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- Brachytherapy Proves Effective in **Treating Skin Cancer**
- **>** Study Finds Key Brain Region Smaller in Birth Control Pill Users



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Online Adaptive Therapy Boosts the Power of Radiation Oncology By Richard Dargan

A radiation delivery method that detects ongoing changes in tumors and patient physiology is poised to bring even more precision to cancer treatment, according to a leading authority who delivered the Annual Oration in Radiation Oncology Wednesday.



Kachnic

The traditional approach to radiation therapy planning involves acquiring CT images at the time of the treatment simulation. While very accurate, this method doesn't account for changes that occur with the patient and tumor during or inbetween treatments.

'The treatment is static, but the patient and tumor are not," said Lisa A. Kachnic, MD, chair of Radiation Oncology at

Borgstede is RSNA President

James P. Borgstede, MD, is RSNA president for 2020. Dr. Borgstede is a professor of radiology at the University of Colorado in Denver. He is also vice chair of professional services, clinical operations, quality and safety for the Department of Radiology at the University of Colorado.

As president of the RSNA board,

Dr. Borgstede will support RSNA's commitment to promoting innovative educational opportunities and the advancement of radiologic technologies.

Dr. Borgstede earned his medical degree from the University of Illinois, Chicago, and completed his residency at the University of Colorado Health Sciences Center in Denver.

An RSNA member since 1976, Dr. Borgstede was a member of the Quality Committee. He joined the RSNA Board of Directors in 2013 and served as board chair in 2018. Prior to serving as board chair, Dr. Borgstede was the board liaison for the International Advisory Committee and the Committee on International Radiology Education and was chair of the Board Committee on International Affairs. Dr. Borgstede has been active with the RSNA R&E Foundation, serving on the Board of Trustees, the Corporate Giving Subcommittee, the Finance Committee and as chair of the R&E Foundation from 2012 to 2014.

Recognized in 2019 as an Honored Educator, Dr. Borgstede has delivered numerous scientific presentations and refresher courses. At RSNA 2007, Dr. Borgstede lectured during the Opening Plenary Session.

Adaptive radiation therapy is an imaging feedback strategy to improve our treatment plan in response to variations that we see during the therapy process relative to that initial CT simulation.

Lisa A. Kachnic, MD

Columbia University in New York City. "The tumor can shrink or grow, and the patient's physiology can change. If you choose to re-plan treatment, then you have to go through the whole process again, which can involve hours of work.'

Over the past decade, Online Adaptive Radiation Therapy (OART) has emerged as a promising option for treatment planning that accounts for motion and changes in the patient like weight loss, tumor response, shifts in the nearby organs, along with alterations in clinical goals such as dose increase.

"Adaptive radiation therapy is an imaging feedback strategy to improve our treat-

Haffty is RSNA Chair

Bruce G. Haffty, MD, is RSNA chair for 2020. Dr. Haffty is associate vice

cer Institute of New Jersey and Rutgers New Jersey Medical School.

As RSNA chair, Dr. Haffty will lead the board in its continued focus on bringing value to RSNA membership in North America and throughout the world through its offerings in research and education.

Dr. Haffty has volunteered with RSNA in a number of roles, including as third vice president and as co-chair of the Bolstering Oncoradiologic and Oncoradiotherapeutic Skills for Tomorrow (BOOST) Program. At RSNA 2009, he delivered the Annual Oration in Radiation Oncology. Dr. Haffty was named RSNA Outstanding Educator in 2013. Dr. Haffty has been on the RSNA Board of Directors since 2014, most recently serving as liaison for science. He also served on the RSNA News editorial board.

Dr. Haffty completed his medical school and residency training at Yale University School of Medicine and spent the next 18 years specializing in breast, head and neck cancers in Yale's Department of Therapeutic Radiology. He served on the faculty at Yale from 1988 through 2005. Dr. Haffty was promoted to professor of therapeutic radiology in 2000 and served as residency program director and vice chairman and clinical director.



chancellor, Cancer Programs, at Rutgers Biomedical and Health Sciences. He also serves as professor and chairman in the Department of Radiation Oncology at Rutgers Robert Wood Haffty Johnson Medical School, Rutgers Can-

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ment plan in response to variations that

we see during the therapy process relative

to that initial CT simulation," Dr. Kachnic

said. "The overarching goal is to improve

During her lecture, "Online Adaptive

Radiation Therapy (OART): The True Inter-

section of Diagnostic Radiology and Radia-

tion Oncology," Dr. Kachnic demonstrated

how adaptive therapy is already here in the

form of on-board cone or fan beam CT and

MRI acquisition systems paired with lin-

acs - medical linear accelerators used for

external radiation treatments - that guide and verify pre-treatment patient positioning.

Today's adaptive methods include a

fixed interval approach in which a second

CT simulation is performed a few weeks

after the first and a triggered method that

weekly cone-beam CT.

mulation.

encompasses an initial CT simulation and a

CT simulation and follow-up MRI for new

dose calculations and get a truer dose accu-

MRI-guided treatments rely on an initial

tumor control and decrease toxicity.

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Thursday At a Glance

 7:15-8:15 a.m.

 RSNA Diagnosis LiveTM Case-based

 Competition

 Keeping Radiology Weird: Spot Diagnoses

 from the Pacific Northwest (E451B)

 Controversy Session

 AI: Is it Ready for Your Practice (E351)

Hot Topic Session Practical Pearls in Acute Ischemic Stroke Imaging (E353A)

8:30 - 10 a.m. Educational Courses

Educational Courses
8:30 a.m Noon
Series Courses
10:30 a.m Noon
Scientific Paper Sessions
10:30 a.m 1:50 p.m.
AI Theater Presentations (AI Showcase, North Building, Level 2)
12:15 - 12:45 p.m.
Scientific Poster Discussions
(Learning Center)



<u>1 - 3 p.m.</u>

Interventional Oncology Series *Musculoskeletal Intervention* (S405AB) 2:30 - 4 p.m.

Educational Courses

<u>3-4 p.m.</u>

(S401CD)

Hot Topic Sessions Management of the Axilla-Biopsy and Staging

(E353C) 4D Flow Imaging in Congenital and Acquired Cardiovascular Disease-Clinical Impact Imaging of the Placenta-Where Do We Stand in 2019? (S404AB) Imaging of Traumatic Brain Injury-Present and Future (E451A) Integrating Immunotherapy with Radiation Therapy (S402AB)

4:30 - 6 p.m. Educational Courses

View the full program and add sessions to My Agenda on the RSNA 2019 App or at *Meeting.RSNA.org.*

DailyBulletin

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Friday Edition of *Daily Bulletin* Available Online

The digital *Daily Bulletin* is available on the RSNA 2019 mobile app and online at *RSNA.org/Bulletin*. Access additional meeting coverage in the Friday online edition. Get alerts on *Daily Bulletin* stories through social media at #RSNA19 on Facebook (*facebook.com/RSNAfans*), Instagram (RSNAgram) or Twitter (@RSNA).





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Readmission, Retreatment Rates for Unruptured Cerebral Aneurysm Vary Based on Treatment

By Melissa Silverberg

The two primary ways to treat unruptured cerebral aneurysm (UA) – coiling or clipping – have different risk levels for retreatment and readmission, according to a new analysis presented on Wednesday.

Pedram Golnari, MD, of the Feinberg School of Medicine at Northwestern University presented, "Readmission and Retreatment after Elective Treatment of Unruptured Cerebral Aneurysm: A Nationwide Readmission Database Analysis."

The study's co-author Pouya Nazari, MD, also of Northwestern University, was honored with the RSNA's 2019 Kou York Chynn Neuroradiology Research Award.

Dr. Golnari said about 30,000 people in the United States suffer from subarachnoid hemorrhage each year due to a ruptured cerebral aneurysm, a condition which can be fatal in 50% of cases. An unknown number of people have an unruptured aneurysm, but finding and treating those patients can save lives.

Clipping is much more aggressive, so it can result in higher readmissions, but it is also a more permanent way of resolving the aneurysm, so it can result in lower retreatment rates than coiling.

Pedram Golnari, MD

"Detecting unruptured aneurysms can be critical," Dr. Golnari said.

Once a UA is identified, physicians and patients can decide between microvascular clipping, an invasive surgical procedure that requires a craniotomy, or platinum coil embolization, which is less invasive and involves placement of coils via a catheter threaded through the body to the brain. The coils are used to fill the aneurysm and close off vascular flow, and therefore decrease the risk of rupture.

'There have been studies Golnar and controversies over which one is a better modality for treatment, but we didn't have a clear understanding of how each method relates to readmis-

Study Comprises 2,000 Hospitals

Dr. Golnari and his team used data from the Nationwide Readmission Database which contains information from 2,000 hospitals across 27 states — to find a cohort of 61,894 patients who underwent elective coiling or surgical clipping of UAs between

sion and retreatment rates," Dr. Golnari said.



2010 and 2015 and were treated and discharged. Among all of the patients, 5.98% were readmitted within 30 days, and 8.99% were readmitted to the hospital within 90 days.

Patients who underwent coiling had a lower readmission rate than those who underwent clipping (4.87% vs. 8.68%) at 30 days, as well as 90 days (7.82% vs. 11.87%). The most common diagnosis for readmission was isch-

emic or hemorrhagic stroke. Patients whose UAs were clipped had higher rates of infection and seizure as causes for readmission compared to those whose aneurysms were treated with the less-invasive coil method.

Overall, retreatment rates are much lower than readmission rates, according to the data, with 0.14% being retreated after 30 days and 0.33% after 90 days. However, patients who underwent coiling had a higher incidence of needing retreatment compared

to those who had their UA clipped at both 30 days (0.18% vs. 0.04%) and 90 days (0.37% vs. 0.22%).

"Clipping is much more aggressive, so it can result in higher readmissions, but it is also a more permanent way of resolving the aneurysm, so it can result in lower retreatment rates than coiling," Dr. Golnari said.

The takeaway, that patients undergoing clipping of UA have higher readmission rates, but lower retreatment rates, can be used by patients and their physicians in deciding on a treatment method, Dr. Golnari said.

He said he hopes others can use this research to study the causes of readmission and work to identify and reduce risk factors for those patients.

Over the five years analyzed for the study, Dr. Golnari saw a decline in readmission rates for UA patients but not to a statistically significant degree. He said that was surprising because during this time period the Affordable Care Act was passed, which included a Hospital Readmissions Reduction Program and penalties for hospitals with high readmission rates.

We still need to make more efforts to reduce readmission rates," Dr. Golnari said. "There's more that needs to be done."

Readability of Lung Cancer Screening Websites Can Affect Patient Participation

By Jennifer Allyn

Physicians discuss lung cancer screening (LCS) with patients as part of the shared decision making for the screening. Following the conversation, patients are likely to head to the internet for more information. The problem is that there is a wide variety of information about LCS on an equally wide variety of websites.

Patients and providers have cited insufficient knowledge of LCS as a significant barrier to participation. A study presented Wednesday, assessed the content, multimedia structure and readability of LCS

program websites of U.S. health care institutions

"It is estimated that only 1.9% of the up to 7.6 million people eligible for lung cancer screening have been screened," said Brent Little, MD, Massachusetts General Hospital, Boston. "Knowing that the internet is a highly accessed source of information for patients, it's important to make sure the online information is correct and helpful."

Researchers reviewed the top 269 search results for websites of LCS programs in the U.S. as identified from a Google search

METHODS AND MATERIALS

using the terms "lung cancer screening," "low-dose CT screening" and "lung screening."

Using a common checklist, the identified websites were analyzed by a team of thoracic radiologists. The radiologists noted the text, images, videos and PDF attachments of each website.

The average grade level readability scores of the text were calculated using common web-based readability tools. Researchers found a median reading level of 10th grade on most LCS websites. Current recommendations by the American Medical Association (AMA) suggest a reading grade level of 6th grade or lower for medical information on the internet. Only four websites (1.6%) met this requirement.

Of the identified websites, 64% conined at least one image and only 23% had at least one video. Patients looking for testimonials from previously screened patients would only find those on 15% of websites.

"A wall of text, especially about medical topics, can be intimidating and difficult for patients to digest. In order to hold a reader's attention – especially in cases of complex medical content - images and videos must be included and used effectively," Dr. Little said. "Multimedia content can help a visitor understand and retain complex information and testimonials are especially powerful in influencing health decision making behavKnowing that the internet is a highly accessed source of information for patients, it's important to make sure the online information is correct and helpful.

Brent Little, MD

ior, including cancer screening."

Only 5% of websites had content in multiple languages, while only 25% of websites had at least one link to a national LCS informational website, such as NIH (9%) or shouldiscreen.com (6%).

Researchers hope that this review of websites will prompt and guide quality improvement efforts in website tice settings.

"Websites should be formulated with language that is easy to understand, should contain consistent and accurate information about the basics of screening and should incorporate multimedia content designed to encourage comprehension of lung cancer screening and screening programs," Dr. Little said. "Lung cancer screening websites should be viewed as powerful opportunities for patient recruitment, engagement and education."





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We need to embrace and

enact these kinds of diversity

and inclusion efforts at our

local institutions where we

Pipeline Programs, Mentorship, Key to Diversity in Radiology Workforce

By Richard Dargan

Pipeline programs that promote diversity are key to boosting the number of underrepresented minorities in radiology, according to an expert who spoke Wednesday.

Radiology has experienced a paucity of underrepresented minorities for years. Recent reports show single-digit percentages of underrepresented minorities across all radiology career levels and subspecialties. In 2012, underrepresented minorities made

up only about 8% of diagnostic radiology residents, ranking radiology 18th in diversity among physician specialties, said session presenter Paul Rochon, MD, associate professor at the University of Colorado School of Medicine in Boulder.

Dr. Rochon is a

member of the Society of Interventional Radiology (SIR), where he is among the 1% of members who reported being a member of a minority.

"There is a lot we need to do and that's where pipeline programs come into play," Dr. Rochon said.

Pipeline programs provide educational and career support to students from underrepresented minorities interested in applying to or entering the health care field. As an example, Dr. Rochon cited the pipeline pro-

gram Nth Dimensions, a 2004 initiative targeting underrepresented minorities in orthopedic surgery. The program implemented a targeted pipeline curriculum that included a summer internship.

A 2016 study found that completion of the internship was associated with increased odds of applying to an orthopedic surgery residency.

"We need to embrace and enact these kinds of diversity and

inclusion efforts at our local institutions where we can share the passion that we have in our profession," Dr. Rochon said. Outreach efforts

can share the passion that should target both we have in our profession. medical students Paul Rochon, MD and undergraduates.

Radiology department representatives can help by making medical school students feel welcome throughout the interview process. At the undergraduate level, Dr. Rochon recommended stronger recruitment efforts at schools with a high percentage of underrepresented minorities, like traditional black colleges and Puerto Rican schools.

"When I was in a pre-professional program at my undergraduate institution, all we really knew were the primary care specialties because they were the physicians who

were able to go out to our school," he said. "So I challenge those of us who work in radiology to make an effort to go back to your undergraduate institutions."

Progress Starts at the Ground Level Mentorship and sponsorship go hand-in-hand by

helping guide underrepresented students and positioning them to succeed.

"It's important we're doing things from a national, organizational standpoint, but it really starts at the ground level," Dr. Rochon said.

The combined effort of RSNA, SIR and the American College of Radiology is also critical to improving minority representation in radiology. Dr. Rochon pointed to campaigns like Radiology Cares®, the Face of Radiology and SIR's Vision to Heal® as successful outreach initiatives.

Increasing minority faculty representation is another foundational component of promoting diversity, Dr. Rochon said. While minority professorship numbers have grown



in recent years, lower rates of academic promotion bedevil radiology. Research shows that only 18% of black assistant professors advanced to associate professors compared to 30% of their white colleagues.

Minority recruitment would also benefit from efforts to dispel stereotypes about the radiologist being isolated from patient interaction, Dr. Rochon said.

"We know that it is not true, but that is what our medical students and people in other specialties believe," he said. "In fact there are a lot of opportunities for us to have direct patient care. We need to get out there in the community and let people know what we do."

Time is Now for Paid Family Leave in Radiology By Mary Henderson

Elizabeth Kagan Arleo, MD, kicked off a panel discussion held in conjunction with the American Association for Women Radiologists (AAWR) Wednesday morning by boldly stating that now is the time for 12 weeks of paid family/parental leave in private radiology practice.

"Providing paid family/parental leave is not only the right thing to do, it will help promote well-being, prevent burnout and contribute to patient safety," said Dr. Arleo, associate professor of radiology at Weill Cornell Medicine, NY, and AAWR president

partner physician at Coastal Radiology, Nina

Kottler, MD, VP of Clinical Operations at Radiology Partners, and Kamran Ali, MD,

"The U.S. is the only country in the

world that doesn't guarantee paid maternity

leave," said Sartor. With no federal paid leave policy expected in the near future, she

said, "it's up to individual workplaces to

Sartor said there's a strong business

case to be made for offering paid family/

parental leave. Not only is it the number

Wichita Radiological Group.

lead the way on this issue."

Joining Dr. Arleo on stage to discuss the challenges, strategies and business case for private radiology practices offering the benefit were panelists Annie Sartor, campaigns director at Paid Leave for the United States (PL+US), Catherine Everett, MD, MBA, managing

Providing paid family/ parental leave is not only the right thing to do, it will help promote well-being, prevent burnout and contribute to patient safety.

Elizabeth Kagan Arleo, MD the benefit, and none include paternal leave. Wichita Radiology Group 1s the tirst and only private practice in the U.S. known to offer 12 weeks of paid family/parental leave.

> "Twenty percent of our group is female and I also had my own personal experiences," said Dr. Ali, head of the group and clinical associate professor at KU School of Medicine. "When my children were born, there was a stigma around leaving early to be with my wife and child and pressure not to look weak or to rock the boat."

After doing some research, he determined that a paid 12-week family/parental leave aligned with the practice's mission.



(left to right) Kamran Ali, MD, Nina Kottler, MD, Catherine Everett, MD, Annie Sartor, and Elizabeth Kagan Arleo, MD, discuss paid family leave.

"I was pleasantly surprised at how supportive the shareholders were in discussing the merits of such a policy," he said. "When you are willing to have the conversation,

In the robust discussion that followed, audience members emphasized the importance of including all genders and genera-

Thursdav's **Physics Quiz** tions in paid leave policies and for incorporating self-care and elder care into use of the benefit.

The AAWR compiled a list of resources to assist in implementing paid family/parental leave, which are available by emailing snige(a)acr.org



[Answer on page 10A.]

things can happen."

one benefit employees desire, according

to Sartor, it positively impacts recruitment efforts, employee retention, productivity and morale. Nonetheless barriers exist. "Coming from a small practice, extended leave can be an extreme hardship," said Dr. Everett. Other factors that affect a radiology practice's ability to offer the benefit include

the non-flexible workload and the need for subspecialty coverage. "With women representing just 25% of all radiologists, there are also cultural issues at play," she said.

Dr. Kottler surveyed

Radiology Partners, one of the largest physician-led and physician-owned radiology practices in the country on the topic of paid family/parental leave. Of the 20 responding groups, just 30% offer

Appendicitis Diagnosis Yields Reduced Dose But Increased Examinations

By Lynn Antonopoulos

Over the past 15 years, a shift in imaging practices from CT to US in pediatric appendicitis cases reflects an emphasis on radiation exposure reduction and has translated to a value improvement over time in the outcomes/cost equation.

Results of a retrospective analysis of data from the Pediatric Health Information System (PHIS) show that initially, the change in modalities did not deliver benefits of cost reduction or efficiency, noted Shireen Hayatghaibi, MA, MPH, of Texas Children's Hospital in Houston during a Wednesday session.

Hayatghaibi and colleagues examined data from 76,710 pediatric patients undergoing more than 105,000 imaging procedures performed between 2004 and 2018 at 30 different hospitals across the U.S.

"We wanted to identify the dominant imaging strategies for diagnosing appendicitis nationally and how they have changed over time, especially with the Image Gently[®] campaign in place," she said.

The team looked at patient demographics, imaging related to diagnosis of appendicitis including CT, US, MRI and radiography, and the charges associated with imaging.

Ultrasound Use Gains Popularity in Diagnosis Hayatghaibi said that from 2004 to 2008, the number of imaging exams performed on the patient increased, as did the cost.

adiological Society

of North America

However, since 2008, those costs have

Despite the shift in imaging strategies, the team did not see a spike in negative appendectomy rates, and diagnostic accuracy rates for appendicitis were excellent.

Shireen Hayatghaibi, MA

decreased. In the study, US was the dominant diagnostic imaging strategy after 2011. From 2004 to 2018, she said CT utilization decreased from approximately 42% to 19% and US use increased from almost 26% to 62.5%.

Use of radiography was cut by half dropping from 32% to just over 16%. MRI utilization increased but remained low at only 2.2%.

Of the imaging modalities most commonly used in appendicitis diagnosis, US was demonstrated as least costly in the study's charge data. Despite the lower price tag for US imaging, Hayatghaibi said an increased mean number of imaging exams



Hayatghaibi

per patient very likely contributed to initial cost increases.

The mean number of imaging exams per patient by modality was 1.02 for patients with CT, 1.29 for those with US, and 2.09 for patients with MRI as part of their encounter.

"Although we were unable to gather clinical data with the PHIS database, we assume that US use resulted in more equivocal exams or that more corroboration of US findings was needed thereby increasing the median number of imaging exams," Hayatghaibi said.

She added that despite the shift in imaging strategies, the team did not see a spike in negative appendectomy rates and diagnostic accuracy rates for appendicitis were excellent.

She suggested technician training might have an impact on the number of exams needed to confirm diagnosis. "There is an equity factor that we have not addressed — not all institutions have experienced and trained sonographers who can perform a high-quality, diagnostic ultrasound of the appendix."

Hayatghaibi said she and her team are studying the impact of the US technologist and radiologist on other factors such as appendix visualization, use of CT and key clinical outcomes including hospital admission, need for surgery and surgical complications.

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XSNA 2019

SEE POSSIBILITIES

RSNA 2019 attendees gathered this week with their colleagues from around the world to learn together, build relationships and celebrate the diversity of voices in radiology. Attendees from all career levels enjoyed a wide variety of educational and unique activities designed to show their commitment and enthusiasm for the specialty.







Attendees had the opportunity to select recognition ribbons for their RSNA volunteer work, enjoyed group photos in front of the RSNA meeting marquee and provide suggestions for the onsite artist to create a unique representation of radiology.



2020 RSNA Board of Directors (from left): Bruce G. Haffty, MD, Chairman, New Brunswick, NJ; Umar Mahmood, MD, PhD, Liaison for International Affairs, Boston, MA; Mary C. Mahoney, MD, President-Elect, Cincinnati; James P. Borgstede, MD, President, Colorado Springs; Carolyn C. Meltzer, MD, Liaison for Science, Atlanta, GA; Jeffrey S. Klein, MD, Liaison for Publications and Communications, Burlington, VT; Matthew A. Mauro, MD, Liaison for Education, Chapel Hill, NC; and Curtis P. Langlotz, MD, PhD, Liaison for Information Technology and Annual Meeting, Stanford, CA.

Ablation Therapy Effective Treatment for Knee Pain

By Mike Bassett

The knee is one of the joints most commonly affected by osteoarthritis, and the pain associated with it is considerable and it can become disabling.

But, according to a study presented Wednesday, image-guided radiofrequency ablation (RFA), when applied to the knee, can significantly reduce knee pain and symptoms associated with osteoarthritis.

In fact, according to Felix Gonzalez, MD, who presented the study, more than 87% of the patients who participated in the study reported "significant pain relief" of at least 50%,

with most patients having more than 75% pain reduction.

"Once you've treated that pain, patients become more mobile, the swelling decreases, and they are able to engage in more physical activity," said Dr. Gonzalez, assistant professor of radiology and imaging sciences, Emory University School of Medicine in Atlanta.



Gonzalez

Cool RFA Provides Solution for Complex Anatomy

While conventional radiofrequency ablation has been used for decades to treat pain in areas like the lower back, it has been less successful as a treatment for the knee, because of the complex position of the nerves and other structures in that joint.

However, the "cooled" version (in which water circulates through the probe connected to the radiofrequency generator) has

made RFA more feasible for knee arthritis. According to Dr. Gonzalez, conventional RFA covers a very narrow treatment area, while the cooled version can cover an area five times larger.

Why is that important for the knee? "Sensory nerves exist in a specific loca-

tion along the knee," he said. "So the reason we need a larger treatment zone is that those nerves don't travel through the same space in everyone. A nerve may travel a little more securely and higher in one patient, and in someone else it may travel a little lower. By having a bigger treatment zone you can account for the variability that exists between each person with regard to the nerve anatomy."

"For traditional ablation therapy, you need to know exactly where the nerve is in the structure you are treating, and the probe has to be just adjacent to it," Dr. Gonzalez added. "But there is variability in the patients we are treating, so having a larger treatment zone allows the RFA therapy to be more effective in treating the pain."

Dr. Gonzalez noted that while traditionally genicular nerve ablation targets three nerves (inferomedial, superolateral and superomedial), in this study he and his colleagues targeted four nerves, with the addition of the suprapatellar nerve.

The procedure is actually a two-step process, Dr. Gonzalez said, with study patients undergoing anesthetic blocks at each of the

Image Sharing Town Hall

four anatomic sites. If the patients experienced short-term pain relief in those nerve branches, RFA was performed one to two weeks after the nerve block.

A total of 50 patients (77 knees among them) were treated. These were adult patients older than 45 years, with pain from moderate to severe osteoarthritis refractory to anti-inflammatory analgesia, and who had failed to respond to multiple intraarticular lidocaine-steroid injections.

Of those 77 cases, 82% showed improvement at a follow-up of two weeks, 82% at one month, 79% at three months, and 81% at six months.

Dr. Gonzalez and his colleagues also found that overall symptoms, stiffness, pain, and functional daily living — as evaluated using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Knee Injury and Osteoarthritis Outcome Score (KOOS) — significantly improved.

"Cooled RFA of the genicular nerve proves a safe way to treat knee arthritis pain," Dr. Gonzalez concluded.

Joe Named to R&E Foundation Board of Trustees

The RSNA R&E Foundation named Bonnie N. Joe, MD, PhD, to the Foundation's Board of Trustees beginning in 2020.

Dr. Joe is a professor in residence and chief of breast imaging in the Department of Radiology and Biomedical Imaging at the University of California, San Francisco (UCSF). She earned a PhD in electrical and computer engineering/biomedical engineering from Carnegie Mellon University and completed her medical degree at the University of Pittsburgh.

A member of the UCSF Executive Research Coun-

cil, Dr. Joe leads efforts to advance imaging-based approaches to breast cancer diagnosis, earlier detection, and reduction of disease recurrence and improved survival. Her expertise includes all aspects of breast imaging, including breast MRI. She has served as principal investigator and co-investigator for several grant projects and published over 100 articles related to her research.

Dr. Joe received the Siemens Medical Solutions/RSNA Research Fellow

Thursday's **Answer**

[Question on page 6A.]

False, CTDIvol is, roughly, a measure of absorbed dose to a fixedsized, cylindrical phantom. Effective dose in CT is generally estimated from dose length product and a conversion factors or Monte Carlo simulation.



Grant in 2002 and the Bayer HealthCare Pharmaceuticals/RSNA Research Scholar Grant in 2005, and she currently serves as chair of the Foundation's Radiology Research Trainee Grant Study Section.

The Board of Trustees direct the work of the R&E Foundation, which provides a critical source of support for investigators seeking to improve patient care through radiologic research and education. Since it

began in 1984, the Foundation has awarded over \$60 million to fund more than 1,450 grant projects.

The Foundation is led by Thomas M. Grist, MD, chair, and Vijay M. Rao, MD, vice chair. Trustees include Ronald L. Arenson, MD, Stamatia V. Destounis, MD, Michael J. Harsh, Brian S. Kuszyk, MD, Umar Mahmood, MD, PhD, Carolyn C. Meltzer, MD, Reginald F. Munden, MD, DMD, Satoshi Minoshima, MD, PhD, and Mitchell D. Schnall, MD, PhD.



Rucker

IA TJirelJ

In a Town Hall hosted by RSNA, The Sequoia Project and Carequality on Monday, David S. Mendelson, MD, The Mount Sinai Health System; Donald Rucker, MD, U.S. National Coordinator of Health Information Technology; Curtis Langlotz, MD, PhD, RSNA Board member; Geraldine B. McGinty, MD, ACR board of chancellors chair and others presented on the importance of providing convenient and secure access to medical images for patients and care providers. They discussed plans to leverage the existing Carequality Interoperability Framework, which is used at tens of thousands of care sites across the U.S. to exchange over 80 million patient documents each month. Imaging vendors LifeImage, Ambra Health and Philips have committeed to the project.

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Planning is Key to Handling Mass Casualty Incidents

By Mike Bassett

Whether they are natural or man-made, disasters happen, and radiology departments must be able to provide key services under particular scenarios.

Therefore, according to Ronald M. Bilow, MD, an emergency radiology director at UTHealth McGovern Medical School in Houston, TX, radiology departments should consider developing a viable disaster preparedness and response plan they can implement for mass casualty incidents (MCIs).

In a presentation Wednesday, Dr. Bilow noted that some radiology departments, particularly those in level 1 trauma centers, operate under the assumption that they can handle patient surges from MCIs by performing their work normally, but faster.

"Using standard operating procedures is just not a good idea," Dr. Bilow said, adding that radiology departments should take a proactive approach to preparing for MCIs.

The definition of a MCI – an incident

that overloads the response system – is a warning to radiology departments of what they could face in certain situations.

For example, Dr. Bilow pointed to the horrific 2016 Bastille Day truck attack in Nice, France, which resulted in 86 deaths and injured another 458 people. Many of the patients who were taken to a local hospital underwent CT exams, resulting in datasets that grew so large and so quickly that the PACS network ground to a halt.

While no one can plan for every possible scenario, Dr. Bilow recommended running a hazard vulnerability analysis in order to evaluate the likelihood and impact of potential threats and identify risks in the hospital's vicinity. For example, a hospital in San Francisco should focus on the risk of an earthquake and, depending on its magnitude, the potential for infrastructure

This is not business as usual.

Radiology departments have

to anticipate scenarios, plan

capabilities and limitations.

Ronald M. Bilow, MD

ahead, and know their

damage and casualties.

Proactively planning for a MCI, Bilow explained, involves asking and answering a number of questions regarding how a radiology department's workflow will be managed during a MCI.

For example: How should staff be mobilized when a mass casualty event occurs? How should equipment be utilized? How will reports be structured and delivered? Can CT protocols be changed to save time?

It is also important that radiology departments coordinate planning with the entire hospital. Dr. Bilow's department realized it had a potential problem when it was discovered that a hospital plan for a MCI called for patients triaged as "walking wounded" to undergo imaging via a portable X-ray unit rather than be sent to the emergency room.

"But when I talked to our PACS analyst I found out that images can't be sent from that portable unit to the PACS," Dr. Bilow said. "And that basically meant you would need a radiologist on site, which was something the hospital didn't plan for."

Radiology departments also need to consider how they will handle the post-disaster or recovery period, Dr. Bilow pointed out. "You need to have some kind of a plan in place to return to normal operations — you



Finally, he stressed that there needs to be a mechanism in place to analyze a department's performance in the aftermath of a mass casualty event — what worked and what didn't? This review should include everyone involved, and then staff should conduct drills to practice the plan.

"This is not business as usual," Dr. Bilow emphasized. "Radiology departments have to anticipate scenarios, plan ahead, and know their capabilities and limitations."



Thursday's **Physics Tip**

Active implants and even cell phones can cause artifacts similar to grid line artifacts when using wireless digital radiography image receptors.



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Augmented Reality/AI Promising for Percutaneous Image-Guided Interventions

Minimally invasive spinal surgery (MISS), which aims to minimize tissue trauma and reduce post-operative recovery time, is a cost-effective method for improving patient outcomes. A key component to MISS is ensuring that a device is accurately placed.

Traditionally, such percutaneous imageguided interventions have been done via 2D fluoroscopic imaging or more recently, using 3D imaging-guidance with conebeam CT (CBCT) and integrated navigational software. Because both methods offer limited effectiveness, researchers have been testing alternatives.

"The past two decades have seen substantial growth in percutaneous imageguided interventions," said Pierre Auloge, MD, a radiologist at the University Hospital of Strasbourg, France, during a Wednesday session. "In recent years, the development of new technologies like augmented reality (AR) and artificial intelligence (AI) are making it possible to imagine ever-more efficient guidance tools."

Increasing Safety, Reducing Radiation Dose

AR is a navigational technique that superimposes virtual 3D anatomic data onto real-world 2D visual images in real-time.

"Augmented reality makes it possible to enrich reality with virtual images," Dr. Auloge said. "This facilitates the practitioner's work by standardizing percutaneous approaches to the spine and thus increases patient safety and reduces radiation dose." New technologies are bringing imaging guidance into a new era, with AR and AI promising to make interventions safer, faster and better.

Pierre Auloge, MD

Integrating AI software into an AR-based guidance system further enables automatic landmark recognition, the generation of safe/accurate needle trajectories, and motion compensation using fiducial markers linked by a computer algorithm.

"Essentially, the system is a classical C-arm but with four cameras integrated in the flat panel, which film the operative scene," Dr. Auloge said.

After a volumetric acquisition, the system automatically performs the segmentation of the vertebrae and colors the pedicle. The operator then clicks on the pedicle where he or she wants to insert the trocar, and the software automatically proposes a trajectory.

"The four cameras show the trajectory with different projections on the monitor – not a headset," Dr. Auloge said. "This means the operator can adjust the trajectory of their needle with the virtual trajectory and can advance the needle without radiation."



Augmented reality is a navigational technique that superimposes virtual 3D anatomic data onto real-world 2D visual images in real-time. — *Image courtesy of Pierre Auloge*

A New Era in Imaging Guidance Dr. Auloge shared the results of a recent study that tested an ARand AI-based guidance system for vertebroplasty. The retrospective study of 100 patients compared the classic fluoroscopic approach with the new AR/AI guidance system. "The goal was to evaluate the system for safety, accuracy, reproducibility and dose reduction," Dr. Auloge

Dr. Auloge said. According to Dr. Auloge, the results are very promising. The AR and AI percutaneous vertebroplasties showed high precision, excellent safety and a reduction in the radiation dose for both the patient and the operator. Furthermore, after a short learning curve, the AR/AI procedure time is close to that of fluoroscopic-guided interventions.

"New technologies are bringing imaging guidance into a new era, with AR and AI promising to make interventions safer, faster and better," Dr. Auloge said.

"But getting the most out of these technological advances requires the full involvement of radiologists."

Amplify Voices to Support Diversity

In the Discovery Theater on Wednesday, Dania Daye, MD, PhD, led a panel of radiology leaders in a discussion highlighting the value of diversity and inclusion in radiology. In opening remarks,

RSNA Board Chair Mary C. Mahoney, MD, recognized the progress RSNA has made in elevating wom-

en in particular to leadership roles.

"I am truly honored to be a leader in an organization that does so much to support women and diversity and inclusion," said Dr. Mahoney, noting that RSNA first elevated a woman to the role of president in 1995 with six to follow, and that 33% of RSNA committee chairs and faculty are women.

Referencing the call to embrace diversity, Geraldine McGinty, MD, ACR Board chair, said, "It starts with expanding our idea of what a leader looks like." She emphasized the critical importance of empowering diverse voices in the field.

Speaking about the pipeline, Paul J. Rochon, MD, said, "We need to dispel the myth that radiologists are isolated from patient interactions—the invisibility factor." He highlighted statistics demonstrating largely single digit percentage representation of underrepresented minorities across all career levels and subspecialties in radiology. (See Page 6A for more from Dr. Rochon.)

Finally, ongoing retention and promotion processes free from unconscious bias are required to ensure talented professionals with diverse perspectives make it through that pipeline into leadership.

RSNA Board member Carolyn C. Meltzer, MD, described being stunned by gender aggression as an assistant professor when she noticed faculty leaders would



Pictured left to right: Dr. Daye, Dr. Mahoney, Dr. McGinty, Dr. Rochon, and Dr. Meltzer

introduce male colleagues formally as "Dr. Smith," then in the same moment introduce women by their first names. She noted that research shows this happens often, and that it imposes a devaluing of those individuals.

"We have to think about every part of how people advance and look at bias at each step in the meritocracy," Dr. Meltzer said. She discussed documents where bias appears, including letters of recommendations—which use different language to describe men and women—and grant proposal reviews, where women are more likely to be characterized as part of a team while men tend to be called pioneers. This is important, she stressed, because those different words translate to a difference in funding levels.

"We need allies," she said, acknowledging the diversity of the people in the room, "We need everybody embracing this if we are going to be successful."

Dr. Daye asked the panel for tips to address the noted microaggressions. Dr. Meltzer suggested addressing the situation in the moment from an appreciation and inquiry standpoint, seeking to understand rather than being confrontational.

"I would add that amplification is key," Dr. Mahoney said. "We should speak up and bring attention back to a colleague's point when she has been passed over. We need to do that for each other."

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Coronary Artery Calcium Scoring from CT Aortographs Can Help Assess Risk for Heart Attack

By Melissa Silverberg

A test used to diagnose the rare condition of aortic dissection may tell radiologists something else important about the patients who undergo that scan.

Visual coronary artery calcium (CAC) scores from CT aortographs (CTAo) and what they can tell doctors about a patient's long-term risk was the subject of a Wednesday presentation by Duan Chen, MD, MS, and Alison Schonberger, MD, both with the Department of Radiology at the Albert Einstein College of Medicine at Montefiore Medical Center in New York.

"We see a lot of patients in the emergency department with severe chest pain and a CT aortograph is one of the tests we do to rule out a very serious diagnosis of an aortic dissection, but only about 2% of those tested are actually experiencing that condition, so we wanted to see what else we could learn from this data that may help our patients," Dr. Chen said. "We were really surprised with the findings."

Researchers studied data on a cohort of patients who received emergency CTAo from 2007 to 2012, examining events including death, aortic dissection, myocardial infarction (MI), cerebrovascular accident and pulmonary embolism. Visual CAC scores were computed from the patient's original images utilizing a validated 12-point scale. We think this is a missed opportunity for radiologists to impact clinical management in acute chest pain patients.

Alison Schonberger, MD

calcium (13%).

Clinical Care

patients without coronary

Even patients with a

with no coronary calcium.

conduct similar studies.

twice as likely (25%) to die than a patient

Opportunity for Radiologists to Impact

Drs. Chen and Schonberger are continu-

ing to study the data which controls for

age and gender, but does not consider co-

morbity factors like smoking or a history

of diabetes, and hope other institutions will

"We think this is a missed opportunity

for radiologists to impact clinical manage-

ment in acute chest pain patients,"

CAC score considered

low on the scale was

Schonberger

Of the 1,662 patients in the study who had a CTAo, 36% had at least one subsequent documented clinical event, with the most common events being death and myocardial infarction.

"We found an unexpected higher rate of death and non-fatal events," Dr. Schonberger said. "Although these chest CTs were originally performed to rule out an aortic dissection, more people had an MI, stroke, or died, than were diagnosed with an aortic dissection."

The study also included a survival analysis that looked at the association between CAC scores and mortality among these patients and found a strong correlation. In that analysis, the researchers found eightyear mortality for patients with high calcium was much higher (57%), than for those



Dr. Schonberger said.

Right now, radiologists do not always assign a CAC score on these types of scans, but after conducting this analysis, the doctors said this addition could help communicate necessary next steps for certain patients.

"Patients with negative CT scans for aortic dissection are often discharged without plans for coronary risk assessment," Dr. Schonberger said. "But as we saw, many of these patients are at high risk for having an event and even dying. We believe there is potential for radiologists to aid in clinical management of these patients by reporting coronary calcium scores."

Study Justifies Starting Screening Mammography with Digital Breast Tomosynthesis at Age 40

By Nick Klenske

The issue of what age to start mammogram screening has generated a fair amount of controversy. Whereas the American College of Radiology, Society of Breast Imaging and the American Society of Breast Surgeons all recommend starting screening mammography at age 40, others recommend starting at age 45 or even 50.

At the center of this controversy is the discussion of benefits vs. harms. The lower incidence of breast cancer and the higher rate of false positive recalls for younger women has led some to suggest that screening younger age groups is not effective. However, the implementation of digital breast tomosynthesis (DBT) may provide data toward ending the debate.

"DBT is a newer technique that, compared to conventional digital mammogram, has been shown to reduce false positive recalls while also increasing cancer detection rates," said Maryam Etesami, MD, an assistant professor and service chief of breast MRI at Yale University School of Medicine. "Therefore, screening with DBT may be even more beneficial in younger women compared to data available from conventional mammogram, which is what the current age recommendations are heavily based on."

Comparing DBT Performance in Different Age Groups

During a Wednesday session, Dr. Etesami shared the results of a recent study on the

performance metrics of DBT mammogram screening in women aged 40 to 54.

The study retrospectively compared the performance metrics of DBT screening and characteristics of DBT screen-detected cancers in three age groups: 40–44, 45–49, and 50–54 years old. The DBT screenings, which were offered to all women at no additional cost, took place at four imaging centers (one academic center and three outpatient sites) from 2012 to 2018. The study comprised 52,360 DBT screening mammograms (14,757 in the 40–44 age group, 17,649 in the 45–49 age group and 19,954 in the 50–54 age group).

After analyzing the data, researchers found that the cancer detection rate with DBT screening in women aged 40–44 and 45–49 is not significantly less than in women aged 50–54. Furthermore, the majority of screen-detected cancers in women aged



Etesami

40–49 were invasive and moderate- to high-grade, but without axillary lymph node involvement at the time of diagnosis.

Researchers also found that the overall recall rate is higher in younger women. However, according to Dr. Etesami, this difference is likely due to a higher percentage of baseline mammograms and lack of comparison studies in younger women. "There is no significant difference in recall rate between the three age groups when comparing baseline and non-baseline exams

DBT screening in women aged 40 to 49 is both effective and has little risk for potential harm or false positive diagnoses.

also low in all three age groups (about 1.5%), without significant difference."

separately," she said. "Biopsy rates were

DBT is Effective, Shows Little Risk for Harm

According to Dr. Etesami, this study provides more evidence to justify starting screening mammography at age 40.

"DBT screening in women aged 40 to 49 is both effective and has little risk for potential harm or false positive diagnoses," she added. "Delaying screening may only shift the higher recall rate of baseline mammograms to older women, while losing the opportunity to detect aggressive cancers at an earlier stage."

CONTINUED FROM PAGE 1A

Online Adaptive Therapy Boosts the Power of Radiation Oncology

Dr. Kachnic presented results from prostate cancer treatment studies to show the potential value of these adaptive approaches. Radiation dose escalation has been shown to improve the grim survival outlook for prostate cancer patients, but the higher dose can damage surrounding organs.

Ongoing research using adaptive doses on prostate cancer patients shows the promise of the technology. Patients in the study saw a statistically significant improvement in two-year survival, with no Grade 3 or higher toxicity.

"This is where the beauty of these daily adaptive treatments lies," Dr. Kachnic said.

A Turning Point in Radiation Oncology

Dr. Kachnic underscored that while current systems represent an improvement over older approaches, they still have limitations.

"The MRI linacs currently in use are expensive and resourceintensive and can add up to an hour to a one- to two-minute treatment," Dr. Kachnic said. "Patients often need an entirely new CT-based planning session."

Future methods that deploy artificial intelligence will likely provide more advanced image guidance, allowing radiation oncologists to combine clinical patient and tumor data with imaging for adaptive decision-making. This synthesis of data would allow them to adjust radiation doses and/or distributions to the target and to the surrounding at-risk organs.

"Machine learning can account for the movement of tumors and normal tissue on a daily basis," Dr. Kachnic said. "Replanning treatment would take only about 15 minutes."

Additional developments will include the integration of functional information into radiation therapy. To that end, Dr. Kachnic said, a PET-linac machine is currently in development. Biologically-adapted radiation therapy also holds potential.

"I truly believe that we're at a turning point in radiation oncology," Dr. Kachnic said. "Our techniques have been refined to really allow accurate delivery, and now we're looking to the insight from molecular biology and genetics to further refine targeting."

CONTINUED FROM PAGE 1A

Borgstede is RSNA President

From 2004 to 2008, Dr. Borgstede was on the editorial board for the *Journal of the American College of Radiology*, where he currently serves as a reviewer. Since 2004, he has served on the editorial advisory board for *American Family Physician*.

Dr. Borgstede has held committee or leadership positions in a number of organizations, including the Colorado Radiological Society (CRS), El Paso County Medical Society, Rocky Mountain Radiological Society and the Society of Radiologists in Ultrasound. He was president of the International Society of Radiology and a past chairman and past president of the Board of Chancellors at the American College of Radiology (ACR). Since his presidency at ACR, he has continued on various ACR committees, including the Committee on International Service, with which he traveled multiple times to Grace Children's Hospital Port-au-Prince, where he worked as part of the Haiti Radiology Project.

The recipient of numerous honors and awards throughout his career, Dr. Borgstede has received the gold medal and the William T. Thorwarth Award for Excellence in Economics and Health Policy from ACR. He received service awards from CRS and was the first CRS gold medalist. He received the University of Colorado Hospital President's Award for Leadership, and in 2019 he was awarded a Presidential Citation for Meritorious Service. In 2015, Dr. Borgstede was included in the "Denver Best Doctors 2015-2016" list by the Denver Business Journal. He has been selected for inclusion in Best Doctors in America from 2001 to 2006, 2009 to 2012, and 2016 to 2018.

CONTINUED FROM PAGE 1A Haffty is RSNA Chair

Dr. Haffty has authored or coauthored 50 books, book chapters and theses, more than 400 peerreviewed articles and numerous editorials and letters. Dr. Haffty is a leader in national clinical trials and is currently co-investigator on several national clinical trials through the NRG Oncology and Alliance for Clinical Trials in Oncology cooperative groups.

At Rutgers Robert Wood Johnson Medical School, New Jersey Medical School and Cancer Institute of New Jersey — now part of Rutgers, Dr. Haffty spearheaded the expansion of the Radiation Oncology Program and developed residency programs in radiation oncology and medical physics — the only such programs in the state of New Jersey.

Through his extensive work with the American Society for Radiation Oncology, Dr. Haffty served as the founding president of the Association of Directors of Radiation Oncology Programs (ADROP) in 2000, providing tools and resources to advance the quality of residency training and education in radiation oncology.

Dr. Haffty's research on new methods of delivering radiation therapy for breast cancer has created unique factors associated with outcomes, paving the way for molecular targeted therapies in combination with radiation.

In addition to editing the comprehensive *Handbook of Radiation Oncology*, Dr. Haffty has served on numerous editorial boards. He currently serves on the editorial board of *The Breast Journal* and serves as deputy editor *of Journal of Clinical Oncology*.

Dr. Haffty is a past president of the American Radium Society, past chairman of the Residency Review Committee in Radiation Oncology, past president of the American Board of Radiology and past president of American Society for Radiation Oncology.



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