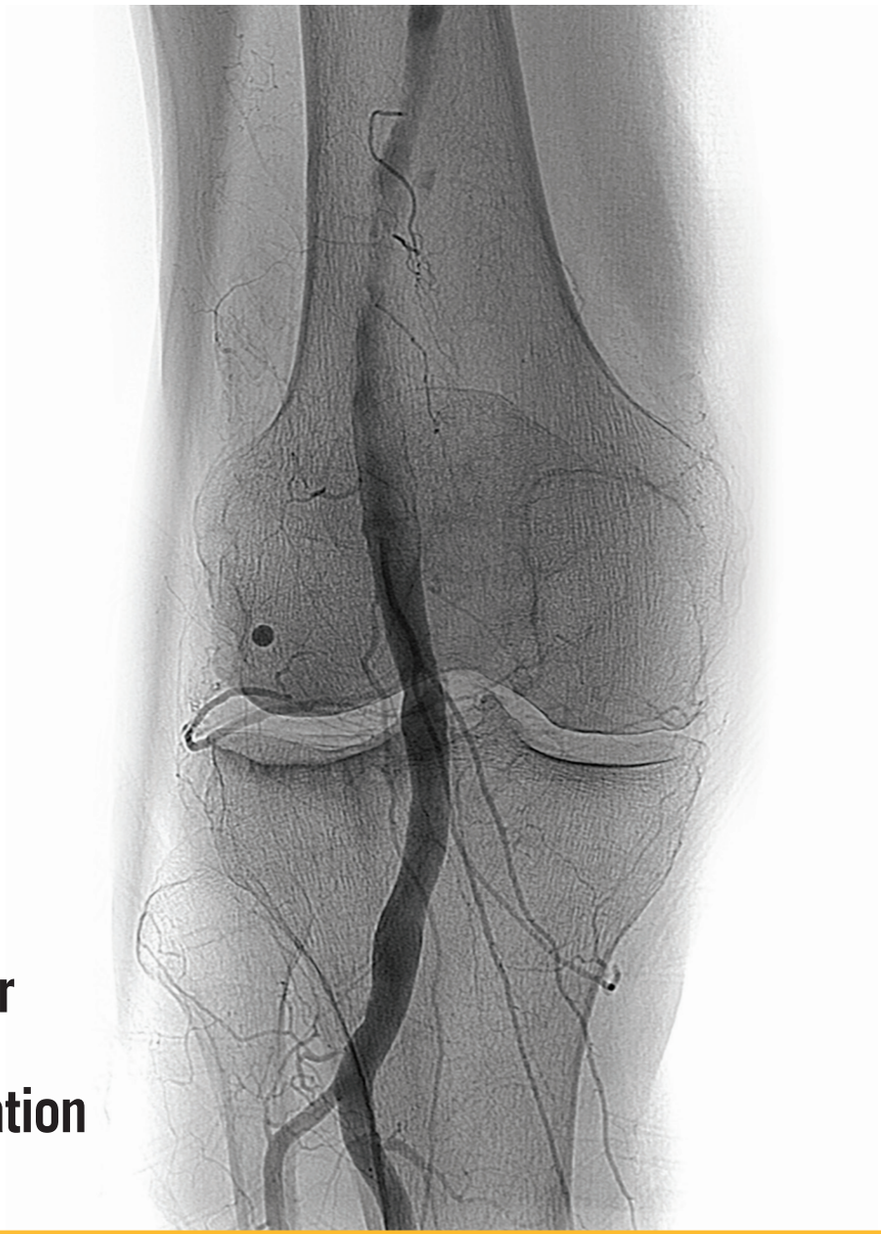
UCLA Health

# UCLA Radiology

NEWSLETTER OF THE DEPARTMENT OF RADIOLOGICAL SCIENCES

SUMMER 2019



## Genicular Artery Embolization

# Chair's Message

**Dieter Enzmann, MD**
Professor of Radiology

Leo G. Rigler Chair

Department of
Radiological Sciences

David Geffen School of
Medicine at UCLA

Much discussion revolves around transitioning from "volume" to "value" in the healthcare market. Radiology, as a large-scale, high-volume diagnostic business, has historically focused on measuring volume in exam count and in wRVUs. Economies of scale are clearly important to radiology services, but patients prefer personal care over scale. A monochromatic radiology goal of being superefficient "image readers" is precarious, because not only does it misinterpret patient expectations, but it also suggests machine learning as a plausible, superefficient "image reader" substitute.

Resilience, a topic often resurrected in times of rapid change, is an adaptive trait enabling diverse, robust responses to withstand shocks to an environment to which you are already well adapted. Being highly efficient "image readers" whose responses are primarily bounded by even further efficiency increases is not a resilient position for radiologists. Is the traditional focus on high efficiency balanced enough for radiology to demonstrate its value in the current environment?

Were a healthcare CEO asked about success factors, attracting and keeping patients in the healthcare system would rank most highly. Patient volume is a result, not a driver. The value of Netflix is based more on the number and growth of subscribers, the analog of attracting and retaining patients, than on its internet streaming speed, the analog of an operational performance measure.

While radiology efficiency is essential to clinical operations performance, how will it show its ability to attract and retain patients? This requires interaction with patients to build "value" beyond production efficiency. Patients are the "real" customer, not images and not the wRVU.

Discussions of value inevitably get complicated. Let's keep it simple – radiology services need to be "indispensable" to physicians, healthcare systems, and most importantly to patients. You have to be known to be indispensable. Even a highly accurate, written expert report is not enough to reach this goal. Radiology is a team sport and radiologists themselves must take time to become known by building trusting relationships through communication (face-to-face is best) and consultation, even though no wRVU is generated.

Retaining customers is a general business imperative, hence, a health system priority. Radiologists should reflect on the job-to-be-done (jtbd) for which they were "hired." That "jtbd," now includes informing and educating patients on how their imaging test results bear on their health. In an era of ubiquitous communication and telemedicine (*myUCLAhealth*), diagnostic radiologists (DxR) can fulfill the "jtbd" and become more "valuable" to patients with personalized expertise. UCLA Radiology is inaugurating a "primary radiologist" and a "primary mammographer" program for DxRs to personally connect to long-term (retained) patients. Radiology will become even more "indispensable" when radiologists directly attract and retain patients. It will become more resilient.

Were a healthcare CEO asked about success factors, attracting and keeping patients in the healthcare system would rank most highly.

# Genicular Artery Embolization Offers Minimally Invasive Treatment for Osteoarthritis of the Knees

**Siddharth Padia, MD**
Associate Professor of Radiology
Director of Interventional Radiology at UCLA Santa Monica
Department of Radiological Sciences
David Geffen School of Medicine at UCLA

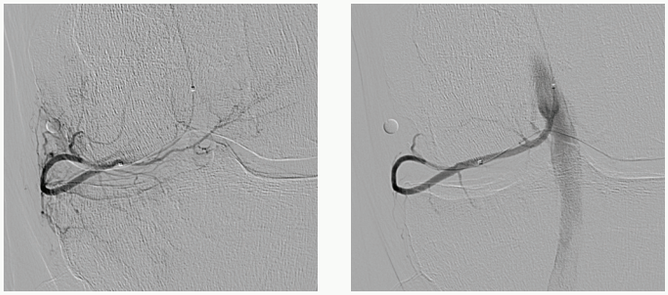
Osteoarthritis of the knees is a very common cause of disability, with pain and reduced tolerance for activity having a significant negative impact on patients' lifestyles. A promising new treatment, genicular artery embolization, may offer effective treatment to patients who have failed more conservative treatments but are not ready for joint replacement. UCLA interventional radiologists are currently enrolling patients in a clinical trial of the new treatment, a minimally invasive outpatient procedure that allows patients to resume normal activities the next day.

Most patients are able to manage mild to moderate arthritic knee pain with conservative measures, including nonsteroidal anti-inflammatory medications, ice and physical therapy. Some find symptom relief in injections of cortisone to reduce inflammation or hyaluronic acid to help cushion the joint. But these therapies are not effective in all cases — or can lose their effectiveness with time and repetition. Patients whose symptoms are not successfully controlled with these conventional therapies and who are not candidates for knee replacement surgery — or who are not open to surgery — may benefit from the new procedure, which seals off blood flow from abnormal new vessels that form in the arthritic joint. "Many people with recurrent pain after knee injections are simply not ready for knee replacement surgery or are not good candidates. For these patients, more treatment options are needed," explains Siddharth Padia, MD, Associate Professor of Interventional Radiology and Director of Interventional Radiology at UCLA Medical Center, Santa Monica.

Osteoarthritis is due at least in part to a cycle of inflammation and cartilage degeneration in the affected joint. It is thought that the formation of abnormal neovessels contributes to joint inflammation by excessively vascularizing the joint. The abnormal vessel growth is also accompanied by sensory nerve growth, which significantly contributes to patients' symptoms. Genicular artery embolization cuts neovessels off from their blood supply and restores normal circulation to the joint.

**How is genicular artery embolization performed?**

The outpatient embolization procedure is performed under conscious sedation. After a local anesthetic is applied to the fold of the leg, a small catheter is inserted into the femoral artery and threaded into the relevant genicular arteries under X-ray guidance. Dye is injected into the catheter and an angiogram is performed to identify the abnormal flow in the genicular arteries. During the procedure, a three-dimensional CT scan is also done to reveal the spatial relationship between the neovessels and structures of the joint.



*Initial and final angiograms of the knee after embolization. A circular marker was placed at the site of pain. The area of hypervascularity/ inflammation corresponding to the patient's medial knee pain was embolized, with subsequent resolution of hypervascularity.*

The interventional radiologist injects the embolizing agent to restrict blood circulation in the targeted arteries. The procedure is completely painless, and patients treated with genicular artery embolization are usually able to go home within two to three hours and can resume normal activities the following day.

**Results from prior studies**

Recently published results from a study in Japan conducted by Yuli Okuno, MD, PhD, who helped pioneer the procedure, show significant improvements in pain symptoms and joint function following the embolization procedure. The WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) — a set of questionnaires used to evaluate osteoarthritis patients for pain, stiffness and joint function — was used to measure outcomes at multiple post-procedure milestones. In the study, WOMAC scores decreased from a pre-procedure baseline average of 43 (out of a total of 96 possible) to 24 at one month, 14.8 at four months, 11.2 at six months, 8.2 at one year and 6.2 at two years.

Significantly, nearly all patients in that study who were treated with NSAIDs, opiates or joint injections prior to the embolization procedure no longer required these treatments for their knee pain at one and two years following the procedure. This demonstrates that the embolization procedure provides effective and durable relief for joint pain. "In some instances, the pain from knee arthritis can be so severe as to require opioids for pain control. There is a significant need to decrease the use of these medications due to concerns about tolerance and addiction. Genicular artery embolization has been shown to markedly reduce the need for opioids," states Dr. Padia.

Those enrolled in the clinical study of genicular artery embolization at UCLA will receive the embolization procedure and post-procedure follow-up at no cost to the patient or the patient's insurance. For more information, please visit uclahealth.org/radiology/clinical-trials.

# Using Artificial Intelligence to Achieve More Timely and Accurate Breast Cancer Diagnosis

**William Hsu, PhD**
Associate Professor of Radiology, Bioengineering and Bioinformatics
Department of Radiological Sciences
David Geffen School of Medicine at UCLA

While screening mammography has been shown to reduce breast cancer-related mortality, interpretation of screening exams is imperfect. Nationally, one in eight cancers have been found to go undetected by radiologists and 10 percent of all screening exams are called back for diagnostic workup, with a majority being false-positive results. Improving the interpretation of screening mammograms would minimize potential harms and enhance benefits to the population of women being screened.

As part of the multi-institutional Athena Breast Health Network, UCLA established a breast screening research registry, which collects clinical, imaging, pathology and cancer outcomes data on women who have undergone mammography screening. This registry provides a unique resource for developing novel artificial intelligence (AI) and machine learning (ML) algorithms that uncover patterns in clinical and imaging data from a large group of patients to predict the development of breast cancer. A project called the Tissue Countdown to Cancer is currently under way to determine if AI/ML can be applied to seemingly normal mammographic images to identify subtle variations in appearance that could be indicative of cancer formation.

"At UCLA, we perform a large number of breast screening exams annually that could be used to help us build and validate a prediction model," says William Hsu, PhD, associate professor of radiology and member of the Medical & Imaging Informatics group. "We're hoping our model can be used to achieve a more timely diagnosis of cancer, inform management of patients with elevated risk due to genetic predisposition, and reduce diagnostic uncertainty of the radiologist."

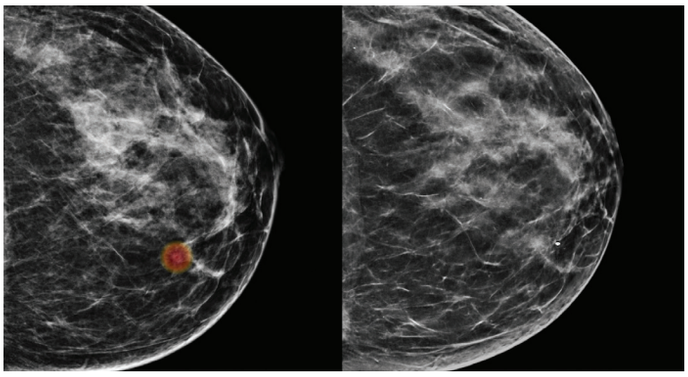
Routine screening mammograms provide a series of views of a patient's breast over time. Features that would not appear to be significant in the context of a single image may yield more information when viewed as part of a sequence. The model is applied to subtle changes in the breast tissue from scan to scan paired with other clinical findings such as BRCA1/2 mutation status. The output of the model is a visualization that can be overlaid atop a mammogram to identify regions of the image that are more likely to develop cancer over time.

The project is based in part on the idea that changes in the cellular, tissue, organ and systemic environments precede the development of cancer and help create the conditions in which cancer cells grow. To the extent that these environmental changes can be detected through analysis of screening images, the information can be used to help determine the most appropriate response to evidence of possible cancer growth.

In building their models based on multiple series of images, researchers can use AI to identify differences between successive images — such as small, subtle regions of breast tissue becoming more varied or denser in appearance. As their models grow more sophisticated, researchers hope they will yield more advanced predictive capabilities. They are exploring the use of deep learning models — an evolution of machine learning that employs many layers of data transformation to extract more meaning from input data. "At the end of the day, we're trying to generate a probability map that can be visualized and overlaid on the screening image. Each pixel in our map represents the likelihood that observed changes in that part of the region may be a precursor to a malignancy," states Dr. Hsu. "We're trying to give radiologists a little more information to help them identify anomalies earlier and decide whether action or closer follow-up is needed."

Dr. Hsu is working with a multidisciplinary team, which includes Anne Hoyt, MD, section chief of Breast Imaging at UCLA; the UCLA Integrated Diagnostics program, which is a collaboration between the departments of radiology and pathology that involves a team of radiologists, clinical translational researchers, information scientists; and Arash Naeim, MD, the UCLA site-lead for the Athena Breast Health Network.

"Our goal is to help radiologists gain greater confidence in what they are seeing in screening images," explains Dr. Hsu. "As they are faced with the task of reviewing a growing number of images as screening technology improves, our hope is that these models can help them focus in on areas that may be of particular concern to increase the number of cancers detected while addressing longstanding concerns such as callback rates."



*Two mammograms, taken seven months apart. The 2D mammogram (left) was originally found to be negative. A spiculated mass, later found to be invasive cancer, was identified in the 3D mammogram (right). Our AI/ML approach will highlight suspicious areas in the normal-appearing image using a probability map (color overlay).*

# Ferumoxytol Contrast Excels in MR Imaging of Congenital Heart Disease

**J. Paul Finn, MD**
Professor of Radiology
Vice Chair of Innovative Technology
Chief of Diagnostic Cardiovascular Imaging
Department of Radiological Sciences
David Geffen School of Medicine at UCLA

Ferumoxytol is proving to be advantageous as a contrast agent in imaging studies of pediatric and adult congenital heart disease patients. Marketed as Feraheme® to treat anemia in adults with chronic kidney disease, ferumoxytol is used by UCLA radiologists as a contrast agent for a variety of applications, including 4D MUSIC (Multiphase Steady State Imaging with Contrast) imaging in pediatric congenital heart disease patients and for 3D angiography in adult congenital heart disease patients.

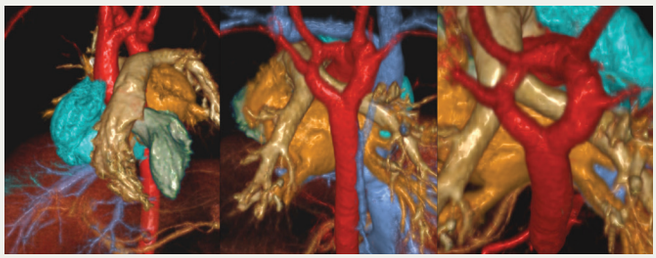
Unlike nearly all gadolinium contrast agents, which leak quickly from blood vessels into the interstitial fluid space, ferumoxytol — a relatively large iron-based molecule — stays in the blood plasma for hours. This eliminates the timing constraints of gadolinium studies, which must be done after the contrast has circulated to the structures being imaged but before too much leaks into the surrounding tissue. It also produces better images — gadolinium images of blood vessels grow less distinct as the contrast leaks from blood vessels and heart structures into adjacent tissue.

"Ferumoxytol is a good choice for imaging any patients with congenital heart disease in whom we want to enhance the blood vessels and the cardiac chambers," states J. Paul Finn, MD, professor of radiology and chief of Diagnostic Cardiothoracic Imaging at UCLA. UCLA has significant experience using ferumoxytol across a spectrum of patients, having performed approximately 600 cases "with tremendous results," according to Dr. Finn.

For newborns with congenital heart disease, UCLA has been using ferumoxytol in 4D MUSIC MRI for about five years under the IND (Investigational New Drug) program and an NIH (National Institutes of Health) grant in a collaboration among UCLA radiologists (including physicist Pen Hu, PhD), cardiologists and cardiac surgeons. The combination of ferumoxytol and MUSIC produces, "very detailed 4D images of the heart and blood vessels, even in tiny babies," says Dr. Finn.

Developed by investigators at UCLA, MUSIC captures a four-dimensional representation of the beating heart, which can be processed after imaging to yield any desired image slices and planes. The entire volume can be captured in about 15 minutes and includes all phases of the heart's contraction. This is in contrast to conventional MRI, which captures single slices in pre-determined image planes and typically requires 1-1/2 hours for an imaging session. Acquiring conventional MRI images of newborn hearts with congenital defects also requires the constant oversight of a skilled technologist and physician.

The MUSIC images are acquired during uninterrupted ventilation, with no need for the anesthesiologist to suspend ventilation for each imaging pass as with conventional MRI. The high-resolution MUSIC data are supplemented with lower-resolution blood flow information acquired using a related 4D technique.



*Color rendered views from a 4D MUSIC MRI study in a baby show a double aortic arch forming a complete vascular ring (red) that caused difficulty swallowing. The patient went on to have successful corrective surgery.*

The combination provides a very comprehensive evaluation of heart anatomy and function. "With MUSIC, almost independently of the underlying anatomy — and no matter how complex the abnormality — our technique is the same," states Dr. Finn.

For adult congenital heart disease patients, ferumoxytol is being used at UCLA to acquire 3D angiographic images throughout the thorax along with detailed functional imaging and blood flow analysis. "Many adult congenital heart disease patients have Fontan shunts, and these can become thrombosed or narrowed," explains Dr. Finn. "It is very important to evaluate them with imaging." Ferumoxytol's resistance to leaking out of the blood vessels eliminates the need for careful timing in imaging studies and produces images whose clarity is undiluted by the leakage of contrast agent into adjacent tissue.

Ferumoxytol is the logical choice for imaging studies in patients with renal impairment, where physicians are seeking to avoid the use of iodinated contrast agents with CT and gadolinium contrast agents with MRI. Ferumoxytol holds enormous promise as an imaging agent due to the unique advantages it can offer.

UCLA has active IRBs for several projects that explore other imaging uses of ferumoxytol. These include combining MRI with non-contrast CT imaging to produce information-rich hybrid images of calcification; boney structures or intravascular wires, catheters or devices. Ferumoxytol is also being explored in imaging renal and liver masses and as a stress agent in cardiac stress testing. "Ferumoxytol holds promise to open up new vistas in the kinds of tests we offer," states Dr. Finn, "and in the ease and speed with which we can do them. For now, we still regard it as a special test that needs to be done with close patient monitoring, in compliance with FDA guidelines."

# Tarsadia Foundation funding supports research using 3-D printing to model aneurysms and explore rupture risks

**Gary R. Duckwiler, MD**
Professor of Radiology
Chief of Interventional Neuroradiology
Director of Interventional Neuroradiology Fellowship Program
Co-Director of UCLA HHT Center of Excellence
Department of Radiological Sciences
David Geffen School of Medicine at UCLA

Unruptured intracranial aneurysms are frequently detected as incidental findings in patients undergoing computed tomography (CT) or magnetic resonance imaging (MRI) for other reasons. While physicians know that only a minority of these will rupture if left untreated, the often catastrophic consequences of hemorrhagic stroke from a ruptured intracranial aneurysm — including death and devastating disability — make knowledge of which aneurysms are likely to burst of great clinical importance.

"Many of these smaller, unruptured aneurysms that are detected incidentally may never cause a problem," states Gary Duckwiler, MD, Professor and Chief of the Division of Interventional Neuroradiology (DINR) at Ronald Reagan UCLA Medical Center. "Treating all unruptured aneurysms would expose many patients to unnecessary risks."

**New research examines flow dynamics and biological factors**

Dr. Duckwiler is leading a team of researchers investigating how biological activity and flow dynamics at the aneurysm site can help determine the likelihood of a future rupture. A significant donation recently made by the Tarsadia Foundation to UCLA's DINR Research Fund will help fund these investigations.

Using real patient data, Dr. Duckwiler's group is creating models using 3-D printing of actual aneurysms and lining them with human endothelial cells to test what changes take place when they are subjected to simulated blood flow. Observing the changes, and knowing the clinical facts of these cases — which aneurysms remained stable over time, which ones enlarged, which unexpectedly ruptured — will help the researchers better understand factors affecting the course of an aneurysm.

Decisions on when to treat incidentally detected unruptured aneurysms are currently made based on known associations between aneurysm rupture and the size and growth of the aneurysm over time. The location and shape of aneurysms are also known to play a role. But even when accounting for these factors, and considering such general health and lifestyle factors as family history, blood pressure, smoking and alcohol use, the risk can be difficult to assess. "Sometimes very small aneurysms can rupture when risk factors would indicate that they would have a low probability of rupture," states Dr. Duckwiler.

**HERE ARE WAYS YOU CAN SUPPORT** uclahealth.org/radiology/giving

**Donor supported research at UCLA Radiology**

Private donations like the Tarsadia Foundation gift help fill a need that is often not met by government grants, which are often available only to pursue avenues of inquiry that have already demonstrated a high degree of promise. "An area of study in its infancy — like our work on aueurysm flow dynamics — is extremely difficult to fund with government grants," explains Dr. Duckwiler. "Without funding like that of the Tarsadia Foundation, such high-risk, high-reward research is often not possible."

## Tushar Patel's Tarsadia Foundation Gift Helps Fund Aneurysm Research

Tushar Patel is the founder and chairman of Tarsadia Investments, a privately held capital investment firm that manages approximately $2 billion. Tarsadia invests in health care, financial service, life sciences, real estate and technology.

Born in India, Mr. Patel immigrated with his family, first to Zambia and then to the United States. He started working for his father at a very young age in the hospitality industry and immersed himself in all aspects of the business. He studied business at California State University, Fullerton and helped expand his family business in hospitality and real estate, and grow into an investment company with multiple areas of focus.

Through the Tarsadia Foundation, Mr. Patel supports the health and well-being of the community as well as education and economic empowerment for the underserved. Mr. Patel became interested in Dr. Duckwiler's research in aneurysms because of his own health experiences. Mr. Patel hopes that the Tarsadia Foundation's involvement can raise awareness of aneurysms and their potentially devastating consequences, help those suffering from aneurysms, provide education to patients and family members, and help Dr. Duckwiler and others improve aneurysm care and prevention.

David Geffen School of Medicine

## Cutting Edge Interventional Solutions for Brain and Spinal Disease

Course Director

**Reza Jahan, MD**
Professor of Radiology
Medical Director of Translational Research Imaging Center Laboratory
Department of Radiological Sciences
David Geffen School of Medicine at UCLA

**October 12th, 2019**
**Course and Hands-on Workshop**
UCLA Medical Center,
Santa Monica

**Registration and course information**
**uclahealth.org/radiology/cme**

CME OFFICE OF CONTINUING MEDICAL EDUCATION
DAVID GEFFEN SCHOOL OF MEDICINE at UCLA

# DEPARTMENT HIGHLIGHTS

## New Women's Imaging Center in Westlake Village

UCLA Westlake Village Women's Imaging Center
30700 Russell Ranch Road, Suite #110
Westlake Village, CA 91362
Central scheduling: 310-301-6800

The UCLA Department of Radiology brings world-class expertise to the Westlake Village community with the launch of our UCLA Westlake Village Women's Imaging Center, set to open this summer. Over 100 UCLA radiologists will bring a wealth of expertise to the community, with subspecialists available to interpret specialized studies.

At our Women's Imaging Center, 3D mammography, ultrasound, MRI, DEXA and breast biopsies are offered in a spa-like setting designed to promote ease and comfort. 3D mammography has been shown to have 40 percent greater specificity and 15 percent fewer call-backs for additional patient evaluations than traditional mammograms. Our Women's Imaging Center is the first outpatient center in Ventura County to use the Siemens MAGNETOM Vida 3-Tesla MRI, a state-of-the-art technology that can adapt to the patient's body and movement, resulting in higher-quality images while increasing patient comfort.

## Santa Clarita Administrative Team

The UCLA Santa Clarita Imaging and Interventional Center front desk team uses CI-CARE practices to make sure we always put our patients first. The front desk team is the first encounter for every radiology patient visiting our facility and our team exhibits professionalism and compassion in all their interactions, whether checking in patients or helping to schedule follow-up care. In providing the best service to each patient, our team routinely supports patients who see other providers in the community, provides images patients can keep on CD, supports walk-in X-ray cases and helps with scheduling as needed. To learn more about Santa Clarita Imaging and Interventional Center, go to uclahealth.org/radiology/scic

*Top from left to right, Pricilla Cervantes, Samantha Ramirez, Andranik Khacheryan, Brittany Lemos, Bottom from left to right, Giovana Paz, Adriana Castaneda, Christina Garcia*

UCLA Health

Department of Radiological Sciences
405 Hilgard Avenue
Los Angeles, CA 90095

NONPROFIT
ORGANIZATION
U.S. POSTAGE
PAID
UCLA

You have the power to make a world of difference in radiological sciences. Join forces with UCLA to advance human health and improve outcomes and quality of life for patients and their loved ones. If you would like information on how you can help, please contact:

Silviya Aleksiyenko, MPA
Director of Development
Health Sciences Development

**saleksiyenko@support.ucla.edu**
or go to: **uclahealth.org/radiology/giving**
**310-206-9235**

## Our locations

UCLA Radiology is committed to providing outstanding patient care through excellence in clinical imaging at a number of convenient locations.

For more information, visit **uclahealth.org/radiology** or call **(310) 301-6800**.


UCLA Radiology
SUMMER 2019



Contact us at:
**RadNewsletter@mednet.ucla.edu**

A Publication of
UCLA Department of Radiological Sciences