Interventional Cardiologists and Surgeons Bring New Innovations

Rapid advances in technology and technique are blurring traditional lines between cardiac surgery and interventional cardiology in the 21st century. These remarkable breakthroughs also mean a new paradigm of care, bringing together interventional cardiologists, cardiothoracic surgeons and other experts to evaluate each patient and design customized treatment plans that meet individual needs.

And collaborative care, in turn, spawns new innovation.

“In addition to improving outcomes and overall patient satisfaction, the team approach creates opportunities for collaborative care and training that would never occur in a traditional treatment setting,” says Richard J. Shemin, M.D., who joined UCLA last year as the Robert and Kelly Day Professor, chief of cardiothoracic surgery and co-director of the new UCLA Cardiovascular Center.

Advances arising from this increasingly collaborative setting are rapidly expanding treatment options for the full range of cardiovascular diseases and procedures,

including heart-valve repair and replacement, aortic-aneurysm repair, coronary-artery disease, and the ablation of arrhythmias, such as atrial fibrillation. When surgery is the best option, the goal is to reduce the trauma of surgery with less invasive approaches. For example, robotic devices have become an increasingly valuable tool to interface between the surgeon and the instruments used to perform an operation. The da Vinci robotic system, explains Dr. Shemin, allows cardiothoracic surgeons to perform mitral-valve repairs and bypass procedures through mini-incisions and a trio of keyhole openings no bigger than the width of a pencil for the operative instruments.

While seated at a console, the surgeon performs the robotic procedure with instruments that allow micro-manipulation, and a three-dimensional camera provides a magnified view of the surgical site. Other advantages include full range of motion of the miniaturized instruments working in very confined spaces within the heart and computer software that cancels any perceptible micro-tremor.

Aesthetic considerations also factor into less invasive treatment options for cardiovascular disease. For example, mitral-valve conditions requiring repair of the valve are relatively common in young women. For those who require surgery, skin-surface scarring is limited by the minimally invasive robotic approaches. By strategically positioning incisions under the crease of the breast, the same location used by a plastic surgeon in placing breast implants, the surface scar is minimal and hidden.

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Robotics also holds future promise for less invasive coronary-artery bypass surgery options. Research shows that the key to the long-term success of bypass surgery is the use of the left internal mammary artery (located beneath the chest bone) to bypass blockages of the main artery on the front surface of the heart (left anterior descending coronary artery), Dr. Shemin explains.

“If we have to take one vessel that’s most important in terms of symptoms and long-term survival, research has consistently shown that is the one,” says Abbas Ardehali, M.D., associate professor and surgical director of lung and heart-lung transplantation at UCLA.

Today, high-risk patients often have stents implanted to open the native coronary artery rather than undergo an invasive open procedure required for an internal-mammary-artery bypass. The robotic techniques make bypass surgery a minimally invasive alternative option, enhancing survival and symptom relief. Hybrid procedures can be performed allowing a robotic left-internal-mammary-artery bypass grafting to the left anterior descending artery (LIMA to the LAD) and stenting of other coronary-artery blockages.

Minimally invasive options for aortic-valve replacement are currently performed at UCLA. Dr. Shemin envisions stenting of coronary arteries and valve surgery performed as a single procedure in the same hybrid OR cath room. Trials for percutaneous heart valves inserted via the groin or the chest wall are underway. Dr. Shemin and Jonathan Tobis, M.D., UCLA interventional cardiologist, will lead the team of surgeons and interventional cardiologists when trials of the percutaneous aortic valve begin at UCLA in Spring 2008.

Already, new interventional approaches allow cardiologists and cardiac surgeons to perform delicate ablation procedures to correct potentially deadly ventricular arrhythmias caused by tissue abnormalities on the surface of the heart and to treat the most common cardiac arrhythmia, atrial fibrillation. Minimally invasive ablation techniques previously were available only for arrhythmias originating from inside the heart. But now, epicardial ablation to correct ventricular arrhythmias can be performed on the exterior of the heart.

Epicardial ablation involves threading the ablation device through the skin into the sac around the heart. The energy is transmitted to the epicardial surface of the atrial or ventricular muscle via catheters that can ablate tissue with either heat or cold.

“Irregular heart rhythms can originate anywhere, even on the heart’s surface. The closer the cardiologists can get to the origin of the arrhythmia, the more effective treatment will be,” says Kalyanam Shivkumar, M.D., Ph.D., director of the UCLA Cardiac Arrhythmia Center and Electrophysiology Programs.

For patients with intractable angina caused by lack of blood flow to the heart, transmyocardial laser revascularization (TMLR) offers relief to those who are ineligible for bypass surgery and whose arteries are too diseased to support a stent. TMLR utilizes a laser to create a series of tiny channels into areas of heart muscle lacking adequate blood supply. The laser stimulates growth of new blood vessels and may also destroy nerve fibers that radiate pain, thus improving the patient’s anginal symptoms.

During robotic procedures, the surgeon at the console views the image and controls the instruments, while a nurse and another surgeon at the patient’s side change instruments and deliver sutures.

New ORs Open Doors to Innovative Procedures

Perhaps the most tangible evidence of the new alliance between interventional cardiology and surgery is the configuration of procedure rooms at the new Ronald Reagan UCLA Medical Center, which will open in Spring 2008.

The Cardiac Interventional Suite will house six procedure rooms. Two will be hybrid rooms that allow cardiologists, cardiothoracic surgeons and vascular surgeons to perform multiple interventional and surgical procedures in one location. In addition to flexibility that helps manage patient flow, hybrid operating rooms are ideal for complex cases where both interventional and surgical procedures are performed. For example, a cardiologist might use an interventional procedure to place a stent to open a blocked carotid artery, and then the surgeon can immediately step in to surgically replace a damaged heart valve.

“Working in new ways with modern imaging and devices expands the safety of cardiovascular procedures, reducing hospital stays and improving the time required to recover from procedures. The ultimate goal of the hybrid room is to perform hybrid procedures bringing cardiologists and surgeons closer together into highly skilled teams working to treat the patient’s cardiac conditions,” predicts Richard J. Shemin, M.D., chief of cardiothoracic surgery.

In addition to advanced techniques and technology, Dr. Shemin says that expertise and depth of experience of the cardiovascular team enhances quality and ensures accurate diagnosis and performance of safe and appropriate procedures.
Arrhythmias Treated with Less Invasive Procedures

Fifty years of innovation in cardiac electrophysiology have turned this cardiology subspecialty into a leader in medical innovation, often offering curative treatments to previously intractable heart arrhythmias.

Implantable devices now not only regulate slow heartbeats (bradycardia), but can reset dangerously fast heartbeats (ventricular tachycardia) with a strong electrical shock. Ablation techniques effectively cut off faulty connections, or short circuits, in the heart's electrical wiring and provide permanent relief from uncomfortable and sometimes dangerous heart-rhythm irregularities. Minimally invasive treatment approaches can now address electrical short circuits both inside and outside the heart, eliminating the surgical trauma of an open-heart operation and sending patients home the same day.

“Electrophysiology has emerged as one of the ‘Top Gun’ specialties within medicine,” says Kalyanam Shivkumar, M.D., Ph.D., director of the UCLA Cardiac Arrhythmia Center and Electrophysiology Programs. “Arrhythmias that were previously thought to be incurable are now being effectively managed, and sometimes cured, with catheter ablation and advanced implant technologies.”

Atrial fibrillation involves disordered electrical activity in the upper chambers of the heart, or atria. The condition initially causes brief bouts of irregular and rapid heartbeats and usually progresses to longer episodes, eventually becoming recurrent and finally chronic. Patients may experience palpitations, fatigue, shortness of breath or chest discomfort, and approximately one-sixth of all strokes are due to atrial fibrillation. Ventricular arrhythmias, those arising from the lower chambers of the heart, are particularly dangerous and increase risk of sudden death due to cardiac arrest, which causes more than 250,000 deaths in the U.S. each year.

Before the first implantable cardiac pacemaker in 1958, cardiologists had few tools beyond medication for addressing arrhythmias. Today, implantable cardioverter defibrillators (ICDs) address a range of heart-rhythm abnormalities. In addition to monitoring and correcting for slow heartbeats, some ICDs detect life-threatening ventricular tachycardia and administer a strong electric shock to reset the rate. “It’s like having an emergency response team standing by 24/7,” Dr. Shivkumar says.

Another type of ICD improves the squeezing function of the heart by resynchronizing the heart muscle of both the right and left lower chambers. And research is ongoing into implantable devices that monitor and regulate blood pressures within the heart.

Innovative research with catheters and energy sources in the late 1980s led to the first minimally invasive ablation options that used electricity, radiofrequency and eventually other energy sources to correct troublesome and dangerous arrhythmias.

Endocardial ablation, which uses heat to destroy abnormal tissue inside the heart, is the standard of care for both atrial and ventricular arrhythmias. This outpatient procedure involves threading the wires directly into the heart through the neck or groin veins. X-ray ultrasound images and sophisticated mapping systems diagram the heart’s electrical circuitry and guide catheter placement. “It allows us to get a roadmap of the abnormal heart rhythm and pinpoint the source of the arrhythmia,” Dr. Shivkumar says.

After evaluating the roadmap, physicians use the wires to apply electrical current or radiofrequency to trouble spots. “Abnormal tissues are literally burned from

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While outcomes-research has provided information used by experts to establish consensus on optimal standards of care for patients with cardiovascular disease, that hasn’t always translated into optimal care. In fact, studies have consistently revealed sizable gaps between what the evidence shows to be the best treatment approach for a particular condition and the application of that treatment in clinical practice.

“Too often, treatment decisions are made based on anecdotal experience mixed with what the physician has read in the literature, but without regard to any systematic guidelines,” says James N. Weiss, M.D., chief of cardiology at UCLA Medical Center. “It has become apparent that many patients are not being treated with the proven therapies.”

The American College of Cardiology and American Heart Association have evidence-based treatment guidelines for most clinical conditions, but because the information is frequently updated, practitioners are not always aware of the latest recommendations, or are too busy to go through their own mental checklists to determine whether patients are on appropriate medications, Dr. Weiss notes.

At UCLA, the Division of Cardiology has responded to this problem by bringing together teams of researchers to define systematic guidelines that can be followed in the hospital to improve outcomes and ensure that clinical therapies are given to patients on a consistent basis. In addition, many of the division’s ongoing programs contribute to the research trials that determine which therapies are optimal.

The most notable of these efforts has also helped to improve treatment for coronary-artery disease across the country. CHAMP (Cardiovascular Hospitalization Atherosclerosis Management Program) was started in 1994 at
UCLA by Gregg C. Fonarow, M.D., director of the Ahmanson-UCLA Cardiomyopathy Center, to create a hospital-based system to reduce the risks and consequences of heart disease through improved use of secondary prevention treatments. CHAMP served as a performance-improvement system by developing a protocol to ensure proper implementation of safe and effective patient care and provision of key evidence-based therapies and counseling. Among its innovations, CHAMP was the first program to start patients on statins and other important protective medications during hospitalization.

“We had become aware that there were large treatment gaps—a tremendous proportion of patients who should have been receiving therapies recommended by the guidelines were not receiving them when they left the hospital, and they were coming back with recurrent events that could have been prevented had their care been different,” says Dr. Fonarow. “CHAMP was a way of developing a system to ensure reliable care no matter which physician was caring for a patient by creating safety checks, redundancies and prompts.” Among other things, CHAMP found that hospitalization serves as a “teachable moment”; when therapies are started in the hospital they are more likely to be adhered to than when they are begun during outpatient care.

CHAMP became the forerunner for what is now the American Heart Association’s Get With the Guidelines (GWTG) program. Approximately 1,400 U.S. hospitals participate in GWTG, for which Dr. Fonarow is the national chair. Studies of GWTG have replicated CHAMP’s initial findings on improvements in quality of care and outcomes in hospitals large and small, teaching and non-teaching, rural and urban.

“This has changed the face of cardiovascular care across the country,” says Dr. Fonarow. CHAMP continues to integrate new therapies as evidence indicates that they should be routinely applied. In addition, Dr. Fonarow’s team has taken the CHAMP platform and applied it to heart failure through a program called OPTIMIZE Heart Failure, which was used in 259 U.S. hospitals and has served as a precursor for what is now the American Heart Association’s Get With The Guidelines-Heart Failure program. The same principles are also being applied for stroke treatment.

The platform is also being used to test the impact of using evidence-based protocols for the treatment of heart disease in women. Karol Watson, M.D., Ph.D., UCLA cardiologist, notes that women with heart disease tend to present differently than men. “In men, the symptoms are typically what we call classic—they are undeniable and very difficult to ignore, because often it’s like an elephant has stomped on their chest and they have unrelenting pain,” she says. “While chest pain is a common feature for women, more common are somewhat non-specific symptoms such as fatigue and shortness of breath, which makes it easier to overlook.”

Coronary angiography, the gold standard for diagnosing the disease in men, appears to be less effective in diagnosing women, Dr. Watson adds. Evidence is also emerging that heart disease is more likely to affect the small vessels in women than in men; this may mean that in some cases the medications indicated would differ. Women might respond better to ACE inhibitors, which improve endothelial function, than to medications that dilate the blood vessels, Dr. Watson suggests. “Studies have shown that microvascular disease is associated with as poor an outcome in women as macrovascular disease,” she says. “Disease of the large vessels can be diagnosed with an angiogram, but not disease of the tiny vessels. So we need to find other ways to find the disease, as well as looking at whether therapies that improve microvascular function will improve outcomes in these patients.”

In addition to applying what is already known about treatment of women with heart disease, Dr. Watson’s program is enrolling patients in an effort to build on the knowledge base and show whether evidence-based treatment will make a difference. Even simple questions such as whether cholesterol- and blood pressure-lowering therapies are beneficial for women, in whom they haven’t been tested specifically, must be addressed, Dr. Watson notes.

Recommended Reading
Survival rates for pediatric patients with congenital heart disease have improved dramatically in recent years, to the point that for most congenital abnormalities 90-95 percent of patients survive into adulthood—and for many the survival rate is 99 percent or higher. These improvements are the result of a number of advances in the way congenital disease is diagnosed and treated, says Kevin Shannon, M.D., UCLA pediatric cardiologist. Better imaging technology is enabling pediatric cardiologists to detect potential problems and treat them before they become serious concerns. Surgical and postoperative treatment has progressed to the point that two- and three-day hospital stays after open-heart surgery are common.

With these dramatic strides in long-term prognosis, Dr. Shannon notes, the focus is shifting to quality of life. “Many of these children have psychological or social issues associated with the fact that they have scars, they have to take a lot of medications, they frequently miss school because of doctor’s appointments and they can’t always keep up with their peers,” he says.

The issue of multiple appointments is being addressed through the UCLA Medical Home Project, part of a national initiative aiming to improve the coordination of pediatric care so that patients with certain diagnoses requiring chronic care can have multiple needs attended to on each visit, minimizing the frequency of their appointments.

In terms of the actual treatment, Dr. Shannon notes, patients’ quality of life has benefited from a shift toward minimally invasive surgical approaches that reduce the amount of scarring. These include transcatheter techniques for certain procedures, such as closure of atrial septal defects. Pediatric cardiologists are also seeking to minimize pharmacologic interventions by using drugs that are combination therapies and those that have longer half-lives, so that they need to be taken only once per day, rather than two or three times.

“We are now more aggressive about fixing things like leaky valves or small residual shunts,” Dr. Shannon adds, “because we know that even though they may seem to be a minor hemodynamic burden, over 20 to 30 years it will make a difference.” For example, he notes, removing the pulmonary valve as part of repairing tetralogy of Fallot—a congenital anomaly typically characterized by four defects within the heart structures—was found to cause many patients to progress to severe right-ventricular dysfunction as adults, impairing their quality of life. “Now we are much more likely to put in an artificial valve so that we preserve patients’ heart function over the long term,” Dr. Shannon says.

This paradigm has been made possible by the ability to use MRI to image and quantify heart function, particularly of the right ventricle. “We can now see the deleterious effects of not having that valve at a younger age and intervene early to preserve heart function rather than later, when we are just trying to stop the deterioration,” Dr. Shannon explains.

Indeed, thanks to advances in MRI technology, specialists have a minimally invasive technique for obtaining pictures of heart lesions that are equal in quality to those obtained with the more invasive catheterization procedure. This has changed the way many congenital heart disease cases are followed by providing a simpler way to detect changes in the anatomy and function of the heart and its vessels.

“Cardiac MRI and cardiac CT have become extremely valuable in diagnosing and monitoring patients with congenital heart disease,” says Stefan Ruehm, M.D., UCLA radiologist. “With advances in these techniques, we are able to generate high-resolution images that can clearly display the type and severity of the congenital heart defect.”

Recommended Reading
Sudden Death in the Young Athlete

A simple echocardiogram can be used to diagnose hypertrophic cardiomyopathy—a relatively common genetic cardiac disorder, characterized by an excessive thickening of the heart muscle, that affects about 1 in 500 people—but because it is so heterogeneous in its presentation, it is often missed in primary-care settings, according to Michael S. Lee, M.D., UCLA interventional cardiologist. “When you see high school or college athletes who die suddenly even though they underwent screening for hypertrophic cardiomyopathy before they were cleared to play, it reminds you how important it is that physicians ask the right questions,” Dr. Lee explains.

Appropriate screening should include inquiries about whether any first-degree relatives have had the condition, as well as for a heart murmur and checking for any history of chest pain, shortness of breath, fatigue, palpitations, light-headedness, dizziness or blackouts, Dr. Lee says. He points out that although there is no cure, treatments with beta-blockers and calcium antagonists can reduce symptoms. Patients who still have symptoms despite medication can either undergo a minimally invasive procedure or surgery to relieve symptoms; patients at risk for sudden death should be screened for possible use of an implanted defibrillator.

“Hypertrophic cardiomyopathy is a complex disease that can have catastrophic consequences,” Dr. Lee concludes. “Patients may have debilitating symptoms that severely affect their quality of life. Appropriate screening and identification of patients who are at high risk for sudden death is critical, and physicians who specialize in this disease process should be the ones providing the treatment.”

Camp with a Heart

In almost every way, the surgery had returned a sense of normalcy to the patient's life. But the boy, born with a congenital heart defect and now experiencing dramatically improved heart function that enabled him to play baseball and get on rollerblades for the first time, was having trouble with one aspect of his recovery.

“He was very self-conscious about his scar, to the point that he wouldn't even take his shirt off for me to examine him,” says Kevin Shannon, M.D., UCLA pediatric cardiologist. “When I asked him about it, he said no one other than his best friend had seen his scar.”

In searching for a program in which his patient could be around other children with heart disease in a summer camp-type environment, Dr. Shannon came up with Little. There was a program in Louisiana, but for the patient's mother—who still worried about her son's health status—that was too far. But Lisa Knight, a nurse who worked with Dr. Shannon, had an idea. She looked at the literature for the Louisiana camp and said simply, “We can do that.” The next thing they knew, Knight and Dr. Shannon were summer camp operators.

Camp del Corazon, on Catalina Island, was founded in 1995 as the first medically supervised, free camp specifically for children with heart disease in the western United States. It remains the largest of its kind on the West Coast—growing from 49 campers that first year to approximately 400 this year. The camp has also created a program called PACE (Progressive Adult Congenital Experience) to assist young adults ages 18-25 in the transition to adulthood. Volunteer doctors, nurses and counselors staff all programs.

“There are very limited resources for children who are growing up with heart disease,” says Knight, who serves as Camp del Corazon's executive director (Dr. Shannon is medical director). “This is one of the few opportunities for them to actually get a summer camp experience.”

For more information, go to www.campdelcorazon.org or call 818-754-0312.
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Clinical Updates

Bariatric Surgery
- Laparoscopic sleeve gastrectomy offers a lower-risk alternative to the gastric bypass procedure.

Cardiology, Cardiothoracic Surgery and Pulmonary Medicine
- UCLA has assembled a specialized team to diagnose and treat hypertrophic cardiomyopathy.
- Treating aortic disease calls for early diagnosis and treatment as well as preparedness to handle emergency cases.
- In addition to conventional lung volume-reduction surgery, UCLA offers a clinical study using one-way valves to treat lung over-inflation.

The UCLA Lung Cancer Program is distinguished by its multidisciplinary approach and the wealth of experience accumulated as a busy center of care and innovation.*

The UCLA Division of Cardiothoracic Surgery is among the nation’s leaders in providing care for a wide range of heart and lung disorders.*

Digestive Diseases
- UCLA offers the most effective ablation available for treating high-grade and multifocal low-grade dysplasia associated with Barrett’s esophagus.
- Transhiatal esophagectomy provides a less invasive alternative to traditional open esophageal surgery.

Emergency Medicine
- Recent studies have led to improved understanding and treatment of severe sepsis and septic shock.

Neurosurgery and Neuroendocrinology
- The UCLA Pituitary and Neuroendocrine Program offers patients the newest leading-edge treatments.*

Ophthalmology
- Advances in minimally invasive decompression surgery for Graves’ disease produce better cosmetic results with fewer complications.

Orthopaedic Surgery
- The recent approval of new ankle replacement devices means more patients can benefit from the procedure.
- A clinical study offers an innovative new implant in place of lumbar spinal fusion to stabilize the spine while preserving mobility.

Pediatric Allergy/Immunology
- The UCLA Skin Allergy/Eczema Clinic uses a multidisciplinary approach to diagnose the underlying factors leading to severe eczema and treat the symptoms appropriately.

Pediatric Gastroenterology
- Eosinophilic esophagitis is now recognized as a distinct condition with unique etiology, symptoms, treatment and consequences.

Radiology
- PET-CT technology is being used to provide staging information in cancer patients and to evaluate dementia and therapy-refractory seizure disorder.
- UCLA radiologists and technologists use ultrasound and MR arthrography to diagnose some musculoskeletal injuries and disorders.

Surgery
- UCLA is one of the few centers in the world to offer laparoscopic surgery for complex anatomic liver resections.

Newsletters and Reprints

Newsletters
- Jules Stein Eye Institute Clinical Update, Volume 17, Number 1 January 2008
- UCLA Pediatric Update, Volume 14, Number 2 Winter 2008

Video Articles
- Operation Mend: UCLA Medical Center teams up to heal scars of war streaming.uclahealth.org/operationmend
- A new device to treat spinal stenosis allows movement of the spine streaming.uclahealth.org/spine

Insights Health Care
Reprinted from Smart Business Los Angeles
- Preventive Screening: How early detection improves the chances of beating colorectal cancer
- Clearing the Air: The causes, symptoms and treatments for lung cancer

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