the case instead of using a traditional transtelephonic monitor.


WRAP-IT

Cleveland Clinic physicians are leading the Worldwide Randomized Antibiotic Envelope Infection Prevention Trial (WRAP-IT). This is a large international multicenter trial testing the TYRX™ absorbable antibacterial envelope, which was FDA-approved in 2013. The envelope is constructed of mesh designed to hold and stabilize a cardiac implantable electronic device (CIED) after implantation. The envelope also releases the antibiotics minocycline and rifampin over 7 days or longer. These medications are fully absorbed by the body approximately 9 weeks after implantation. Approximately 7,000 patients from 225 sites around the world will participate in the study.

Image courtesy of Medtronic plc.
Sternal-Sparing Aortic Valve Replacement
In 2014, Cleveland Clinic surgeons continued perfecting a novel method for performing isolated aortic valve replacement (AVR) procedures through a small incision between the ribs. This procedure allows the surgery to be done without cutting the sternal bone. This technique, which is now being routinely used for isolated AVR procedures at Cleveland Clinic, involves a 2-cm incision. The procedure enables patients to return to normal activities faster and have a less painful recovery than patients who have a sternotomy.

Chord-X Mitral Valve Chordal Repair System
The Chord-X™ Mitral Valve Chordal Repair System allows surgeons to adjust the length of artificial chords used in mitral valve repair procedures. The technology was developed by Cleveland Clinic surgeons in conjunction with On-X Life Technologies, Inc. Each year, approximately 60,000 mitral valve procedures are done in the United States. This system allows surgeons to accurately measure chord length, reduce the time spent in the operating room, standardize artificial chord replacement, and adjust and create customized chordal loop lengths.
PleuraFlow Active Clearance Technology

Cleveland Clinic physicians were involved in the development and trial of a chest tube system that allows postoperative clots to be cleared without compromising the integrity of the sterile environment inside the tube. The PleuraFlow® Active Clearance Technology® (ACT) is placed between the chest tube and the drainage container tubing. A magnetic drive is used to break up clots and completely clear the tube.

Mitra-Spacer

Cleveland Clinic physicians pioneered the use of the Mitra-Spacer™ device in patients. The Mitra-Spacer is used to repair the mitral valve. It consists of a space-occupying element made of a polyurethane-silicone polymer that is anchored in the left ventricular apex through the mitral valve. It is put in place using a transapical or transseptal approach. Early outcomes from the first successful human implant are encouraging, and have resulted in recovery from multiple organ failures and termination of dialysis.
**Cholesterol-Lowering Injections**

Statin medications have effectively been used for more than 20 years to reduce cholesterol levels in patients with heart disease. However, some patients cannot tolerate statins and, therefore, do not benefit from them. A new class of cholesterol-lowering medications called PCSK9 inhibitors provides an alternative treatment that can lower LDL cholesterol by 50% to 70%. These new medications are administered by subcutaneous injection once monthly. Cleveland Clinic physicians are involved in the trials and oversight of the studies related to these drugs.

**ARNI for Patients with Congestive Heart Failure**

A novel medication for patients with congestive heart failure tested by Cleveland Clinic researchers was shown to reduce the risk of death by 20%. The agent, known as an angiotensin receptor-neprilysin inhibitor (ARNI), is on the fast track for approval by the Food and Drug Administration. The treatment was shown to be more effective than traditional therapy with angiotensin-converting enzyme inhibitors in reducing hospitalizations and emergency treatment for congestive heart failure.