

Daily Bulletin

THE OFFICIAL NEWSPAPER OF THE RSNA ANNUAL MEETING • ONLINE AT RSNA.ORG/BULLETIN

Driving Value Through Imaging

As healthcare moves from a volume- to value-based environment, radiologists need to own responsibility for accurate and timely diagnosis to drive value, according to Vivian S. Lee, MD, PhD, MBA, who delivered the Annual Oration in Diagnostic Radiology, "Health Care Transformation: Driving Value through Imaging."

By Mike Bassett

We are facing a pretty significant healthcare crisis in this country," said Dr. Lee, who is senior vice president of the University of Utah Health Sciences, CEO of the University of Utah Healthcare, and dean of the University of Utah School of Medicine. She pointed out that healthcare costs in the U.S. have increased by more than 50 times compared to the rate at which wages have increased over the last 50 years, "and this increase in costs is simply unsustainable."

To make matters worse, she added, despite the world's highest per capita healthcare expenditures, "the U.S. falls woefully short in most measures of health quality or outcomes," when compared to

other Organization for Economic Cooperation and Development (OECD) nations.

So the question, according to Dr. Lee, is how do we focus our healthcare delivery system on value?

Which begs the question of how value is defined.

She pointed out that her home state of Utah has the lowest healthcare cost per capita in the country, yet constantly ranks high among the other 49 states in terms of the health of its population.

Dr. Lee explained that the University of Utah Health Sciences thinks about value with a very simple equation: how quality and service can be combined at a reasonable cost.

In the case of the University of Health Sciences, the institution is providing bet-

ter quality (it is ranked number 1 in quality as determined by quality rankings

of 100 academic health centers), while national benchmarks for patient satisfaction scores show that 24 percent of Utah Health providers rank in the top 1 percent of providers, 44 percent rank in the top 10 percent.

"At the same time, we have been very attentive to costs," Dr. Lee said. "We are among the lowest cost academic systems in the country."

Dr. Lee went on to describe how—at a system level—her institution and others like

it are "thinking about the need to drive more toward value, to measure quality, to measure patient satisfaction, to feed that data back to providers, and give them the opportunity to respond to that and improve."

And what role will radiology play in this process?

"I think without a doubt those of us who have trained in the last 20 or 30 years will say we have had an enormous impact on the field of medicine," Dr. Lee said.

CONTINUED ON PAGE 8A



Vivian S. Lee, MD, PhD, MBA, delivers the Annual Oration in Diagnostic Radiology.

Imaging Plays Key Role in Race to Combat the Zika Virus

By Richard Dargan

Radiology research is providing important information about the effects of the Zika virus to researchers searching for potential treatments and a vaccine, according to presenters at a Hot Topic Session on Monday.

Spread to humans primarily through the bite of an infected mosquito, the Zika virus was first discovered in 1947 in Africa. It remained relatively unknown to the public until 2015, when an outbreak occurred in Brazil just a year before Rio de Janeiro, the country's second-largest city, was set to host the Summer Olympics. Brazilian physicians who quickly realized the dramatic impact of the virus when transmitted from a pregnant mother to her fetus worked together to publish a special report on the Zika virus in the August 2016 online edition of *Radiology*.



Researchers including Richard L. Robertson, MD, (at the podium) shared findings on recent Zika research published in *Radiology*. (See research photos on Page 8A.)

"Creating a collaborative circle to support the researchers was the key that allowed us to quickly map the disease and understand its meaning and severity," said presenter Jacob Szejnfeld, MD, PhD, from the Federal University of São Paulo, and an author on the *Radiology* study.

"*Radiology* and RSNA were sensitive to recognize the urgency and importance of the

CONTINUED ON PAGE 8A

AODR Presentation Dedicated to Singleton

THE ANNUAL ORATION in Diagnostic Radiology was dedicated to the memory of Edward B. Singleton, MD, a beloved teacher and luminary radiologist recognized for his extensive research of rare pediatric disorders.

A Texas native, Dr. Singleton earned his medical degree at University of Texas Medical Branch in his hometown of Galveston. He trained as a radiologist at the University of Michigan in Ann Arbor before returning to Texas in 1953 to become the chief of radiology at St. Luke's Texas Children's Hospital, where he remained his entire career. In recognition of his contributions and devotion to pediatric radiology, the Edward B. Singleton Endowed Chair in Pediatric Radiology was established at Texas Children's Hospital in 2012.

A pioneer in the field of pediatric radiology, Dr. Singleton authored or co-authored more than 130 scientific

manuscripts, 14 book chapters and three textbooks. He served as a clinical professor at the University of Texas in Houston and professor of radiology at Baylor College of Medicine in Houston. He was twice recognized for teaching excellence by Baylor College of Medicine.

During his illustrious career, Dr. Singleton was awarded gold medals by the American College of Radiology, the American Roentgen Ray Society, RSNA, the Society of Pediatric Radiology and the Texas Radiology Society. He delivered the RSNA Annual Oration in Diagnostic Radiology in 1980.

Dr. Singleton passed away January 10, 2015, at 94.



Edward B. Singleton, MD

Radiation Safety



American Association of Physicists in Medicine

Tip of the Day

Dose alerts are set for equipment as a complete unit, and the alert may kick in during a high-dose procedure like CT-fluoroscopy, interrupting imaging. Always ensure someone in the room has the override password when performing high-dose procedures.

INSIDE TUESDAY

How do Residents Use Social Media?



We asked doctors in the Residents Lounge. 10A

Preparing for Terror

Experts discuss what radiologists can do prepare for a radiological or nuclear terrorism event. 18A



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Tuesday At a Glance

7:15-8:15
Controversy Session: A New Perspective on Radiation and Sedation Risk in Children: Should ALARA be as ‘Low’ or as ‘Light’ as Reasonably Achievable? (E451A) SPSC30

Hot Topic Session: Multi-Spectral Cardiovascular CT Imaging (E352) SPSH30

RSNA Diagnosis Live™: Imaging in the Cobra Kai Dojo (E451B) SPDL30

8:30-10:00
Educational Courses

BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow

RSNA Diagnosis Live™: Do You Know Your Head and Neck Anatomy? (E451B) RC306

8:30-NOON
Series Courses

10:30-NOON
Scientific Paper Sessions

BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow

RSNA Resident and Fellow Symposium: Career 101: Contract Negotiation (E451B) MSRP31

Turkey Presents: The Meaning of Evolution for Radiology and Advances in Neuroradiology (E353C) SPCP31

11:00-1:00
3-D Printing Theater Presentations (Learning Center) GEN30

12:15-1:15
Exhibit and Poster Discussions (Learning Center)

1:00-3:00
RSNA Resident and Fellow Symposium: Career 102: Financial Planning (E451B) MSRP32

1:30-2:45
Plenary Session (Arie Crown Theater) PS30

Presentation of the Alexander R. Margulis Award for Scientific Excellence

Presentation of the Gold Medal of RSNA

New Horizons Lecture
Beyond Imaging: Radiology of Tomorrow
Hedvig Hricak, MD, PhD, Dr(hc)

1:30-6:00
Interventional Oncology Series: Lung and Muskuloskeletal (S405B) VSIO31

2:30-4:00
Educational Courses

3:00-4:00
Scientific Paper Sessions



3-D printing exhibit in the Learning Center

3:00-4:15
BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow

3:00-6:00
Pediatric Series: Abdomen (S102AB) RC413

4:30-6:00
Educational Courses

RSNA Diagnosis Live™: High Resolution CT of Diffuse Lung Disease: Read Cases with the Experts (E450A) RC401

4:45-6:00
BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow

View the full program and add sessions to My Agenda on the RSNA 2016 App or at Meeting.RSNA.org.

Daily Bulletin

TUESDAY
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The RSNA 2016 Daily Bulletin is the official publication of the 102nd Scientific Assembly and Annual Meeting of the Radiological Society of North America. Published Sunday, November 27–Thursday, December 1.

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Further, Together

Protocols Focused on Detection of Injury, Adaptation in Young Athletes

Early detection of stress injuries and overuse changes in adolescent athletes may lead to improved treatment and allow for new training guidelines. Two studies presented Monday evaluated techniques designed to examine young athletes with the aim of optimizing imaging methods and slowing injury progression.

By Lynn Antonopoulos

MRI Technique Offers Improved View of Physal Changes

Researchers at Academic Medical Center in Amsterdam explored the use of MRI over conventional radiography to identify subtle stress changes of the distal radial growth plate in young gymnasts with the hope of diagnosing growth plate injury at an earlier stage.

Radial epiphysitis or “gymnast wrist” is an injury requiring long recovery periods and causing long-term degeneration of the wrist joint. Laura Kox, MD, reported that while conventional radiology can be used to identify severe cases of gymnast wrist, “MRI is capable of depicting more subtle changes because of its ability to image cartilage and bone marrow edema.”

Dr. Kox and her colleagues established a series of test sequences examining the distal radial physes to identify the aspects typical for symptomatic gymnasts, asymptomatic gymnasts and non-gymnastic controls. They examined 19 gymnasts with wrist pain, five without wrist pain and five non-gymnasts between the ages of 12 and 17 years.

All participants underwent radiography and MRI of the wrist. MRI was performed on a 3T scanner and included coronal proton density (PD) images with and without fat saturation as well as 3-D WATSc and T1-weighted and T2-weighted Dixon series.

An experienced musculoskeletal radiologist evaluated the appearance of the

physes and 3-D reconstructions were created for analysis. The water fraction in the adjacent metaphyseal bone was quantified using Dixon water-only images. Magnetic resonance images of symptomatic gymnasts were compared with those of asymptomatic and non-gymnast controls.

The results show that the median volume of the physis of symptomatic gymnasts was 817 mm³ compared to 829 mm³ in asymptomatic gymnasts. The median water fraction in the metaphysis was 38 percent for symptomatic gymnasts and only 30 percent in those that were asymptomatic. Thus the water fraction method proved more useful in discerning changes in gymnasts’ wrists.

Other abnormalities were found in both groups such as metaphyseal intrusions and disruption of the physal layer, but these were not recognized on the radiographic images. The results emphasize the importance of MRI in early diagnosis of physal

stress injury.

Dr. Kox and her team plan to expand their research to a larger population in the hope of evaluating the effect of rest on the growth plate and applying their findings to provide treatment information for their patients.

Finer Adaptive and Overuse Changes Identified through Ultrasound Exam

In a similar study, presenter Kathryn Garcia, high school intern at Stanford University, and her fellow researchers at Stanford Children’s Hospital used ultrasound (US) to assess for differences in thickness of soft tissue, flexor and exten-

sor tendons and volar plate as well as bony and physal deformities in adolescent rock climbers.

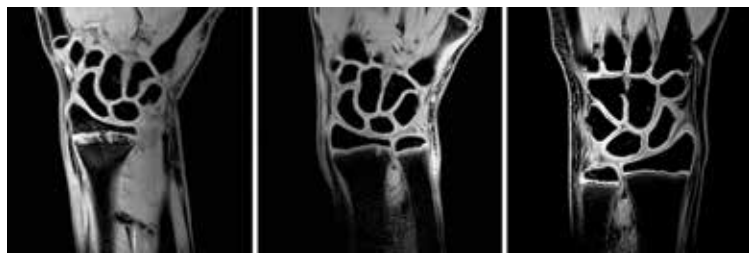
Garcia and her team examined the third and fourth digits of the right hands of 20 adolescent rock climbers (ages 10-18) and six non-climbing, age-matched control subjects. The climbers were grouped into three levels based on the number of hours/week, years of climbing and preferred climbing technique with Level 3 representing the most intense training.

Findings revealed adaptations correlating with training intensity including significant soft tissue hypertrophy of the flexor compartment and bony remodeling compared to non-climbing controls. In all, 53 percent of climbers in the study also demonstrated overuse injuries, likely due to repetitive trauma and imbalance of mechanical force.

Compared with non-climbing control subjects, climbers demonstrated significantly thicker flexor tendons, MCP volar plates and soft tissues (all $p < 0.05$). Climbers also had comparatively larger bony tubercles at flexor digitorum profundus insertion.

“We discovered some unexpected injuries in the physis, such as fractures and deformities,” says Garcia. “We also found more phalangeal malalignment in the fingers of young climbers than expected.”

Joint effusions were found in 68 per-



Cartilage-sensitive MRI images illustrating a severe case of radial epiphysitis in a gymnast with wrist pain (left), and a more subtle change with intrusion of the growth plate cartilage into the metaphysis in an asymptomatic gymnast (center). The healthy physis of a non-gymnast child (right).



Laura Kox, MD



Kathryn Garcia

cent of climbers while significant phalangeal malalignment was seen in 53 percent. Physal deformities were identified in four climbers, all of whom were Level 3 climbers. The findings show that more training can lead to more significant damage over time regardless of intensity.

Responding to an audience question about MRI correlation of the US study results, Erika Rubesova, MD, a study author, said MRI correlated to the US findings showing the thickness changes, but the sampling was too small and requires an additional study with a larger population.

Garcia said she plans to perform follow-up examinations of the climbers to evaluate the progression or improvement of injuries with a change of training practices. “Long term, we hope to develop guidelines for the training of young rock climbers,” she added.

2016 Honorary Members



Honorary Membership is presented for significant achievements in the field of radiology. On Monday RSNA President Richard L. Baron, MD, presented the 2016 Honorary Memberships. Pictured (left to right): Carlo Bartolozzi, MD, of Pisa, Italy, Dr. Baron, Osamu Matsui, MD, PhD, of Kanazawa, Japan, and Luis Donoso-Bach, MD, PhD, of Barcelona, Spain.

Medical Physics

Question of the Day

Q I want to buy a new mammography unit, but it has a tungsten target. Don't I need the characteristic x-rays from Molybdenum to have the optimal energy range for breast imaging?

[Answer on page 11A.]

Tickets Available for Chicago Blackhawks vs. Florida Panthers

The 2015 Stanley Cup Champions the Chicago Blackhawks will battle the Florida Panthers on the ice tonight, and tickets are available for purchase. The United Center is a state-of-the-art sports facility with all the amenities guaranteed to make your game viewing experience unforgettable. Thousands flock to the city's West Side for each home Blackhawks game. Nothing thrills more than the sound of the puck hitting the goal after a slap shot and the announcement of “GOAL!” by the ref.

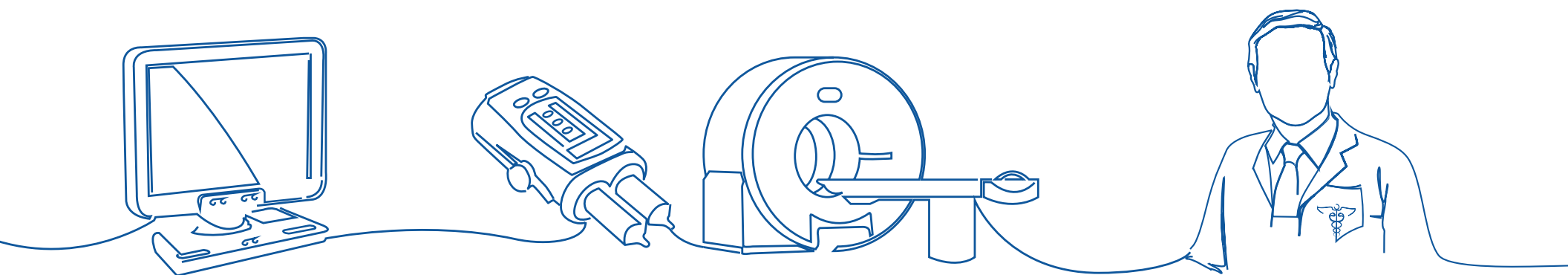
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RSNA 2016 Gold Medalists

RSNA's highest honor—the Gold Medal—will be awarded to three individuals during today's plenary session.

AN INTERNATIONALLY RECOGNIZED EXPERT in the field of imaging informatics, **Paul J. Chang, MD**, was a pioneer in creating rapid methods of moving digital radiology images and spearheaded numerous research and development projects related to imaging informatics and enterprise-wide informatics challenges.



Paul J. Chang, MD

Dr. Chang's early work in workstation design has resulted in presentation and navigation models that are widely used by the majority of picture archiving and communication systems (PACS). While at the University of Iowa, he established and evaluated one of the first ultrasound rural tele-radiology networks to provide primary interpretation. Dr. Chang co-invented a novel lossless wavelet-based image distribution mechanism, dynamic transfer syntax (DTS); this technology was subsequently commercialized by the creation of Stentor PACS, which was later acquired by Philips Medical Systems.

Under his leadership and in collaboration with RSNA, RSNA Diagnosis Live™, a novel cloud-based interactive educational platform featuring gamification and deep analytics was developed. Diagnosis Live continues to be a very popular part of the RSNA annual meeting and is being used in residency programs worldwide.

Dr. Chang is professor and vice chairman of radiology informatics at the University of Chicago School of Medicine. He also serves as medical director of enterprise imaging and of SOA infrastructure at University of Chicago Hospitals. He received his undergraduate degree from Harvard University and his medical degree from Stanford University.

Concurrent with his medical school training, he also received his Master of Science degree in engineering-economic systems from Stanford. Dr. Chang completed his residency and fellowship training in diagnostic radiology at Stanford University Hospital.

Dr. Chang has been a member of the RSNA Radiology Informatics Committee (RIC) and serves as an informatics consultant to RSNA for the RadSCOPE electronic education initiative. He presented the 2012 New Horizons Lecture at the RSNA annual meeting.

A distinguished leader in healthcare delivery



Burton P. Drayer, MD

and medical education, **Burton P. Drayer, MD**, is internationally known for his research using anatomic, physiologic and functional imaging of the aging brain. He was the first to define the normal and abnormal presence of brain iron using MRI. His research interests also include neurodegenerative disorders, brain infarction, xenon-enhanced CT for measuring regional cerebral blood flow, MR angiography, multiple sclerosis and intrathecal

contrast media toxicity.

Dr. Drayer is CEO of the Mount Sinai Doctors Faculty Practice and Dean for Clinical Affairs, the Icahn School of Medicine at Mount Sinai Medical Center in New York City. Dr. Drayer also serves as the Dr. Charles M. and Marilyn Newman Professor and system chair of the Department of Radiology, Icahn School of Medicine, and as executive vice president for Risk, the Mount Sinai Medical Center.

Dr. Drayer, who served as RSNA president in 2011, received his undergraduate degree in political science from the University of Pennsylvania in Philadelphia. In 1971, he received his medical degree from Chicago Medical School and went on to complete a medical internship and neurology residency at the University of Vermont in Burlington. Dr. Drayer completed his radiology residency followed by a neuroradiology fellowship at the University of Pittsburgh Medical Center.

Dr. Drayer's many accolades include the Cornelius G. Dyke Award from the American Society of Neuroradiology (ASNR) and the Distinguished Service Award from the American Board of Radiology (ABR). He received the ASNR gold medal in 2011.

An RSNA member since 1980, Dr. Drayer currently serves as chair of the RSNA Research & Education (R&E) Foundation Board of Trustees. He served as RSNA first vice president in 2003. Dr. Drayer has been an active volunteer, serving as chair of the Public Information Committee, and a member of the Public Information Advisors Network and the R&E Foundation's Public Relations Committee.

Dr. Drayer was elected to the RSNA Board of Directors in December 2003, was liaison for the annual meeting

and technology until 2008, and served as Chairman of the Board and president-elect in 2009 and 2010 respectively.

A world-renowned abdominal radiologist,



Robert J. Stanley, MD

Robert J. Stanley, MD, became a leading authority in the early development of body CT imaging and has been a mentor to future generations of radiologists.

Dr. Stanley grew up in New Jersey, where he earned his undergraduate degree at St. Peter's College in Jersey City, N.J. He then headed west and earned his medical degree at St. Louis University, where he also completed a medicine internship and a year of surgery residency before completing his radiology residency. More recently, he received a Master of Science degree in health administration at the University of Alabama at Birmingham (UAB), where he is professor emeritus in the Department of Radiology.

Dr. Stanley's involvement with whole-body CT began in earnest in the fall of 1975 when EMI Corp. collaborated with Washington University and the Mayo Clinic in Rochester, Minn. (MIR), for the implementation and evaluation of its first two whole body CT scanners in the United States. Given the opportunity, along with Stuart S. Sagel, MD, to head up the newly created body CT facility, Dr. Stanley soon became an authority in the new imaging field.

Just prior to leaving MIR, Dr. Stanley and his co-authors, Dr. Sagel and Joseph K. T. Lee, MD, completed the first edition of their landmark CT textbook, *Computed Body Tomography with MRI Correlation*, currently in its fourth edition.

Dr. Stanley continued to serve on the clinical faculty at UAB, primarily working with residents in their body CT education until July 2014, when he retired from the clinical faculty.

In 2014, he was awarded the Walter B. Cannon Medal for distinguished contributions to GI radiology by the Society of Abdominal Radiology. Also in 2014, he was awarded the first SCBT-MR gold medal for significant contributions to CT imaging. Dr. Stanley was an advisory editor and associate editor on the *Radiology* Editorial Board, and has also served on the RSNA Public Information Advisors Network.

RSNA Research & Education (R&E) Foundation Celebrates #GivingTuesday

The R&E Foundation participates in #GivingTuesday, a global day dedicated to giving.

LAST YEAR, MORE than 45,000 organizations in 71 countries came together to celebrate #GivingTuesday — a movement to celebrate and provide incentives to give. Since its founding in 2012, #GivingTuesday has inspired giving around the world, resulting in greater donations, volunteer hours and activities that bring about real change in communities.

To meet the increasing demand for RSNA R&E Foundation grants, the



Foundation launched the Inspire-Innovate-Invest Campaign in 2014. The Foundation seeks to raise \$17.5 million to fund grants in radiologic research

and education, bridging gaps in funding for promising investigators and educators.

Celebrate #GivingTuesday by making a donation to the Foundation today at RSNA.org/Foundation or by visiting the R&E Foundation booth in the Connections Center.

MONDAY'S PRESS RELEASES

Research developments presented at the annual meeting are shared with the public through print, broadcast and internet media stories. Three stories were released to the press on Monday:

Head Impacts Lead to Brain Changes in High School Football Players

Brain imaging exams performed on high school football players after just one season revealed changes in both the gray and white matter that correlated with exposure to head impacts, says a new study. The study included 24 players from a high school football team in North Carolina, each of whom wore a helmet outfitted with the Head Impact Telemetry System (HITS) during all practices and games. Each player underwent pre- and post-season imaging to assess changes in brain structure and function. None of the players were diagnosed with concussion, but players with greater head impact exposure had the greatest change in imaging metrics.

Large Study Finds No Evidence for Age-Based Mammography Cut-Off

In the largest-ever study on screening mammography outcomes, researchers found that there is no clear cut-off age to stop breast cancer screening. Using data from the National Mammography Database, the research team from University of California, San Francisco, analyzed data from more than 5.6 million screening mammograms performed over a 7-year period between January 2008 and December 2014 in 150 facilities across 31 states in the U.S. Data from 3.6 million women over age 40 were sorted into patient groups by age in 5-year intervals. Based on increasing age, performance metrics demonstrated an upward trend for cancer detection rate and positive predictive values, and a downward trend in recall rates until age 90.

Study Finds Cause of Visual Impairment in Astronauts

Over the last decade, flight surgeons and scientists at NASA began seeing a pattern of visual impairment in astronauts who flew long-duration space missions. The astronauts had blurry vision, flattening at the back of their eyeballs and inflammation of the head of their optic nerves. This new study found that long-duration astronauts had significantly greater post-flight increases in orbital and ventricular cerebrospinal fluid (CSF) volume. The large post-spaceflight ocular changes observed in International Space Station crew members were associated with greater increases in intraorbital and intracranial CSF volume.

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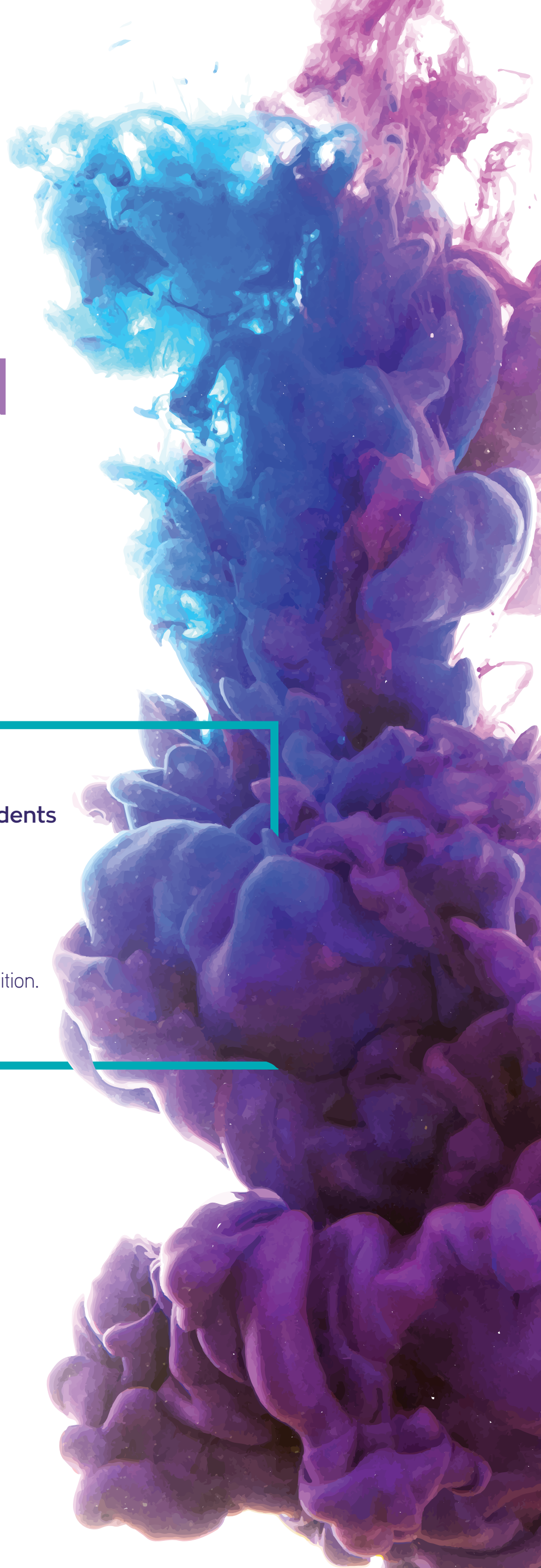


Image-guided Cryoablation May Offer Alternative to Surgery for Kidney Cancer

By Mike Bassett and Paul LaTour

The use of percutaneous image-guided cryoablation on patients with T1 renal cell carcinoma is both effective and safe, according to a scientific poster presentation given Monday.

“The standard of care is to maximize preservation of renal function as much as possible. With this evidence, it’s safe to say in the appropriate patient and the appropriate context, percutaneous cryoablation could be a first-line therapy,” said presenter Farzad Sedaghat, MD, a radiology fellow at Brigham & Women’s Hospital (BWH) in Boston.

While partial nephrectomy is currently the gold standard for treating renal cell carcinoma, the use of image-guided cryoablation “has become a very good alternative over the last 15 to 20 years,” said study co-author Kemal Tuncali, MD, also of BWH.

“Not all patients are good candidates for partial nephrectomy,” said Dr. Tuncali. “It’s a big surgery under general anesthesia.” He added that issues like advanced age, comorbidities, and the location of the tumor on the kidney could make some patients unsuitable for surgery.

Image-guided cryoablation, on the other hand, is much less invasive. It involves the insertion of a needle into the tumor and the use of energy (in this case freezing) to destroy the tumor.

Dr. Tuncali said that the technique is known to have good results, “but to be comparable to surgery much longer follow-ups are needed. We have to follow the patients for up to 10 years to make sure there is no recurrence of the disease and to see how patients do as far as survival outcomes.”

The purpose of this study was to demonstrate the recurrence rates, medium to long-term survival outcomes, and adverse events in 285 patients with solitary renal cell carcinomas who underwent percutaneous image-guided cryoablation between Aug. 1, 2000, and Dec. 31, 2013.

Tumors (median size 2.5 cm) were ablated using one to seven cryoprobes, while CT or MRI was utilized for image guidance.

The success rate (meaning no tumor recurrence) was 97.8 percent.

“And with ablation, we also talk about secondary technique efficacy in which patients who had a recurrence we retreated with

ablation,” he said. “And in that case the overall success rate was 99 percent. So, only 1 to 2 percent of patients showed recurrence in intermediate or long-term follow up.”

As for survival rates, using the Kaplan-Meier survival analysis, Dr. Tuncali and his colleague found that overall five-year and 10-year survival rates were 90 percent and 79 percent respectively. The 10-year cancer-free survival rate was 94 percent, while the disease-specific survival rate was 98 percent.

Dr. Sedaghat said the risk of hemorrhage from the procedure is often brought up. However, the research he presented showed minimal incidents of hemorrhaging.

“Hemorrhage requiring transfusion happened in less than 1 percent of patients and we never required any other further intervention. It’s quite safe,” he said.

They reported the overall complication rate was 14 percent. Adverse events (AEs) included nine grade 1 AEs (such as pain or perinephric hematoma), 17 grade 2 AEs (including myoglobinemia and urinary retention), 11 grade 3 AEs (including urinary tract infec-



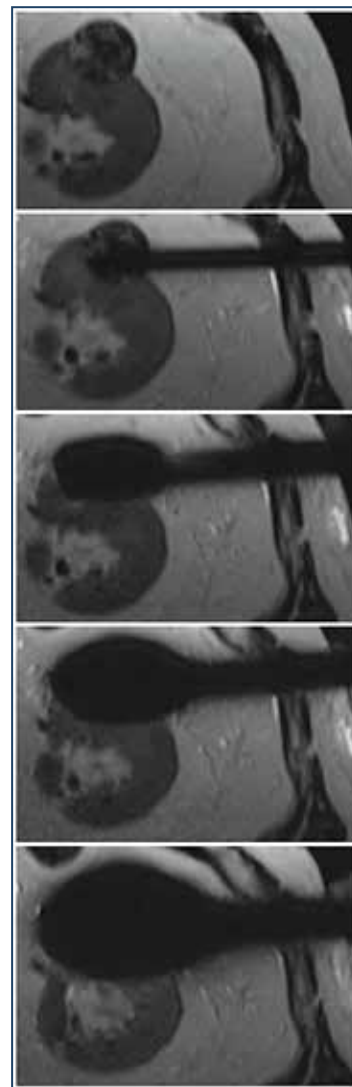
Farzad Sedaghat, MD

tions, anemia and pneumonia), and three grade 4 complications (CVA, aspiration pneumonia and hypertensive emergency).

“We concluded that percutaneous ablation of T1 renal cell carcinoma resulted in highly successful intermediate and long-term outcomes,” Dr. Tuncali said. “This data may help physicians and patients in choosing among various treatment options.”

Dr. Tuncali emphasized that the value of this study was its size and that it looked at results over the long-term.

“A number of studies have been published looking at image-guided ablation or radio frequency ablation of kidney tumors, but all have been relatively small series,” he said. “The advantage of our study is that it included a larger patient population and included intermediate and long-term follow ups.” He added that a randomized control trial comparing the long-term efficacy of ablation to partial nephrectomy would be useful.



Serial intra-procedural MRI images from a percutaneous MRI-guided cryoablation of a renal cell carcinoma demonstrating iceball growth.

Imaging Plays Key Role in Race to Combat the Zika Virus

CONTINUED FROM COVER

material and agreed to publish it on a fast track.”

The Zika virus has some similarities to other congenital infections, including Rubella — a devastating viral infection that affected tens of millions of people before it was eradicated with the help of a vaccine — according to presenter Richard L.

Robertson, MD, pediatric neuroradiologist at Boston Children’s Hospital in Boston.

Like Rubella, Zika is most dangerous when the infection occurs during the first trimester of pregnancy. But while Rubella is less dangerous when infection occurs later in pregnancy, evidence has shown that Zika infections can still cause brain abnormalities and intrauterine fetal death in the third trimester.

Researchers are studying whether Zika has similarities to Cytomegalovirus (CMV), a congenital infection still seen in the general populace. The risk of congenital CMV transmission is highest in pregnant women with no immunity who acquire primary CMV infection during pregnancy.

“We need to ask the question: Is Zika striking populations so strongly due to no prior immunity in the population?” Dr. Robertson said. “And are there co-infections or other environmental factors that increase risk?”

Imaging Reveals Devastating Effects of Zika

Zika has become synonymous with microcephaly, in which the baby’s head is exceptionally small due to an underdeveloped

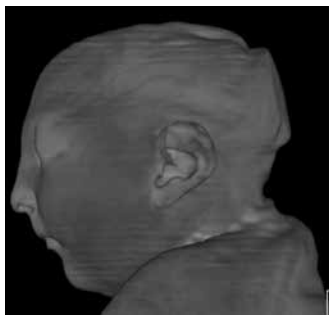
brain. But there are a number of other fetal abnormalities that can be seen on imaging, according to presenter Patricia Soares de Oliveira-Szejnfeld, M.D., from the Federal University of São Paulo, an author on the *Radiology* study, which detailed the spectrum of imaging findings in babies and fetuses infected with the Zika virus.

Researchers discussed their *Radiology* research at the Monday session, sharing MRI and ultrasound images revealing a devastating panorama of effects on the fetal brain, including gray and white matter volume loss, calcifications and the condition ventriculomegaly, in which certain ventricles in the brain are enlarged.

“Ultrasound during the second trimester is a valuable tool to detect Zika virus infection,” Dr. Oliveira-Szejnfeld said. “Fetal MRI adds specific information about the diagnosis and evaluation of brain

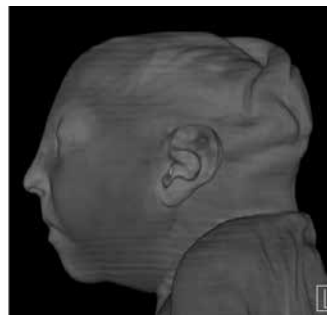
damage, especially for cortical and posterior fossa malformations.”

Presenter Fernanda Tovar-Moll, MD, PhD, from the D’Or Institute for Research and Education in Rio de Janeiro, credited multidisciplinary collaboration for new insights into the mechanisms behind Zika’s effects on fetal development. There is evidence that infection affects apoptosis — the process by which cells undergo programmed death, said Dr. Tovar-Moll, lead author on the *Radiology* study.



Surface reconstruction postnatal CT image obtained 1 week after delivery at 38 weeks of gestational age in the case of a 24-year-old woman pregnant with twins, with characteristic rash at 9 weeks of pregnancy and confirmed Zika virus infection.

(Radiology 2016;281:1:203–218 ©RSNA 2016. All rights reserved. Printed with permission.)



Combating Zika will require a three-pronged approach, according to Andrew Hale, MD, senior fellow in infectious diseases at Beth Israel Deaconess Medical Center and Harvard Medical School in Boston. They are: mosquito abatement, the search for effective medications and the development of a vaccine.

The insecticide Naled is safe and effective at reducing the two types of mosquitoes that act as vectors for the disease,

he said, and researchers are also studying genetically modified mosquitoes as a way to lower the risk of transmission. A recent study suggested that the drug 7DMA, previously developed to treat Dengue, another mosquito-borne virus, may be a promising option for combating Zika virus infection.

A vaccine currently under investigation has been 100 percent effective at preventing Zika infection in mice and rhesus monkeys, but it will be at least two years before it is available to use in humans, Dr. Hale said.

Zika Focus of RSNA 2016 Sessions

Essentials of Intrauterine Zika Virus Infection: Pre and Postnatal CNS Findings (PD232-SD-WEA3), Wednesday, 12:15 to 12:45 p.m., PD Community, Learning Center Station #3

Neuroradiological Findings Related to Zika Epidemic: Experience from a Brazilian University Hospital (NR394-SD-WEB2), Wednesday, 12:45 to 1:15 p.m., NR Community, Learning Center Station #2

Microcephaly in Zika Virus Era: An Imaging Pattern Recognition Approach (NR330-ED-X), All Day, NR Community, Learning Center

CT Models Predict COPD and Smoking-Related Morbidity in Cigarette Smokers

By Lynn Antonopoulos

Biomarkers extracted from inspiratory CT scans during lung cancer screenings reveal measures for emphysema and airway obstruction useful in predicting chronic obstructive pulmonary disease (COPD) and smoking-related morbidity in cigarette smokers, according to research presented Monday.

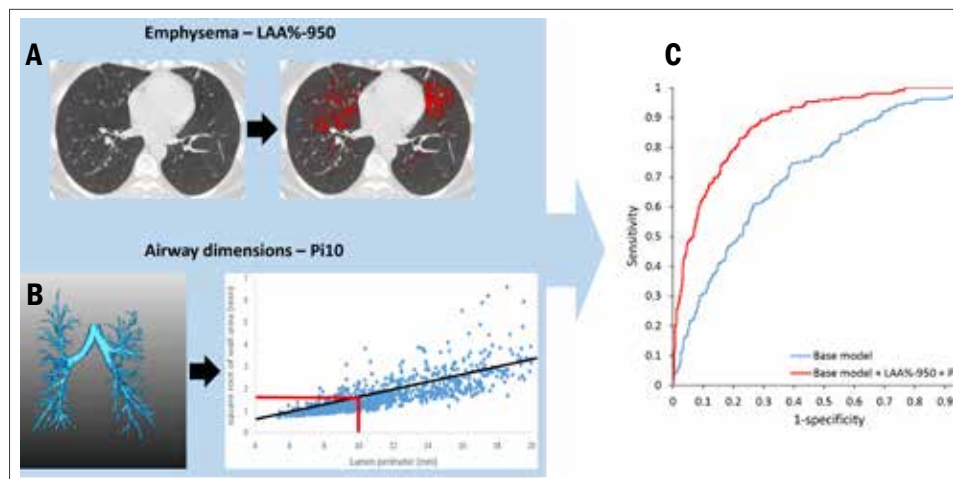
Researcher Jean-Paul Charbonnier, MS, PhD candidate at Radboud University in the Netherlands, discussed the results of a study using quantitative CT (QCT) aimed at quantifying features related to COPD and smoking-related morbidity. The models developed may be used in clinical practice to more quickly provide insights into patients' health and, in the case of lung cancer screenings, detect more than just pulmonary nodules.

Setting the framework

Charbonnier and his colleagues examined data from 1,544 subjects participating in the first phase of the COPDGene® study, one of the largest studies to investigate causal genetic factors of COPD. They used clinical and functional characteristics collected from subjects during physical examinations. Additionally, they performed image analysis on available inspiratory and expiratory CT scans to quantify emphysema, airway dimensions and air trapping.

Based on QCT, COPD was defined by a ratio of forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) <0.7. Smoking-related morbidity was defined as FEV1/FEVC <0.7 with either a St. George's Respiratory Questionnaire score greater than or equal to 25 or an exacerbation frequency greater than or equal to two.

During the extraction of quantitative



Prediction of smoking-related morbidity (defined as having COPD with more than 1 exacerbation per year or a St. George's Respiratory Questionnaire score ≥ 25) using quantitative CT (QCT) derived measures from inspiratory CT. The base model consisted of age, gender, BMI, pack years, smoking status and total lung capacity. The QCT model additionally included emphysema (A) (LAA percent -950) and airway dimensions (B) (Pi10). The performance of the prediction models was assessed on a validation data set (585 subjects with and 212 subjects without smoking-related morbidity), with an area under the ROC curve of 0.72 for the base model (blue ROC curve), and 0.88 for the QCT model (red ROC curve) (C).

information, the researchers faced some challenges in comparing subjects' lungs, typically because of differences in anatomy or scanner parameters. "Variations can be difficult for automated algorithms that perform the CT quantification," Charbonnier said. "Visual assessments are sometimes needed and take a substantial amount of time and effort."

Emphysema was defined as the percentage of low-attenuation areas <-950HU (LAA percent -950). Airway wall abnormalities were also defined on inspiratory CT using measurements taken from multiple cross-sectional lumen perimeters and airway wall areas. Using linear regression, the measurements were represented as the

square root of wall area of an airway with a perimeter of 10 mm (Pi10). Air trapping was defined on expiratory CT as the percentage of low-attenuation areas <-856HU (LAA percent -856).

Developing prediction models

The researchers fitted six logistic regression models for the prediction of both COPD and smoking-related morbidity using a random subset of 747 subjects. The models were validated on a separate subset of 797 subjects using the area under the receiver operating curve.

Model 1 included age, gender, BMI, smoking status, total lung capacity and pack years – a calculation multiplying the

number of packs of cigarettes smoked per day by the number of years a person has smoked. Models 2 through 6 additionally included emphysema (model 2), air trapping (model 3), airway dimensions (model 4), emphysema and airway dimensions (model 5) and emphysema, air trapping and airway dimensions (model 6).

Findings revealed that CT-quantified emphysema, air trapping and thickening of the airway walls are all predictors of COPD and smoking related morbidity. They were also independent predictors of smoking-related morbidity in all except for LAA percent -950 in model 5. Because emphysema and airway wall thickening can be detected on inspiratory CT, Charbonnier said the conditions could be detected during standard lung cancer screenings.

Employing computer-based algorithms, the team assessed the large amount of data and provided a level of disease quantification that, according to Charbonnier, would otherwise be difficult or even impossible for human observers. He said, "Automatic and semi-automatic methods to analyze medical images are potentially important tools to assess image information more accurately and effectively and help medical experts make a faster decision with more confidence."

Charbonnier noted that the additional time required to review the QCT results happens offline and does not add time to the patient's screening experience. "We live in an age in which technology plays an important part in our daily life," he said, "and advances in medical imaging pave the way for better and faster diagnosis of many different diseases."

CT-guided Botox Injections Show Promise in Easing Pelvic Pain

By Elizabeth Gardner

One in seven U.S. women experience pelvic pain, which accounts for 10 percent of gynecology visits and \$2.8 billion in healthcare costs every year. While pelvic pain has a variety of causes, about one in 50 women are diagnosed with myofascial pain in their pelvic floor muscles.

In addition to chronic pain, this condition can cause painful intercourse and urination, urinary retention and constipation. About 40 percent of women diagnosed with myofascial pelvic pain (MPP) don't respond to first-line treatments like physical therapy, acupuncture, biofeedback, NSAIDs, opioids or muscle relaxers. But Botulinum Toxin A (Botox) injections can help relieve their symptoms and may help to an even greater degree with fewer side effects if delivered using CT-guided injections.

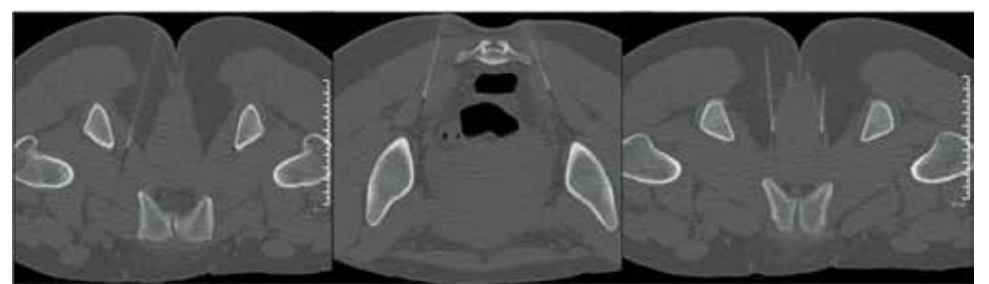
A research team at Johns Hopkins studied pain relief in 57 MPP patients who received Botox injections, and found that the CT-guided injections were 100 percent successful in reaching their targeted muscles, with fewer complications than injections guided solely by physical exam landmarks—the standard practice when injections are administered in a gynecologist's office.

The doses we're using are a half to a sixth of the doses used in a gynecologist's office, but we get the results because we're targeting injections where they are needed.

Anna Moreland, MD

In a Monday session, presenter Anna Moreland, MD, a radiology resident at Johns Hopkins and a consultant for NeuWave Medical, which creates probes used to guide the injections, said the procedure minimizes the amount of Botox needed as well as the risk that it will spread to unintended areas. As a result, the image-guided technique reduces the risk of temporary, but miserable, side effects such as urinary retention and fecal incontinence that occur in 7 to 10 percent of cases where Botox is injected without image guidance. Botox inhibits the release of acetylcholine, causing flaccid paralysis of the muscles and relieving muscle spasm.

"The doses we're using are a half to a sixth of the doses used in a gynecologist's office, but we get the results because we're targeting injections where they are needed," Dr. Moreland said.



Left to right: a CT-guided Botox injection into the obturator internus, piriformis and levator ani muscles. — Image courtesy of Anna Moreland, MD.

The study population consisted of patients referred by gynecologists who specialized in chronic pelvic pain and requested injections of specific pelvic floor muscles according to point tenderness on pelvic exam. The patients' median age was 39 with a range from 21 to 68. Fifteen percent had had prior Botox injections without image guidance.

Patients were moderately sedated. Following scout CT, a 22-gauge needle was placed into each target muscle under CT fluoroscopic guidance. Botox suspended in saline was injected into the piriformis, obturator internus and/or levator ani. Most patients had only one session, but some had up to three. The median number of muscles injected during a session was two, though some patients had as many as six muscles injected during a single session.

The amount of Botox varied depending on the muscle: 50 units were used in the piriformis or obturator, and 25 units were used in the levator. If a muscle had previously under-responded to 50 units, the dose was increased to 100 units.

None of the patients had complications, either major or minor, and 73 percent reported improvement in symptoms.

Further research is needed on cost and efficacy comparisons between the two treatment techniques and settings. While using CT increases the cost of a treatment, it may also reduce the need for multiple treatments, as well as reducing the outlay for the Botox itself. The image-guided treatments typically use 50 units (at \$1 each), whereas treatments in a gynecology office might use 100 to 300 units, Dr. Moreland said.

RSNA Asks: How Do Residents/Fellows Use Social Media?

The Daily Bulletin visited the Residents Lounge on Monday to ask residents from across the globe, “How do you use social media in your daily life as a radiology resident?” While some are using social media for work-related reasons, others said they using it strictly for play.



“I’m on Facebook and Twitter, and with regards to radiology, I follow the major organizations,” said **Melkamu Adeb, MD**, a fourth-year resident from Bridgeport Hospital, Conn. “Whenever there is a scientific finding or a paper comes out, I share it.”



“I use it for private reasons but not for professional purposes,” said **Julius Renne, MD**, a last year resident at the Hannover Medical School, Germany.



“I use it to follow societies such as Radiopaedia and RSNA — what they’re reporting and the daily cases they are showing to get a diagnosis and general knowledge,” said **Filipa Duarte Figueiredo**, a second-year resident at Garcia de Orta, in Almada, Portugal.



“We have our own, free UBC radiology teaching app that we promote on Twitter,” said **Kathryn Darras, MD**, a fourth-year resident at the University of British Columbia (UBC) in Vancouver. “We use it for medical school teaching.”



“I use social media not for my job but to communicate with friends,” said **Yousun Won, MD**, a third-year resident at Soonchunhyang University Hospital in Bucheon, Korea.



“I use social media for a lot of things, specifically for IR,” said **Prakhar Agarwal, MD**, a third-year resident at Montifiore Hospital in the Bronx, New York. “I’m using it at RSNA 2016 to learn all about the advancements in radiology. You can’t walk to every part of the meeting but you get to hear from influential people on Twitter all the time.”



“I’m on Twitter and follow Radiopaedia, RSNA and RadioGraphics so I have access to cases of the day,” said **Angela Atinga, MBBChir**, a fourth-year resident from the Imperial NHS Trust in London. “On Instagram I follow one of the radiologists from the U.K. and will probably interact with other radiologists and share cases.”



“I use Twitter, mainly for getting radiology news,” said **Andrea Fuentealba, MD**, a second-year resident at Clinica Indisa, in Santiago, Chile. “I read opinions from other centers in the U.S., so I can see what’s going on in other countries.”

RSNA Spotlights Residents and Fellows

Highlighted by the annual RSNA Resident and Fellow Symposium, RSNA 2016 offers a full roster of programming geared toward residents and fellows, along with networking opportunities. New this year: Check out the Resident and Fellow Tweet Up planned for today (details below).

Experts Discuss Career Essentials

RSNA Resident and Fellow Symposium

Provided by the RSNA Resident and Fellow Committee, the symposium offers a wide range of career-related issues beneficial to radiology trainees. Add the symposium to My Agenda at Meeting.RSNA.org.

Tuesday, 10:30 a.m. – 12 p.m.

Career 101: Contract Negotiation

- Academics
- Private Practice
- Leadership Skills for Trainees

Tuesday, 1:30 – 3 p.m.

Career 102: Financial Planning

- Personal Financial Planning
- Insurance (Rad-to-Rad on Personal Finance)
- Physician’s Perspective
- What RSNA Has to Offer Members-in-Training

Other programming geared toward residents and fellows includes interactive Diagnosis Live™ sessions, strategies for American Board of Radiology exam preparation, case-based interactive review sessions, a four-part cardiac CT mentored case review and a course on international radiology outreach.



Additional Offerings

Residents Lounge

RSNA members-in-training and non-member residents are offered a place to relax and network while enjoying complimentary refreshments. The lounge (pictured above) is open Sunday through Thursday, 8 a.m. – 6 p.m.

Resident and Fellow Tweet Up

Get some face-to-face time with radiology residents and fellows you’ve conversed with on Twitter at this IRL (in real life) networking event for trainees. The Tweet Up will be held in the Discovery Center from 3:30 – 4:30 p.m., Tuesday, Nov. 29.

Electronic Tools Connect Radiologists with Patients

By Felicia Dechter

IN THIS ERA OF CONSUMER-DRIVEN HEALTHCARE, patient portals, online health resources and social media, radiologists must use such tools to provide personal and patient-friendly services and use a variety of means to connect with patients.

Harnessing the power of the Internet and social media to make radiology more patient centered was the topic of Monday's RSNA Public Information Committee-sponsored session, "Tweet This: How to Make Radiology More Patient Centered."

Patient-centered care is not a new idea, but the principles were reinforced in the 2001 Institute of Medicine report, "Crossing the Quality Chasm: a New Health System for the 21st Century," said presenter Susan John, MD, chairman of Diagnostic and Interventional Imaging and professor of Diagnostic Imaging and Pediatrics at Memorial Hermann Hospital in Houston.

"Since then, the concept of customized patient care that honors the patient's values, preferences, and needs has become the guiding principle of high-quality care in diagnostic and interventional imaging practices," Dr. John said. "Personalized interactions between members of the health-care team, patients and families are what define patient-centered care."

These interactions can occur in many ways, depending on the type of imaging facility, the imaging procedure being performed, and the desired outcome of the communication. For example, Dr. John's institution hosts an "Ask the Imaging Expert" website encouraging patients to post general questions about imaging procedures.

Key to creating a patient-centered culture is teaching medical students, residents and fellows how to keep the patient as the focus during their care, which includes education on the importance of communicating with patients compassionately and effectively.

The importance of accurate, well-written radiology reports has been elevated to a new level with the advent of patient portals through which patients can directly view their reports.

"Electronic communication tools are becoming increasingly valuable as methods of information transfer between patients and physicians," Dr. John said. "In the future, I anticipate that patient portals and facility websites will develop even more elegant ways to facilitate high quality patient experiences in radiology."

Social Media Drives Patient Engagement

Using social media to strengthen radiology is critical, said Whitney Fishman Zember, MBA, managing partner of innovation and consumer technology at the New York City-based MEC, a leading advertising media planning agency with expertise in digital media, social media marketing and more.

"Social media is a powerful tool for any brand or business when it comes to driving consumer engagement, relationships and conversation," Zember said. "It is no dif-



Using electronic tools to connect with patients was discussed at Monday's RSNA Public Information Committee-sponsored session, "Tweet This: How to Make Radiology More Patient Centered." Right: Susan John, MD, leads the panel discussion.

ferent for radiology practices seeking stronger relationships with their patients —and potential patients — and/or to market their services."

Social media allows practices and doctors to grow awareness of their offerings, engage in dialogue of patients and move from being simply a service to a trusted source or advisor. It also an outlet where consumers go to find trusted help, as well as vent their frustrations, Zember said.

"Therefore, it will continue to be a platform radiology can use not only to monitor consumer sentiment and opinions, but also a place where doctors and practices can create sources for consumers to rely on, converse and connect with, and build relationships outside of the hospital or doctor's office," Zember said.

Websites and social media specific to radiology — including the RSNA/ACR patient information website, *RadiologyInfo.org*, was discussed by presenter, Elliot K. Fishman, MD, professor of Radiology, Oncology, Surgery

and Urology at Johns Hopkins Hospital in Baltimore.

A good radiology website is one that knows its audience, Dr. Fishman said. For example, *RadiologyInfo.org* offers a library of resources for patients including information on how various imaging procedures are performed optimized for patients and their families.

"The key to a good website is to know your target audience. Is it patients? Is it referring doctors? Is it for other radiologists?" he asked. "Only when you know your intended audience can you

The key to a good website is to know your target audience. Is it patients? Is it referring doctors? Is it for other radiologists?

Elliot K. Fishman, MD

make that decision."

Many websites can be used to engage patients, but Dr. Fishman emphasizes that users should only view those from a trustworthy source.

"Patients want accurate and unbiased data about different procedures and exams," he said. "Sites like *RadiologyInfo.org* are excellent."

Residents Mix and Mingle at RSNA/ACR Reception

Residents from around the world gathered Monday for the annual Residents Reception hosted by RSNA and the American College of Radiology (ACR). Attendees enjoyed food and drink while mingling with peers and longtime radiology leaders.



Medical Physics Answer

[Question on page 4A.]

A Before digital detectors, that was the case. Digital systems have greater exposure latitude and post-processing techniques that make the characteristic radiation (from Mo or Rh) less important than it was for screen-film systems.

Q&A courtesy of AAPM.

Dual-Contrast Photon-Counting CT Improves Diagnosis of Liver Lesions

Dual-contrast CT imaging protocols could improve the diagnosis of liver diseases while reducing radiation dose, according to research presented Monday.

By Richard Dargan

Distinguishing liver abnormalities like hemangioma from more serious conditions like hepatocellular carcinoma (HCC) is vitally important for treatment decisions. However, smaller liver lesions can be difficult to classify on imaging. A better imaging method would help patients with benign liver growths avoid unnecessary and expensive procedures.

German researchers recently evaluated an experimental technique that relies on simultaneous administration of two separate contrast agents: iodine for the arterial phase and gadolinium for the venous phase. After contrast injection, spectral photon counting CT (SPCCT) is used to simultaneously assess the gadolinium and iodine enhancement in the liver in different contrast phases.

"This multi-phase visualization of the liver at one time point by a single CT scan exhibits perfect co-registration of

the images in different phases, allowing for more accurate and quantitative subsequent voxel-by-voxel post processing and a significant reduction in radiation dose," said Daniela Muenzel, MD, from the Laboratory for Advanced Computed Tomography Imaging at the Technical University of Munich.

Dr. Muenzel and colleagues created a simulation model to test dual contrast-enhanced liver imaging. SPCCT was simulated with the two different contrast agents and material decomposition provided iodine and gadolinium maps calculated from the spectral information. Researchers inserted characteristic liver lesions like hemangioma, HCC, cysts and metastases into the simulation.

Results demonstrated that the combination of SPCCT and an optimized contrast injection protocol made it feasible to provide contrast-enhanced images with arterial distribution of gadolinium and portal-venous phase of iodine in a single



Daniela Muenzel, MD, (above) from Laboratory for Advanced Computer Tomography Imaging at the Technical University of Munich, Germany, and colleagues created a simulation model to test dual contrast-enhanced liver imaging.

CT scan with reduced radiation dose. The four inserted liver lesions were clearly visible and the characteristic patterns of contrast enhancement were seen in arterial and portal-venous images.

"By using two contrast agents and different uptake characteristics in liver lesions, we can classify cysts, hemangiomas, HCC and metastases in a single CT scan," Dr. Muenzel said.

In addition to potential dose reduction, the technique also eliminates misregistration artifacts between acquisitions, Dr. Muenzel said.

The technique will need additional testing before it is ready to be used in humans. Eventually, the researchers hope to conduct liver imaging studies in patients and look for other clinical indications that can be addressed by SPCCT with two contrast agents applied simultaneously.

By using two contrast agents and different uptake characteristics in liver lesions, we can classify cysts, hemangiomas, HCC and metastases in a single CT scan.

Daniela Muenzel, MD

Full-Day Liver Symposium on Friday, Dec. 2

A full-day session, "Novel Concepts in Hepatobiliary Tumor Imaging Symposium" (SPHT61) focused on liver imaging will be held from 8:30 a.m. to 2 p.m., Friday, Dec. 2.

Sessions include:

- **How to Screen and Diagnose HCC: American, Asian, and European Guidelines; Why are They Different and What are the Consequences?**
- **Hepatic Dynamic CT with Iterative Reconstruction**
- **Abbreviated MRI for HCC Screening and Surveillance: An Accurate Alternative to US**
- **Imaging-based Management Guidelines for HCC**

The symposium is a joint effort of RSNA and four of the world's leading abdominal imaging societies—the French Society of Abdominal Imaging, the Society of Abdominal Radiology, the Japanese Society of Abdominal Radiology and the Korean Society of Abdominal Radiology.

View a full schedule at Meeting.RSNA.org.

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ASRT Booth 1711, South Hall A
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New Horizons Lecture Presented Today

CANCER CARE — along with imaging — is on the brink of profound change, according to Hedvig Hricak, MD, PhD, Dr (hc). Over the last quarter century, researchers have been assembling the biological syntax and lexicon that are now starting to shape modern oncology.

Shifting public expectations and technological innovations are also intensifying progress toward precision medicine. In the next 10 years, radiologists will be able to take advantage of new molecular imaging probes and techniques as well as computer tools for pattern recognition, deep learning and artificial intelligence (AI). These new techniques and tools will put imaging at the center of the evolving paradigm of precision oncology, offering an unprecedented opportunity to once again reshape and enhance the specialty.

Dr. Hricak will deliver the New Horizons Lecture “Beyond Imaging – Radiology of Tomorrow” in Tuesday’s plenary session.

As a specialty of technological innovations, radiologists have always embraced new technologies. But radiologists are also key participants in patient-centered care. In the last 50 years, the specialty has gone through a number of transformations, always emerging as more clinically essential than before. In the years ahead, radiologists must and will continue to evolve — becoming not only stewards of the ever-increasing demand for imaging and image-guided therapies, but also highly valued clinical consultants and innovators in the era of precision medicine.

Dr. Hricak is chair of the Department of Radiology at Memorial Sloan-Kettering Cancer Center, professor of radiology at

Weill Cornell College of Medicine, and professor at Gerstner Sloan-Kettering Graduate School of Biomedical Sciences, all in New York. She is a renowned genitourinary imaging authority who helped develop the use of MRI and CT for gynecological cancers and the use of MRI for prostate cancer. Dr. Hricak is a member of the National Academy of Medicine and has received numerous honors for her research and her efforts to promote international education and collaboration in radiology. She received the RSNA Gold Medal in 2015 and served as RSNA president in 2010.

► 1:30 p.m., Arie Crown Theater



Hedvig Hricak, MD, PhD, Dr (hc)

Margulis Award Presented Today

The Alexander R. Margulis Award for Scientific Excellence, an annual award recognizing the best original scientific article published in *Radiology*, will be presented during today’s plenary session. The award is named for Alexander R. Margulis, MD, a distinguished investigator and inspiring visionary in the science of medical imaging. After the presentation, copies of the award-winning article will be available in the Membership & Resources area in the Connections Center.

Driving Value through Imaging

CONTINUED FROM COVER

However, as she pointed out, it seems like radiology has been under siege since the turn of the century, with downward pressure on reimbursements, a declining job market, and a decrease in the number of medical students going into radiology.

“There are clearly some questions about the value of our role and the value of our field,” she said.

Speaking as a healthcare executive, Dr. Lee said that in a world in which radiology is moving from being a profit center to a cost center, health systems need new perspectives from their radiology colleagues to help them think about really driving value. She asked the audience to consider, “How can you help our health systems succeed?”

Dr. Lee focused on specific areas of “vulnerability” for healthcare systems, such as earlier diagnosis and reducing misdiagnosis, appropriate and timely management of complex patients, and the reduction of pharmacy costs. “These are all vulnerabilities in our health systems that we need help on,” she said.

For example, Dr. Lee said, efforts to achieve more effective teamwork, better IT support for diagnostic processes, and appropriate work systems and cultures, will be useful in helping health systems reduce diagnostic errors.

“There is no leadership in this space,” Dr. Lee said. “So this is a perfect opportunity for radiologists to step up and say we own this space.”

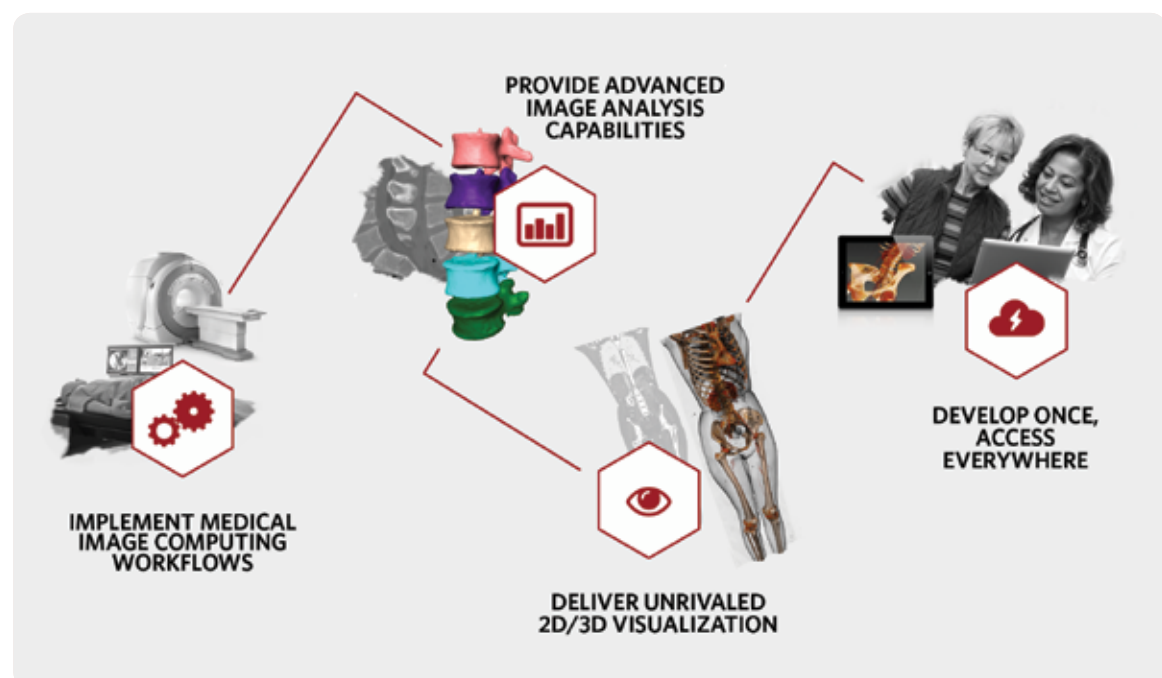
Dr. Lee also noted that the high cost of certain drugs is another vulnerability for health systems. At the University of Utah, for example, pharmacy costs for most patients were down last year, yet 1 percent of the most complex patients accounted for 13 percent of total pharmacy costs.

And one of the biggest areas of these costs are cancer drugs, with some drugs costing as much as \$30,000 per dose. Furthermore, Dr. Lee pointed out, in many of these cases the percentage of responders is 20 to 25 percent. Therefore, a specialty like molecular imaging can be very valuable in identifying patients who are really going to benefit from the most expensive drugs.

“These are the areas I hope our field will contribute to,” Dr. Lee said. “Drive the value of imaging by using imaging to assess the value of new tests, new drugs, and new devices, and integrate imaging into better clinical diagnosis and better decision making.”

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Deep Learning May Play a Role in Assessing Breast Texture

By Elizabeth Gardner

CAN A COMPUTER NETWORK that mimics the neural structure of the brain and the visual cortex and is trained to analyze and recognize nonmedical images (or deep learning), assess breast texture — and therefore risk of breast cancer — more accurately than standard radiographic texture analysis?

In a study presented Monday during the Hot Topics in Breast Imaging series, researchers determined that convolutional neural networks can analyze full-field digital mammographic (FFDM) images and extract features that are missed both by human eyes and by other types of computer analysis.

“I think that in the future, both texture analysis and deep learning will be applied to mammograms on a routine basis,” said Maryellen Giger, PhD, A.N. Pritzker Professor of Radiology at the University of Chicago.

Breast cancer is the second leading cause of death in North America for women. Currently, mammography is an effective tool for early breast cancer detection and the reduction of mortality rates.

Breast density and mammographic parenchymal patterns can both be useful in assessing the risk of developing breast cancer. Better risk assessment allows physicians to better manage patients, and can potentially lead to personalized screening regimens and precision medicine.

Previous work by Giger's Lab at the University of Chicago suggests that parenchymal texture predicts cancer risk more accurately than breast density percentage. A 2014 study published by Dr. Giger and Hui Li, MD, and colleagues in the *Journal of Medical Imaging* used radiographic texture analysis to compare a low-risk population with two high-risk popula-

tions (women with BRCA 1 or 2 and women with unilateral breast cancer). The high-risk group had coarser and lower contrast parenchymal patterns than the control group, even though the breast density percentage was not significantly different between the two groups.

The retrospective study presented Monday compared radiomic texture analysis (RTA) with a convolutional neural network, “AlexNet,” that had been pre-trained on a library of 1.28 million non-medical images from ImageNet, a large database intended to provide raw material for training visual object recognition software.

The University of Chicago study included 456 clinical FFDM cases from two high-risk groups, BRCA1/2 gene-mutation carriers (53 cases) and unilateral cancer patients (75 cases), and a low-risk group (328 cases). Regions of interest of 256 x 256 pixels were selected from the central breast region behind the nipple in the cranio-caudal projection, a location that usually includes the densest part of the breast.

The study compared the use of image features, which were automatically extracted using pre-trained convolutional neural networks with transfer learning, and the use of features from radiographic texture analysis.

The convolutional neural network was pre-trained using a database of 1.2 million high-resolution images in about a thousand categories that include animals, modes of trans-

I think that in the future, both texture analysis and deep learning will be applied to mammograms on a routine basis.

Maryellen Giger, PhD



Researchers at a Monday Hot Topic Session in Breast Imaging presented a study showing that deep learning has the potential to help clinicians in assessing mammographic parenchymal patterns for breast cancer risk assessment.

portation and microscopic images, in addition to standard medical images. The area under the ROC curve served as the figure of merit in the task of distinguishing between high-risk and low-risk subjects.

The group's analysis showed that the neural network performed similarly to radiographic texture analysis in distinguishing between low-risk and high-risk individuals. When both methods were used together, there was statistically significant improvement in distinguishing the two risk groups.

“Deep learning has potential to help clinicians in assessing mammographic parenchymal patterns for breast cancer risk assessment,” the research concluded.

Dr. Giger plans to continue research on neural networks and noted that her lab has other deep learning presentations at RSNA 2016.

New Hands-on Prostate MRI Course is a Hit

A NEW COURSE ON PROSTATE IMAGING is among the many popular hands-on courses being presented at RSNA 2016. The course, using the American College of Radiology's MRI Prostate Imaging Reporting and Data System (PI-RADS) was introduced on Monday and filled to capacity.

The course was co-organized by Jelle Barentsz, MD, PhD. He and a team of 10 international experts delivered interactive, individualized training on PI-RADS using 50 computers, which allowed optimal training of 30 cases from daily practice.

“I have never seen so many enthusiastic and active participants,” said Dr. Barentsz, professor of radiology and chair of the Radboud Prostate MR-Referencing Center of Radboud University

Medical Center, the Netherlands. “MRI of the prostate is booming, which shows the enthusiasm and need for training PI-RADS. More and more urologists are requesting prostate MRIs, and they expect good quality.”

The course repeats Tuesday through Thursday, from 8 to 10 a.m.

PROSTATE MRI (HANDS-ON)

Tuesday 8–10 a.m.	RCA31	Room S401AB
Wednesday 8–10 a.m.	RCA41	Room S401AB
Thursday 8–10 a.m.	RCA51	Room S401AB



Monday's Prostate MRI course was filled to capacity.

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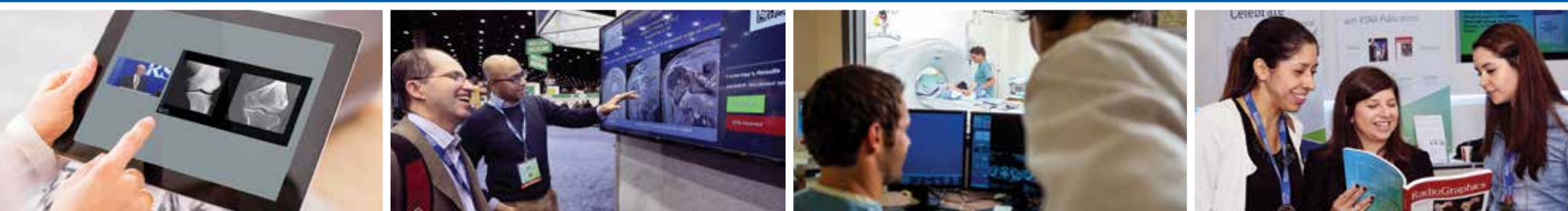
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Combined Modalities May Improve Diagnosis, Treatment of Crohn's Disease

By Mike Bassett

PET/MR ENTEROGRAPHY and elastosonography (USE) can be used to optimize the imaging of Crohn's disease, according to presentations by German and Italian investigators during a Monday session.

Combined Use of PET, MRI Presents Advantages, Challenges

In a study looking at the use of PET/MR enterography for the assessment of inflammation in Crohn's disease, Thomas Lauenstein, MD, of the Evangelischen Krankenhaus Düsseldorf, described how MRI and PET could be combined to take advantage of the best features of each modality.

"We know that MRI is a very good tool for the assessment of bowel morphology, with a very high specificity for the iden-



Thomas Lauenstein, MD

Not only is USE noninvasive, but it improves the diagnostic accuracy in the evaluation of Crohn's disease in both detection and characterization of pattern changes, as well as in the guidance and evaluation in response to therapy.

Dario Picone, MD

tification of inflammatory bowel disease (IBD)," Dr. Lauenstein said. "On the other hand, PET, using FDG, is a very sensitive tool for the assessment of inflammation in general."

Therefore, the idea of combining the two "seems to be very appealing," he said. But, he also pointed out that combining the two modalities could produce contradictory results.

In the study, 50 patients with Crohn's disease underwent PET/MR enterography with FDG using an integrated PET/MR scanner. Using different segment-based cut-off values for PET, the researchers found a cutoff for SULmax of >1 was associated with the highest accuracy and sensitivity for the detection of inflammation.

Using this cutoff, PET proved to have high sensitivity in detecting inflammation (88 percent), while MRI had high specificity (96 percent). "The combination of PET and MRI in PET/MR enterography, in terms of sensitivity and specificity, proved to be a good compromise," Dr. Karsten J. Beiderwellen, MD, a study author, said. "However, in this patient cohort and using the proposed reading mechanism, [there was no] increase in diagnostic accuracy."

PET/MR enterography "combines the

advantages of MR and PET — the high specificity of MR and the high sensitivity of PET," Dr. Lauenstein concluded. "However, at some point it also creates some disadvantages. In some situations it will be difficult to interpret the images because of contradictory data, and this is still challenging."

Elastosonography Shows Promise for Crohn's Disease Management

In another study presented Monday, Giuseppe Lo Re, MD, University of Palermo, Italy, and colleagues evaluated how USE can be used to discriminate between edematous inflammation and fibrotic change of the mesentery and bowel wall in patients with Crohn's disease.

With Crohn's disease "the distinction between inflammation and fibrosis can be tricky," said Dario Picone, MD, a study co-author. "But this distinction is very important because it impacts the management of patients." He pointed out that unlike some imaging tests used to identify bowel wall thickening, hyperperfusion, and active inflammation, USE is a noninvasive method of evaluating tissue stiffness, and has also been used to evaluate liver, breast and thyroid.

"Also, recent clinical studies on animals and humans have reported promising results for distinguishing inflamed from fibrotic bowel by using USE," Dr. Picone said.

In this study, 35 patients underwent MR enterography and real-time USE at the same time. Apparent diffusion coefficient values were calculated in the mesentery and bowel wall of patients with pathological ileum (a section of the small intestine) compared to those with normal ileum (the control group) and they were compared with USE color images (red/light green-



Giuseppe Lo Re, MD

normal, dark green-edematous, blue-fibrotic) and T2 signal in the same location.

"The results demonstrated that in the study group, the USE color-scale coding showed a color variation from blue to red in the fibrotic pattern of mesentery and bowel wall in 15 patients, and blue to green in the edematous pattern in 20 patients," Dr. Picone said. "Moreover the signal of the bowel wall and mesenteric fat was iso/hypointense on T2-weighted sequence in the fibrotic pattern and hyperintense in the edematous pattern. There was a significant diffusion in 18 patients with Crohn's disease in the active phase.

"Not only is USE noninvasive," Dr. Picone said, "but it improves the diagnostic accuracy in the evaluation of Crohn's disease in both detection and characterization of pattern changes, as well as in the guidance and evaluation in response to therapy."

"Evaluation of Crohn's disease through USE, DWI and T2 is a growing field, and many tools are available," Dr. Lo Re concluded. "USE is a quick, safe and noninvasive technique to confirm the presence of alteration of mesenteric fat and bowel wall in Crohn's disease, and also it allows the identification of the types of change."

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Tuesday in the Discovery Theater



New this year, the Discovery Theater, located in the Connections Center, Lakeside Center East, Level 3, provides RSNA 2016 attendees with the opportunity to enjoy a variety of presentations, including both educational sessions and relaxing entertainment.

Make plans to visit the Discovery Theater today to enjoy one or more of the following programs:

Nancy Pochis Bank Art Studio Live Painted Mural

Tuesday 8 a.m. – 6 p.m.

RadiologyInfo.org -- Providing Patients with Credible Information

Tuesday 9 - 9:30 a.m.

The Impact of an RSNA R&E Grant

Tuesday 10 - 10:30 a.m.

Find the Right Candidates by Using RSNA's Career Center

Tuesday 10 - 10:30 a.m.

How did I miss that? How did I find that? Medical Image Perception

Tuesday 10:30 – 11 a.m.

Chicago Diamond Trio

Tuesday 12 -1 p.m.

Chicago Diamond Trio

Tuesday 2:30-3:30 p.m.

More to See at RSNA 2016: Sessions in Every Subspecialty

RSNA attendees can access a vast array of educational courses, scientific sessions and posters and exhibits in a range of subspecialties. View scientific posters and education exhibits in the Learning Center through Friday.

Virtual meeting registrants may also view posters and exhibits by logging on from in or outside McCormick Place.

GENITOURINARY

SG05-01 (Educational Course)

Comparison of Initial and Subspecialist Second Opinion Reads of Multiparametric Magnetic Resonance Imaging of the Prostate Prior to Repeat Biopsy

Tuesday, 10:30-10:40 a.m.,

Room N229

RESearchers INVESTIGATE the value of second-opinion evaluation of multiparametric MRI (mpMRIs) of the prostate by subspecialised urologists at a tertiary center for the detection of significant cancer in transperineal MR/US fusion prostate biopsy.

SSK09-06 (Scientific Session)

24 Months Follow-Up Results of MRI-Guided Transurethral Ultrasound Ablation for Localized Prostate Cancer

Wednesday, 10:30-12 p.m.

RESearchers PRESENT results demonstrating whole-gland ablation can be safely and accurately achieved using MRI-guided transurethral ultrasound ablation — a minimally-invasive treatment option for organ-confined prostate cancer.

MUSKULOSKELETAL IMAGING

RC408 (Educational Course)

Trauma Imaging Pitfalls

Tuesday 4:30-6 p.m.,

Room N228

PRESENTERS ADDRESS difficult diagnoses and strategies to improve detection while imaging trauma cases of the abdomen, diaphragm, bowel/pelvis and extremities.

MOLECULAR IMAGING

RC418A (Educational Course)

Imaging Proteomics Genomics Interaction -

New Frontiers Ahead

Tuesday, 4:30-6 p.m.,

Room S40AB

PRESENTERS WILL DISCUSS the major differences between proteome and genome data, how the proteome signal might be correlated with imaging features and provide insights into imaging of proteomics-genomics interaction.

BREAST

BR178-ED-MOA8 (Education Exhibit)

Breast Imaging in the Transgender Patient: Traversing New Terrain

Monday, 12:15-12:45 p.m.,

Breast Community, Learning Center, Station #8

THIS EXHIBIT PROVIDES attendees with an approach to breast imaging in the transgender patient and provides information on the appropriate terminology to use with transgender patients who may present for screening or diagnostic breast evaluation.

MSRT44 (Educational Section)

ASRT@RSNA 2016: The Argument for Screening Mammography (and Against the United States Preventive Services Task Force Recommendations)

Wednesday 1-2 p.m.,

Room N230B

PRESENTERS WILL DISCRIMINATE between the subjective negative conclusions of the U.S. Preventive Services Task Force (USPSTF) and the true objective data supporting annual screening mammography beginning at 40.

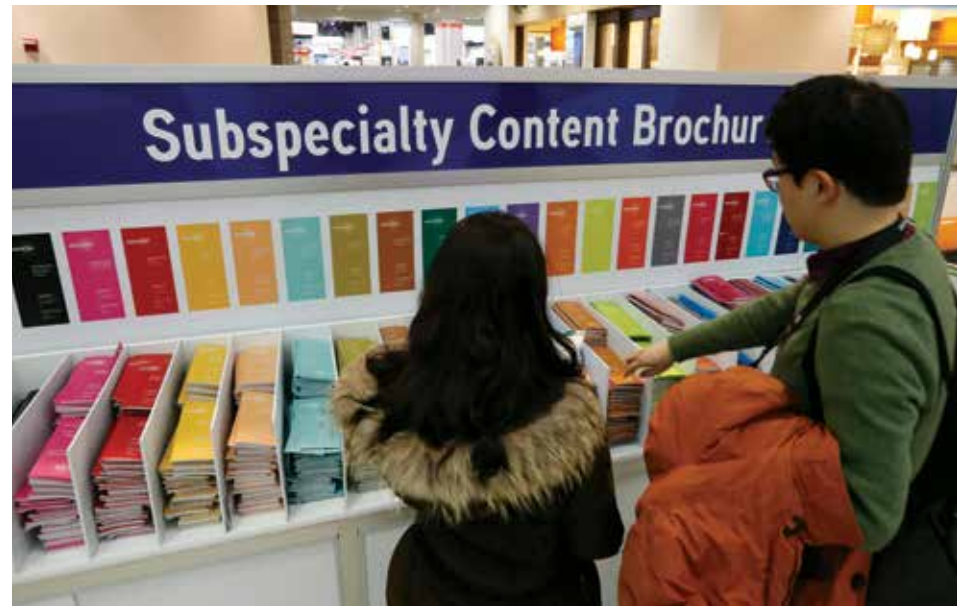
INFORMATICS

RCB41 (Educational Course)

Hands-on Basic DICOM with Horos/Osiris

Wednesday, 8:30-10 a.m., Room S401CD

PRESENTERS WILL DESCRIBE basic DICOM object metadata structure, demonstrate Osiris/Horos DICOM viewer



functions including image display, and measurements and use Osiris/Horos to send/receive DICOM objects.

INTERNATIONAL RADIOLOGY

RC602 (Educational Course)

International Radiology Outreach - Why? How? Who?

Thursday, 8:30-10 a.m.,

Room E353A

PRESENTERS WILL DISCUSS the importance of developing safe sustainable initiatives that are beneficial to the international outreach communities and outline opportunities to participate in outreach endeavors.

MULTISYSTEM/SPECIAL INTEREST

MSE-TUB (Educational Course)

Multisystem/Special Interest Tuesday Poster Discussions

Tuesday, 12:45-1:15 p.m.,

MS Community, Learning Center

SESSIONS INCLUDE:

- Revisiting Taxonomy, Classification, and Cross Sectional Imaging Findings in Lymphatic Disorders-A Road Less Travelled
- Multimodality Imaging in Secondary Hypertension: A Comprehensive Review and Pictorial Essay

NUCLEAR IMAGING

RC511 (Refresher Course)

Advances in Cardiac Nuclear Imaging: SPECT/CT and PET/CT

Wednesday, 8:30-10 a.m., Room S504CD
Presenters discuss advancements associated with new scintillation cameras and SPECT-CT and PET-CT cameras, including the benefits of CT attenuation correction and the adjunctive benefits of anatomic definition provided with CT and physiologic/function information provided by SPECT and PET.

ONCOLOGIC IMAGING

SPSC41 (Controversy Session)

Controversy Session: Intravenous Contrast Media: Should There Be Any Contraindications to Use?

Wednesday, 4:30-6 p.m.,

Room S404AB

PRESENTERS DISCUSS the risks of intravenous iodinated contrast media and cover the rationale for current policies on IV media administration.

PROFESSIONALISM

RC616 (Educational Course)

Communicating Effectively with Patients (Sponsored by the RSNA Public Information Committee)

Thursday, 8:30-10 a.m., Room N229

PATIENTS who are becoming increasingly involved in their healthcare frequently turn to the Internet for information on their conditions, diagnosis and treatment options. This course will provide specific examples and a strategy for communicating honestly and directly with patients.

PEDIATRIC RADIOLOGY

PD008-EB-X (Education Exhibit)

Arterial Spin Labeling and Its Applications in Pediatric Central Nervous System: Pictorial Review

All Day,

PD Community, Learning Center

PRESENTERS WILL REVIEW arterial spin labeling (ASL) methodologies and clinical applications and offer examples of ASL applications in different clinical neuropsychiatric scenarios: stroke, hypoperfusion syndromes, PRES, infection, epilepsy, migraine, encephalopathy, oromotor disorders and neuro-oncology.



Subspecialty content brochures will be available in the Grand Concourse Lobby, Level 3; Lakeside Center, Level 3 and Learning Center.

Preparedness is Key for Radiologists in Event of Radiological or Nuclear Terrorism Incident

By Paul LaTour

RADIOLOGISTS PLAY important medical and educational roles regarding a potential radiological or nuclear terrorism event in the United States. However, in order to maximize their effectiveness, they need to be prepared ahead of time.

That was the theme running throughout an educational session presented Monday, "Radiological and Nuclear Terrorism: Like it or Not, Radiology Professionals Will Be in the 'Hot' Seat."

"Whether or not you are prepared, radiologists will be integrated into the hospital's radiation response plan," said Nicholas Dainiak, MD, medical and technical director at the Radiation Emergency Assistance Center/Training Site (REAC/TS) in Oak Ridge, Tenn.

"Without preparation, we're going to fail," he added.

Disaster response plan practice is key

In general, radiologists can prepare by understanding overall local, state, regional and national responses to a radiological or nuclear attack. Closer to home, Dr. Dainiak said radiologists should also learn and participate in their hospital's disaster response plan practice exercises. And if necessary, lobby their hospital leaders to develop those exercises.

"Exercises are the best way to develop relationships with fellow physicians," Dr. Dainiak said.

Because of their background and train-

ing, Dr. Dainiak said radiologists understand basic radiation physics and radiobiology, are knowledgeable about selecting appropriate imaging exams and can help educate the general public about the dangers of radiation to lessen fear during the fallout.

Dr. Dainiak offered some questions for radiologists to proactively ask themselves in order to assess their level of preparedness. They include how would your routine day change, how would you advise primary caregivers about radiation exposure and how would you recommend allocation of scarce resources?

Radiologists can promote public education

Radiologists can also work proactively to educate the public about the nature of radiation and its health effects. Dr. Dainiak pointed to a 2005 study published in Health Physics that showed increased knowledge about radiation effects helps to eliminate the fear that exists for many people.

"So the more we can teach, the more knowledgeable our patient population is, the less fear there will be. That applies to physicians and nurses, too, by the way," said Dr. Dainiak, who is also a clinical professor of medicine in the Department of Therapeutic Radiology at the Yale University School of Medicine in New Haven, Conn.

Despite the plans and structures in place, the overall level of preparedness for large-scale radiological or nuclear terrorism



Moderator Donald P. Frush, MD, (far left) stands with presenters (left to right) Brooke R. Buddemeier, John J. Lanza, MD, PhD and Nicholas Dainiak, MD.

attacks is less than it is for events such as natural disasters and biological incidents, according to presenter John J. Lanza, MD, PhD, director of the Florida Department of Health in Escambia County.

Dr. Lanza encouraged radiologists to seek volunteer opportunities now that will lead to better preparedness should a radiological or nuclear terrorism event occur.

He pointed to the 32 core capabilities that are part of the National Preparedness Goal, created by the Federal Emergency Management Agency (FEMA). The goal defines what it means for the whole community to be prepared for all types of disasters and emergencies.

"This is a marketing pitch to get you involved with that," Dr. Lanza said. "The world will not come to an end if nuclear detonation occurs. It won't be a good day for anybody, but we need to do what we can to help."

What to expect in a crisis

Presenter Brooke R. Buddemeier, a health physicist at the Lawrence Livermore

National Laboratory, described in detail fallout scenarios from the hypothetical detonation of a radiological dispersal device in Brooklyn, N.Y., and an improvised nuclear device in Washington, D.C.

In addition, he disproved medical response myths circulating about radiation from a nuclear event. He explained that, contrary to belief, radioactive contamination is not immediately dangerous to life and health. It presents little hazard to medical staff and is easily managed and contained.

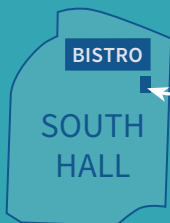
Buddemeier also pointed out that critical care takes precedence over monitoring for decontamination. He said removing outer clothing and wiping exposed skin is often sufficient for simple decontamination.

Knowing those facts and others aid in preparations for all medical and emergency personnel.

"If you know what to do to support the victims of an event like this, you can save a lot of lives. We can help mitigate the consequences," Buddemeier said.

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