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Shoulder “Brightness” on Ultrasound May Be a Sign of Diabetes

AT A GLANCE

- **Brightness of the shoulder’s deltoid muscle on ultrasound may be an indicator of diabetes or pre-diabetes.**
- **Using shoulder ultrasound images, radiologists were able to accurately identify diabetic status in 89 percent of patients.**
- **Low levels of glycogen may underlie the bright appearance of the shoulder on ultrasound in patients with diabetes and pre-diabetes.**

CHICAGO – A shoulder muscle that appears unusually bright on ultrasound may be a warning sign of diabetes, according to a study being presented next week at the annual meeting of the Radiological Society of North America (RSNA).

Ultrasound is commonly used to diagnose sources of pain in the shoulder. More than 10 years ago, musculoskeletal radiologist Steven B. Soliman, D.O., from Henry Ford Hospital in Detroit, began noticing a pattern when images of the deltoid muscle, the largest muscle of the shoulder, appeared bright on ultrasound.

“Every time we would ask one of these patients if they were diabetic, they would say ‘yes’ or they would tell us they were borderline and not taking any medications,” Dr. Soliman said.

The observations prompted Dr. Soliman and colleagues at Henry Ford to conduct a study to see if the brightness, or echogenicity, of the shoulder muscle could be predictive of

diabetes. The results revealed that by using the echogenicity of the muscle, radiologists were able to predict type 2 diabetes, the most common type of diabetes, in almost nine out of 10 patients. Brightness on ultrasound also was an accurate predictor of pre-diabetes, a condition of abnormally high blood sugar that generally progresses to diabetes without changes in lifestyle.

The researchers said the findings could allow for earlier interventions.

“If we observe this in patients with pre-diabetes and diabetes, we can get them to exercise, make diet modifications and lose weight,” Dr. Soliman said. “If these interventions happen early enough, the patients may be able to avoid going on medications and dealing with all the complications that go with the disease.”

For the study, Dr. Soliman and colleagues compiled 137 shoulder ultrasounds from patients with type 2 diabetes, including 13 with pre-diabetes. The researchers also obtained 49 ultrasounds from obese patients without diabetes.

The researchers showed the ultrasounds to two musculoskeletal radiologists who were unaware whether the images came from patients with or without diabetes. The radiologists were asked to classify the patients, based on the brightness of their shoulder muscle, into one of three categories: normal, suspected diabetes and definite

diabetes. A third musculoskeletal radiologist acted as an arbitrator in the cases where the other two radiologists disagreed.

The results showed that a consensus diagnosis of “definite diabetes” by the radiologists was a powerful predictor of diabetic status. Using the shoulder ultrasounds, the radiologists correctly predicted diabetes in 70 of 79 patients, or 89 percent.

“We weren’t surprised that we had positive results because the shoulder muscle on patients with diabetes looked so bright on ultrasound, but we were surprised at the level of accuracy,” Dr. Soliman said.

A hyperechoic, or unusually bright-looking, deltoid muscle was also a strong predictor of pre-diabetes. The musculoskeletal radiologists assigned all 13 pre-diabetic ultrasounds to either the “suspected diabetes” or “definite diabetes” categories.

“A lot of the patients weren’t even aware that they were diabetic or pre-diabetic,” said Dr. Soliman, who noted that this lack of awareness is a major problem in the U.S.

According to the Centers for Disease Control and Prevention (CDC), nearly one in four Americans with diabetes—about 7.2 million people—are unaware they have the disease and are left undiagnosed.

“Also, the CDC states that pre-diabetes affects an astonishing 84.1 million adults, or nearly 34 percent of the adult U.S. population, and an overwhelming 90 percent of these people are completely unaware of their pre-diabetic status and are at a high risk of developing type 2 diabetes,” Dr. Soliman said.

The reasons for the brighter-appearing shoulder muscle on ultrasound among patients with diabetes is not completely understood, according to Dr. Soliman, but the researchers suspect it is due to low levels of glycogen in the muscle, a key source of energy for the body that is stored primarily in the liver and muscles. A study of muscle biopsies in patients with diabetes found that muscle glycogen levels are decreased up to 65 percent. Prior research has also shown that the muscles of athletes appear brighter on ultrasound after exercise, when their glycogen stores are depleted.

“It could be that this appearance in people with diabetes and pre-diabetes is related to the known problems with glycogen synthesis in their muscles because of their insulin abnormalities,” Dr. Soliman said.

If they see a bright shoulder muscle on ultrasound, radiologists at Henry Ford now put notes in their reports indicating that this observation has been linked to diabetes.

The researchers plan to continue studying the connection between shoulder muscle echogenicity and diabetes with an eye toward quantifying the phenomenon and seeing if it is reversible.

Co-authors are Paul Williams, M.D., Kelli A. Rosen, D.O., Jessica K. Kim, B.S., D.O., Paul J. Spicer, M.D., and Marnix T. van Holsbeeck, M.D.

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Researchers Use MRI to Predict Alzheimer's Disease

AT A GLANCE

- **MRI assessment of the brain's white matter using diffusion tensor imaging (DTI) is a promising option for analysis of dementia risk.**
- **Researchers achieved 89 percent accuracy in predicting which patients would later develop Alzheimer's disease.**
- **MRI measures of white matter integrity could speed interventions that slow the course of Alzheimer's disease or delay its onset.**

CHICAGO – MRI brain scans perform better than common clinical tests at predicting which people will go on to develop Alzheimer's disease, according to a study being presented next week at the annual meeting of the Radiological Society of North America (RSNA).

Alzheimer's disease is a progressive, irreversible brain disorder that destroys memory and thinking skills. The disease affects 5.5 million Americans, according to the National Institutes of Health.

"Alzheimer's disease is the most common cause of dementia in the world and is expected to increase globally, and especially in the U.S., as the population gets older," said the study's lead author Cyrus A. Raji, M.D., Ph.D., assistant professor of radiology at the Mallinckrodt Institute of Radiology at Washington University School of Medicine in St. Louis. "As we develop new drug therapies and study them

in trials, we need to identify individuals who will benefit from these drugs earlier in the course of the disease."

Common predictive models like standardized questionnaires used to measure cognition and tests for the APOE4 gene, a gene variant associated with a higher risk of Alzheimer's disease, have limitations and—with accuracy rates of about 70-71 percent—fail to identify many people who go on to develop the disease.

MRI exams of the brain using diffusion tensor imaging (DTI) are a promising option for analysis of dementia risk. These exams assess the condition of the brain's white matter.

"With DTI you look at the movement of water molecules along white matter tracts, the telephone cables of brain," Dr. Raji said. "When these tracts are not well connected, cognitive problems can result."

DTI provides different metrics of white matter integrity, including fractional anisotropy (FA), a measure of how well water molecules move along white matter tracts. A higher FA value indicates that water is moving in a more orderly fashion along the tracts, while a lower value means that the tracts are likely damaged.

For the new study, Dr. Raji and colleagues set out to quantify differences in DTI in people who decline from normal cognition or mild cognitive impairment to Alzheimer's dementia compared to controls who do not develop dementia. They performed brain DTI exams on 61 people drawn from the Alzheimer's Disease Neuroimaging Initiative, a major, multisite study focusing on the progression of the disease.

About half of the patients went on to develop Alzheimer's disease, and DTI identified quantifiable differences in the brains of those patients. People who developed the disease had lower FA compared with those who didn't, suggesting white matter damage. They also had statistically significant reductions in certain frontal white matter tracts.

"DTI performed very well compared to other clinical measures," Dr. Raji said. "Using FA values and other associated global metrics of white matter integrity, we were able to achieve 89 percent accuracy in predicting who would go onto develop Alzheimer's disease. The Mini-mental State Examination and APOE4 gene testing have accuracy rates of about 70 – 71 percent."

The researchers conducted a more detailed analysis of the white matter tracts in about 40 of the study participants. Among those patients, the technique achieved 95 percent accuracy, Dr. Raji said.

While more work is needed before the approach is ready for routine clinical use, the results point to a future role for DTI in the diagnostic workup of people at risk for Alzheimer's disease. Many people already receive MRI as part of their care, so DTI could add significant value to the exam without substantially increasing the costs, Dr. Raji said.

Perhaps most importantly, MRI measures of white matter integrity could speed interventions that slow the course of the disease or even delay its onset.

"Research shows that Alzheimer's disease risk can be reduced by addressing modifiable risk factors like obesity and diabetes," Dr. Raji said. "With early detection, we can enact lifestyle interventions and enlist volunteers into drug trials earlier."

Co-authors are Maxwell B. Wang, B.S., Erin Moe, B.A., Eva M. Palacios and Pratik Mukherjee, M.D., Ph.D.

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Women Benefit from Mammography Screening Beyond Age 75

AT A GLANCE

- **A study of 763,256 mammography exams over 10 years analyzed the incidence of breast cancer among 76,885 women age 75 and older.**
- **Women 75 and older made up 16 percent of all patients diagnosed with screen-detected cancers in the study, and most of the cancers found among this age group were invasive.**
- **Women over age 75 should continue to get annual screening mammograms as long as they are in good health.**

CHICAGO – Women age 75 years and older should continue to get screening mammograms because of the comparatively high incidence of breast cancer found in this age group, according to a new study being presented next week at the annual meeting of the Radiological Society of North America (RSNA).

Guidelines on what age to stop breast cancer screening have been a source of confusion in recent years. In 2009, the United States Preventive Services Task Force (USPSTF) released controversial guidelines stating there was not enough evidence to assess benefits and harms of screening mammography in women age 75 and older. However, other professional groups advise that women may continue to undergo mammography screening as long as they are in good health.

“Ongoing debate exists regarding the age to cease screening mammography,” said Stamatia V. Destounis, M.D., radiologist at Elizabeth Wende Breast Care, LLC, in Rochester, N.Y. “Our findings provide important data demonstrating that there is value in screening women over 75 because there is a considerable incidence of breast cancer.”

For the study, Dr. Destounis and colleagues analyzed data from 763,256 screening mammography exams at Elizabeth Wende Breast Care between 2007 and 2017. Screening-detected cancer was diagnosed in 3,944 patients. Further analysis was performed to identify the number and type of cancers diagnosed among women 75 years of age and older.

There were 76,885 patients (10 percent) age 75 and older included in the study. The average age of the patients was 80.4. A total of 645 malignancies were diagnosed in 616 patients, for a cancer rate of 8.4 detections per 1,000 exams in this age group.

“For the relatively small percentage of our screening population that was comprised of women 75 and older, the patients diagnosed in this population made up 16 percent of all patients diagnosed with screening-detected cancers,” Dr. Destounis said.

Researchers also found that 82 percent of the malignancies diagnosed were invasive cancers, of which 63 percent were grade 2 or 3, which grow and spread more quickly. Ninety-eight percent of the cancers found were able to be treated surgically. Positive lymph nodes were reported at surgical excision in 7 percent of the patients. Seventeen cancers were not surgically treated due to advanced patient age or overall degraded patient health.

“Most of the tumors found in this age group were invasive, and almost all of these patients—98 percent—underwent surgery,” Dr. Destounis said.

Mammography plays a critical role in the early detection of breast cancer, because it can show changes in the breast up to two years before a woman or her physician can feel them, and early detection leads to better treatment options and improved survival.

Dr. Destounis advises women over 75 who are in relatively good health to continue routine screenings.

“The benefits of screening yearly after age 75 continue to outweigh any minimal risk of additional diagnostic testing,” she said.

Co-authors are Andrea L. Arieno, B.S., and Amanda Santacroce, B.A.

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Playing Youth Football Could Affect Brain Development

AT A GLANCE

- **A new study of young football players found that gray matter pruning was altered after one season of play.**
- **Pruning, or reduction in gray matter volume, is an important part of brain development.**
- **Changes in pruning were seen in players who experienced a high number of head impacts during the season.**

CHICAGO – Young football players may experience a disruption in brain development after a single season of the sport, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“This research demonstrates that playing a season of contact sports may affect normal gray matter pruning in high school and youth football players,” said Gowtham Krishnan Murugesan, M.S., research assistant in the Department of Radiology at UT Southwestern Medical Center in Dallas, Texas.

The brain is highly complex with an abundance of neural connections. New connections are formed, and unused connections fall away in a process called pruning. Much like

cutting back dead or unnecessary branches keeps a tree healthy and helps it grow, brain pruning is necessary to healthy brain development.

“Pruning is an essential part of brain development,” Murugesan said. “By getting rid of the synapses that are no longer used, the brain becomes more efficient with aging.”

The researchers set out to determine whether exposure to repetitive head impacts affects normal pruning of the brain in young football players.

For the study, 60 youth and high school football players without history of developmental, neurological or psychiatric abnormalities and no history of concussion prior to or during the season were outfitted with the Head Impact Telemetry System (HITS). HITS helmets are lined with accelerometers or sensors that measure the magnitude, location and direction of impacts to the head. Impact data from the helmets were used to calculate a risk of concussion exposure for each player.

Players were then split into two groups: high-impact players (24) and low-impact players (36), based on each player’s risk of cumulative head impact exposure as determined by HITS.

Pre- and post-season resting state functional (fMRI) scans were performed on all players, and changes in power within five components the default mode network (DMN) were analyzed.

The DMN is a network of regions deep in the gray matter areas of the brain. It includes structures that activate when a person is awake and engaging in introspection or processing emotions, which are activities that are important for brain health.

The post-season results showed significant increases in power and gray matter volume in the frontal DMN in the high-impact group.

“Disruption in normal pruning has been shown to be related to weaker connections between different parts of the brain,” Murugesan said. “Our study has found a significant decrease in gray matter pruning in the frontal default mode network, which is involved in higher cognitive functions, such as the planning and controlling of social behaviors.”

Studies of biomechanical data from this same group of participants were conducted at Wake Forest University in Winston-Salem, N.C. Their findings showed that most head impacts occurred during practice.

“By replacing high-impact practice drills with low- or no-impact drills, the overall head-impact exposure for players can be reduced,” Murugesan said.

The researchers also suggested that minor modifications to the game could also be implemented to reduce full-speed contact.

“The new National Football League kickoff rule eliminating the running start is an example,” Murugesan said.

The researchers hope to conduct further study to fully understand the long-term changes in resting state brain networks and their association with neuropsychological task performance.

Co-authors are Ryan A. Fisicaro, M.D., James M. Holcomb, B.S., B.A., Elizabeth M. Davenport, Ph.D., Ben Wagner, B.S., Jillian Urban, Mireille Kelley, Derek Jones, Christopher T. Whitlow, M.D., Ph.D., Joel Stitzel, and Joseph A. Maldjian, M.D.

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Weight Loss Procedure Shrinks Both Fat and Muscle

AT A GLANCE

- **A novel interventional procedure used to treat obesity leads to the loss of both fat and muscle.**
- **Patients lost an average of 6.4 percent of their body weight after left gastric artery embolization, but also showed a decrease in skeletal muscle index of 6.8 percent.**
- **Visceral fat, the more dangerous fat surrounding the organs, did not decrease significantly over the course of follow-up.**

CHICAGO – Left gastric artery embolization, a novel interventional procedure used to treat obesity, leads to the loss of both fat and muscle, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA). Researchers said the loss of muscle mass is concerning and underscores the importance of proper nutritional counseling after the procedure.

Obesity is a major health issue worldwide, linked with serious conditions like heart disease, cancer and diabetes. First-line treatments such as diet and exercise often don't work, leading many patients to opt for gastric bypass surgery. The surgery, which reduces the size of the stomach, has been effective in treating obesity, but carries with it significant costs and potential complications.

Currently under investigation in clinical trials, left gastric artery embolization is a less invasive option to surgery. In the procedure, microscopic beads are injected under imaging guidance into the artery that supplies blood to the stomach. The beads block blood flow to the stomach and reduce the production of ghrelin, a hormone that stimulates hunger. Early studies have shown that embolization is effective in helping people lose weight, but information is lacking on how it might change a patient's composition of muscle and fat.

"There has been lots of research focused on the efficacy of gastric artery embolization for weight loss," said the study's lead author, Edwin A. Takahashi, M.D., vascular and interventional radiology fellow at the Mayo Clinic in Rochester, Minn. "However, there has been no data on what is contributing to the weight loss, whether the patients are losing fat, as desired, or muscle mass, or some combination of the two."

To learn more, Dr. Takahashi and colleagues studied CT scans of 16 overweight or obese patients who had undergone left gastric artery embolization to treat gastrointestinal bleeding. CT scans, when used in conjunction with special software, allow for measurements of body composition based on the different densities of tissues like fat and muscle.

The scans were done before and approximately 1.5 months after the procedure. The results were compared to those of a control group of 16 outpatients who did not undergo left gastric artery embolization but had CT scans at two different time periods for nonspecific abdominal pain.

All 16 individuals experienced significant weight loss after the embolization procedure, losing an average of 6.4 percent of their body weight over 1.5 months. Body mass index, a measure of body weight relative to a person's height, dropped by 6.3 percent.

While the weight loss was not surprising to the researchers, the changes in body composition were. The skeletal muscle index, a measure of the amount of muscle that connects to the skeleton and helps move the limbs, fell by 6.8 percent. Skeletal muscle is important to health, and loss of it can impair physical function and metabolism and put a person at higher risk of injury.

“The significant decrease in the amount of skeletal muscle highlights the fact that patients who undergo this procedure are at risk for losing muscle mass and need to be managed accordingly after procedure,” Dr. Takahashi said. “We must make sure they receive adequate nutrition to minimize the amount of muscle tissue they lose.”

The patients also lost a significant amount of body fat. Their overall body fat index dropped by an average of 3.7 percent. However, much of the fat loss was subcutaneous, or the fat that lies directly under the skin. Visceral fat, the more dangerous fat surrounding the organs and associated with serious health problems like heart disease and diabetes, did not decrease significantly over the course of follow-up.

The researchers plan to expand their studies in the future to include people who are specifically undergoing embolization as a treatment for obesity.

Co-authors are Naoki Takahashi, M.D., Chris Reisenauer, M.D., Michael R. Moynagh, M.D., F.F.R. (R.C.S.I.), and Sanjay Misra, M.D.

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Artificial Intelligence May Help Reduce Gadolinium Dose in MRI

AT A GLANCE

- **A deep learning algorithm may allow for gadolinium dose reduction in MRI exams.**
- **Image quality was not significantly different between full-dose, contrast-enhanced images and low-dose images enhanced by the algorithm.**
- **The results demonstrate the potential for creating the equivalent of full-dose, contrast-enhanced MR images without any contrast agent use.**

CHICAGO – Researchers are using artificial intelligence to reduce the dose of a contrast agent that may be left behind in the body after MRI exams, according to a study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Gadolinium is a heavy metal used in contrast material that enhances images on MRI. Recent studies have found that trace amounts of the metal remain in the bodies of people who have undergone exams with certain types of gadolinium. The effects of this deposition are not known, but radiologists are working proactively to optimize patient safety while preserving the important information that gadolinium-enhanced MRI scans provide.

“There is concrete evidence that gadolinium deposits in the brain and body,” said study lead author Enhao Gong, Ph.D., researcher at Stanford University in Stanford, Calif. “While

the implications of this are unclear, mitigating potential patient risks while maximizing the clinical value of the MRI exams is imperative.”

Dr. Gong and colleagues at Stanford have been studying deep learning as a way to achieve this goal. Deep learning is a sophisticated artificial intelligence technique that teaches computers by examples. Through use of models called convolutional neural networks, the computer can not only recognize images but also find subtle distinctions among the imaging data that a human observer might not be capable of discerning.

To train the deep learning algorithm, the researchers used MR images from 200 patients who had received contrast-enhanced MRI exams for a variety of indications. They collected three sets of images for each patient: pre-contrast scans, done prior to contrast administration and referred to as the zero-dose scans; low-dose scans, acquired after 10 percent of the standard gadolinium dose administration; and full-dose scans, acquired after 100 percent dose administration.

The algorithm learned to approximate the full-dose scans from the zero-dose and low-dose images. Neuroradiologists then evaluated the images for contrast enhancement and overall quality.

Results showed that the image quality was not significantly different between the low-dose, algorithm-enhanced MR images and the full-dose, contrast-enhanced MR images. The initial results also demonstrated the potential for creating the equivalent of full-dose, contrast-enhanced MR images without any contrast agent use.

These findings suggest the method’s potential for dramatically reducing gadolinium dose without sacrificing diagnostic quality, according to Dr. Gong.

“Low-dose gadolinium images yield significant untapped clinically useful information that is accessible now by using deep learning and AI,” he said.

Now that the researchers have shown that the method is technically possible, they want to study it further in the clinical setting, where Dr. Gong believes it will ultimately find a home.

Future research will include evaluation of the algorithm across a broader range of MRI scanners and with different types of contrast agents.

“We’re not trying to replace existing imaging technology,” Dr. Gong said. “We’re trying to improve it and generate more value from the existing information while looking out for the safety of our patients.”

Co-authors are Jonathan Tamir, B.Sc., John Pauly, Max Wintermark, M.D., and Greg Zaharchuk, M.D., Ph.D.

Dr. Gong received an RSNA “Trainee Research Prize – Resident” award for his research.

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Researchers Aim to Prevent Medical Imaging Cyberattacks

AT A GLANCE

- **New research addresses the potential risk of cyberattacks in medical imaging.**
- **Researchers from Israel developed a system to send an alert if a CT machine receives a malicious command.**
- **Researchers from Switzerland trained an artificial intelligence network to alter mammograms.**

CHICAGO – Two new studies being presented this week at the annual meeting of the Radiological Society of North America (RSNA) address the potential risk of cyberattacks in medical imaging.

The Internet has been highly beneficial to health care—radiology included—improving access in remote areas, allowing for faster and better diagnoses, and vastly improving the management and transfer of medical records and images. However, increased connectivity can lead to increased vulnerability to outside interference.

Researchers and cybersecurity experts have begun to examine ways to mitigate the risk of cyberattacks in medical imaging before they become a real danger.

Medical imaging devices, such as X-ray, mammography, MRI and CT machines, play a crucial role in diagnosis and treatment. As these devices are typically connected to hospital networks, they can be

potentially susceptible to sophisticated cyberattacks, including ransomware attacks that can disable the machines. Due to their critical role in the emergency room, CT devices may face the greatest risk of cyberattack.

In a study presented today, researchers from Ben-Gurion University of the Negev in Beer-Sheva, Israel, identified areas of vulnerability and ways to increase security in CT equipment. They demonstrated how a hacker might bypass security mechanisms of a CT machine in order to manipulate its behavior. Because CT uses ionizing radiation, changes to dose could negatively affect image quality, or—in extreme cases—pose harm to the patient.

“In the current phase of our research, we focus on developing solutions to prevent such attacks in order to protect medical devices,” said Tom Mahler, Ph.D. candidate and teaching assistant at Ben-Gurion University of the Negev. “Our solution monitors the outgoing commands from the device before they are executed, and will alert—and possibly halt—if it detects anomalies.”

For anomaly detection, the researchers developed a system using various advanced machine learning and deep learning methods, with training data consisting of actual commands recorded from real devices. The model learns to recognize normal commands and to predict if a new, unseen command is legitimate or not. If an attacker sends a malicious command to the device, the system will detect it and alert the operator before the command is executed.

“In cybersecurity, it is best to take the ‘onion’ model of protection and build the protection in layers,” Mahler said. “Previous efforts in this area have focused on securing the hospital network. Our solution is device-oriented, and our goal is to be the last line of defense for medical imaging devices.”

He added that it is also important to note that although these types of attacks are theoretically possible, there is no indication that they ever actually occurred.

“If health care manufacturers and hospitals will take a proactive approach, we could prevent such attacks from happening in the first place,” he said.

A second study, to be presented tomorrow, looked at the potential to tamper with mammogram results.

The researchers trained a cycle-consistent generative adversarial network (CycleGAN), a type of artificial intelligence application, on 680 mammographic images from 334 patients, to convert images showing cancer to healthy ones and to do the same, in reverse, for the normal control images. They wanted to determine if a CycleGAN could insert or remove cancer-specific features into mammograms in a realistic fashion.

“As doctors, it is our moral duty to first protect our patients from harm,” said Anton S. Becker, M.D., radiology resident at University Hospital Zurich and ETH Zurich, in Switzerland. “For example, as radiologists we are used to protecting patients from unnecessary radiation. When neural networks or other algorithms inevitably find their way into our clinical routine, we will need to learn how to protect our patients from any unwanted side effects of those as well.”

The images were presented to three radiologists, who reviewed the images and indicated whether they thought the images were genuine or modified. None of the radiologists could reliably distinguish between the two.

“Neural networks, such as CycleGAN, are not only able to learn what breast cancer looks like,” Dr. Becker said, “we have now shown that they can insert these learned characteristics into mammograms of healthy patients or remove cancerous lesions from the image and replace them with normal looking tissue.”

Dr. Becker anticipates that this type of attack won’t be feasible for at least five years and said patients shouldn’t be concerned right now. Still, he hopes to draw the attention of the medical community, and hardware and software vendors, so that they may make the necessary adjustments to address this issue while it is still theoretical.

Dr. Becker said that artificial intelligence, in general, will greatly enrich radiology, offering faster diagnoses and other advantages. He added that there are positive aspects to these findings as well.

“Neural networks can teach us more about the image characteristics of certain cancers, making us better doctors.”

Mahler’s co-authors are Erez Shalom, Ph.D., Arnon Makori, M.D., Israel Goldenberg, B.Sc., Ilan Shelef, M.D., Yuval Elovici, Ph.D., and principal investigator Yuval Shahar, M.D., Ph.D. Dr. Becker’s co-authors are Lukas Jendele, Ondrej Skopek, Soleen Ghafoor, M.D., Nicole Berger, M.D., Magda Marcon, M.D., and Ender Konukoglu, Ph.D.

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Pulsed Radiofrequency Relieves Acute Back Pain and Sciatica

AT A GLANCE

- **Pulsed energy to treat acute lower back pain is safe and effective.**
- **Researchers treated 128 patients with the minimally invasive CT-guided technique.**
- **Patients who received the treatment saw greater overall improvement in pain and disability scores during the first year.**

CHICAGO – A minimally invasive procedure in which pulses of energy from a probe are applied directly to nerve roots near the spine is safe and effective in people with acute lower back pain that has not responded to conservative treatment, according to a study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Lumbar disk herniation is a common, often debilitating, condition that affects the disks that act as cushions between the vertebrae of the lower spine. Herniation occurs where the jelly-like material in the center of the disk bulges through a tear in the disk's tough exterior layer and puts pressure on the roots of the nerves. Herniated disks are often the source of sciatica, or pain that radiates downward from the lower back into the leg.

Conservative treatment options for herniated disks range from over-the-counter pain medications to injections of corticosteroids directly into the affected area of the spine. Those who don't respond may require surgery. In some cases, the entire disk must be removed and the vertebra fused together for stability.

An alternative technique, CT-guided pulsed radiofrequency (pRF), applies energy through an electrode under CT guidance to the portion of the nerve responsible for sending pain signals.

"Pulsed radiofrequency creates a nerve modulation, significantly reducing inflammation and its associated symptoms," said study senior author Alessandro Napoli, M.D., Ph.D., professor of interventional radiology at Sapienza University of Rome in Italy.

Dr. Napoli and colleagues studied the approach in patients with back pain from lumbar disk herniation that had not responded to prolonged conservative treatment. In 128 patients, the pRF treatment was delivered directly under CT guidance to the root of the nerve. The treatment was applied for 10 minutes.

For comparison, a group of 120 patients received one to three sessions of CT-guided steroid injection on the same anatomical target with no pRF.

The one-year outcomes demonstrated that CT-guided pRF was superior to the injection-only strategy. Patients who received pRF saw greater overall improvement in pain and disability scores during the first year. Relief of leg pain was faster in patients assigned to pRF, and they also reported a faster rate of perceived recovery. The probability of perceived recovery after one year of follow-up was 95 percent in the pRF group, compared with 61 percent in the injection only group.

“Given our study results, we offer pulsed radiofrequency to patients with herniated disk and sciatic nerve compression whose symptoms do not benefit from conservative therapy,” Dr. Napoli said.

The results of the study are superior to those typically reported for usual care strategies and injections and may help a substantial number of patients with sciatic disk compression to avoid surgery, Dr. Napoli added.

The use of pRF also could improve outcomes for patients set to receive corticosteroid injections.

“We learned that when pulsed radiofrequency is followed by steroid injection, the result is longer lasting and more efficacious than injection only,” Dr. Napoli said. “The effect of pulsed radiofrequency is fast and without adverse events.”

Today, therapy for spine disorders allows for definitive treatment of symptoms and conditions using different techniques and technologies.

“Of the different therapies available, pulsed radiofrequency is among the least invasive,” Dr. Napoli said. “Treatment lasts 10 minutes, and one session was enough in a large number of treated patients.”

Co-authors are Roberto Scipione, M.D., Fabrizio Andrani, M.D., Susan Dababou, Cristina Marrocchio, Michele Anzidei, M.D., and Carlo Catalano, M.D.

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New Study Supports Mammography Screening at 30 for Some Women

AT A GLANCE

- **Women under age 40 with dense breasts or with a personal or family history of breast cancer may benefit from mammography screening beginning at age 30.**
- **Over 5.7 million mammograms performed in 150 facilities across 31 U.S. states over an 8-year period were analyzed.**
- **Compared to women ages 40 to 44 at average risk, women in their 30s with the three evaluated risk factors showed similar cancer detection rates and recall rates in incidence screening.**

CHICAGO – A new, large-scale study of more than 5 million mammograms found that annual mammography screening beginning at age 30 may benefit women with at least one of three specific risk factors: dense breasts, a personal history of breast cancer or a family history of breast cancer. The study will be presented today at the annual meeting of the Radiological Society of North America (RSNA).

Mammography is the standard imaging exam for breast cancer screening. The American Cancer Society says that women should have the choice to get an annual mammogram beginning at age 40 and recommends that all women at average risk should be screened annually beginning at age 45. Some other leading professional groups recommend annual mammography screening beginning at age 40, and RSNA supports this recommendation.

However, for younger women, the directives are less clear.

“Women under 40 have not been the focus of our attention when it comes to breast cancer screening,” said Cindy S. Lee, M.D., assistant professor of radiology at NYU Langone Health in New York City. “Everyone is talking about the 40 to 49 range, and not the 30 to 39 age range. It’s difficult to study this group because most women in this age range do not get mammograms, but some of these young women have increased risk for breast cancer and may need earlier and/or supplemental screening.”

For the study, Dr. Lee and colleagues compared the performance metrics of screening mammography in women between the ages of 30 and 39 with three specific risk factors versus women, age 40 - 49, without these risk factors, using data from the National Mammography Database (NMD), the largest source of screening mammography outcomes in the U.S. The NMD contains information from over 19 million mammograms, including self-reported patient demographics, clinical findings, mammography interpretations and biopsy results.

The researchers analyzed data from over 5.7 million screening mammograms performed on more than 2.6 million women over an eight-year period between January 2008 and December 2015 in 150 facilities across 31 states in the U.S. The research team compared screening performance metrics among subgroups of women based on age, risk factors and breast density.

Three specific risk factors for breast cancer were evaluated in this study: family history of breast cancer (any first-degree relative regardless of age), personal history of breast cancer and dense breasts.

“Current breast risk prediction models incorporate different risk factors, which are weighed differently and can produce different results for the same patient. This complexity can lead to confusion and uncertainty for both doctors and patients,” Dr. Lee said. “Our study defined ‘increased breast cancer risk’ in a simpler and more inclusive way. Any woman with dense breasts, personal history or family history of breast cancer in any first-degree relative is considered to have increased risk.”

She added that breast density is an important risk factor for breast cancer, but is excluded from all risk models except one.

Four performance metrics for screening mammography were calculated for each patient age and risk group: cancer detection rate, recall rate, and positive predictive value for biopsy recommended (PPV2) and biopsy performed (PPV3). Recall rate is the percentage of patients called back for follow-up testing after a screening exam. PPV reflects the percentage of cancers found among exams for which biopsy was recommended or performed.

In the under 40 group, some of the women had increased risk either because of dense breasts, family history or a personal history of breast cancer.

Overall, women age 30-34 and 35-39 had similar cancer detection rates, recall rates and PPVs. Cancer detection rates were significantly higher in women with at least one of the three evaluated risk factors. Moreover, compared to women ages 40 to 44 at average risk, incidence screening (at least one prior screening examination) of women in their 30s with at least one of the three evaluated risk factors showed similar cancer detection rates and recall rates.

“Women with at least one of these three risk factors may benefit from screening mammography beginning at age 30, instead of 40,” Dr. Lee said.

Co-authors are Heidi Ashih, Ph.D., Debapriya Sengupta, M.B.B.S., M.P.H., Edward A. Sickles, M.D., Margarita L. Zuley, M.D., and Etta D. Pisano, M.D.

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Cryoablation Shows Promise in Treating Low-Risk Breast Cancers

AT A GLANCE

- **Cryoablation may offer a promising alternative for treating early, low-risk breast cancers.**
- **The procedure takes less than an hour, and patients are able to return to their normal activities shortly thereafter.**
- **Since the study began, there has only been one case of cancer recurrence.**

CHICAGO – Cryoablation—the destruction of cancer cells through freezing—shows early indications of effectiveness in treating women with low-risk breast cancers, according to research being presented today at the annual meeting of the Radiological Society of North America (RSNA). Researchers said that over the four years of the study, there has only been one case of cancer recurrence out of 180 patients.

“If the positive preliminary findings are maintained as the patients enrolled in the study continue to be monitored, that will serve as a strong indication of the promise of cryotherapy as an alternative treatment for a specific group of breast cancer patients,” said study lead author Kenneth R. Tomkovich, M.D., radiologist at Princeton Radiology and director of Breast Imaging and Interventions at CentraState Medical Center in Freehold, N.J.

Cryoablation, also known as cryotherapy, has been used to treat cancers in other organs in the body, including the kidneys and lungs, but has yet to become an established treatment for breast cancer. Dr. Tomkovich began studying it for that indication more than 10 years ago, as imaging advances in mammography and ultrasound and the development of tomosynthesis enabled the detection of more low-risk cancers. These small, early-stage cancers have the potential to become invasive and life-threatening without treatment. But treatment options have not kept pace with imaging advances.

“We’re finding smaller and smaller breast cancers, but we’re still treating them the same way we did 30 years ago,” Dr. Tomkovich said.

Cryoablation represents a potential new weapon in the arsenal against breast cancer. The procedure begins with the introduction of a probe into the tumor through a pea-sized incision in the skin while the patient is under local anesthesia. The probe is guided by high-definition ultrasound in conjunction with mammography images. Once the probe is in place, liquid nitrogen is introduced into it. During the initial, eight-minute freeze cycle, an ice ball forms around the tumor, killing the cancer. After a thaw cycle, another eight-minute freeze cycle is used to ensure complete destruction of the cancer cells. The procedure takes less than an hour, and patients are able to return to their normal activities shortly thereafter.

As part of the Ice 3 Trial, Dr. Tomkovich and colleagues at 18 centers across the U.S. have been studying cryoablation as a primary treatment for breast cancer without surgical lumpectomy. Starting in 2014, the researchers began performing cryoablation on women ages 60 and over with biopsy-proven, low-risk breast cancer. The patients undergo the procedure and then are followed for recurrence with mammography at six and 12 months and then annually for five years.

As of now, the researchers have three-year follow-up data on about 20 patients and two-year follow-up data on more than 75 patients. The preliminary results have been very promising. The procedure was successfully completed in all patients, and no serious adverse events have been reported. Only one patient experienced a recurrence, giving the procedure a 99.4 percent success rate so far.

“Lumpectomy is 90 to 95 percent effective at removing cancer,” Dr. Tomkovich said. “We were going for something close to that, but our preliminary results have been even better. We’re getting the same results at 18 centers around the country.”

Cryoablation has advantages over ablation techniques that use heat to destroy tumors. For one, tissue retains its appearance when frozen, while heating tends to deform it, making imaging less reliable. Dr. Tomkovich likens the process to how bacon keeps its shape when frozen but curls up and shrinks when cooked. In addition, there is preliminary evidence from studies on mice that cryoablation can stimulate an immune system response against cancer cells in the body.

Final results of the study will be published when five-year follow-up data is available for all the women who were treated.

“If it’s proven that cryoablation works, then some women might be more inclined to opt for it over surgery,” Dr. Tomkovich said.

Disclosure: Dr. Tomkovich is a consultant for Scion Medical Technologies, LLC, and is on the Scientific Advisory Board for IceCure Medical, Inc.

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Online Gaming Addiction in Men Affects Brain's Impulse Control

AT A GLANCE

- **fMRI exams of men addicted to online gaming revealed alterations in brain regions associated with impulsivity.**
- **Internet gaming disorder (IGD) is a condition characterized by compulsive playing of online games to the exclusion of other interests.**
- **The research adds to a growing body of literature linking the behavioral problems associated with IGD to those found in individuals with substance abuse issues.**

CHICAGO – Researchers using functional MRI (fMRI) have found differences in the brains of men and women who are addicted to online gaming, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA).

“Internet use is an integral part of the daily lives of many young adults, and a loss of control over Internet use could lead to various negative effects,” said the study’s senior author, Yawen Sun, M.D., diagnostic radiologist at the Department of Radiology of Ren Ji Hospital, affiliated with the Shanghai Jiao Tong University School of Medicine in Shanghai, China. “Internet gaming disorder has become a major public health concern worldwide among both adolescents and young adults.”

Internet gaming disorder (IGD) is a condition characterized by compulsive playing of online games to the exclusion of other interests. Individuals with IGD often suffer significant impairment or distress and may experience negative effects at work, in school or in relationships because of the amount of time they spend playing. They also show symptoms of withdrawal when not playing.

While some evidence exists that IGD is more prevalent among men, there is little existing research on differences in the structure and function of the brains of men and women with the disorder.

The researchers studied 32 men and 23 women with IGD. They performed resting-state fMRI on the study participants, along with 30 male and 22 female age-matched healthy controls. Resting-state fMRI allows a view of the brain activity when it is not focused on a particular task. The study looked at relationships between brain activity as seen on fMRI and scores on the Barratt Impulsiveness Scale-11, a commonly used test to assess behavioral inhibition.

The results illuminated key differences between the men and women with IGD. Men with IGD showed alterations in regional- and network-level brain function. In particular, they had lower brain activity in the

superior frontal gyrus, an area of the brain's prefrontal lobe that is important to impulse control. The women with IGD did not exhibit any of these brain alterations.

“Our findings demonstrated that alterations in cerebral activity are observed in men with IGD, but not in women with IGD, and that the lower brain activity in the superior frontal gyrus in men with IGD may be associated with higher impulsivity,” Dr. Sun said.

This and other differences apparent in the study suggest that IGD may interact with gender-specific patterns of brain function in men and women.

Different rates of maturation in men's and women's brains could also contribute to gender-specific alterations in IGD, Dr. Sun noted. For instance, the prefrontal cortex, which has a central role in executive function and inhibition, matures later in men.

“Men have shown lower levels of impulse control in comparison with women, and their impulse control also increases more gradually,” she said. “Given the role of inhibitory control in the initiation of IGD, young men may tend to experiment with pathological Internet use to a greater degree than young women do.”

A dysfunctional prefrontal cortex specifically in men with IGD may be associated with high impulsivity, a finding partly consistent with those of previous studies of substance addiction. The research adds to a growing body of literature linking the behavioral problems associated with IGD to those found in individuals with substance abuse issues.

“However, it remains unclear whether the brain functional and structural changes found in IGD are gaming-induced or precursors for vulnerability,” Dr. Sun said. “I think future research should focus on using functional MRI to identify brain susceptibility factors relating to the development of IGD.”

Internet, or online, gaming has grown tremendously over the past decades. It includes social gaming, mobile gaming, and multiplayer gaming, which generates billions of dollars in revenue in the U.S. alone. Recent surveys have reported that there are more than 55 million online console gamers in the U.S. According to data measurement company Nielsen, 162 million people, or roughly half the U.S. population, live in a household with a video game console.

Co-authors are Xu Han, M.D., Yao Wang, Weina Ding, Yan Zhou, Ph.D., and Jianrong Xu.

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Valerie P. Jackson, M.D., Named President of RSNA

CHICAGO – Valerie P. Jackson, M.D., was named president of the Radiological Society of North America (RSNA) Board of Directors today at the Society’s annual meeting in Chicago.

An expert in the field of breast imaging, Dr. Jackson is the executive director of the American Board of Radiology (ABR), a position she has held since 2014. She previously served on ABR’s board of trustees from 2001 to 2010. Dr. Jackson received her medical degree in 1978 from the Indiana University School of Medicine, and completed her residency at the Indiana University Medical Center in 1982. Dr. Jackson is the Eugene C. Klatte Professor Emeritus and has had numerous academic appointments at Indiana University School of Medicine over the years, including lecturer, professor and chair of the Department of Radiology and Imaging Sciences.

As president, Dr. Jackson will develop programs and initiatives that support RSNA’s mission to promote excellence in patient care and health care delivery through research, education and technologic innovation.

“The RSNA annual meeting is the leading forum for the introduction of medical imaging technologies, and the increasingly international attendance at the meeting allows people from all over the world to share knowledge and ideas,” Dr. Jackson said. “RSNA continues to grow as a world leader in informatics and has become a critical convener for artificial intelligence, machine learning and deep learning. While the focus of my career has been predominantly in education, I plan to work hard to continue to advance RSNA in all of these areas.”

Dr. Jackson has published more than 100 peer-reviewed articles and 20 books and book chapters with an emphasis on breast imaging and radiologic education. She has served as principal investigator on numerous funded grants, including several focused on radiologic education. Dr. Jackson has been a course director and presenter at the RSNA Faculty Development Workshop and is a highly regarded lecturer and educator, having given more than 320 scientific and educational presentations at meetings worldwide.

Dr. Jackson has served as a manuscript reviewer for numerous journals including *American Journal of Roentgenology*, *Journal of the American College of Radiology*, *Investigative Radiology*, *Medical Physics*, *Academic Medicine* and *Radiology*, where she served as associate editor on the editorial board from 1989 to 1998, and as consultant to the editor in 1999.

An RSNA member since 1982, Dr. Jackson has served the Society in numerous roles, including chair of the Refresher Course Committee from 2009 to 2012 and chair of the Breast Imaging Subcommittee of the

Scientific Program Committee from 2003 to 2006. She was a member of the Public Information Advisors Network from 1997 to 2017, and a member of the *RSNA News* Editorial Board from 2005 to 2008. She served RSNA as first vice president from 2008 to 2009 and was a member of the RSNA Centennial Committee. Dr. Jackson has been active on many committees of the RSNA Research & Education (R&E) Foundation and served on the R&E Foundation Board of Trustees from 2009 to 2015. She joined the RSNA Board of Directors in 2012 and served as president-elect in 2018.

Dr. Jackson has held committee or leadership positions in a number of radiologic organizations, including the Indiana Radiological Society (IRS), American Roentgen Ray Society, Association of University Radiologists, Radiology Research Alliance, Academy of Radiology Research, Society of Breast Imaging (SBI) and the American College of Radiology (ACR).

The recipient of numerous honors throughout her career, Dr. Jackson is a fellow of the ACR and has received the gold medals of the IRS, SBI and ACR. The Valerie P. Jackson Education Fellowship also recognizes her work with ACR. Dr. Jackson delivered the Annual Oration in Diagnostic Radiology, “Screening Mammography: Controversies and Headlines,” at RSNA 2002.

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James P. Borgstede, M.D., Named President-Elect of the RSNA Board

CHICAGO – James P. Borgstede, M.D., was named president-elect of the Radiological Society of North America (RSNA) Board of Directors today at the Society’s annual meeting in Chicago.

Since 2008, Dr. Borgstede has been professor of radiology at University of Colorado in Denver. He is also vice chair of professional services, clinical operations and quality for the Department of Radiology at the University of Colorado. He received his medical degree in 1974 from the University of Illinois, Chicago, and completed his residency in 1978 at the University of Colorado Health Sciences Center in Denver.

As president-elect of the RSNA board, Dr. Borgstede will support RSNA’s commitment to fostering radiologic research and providing high-quality education.

RSNA provides unparalleled leadership in radiology research and education,” Dr. Borgstede said. “I am excited to have the opportunity to serve our specialty and our patients through RSNA. As an RSNA leader, my goals include promotion of innovative education and cutting-edge research for the benefit of our patients and radiologists throughout the world.”

Over the years, Dr. Borgstede has been very involved with the RSNA annual meeting. He has delivered scientific presentations and refresher courses, participated in symposiums, and was co-presenter in 2005 of a special focus session, “The Diffusion of Imaging and Peril of Inappropriate Utilization.” At RSNA 2007, Dr. Borgstede lectured during the Opening Plenary Session. He has had dozens of articles published and has lectured at more than 120 scientific and educational meetings worldwide.

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*.

An RSNA member since 1976, Dr. Borgstede was a member of the Quality Committee from 2009 to 2011. 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 International Radiology Education Committee and was chair of the Board Committee on International Affairs. Dr. Borgstede has been active on many committees of the RSNA Research & Education (R&E) Foundation. He served on the R&E Foundation Board of Trustees from 2008 to 2014, the Corporate Giving Subcommittee from 2009 to 2012, the Finance Committee from 2012 to 2014, and was chair of the R&E Foundation from 2012 to 2014.

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 (SRU). He was president of the International Society of Radiology from 2014 to 2016. He was ACR chairman of the Board of Chancellors from 2004 through 2006 and president from 2006 through 2007. 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 is a recipient of the University of Colorado Hospital President's Award for Leadership. 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.

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Mary C. Mahoney, M.D., Named Chair of the RSNA Board

CHICAGO – Mary C. Mahoney, M.D., was named chair of the Radiological Society of North America (RSNA) Board of Directors today at the Society’s annual meeting in Chicago.

Dr. Mahoney is the Benjamin Felson Endowed Chair and Professor of Radiology at the University of Cincinnati (UC) College of Medicine in Cincinnati, Ohio. Since 2016, Dr. Mahoney has been chief of imaging services at UC Health in Cincinnati and is on the medical staff of several Cincinnati area institutions, including UC Medical Center and West Chester Hospital in West Chester, Ohio.

After graduating magna cum laude from Brown University in 1979, Dr. Mahoney received her medical degree in 1983 from UC College of Medicine, and is a member of its honor society, Alpha Omega Alpha. She completed her diagnostic radiology residency—serving as chief resident from 1987-1988, followed by a fellowship—at UC Medical Center.

As chair, Dr. Mahoney will lead the board in its continued focus on presenting the leading radiology research, education and technologies to meet the changing needs of RSNA members and to improve patient care.

“I am honored and excited to be named chair of the RSNA Board of Directors,” Dr. Mahoney said. “This is a critical time for our profession’s future, and RSNA has already embarked upon leading key initiatives to ensure radiology’s indispensable position in improving patient care. I look forward to overseeing the Society’s strategic expansion as we continue to meet the needs of our members.”

Dr. Mahoney has published more than 70 peer-reviewed articles and 15 book chapters and has co-authored two books with an emphasis on breast imaging. She has served as a principal or co-investigator on numerous funded grants, including several focused on imaging modalities and biopsy. Dr. Mahoney has given many scientific research presentations nationally and internationally, and has been an invited lecturer at over 280 institutions and meetings worldwide.

She is a graduate of the Executive Leadership in Academic Medicine (ELAM) program for women leaders in medicine. She has been instrumental in building the Advanced Imaging Core Lab at UC College of Medicine and the multidisciplinary breast center within UC Cancer Institute.

Since 2002, Dr. Mahoney has been a manuscript reviewer for *Radiology*. She is currently on the editorial boards of *Cureus*, *RSNA News* and *Contemporary Diagnostic Radiology*, as well as serving on the editorial

advisory board of *Radiology Business Journal*. Dr. Mahoney has been a Self-Assessment Module (SAM) reviewer since 2005 for the American Board of Radiology (ABR).

Over the years, Dr. Mahoney has served RSNA in many capacities. She was the scientific session presiding officer from 2003 to 2009. She has served on many committees, including the Research and Education (R&E) Foundation Public Relations Committee and the Public Information Advisors Network. She has chaired the Public Information Committee, Patient-Centered Radiology Steering Committee and the Radiology Editor Search Committee. She joined the RSNA board in 2014.

Dr. Mahoney has held committee or leadership positions in a number of other organizations, including the Society of Breast Imaging (SBI) and the American Roentgen Ray Society. She served on the ABR Board of Trustees from 2010 to 2015 and the ABR Board of Governors from 2015 to 2018 and currently serves on the American College of Radiology (ACR) Board of Chancellors. Dr. Mahoney is a fellow of both ACR and SBI and is a member of the Society of Chairs of Academic Radiology Departments.

The recipient of many awards and honors throughout her career, Dr. Mahoney was recognized by ABR for her extraordinary service and dedication in 2008 and 2010. She was included on the “Best Doctors in Cincinnati” list and has been selected for inclusion in *Best Doctors in America* every year since 2011. She was named a Health Care Hero finalist twice by the *Cincinnati Business Courier* and received a Marquis Who’s Who Lifetime Award in 2017.

Dr. Mahoney has been a nationally recognized proponent and staunch advocate of patient-centered radiology. She has been involved in numerous initiatives campaigning to encourage and facilitate radiologists’ meaningful engagement in the patient experience.

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Snoring Poses Greater Cardiac Risk to Women

AT A GLANCE

- **Obstructive sleep apnea and snoring may affect cardiac function in women differently than in men.**
- **Three groups of UK Biobank participants were analyzed: those with OSA, those with self-reported snoring and a healthy control group.**
- **Women who snored were more likely to have a significant increase in left ventricular mass, making the heart work harder.**

CHICAGO – Obstructive sleep apnea (OSA) and snoring may lead to earlier impairment of cardiac function in women than in men, according to a new study presented today at the annual meeting of the Radiological Society of North America (RSNA). Moreover, the findings suggested that OSA may be vastly underdiagnosed among snorers.

A common but dangerous sleep disorder, OSA causes an increased risk for left ventricular and, more rarely, right ventricular dysfunction in the heart.

OSA is the most common type of sleep apnea. It occurs when the throat muscles intermittently relax and block the airway while a person sleeps. While there are several symptoms of OSA—such as gasping for air during sleep, waking with a dry mouth, morning headache and irritability—loud snoring is a common sign. Complications

of OSA may include daytime fatigue and sleepiness, complications with medications and surgery, and cardiovascular problems.

Researchers investigated cardiac function in relation to diagnosed OSA and self-reported snoring from data available through UK Biobank. A national and international health resource, UK Biobank is open to researchers and follows the health and well-being of 500,000 volunteer participants. Its aim is to improve the prevention, diagnosis and treatment of a wide range of serious and life-threatening illnesses.

For this study, data from 4,877 UK Biobank participants who had received a cardiac MRI were analyzed. The patients were allocated to three study groups: those with OSA (118 patients), those with self-reported snoring (1,886 patients), and those who are unaffected—without OSA or snoring (2,477 patients). There were 396 individuals who did not meet research criteria.

“Our analysis showed that in both genders of the OSA and snoring groups there was an increase in left ventricular mass, meaning that the walls of the heart’s main pumping chamber are enlarged, making the heart work harder,” said lead author Adrian Curta, M.D., radiology resident at Munich University Hospital in Munich, Germany. “We also found that men showed an increase in the ejection fraction of both ventricles.”

Ejection fraction is the percentage of the heart chamber's total volume that is pumped out with each heartbeat.

When the researchers compared the snoring group to the unaffected group, they found a more significant difference in the left ventricular mass in women than in men. The cardiac changes in the self-reported snorers point to earlier impairment and might be an indication of undiagnosed OSA.

“We found that the cardiac parameters in women appear to be more easily affected by the disease and that women who snore or have OSA might be at greater risk for cardiac involvement,” Dr. Curta said. “We also found that the prevalence of diagnosed OSA in the study group was extremely low. Together with the alterations in cardiac function in the snoring group, it leads us to believe that OSA may be grossly underdiagnosed.”

The findings suggest that the transition from snoring to OSA is an evolving process that is associated with left ventricular hypertrophy, an independent predictor for increased adverse events and in-hospital mortality in many procedures.

Dr. Curta stresses the importance for people who snore to get screened for OSA, and cautioned that those with OSA should be properly treated.

“I would encourage people who snore to ask their partner to observe them and look for phases during sleep when they stop breathing for a short while and then gasp for air,” Dr. Curta said. “If unsure, they can spend the night at a sleep lab where breathing is constantly monitored during sleep and even slight alterations can be recorded.”

Treatment is dependent on the cause of an individual's OSA, Dr. Curta noted. Weight loss, for example, can often improve OSA in overweight individuals. Apart from that, there are surgical techniques and special machines that keep the upper airways open at nighttime by applying continuous positive airway pressure (CPAP).

Since this was a population study, the researchers hope to conduct further studies to gain more insight into the gender differences associated with snoring and OSA.

Co-authors are Holger Hetterich, M.D., Regina Schinner, Aaron M. Lee, Wieland H. Sommer, M.D., Harald Kramer, M.D., Nay Aung, Mihir Sanghvi, Kenneth Fung, Elena Lukaschuk, Jackie Cooper, Jose M. Paiva, Valentina Carapella, Stefan Neubauer, Stefan Piechnik and Steffen E. Petersen.

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For patient-friendly information on cardiac MRI, visit [RadiologyInfo.org](https://www.RadiologyInfo.org).

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Youth Football Changes Nerve Fibers in Brain

AT A GLANCE

- **Repetitive blows to the head can result in changes in the brains of youth football players.**
- **MR images revealed that the football players developed changes in the corpus callosum, a critically important band of nerve fibers that connects the two halves of the brain.**
- **To maximize the safety of sports activity, it is important to understand the effects of repetitive head impact exposure, even if the amount of impact is small.**

CHICAGO – MRI scans show that repetitive blows to the head results in brain changes among youth football players, according to a new study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Football has been the subject of much scrutiny in recent years due to growing concerns over the long-term consequences of repetitive head impacts. Players who show signs of concussion are typically removed from games, but many hits to the head are subconcussive—or below the threshold of a concussion—and, therefore, don't cause any immediate symptoms. There is rising concern that youth football players who experience these collisions in practices and games may be vulnerable to their effects.

“The years from age 9 to 12 are very important when it comes to brain development,” said study lead author Jeongchul Kim, Ph.D., from Wake Forest School of

Medicine in Winston-Salem, N.C. “The functional regions of the brain are starting to integrate with one another, and players exposed to repetitive brain injuries, even if the amount of impact is small, could be at risk.”

Dr. Kim and colleagues studied the results of these collisions on youth football players using a novel MRI method that looks at the strain evident on white matter tracts—the bundles of nerve fibers that carry information between different areas of the brain.

“The focus here was on deformations of these fiber bundles,” Dr. Kim said. “Changes from collisions might cause elongation or contraction of these bundles.”

Twenty-six male youth football players, average age 12, underwent MRI studies before and approximately three months after the season was over. For comparison, 22 similarly aged boys who did not participate in contact sports had MRIs on the same schedule.

The MRI results showed that the football players developed changes in the corpus callosum, a critically important band of nerve fibers that connects the two halves of the brain. The primary role of the corpus callosum is to integrate cognitive, motor and sensory functions between the two sides of the brain.

There were signs of greater axial strain (contraction) in some parts of the corpus callosum, and indications of radial strain (expansion) in other parts.

“The body of the corpus callosum is a unique structure that’s somewhat like a bridge connecting the left and right hemispheres of brain,” Dr. Kim said. “When it’s subjected to external forces, some areas will contract and others will expand, just like when a bridge is twisting in the wind.”

The results suggest that repetitive subconcussive head impacts associated with participation in youth contact sports could lead to changes in the shape of the corpus callosum during this critical time of brain development. Dr. Kim cautioned, however, that more evidence is needed to confirm the findings. His group intends to continue studying the players, when possible, to see if any additional deformation occurs.

The ultimate goal of the research, Dr. Kim said, is to provide guidelines for safe football play. MRI may have a role in that process by helping to determine if and when an athlete is able to return to play after a head injury. Positron emission tomography, an imaging technique that can detect signs of inflammation in the brain, is also potentially useful in this regard, according to Dr. Kim.

“It’s best to detect changes at the earliest possible time,” he said.

Co-authors are Youngkyoo Jung, Ph.D., Richard A. Barcus, Joel Stitzel, Jillian Urban, Elizabeth M. Davenport, Ph.D., Alexander K. Powers, M.D., Joseph A. Maldjian, M.D., and Christopher T. Whitlow, M.D., Ph.D.

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