

INSIDE MONDAY

► **Five-Minute Knee MRI Comparable to Standard MRI**

Improve image quality and increase patient comfort with quicker MRI. 4A

► **Outstanding Researcher, Educator Awarded**

Pioneers in research and education were recognized for their contributions on Sunday. 4A

► **Interventional Radiology in the Management of Vascular Complications in Liver Transplant**

Presenters review several potential complications and treatment recommendations. 8A

► **In Uganda, Family Obligations Hinder Breast Cancer Care, Education**

Researchers surveyed Ugandan women to identify barriers to care and propose education to improve access. 8A

► **Real-Time Virtual Sonography Cerebral Pathologies**

Real-time virtual sonography (RVS), or fusion imaging, combines ultrasound (US) and MR images and could someday offer clinicians a clearer picture of fetal brain. 9A

► **Deep Learning & Machine Intelligence: Reality Check**

Potentially useful technologies will add value to the specialty, not replace us. 11A

► **3-D MRI Fetal Images Superior in Quality to 3-D US**

Many radiologists are turning to 3-D MRI for anatomy exploration of the fetus and to support diagnostic decisions. 13A

► **CT Has Potential Role in Assessing Pancreatic Cancer Treatment**

CT-derived texture analysis of pancreatic tumors could help assess and predict a patient's response to chemotherapy, according to research presented Sunday. 14A

► **Synthesized Mammography Effective in Assessing Breast Density**

Understand the scientific evidence of breast density as a risk factor for breast cancer. 17A

Continued Reinvention of Radiology can Transform the Profession

By Jennifer Allyn

The greatest opportunity and most urgent need facing radiology is to innovate the practice to optimize value, according to RSNA President Richard L. Ehman, MD.

"No other major medical specialty is so profoundly based on a remarkable invention that changed the world," Dr. Ehman told the audience in Arie Crown Theater for Sunday's Opening Session. "And it is your collective focus on the well-being of our patients that drives all of our efforts and innovations."

In his President's Address, "Is it Time to Reinvent Radiology?" Dr. Ehman reflected on the theme of this year's annual meeting to discuss how the lessons from the past can help advance the unique aspects of radiologic science that are driving the innovations of tomorrow. "It is time to explore the frontiers of our discipline to support our culture of invention that will ultimately help transform what we do to better serve our patients," he said.



RSNA President Richard L. Ehman, MD, addresses annual meeting attendees at Sunday's Opening Session.

Radiologists are fierce early adopters of new technology when they believe it can improve the service they provide for patients.

Richard L. Ehman, MD

From the earliest days of medical imaging, exploring the possibilities of radiography has had an extraordinary impact on patient care. In fact, expanding the capabilities of

medical imaging has changed patient care so greatly that most physicians cannot imagine practicing without them.

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Tomorrow's Radiologist Must Tap into the Infinite Possibilities of Innovation, Technology and Teamwork — Today

By Mike Bassett

Along with being persistent innovators, tomorrow's radiologists must work to establish themselves as imaging, information science and image-guided therapeutics experts who will play a vital role on healthcare teams, said Roderic I. Pettigrew, PhD, MD, in an opening session lecture on Sunday in Arie Crown Theater.

In his presentation, "Tomorrow's

Radiology," Dr. Pettigrew, founding director of the National Institute of Biomedical Imaging and Bioengineering, stressed that the overall goal of today's healthcare enterprise is to achieve healthy longevity — to be born healthy, acquire no significant disease and to reach the end of life without pain or suffering from disease.

"That bold vision requires technological innovation for earlier precision diagnostics and therapeutics," Dr. Pettigrew said. "And tomorrow's radiology will play a critical role in achieving this goal."

"We emphasize innovation because we realize that like imagination, there is no end to innovation," Dr. Pettigrew said.



Pettigrew

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Radiology Occupies a Central Place in Precision Medicine

By Richard Dargan



Zerhouni

As the 21st century progresses, radiology will play an increasingly important role in answering questions surrounding the origin and progression of disease, driving medicine into an era of precision care, said a leading expert during one of yesterday's plenary lectures.

Radiologist Elias A. Zerhouni, MD, a top executive at the Paris-based pharmaceutical company Sanofi and former

director of the National Institutes of Health (NIH), expressed gratitude for being back in his "radiology family" before outlining the challenges and opportunities ahead for the profession. He said that predicting that future is not nearly as difficult as some believe.

"The first principle that I will share with you is that what will be is already here," he said. "The other phenomenon we are seeing

is that the speed at which things will happen tends to be overestimated."

In his talk, "Imaging Innovation in 21st Century Biomedicine — Challenges and Opportunities," the RSNA Gold Medal award winner noted that overly optimistic timetables often fail to take into account the multi-dimensional complexity of bio-

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Monday At a Glance

<p>7:15-8:15 Controversy Session <i>PET/MR: Is There Added Value in Oncology?</i> (E350)</p> <p>Hot Topic Session <i>Machine Learning and Artificial Intelligence in Lung Imaging</i> (E451A)</p> <p>RSNA Diagnosis Live™: <i>Mess With the Bull, You Get the Horns</i> (E451B)</p> <p>8:30-10:00 Educational Courses <i>Molecular Imaging Symposium: Basics of Molecular Imaging</i> (S405AB)</p> <p>BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow <i>Head and Neck — Nasopharynx & Perineural Spread</i> (S402AB) <i>Breast — Oncology Anatomy</i> (S103CD)</p> <p>8:30-NOON Series Courses</p> <p>10:00-11:00 RSNA Diagnosis Live™: Resident Competition (Discovery Theater)</p>	<p>10:30-NOON Scientific Paper Sessions BOOST: Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow <i>CNS — Case-Based Review</i> (S103AB) <i>Gynecologic — Oncology Anatomy</i> (S103CD)</p> <p>Colombia Presents: Diagnostic Imaging in Tropical and Infectious Diseases (E353C)</p> <p>11:00-1:00 3-D Printing Theater Presentations (Learning Center)</p> <p>11:00-2:00 Machine Learning Theater Presentations (Machine Learning Showcase, North Hall)</p> <p>12:15-1:15 Poster Discussions (Learning Center)</p> <p>1:30-2:45 Plenary Session (Arie Crown Theater) PS20 <i>Presentation of Honorary Memberships</i></p>
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New Horizons Lecture
A New Light: The Birth, and Rebirth, of Imaging
 Daniel K. Sodickson, MD, PhD

1:30-6:00
Interventional Oncology Series: Hepatocellular Carcinoma and Cholangiocarcinoma (S406B)

2:30-4:00
Educational Courses

3:00-4:00
Scientific Paper Sessions

View the full program and add sessions to My Agenda on the RSNA 2017 App or at Meeting.RSNA.org.

3:30-5:00
Molecular Imaging Symposium: Teaching Residents and Their Teachers about Molecular Imaging with Cases: Has the Time Come? (S405AB)

4:30-6:00
Educational Courses
RSNA Diagnosis Live™: Chest and Abdomen (E451B)
Special Interest Sessions (See page 4A for session previews)

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

Daily Bulletin

Monday © 2017 RSNA
 The RSNA 2017 *Daily Bulletin* is the official publication of the 103rd Scientific Assembly and Annual Meeting of the Radiological Society of North America. Published Sunday, November 26–Thursday, November 30.

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Margulis Award Presented Today

The RSNA Alexander R. Margulis Award for Scientific Excellence recognizes the best original scientific article published in *Radiology* for a given year. The Margulis Award Nominating Committee and the Margulis Award Selection Committee review published manuscripts based on their novelty, quality, importance, and potential scientific and clinical impacts. The 2017 Margulis Award will be presented during today's Plenary Session at 1:30 p.m.

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BRONZE

Special Interest Sessions Highlight Current Issues in Radiology

The RSNA Board of Directors has determined these courses to be of particular importance, and increased audience interest is expected. All courses are presented from 4:30 to 6 p.m. today.



SPSI21: EXPERIENCING RADIOLOGY: PATIENTS' PERSPECTIVES

Room S402AB

The session will help radiologists put the concepts of patient-centeredness and value-over-volume into practice. Learn how to understand your patients' perspectives as they navigate through the healthcare continuum, especially as it relates to radiology.

SPSI22: THE IMAGING OF COGNITION — DEMENTIA

Room E353C

Presenters will discuss how to integrate structural and functional biomarkers in dementia imaging, the role of MR and PET imaging for patients with dementia and those at risk and the future of imaging research in dementia. Learn about the Imaging Dementia—Evidence for Amyloid Scanning (IDEAS) study and the use of amyloid PET for patients with cognitive decline or dementia.

SPSI23: TRANSLATION OF QUANTITATIVE IMAGING FROM CLINICAL RESEARCH TO CLINICAL PRACTICE: WHY AND HOW?

Room E353B

Learn about the opportunities and advantages of quantitative imaging biomarkers in clinical and academic practice and the role of the RSNA Quantitative Imaging Biomarkers Alliance (QIBA), particularly in the era of precision medicine. Presenters will discuss examples of FDG PET/CT SUV measurements in oncology and CT volumetry QIBA processes that aid in the translation of quantitative imaging biomarkers.

SPSI24: HOW FOCAL AND LOCAL ARE OUR INTERVENTIONS? SYSTEMIC AND IMMUNOLOGIC EFFECTS OF INTERVENTIONAL ONCOLOGY

Room N226

Presenters will discuss the current clinical results of immuno-oncology, including the potentially beneficial and harmful systemic effects of focal interventional oncologic therapy. Learn how immuno-oncologic techniques can be combined with both percutaneous and transcatheter interventional oncologic therapies to potentially achieve better clinical outcomes.

SPSI25: INTEGRATION OF CEUS INTO RADIOLOGY PRACTICE

Room N228

Presenters will discuss how to integrate CEUS into a radiology practice, especially for multimodality liver tumor assessment of focal liver lesions in non-cirrhotic liver, the liver at risk for HCC and renal mass imaging. The session will feature up-to-the-minute information about the first-in-human clinical trials of molecular imaging with ultrasound for patients with prostate, ovarian and breast cancer.

SPSI26: PREPARING IMAGING INVESTIGATORS TO DIVE INTO THE "SHARK TANK"

Room S404AB

Learn about venture capital funding as an alternative to traditional research funding options. Participating researchers will take part in an interactive session modeled after the popular television show "Shark Tank." Tips for developing a proposal and protecting licensing rights will be covered. *Look for full coverage of this session in Wednesday's Daily Bulletin.*

SPSI27: SPECIAL INTEREST SESSION: HIGH IMPACT CLINICAL TRIALS

Room S404CD

Three late-breaking clinical trials, selected for their significant contributions to radiology research, will be discussed:

- Decision Quality and Quality of Life after Treatment for DCIS: A Trial of the ECOG-Acrin Cancer.
- Core Laboratory versus Local Site Interpretation of Coronary CT Angiography (CTA): Association with Cardiovascular Events in the PROMISE (PROspective Multi-center Imaging Study for Evaluation of Chest Pain). *This study will be published online in Radiology this week. Look for full coverage of this session in Wednesday's Daily Bulletin.*
- A Pivotal Study of Opto-Acoustic Imaging to Diagnose Benign and Malignant Breast Masses: A New Evaluation Tool for Radiologists. *This study will be published online in Radiology.*

Outstanding Researcher, Educator Awarded



During Sunday's Opening Session in Arie Crown, RSNA President Richard L. Ehman, MD, presented the Society's Outstanding Researcher Award to Mitchell D. Schnall, MD, PhD, and the Outstanding Educator Award to Dorothy I. Bulas, MD. Each year, the RSNA Board of Directors selects recipients who have demonstrated significant contributions and a long-term commitment—15 years or more—to radiologic education or research.

Five-Minute Knee MRI Is Comparable to Standard MRI

By Mary Henderson

Fast five-minute knee MRI using parallel imaging is diagnostically interchangeable with and has similar accuracy to standard knee MRI, according to researcher Erin F. Alaia, MD, who presented study results during a Sunday session.

"MR images are so good, they are better than we need," said Dr. Alaia, a musculoskeletal radiologist at New York University (NYU). "With high-field magnets and multi-channel coils, we can improve the resolution or scan faster."

In the study, 100 3T MRIs were performed on 100 patients (mean age 38.8 years) and 50 1.5T MRIs were performed on 46 patients (mean age 46.4 years) at NYU and the Cleveland Clinic between 2015 and 2016. The exams consisted of five fast multi-planar 2-D fast spin-echo (FSE) sequences using parallel imaging and five standard sequences. Four musculoskeletal radiologists retrospectively reviewed all images.

"The fast-knee MRI takes five minutes while the standard MRI can take up to 18 minutes to complete," Dr. Alaia said. "It's a valuable tool for patients with claustrophobia and for dealing with motion artifacts."

The researchers looked for agreement between the fast and standard MRI readings for evaluating internal

derangement of the knee, including meniscal, ligamentous, chondral and bone pathology. For fast and standard MRI, inter-reader agreement was similar. While there was no significant difference in the frequency of major findings reported on fast-knee and standard MRI, more ACL tears were reported on fast MRI and more cartilage defects were reported on standard MRI.

The fast five-minute knee MRI can increase throughput, improve image quality by decreasing motion artifact and increase patient comfort, Dr. Alaia said.



Alaia

The fast-knee MRI takes five minutes while the standard MRI can take up to 18 minutes to complete.

Erin F. Alaia, MD



Manual MR Processes to Automated Accuracy What a Contrast



Salem Regional Medical Center Case History

For Salem Regional Medical Center (SRMC), enhancing their MEDRAD® MR Smart injection system with contrast dose management software was a game changer. By automating once-manual processes, contrast dose management “not only helped ensure that documentation was complete, in our experience it made it more accurate,” confirmed SRMC Radiology Operations Supervisor Andrew Clark.

Download the case history to learn more about contrast dose management’s measurable impact on SRMC at CDM.bayer.com.

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RSNA Honorary Members

Honorary membership is presented for significant achievements in the field of radiology. Today, during the morning Plenary Session, RSNA will award three honorary memberships.

Hassen A. Gharbi, MD, PhD

A pioneering pediatric radiologist in North Africa, Hassen A. Gharbi MD, PhD, earned his medical degree in 1967 from the Université Paris Medical School, where he subsequently received degrees in radiology, aeronautic medicine and medical electronics. He received a post-doctoral degree in optic physiology from the Faculty of Science at the Orsay campus of the Université Paris and a degree in management of radiation accidents from Oak Ridge Associated Universities, Oak Ridge, TN.

He began his career as an assistant professor in the biophysics department at the Université Paris Medical School. When he returned to Tunisia in 1970, he founded and served as head of the first department of radiology at the Tunis Children's Hospital, where he remained until 1989. Simultaneously, Dr. Gharbi served as head of the medical biophysics department at the Medical School of Tunis from 1970 to 1985 and as vice dean from 1971 to 1973. He served as president of the Radiological National Commission in the Ministry of Public Health, Tunis, from 1975 to 1985. Now retired, Dr. Gharbi remains active in radiology teaching programs in Tunisia and other developing countries.

Credited with introducing ultrasonography in Tunisia in 1978, Dr. Gharbi's research on US classification of the hydatid cyst was published in *Radiology* in 1981 and remains an important resource to radiologists around the world. Dr. Gharbi founded the Tunisian National Centre of Radiation Protection in 1971 and served as director for nearly 20 years.

Dr. Gharbi currently serves on RSNA's International Advisory Committee (IAC), the Regional Committee for Middle East/Africa IAC and the Education Exhibits Obstetrics/Gynecology Subcommittee. Among his many honors, Dr. Gharbi



Gharbi



Mendonça



Riklund

received the prestigious Antoine Bécélère Medal from the International Society of Radiology and honorary memberships in the European Society of Radiology and the Society for Pediatric Radiology.

Renato Adam Mendonça, MD, PhD

A preeminent educator and advocate for strong relationships between international radiologic organizations, Renato Adam Mendonça, MD, PhD, is the chief of the Department of Neuroradiology at Delboni Auriemo, São Paulo.

Dr. Mendonça earned his medical degree in 1976 from the Medical School of Federal University of Paraná in Curitiba, Brazil. He began his medical career in the radiology department at the Hospital Beneficência Portuguesa, (now Hospital BP) in São Paulo and eventually became head of the neuroradiology section. During his 30 years at Hospital BP, Dr. Mendonça was an advocate for the development of the radiology resident training program, which has become one of the most prestigious in the country. From 2010 to 2015, he was the medical director of Diagnósticos da America.

Dr. Mendonça is the current treasurer of the International Society of Radiology. He is

a former president of the Radiological and Diagnostic Imaging Society of São Paulo (SPR) and is the scientific director and current chair of the Educational Committee. As the scientific director, Dr. Mendonça has been instrumental in the continued partnership with RSNA to host the Jornada Paulista de Radiologia (JPR) in Brazil every two years.

His professional involvement also includes serving as a member and past vice president of the Brazilian College of Radiology and Digital Imaging and as a founding member of LATINSAFE, an alliance of radiologists in Latin America that advocates for radiation protection for patients. Dr. Mendonça is the vice chair of RSNA's International Advisory Committee and a member of the Regional Committee for Latin America. He lectures throughout Brazil on radiology and neuroradiology.

Katrine Riklund, MD, PhD

A respected leader in diagnostic radiology and nuclear medicine, Dr. Riklund has devoted her career to collaboration between the two disciplines, laying the groundwork for the dramatic growth of hybrid imaging. As the founding president of the European

Society of Hybrid Medical Imaging (ESHI), Dr. Riklund is working to provide better education and training in hybrid imaging for both specialties.

Born in Norrbotten, Sweden, Dr. Riklund earned her medical degree and also her postdoctoral degree in diagnostic radiology and nuclear medicine at Umeå University in Sweden. She has remained at Umeå, serving as an associate professor, head of the Clinical Department of Radiology, head of the Department of Radiation Sciences and as deputy dean of the Medical Faculty. She is currently a professor in diagnostic radiology, a consultant for radiology and nuclear medicine and pro vice chancellor at Umeå University.

As a researcher, Dr. Riklund helped bridge the divide between immunology and nuclear medicine by developing an evaluation of monoclonal antibodies in the diagnosis and treatment of gynecological cancers. Thereafter, she focused her research on hybrid imaging with PET/CT and PET/MR, which plays an increasingly crucial role in the routine staging of oncologic disease, treatment planning and follow-up.

Dr. Riklund has served as president of both the Swedish Society of Nuclear Medicine and the Swedish Society of Medical Radiology. Her longstanding relationship with the European Society of Radiology (ESR) includes serving as president of the 2016 European Congress of Radiology (ECR) and as chairperson of the ESR board of directors and currently as the immediate past president of ESR.

Dr. Riklund has served as an imaging expert on Guidelines in Colorectal Cancer Care and Guidelines for Breast Cancer Care for the National Board of Health and Welfare. Dr. Riklund serves as the ESR representative on the RSNA Committee on International Radiology Education (CIRE).

Baron Receives Posthumous Gold Medal



RSNA President Richard L. Ehman, MD, presented a posthumous Gold Medal for Richard L. Baron, MD, RSNA past president, to his wife, Shirley Baron, PhD, during Sunday's Opening Session. Dr. Baron died suddenly in May.

New Horizons Lecture Presented Today

A New Light: The Birth, and Rebirth, of Imaging



Sodickson

Imaging began as an effort to match or exceed the capabilities of the human eye and now is on the verge of emulating the workings of the human brain, according to Daniel K. Sodickson, MD, PhD, who will present today's New Horizons Lecture. A renaissance of technological and methodological developments is circumventing previous limits on imaging speed, spatial resolution, information content and ultimately, value. These developments are catalyzing a fundamental shift from the traditional series of snapshots to a new paradigm of streaming information that strengthens radiologists' ability to see what lies beneath.

This rebirth of imaging also gives pause to revisit the history of imaging. Dr. Sodickson will review the history of biomedical imaging and explore its evolving role in our rapidly changing world. Radiologists who embrace emerging paradigms of technology and information will play a critical role in leading imaging through what promises to be an extraordinary period of growth and change.

Dr. Sodickson is the vice chair for research in the Department of Radiology, director of the Bernard and Irene Schwartz Center for Biomedical Imaging and a professor of radiology, physiology and neuroscience at NYU School of Medicine in the NYU Langone Health system in New York City. He also is chair of the National Institutes of Health study section on biomedical imaging technology. Dr. Sodickson is credited with founding the field of parallel imaging, which allows distributed arrays of detectors to gather MR images at previously inaccessible speeds. As a result of his discovery, most modern MR scanners are now equipped with parallel imaging hardware and software, and parallel imaging acceleration is being used routinely in clinical MRI examinations and research imaging studies around the world. For his work in parallel imaging, Dr. Sodickson was awarded the gold medal of the International Society for Magnetic Resonance in Medicine (ISMRM) in 2006. He is the current president of ISMRM.

1:30 p.m., Arie Crown Theater

Category

Tip of the Day

Increasing the SID for upright radiographic exposures from 40" to 72" improves image quality through reduced focal spot blur and reduces patient dose.

American Association of
Physicists in Medicine



Chronic thromboembolic pulmonary hypertension (CTEPH): The under-recognized disease that all radiologists should know about

Would you know if your patient had CTEPH? To find out more, join us at this expert-led educational symposium

8:30–10:00 am, Tuesday, November 28, 2017
Room S105D, South Hall Level 1, McCormick Place

Chair: Carole Dennie

8:30	What is CTEPH, why does it matter, and who is at risk?	Carole Dennie (CAN)
8:50	CTEPH: How you can help to make this crucial diagnosis	Albert Hsiao (USA)
9:10	Role of imaging in guiding treatment approaches for CTEPH	Bernhard Meyer (DE)
9:30	What are the future imaging modalities for CTEPH diagnosis?	Deepa Gopalan (UK)
9:50	Q&A and close	Carole Dennie (CAN)

BREAKFAST WILL BE PROVIDED



1 in 25 PE patients could develop CTEPH*
As many as 1 out of 25 previously treated pulmonary embolism (PE) patients (>3 months of anticoagulation¹) could develop a form of pulmonary hypertension called CTEPH^{2,3}

*Based on a study with 223 patients in which 3.8% were diagnosed with CTEPH within 2 years of their first episode of pulmonary embolism with or without prior deep vein thrombosis (95% CI: 1.1–6.5). CTEPH did not develop after 2 years in any of the 132 remaining patients with more than 2 years of follow-up.

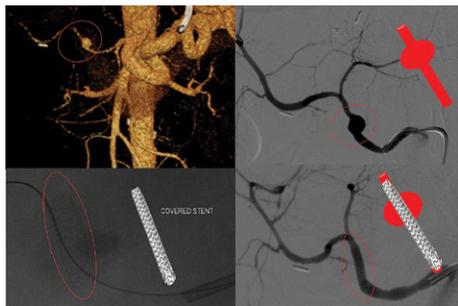
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3. Tapson VF, Humbert M. *Proc Am Thorac Soc* 2006;3:564–7.

Radiology's Role in Managing Vascular Complications in Liver Transplant

By Lynn Antonopoulos

Medical and surgical complications are a significant source of morbimortality and loss of grafts in the mid- and long-term periods after liver transplantation surgery. Interventional radiologists must be aware of possible vascular complications occurring post-surgery and be prepared to address these problems, according to presenter Elena Villacastín-Ruiz, MD, a vascular and interventional radiologist at Hospital Universitario Río Hortega (HURH) in Spain.

Specialists at HURH have performed more than 500 liver transplants and have developed strict protocols for diagnosing vascular complications. “The multidisciplinary work of surgeons and interventional radiologists has allowed us to solve the complications and avoid the loss of grafts,” Dr. Villacastín-Ruiz said.



CT scan shows a pseudoaneurysm in the arterial anastomosis. It is confirmed in the arteriography study. The treatment is performed by placement of a covered stent. It achieves the complete exclusion of the aneurysm. The permeability of both the right and left arterial branches is preserved.

During her Sunday afternoon education session, Dr. Villacastín-Ruiz presented a series of potential vascular issues frequently affecting successful liver transplantation surgery. “Vascular complications usually occur in the early postoperative period,” said Dr. Villacastín-Ruiz adding, “The prognosis depends on how early we can diagnose and treat them.”

Managing Complications

According to Dr. Villacastín-Ruiz, the most frequent and serious complication, and a common cause of loss of graft, is hepatic artery thrombosis which has an 11 to 35 percent mortality rate. It often occurs in the first month after transplantation and is generally caused by problems with surgical reconstruction of the artery. Even after initial transplant success, late hepatic artery thrombosis may occur more than a month after transplantation with graft survival depending on arterial collateral vascularization.

Therapeutic options for hepatic artery thrombosis include revascularization (surgical or endovascular), transcatheter fibrolytic therapy, retransplantation (limited by donor shortage) and observation (for patients who develop collateral vascularization distal to thrombosis).

Less frequent complications related to the hepatic artery are stenosis, pseudoaneurysm and arterial steal syndrome, a condition in which blood flow is diverted to another arterial branch, typically the splenic or gastroduodenal branch. First-line treatment options range from endovascu-



Villacastín-Ruiz

lar angioplasty (stenosis) or covered stent placement (stenosis and pseudoaneurysm) to coil embolization (arterial steal syndrome).

While less common, portal vein problems can occur and usually require intervention with angioplasty and stent placement. Portal vein stenosis occurs more frequently in pediatric patients and in live donor transplantation. If left untreated, it may lead to thrombosis.

Treatments Depend on Timing

According to Dr. Villacastín-Ruiz, treatment options for portal vein thrombosis are more varied and depend on timing. “Complete early thrombosis occurring less than 48 hours after transplantation requires surgical revision. First-line therapy for complete or partial thrombosis occurring 48 hours to 30 days is generally managed with thrombolysis and stent placement. For late thrombosis occurring more than 30 days post transplantation, observation is recommended for

asymptomatic patients, and thrombectomy and transjugular intrahepatic portosystemic shunt placement or fibrinolysis are recommended for symptomatic patients,” she said.

The least common vascular complications of liver transplantation include stenosis and thrombosis of the cava and suprahepatic veins. Dr. Villacastín-Ruiz said strictures of these veins are treated by transjugular access. “Percutaneous transhepatic access should be used only when the anastomosis cannot be catheterized from the jugular access.”

Balloon angioplasty with stent placement is the preferred treatment and is nearly 100 percent successful, according to Dr. Villacastín-Ruiz. However, she said relapses are common. “Surgical review is reserved for the unresolved endovascular cases and, ultimately, retransplantation is necessary in patients with severe graft dysfunction.”

In Uganda, Family Obligations Hinder Breast Cancer Care, Education

By Mary Henderson

In the sub-Saharan African country of Uganda, statistics on breast cancer are particularly sobering. The incidence of the disease has been increasing five percent every year for the last decade and a half, and the five-year breast cancer survival rate is just 56 percent, compared to more than 85 percent in North America.

“Cancer claims more lives in Uganda than HIV, tuberculosis and malaria combined and breast cancer is the second highest cause of cancer mortality,” said Scott J. Parker, MD, a radiology fellow at the Huntsman Cancer Institute at the University of Utah.

Cancer claims more lives in Uganda than HIV, tuberculosis and malaria combined and breast cancer is the second highest cause of cancer mortality

Scott J. Parker, M.D.

During a Sunday session in the Learning Center, Dr. Parker discussed the results of a study designed to better understand the role family obligation stress plays in the breast

health behavior of Ugandan women.

“Despite the fact that treatment for breast cancer is provided free of cost at the Uganda Cancer Institute, up to 89 percent of new breast cancer diagnoses present with stage III or IV disease,” he said. “The average woman waits over two years after self-detecting a lump before seeking medical care.”

Survey Shows Dire Need for Breast Cancer Education

To gather more data about Ugandan women and their breast health-seeking behavior, Dr. Parker traveled to Uganda with a team of researchers in 2016 to help administer the Breast Cancer: Attitudes on Surveillance and Knowledge (ASK) Survey.

“Ultimately the key to increasing breast cancer survival rates is early detection,” Dr. Parker said. “Understanding what limits that early detection is valuable.”

The survey was administered to 401 Ugandan asymptomatic women (ages 25–74) in both rural and urban locations. Of the respondents, 69 percent were employed full-time, 62 percent were married or living with a partner and the median household size was 5–6 people. More than half of the women surveyed reported never receiving breast cancer education and a third had never participated in preventative healthcare visits. The ASK Survey also included a multi-item scale to measure family obligation stress by asking women about the amount of time and resources they devote to family care and self-care—and the extent

to which they are overwhelmed by the demands of family responsibilities.

Members of the Statistics Department at the University of Washington analyzed the ASK survey data to identify associations between family obligation stress and socio-demographic and economic factors with the women’s breast health-seeking behavior, including gathering information and obtaining check-ups.

Results of the analysis revealed that family obligation stress increased with the number of children and adults in the home and full-time employment or student status, Dr. Parker said.

“Higher family obligation stress was associated with lower rates of receiving breast cancer education and less participation in preventative healthcare visits and contributes to delayed diagnosis of breast cancer among women in Uganda,” said Dr. Parker. “We believe this may also be true in other similar cultures.”

Based on the results, Dr. Parker said future clinical interventions should consider the effect of family obligation stress by providing education in locations other than the medical clinic, such as the workplace, churches and schools.

“Educational efforts could be targeted at schools, where mothers are picking up their children,” he said. “HIV/AIDS campaigns did a good job of targeting their message to schools. If teenage girls are educated on breast cancer, by the time women reach their 30s and 40s, breast care would be more familiar to them.”



Parker

Real-time Virtual Sonography Shows Promise for Assessing Fetal Brain Pathologies

By Elizabeth Gardner

Real-time virtual sonography (RVS), also called fusion imaging, combines ultrasound (US) and MR images and could someday offer clinicians a clearer picture of fetal brain anomalies than either technique used alone, according to researchers at a Sunday session.



Antonelli

RVS, a new technique that uses magnetic navigation and computer software for the synchronized display of real-time US and multiplanar reconstruction MRI images, is already used for US-MR guided biopsies, but has not yet been applied to fetal anomalies, said principal investigator Silvia Bernardo, MD.

Amanda Antonelli, MD, from Sapienza Università di Roma, Italy, presented findings from a preliminary study of 35 patients who had undergone fetal MRI after US examinations showed possible cerebral pathology. RVS combines the two sets of images by synchronizing them during an US examination, using a small magnetic field generator and a magnetic sensor attached to the US probe. In 25 out of the 35 cases, RVS yielded better information than either MRI or US alone.

Although both US and MRI studies are often used in such evaluations, they are used as single modalities and most often are performed by different specialists.

“RVS allows better identification of the different fetal pathologies and could improve the performance of ultrasound examinations,” Dr. Antonelli said.

The principal application of RVS in this study was to examine midline, cerebral gyration and vascular malformations.

Patients underwent fetal MRI on a 1.5 Tesla magnet using a multi-channel phased array coil according to a standard fetal MR protocol with a duration of 20 to 30 minutes. Subsequently, they had an US examination in a room equipped with a small magnetic field generator that powered a magnetic sensor on the US probe. The sensor allowed the synchronization of the MR images and the US images in real time. The MRI image dataset was loaded into the machine and images were displayed together with the US image on the same dual display monitor.

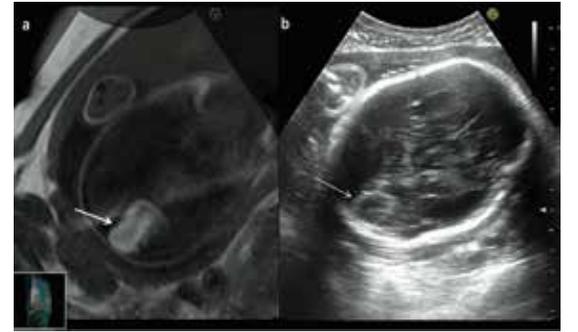
In all 35 cases, RVS was technically possible, with a 100 percent match between MR and US images. Data registration, matching and RVS could be completed within half an hour of the end of the exam, and sometimes in as little as 15 minutes.

RVS helped clarify the diagnosis in 25 percent of the cases. In 25 out of 35 cases of encephalic pathology, RVS allowed a more thorough diagnosis. In the remaining cases, MRI alone was superior to both US and RVS.

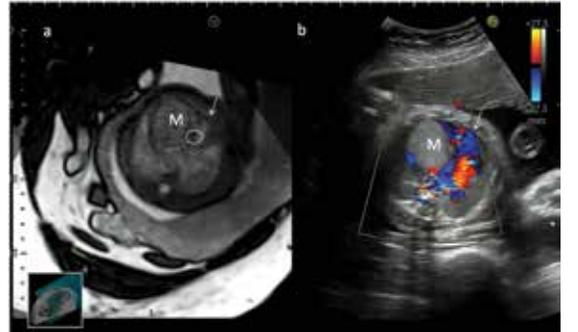
MRI was superior to US alone in four cases. In one case of an encephalic lesion seen on US, MRI was able to detect the extra-axial nature of the lesion and to identify the presence of blood components. In a study of the encephalus in a fetus affected by cardiac rhabdomyomas, MRI showed multiple cortical brain lesions, not detectable on US even with the use of RVS.

In a cortical gray-white matter blurring case, MRI depicted the poor neuronal migration toward the cortical layers while US was able to identify the ventriculomegaly but not the cortical anomalies. In the last case, MRI was able to detect the split spinal cord in the vertebral canal in a case of diastematomyelia, while US pointed out interpeduncular distance augmentation alone.

This research was awarded an RSNA Student Travel Stipend Award.



Fetus at 21 GW. Coronal T2 WI of the fetal head (A) with the corresponding US plane (B) synchronized on the biparietal diameter. Fetal movement at the moment of synchronization but the coronal plane for the fusion image is preserved. Diagnosis of agenesis of the corpus callosum with the typical “moose head sign” and the visualization of a pseudocystic image on the midline.



Fetus at 18 SG + 3 gg with a diagnosis hydrocephalus. Axial T2 WI of the fetal head (A) with the corresponding US plane (B) synchronized on the occipital plane. Good synchronization with optimal anatomical visualization of fetal lateral ventricles.

RSNA 2017 Press Releases

Several press releases will be distributed to the media highlighting research presented at RSNA 2017. RSNA's media outreach helps the public gain a greater understanding of radiology and its role in personal healthcare. The following research developments were released to the media in advance of the annual meeting.

MRI Uncovers Brain Abnormalities in People with Depression and Anxiety (NR394-SD-THB4)

Researchers using MRI have discovered a common pattern of structural abnormalities in the brains of people with depression and social anxiety, according to a study from Sichuan University in Chengdu, China. The researchers used MRI to assess alterations in the brain's gray matter among 37 patients with major depressive disorder, 24 patients with social anxiety disorder and 41 healthy controls. Patients with depression and anxiety, relative to healthy controls, showed gray matter abnormalities in the brain's salience and dorsal attention networks. They also showed cortical thickening in the insular cortex.

Overweight Women May Need More Frequent Mammograms (BR252-SD-WEB1)

Women with a body mass index (BMI) greater than 25 face an increased risk of not detecting their breast tumor until it has become large, according to a new study

from Karolinska Institutet in Sweden. Researchers studied 2,012 cases of invasive breast cancer and looked for how disease progression was related to BMI and breast density. For cancers detected at screening, both BMI and breast density were associated with having a large tumor at diagnosis. However, for interval cancers, or cancers detected within two years of a normal mammogram, only BMI was linked with having a large tumor and worse prognosis. The researchers said that women with higher BMI may need shorter intervals between mammography screening exams.

Male Triathletes May Be Putting Their Heart Health at Risk (CA205-SD-SUB1)

Competitive male triathletes face a higher risk of a potentially harmful heart condition called myocardial fibrosis, or scarring of the heart, according to research conducted at University Medical Center Hamburg-Eppendorf in Hamburg, Germany. The condition can progress to heart failure. The researchers studied a group of triathletes, including 55 men, average age 44, and 30 women,

Today's Press Releases

- New Studies Show Brain Impact of Youth Football (SSE19-04)
- Radiology Offers Clues in Cases of Domestic Abuse and Sexual Assault (RC208-06)
- Neurofeedback Shows Promise in Treating Tinnitus (SSC11-07)

Tuesday's Press Releases

- Fat Distribution in Women and Men Provides Clues to Heart Attack Risk (SSC09-08)
- Weight Loss Through Exercise Alone Does Not Protect Knees (SSJ16-03)
- Migraines Linked to High Sodium Levels in Cerebrospinal Fluid (SSG11-03)

Wednesday's Press Releases

- Hip Steroid Injections Associated with Bone Changes (SSK13-07)
- CT Shows Enlarged Aortas in Former Pro Football Players (SSK04-08)
- Study Finds No Evidence that Gadolinium Causes Neurologic Harm (SSM16-01)
- Minimally Invasive Treatment Provides Relief from Back Pain (SSK13-01)

average age 43. The study group underwent contrast-enhanced cardiac MRI exams. Evidence of myocardial fibrosis was apparent in the left ventricle in 10 of 55 of the men, or 18 percent, but in none of the women. The athletes with myocardial fibrosis had completed significantly longer total swimming and cycling distances and had higher peak exercise systolic blood pressure.

Thursday's Press Releases

- Emergency Radiologists See Inner Toll of Opioid Use Disorders (SSQ06-09)
- Brain's Appetite Regulator Disrupted in Obese Teens (SSQ17-02)
- Smartphone Addiction Creates Imbalance in Brain (SSQ16-01)

Friday's Press Release

- 3-D Printed Prosthetic Implants Could Improve Treatment for Hearing Loss (SST08-01)

All RSNA 2017 press releases are in the newsroom at RSNA.org/Press17, available on the day of the presentations.

Women Prefer Getting Mammograms Every Year (BR222-SD-MOA2)

Women prefer to get their mammograms every year, instead of every two years, according to a new study from Einstein Medical Center in Philadelphia. The research team surveyed 731 women (mean age 59). Women were asked whether an abnormal mammogram or breast biopsy causes emotional harm, whether screening every two years was associated with less or more anxiety and whether they preferred to have a screening mammogram every other year or every year. Of the women surveyed, 71 percent preferred getting screened every year. In 2009, the U.S. Preventive Services Task Force issued a controversial recommendation that women at average risk be screened every two years, beginning at age 50.

RSNA 2017 Sessions Invite Attendees to “Explore. Invent. Transform.”

In keeping with this year’s theme, attendees will discover myriad sessions reflecting the critical role of imaging in the future of healthcare. Below is a sampling.



RCC25 (EDUCATIONAL COURSE)

How to Translate Radiology Reports to the Language that Patients Understand

Learn how informatics can be used to develop methods to augment your current workflow to make it more patient-centric, by providing multimedia and annotated radiology reports to help patients to understand reports typically written for referring physicians.

Monday, 4:30-6:00 p.m. | Room S501ABC

IN217-SD-TUA3

Construction of Patient-Specific Imaging Phantoms Using a Desktop 3-D Printer and Customized Filaments with a Wide Range of Radiodensities

Researchers will construct patient-specific imaging phantoms using a desktop 3-D printer and customized filaments with a range of attenuation properties, such as those encountered in the human body.

Tuesday, 12:15-12:45 p.m. | Informatics Community, Learning Center, Station 3

BR242-SD-TUB4

Automated Pre-Selection of Mammograms without Abnormalities Using Deep Learning

Researchers evaluate the potential of a computer system to select exams with a low likelihood of containing cancer.

Tuesday, 12:45-1:15 p.m. | Breast Community, Learning Center, Station 4

RC350 (EDUCATIONAL COURSE)

Targeted Treatment and Imaging of Liver Cancers: Basic to Advanced Techniques in Minimally-Invasive Therapies and Imaging

Presenters will discuss the role of the interventional radiologist in the treatment and management of patients with primary and metastatic liver cancer as part of the multidisciplinary team.

Tuesday, 8:30-10:00 a.m. | Room S403A

MSAS32

Patients Are Expecting a Retail Experience: 5 Principles from Retail Healthcare (Sponsored by the Associated Sciences Consortium) (An Interactive Session)

This session focuses on the underlying people, processes and technologies that create an enhanced retail consumer experience. Attendees will learn to identify opportunities for clinical practices to enhance the patient experience and prepare your organization for the shift to treating the patient as a consumer.

Tuesday, 10:30 a.m.-12:00 p.m. | Room S105AB

SSJ12 (SCIENTIFIC SESSION)

Point-of-Care Virtual Radiology Consultations in Primary Care: A New Model for Patient-Centered Care in Radiology

Presenters discuss the value of point-of-care virtual consultations through implementing synchronous video-based virtual consultations in which referring physicians can consult with a radiologist virtually and review studies in real-time while seeing a patient.

Tuesday, 3:10-3:20 p.m. | Room S104B

RC517 (EDUCATIONAL COURSE)

Emerging Technology: Elastography – Opportunities and Challenges

Presenters will discuss the elastography measurements that are integrated into the management of patients with chronic liver disease as well as the imaging techniques and protocols of US and MR elastography.

Wednesday, 8:30-10:00 a.m. | Room S505AB

RCC42 (EDUCATIONAL COURSE)

Platforms and Infrastructures for Accelerated Discoveries in Machine Learning and Radiomics

Presenters will discuss the challenges involved in creating machine learning

(ML) and radiomics experiments with standard clinical systems and review tools that can bridge the gap between existing clinical systems and translational research in medical imaging.

Wednesday, 10:30 a.m.-12:00 p.m. | Room S501ABC

ML009

Invited Poster: Beyond Deep Learning: The Role of Medical Expertise in Guiding Artificial Intelligence

This session will focus on the continued growth of artificial intelligence (AI) algorithms and the ultimate task that radiologists will need to perform — mapping between biology/pathology and image representations.

Wednesday, 12:15-12:45 pm. | Room ML009, Machine Learning Community, Learning Center

VS1041-11

A Data-Driven Model for Microwave Ablation

The session will feature a data driven image-guided thermal ablation model computed from real patient data that reduces the risk of untreated tumor or damaging critical structures.

Wednesday, 1:30-6:00 p.m. | Room S405AB

SPSH50

Hot Topic Session: Abbreviated MRI Exam – Breast MRI in 5 Minutes

Presenters will discuss the concept of an abbreviated breast MRI (AB-MR) exami-

nation and the role of AB-MR as a screening tool. The session will also cover the role and applications of ultrafast imaging in an AB-MR examination

Thursday, 7:15-8:15 a.m. | Room E450A

RCC51 (EDUCATIONAL COURSE)

Mission Critical: How to Increase Your Value by Mastering the Intersection of Quality Improvement and Informatics

Presenters will identify the required structural framework necessary for improving quality, describe the improvements facilitated by a range of commercially available informatics tools and discuss how to implement a radiologist-based quality improvement process in your own department.

Thursday, 8:30-10:00 a.m. | Room S501ABC

ML120-ED-X (EDUCATION EXHIBIT)

Deep Learning Applications in Radiology, Recent Developments, Challenges and Potential Solutions

This exhibit offers an overview of different deep learning (DL) architectures and applications of DL for various radiology tasks, and will address challenges and solutions for DL in radiology.

All Day

PH116-ED-X (EDUCATION EXHIBIT)

Deep Learning in Medical Image Analysis: What’s Next?

The exhibit explores the basics of deep learning (DL) for detection and segmentation tasks, the differences between supervised, semi-supervised and unsupervised DL and the potential for DL learning in direct image-based quantification, diagnosis and prognosis.

All Day



The Reality of Deep Learning/Artificial Intelligence in Radiology: They Will Redefine the Specialty

By Mike Bassett

While there has been a lot of hype — and even fear — about the role deep learning (DL) and artificial intelligence (AI) play in radiology, the reality is that they are both potentially useful technologies that will add value to the specialty in a number of ways.

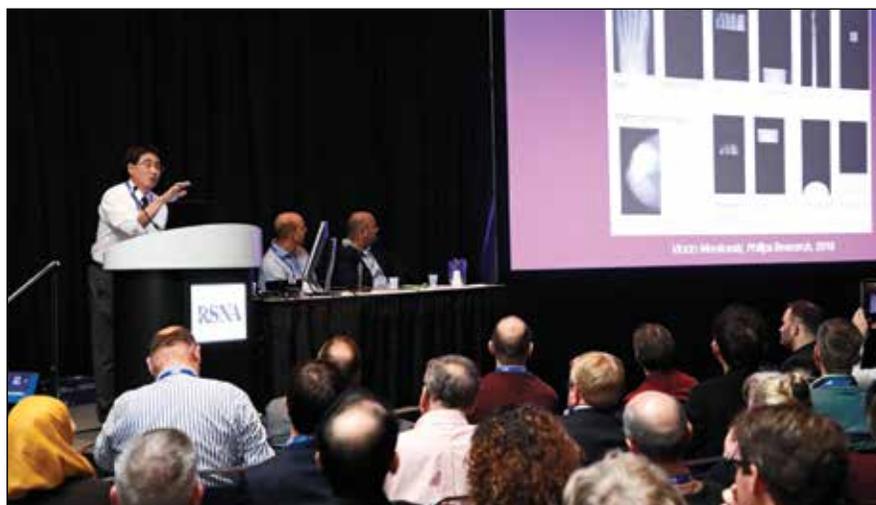
“Deep Learning is not going to replace us,” said Paul Chang, MD, of the University of the Chicago School of Medicine, during a Sunday session on DL and AI in radiology. “But it will redefine us.”

And radiology will need this technology more than ever due to the increasing demands on clinical imaging. Data sets are getting more complex and there is an increasing need to correlate images with other clinical information in order to implement practices such as radiogenomics, Dr. Chang said.

“So deep learning will help us because we are going to need something — we need some tool — some mechanism — to meet these new imaging challenges,” Dr. Chang said. “We are going to need some kind of cybernetic help to get through a day’s work and help us maintain and improve quality.”

Infrastructure Remains a Challenge

But these are early days when it comes to incorporating DL and AI into the practice of radiology, and numerous challenges still exist.



Chang

For example, how can radiology confidently validate the performance of these new technologies?

“Deep learning is a great name for it because it has two meanings,” Dr. Chang said. “It can mean ‘very capable’ or deep as in ‘deep waters’ or ‘obscure,’ and that’s the problem.”

“There are very deep layers to deep learning systems and it’s very difficult to

We are going to need some kind of cybernetic help to get through a day’s work and help us maintain and improve quality.

Paul J. Chang, MD

unless they have the necessary data and infrastructure, Dr. Chang said.

Which brings up another challenge. Radiology doesn’t have the infrastructure to either feed, train or consume these systems.

understand why they work.”

Comprehending DL requires the use of cases and tons of data.

But radiologists really can’t get compelling use cases

unless they have the necessary data and infrastructure, Dr. Chang said.

Which brings up another challenge.

Radiology doesn’t have the infrastructure to either feed, train or consume these systems.

“Other industries have really revved up for cloud computing and big data and are ready to consume deep learning, because deep learning loves that kind of environment,” Dr. Chang said. “Radiology is still struggling with electronic medical records (EMRs) and PACS and we generally don’t have a true IT infrastructure that can feed and consume these systems.”

The specialty should first pursue a “hedge strategy” by building infrastructures necessary to prepare for the cloud and big data, registries and advanced analytics, as well as DL, he said.

“The bottom line is that deep learning won’t replace people — it will enhance them,” Dr. Chang said. “We should be looking for the minimally heuristic use case sweet spot like workflow optimization. Something that isn’t sexy, but is an easy win, saves money, and improves lives.”

For those still unsure how DL fits into the healthcare landscape, Dr. Chang offers another comparison: “The analogy I use is the gold rush,” he said. “Everyone went out west to dig for gold. Most miners either failed or died, but there were people who thrived — the people selling the miners the shovels. You needed to build an infrastructure.”

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R&E Foundation Continues to Fuel Innovation in Radiology

By Shelley Taylor

The RSNA Research & Education (R&E) Foundation provided \$4 million to researchers at 50 different institutions this year, and that funding is fueling innovation in radiology, according to R&E Foundation Chairman N. Reed Dunnick, MD, who delivered the Report of the RSNA R&E Foundation on Sunday.

“As radiologists we must maintain the intellectual leadership in imaging and image-guided therapies and earn the respect of the medical community,” Dr. Dunnick said. “Funding research performed by radiologists is critical for our continued success and the most important way we can support the future of our field.”

Dr. Dunnick pointed to four R&E grant recipients who figure prominently at RSNA 2017. Richard Ehman, MD, who delivered the RSNA President’s Address earlier in the day, received an early-career R&E Research Scholar Grant to investigate novel MRI technology, which led to additional funding through the National Institutes of Health. Dr. Ehman now holds more than 70 patents.

Daphne Haas-Kogan, MD, who will present the Annual Oration in Radiation Oncology this week, also received a Research Scholar Grant. She is a leading authority on pediatric brain tumors and was recently appointed to the Blue Ribbon Panel that will advise the National Cancer Moonshot Initiative.

An R&E Research Grant recipient, Jonathan Kruskal, MD, PhD, is a leader in quality improvement and is slated to present the 2017 RSNA Annual Oration in Diagnostic Radiology. And Mitchell Schnall, MD, PhD,



Dunnick

who received a Research Scholar Grant in 1992, was awarded the 2017 Outstanding Researcher Award on Sunday for his work in translational biomedical imaging. Since that first grant, Dr. Schnall has secured \$125 million in additional research funding from national and private sources, and now leads the Department of Radiology at the University of Pennsylvania Perelman School of Medicine.

“I have seen first-hand the power of an early career grant to develop leaders in research and education,” Dr. Dunnick said, mentioning that more than 250 other past and current R&E grant recipients will present research during this annual meeting. “We must help more investigators become successful imaging scientists in diagnostic radiology, interventional radiology and radiation oncology,” he added.

I have seen first-hand the power of an early career grant to develop leaders in research and education.

N. Reed Dunnick, MD

Dr. Dunnick thanked the community of radiologists, practice groups and corporations that has come together to invest in the future of radiology, noting the Inspire-Innovate-Invest Campaign – with a goal of raising \$17.5 million – will come to a close at the end of the year.

“Your donation is the seed of future growth,” he said. He explained that Foundation grant recipients report receiving an additional \$50 in subsequent funding from other sources for every dollar they received from the Foundation.

“Consider for a moment the significance of such a return on investment, and the long-term growth of a gift made today,” he concluded. Dr. Dunnick invited audience members to visit the R&E Foundation booth in the Connections Center to learn how they can contribute and help the Campaign finish strong.

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3-D MRI Fetal Images Superior in Quality to 3-D US

By Jennifer Allyn

When there is a question of findings during 3-D ultrasound (US) in the third trimester of pregnancy, many radiologists are turning to 3-D MRI for anatomy exploration of the fetus and to support diagnostic decisions.

While not routinely used during prenatal care, 3-D MRI does offer excellent tissue contrast as a second evaluation in difficult cases or to reinforce an US diagnosis, according to Heron Werner, MD, PhD, at Clinica de Diagnóstico por Imagem in Rio de Janeiro.

US scanning over the past several decades has opened a new window into the study of the fetus, because it is patient-friendly, cost-effective and safe. MRI for fetal imaging has been in use since the 1980s and offers high-resolution images with excellent tissue contrast. It provides additional information about fetal abnormalities and conditions in situations where US cannot provide high-quality images, such as advanced gestational age, reduction of the amniotic fluid and maternal obesity.

"Ultrasound examination is the primary method of fetal assessment, while MRI is complementary in that it is a diagnostic technique that can provide sharp images of the human body," Dr. Werner said. "The large field of view from MRI offers the 3-D reconstruction of the whole fetal body, allowing radiologists to identify some phenotypes of different syndromes." These syndromes can include craniosynostosis, cleft lip, limb reduction, Beckwith-Wiedemann syndrome, conjoined twins and club feet.



Werner

resolution US probes with harmonic images, while the MRI was a 1.5-T scanner with body coil.

The 3-D images were post-processed. Maximum intensity projection images were reconstructed and the gestational sac was manually segmented. The images were then volume rendered and the amniotic fluid was removed by threshold techniques.

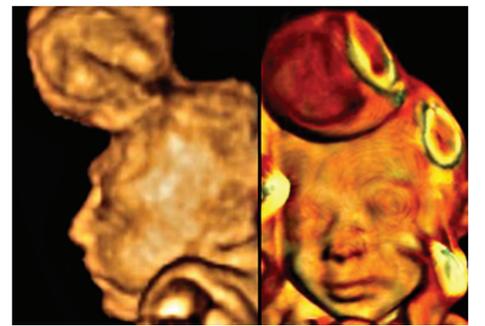
Despite recent improvements in 3-D US, the results obtained from 3-D MRI were superior in the third trimester, even with fetal movements being one of the principal difficulties in capturing the images.

"For rare genetic conditions, complex malformations or even in the case of twins or triplets, 3-D MRI helps physicians understand fetal anatomical characteristics," Dr. Werner said. "3-D MRI also assists during multidisciplinary discussions among physicians who may initially differ on diagnosis or the urgency of the condition."

Ultimately, Dr. Werner foresees that 3-D MRI will be most beneficial to parents in helping them visualize their unborn baby and the challenges that the baby may face after it's born. "It is one thing to tell a parent that their baby has a tumor or serious abnormality, but it is another thing to show them," Dr. Werner summarized. "3-D MRI can help



3-D MRI showing a 27-week fetus with brachycephaly, low ear implantation, syndromic profile and vestigial tail.



3-D ultrasound and 3-D MRI of a 23-week fetus with encephalocele.

both physician and parents understand the prognosis of fetal abnormalities and help facilitate treatment decisions."

It is one thing to tell a parent that their baby has a tumor or serious abnormality, but it is another thing to show them.

Heron Werner, MD, PhD

From September 2009 to December 2016, 52 fetuses were selected from cases evaluated for external malformations. Morphological abnormalities were first imaged by 3-D US, with 3-D MRI reinforcing the preliminary findings. 3-D US scans were performed transabdominally using high-

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CT Has Potential Role in Assessing Pancreatic Cancer Treatment

CT-derived texture analysis of pancreatic tumors could help assess and predict a patient's response to chemotherapy, according to research presented Sunday.

By Richard Dargan

Patients with pancreatic cancer, the fourth leading cause of cancer-related death in the United States, often undergo chemotherapy as part of their treatment, but not everyone responds to the treatment the same way. Imaging biomarkers that may predict pancreatic cancer chemotherapy response are lacking, said study author Rohit Dewan, DO, a clinical fellow at the University of Pittsburgh Medical Center in Pittsburgh, PA. A blood test that measures levels of CA 19-9, a substance released by pancreatic tumor cells, is often used to measure treatment response, but up to 10 percent of patients whose tumors are growing do not show an increase in CA 19-9 levels. In addition, imaging features like tumor size and vascularity are unreliable.

Dr. Dewan and colleagues recently studied a novel approach to treatment response monitoring that focuses on the textural features of a tumor as derived from CT. They looked at 39 patients with early-stage cancer. The patients underwent CT before and after chemotherapy, and surgical resection was performed within five days of the second CT.

CT textural features were extracted from a region of interest on the largest tumor cross-section using commercially available software called TexRAD that produces textural variables like tumor skewness, kurtosis and entropy.

The researchers assessed surgical specimens for tumor histologic response using the Evans grading system, in which grade I represents no or minimal response and grade IV is a complete response. A biochemical response was defined as more than a 50-percent decrease in CA19-9 level. Correlation among textural parameters, tumor grade, Evans grade and biochemical response was assessed.

A statistically significant correlation was shown between specific textural variables such as tumor entropy, skewness and mean positive pixel on the initial CT scan and Evans grade of histological response. Tumor entropy on post-treatment CT as well as changes in tumor skewness correlated with Evans grade. Changes in tumor kurtosis and skewness also correlated with biochemical response.

“We found a significant correlation between the texture parameters in the

“We found a significant correlation between the texture parameters in the region of interest and the tumor response to chemotherapy.”

Rohit Dewan DO.



Dewan

region of interest and the tumor response to chemotherapy,” Dr. Dewan said. “The results show that quantitative parameters of tumor heterogeneity on baseline CT are much better predictors of treatment effect than CA19-9.”

Dr. Dewan noted that texture analysis may have particular importance for cases in which the pancreatic cancer is locally advanced, in which case it is treated with chemotherapy first followed by surgery. The information could easily be included

in picture archive and communication systems, he said

“This approach has a lot of potential,” Dr. Dewan said. “The software extracts several parameters, and in the future we hope to learn more about which variables are most important.”

The researchers are planning on validating this method in larger cohorts and also look at the correlation with molecular and genetic markers of disease aggressiveness.

News from the ABR

American Board of Radiology (ABR) leadership will be delivering the annual update session, “What’s New from the ABR?” (RC202), on Monday at 8:30 a.m. in Room S403A.

Presenters will discuss the latest news about ABR certificate programs, including an update on the new Online Longitudinal Assessment (OLA), which will replace the traditional MOC exam taken every 10 years. OLA is the latest in a series of MOC improvements implemented by the ABR over the past few years.

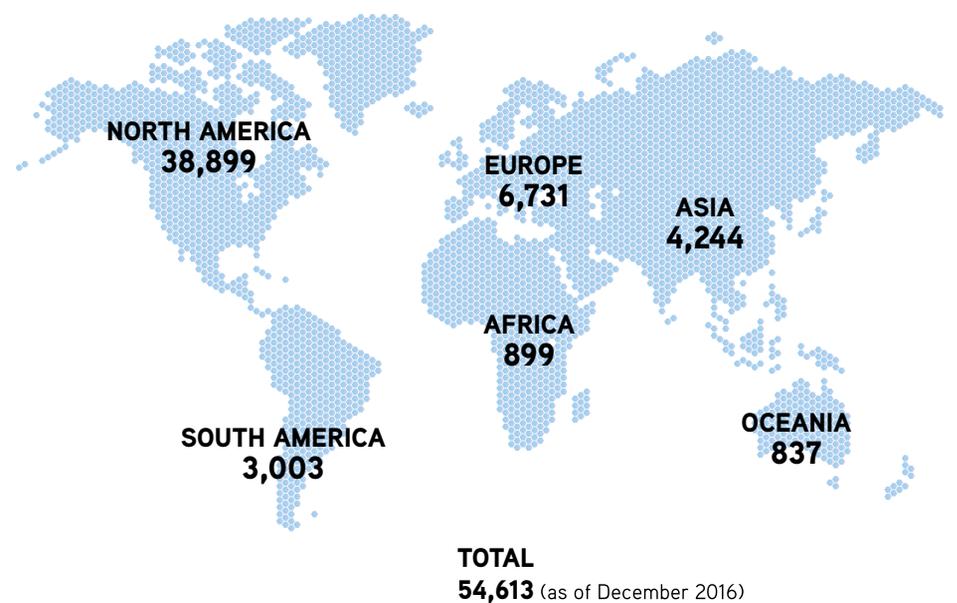


For more information, visit the ABR booth, #7609 in North Hall B, or go to theabr.org.

Question of the Day

Q A 40 kg child has an abdomen CT scan. The dose index reported by the scanner is 4.5 mGy (32 cm phantom). What is the best estimate for the dose to the child? [Answer on page ?A.]

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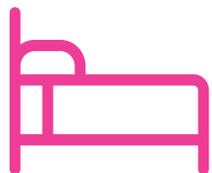
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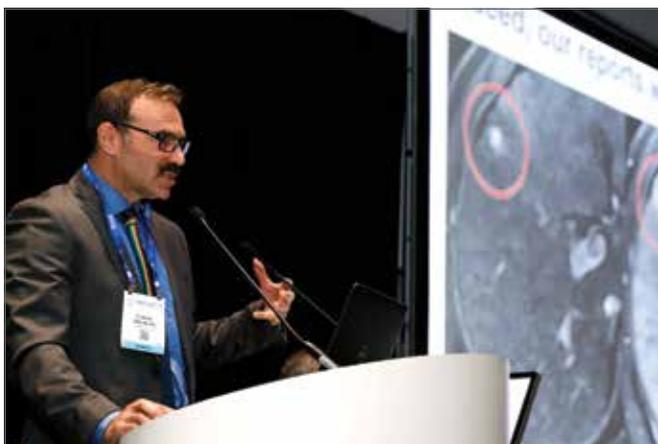
LI-RADS Promotes Improved Liver Imaging Techniques, Reporting

By Lynn Antonopoulos

From its earliest beginnings in 2006 to its most recent update this year, the Liver Imaging Reporting and Data System (LI-RADS) is helping radiologists deliver clearer and more consistent imaging reports to hepatologists and surgeons worldwide.

“LI-RADS is the leading system for interpretation and reporting of liver imaging exams in adults with cirrhosis. It is also the first radiology system for liver imaging developed by radiologists,” said Claude B. Sirlin, MD, keynote speaker and one of the founders of LI-RADS.

The system was designed in response to hepatologists and surgeons who complained that terminology like “indeterminate,” “worrisome” and “suspicious” was ambiguous and not actionable. According to Dr. Sirlin, professor and vice chair (translational research) of radiology at University of California, San Diego (UCSD), “LI-RADS is a blend of evidence, expert opinion and a desire for congruency with other systems of its kind. It rigorously defines and standardizes liver imaging technique, terminology, interpretation and reporting and has improved communication between radiol-



Sirlin

ogists and specialists diagnosing hepatocellular carcinoma (HCC) in patients with cirrhosis or those at risk for HCC.

LI-RADS was created at the UCSD around the same time as a similar system was launched at Thomas Jefferson University (TJU). In 2008, the American College of Radiology (ACR) gathered a committee of North American radiologists to use the systems created at UCSD and TJU to further develop LI-RADS.

Following years of refinement, including significant work in gathering evidence

and expert opinions, among other things, the current iteration is the result of several updates, each focused on tightening gaps and improving precision and simplicity.

As evidence of its growing value and influence, Dr. Sirlin noted that the Sunday series was the first RSNA session dedicated to research conducted to evaluate the accuracy and utility of LI-RADS. “Initially a North American effort by diagnostic radiologists, it is now an international consortium with over 250 contributors in 30 countries and includes not only diagnostic radiologists, but also allied specialists: interventionalists, hepatologists, surgeons and pathologists,” Dr. Sirlin said.

There have been four releases of LI-RADS, including the latest version for 2017. It contains detailed processes and terminology for four areas: ultrasound (US) screening, contrast-enhanced US (CEUS), CT/MRI diagnosis and staging and CT/MRI treatment response.

Looking ahead, Dr. Sirlin said the future of LI-RADS will include more widespread adoption and additional improvements, including collection of more rigorous evidence, further refinement reflecting an international perspective, expansion beyond adults at risk for HCC, CEUS treatment response evaluation assisted interpretation and reporting and deep learning to augment and facilitate the use of LI-RADS.

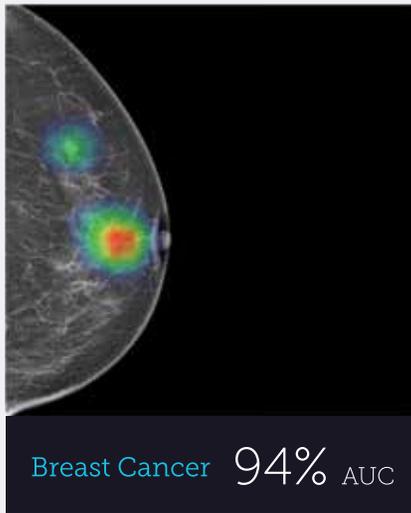
LI-RADS is an adventure and a platform for international collaboration, education, mentorship, cross-fertilization, research and dissemination of knowledge.

Claude B. Sirlin, MD

Given its expansion and the improvements it has delivered to the area of HCC diagnosis, Dr. Sirlin said he anticipates LI-RADS will enable the development of international registries to accelerate progress across the entire field of liver imaging while ensuring that radiologists remain

at the forefront of the effort. “LI-RADS is an adventure and a platform for international collaboration, education, mentorship, cross-fertilization, research and dissemination of knowledge,” he said.

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MEETING PROGRAMS

Monday 10:30-10:40 AM | SSC03-01 | Room: S504CD
Automatic Detection of Malignant Pulmonary Nodules on Chest Radiographs Using a Deep Convolutional Neural Network: Detection Performance and Comparison with Human Experts

Monday 10:50-11:00 AM | SSC03-03 | Room: S504CD
Deep Learning-based Automatic Detection Algorithm for the Detection of Malignant Pulmonary Nodules on Chest Radiographs



Quality Storyboard Walks

Join experts in quality improvement (QI) in radiology as they walk through the QI storyboards, highlighting examples of great work and sound methodology. Bring your walking shoes and come prepared for an interactive session. Those who are interested in leading and publishing QI projects in the coming months and years will find this especially valuable.

The poster walks will be held Monday, Nov. 27, at 3 p.m. and Tuesday, Nov. 28, at 4 p.m. The walks begin in the Quality Storyboard section of the Learning Center, Lakeside Center East, Level 3.

Student Travel Awards Displayed in the Learning Center

RSNA Travel Awards for young investigators support candidates invited to present high-quality science. The \$500 award helps defray the costs of attending the RSNA annual meeting. To be eligible, abstract presenters or poster exhibitors must be pre-doctoral students or have been awarded their doctoral degrees no more than three years prior to submission.

A list of the 400 presenters who received 2017 Travel Awards can be viewed in the Learning Center, Lakeside Center East, Level 3. Full eligibility requirements for the award will be available with the 2018 Call for Abstracts in mid-January.



Synthesized Mammography Effective in Assessing Breast Density

By Elizabeth Gardner

Synthesized mammography is comparable to full field digital mammography (FFDM) when assessing breast density, according to research presented Sunday.

A new study from the University of Utah, Salt Lake City, showed that at least four out of seven readers made the same density determinations in 88 percent of the cases studied, regardless of the image type. However, imaging readers showed a slight tendency to assign higher densities when they were looking at synthesized images than at FFDM images.

Breast density has implications both for cancer risk and for the ability to detect the disease during imaging.

Synthesized mammography is a relatively new technique that uses software to reconstruct the 3-D images that are generated during digital breast tomosynthesis into 2-D images, offering views comparable to 2-D FFDM images.

Each of the two image types has a distinctive “look” that’s easily recognized by the reader, said presenter Irfanullah Haider, MD, who was a breast imaging fellow at the University of Utah at the time of the study and is now an instructor in breast imaging at Brigham and Women’s Hospital, Boston. “The synthesized images have higher contrast, and calcifications tend to ‘pop,’” he said.

The university routinely performs both types of imaging when doing a baseline

mammogram for a new patient. Dr. Haider said one purpose of the study is to start building evidence on whether synthesized mammography can safely replace FFDM for baseline studies, reducing the number of studies and the radiation exposure per patient. Also, other studies have shown that patients are less likely to be recalled for another study when the baseline study uses synthetic mammography, Dr. Haider said.

In the retrospective study, seven radiologists read both baseline studies for about 200 patients whose mammograms were performed consecutively between June and November, 2016. Six of the readers had completed

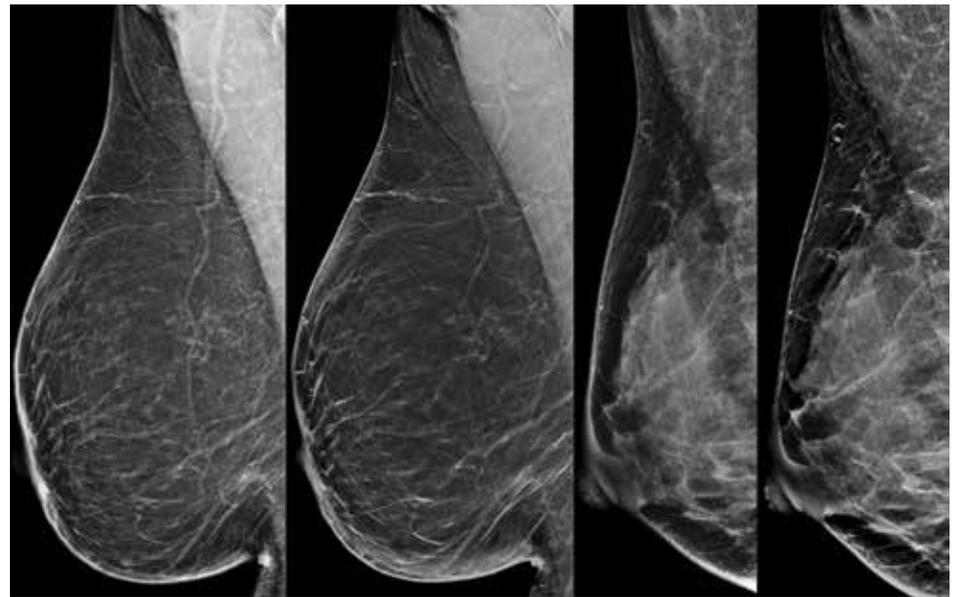
fellowships in breast imaging and the seventh was in a breast imaging fellowship at the time of the study.

The readers first assigned density using the randomized FFDM images alone, blinded to evaluations by other readers, and then assigned density using the synthetic views alone (also blinded to the evaluations of others) during a separate session.

Each study included four views. The study compared how often the readers agreed on the density classification, and whether their assessments and the rate of agreement, differed significantly depending



Haider



Breast density examples, left to right: (1) An almost entirely fatty dense breast on standard digital mammogram and on (2) synthetic mammogram; (3) an extremely dense breast on standard digital mammogram and on (4) synthetic mammogram.

on which modality produced the images. Qualitative density assessment was based on the four categories of the Breast Imaging Reporting and Data Systems (BI-RADS) 5th Edition: 1 (fatty), 2 (scattered fibroglandular), 3 (heterogeneously dense) and 4 (extremely dense). Categories 1 and 2 are considered “non-dense” and categories 3 and 4 are considered “dense.”

Consensus for a given study was defined as agreement by at least four of the seven readers. Where readers disagreed, they never varied by more than one density category in either direction, and in only eight cases was the disagreement clinically significant (defined as a

change from category 2 to category 3, or from category 3 to category 2).

Inter-reader agreement was higher on the FFDM images than on the SM images (.705 vs .627), but both fell into the range of moderate agreement (.61-.80).

Several studies have compared the two modalities for tumor detection, but this is one of the largest studies examining density classification. As of the beginning of 2017, 30 states require women to be notified of their breast density and legislation is pending in five more, according to the American Society of Breast Surgeons.

Tomorrow’s Radiologist Must Tap into the Infinite Possibilities of Innovation, Technology and Teamwork – Today

CONTINUED FROM COVER

For example, he referred to Peter Basser, PhD, of the National Institutes of Health and a team of researchers who invented and developed MR diffusion-tensor imaging, which is now used to map the human connectome.

“His latest innovation actually quantifies neural conduction latency,” Dr. Pettigrew said. “This has the potential to offer new insights into some of our most challenging healthcare conditions in the brain, such as mental health and psychiatric illness.”

Dr. Pettigrew also discussed a 4-D motion compensation MRI technique that allows for the in-utero assessment of cerebral function.

“This technique is able to depict the functional neural network involved in inward thinking,” Dr. Pettigrew said. “This is the so-called ‘default’ mode network believed to be disturbed in autism and related to emotional development.”

A technique like this could allow for the evaluation of a number of factors related to development, ranging from something as simple as a person’s diet to the impact of listening to music, Dr. Pettigrew said.

Other areas in which imaging innovations have had a significant effect on health outcomes include the use of CT to evaluate the risk for coronary artery disease, mixed-reality MRI-guided planning for breast-conserving surgery and the potential of MRI-

ultrasound (US) in treating prostate cancer via focal laser ablation.

Radiologic Innovations Critical to the Future

Radiologists are also demonstrated innovators. For example, Dr. Pettigrew referred to a program at Massachusetts General Hospital, Boston, called the Radiology Consultation Clinic, in which patients meet directly with radiologists to review images with the idea of getting them to take more responsibility for their own health and to follow their physicians’ advice.

“This is the kind of role and impact we can have,” Dr. Pettigrew said, adding that this type of innovation is directly tied to the role radiologists will play going forward — that of imaging and data science experts who are active members of the healthcare team.

This shift is demonstrated by some of the themes highlighted in recent *Radiology* articles, such as integrated diagnostics, radiomics, machine learning and artificial intelligence.

“The key message here is that modern imaging science is information and data science,” Dr. Pettigrew said. “Extracting the data from these images will improve the value proposition in imaging.”

And to do so, he added, tomorrow’s radiologists must follow a clear path.

“Radiologists must leverage the digital revolution, the state of hyperconnectivity we are in, big data science and artificial intelligence.”

We emphasize innovation because we realize that, like imagination, there is no end to innovation.

Roderic Pettigrew, PhD

Radiology Occupies a Central Place in Precision Medicine

CONTINUED FROM COVER



biomedicine. The interactions among DNA, RNA, cells and organisms create enormous diversity that makes the transition to personalized medicine challenging.

“We have to participate, not just peripherally, but in the core scientific challenges of today, which are summarized by the tension between the complexity of biological systems and the precision medicine needed in the individual patient population,” he said.

Resolving that tension will require cross-specialty collaboration, said Dr. Zerhouni, who pointed out that 11 imaging-related Nobel Prizes have come from physics and eight from chemistry.

“Imaging innovation is, by its very nature, interdisciplinary,” he said.

Lack of reliable biomarkers to localize and assess the functionality of therapeutic molecules and their targets in vivo bedevils progress, according to Dr. Zerhouni, but there are promising advances on the horizon. One example is transforming growth factor beta, a signaling protein that is thought to play a role in the growth of glioma, a type of brain cancer. Elevation of this

growth factor has been associated with a poor clinical outcome. Dr. Zerhouni shared results from a study in which researchers using PET were able to track the uptake of a cancer-fighting antibody that neutralizes the growth factor in the brain.

“You can see that the concentration is increasing in the glioma, telling us that this is a diagnostic test that validates the therapeutic target for us,” he said.

Imaging findings are one part of the equation, Dr. Zerhouni said, that must be correlated with other data to enable earlier

detection and characterization of disease and optimize therapies at the individual patient level. He cited the Alzheimer’s Disease Neuroimaging Initiative, the largest-ever NIH public-private

partnership on brain research, as an example of the future’s promise in using data to provide objective markers for disease.

“Is this going to have a huge impact?” he asked. “I think this is probably the most impactful type of research that we will do.”

Dr. Zerhouni closed his address before a packed house at Arie Crown Theater by urging experienced radiologists to mentor newcomers in order to tackle the lofty challenges ahead.

“My plea to you, my plea to RSNA, is to never forget that all of this will be done by people,” he said. “The next generation of radiologic scientists is, to me, the No. 1 priority, and we need to support and train them.”

We have to participate, not just peripherally, but in the core scientific challenges of today.

Elias A. Zerhouni, MD

Continued Reinvention of Radiology can Transform the Profession

CONTINUED FROM COVER

“It is the very exploration by multidisciplinary teams of physicists, engineers, radiologists and chemists that resulted in the innovations that went far beyond the original inventions,” Dr. Ehman said. “This ‘use-inspired’ mindset in radiology still encourages research that integrates basic and applied science from the onset to help explore the potential of an invention resulting in high impact on patient care.”

Dr. Ehman emphasized the rapid translation of medical imaging research and advances into clinical practice. “Radiologists are fierce early adopters of new technology when they believe it can improve the service they provide for patients,” Dr. Ehman said.

Dr. Ehman offered several ways that radiologists can tap the full potential of radiology to achieve the transformations that will lead into the next decades and beyond.

First, radiologists must continue to recognize and capitalize on the unique aspects of the science.

“Research in our field is typically use-inspired and rapidly translated for high impact on patient care,” Dr. Ehman said. “Our advances are often in the form of inventions and our innovation is fueled by technology.



Answer

[Question on page 14A.]

A 9.0 mGy
Q&A courtesy of AAPM.

These innovations — whether they are machine learning, highly-focused protocols or value-focused re-engineering — may allow our most powerful diagnostic tools to be used even more effectively for the benefit of patients.

Richard L. Ehman, MD

And radiology research often harnesses multidisciplinary team science and yields a high return-on-investment by economic standards.”

Second, radiologists must continue to relentlessly innovate, especially focusing on investing in research, which in radiology has been shown to have a very high rate of return. “Some have wondered if we are reaching a technological plateau in medical imaging,” he said. “Yet, if you look at the exploding content of our journals and the vibrant innovation displayed in the scientific sessions and the technical exhibition of this annual meeting, you will see that this is simply not the case.”

As a third area of focus, Dr. Ehman noted that radiologists must continue to strive for innovation around value in medical imaging. While the current perceived value of medical imaging merits excellent reimbursement within the traditional fee-for-

service practice, it is now time to be proactive in adopting innovations that enhance value even if they disrupt the fee-for-service model. “These innovations — whether they are machine learning, highly-focused protocols or value-focused re-engineering — may allow our most powerful diagnostic tools to be used even more effectively for the benefit of patients,” he said.

In conclusion, Dr. Ehman asked members to embrace disruption and continue to reinvent and transform the specialty to provide patients with access to radiology’s strongest capabilities. “Imagine a world in which our most advanced imaging technologies are widely available, modestly-priced and considered high-value, first-line diagnostic tools,” he said. “Knowing that disruption and reinvention of our practice is inevitable, we must guide the process ourselves instead of having it imposed on us by others outside our discipline.”

RSNA SEEKS EDITORS FOR NEW ONLINE JOURNALS

RSNA is seeking applications from candidates interested in serving as the editor of one of three new subspecialty journals RSNA will begin publishing in 2019. The journals will be published solely online and will cover cancer imaging, cardiothoracic imaging and machine learning (ML)/artificial intelligence (AI).

The editors will work closely with the RSNA Board of Directors and other RSNA journal editors to develop and execute the strategic vision for each new publication. The editors will also lead the editorial team, manage the peer review process, and actively solicit submissions of scientific manuscripts to the assigned journal, both from external sources and other RSNA journals. The editors will be expected to commit 20 percent of their time to the position beginning in Spring 2018. A complete description of responsibilities for each of the editor positions can be found at RSNA.org/Journals.

Mary C. Mahoney, MD, RSNA board liaison for publications and communications, will chair the search committee. Interested individuals are invited to send their curriculum vitae and a letter of interest/vision by close of business on Friday, December 29, 2017, to:

Mary Mahoney, MD
RSNA
820 Jorie Blvd, Oak Brook, IL 60523
Email to editorsearch@rsna.org

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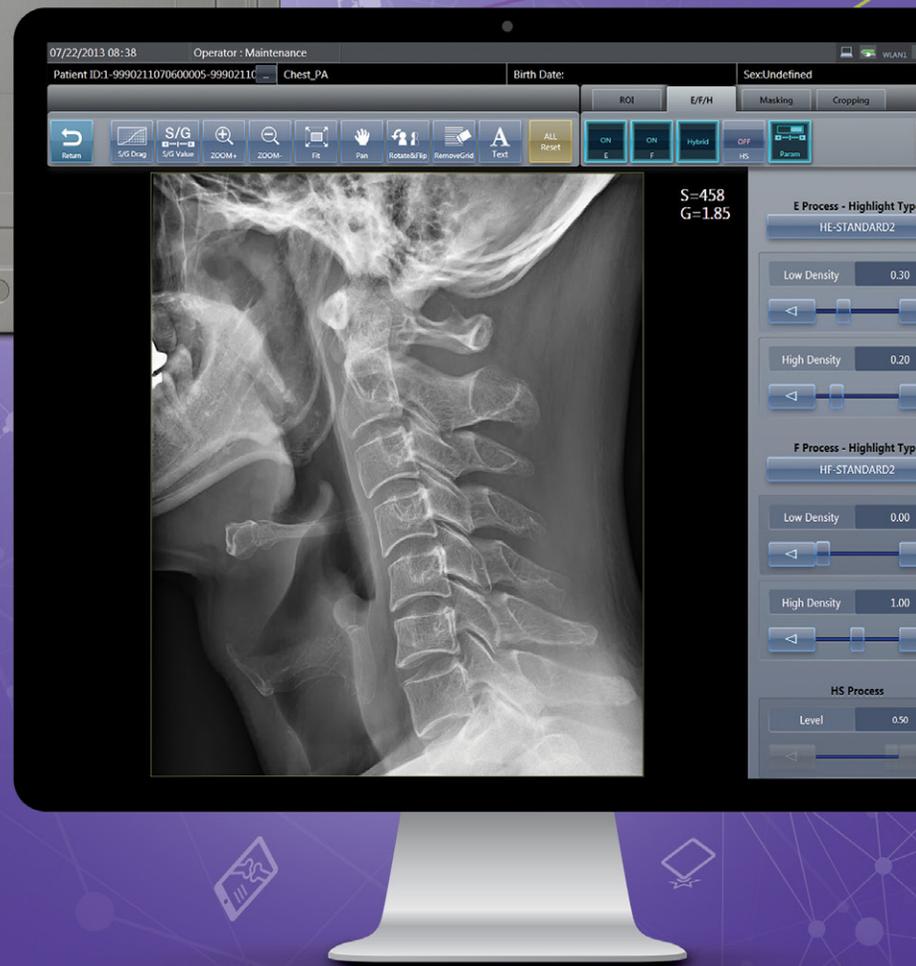
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